

# Mining & Construction

A magazine from Epiroc

miningandconstruction.com

**INSIDE**

**OUR CUSTOMERS**

**Fuel saving in tough conditions**

SmartROCT40 does wonders for Limak Holding

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**Exceeding expectations**

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**Communicating down under**

Sue Goc enjoys new challenges in Australia

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The Battery  
Issue 02–2018



[ Feature ]

## Electric future

Battery-powered machines are saving money – and the environment

26–41

# “Your interest – our top priority”

**D**EAR CUSTOMER, we are your partner. Everyone at Epiroc shares the mindset that the customer’s interest is our top priority. We want to boost your productivity, enhance your safety and cut your emissions – all while lowering your total cost of operation. Ambitious? Yes. Possible? Absolutely. We are traveling with you on this journey.

June 18, 2018 was a milestone for us. It was the day Epiroc was listed on the Nasdaq Stockholm stock exchange and became a fully independent company. We have 145 years of history within Atlas Copco, but we are also brand new.

**I JOINED EPIROC** recently, in early 2018. Part of my focus so far has been to travel around the world to visit our organization and customers. It has been a pleasure to go deep into mines and see major open pits and in-

frastructure sites. The visits have left me excited about the future.

**WHETHER THE COLLEAGUES** I meet are working in R&D, production, service, or another part of our business, they are all focused on making good things better. One example of this innovative spirit is the ongoing move towards battery-operated equipment and away from diesel, especially for underground equipment. We already have a portfolio of battery-powered machines, but this will grow both in numbers and in size. This will generate enormous benefits for you, our customer, in addition to serving the environment. It is the future and it is the right way to go. Make sure not to miss the in-depth reporting in this issue about the exciting electrification trend.

I look forward to continuing our productivity partnership.

## On my radar

### Battery-operated machines

There have been some very exciting product launches in this area.

### Automation

It’s great to see strong interest in our solutions for automation and interoperability.

### Delivery performance

We have ramped up production following increased demand. We closely monitor that we deliver in line with our promises.

Enjoy!

### Per Lindberg

President and CEO, Epiroc



# Epiroc Group – get to know us better

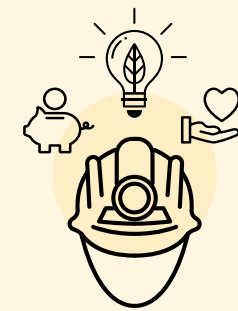
Our innovations

Industries we serve

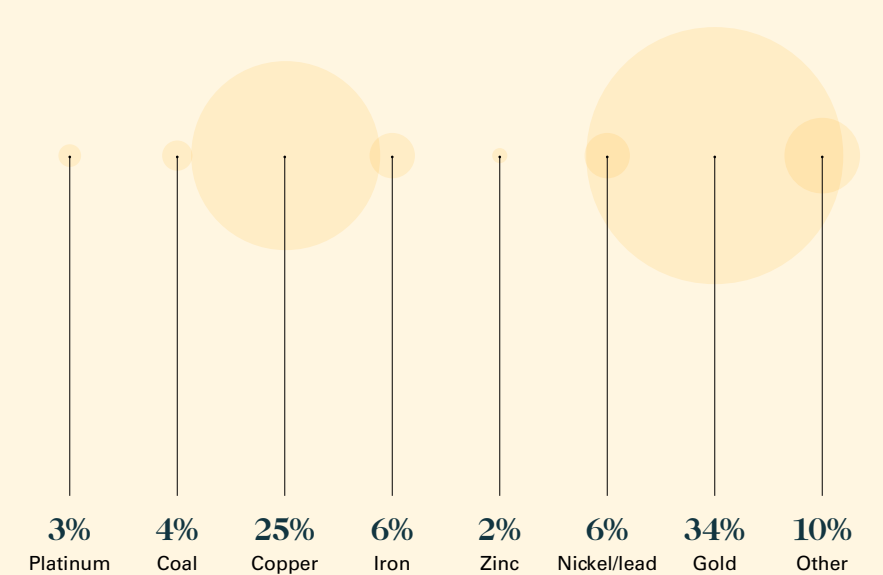
Mining orders received by commodity (2017)

With a heritage that dates back to 1873, Epiroc has been formed out of Atlas Copco's mining and construction business, and builds on proven expertise, quality and performance.

Our solutions aim to solve our customers’ key issues – including requirements to reduce operating costs, increase productivity, increase utilization of equipment, reduce environmental impact, and enhance health and safety conditions.



- **Mining and natural resources**  
Underground mining, surface mining, exploration, geo-technical applications, well drilling, oil and gas.
- **Infrastructure**  
Underground civil engineering, surface civil engineering and urban development, quarrying, deconstruction and recycling.



## About Epiroc

Epiroc is a leading productivity partner for the mining, infrastructure and natural resources industries. With cutting-edge technology, Epiroc develops and produces innovative drill rigs, rock excavation and construction equipment, and provides world-class service and consumables. The company was founded in Stockholm, Sweden, and has passionate people supporting and collaborating with customers in more than 150 countries.



13 000

- More than 13 000 employees
- Customers in more than 150 countries
- 145 years of experience
- Revenues 2017: SEK 31.4 billion

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## The Group in numbers

## Divisions and reporting segments

Equipment & Service / Tools & Attachments

### Rock Drilling Tools

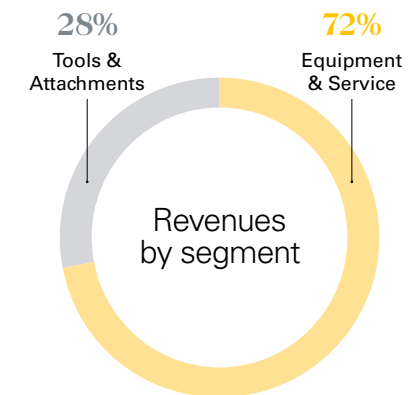
Dedicated to rock drilling tools worldwide

### Hydraulic Attachment Tools

Dedicated to hydraulic attachment tools for carriers

### Rocktec

Dedicated to technology solutions, and drives the automation and interoperability expansions for Epiroc’s divisions



### Drilling Solutions

Dedicated to a wide range of rotary drilling equipment

### Mining and Rock Excavation Service

Dedicated to parts and services aimed at maximizing customers’ productivity

### Surface and Exploration Drilling

Dedicated to rock and exploration drilling equipment

### Underground Rock Excavation

Dedicated to a wide range of tunneling and mining equipment



[FEATURE]

# Battery electrification

The automotive industry has come a long way towards large-scale electrification, and electrification is increasing in other areas. For the mining industry, battery-powered machines have substantial merits.

26–41



SHUTTERSTOCK

## 16 | FACE TO FACE Partnership paying off

The conventional process of slot raise opening is time-consuming and costly. Brazilian mining giant Ferbasa opted for the Easer, in close cooperation with Epiroc, and has not looked back.

## 22 | INNER WORKINGS Improved sampling

South32 tried an alternative to wet reverse circulation for collecting core samples in the Cerro Matoso mine. Epiroc's Explorac 100 rig with compressed air has greatly improved both productivity and quality.

## 44 | OUR CHALLENGE (Re)built to last

45 000 drilling hours were beginning to take their toll on Imperial Metals' Pit Viper 351. After a midlife rebuild and control system upgrade, the rig is drilling like new.



### ON THE COVER

Battery electrification is a game changer for the mining industry. Battery machines are better suited for use in enclosed spaces underground, since the need for cooling and ventilation – which make up the single largest energy cost in mines – will drop to almost nothing.

Next year's **PDAC convention** will take place **March 3–6** in Toronto, Canada. This annual event is the leading convention for people, companies and organizations in, or connected with, mineral exploration. More than 1 000 exhibitors will attend, as well as 3 500 investors and 25 600 attendees from 135 countries. [pdac.ca/convention](http://pdac.ca/convention)



LIMAK HOLDING

08

OUR CUSTOMERS

“It’s super easy and saves a lot of time”

Building the Yusufeli Dam, Limak Holding is lowering the dam body from 715 to 440 meters above sea level. The SmartROCT40 is making a challenging project possible.



JOE WIGDAHL

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GERARD GERY/PARIS MATCH (VIA GETTY)

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The DiscovOre Compass simplifies exploration drilling.

## Safety first

Epiroc is committed to complying with or exceeding all global and local rules and regulations on personal safety. However, some photographs in this magazine may show circumstances that are beyond our control. All users of Epiroc equipment are urged to think of safety first and always use proper ear, eye, head and other protection as required to minimize the risk of personal injury.

**Mining & Construction** is published by Epiroc. The magazine focuses on the company's know-how, products and methods used for mining and construction worldwide.

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MARKUS PETTERSSON

Epiroc is one of the partners in the Sustainable Underground Mining testbed. The recently inaugurated Control Tower in Örebro, Sweden, will be a huge asset in this digitalization venture.

## Epiroc joins partnership for sustainable mining

Carbon dioxide-free, digitalized and autonomous mines. That's the ambition of a newly-formed partnership involving Epiroc. To set a new world standard for sustainable mining at great depth, we have joined forces with LKAB, ABB, Combitech and AB Volvo, starting a unique testbed in the orefields of northern Sweden.

**THE SUSTAINABLE UNDERGROUND** Mining (SUM) testbed will be created in LKAB's

underground mines in Kiruna and Malmberget, and will also take the form of a virtual mine. Here, new technology will be developed and tested in a real mining environment to ensure that the Swedish mining industry can remain competitive and create jobs and growth, both locally in the county of Norrbotten and nationally. This requires new control systems, new and improved mining equipment, as well as complex and efficient management

### RigScan auditing success story in Jordan

**JORDAN'S MINING SECTOR** is flourishing and major contractors are purchasing used equipment when building mines. Epiroc Middle East is helping customers prolong the lifetime of equipment thanks to **RigScan**, an

advanced audit service. Since February 2018, seven rotary blasthole drill rigs have been audited – demonstrating Epiroc's approach to used equipment, as a company that supports the machines even after 10 to 15 years of production.

[More rigscan-audit.com](http://rigscan-audit.com)

### Epiroc Control Tower – the digital mine in action

**WITH THE RECENTLY** inaugurated Control Tower – located in Epiroc facilities in Örebro, Sweden – Epiroc has boosted opportunities to help customers on their digitalization journey. It's designed to be an innovation arena to collaborate around, and to explore and develop automation and infor-

mation management solutions. "We built it to be a place where, along with our customers and partners, we will develop the functionalities of tomorrow's mining operations and also do actual work within these areas," explains **Jonas Albertson**, President Rocktec division.

systems that meet future demands for a sustainable industry. Reaching that goal will demand a new type of collaboration: a digital ecosystem in which the partners' digital systems and operations are linked.

**"SWEDEN'S MINING AND** minerals industry is competing to be the world's most sustainable. Since sustainability requirements and technology are now developing at a rapid pace, Swedish companies have to join forces to ensure that we can mine safely and sustainably in the future. That bodes well for a mining nation like Sweden," says **Mikael Damberg**, Minister for Enterprise and Innovation.

Within the framework of the testbed, the best means of building an efficient autonomous production system that is carbon dioxide-free and has the highest conceivable level of safety will be studied. In the future autonomous and digitalized mine, people and machines will work side by side. Implementation of the project will require very significant investment on a national scale and the partners are therefore seeking collaboration with more suppliers, the Swedish state, research institutes and universities.

**"WE'RE PROUD TO** be part of a collaborative effort to develop the world's most modern mining operation. This aligns well with our focus on autonomous and battery-operated products and solutions that improve productivity and safety in the mines," says **Per Lindberg**, President and CEO of Epiroc. ✕



### Epiroc Mining PDC bit outclasses competitor's Tricone bit

**A COMPETITION** at a coal mine near Grants, New Mexico, pitted the Epiroc 10-5/8 Matrix Body PDC (Polycrystalline Diamond Compact) bit against a competitor's 10-5/8 Tricone bit. The two bits were run on a Pit Viper 275 blasthole rig in similar ground conditions at the mine. The result was a landslide victory for Epiroc, with the PDC bit achieving a 28 percent advantage in average penetration rate and a 140 percent advantage in service life.

#### FIGURE

6 752 009  
METERS

Epiroc takes automated drilling to the next level

**SINCE 2015**, Epiroc has converted 27 blasthole drills located in Australia, Mexico and South Africa to autonomous operation. The drills are being put to work by some of the world's largest mining companies such as BHP, Goldcorp, Barrick and Anglo American. Through August 2018, the rigs have drilled a combined 6 752 009 meters fully autonomously with off-site control.

To serve all our customers to the best of our ability, Epiroc strives to keep our employees inspired.

## What inspires you at work?



**Janet D. Adanusa**  
Human Resources and Administration Manager, Ghana

"Having the support of my immediate manager coupled with the autonomy to do my job is highly motivating for me. I enjoy working with a self-driven team and appreciate the opportunity to provide input on key decisions that affect my work. Also, I relish the opportunity to coach others and find the process inspiring."



