MINING & CONSTRUCTION

MECHANIZED ROCK EXCAVATION WITH ATLAS COPCO – NO 1 / 2013.

ATLAS COPCO CELEBRATES 1873 140 2013

T-WiZ is drillers' best friend

The road to better blasting in South Africa
Page 3

High-tech crushing in Korea
Page 18

New life for an old favorite
Page 22

Atlas Copco

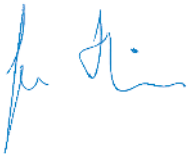
EDITORIAL

Continuous access to rock drilling tools is the lifeblood of the mining and construction industries, and the global demand for our products is higher now than at any time in our 140-year history. To meet this unprecedented demand we have been implementing a series of measures that I am pleased to say is starting to benefit our customers worldwide.

These measures consist of major investments in three key areas. Firstly, we are increasing our production capacity across the globe. For example, at our plant in Fagersta, Sweden, we have increased the capacity by some 40 percent. This is the largest capacity increase ever within Atlas Copco and we are boosting our capacity in the USA, India, Canada and China as well.

Secondly, we are investing in strategic acquisitions such as H&F Drilling in the UK, NewTech in the US and most recently Sanshan in China. Sanshan will provide us with complementary products, increased capacity and a higher market share in China. It also gives us a sales and marketing organization which will make our products and expertise available to many more customers throughout the country.

Lastly, we are continuing to strengthen our global presence with new Atlas Copco companies in an increasing number of emerging markets, not least in Africa. Some of these developments are highlighted in this issue, confirming why Atlas Copco is, and should be, first in mind and first in choice.



JOHAN HALLING
President
Rock Drilling Tools

CONTENTS

FEATURES

3 In the iron mines of South Africa

9 Top results with new rock drilling tools

12 Best of the best for Bauma Germany

14 