**Brad Major**  
Technical Service Manager, Canada

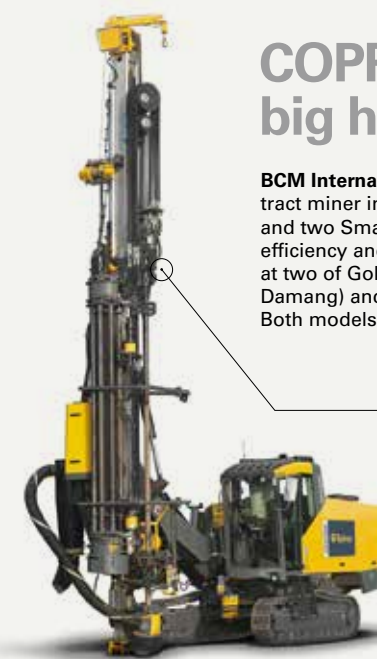
"It's the fact that I'm helping customers and co-workers. I also enjoy personal growth and the great friendship that I've developed with my co-workers around the world. I know this answer is a cliché, but it's the truth."



**Maxim Maklakov**  
Business Line Manager Drilling Solutions, Central Asia

"I'm really inspired by the friendly atmosphere in the office, which is the same in every Epiroc office around the world. Also, I appreciate the experienced and professional customers from whom I can learn many things. And being able to see the results of my work when customers come back to thank us is something that gives me joy."

#### PROJECT NEWS



### COPROD system big hit in Ghana

**BCM International Group**, the largest private contract miner in Africa, has bought 31 SmartROC C50 and two SmartROC CL drill rigs in a bid to increase efficiency and reduce fuel costs. The rigs will be used at two of Gold Fields' sites in Ghana (Tarkwa and Damang) and at BCM's own mine at Nzema, Ghana. Both models are equipped with COPROD technology.

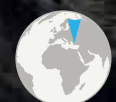
#### UNIQUE SYSTEM

COPROD, a unique rock drilling system from Epiroc, combines the high penetration rate and low diesel consumption of topammer equipment with the hole straightness and hole quality of DTH drilling.

[More bit.do/smartrocc50facts](http://bit.do/smartrocc50facts)

[Read more miningandconstruction.com](http://miningandconstruction.com)





[On location]  
Turkey

# River deep mountain high

## LIMAK HOLDING IS INNOVATING FOR SUCCESS IN CHALLENGING CONDITIONS

With a height of 275 meters, the Yusufeli Dam is a construction project of epic proportions. Its remoteness and size place great demands on contractor Limak Holding. Epiroc rigs are helping the company to meet these efficiently.







Innovation is key in challenging projects. A cableway was built to get the equipment in place.

The dam body in what will be the Yusufeli Dam is being lowered by 275 meters. SmartROC T40 rigs are the key to success.

The anchor drilling is a way of dealing with the unstable rock conditions on site. Pieces of rock falling from the walls would pose a great danger during construction of the dam, so keeping everything in place is hugely important. Horizontal drilling is more difficult to perform than vertical drilling, but the flexibility of the SmartROC T40 makes it possible, which is a big bonus for Limak Holding. This is not least due to the folding boom, which enables the rig to reach further – thus covering a larger area – than other rigs.

“Basically, I can make an extra row of holes – so there’s more drilling and less tramming. Also, it’s easy to make holes of very high quality. I perform drilling operations of 35–40 meters per hour during a shift on a partly hard rock.”

**R**OCK BOLTS ASIDE, there are many more figures that show Limak Holding’s gargantuan task. For instance, 86 kilometers worth of roads – including tunnels – will be built, and more than 3 000 people are working on the project. The natural valley is very deep, but in order to build the dam Limak Holding has to remove a lot of rock when shaping the dam body. The level will be lowered by 275 meters.

“At this point, the level we’re operating at is roughly 500 meters. We’re planning to lower the dam body from 715 to 440 meters above sea level.”

Coskun continues:

“The rock quality – as in hard and fractured formations – and the climate have a negative impact on operations. Being aware of the challenges we would face here in Yusufeli, we were very selective when it came to choosing equipment. For instance, saving fuel in such a big and long-running project is vital.”

Limak has used Epiroc equipment many times in the past. Its first collaboration was on the Devoll Hydroelectric Power Plants in Albania, and Limak has partnered with Epiroc for a number of dam projects in Turkey. For the Yusufeli project, various brands were compared during the pre-purchasing period, after which Limak decided to proceed with the SmartROC T40 as the main drilling rig. A total of nine SmartROC T40 rigs are being used on site, as well as two older-generation SmartROC rigs, five Boomer 282 and three Boomer L2 D rigs.

“Epiroc gave us a commitment that the SmartROC T40 would provide fuel savings of up to 40 percent. At first glance that sounds utopic, but the machine has lived up to the promises. The



fault rates are also low, which is a big advantage – especially since this location is so remote. The SmartROC T40 that started working on site in June 2015 has reached almost 10 000 hours of working performance – and it still fully meets our expectations,” says Coskun.

**STANDING ON THE** floor of the basin looking up, the magnitude of the project hits home. The rigs positioned on the platforms on the dam walls look toy-sized. Down here, three SmartROC T40 rigs are drilling vertical holes that will be filled with explosives.

Exiting from one of the rigs, a SmartROC T40, Operator **Mikail Celik** has just finished a drilling cycle.

“Efficiency is always important, especially in a project this big,” he says. “You want to drill fast without compromising on quality. With this rig, I can use the rod handling system to program the drilling cycle and then the machine will drill to the exact desired length no matter what the type

**F**ROM A DISTANCE, driving through the valley, it looks slightly surreal. Small dots float in mid-air, slowly moving away from the mountain-side. On closer inspection it’s no less intriguing. The bigger dots are drill rigs, while the smaller ones are platforms and other pieces of equipment. All the objects are being carried downwards by a cableway connected to either side of the valley.

“We are working in tough geological conditions and this pushes us to find alternative methods for the continuity of our operations,” says **Atilla Coskun**, Machine Supply Chief of Limak Yusufeli Dam Construction.

The bottom of the valley would normally be filled by water from the Çoruh river, flowing from the mountains of the eastern Anatolia region – referred to as “the roof of Turkey” – to the Black Sea. Since 2013, however, this has been a huge construction site. When operational, tentatively in 2020,

the Yusufeli Dam will be able to store 2.2 billion cubic meters worth of water and the underground power station will generate almost two billion kilowatt hours of energy.

Limak, Cengiz & Kolin JV was awarded the contract to build the dam. Limak Construction Company is responsible for both the dam and the power station construction, facing many challenges along the way. A big one is to make sure that the walls of the dam stay intact.

**OPERATOR MUSTAFA DOĞAN** positions the SmartROC T40 drill rig at the bottom of the basin wall. Parts of the wall are covered with concrete boxes, placed in a check pattern. He drills a hole in the wall and repositions the rig to the side.

“The next step, using another machine, is to place a rock bolt in the hole,” says Doğan. “Then dolly devices are put round it, so that the pressure from the rock is distributed over a bigger area.”

He gestures at the check pattern on the wall. “That’s the boxes, covered in concrete.”



Atilla Coskun  
Machine Supply  
Chief, Limak Holding



Mustafa Doğan  
Operator, Limak  
Holding

## Limak Holding

- Limak Construction was founded in 1976 and has specialized in all types of infrastructure and superstructure projects
- Operating in 10 countries
- Approximately 66 000 employees
- Ranked 85 in the ENR (Engineering News-Record) top 250 international construction companies list





## “I think that Epiroc machines – and the SmartROC T40 in particular – have certain qualities that set them apart”

Mikail Celik, Operator  
Limak Holding

of rock. I just supervise. It's super easy and saves a lot of time. The hole quality is great, too.”

Celik elaborates:

“I've been doing this job since 2002. Having worked with many different brands, I think that Epiroc machines – and the SmartROC T40 in particular – have certain qualities that set them apart. The design provides for maximum efficiency without compromising performance during operation. For instance, the combined effect of the hydraulic system and the control method means that the machine can move a lot quicker.”



Mikail Celik  
Operator, Limak  
Holding

**SOME OF THE ROCK** excavated from the valley will be used to produce portions of the concrete needed on site. With the project getting closer to completion, vast quantities will be needed. Yusufeli is a double-curvature arch dam and the total volume of high-strength concrete to be poured during dam body construction is four million cubic meters. As for the tunnels passing through the mountains, eight Epiroc Boomer face drilling rigs are used during tunneling operations.

To sum up, the Yusufeli Dam project is a challenging but, above all else, rewarding one for Limak Holding.

“The Yusufeli Dam will be the sixth highest arch dam in the world and of great importance to Turkey. We're very proud to be playing a part in this,” says Atilla Coskun. ✕

### Epiroc and Limak Holding

Limak Holding has collaborated with Epiroc on a number of projects, starting with the Devoll Hydroelectric Power Plants in Albania. Since then, the companies have partnered in several dam projects as well as two major airport projects in Turkey: İstanbul Sabiha Gökçen International Airport and İstanbul New Airport. Other ongoing projects include the Ankara-Sivas high-speed railway, the Northern Marmara highway and TANAP (the Trans-Anatolian natural gas pipeline).



ISTANBUL NEW AIRPORT



### Yusufeli Dam

- The Yusufeli Dam and Hydroelectric Power Plant Project, built in the Çoruh basin, will be Turkey's highest dam at an elevation of 275 meters
- The total storage volume will be approximately 2.2 billion cubic meters
- The power plant will generate 1 888 billion kilowatt hours of energy annually

## 5 KEYS TO SUCCESS

<p><b>1</b></p> <p>Shaping the dam body</p> <p><i>The Epiroc SmartROC T40 is a “sine qua non” – a machine absolutely essential for the project. It plays a critical role in shaping the body of the dam.</i></p>	<p><b>2</b></p> <p>Providing fuel efficiency</p> <p><i>SmartROC T40 drill rigs drill excellent holes and also provide fuel savings of up to 40 percent.</i></p>	<p><b>3</b></p> <p>High operating productivity</p> <p><i>The first SmartROC T40 of the project, delivered in June 2015, has clocked up more than 10 000 operating hours.</i></p>	<p><b>4</b></p> <p>Service advantage</p> <p><i>The performance of the SmartROC T40 and its user-friendly design enables Limak Holding to carry out minor servicing and maintenance work using its in-house service team.</i></p>	<p><b>5</b></p> <p>Trust in the brand</p> <p><i>Limak Holding is very familiar with Epiroc equipment and believes in the performance and quality of the brand, making Epiroc a natural choice.</i></p>
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[On location]  
Spain

Thanks to the Boomer S2 rig, a drilling round can be performed up to 40 minutes faster in the El Valle-Boinás mine.

### Boomer S2

- Application: Compact rig for mining and tunneling.
- Key features: Optional ROPS/FOPS certified cab, boom function, accessible service points from ground level.
- Rock drill with improved penetration rate and 1000 hours service interval.
- Optimized Rig Control System (RCS) for faster drilling and lifetime of rock drilling tools.

# Ticking all the boxes

» There were plenty of challenges when OroValle Minerals started trialing the new Boomer S2 face drilling rig. Fast forward a year and expectations have been surpassed.

OroValle Minerals has been mining for gold and copper, primarily, at the El Valle-Boinás mine in northern Spain since 2009. Currently trying to improve productivity and mineral grade content, the company faces some significant challenges, including a complex geology. The new Boomer S2 – the replacement model for the Boomer 282 drill rig, several of which are already in use at the mine – has been playing an important role.

**SINCE THE SPRING** of 2017, OroValle has been trialing the Boomer S2. Drilling Supervisor **Alejandro Barrera** was chosen to be trained by Epiroc and has, in turn, trained others, such as the young Drilling Operator **Daniel Alvarez Fernandez**: “The hardest part was to get used to just one control panel for both booms instead of two, as in the 282 jumbo, but I got accustomed quickly,” says Alvarez Fernandez. “Compared to the 282, the S2 is more comfortable; there is less vibration and less noise, the rig is easier to steer and there’s better visibility at the front so I can see better what I’m doing.”

Alejandro Barrera highlights the safety aspect: “The rig also feels very safe, especially when moving from one work face to another. The machine’s chassis is compact but strong, and feels well-balanced and stable. This gives us more security on the corners.”

#### Are there any other safety aspects?

“Yes, when doing roof bolting with the Boomer S2, nobody has to step in front of the jumbo as the

feed on the boom can be turned backwards towards the operator platform. The operator can remain under a safe area, supported by rock, during the process. This is a big improvement for us.”

#### What about productivity?

“The COP MD20 hammer on the Boomer S2 in combination with the Epiroc Magnum SR35 rods has given us great results, especially when doing blasthole drilling in harder rock. The total drilling cost has been significantly reduced thanks to the great increase in penetration rate, which reduced the drilling time of the holes by 25 percent. When we’re doing blasthole drilling, specifically 55 holes per round of four meters depth, with the Boomer S2 we can drill 30 minutes faster – sometimes even 40 minutes faster – than with the Boomer 282 or any other boomer at this mine.”

#### How do you find the Rig Control System (RCS)?

“I can honestly say that the RCS, including drill plan handling, is one of the best things for drilling in general. Even for a very experienced driller there is always a margin of error, because the human eye is not perfect. With the RCS there’s no mistake. It tells me exactly where I have to drill so it’s easier and faster.”

#### Anything you’d like to improve?

“There have been some small issues with the measuring sensors of the RCS, specifically when it comes to measuring the rock drill’s depth. Epiroc has already changed most of them. When everything is working, the RCS is 100 percent accurate, really precise and something amazing to see.”



Alejandro Barrera, Drilling Supervisor, OroValle Minerals

More [bit.do/boomerS2facts](http://bit.do/boomerS2facts)

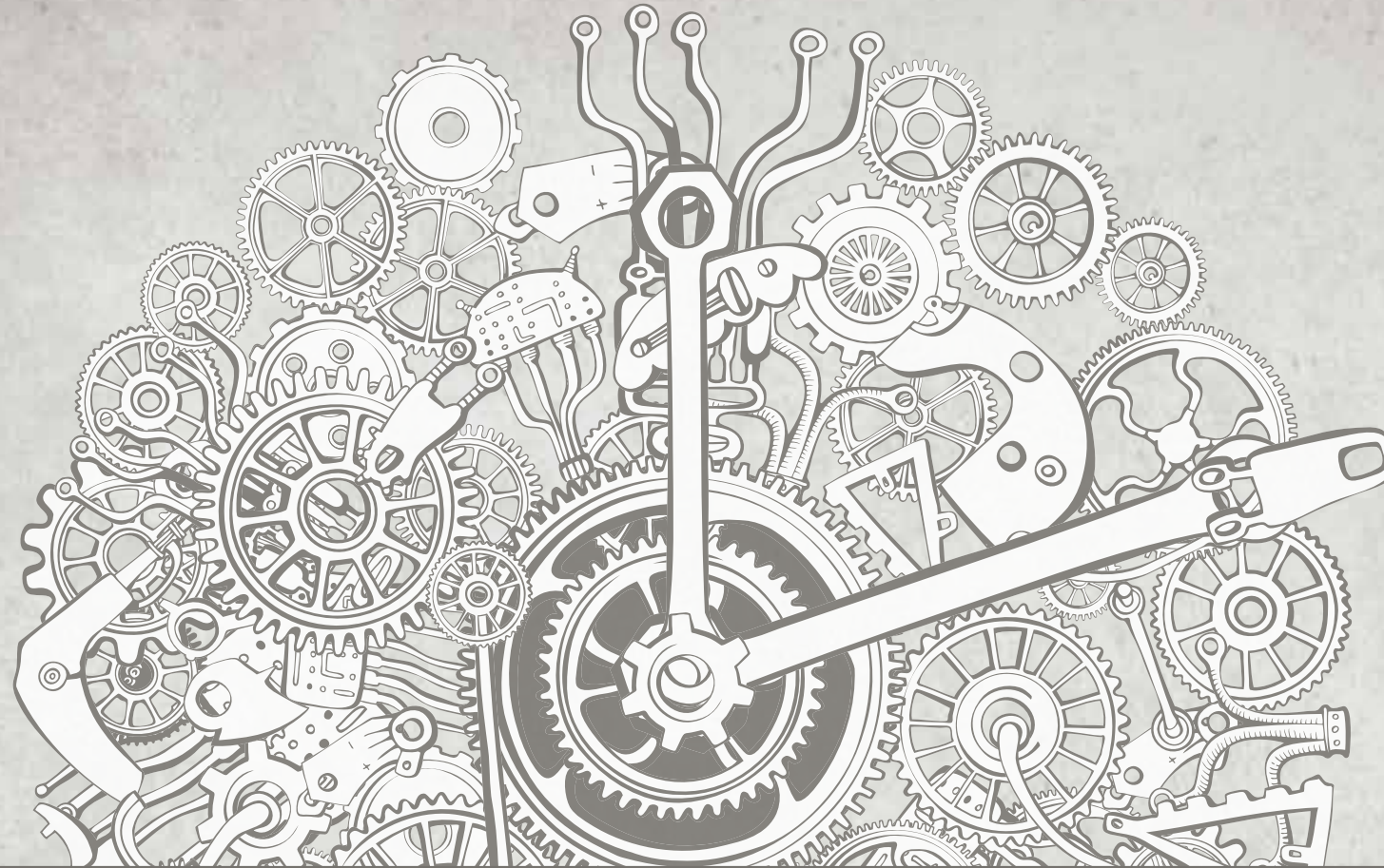


**WANDERLEY LINS**

Mining Engineer, Mining Director at CIA Ferro Ligas da Bahia – Ferbasa, Ipueira Mine. Based in Medrado, Bahia, Brazil.

**PAULO RIBEIRO**

Mechanical Engineer, Business Line Manager at Epiroc Brazil. Based in São Paulo, Brazil.



# IN FOR THE LONG HAUL

»»» A 30-year partnership between one of Brazil's best performing mines and Epiroc has made for a revolutionary solution in the raise boring process. Look out for the rise of the new Easer.

**F**erbasa is among the boldest mining companies in Brazil and is recognized as a pioneer in the use of many vanguard technologies. For more than 30 years, Ferbasa has been doing business with Epiroc – and the relationship still has the same innovative momentum. A recent example is the development of a new solution for slot raise opening. In a true example of synergistic work, the two companies have been collaborating on and testing the Easer – a mobile rig for raise boring. The machine integrates mobility, safety, productivity, flexibility and many other advantages. **Wanderley Lins** (Ferbasa) and **Paulo Ribeiro** (Epiroc Brazil) met up to talk about the partnership.

*When did Ferbasa and Epiroc start doing business together?*

**WANDERLEY LINS:** “The partnership dates back 30 years and has encompassed the use of a wide range



[On location] Brazil







The mobility of the Easer rig has been a significant benefit for Ferbasa. Also, opening the slot raise is much safer for Operator Maristônio Aquino da Silva and his co-workers.

of solutions from Epiroc such as the Boomer 282, Simba 1254, Scooptram ST 6C and Diamec U6. Many milestones have also been achieved. For example, Ferbasa was the first mine in Brazil to use the ITH Simba to drill slot raises, as well as to use slit hammers with them.”

**PAULO RIBEIRO:** “It’s a long-standing relationship, with many challenges and achievements. During all this time, Epiroc and Ferbasa have cooperated to improve results and create new solutions.”

**Why did Ferbasa decide to go for the Easer?**

**WL:** “Ferbasa always seeks to be aligned with the latest technologies available in the market and Epiroc was developing a very exciting new concept with this new Easer model, so we started bouncing off some ideas.”

**PR:** “The conventional process of slot raise opening is time-consuming and costly, lacking in quality and exposes people to risk. We thought it would make great sense for Ferbasa to try out the Easer.”

**What were its most attractive key features?**

**PR:** “The Easer is a combination of a Simba chasis and a small raise boring machine. The main difference is that this rig is mobile, with a high level of maneuverability and fast set-up.”

**WL:** “We saw a huge opportunity for applying this new technology in free face opening – in other words, in blind hole-slot raise operations and in ventilation shaft and infrastructure holes.”

**How did the project start out?**

**WL:** “We began discussions about two years ago

and agreed to bring in the machine for a trial period. The objective was to validate its performance and clarify any issues. At first, we were concerned about the size of the equipment, but during commissioning and operations we were able to confirm its viability. The Easer was used in the underground chromium mine at Ipueira in the city of Andorinha, in the state of Bahia, northeast Brazil.”

**Did the Easer help to improve safety and decrease the use of explosives?**

**WL:** “We have succeeded in decreasing the number of steps required to get the hole done from 12 to only four. Blasting and cable-bolting operations are not necessary anymore.”

**PR:** “Opening a slot raise is now much quicker and safer. Long-hole drill rigs can be used only

**In focus:**  
CIA Ferro Ligas da Bahia – Ferbasa

Currently one of the 500 largest companies in Brazil, Ferbasa conducts activities in the areas of mining, metallurgy and forest resources. Its mission is to combine high-quality products with strong socio-environmental performance. A leader in the production of ferroalloys and the only integrated ferrochrome producer in the Americas, Ferbasa

is one of the 10 largest companies in Bahia.

- Founded in 1961
- Annual revenues of over US\$ 500 million
- Exports mainly to the United States, European Union and Japan
- 17.5 percent sales growth in Q1 2018 (internal market)

More [ferbasa.com.br](http://ferbasa.com.br)

for production purposes, optimizing the process. The Easer also guarantees that the raise will be 100 percent opened during the blasting process.”

**Did Epiroc and Ferbasa face any specific challenges along the way?**

**WL:** “Some rearrangement was required to accommodate the drilling tools, to fit in with operational needs. The drift around the equipment was extended to allow enough space for maneuvers.”

**PR:** “We did adapt the system somewhat, to better direct the drilling waste from the hole and facilitate operational procedures. All these improvements were made in full synergy with our factory and were reported accordingly. This will support our designers in making the necessary improvements to new machines thanks to our experience with Ferbasa.”

**What about human challenges? How did the operators engage?**

**WL:** “They got very enthusiastic about how their work would be safer and much less stressful. And of course, they loved the air-conditioned cabin and the ergonomics in general.”

**PR:** “One of our best technicians was fully responsible for the machine. In addition, Epiroc sent experts from Sweden and Mexico to run training in new processes and equipment features. This was accomplished in just 30 days. We trained two well-qualified operators at first, and then exponentially multiplied their knowledge by sharing with others.”

**Now that all the challenges have been resolved, what other results have you seen?**

**WL:** “It really had a positive impact on our business. Operating costs dropped and are still going down. Other highlights are fewer people involved, higher productivity, greater flexibility and, last but not least, greater safety.”

**PR:** “Our measurements at Ferbasa show savings of up to 60 percent, looking at the direct labor factor alone. We have also been able to demonstrate a 48 percent reduction in the work shifts required to open a slot raise.”

**So could we expect this partnership to keep going? Maybe for 30 more years...?**

**WL:** “Testing of the Easer began in December 2017 and after all the customization and training, it began to drill in January. I do believe that this machine will initiate a new era in the relationship between Ferbasa and Epiroc.”

**PR:** “The test period ended in June 2018. In May, Epiroc held a customer day at Ferbasa, showing the Easer and the Epiroc solutions that integrate their fleet as well. Professionals from all over Brazil and other South American countries visited us, and the Easer was the key attraction. In summary, we strongly believe that the Easer is a new milestone. So yes, we hope that our partnership will extend for at least another 30 years.” ✕



**KEYS TO A SUCCESSFUL PARTNERSHIP**

The combination of a high-performance mine and a focused provider offers great possibilities. Here are four key factors for transforming this potential into tangible KPIs:

**A trusted relationship**

✓ Ferbasa had the confidence to change processes based on the promise of a prototype. Epiroc trusted in their goodwill to invest in the solution. There was much at stake, but also a lot of trust – based on 30 years of successful partnership.

**Innovative spirit**

✓ This was not the first time Ferbasa had invested in innovative proposals from Epiroc. This mining company is not afraid of trying what’s new, and history has proven that this approach pays off.

**Collaborative work**

✓ The commitment, proactivity, fellowship and transparency between Epiroc and Ferbasa’s teams made all the implementations more than possible. The deployment was completed in record time.

**High-level technology**

✓ Seeing the new Easer in action is amazing. Only a revolutionary engineering project could deliver these results.

More [bit.do/easerLfacts](http://bit.do/easerLfacts)



Want to keep track of what's happening in the mining and construction business? Visit [miningandconstruction.com](http://miningandconstruction.com) for links to industry news and other interesting reading.

**Cobalt** is causing a conflict between mining companies and the Democratic Republic of the Congo.



## DRC declares cobalt "strategic", hiking royalties

THE PRIME MINISTER of the Democratic Republic of the Congo has signed a decree to designate cobalt and other minerals as "strategic" and therefore subject to higher royalties. The change is part of a new mining code that came into effect in June 2018, which axes tax exemptions and hikes royalties and profit taxes.

The government considers minerals designated as "strategic" to be important for the economic, social and industrial future of the country, making the royalty 10 percent instead of 3.5 percent. Mining compa-

nies say the tax hikes and the cancellation of 10-year exemptions for existing projects against changes breach previous agreements with the government and will deter further investment.

**Note:** *The DRC is the world's leading miner of cobalt, a mineral which has seen a surge in demand due to the manufacture of electric car batteries and mobile phones. Read more about the use of batteries in mining in this issue's Feature section.*

## Rare birds spotted at restored quarry heath

A PAIR OF NIGHTJARS – rare, nocturnal birds – has been spotted nesting in an area of restored heathland within The Lodge nature reserve at Sandy Heath Quarry in Bedfordshire, UK. This is the first time since 1973 that nightjars have been spotted in the area. Building materials company Lafarge Tarmac has been working with the RSPB, a nature charity, to create heathland and acid grassland on the parts of Sandy Heath Quarry where quarrying has finished.

Peter Bradley, senior site manager at The Lodge nature reserve, said: "We're over the moon. It's a great success story for The Lodge and for everyone who has been involved in the heathland recreation work here over the last 15 years."



SHUTTERSTOCK

SHUTTERSTOCK



**Francisco Cobo**  
President of the European Demolition Association (EDA)

## What are the challenges facing the demolition industry?

### What role does the EDA fill?

"It's been a meeting point for the European demolition industry since 1978. We share experiences and knowledge between countries and companies, and work on improving relations with suppliers. An important task is to educate authorities on the differences between the building and the demolition industries."

### Which differences are those?

"Building companies start from a clean slate – a space to build in. Demolition companies start with a much more complex situation, with a number of unknown problems. They have to investigate the structural condition of the building, find out what potentially dangerous materials have been used, look for pollutants and contaminants like lead or PCB, and choose the best technique to carry out the demolition. There are a lot of environmental as well as health and safety issues to take into consideration in these projects."

### What are the main challenges for the future?

"A lot of focus is on recycling and the circular economy. Debris should not be considered residue, but valuable materials to be reused. Also, there are new discoveries about hazardous materials every year, so we have to continue to develop safe procedures for these."

More [europeandemolition.org](http://europeandemolition.org)



## Pinpointed

### 01 New tunneling training center to create thousands of jobs Melbourne, Australia

A training center in Melbourne – the first of its kind in Australia – is set to instruct thousands of local workers in the art of tunneling. It will include a replica tunnel with a full-height entrance, three multi-purpose engineering workrooms and training facilities including tunnel shaft and concrete lining spray simulators, as well as virtual reality experiences. Victoria's Labor government is investing heavily in tunneling, delivering a pipeline of major projects stretching over more than a decade, and is planning to make the Australian state a world-leading tunneling hub.

### 02 Cement trade booms after reopening of Ethio-Eritrean border Adigrat, Ethiopia

Cement trade between Ethiopia and Eritrea is flourishing, following the normalization of relations and the reopening of the border between the countries on September 11, 2018. The countries have been at a stand-off for two decades, following the war that lasted from May 1998 to June 2000. Business activities have made a remarkable recovery, with cement being a major commodity for import into Eritrea. A minimum of 20 trucks carrying cement leave daily from Adigrat, some 900 kilometers north of Addis Ababa, to the Eritrean border towns of Senafe, Adi Keyh and Dekemhare.

### 03 Major new silver deposit expected in Mexico Durango, Mexico

Canadian company Southern Silver Exploration is enthusiastic about the resource potential of its flagship Cerro Las Minitas (CLM) project in Durango, Mexico. Early stage prospecting revealed major potential for gold-silver-copper mineralization. Sources say the company is working towards an exploration target of about 300 million ounces of silver, which makes for a compelling prospect. From 2010 to date, the company has completed over 50 000 meters of exploration drilling. A preliminary economic assessment is to be published during the first half of 2019.

### 04 Robots explore deep sea floor minerals Norwegian Sea

Scientists from the University of Bergen, Norway, are using autonomous robots and piloted submarines at depths of up to 2 500 meters in a five-year project which will explore the sea floor between Norway and Greenland. The aim is to better understand why some areas are rich in substances such as zinc, gold, copper and rare earth minerals, while other areas

have all but none; also to estimate the size of the deposits and what damage mining the minerals would have on the environment. "The ocean sea floor on Earth is, for the most part, unknown. It's totally fair to say that we know much more about the surface of the moon and Mars than we know about our own planet," scientist Thibaut Barreyre told Reuters.







[On location]  
Colombia

# OPTIMIZING PROCESSES

»—» The drilling for sampling department at South32’s Cerro Matoso mine in Colombia identified an opportunity to improve its drilling process. The company introduced the Explorac 100 rig – and results have left the experts more than satisfied.

**A**t the Cerro Matoso mine in northern Colombia, temperatures can rise to 35 degrees Celsius. Rock slopes show shades ranging from greys to intense brown, which is evidence of the nickel content.

Cerro Matoso, operated by global resources company South32, has been active for over 36 years and is one of the world’s largest ferronickel mines. There is also a production plant producing ferronickel through a metallurgical process and the product is exported mainly to Asia.

When drilling for sampling, it is key to guarantee the safety of the operation, the quality of the samples, the productivity of the process and the cost of management.

“For this reason, we control productivity by measuring the meters per hour drilled and the quality of the samples extracted with a rigorous QA/QC program,” says Drilling Supervisor **Otoniel Vergara**.

**THE DRILLING PROCESS** must be optimized to guarantee the required number of sampled areas in accordance with the mining plan.

“The drilling performance for fiscal year 2017 prompted us to look for alternatives, including new drilling technologies,” Vergara says.

The mine used to perform sampling drilling by the wet reverse circulation (RC) method, using a tricone bit system and water, at a rate of around 8 meters per hour in the pit area. This allowed South32 to obtain wet samples, but with a restric-



Otoniel Vergara  
Drilling Supervisor,  
South32

tion on the capacity of realizable meters. After evaluating the alternatives, the company opted for Epiroc’s Explorac 100 drilling rig. The rig’s RC method with a DTH (down the hole) hammer, performed with compressed air, was the best way to continue obtaining reliable samples and accomplish the required meters.

Other advantages include inclined drilling, maintenance facilities, cost reduction, better operational safety and access to narrow areas.

“With the Explorac 100 we are drilling 16 meters per hour, with production peaks of up to 20 meters per hour,” Vergara says.

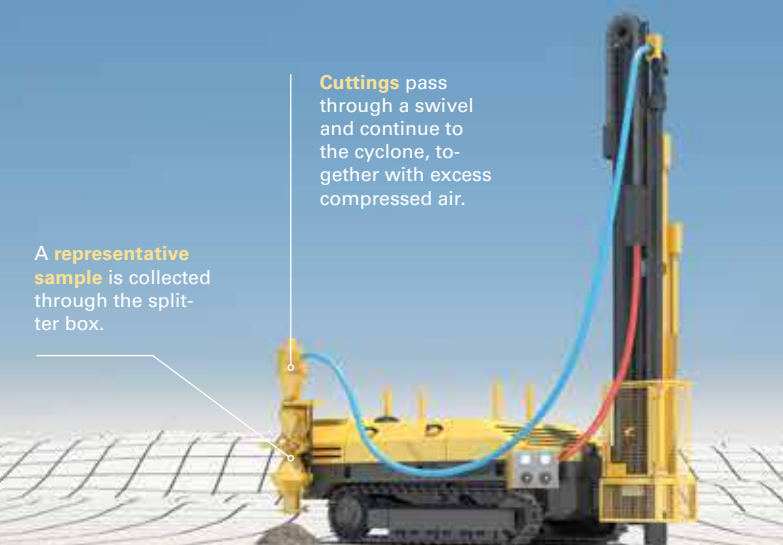
He also highlights the amount of sample recovered from the hole, with levels reaching up to 95 percent – in contrast to the previous levels of 86 percent.

**NEVERTHELESS, FOR EVERYONE** at Cerro Matoso, the most important aspect is safety. The remote control units and technology of the Explorac 100 allow the operators to control the machine from a distance and minimize physical interaction with

## LEARN MORE // RC DRILLING

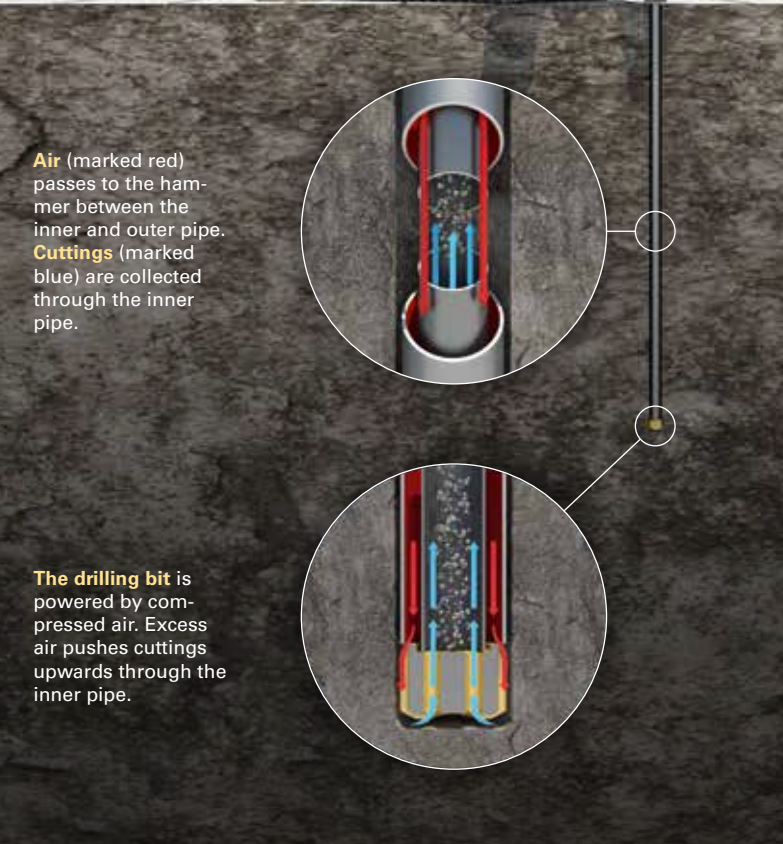
### The fastest way to quality samples

**REVERSE CIRCULATION (RC)** drilling represents a fast and economical way to retrieve the high-quality mineral grade samples needed to efficiently plan mining and quarrying operations.



A **representative sample** is collected through the splitter box.

**Cuttings** pass through a swivel and continue to the cyclone, together with excess compressed air.



**Air** (marked red) passes to the hammer between the inner and outer pipe. **Cuttings** (marked blue) are collected through the inner pipe.

**The drilling bit** is powered by compressed air. Excess air pushes cuttings upwards through the inner pipe.

More [bit.do/rcfacts](http://bit.do/rcfacts)





The Explorac 100 performs DTH (down the hole) sampling drilling with compressed air, enabling more reliable samples and more meters to be drilled. With this rig, South32 is drilling 16 meters per hour at the Cerro Matoso mine compared to 8 meters with the previous rig and method.



Fernán de la Barrera  
Explorac 100  
Operator, South32

drilling tools. This is what **Fernán de la Barrera**, Explorac 100 Operator, values the most.

“This rig is easier to operate. Using the same remote control, you can control all the functionalities. The rods are fitted through an automated arm that I guide from the control without the need to get closer to the pipes,” says de la Barrera.

For the operator, the small size of the machine and the possibility of drilling on slopes provide a remarkable advantage. This is largely due to the characteristics of the terrain.

**ON JUNE 30, 2018**, at the end of their fiscal year and with the support of the Explorac 100, Cerro Matoso achieved its drill plan for sampling. As a result, delivery of a second Explorac 100 is already on its way and Cerro Matoso hopes to transform its drilling fleet for sampling into more versatile and efficient rigs.

“The Explorac 100 has been the great new discovery for South32 at Cerro Matoso. These machines, although small in appearance, are big on efficiency and that’s why they’re such an integral part of our daily work,” says Otoniel Vergara. ✕

### 3. Remote-controlled for safety

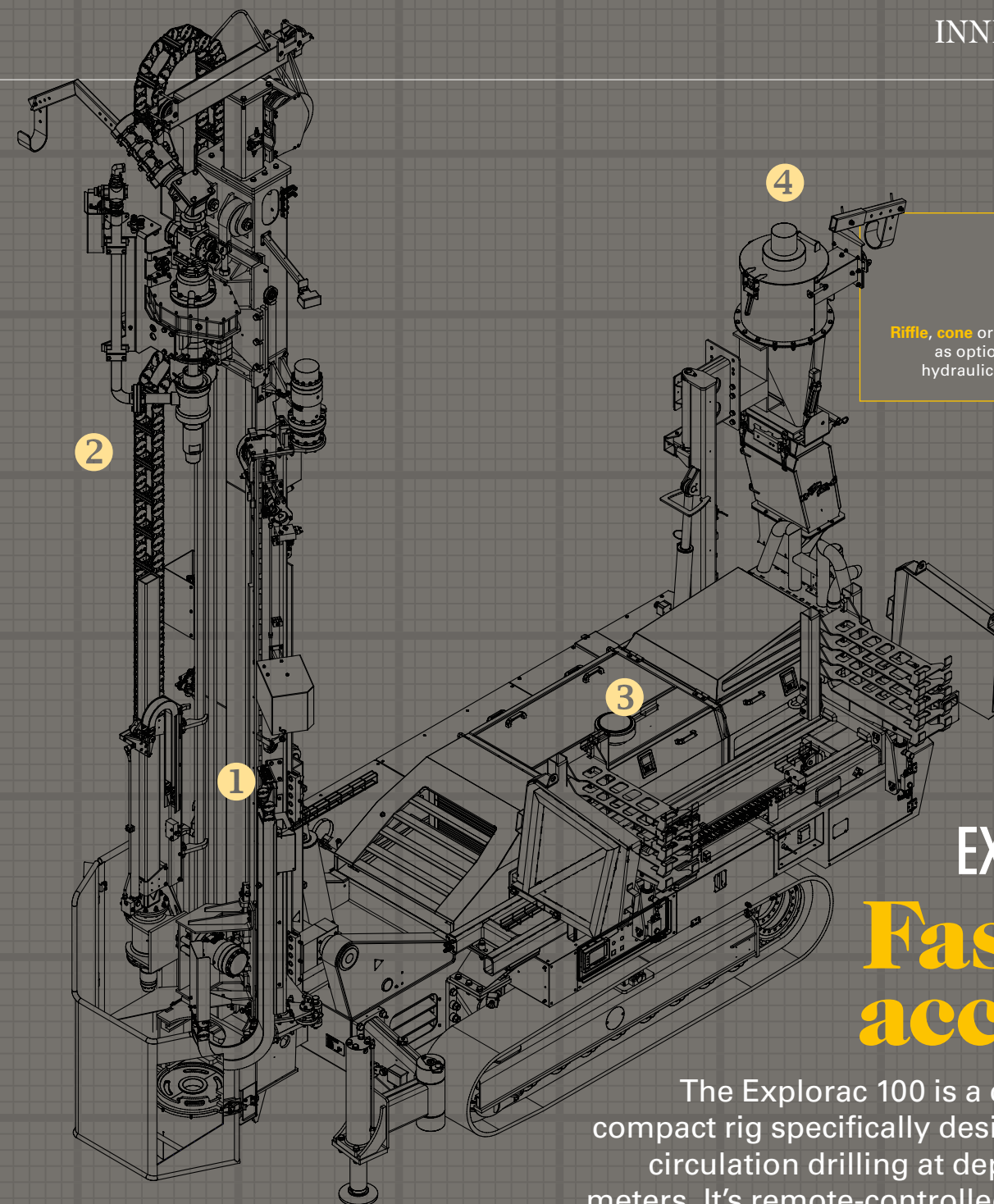
The two **remote control units** offer precise control of the rig at a distance of up to 40 meters, keeping both the operator and helper **out of harm’s way**.

### 2. Flexible drilling

Drilling angles from **45° to 90°**.

### 1. Hands-free rod handling

Rod handling system enables **safe, hands-free** loading, unloading and stacking of drill rods.



### 4. Three splitters to choose between

**Rifle, cone or rotary splitters** are available as options. The **cyclone** is fitted to a hydraulically foldable mounting post.

## EXPLORAC 100

# Fast and accurate

The Explorac 100 is a crawler-mounted compact rig specifically designed for reverse circulation drilling at depths down to 250 meters. It’s remote-controlled for extra safety.

## South32

**SOUTH32 IS A** globally diversified mining and metals company, producing bauxite, alumina, aluminum, energy and metallurgical coal, manganese, nickel, silver, lead and zinc at the company’s operations in Australia, Southern Africa and South America.

South32 is also the owner of a high-grade zinc, lead and silver development option in North America, and has several partnerships with junior explorers focused on base metals.

More [south32.net](http://south32.net)

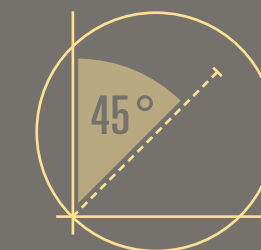
## Cerro Matoso operation

**CERRO MATOSO IS** dedicated to mining and transforming the nickel contained in ferronickel, using an energy-intensive pyrometallurgical process.

For more than 36 years Cerro Matoso has been exploring, extracting, producing and selling the nickel contained in ferronickel for the production of stainless steel. Cerro Matoso produced 43 700 metric tons of nickel in fiscal year 2018.



Drilling with the Explorac 100 has improved South32’s grade control drilling rate from 8 m/h to 16 m/h.



The Explorac 100 facilitates inclined drilling with up to 45 degrees of inclination.



To date, the Explorac 100 has completed more than 826 hours of work at Cerro Matoso with no critical failure.





[FEATURE]  
**Battery  
 electrification**

An opening to use more renewable energy and a way of saving money, battery solutions have huge potential – not least for the mining industry. Large-scale electrification is around the corner, but what will it take to really make it happen?

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# NO TIME TO WASTE

Global climate change is a momentous issue that calls for a major transition. To create a society that is sustainable in the long term, we need to increase the share of renewable energy – and batteries are playing a key role.

Scientists say that increased greenhouse gas emissions mean a risk of an average 2°C of global warming, which would have serious consequences on many levels. The biggest culprit is fossil energy: how we extract, process and use it. Robust efforts are required if the world is to reach the goal set out in the Paris Agreement: keeping the temperature rise well below 2°C and working to limit it even further to 1.5°C.

Key to this is increasing the share of renewable energy. Since this production cannot be managed in the same way as in the case of fossil sources or nuclear power, there will be a greater need for energy storage.

“There’s no shortage of renewable energy – quite the contrary. In global terms, solar and wind energy are what there is most of,” says **Bo Normark**, Thematic Leader Smart Grids and Electric Storage at InnoEnergy, the innovation engine for sustainable energy across Europe.

“If we can get more of it into the energy system, there are huge gains to be made – partly because this energy is clean, and partly because it’s so much more efficient than fossil fuels. It’s an unbeatable combination.”

He continues:

“Where storage is concerned, initially this involved large depots connected by transformer lines, but now the need for shorter storage has increased. In such cases batteries are of great interest.”

The transition to large-scale electrification has come farthest in the automotive industry, with practically all vehicle manufacturers having ambitious projects in progress. Electrification is also increasing in areas such as automation, robotics and medical technology.

“As batteries improve, their applications are broadening. Now it’s possible to power even large vehicles with batteries,” says **Kristina Edström**, Professor of Inorganic Chemistry and head of the Ångström Advanced Battery Center at Uppsala University in Sweden.

If this development is to continue the battery cells need to be made even more powerful, safe, long-lasting and predictable. This last aspect means knowing how much of the capacity you dare use without ruining the battery – and the more you increase the amount of energy, the more important safety becomes.

“It’s already possible to increase the amount of energy, making considerably more powerful batteries – but first we have to prevent undesirable reactions, so that the batteries don’t damage the equipment they’re in,” says **Kristina Edström**.

“Then it’s a matter of combining high power with high energy. Today batteries are either power-optimized or energy-optimized, but sometimes you want both: to be able to run equipment for a long time and recharge it quickly too.”

**INCREASED USE OF** batteries makes many demands: from policies that provide the right conditions for a shift to electrification, to a well-functioning complete ecosystem – from extraction of the raw material to battery recycling – that is sustainable in the long term. Most modern types of battery depend on special metals or metal compounds that are not available in very large quantities. Around a million metric tons of nickel is mined per year, for example, compared with the 1.4 billion metric tons of iron mined each year. Demand for the three main “battery metals” – nickel, cobalt and lithium – has increased dramatically.

“Not least because the automotive industry wants to secure its resources,” explains **Per Storm**, General Manager at EIT RawMaterials North, the largest con-



**Bo Normark**  
Thematic Leader  
Smart Grids and  
Electric Storage,  
InnoEnergy



**Kristina Edström**  
Professor of  
Inorganic Chemistry,  
Uppsala University,  
Sweden







## “I’m certain that using recycled raw materials is becoming increasingly important”

**Per Storm**  
General Manager EIT RawMaterials North



sortium in the raw materials sector worldwide.

“In the medium term, cobalt is the big problem. It’s not mined in that many places and is a by-product of other metals. And a very large proportion of it is mined in Congo, where there are social and environmental concerns.”

He continues:

“As regards nickel, production capacity is greater than in the 1990s when China was rapidly industrializing and there are most likely opportunities to increase it. Lithium is the least used of the three metals and its production can be increased, not least in Chile and Bolivia. I believe that demand for lithium will grow substantially, but that the market can meet the increased demand.”

**A** great advantage of batteries compared with fossil fuels is that they can be recycled, and here systems need to be expanded; partly to reduce the burden on natural resources, and partly because increased environmental awareness is making sustainability a hygiene factor. How mining and processing are car-



**Per Storm**  
General Manager,  
EIT RawMaterials  
North

ried out will also be part of the equation – looking at the overall climate impact in an effort to use the cleanest electricity possible.

“Many big mining companies are largely owned by big international funds such as pension funds, which means there is pressure to act sustainably. I’m certain that using recycled raw materials is becoming increasingly important. Battery manufacturers will make demands too,” says Per Storm.

**TO SUM UP:** We are at the start of a transition that involves major challenges, but offers even greater opportunities. For the mining industry, the advances made by batteries are not just about making electrical power underground pay off. They also put mining in an important position as regards materials and allow locally produced electricity to be used – a great advantage in remote locations.

“If the grid is designed for maximum load, battery capacity can be introduced higher up the grid,” says Bo Normark.

He elaborates: “In Australia, the combination of local solar power and batteries has become extremely attractive. Electrical power using batteries has a huge number of benefits.” ✕

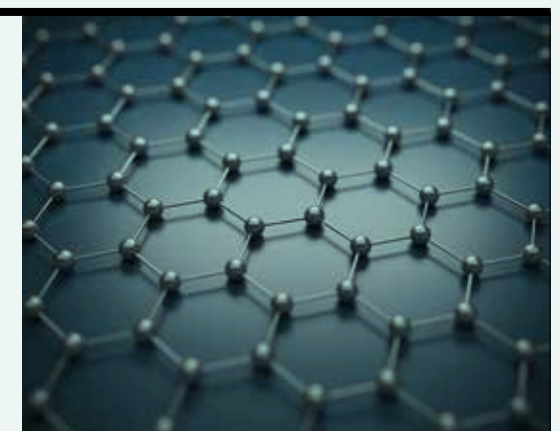
### WHAT NOW?

#### Batteries: The next generation

**BATTERY DEVELOPMENT IS** in an interesting phase as regards both technology and materials. The aim is to be able to manufacture more powerful and safer batteries with a longer life. Nickel, cobalt and lithium are currently the three dominant metals, but their supply is to some extent limited. If the technology is developed so that stability increases,

iron could be used – which would open up completely new possibilities.

Another challenge is to better protect and increase the electrode surface in batteries. Serious efforts are in progress using methods such as thin film technology, so that layers can be placed on top of each other, and **nanotechnology**.







# ELECTRICAL POTENTIAL

»→ Suddenly, all the pieces of the puzzle have fallen into place. The battery revolution is under way. From this fall, Epiroc will be more significantly involved in changing the energy landscape of the mining industry.



[On location]  
Sweden



**“I quickly realized that battery power could not just replace diesel, but could become a profitable business for both us and our customers”**

**Erik Svedlund**  
Marketing Manager Vehicle  
Electrification, Epiroc

**J**une, 2018. These are busy days at Epiroc in Örebro. During the fall an entire new generation of battery-powered mining machinery is to be launched. A key person in this is **Erik Svedlund**, whose job title is Marketing Manager Vehicle Electrification. He has been involved in outlining Epiroc’s vision of emission-free mining environments, made possible by battery power.

“Electric will replace diesel,” says Svedlund. “The machines that we’re developing here already perform equally well or better than diesel machines, except for one thing: running time. But with the rate at which batteries are developing, it won’t be long before that has caught up too.”

There has been an explosion in the market for electric-powered mining machines and the reason is that the technology – primarily battery technology – has matured. The trials carried out previously, using electricity from cables or rails,

involved fixed and awkward solutions. The flexibility needed in a mine environment has always caused the decision to come down in favor of diesel machines. At least, until now.

**ERIK SVEDLUND BECAME** interested in battery-powered machines back in 2010 and started studying the possibilities.

“At the time I was Head of Products and I quickly realized that battery power could not just replace diesel, but could become a profitable business for both us and our customers. I started lobbying internally to start the development of such solutions. This went rather slowly until 2013, when we received a request from a customer in Canada. It then took less than a year from prototype to launch of the Scooptram ST7 Battery, and the machine’s performance exceeded expectations.”

The Scooptram ST7 Battery was among the first generation of battery machines from Epiroc. The machines that are being launched in the second half of 2018 are second generation machines and include not just loaders, but also mine trucks and drill rigs.

“Loaders and mine trucks account for around 80 percent of fuel consumption in mines. These





# “We started developing a modular battery system that allows the modules to be used in any kind of Epiroc machine”

**Anders Lindqvist**  
Project Manager, Epiroc



**Erik Svedlund**  
Marketing Manager  
Vehicle Electrification,  
Epiroc



**Anders Lindqvist**  
Project Manager,  
Epiroc

types of machines are the key – if we don't come up with these, we won't solve anything,” says Erik Svedlund.

**AT EPIROC'S TEST** mine in Kvarntorp outside Örebro, a Scooptram ST7 Battery stands with its bucket full of gravel. If you close your eyes there is nothing to indicate that the loader is running until it starts to move – and all you hear then is the sound of the gears and axles, and the scrunch of tires on gravel. There is no engine noise. As the loader releases the gravel, the jangling can be clearly heard in the otherwise quiet site.

“For the first generation we basically took existing loaders, removed the engine and fuel tank, and put in an electric motor and battery instead,” explains **Anders Lindqvist**, Project Manager within technological development. He continues:

“But it worked. We were placing bets in the office on how long the machine could run on battery, and all the guesses were between one and

three hours. But it proved to keep going for five hours,” he says with a laugh.

Anders Lindqvist and his team learned a lot while working on the first generation. The second generation machines were designed for battery operation from the outset; the mine trucks, for example, have motors on each axle. But it is the batteries themselves that are responsible for the biggest change.

“Quite early on we started developing a modular battery system that allows the modules to be used in any kind of Epiroc machine.”

One advantage of the new battery design is that they can be replaced quickly. In less than 10 minutes a fully charged battery can be in place, so that even energy-intensive operations can continue with only a brief interruption.

**IN JUNE, IT** was 18 months since Epiroc's management gave the green light to developing the second generation machines. Since then, Anders Lindqvist and his team have been at full throttle.



## Q&A

**Morgan Rody**  
Senior Project Manager SIMS,  
Epiroc, Sweden



*SIMS (Sustainable Intelligent Mining Systems) is a three-year EU-financed project to produce demonstrations of future products for the mining industry. Under the project management of Morgan Rody, Epiroc is coordinating the collaboration between the thirteen partners – which include manufacturers, mining companies and universities.*

**Q** What is the EU expecting SIMS to result in?

**A** “Our focus is on what's called Innovation Action. In other words, we start from a research project and produce functioning products to demonstrate that the theory works in practice. The EU has high expectations of concrete results. Seventy percent of our budget – 13 million euros – comes

from the European Commission. So we have to deliver.”

**Q** What type of projects are you working on?

**A** “Battery solutions are a big thing and there's a lot happening in this field. For example, we compared how great the difference is between diesel and batteries.

What level of particulates does diesel operation result in? We also have lots of other projects in progress, such as drones, the next wireless mobile standard 5G, better positioning services, thermal imaging and assisted driving systems for diesel-free machines. Also virtual reality, which has become really hot again. We're aiming to construct a mine in VR so that we can demonstrate solutions at events such as trade shows. Many of the projects are concerned with safety, and we're proud of that. Each person that can be moved out of a dangerous environment is a gain.”

**Q** Has the SIMS collaboration worked well?

**A** “Extremely well! It's useful to meet up properly. And all the partners are aware that what they are doing now will change the mining industry.”

For Epiroc's second generation battery machines, the battery design has changed so that the battery can be replaced in less than 10 minutes. **Göran Sjöberg** is one of the technicians involved in the project.



[Feature] Battery electrification

### In focus: Zero emission initiative

**Epiroc's goal** is to offer a zero emission alternative for all underground mining and tunneling equipment. The complexity and demands of these kinds of products are high, and Epiroc is using internal expertise as well as expertise coming from battery cell and electric drive train manufacturers.

- The technical solution will vary depending on the type of machine, but everything evolves around the battery electric driveline.
- Customer interaction has always been a key factor in Epiroc's development work, in addition to increased demands as regards safety, health, quality and the environment.
- With the zero emission product portfolio, Epiroc is improving both safety and health. As a leading original equipment manufacturer Epiroc considers the mining industry's carbon footprint and shoulders its responsibility as an industry leader.

More [simsmining.eu](http://simsmining.eu)



“This is a new way of working that’s fun and exciting. Now we need our suppliers to come up with new solutions at the same rate that we need them.”

Anders Lindkvist thinks for a moment.

“It’s tremendously enjoyable to be able to introduce so many new things in such a short time. And on three machines in parallel, too.”

**Sofia Bratt** agrees. She is responsible for the project office, which has coordinated the work to develop the second generation.

“There’s been very close collaboration in the group and with our suppliers. It’s been huge fun and has developed all those involved, and I think this type of project will become more common in the future.”

Sofia Bratt describes a process in which they have constantly succeeded in breaking new ground.

“We’ve looked at areas such as battery cell chemistry, drivelines and control systems, and have been able to evaluate what’s most optimal for our applications. An incredible number of people have been involved, which has made great demands of dialogue and communication. It’s required time and resources from everyone involved, but it’s also been very effective.”

**IN THE WORKSHOP** at Epiroc the first machines are being tested calmly and steadily ahead of their launch this fall. More and more customers are starting to demand battery machines. Although the diesel machines did the job, they also brought with them a load of problems: harmful exhaust emissions, noise, waste heat, high maintenance costs, unplanned stoppages for servicing, rising fuel costs and an increasingly complicated infrastructure.

The battery-powered machines need significantly less maintenance, not least because an electric motor contains a fraction of the number of moving parts that a diesel engine has. They give off marginal amounts of waste heat and, of course, have no exhaust emissions. And if the batteries are charged using renewable electricity, they have no climate impact either. Safety and sustainability form an integral part of Epiroc’s strategy, and are also a good example of how we can contribute to our customers’ sustainability work and improve their environmental impact. Battery-powered machines can help achieve one of the UN’s Sustainable Development Goals: access to affordable, reliable, sustainable and modern energy for all.

“Diesel machines are actually poorly suited for use in enclosed spaces underground. A lot of cooling and ventilation are required to deal with the



**Sofia Bratt**  
Manager Project  
Office & Systems  
Engineering



**Fredrik Martinsson**  
Marketing Manager  
Service Electrification,  
Epiroc

exhaust emissions and heat, and this has become the single largest energy cost in mines,” says Erik Svedlund.

“If we take away the diesel engine, the situation changes completely. Ventilation costs reduce dramatically and you can go even deeper while still being cost-effective.”

Unlike the shift to electric cars, therefore, the transition in the mining industry is not primarily driven by legal requirements and more stringent rules on emissions. Underground, the driving force is instead a desire for a safer work environment – and pure and simple economics. The potential savings are enormous.

**THE PERSON KEEPING** an eye on the aftermarket aspect is **Fredrik Martinsson**, Marketing Manager Service Electrification.

“Solving the financial model and at the same

time strengthening the tie to our customers is a key activity,” he says.

Fredrik Martinsson’s task is to come up with a brand new business model that will make it as easy as possible for customers to switch to electric operation. The basic idea is that the customer buys the machine, but has a subscription for the batteries. The advantage is that the investment is lower, operating costs are predictable and Epiroc takes all the responsibility for the training, maintenance and servicing associated with the batteries. If a customer needs more or less power, the subscription can be adjusted.

“We want to dramatically lower the threshold for electrification. We want it to be easy. This is a major change, and it will require hard work by many people over a long period. But everyone – suppliers, customers, the environment and ourselves – will be a winner.”

**Fredrik Engman**, Technician, and **Anders Lindkvist**, Project Manager within technical development, discussing how to best place the powertrain components on a Scooptram ST14 Battery.



**Jonas Ranggård**  
Manager Boliden Mines  
Energy Program

## What does your electric future look like?

### Why is Boliden working on the electrification of vehicles?

“There are a great many advantages to running vehicles on electricity rather than diesel. You can reduce ventilation and maintenance costs, and improve the work environment. From 2023, for example, the EU will be lowering the limit values for NOx in mining environments. Electricity is definitely the best way to deal with these requirements, but such a transition takes time. That’s why we have to start testing the technology now.”

### How far have you got?

“We are still in the starting blocks. In August we began an 18-month project in which we’ll test overhead lines and four mine trucks with current collectors in the open-pit copper mine in Aitik. We decided to start with open-pit mining because we use most diesel above ground. Once the project has ended, we’ll assess whether the savings meet expectations, how good the availability of the vehicles was and what problems we encountered.”

### What will be the next step?

“With our switch to autonomous drilling, we’re able to improve upon the rate of production, the accuracy of the holes, and the fragmentation, leading to downstream improvements in our processes as well as improving our safety.”

More [boliden.com](https://boliden.com)



There are always things to be learned from other organizations and other industries. This is how another player has approached the theme of this issue.

✔ Christian Tarras Ericsson  
📷 Tesla

# The battery-run island

## SAMOA TO GO 100 PERCENT RENEWABLE

### In focus Tesla Powerpack

Tesla Energy may not, until now, have attracted as much attention as the company's electric car business, but projects involving solar and battery installations have been growing at a rapid pace over the last few years. Examples include disaster relief, and bringing grid stability to areas prone to power outages and high energy costs.

Australia is investing heavily in large-scale energy projects, with a major Powerpack farm being built in Victoria and a proposed Powerwall virtual power plant to supply 50 000 homes in South Australia.

Other projects are being run in Puerto Rico, Ta'u in American Samoa and Kauai in Hawaii.

More [tesla.com/powerpack](https://tesla.com/powerpack)

THE ISLAND NATION of Samoa has plans to go completely independent of fossil-based energy production by 2025, ultimately allowing Samoa to power itself on 100 percent renewable energy. To date, Samoa has reached about halfway, with 48 percent of its electricity generated by hydropower, solar and wind farms in the year to June 2018.

Samoa imports millions of liters of oil every year and in 2012, Samoa ended up importing 95 million liters of diesel to support its energy grid – particularly after the damage caused to the nation's hydropower plants by the ravages of Cyclone Evan.

THUS REMOTE LOCATIONS such as Samoa – and for that matter, isolated mine sites far from energy grids – have much to gain from using renewable energy sources instead of costly, complex and environmentally damaging fossil fuel-powered generators.

The problem with solar and wind farms, though, is the inability to accurately forecast output at any given moment. This leads to grid instability and loss of overproduc-

tion, which in the worst cases for Samoa led to power outages; in the best cases, it meant greater dependence on diesel power.

To counter this Samoa has invested in two Tesla Powerpack installations: battery storage systems with a combined capacity of 13.6 megawatt hours. Together with a grid controller software system, this gives the country real-time control over grid stability, reliability and security.

IN A STATEMENT to newspaper Samoa Observer, Samoa's Prime Minister Tuilaepa Sa'ilele Malielegaoi noted that the systems have helped the country provide additional stability to its power grid.

Since the batteries were installed earlier in the summer, the island is no longer having outages and the electricity supply is steady. The local utility has been able to reduce the use of diesel generators and is now working to tweak the system to use even less diesel. Diesel use will drop further as the utility continues to add new renewable sources. ✕



# SURVEY

## A BATTERY-POWERED FUTURE

Want more input on this theme?  
Three people from different fields  
give their views to help paint a  
broader picture.

☑ Gustaf Höök

01 What are the biggest advantages  
of the battery revolution?

02 What is needed for this development  
to be able to continue?



**Per Ahl**

CEO, Svemin (Swedish  
Association of Mines, Mineral  
and Metal Producers), Sweden



**Emma Nehrenheim**

Head of Environment  
and Sustainability,  
Northvolt, Sweden



**Maroš  
Šefčovič**

European Commissioner  
for the Energy Union

01 **"THE MOST IMPORTANT** thing is that it allows climate-smart energy systems based on fossil-free sources. The battery revolution is quite simply a necessity if we are to be able to reduce carbon emissions and cope with climate change. For the mining industry, battery technology is particularly important because the costs of ventilation underground are so high. Electric machinery saves a lot of energy and a lot of money."

02 **"ACCESS TO MINERALS** needs to be secured, partly by finding new deposits and partly through more efficient recycling technology. We need to speed up the development of this technology. Secondly, I am a firm believer in sustainability. More and more companies and consumers want to know where the metals in batteries are mined and how much of the material is recycled. Traceability will therefore be necessary – using blockchain technology, for example, which lets us trace metals in a chain of events."

01 **"BATTERY TECHNOLOGY** allows us to phase out fossil fuels from the energy system. Hydrocarbons are combusted, while the metals in batteries are elements that can be recycled – so the environmental benefit is enormous. Where recycling is concerned it is the waste industry that has been most active, but the mining industry is sitting on a treasure trove of knowledge. I hope that this can be shared with the battery industry, so that we get better at using recycled metals."

02 **"ACCESS TO RAW MATERIALS** is key, and here too I want to emphasize recycling. We must not let the same thing happen as in the telecoms industry, where a massive amount of value is lost because lots of people put their old cellphone in a desk drawer instead of sending it for recycling. Another important thing is that the charging infrastructure needs to be improved in order to be able to cope with peak power loads, so that the industry doesn't suffer when the pattern of electricity use changes."

01 **"SPEAKING FOR THE EU,** we have to be strategic and become independent in battery innovation and manufacturing. This sector is potentially worth EUR 250 billion annually from 2025 onwards, while up to 5 million jobs could be created. We are set to ensure that batteries placed on the EU market are sustainable throughout their life cycle. This is essential to our climate action commitments and our competitiveness."

02 **"THE EUROPEAN Battery Alliance** has evolved into a network of 260 innovation and industrial actors, and their close collaboration with the European Commission, governments and the EIB. We have seen tabled and planned investments amounting to EUR 100 billion. The Commission and the Member States are supporting emerging manufacturing projects in their initial stage, exploring new sources of primary and secondary raw materials in Europe, and investing in research and development and smart specialisation of active regions."

More [bit.do/batteryalliancefacts](http://bit.do/batteryalliancefacts)

## The charge of the light battery

The phenomenon of static electricity is well-known – not least to cat owners and balloon clowns. But how to harness this power?

**01 Galvanic cells**  
☑ In the year 1800, Italian scientist Alessandro Volta stacked alternating disks of zinc and silver separated by fabrics drenched in salt water, with metal connectors to jars of mercury. The world's first battery was born.

**02 Lead acid batteries**  
☑ French physicist Gaston Planté – evidently a bold man – lowered sheets of lead into a sulfuric acid solution in 1859, creating the first rechargeable battery. Lead acid batteries could deliver remarkably large currents and are still used today.

**03 Dry cell batteries**  
☑ The Danish inventor and industrialist Wilhelm Hellebrand designed the first dry cell battery in 1887. It used a paste electrolyte, making it possible to operate in any orientation without spilling, and was thus eminently suitable for portable equipment.

**04 NiMH batteries**  
☑ Nickel metal hydride – or NiMH for short – batteries quickly became a popular type of rechargeable cell, avoiding the use of cadmium and other nasty elements. NiMH batteries were long used in hybrid vehicles before the advent of Li-ion.

**05 Lithium-ion batteries**  
☑ Li-ion batteries have revolutionized the rechargeable battery segment, being used in portable electronics, electric vehicles, and military and aerospace applications. They have a high energy density, tiny memory effect and low self-discharge.

**06 Solid state batteries**  
☑ The next generation of batteries uses solid electrolytes – such as ceramics or glass – in addition to solid electrodes. Advantages include higher energy density and temperature tolerances, as well as lowered charging times.

**07 Graphene batteries**  
☑ In the near future, battery designs using the "wonder material" graphene promise even higher energy densities, reduced weight, significantly shorter charging times, 3D printability and extended operational temperature ranges.

Next issue  
[Feature]

Want to delve deeper into the importance of safety as related to the mining and construction business?  
Make sure not to miss next issue's Feature.



# MY WORK: COMMUNICATIONS MANAGER

Epiroc's greatest asset is our employees. We take pride in offering them an outlet for their creativity in order to provide the best possible value to our customers.

☑ Gustaf Höök  
📷 Joe Wigdahl

## “Good decisions are based on good information”

»→ From rebranding facilities and clothing to communicating with customers, media and employees, no day is ever the same for **Sue Goc**. She loves the creativity and freedom of being Epiroc Australia's Communications and Branding Manager.

“**S**ince 2017 I have been Communications and Branding Manager with Epiroc Australia. The job is quite comprehensive, as it includes both internal and external communication and we are a new brand with a history. The company has also grown quite a bit since I joined in 2000, when it was Atlas Copco. Back then we were under 100 people, whereas Epiroc Australia now has over 500 staff members. As Australia is a large country, our people have to travel a lot, making it hard to track down someone. Then there's the time difference; I'm based in Sydney, but the majority of our stakeholders are in Western Australia. There are definitely challenges, but I really like my job.



### SUE GOC

**Job:** Communications and Branding Manager, Epiroc Australia (based in Sydney)  
**Joined the company:** 2000  
**Best part of the job:** “The creativity and the freedom, and there's always something different happening”

worked in journalism, I like the writing part, and I also enjoy graphic design and photography – putting together a look to create an impression. An important thing I've learnt along the road is to be a good listener and not be afraid to ask what people think about your product or brand. Good decisions are based on good information.” x

We have 17 facilities in Australia, maintenance facilities not included, and every little thing had to be changed – from signs to clothing to documents. Plus, I've been in charge of giving information to all the right people, internally and externally, about the stand-alone process.

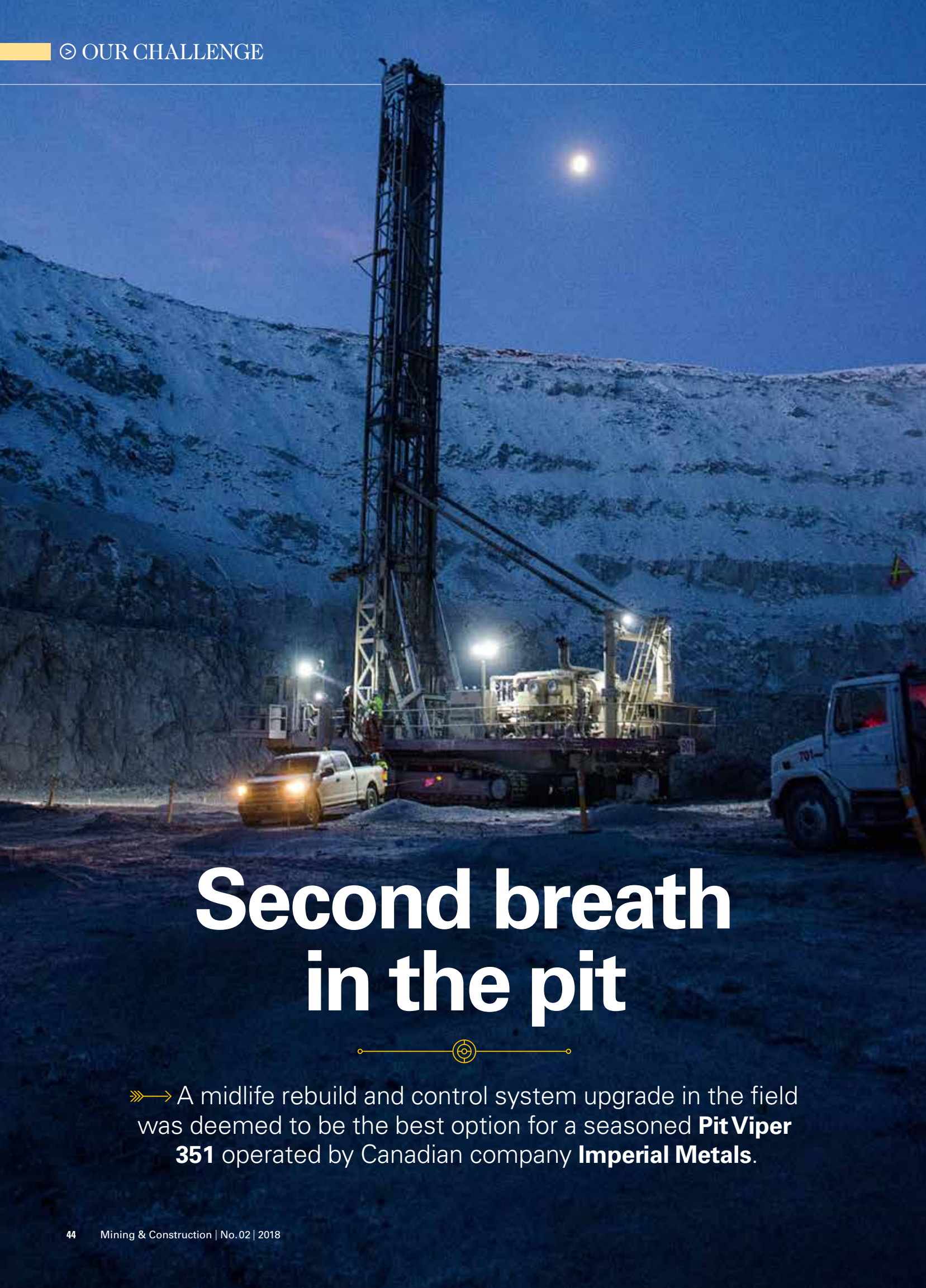
**THE MOST REWARDING** part of the job is when I make people engage with the brand, for example through a successful Facebook post or story. You put a well-crafted message out, people interact in real time and you get a great result. Having previously

**THE SWITCH TO EPIROC** has been a very positive experience. Since Atlas Copco was so big and diverse, the messaging wasn't necessarily clear at all times – but with Epiroc it's very precise. The targeted industry is smaller in that the customer groups are more similar. Epiroc is more open to partnerships and I also feel that communication has become an even more important area. It feels agile and refreshing. The switch has obviously put a lot of emphasis on branding, or rather rebranding.



As Communications and Branding Manager in Australia, **Sue Goc** works on both internal and external communication. The switch to Epiroc has made her job more fun and even more important.





# Second breath in the pit

» A midlife rebuild and control system upgrade in the field was deemed to be the best option for a seasoned **Pit Viper 351** operated by Canadian company **Imperial Metals**.

## 1

### THE CHALLENGE

**WHEN CANADIAN** mining company Imperial Metals opened the Red Chris copper and gold mine in northern British Columbia in 2014, they needed a modern, high-production drilling rig. The mining company had a PV351 running at one of their other sites that had been the primary production drill rig since 2005, and this unit required either a major overhaul or replacement. It was still performing, but 45 000 drilling hours were beginning to take their toll.



**Dave Robinson**  
Epiroc Account Manager for British Columbia and Alberta

A “MIDLIFE REBUILD” seemed like the best option for this workhorse. Sending the rig for a factory refurbishment in the US was, however, out of the question. The transportation costs would be ex-

cessive, and the cost of the downtime high. As the Pit Viper was the primary production drill, delays had to be kept at a minimum.

“Another issue was the operating system (OS) on the Pit Viper. The original OS had been discontinued, so some machines can start ex-

periencing issues with the electronics at this stage,” says **Dave Robinson**, Epiroc Account Manager for British Columbia and Alberta.

**THE ORIGINAL OS** did not provide the Pit Viper 351 with the same precision and automation capabilities as modern control systems, so if possible the electronics and software had to be upgraded in parallel with the rebuild. This, however, had never been accomplished in the field before in Canada.

## 2

### THE SOLUTION

**THE DECISION WAS** made to give the Pit Viper 351 a midlife rebuild and control system upgrade in the field. It was to be recommissioned to the Red Chris site, while a brand new drilling rig was commissioned at the original site.

Technicians disassembled the Pit Viper 351 on site while repairing or changing old parts for new ones, including a new engine and compression systems, undercarriage, rotary head, cylinder, rod support and carousel. Then came the task of modernizing the control system.

“The control system upgrade basically involved removing existing wiring,

boxes and conduits from the mainframe, tower and cab, and replacing them with new components. I think we replaced almost all of the electronics. It was a massive undertaking,” says Dave Robinson.

**WITH SUPPORT FROM** the Epiroc factory in Garland, Texas, the pre-RCS third party operating system was replaced with RCS-4. After this, the rig was disassembled, loaded onto several trucks and moved 1 100 kilometers to the Red Chris mine site. There it was reassembled, tested and commissioned in a period of ten days. The whole process took only a little more than a month.



[On location] Canada

## 3

### THE RESULT

**AT THE TIME** of writing, the Pit Viper 351 has kept on drilling for another 18 000 hours. The greatest improvement is in functionality and automation options.

“The raw performance is about the same after the rebuild. It’s a super-powerful monster of a machine,” says Dave Robinson. “But RCS-4 gives you higher reliability, many more options, faster support and far superior accuracy when drilling. If you use more force than necessary, you can shorten the life of the drill bits. We’ve calibrated and tested the rig on site, and the readings are very accurate. That’s what you want,” says Dave Robinson.

He finds the term “midlife rebuild” slightly misleading, preferring to think of it as scheduled maintenance.

“To me, ‘midlife’ implies the rig’s life is half over. But at 20 000 hours or so, our Pit Vipers are still young, just getting started.”

**IN FACT**, the rig has proved so reliable that Red Chris has not needed a back-up Pit Viper on the site.

More [bit.do/midlifeservices](http://bit.do/midlifeservices)





Tegelbruket is an open youth arena. In total, the premises are regularly visited by about a thousand young people each day.

Tegelbruket a success in Örebro

# Giving youth a chance

»→ Next to an old brickworks is the biggest youth initiative in Örebro's history. Epiroc has supported the venture right from the start.

**A** fulfilling way for young people to spend their free time is one of the most important things a community can offer. That's the idea behind Tegelbruket in Örebro – an open meetingplace, primarily aimed at young people aged from 16 to 25. Run on a not-for-profit basis, it is a joint venture between the organizer YMCA Örebro and adult educational association Sensus.



**Thomas Rasmusson**  
Operations Manager,  
Tegelbruket

"All are welcome here," says Operations Manager **Thomas Rasmusson**. "Tegelbruket is an open arena for young people who want to hang out, develop themselves and have a good time."

It also provides a base for various independent clubs – such as a boxing club and climbing club – that visitors can go to. In total, the premises are regularly visited by about a thousand young people each day. Activities at Tegelbruket include skatepark sessions, organized dance, sports, a gym and study support, where university students help high school students with their schoolwork.

**ANOTHER PIECE IN** the puzzle of how to stimulate long-term positive development is a mentoring program, giving young people aged 14–17 individual support for a year in areas such as career choices and homework help. The initiative is run in collaboration with various external partners, among them Epiroc.

"Epiroc has been on board from the start and has contributed about a third of the 250 mentors that we've been able to provide. The company is usually also involved in the big events that we organize. It means so much to have large employers helping out in this way," says Thomas Rasmusson.

**HE THINKS IT** is hard to overestimate Tegelbruket's significance for the young people of Örebro.

"We're important to a huge number of people. Undoubtedly, they include some youngsters who would have gone down the wrong track otherwise – so there is a great social benefit. When it comes to avoiding social exclusion, the benefit is massive." ✕



[On location]  
Sweden



[On location]  
Mozambique

On March 1, 60 school desks – made of wood from hoods that came with Pit Vipers – were delivered to two schools in Mozambique.

## WASTE PUT TO USE IN MOZAMBIQUE

Superfluous wood that would be thrown away – and two local schools in need of desks for the students. For Epiroc Mozambique, it was a no-brainer.

**H**AVING A SCHOOL desk should be a given for any child going to school. In the Tete province in Mozambique, it's not. That's why **Angelica Coana** and **Bill Jenkins** at Epiroc Mozambique – Logistics Coordinator and Country Manager respectively – thought twice before letting the wooden hoods that came with Pit Vipers, delivered by Epiroc to customer Vale, go to waste.

"We contacted the local authorities, asking if they'd like us to manufacture school desks and donate them to two schools: EPC Mutarara Moatize and EPC Xitata. They were more than happy, of course. I visited the schools and took some photos, before the design was made and a carpenter was assigned to manufacture the desks," says Angelica Coana.

Epiroc Mozambique purchased the steel needed for the manufacturing and a total of 60 desks were made. They were delivered on March 1, much to the satisfaction of both the customer and the schools.



**Angelica Coana**  
Logistics Coordinator,  
Epiroc Mozambique

"Vale was very positive and suggested that we engage in more social projects in the future. And the schools... they were so, so happy. A lot of their students were sat on the floor before receiving the desks. We all know that children are the future, and being able to improve their conditions to study feels truly special," says Angelica Coana.

She adds: "I'm hoping that this project can inspire others at Epiroc. The need we identified is common in Africa, so we should try to put more wood to use." ✕

Read more

[epirocgroup.com/en/sustainability](http://epirocgroup.com/en/sustainability)

## Down and running

**E**VER RACED THROUGH a mine, dressed in runners' gear with a hard hat on your head? That's what some 260 people did outside of Stockholm in mid-September. They were taking part in the annual Sickla

Mine Run, a 2.5 kilometer race that starts and ends above ground but otherwise is held in the Sickla Mine, where Epiroc equipment is tested.

"This is the fourth time the race has been held," says former Epiroc employee **Lennart Gustafsson**, who came up with the initial idea.

"It has been a great success, and it was particularly pleasing to see that more than half of the runners were women."

**THE RACE IS** organized by local sports club Järla IF and is open to the public. Gustafsson has been involved since day one and is responsible for the underground part of the race.

"The biggest challenge is to make sure that the surface and light conditions don't pose any danger to the runners, while keeping the mine vibe," he says. ✕



**Lennart Gustafsson**  
former employee,  
Epiroc



More [sicklaloppet.se](http://sicklaloppet.se)



# BLAST FROM THE PAST YEAR 1962

Innovative products and a wide array of customers: Epiroc is a new company with a long and rich history, dating all the way back to 1873. In each issue of Mining & Construction, we glimpse in the rearview mirror.

☑ Gustaf Höök  
📷 Gerard Gery/Paris Match (via Getty Images)

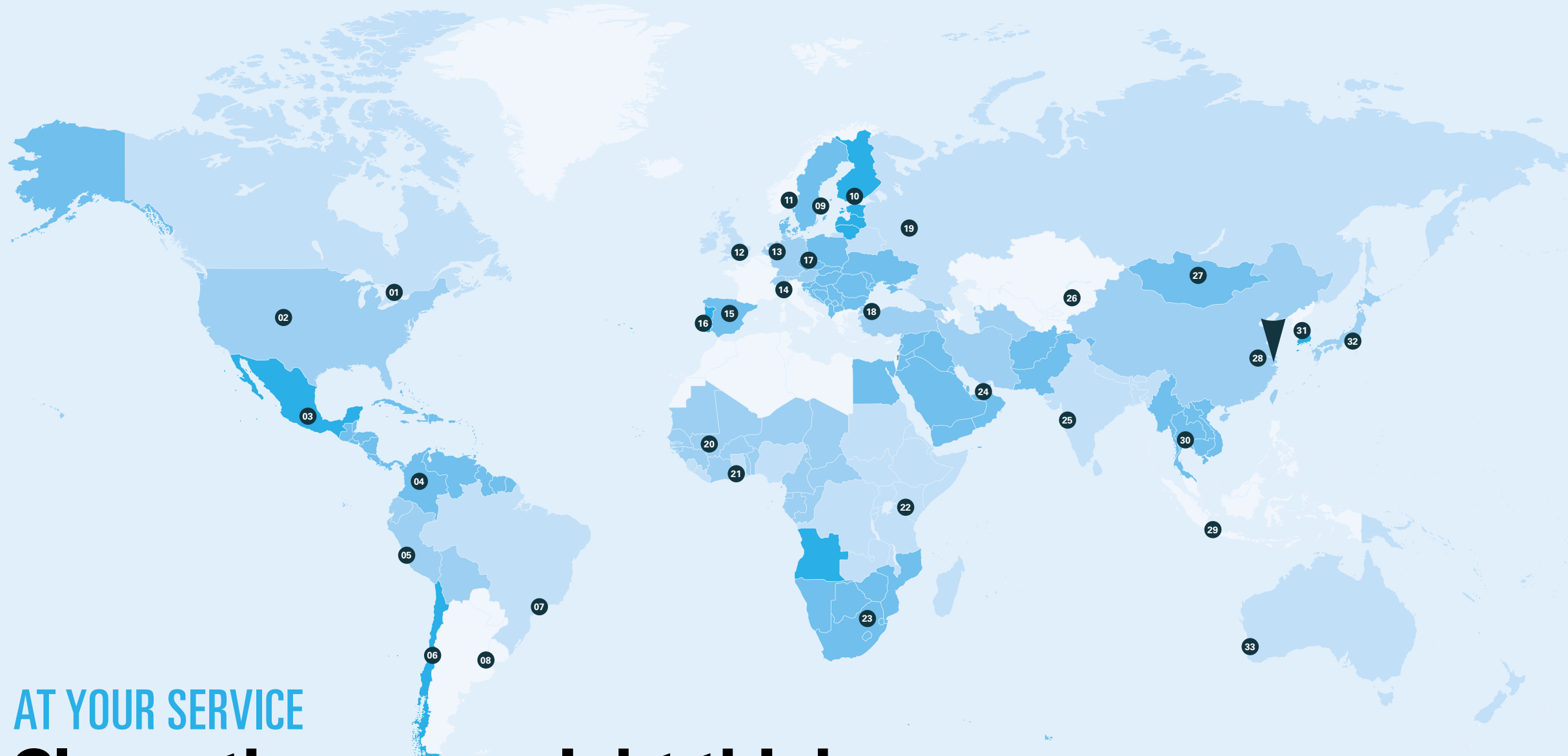
## Portfolio Mont Blanc Tunnel

On August 15, 1962, miners under the Mont Blanc massif covered their ears with their hands, waiting for the explosion that would open the tunnel connecting France to Italy. It marked the beginning of the end for the huge project, which posed various challenges for the two contractors each responsible for 5 800 meters of tunnel. Italy's Condotte d'Acqua – faced with granite, schist, coal schist, and fissured and deteriorated rock – had to use light rock drills, and the company selected Atlas Copco equipment (and Atlas Copco personnel for all servicing) in order to succeed. For Atlas Copco, the Mont Blanc project was the culmination of the Swedish Method – a superior combination of a strong but light drill with a pneumatic pusher leg and tungsten carbide drill bits.

The Mont Blanc Tunnel opened for traffic on July 16, 1965.

More [bit.do/montblanctunnelfacts](http://bit.do/montblanctunnelfacts)





## AT YOUR SERVICE

# Closer than you might think

OUR CUSTOMERS ARE located all over the world and so are we. There is always an Epiroc office to turn to, making us truly local. At the same time, we are a global enterprise with worldwide resources. We have Customer

Centers in 33 regions. In each one, there are one or more Service Centers.

All this supports our goal: Count on us to listen, collaborate and deliver the right solutions for you.

- |                          |                                    |   |                                  |
|--------------------------|------------------------------------|---|----------------------------------|
| 01 Canada<br>Toronto     | 07 Brazil<br>São Paulo             | 13 Europe 1<br>Essen                          | 18 Turkey<br>Istanbul            |
| 02 USA<br>Denver         | 08 Argentina<br>Buenos Aires       | 14 Southern Europe & Northern Africa<br>Milan | 19 Russia<br>Moscow              |
| 03 Mexico<br>Mexico City | 09 Sweden<br>Stockholm             | 15 Spain<br>Madrid                            | 20 Mali & Burkina Faso<br>Bamako |
| 04 CVCA<br>Bogota        | 10 Finland<br>Helsinki             | 16 Portugal<br>Lisbon                         | 21 Ghana<br>Obuasi               |
| 05 Andean<br>Lima        | 11 Norway<br>Oslo                  | 17 Central Europe<br>Prague                   | 22 Eastern Africa<br>Nairobi     |
| 06 Chile<br>Santiago     | 12 UK & Ireland<br>Hemel Hempstead |   |                                  |



[ In focus ]  
**Shanghai, China**

## Hello there!

### What's happening in Shanghai?

ON NOVEMBER 27–30, hundreds of thousands of people will go to Shanghai to visit Bauma China, Asia's largest trade fair for the construction industry. Epiroc is exhibiting for the ninth time a row. We talked to **Mavis Wang**, Marketing Manager at Epiroc China and one of Epiroc's exhibition organizers.



**Mavis Wang**  
Marketing Manager,  
Epiroc China

**What can visitors expect from Bauma China this year?**

"Visitors will have the opportunity to see the industry's upgrade in more than one way. New products will be launched with better technology and a more environmentally friendly focus. Digitalization will also be one of the main focus areas. Epiroc will have two customer workshops at the fair for two product launch activities, and also one contract signing ceremony."

**What impact does Bauma China have for Epiroc?**

"The Bauma trade fair is the most important event in this industry. First and foremost, it's a great opportunity for us to strengthen relationships and meet business partners, old and new."

**Apart from Bauma China, what's happening at Epiroc in China right now?**

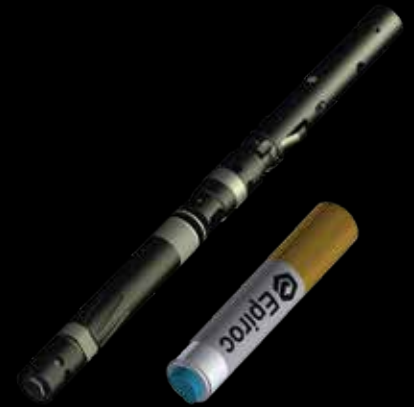
"Digitalization is improving our operational efficiency. At the end of summer we launched a service portal app where we can follow our service resources at every step and help them along the way – for example, by pointing out the availability of our service engineers at different locations. Our first focus has been on improving the internal work efficiency of the service team. In our next phase of the project, customer experience optimization will be the major focus." x

Find Epiroc in your country: [epiroc.com](http://epiroc.com)



# DiscovOre Compass

## Good measure



»— The unique core barrel head assembly of the DiscovOre Compass uses wireless communication technology and will streamline geotechnical demands during exploration drilling. **Patrick Salvador**, one of its creators, goes into detail.

**W**hat does the DiscovOre Compass do?  
 “It records core sample orientation at the bottom of the hole. The probe measures and records the orientation and inclination of the core and sends the data wirelessly to the handheld unit when it is retrieved back to the surface.”



**Patrick Salvador**  
 R&D and Marketing  
 Product Specialist,  
 Rock Drilling Tools  
 division

The DiscovOre Compass makes it easier for the driller to record the information geologists are asking for. It’s a very precise measuring tool and the increased range between the reader and orientation instrument makes it very easy to use. Also, the long-life battery means there is very little maintenance.”

### What was your role in developing this product?

“I integrated the electronics into the mechanical components and ensured proper function and reliability of the whole system. I created multiple CAD designs and used 3D printers to create the prototypes. We then tested the product on a drill rig and made further improvements to its usability and durability.” ×

### How is it different from other core barrels?

“The DiscovOre Compass has an increased range and a reader that makes it possible to archive the results as digital data. No manual editing is needed and reports can be exported from the controlling handheld unit via Wi-Fi, Bluetooth, email or the cloud. Our compass will fit in a standard core barrel and no core barrel extensions are required. The Compass head assembly is the same length as a standard head assembly. It is also shock resistant and waterproof cased.”

### How will this product improve your clients’ business?

“Geologists always ask for a lot of information and drillers need to comply, which means a lot more work.

### The DiscovOre Compass

- Compatible with all Epiroc core drilling rigs
- Has a non-magnetic orientation tool, an inclination accuracy of ±0.1 degrees, an orientation accuracy of ±0.5 degrees and a temp range of -15 °C to +70 °C (+14 °F to +140 °F)
- On the market in 2019

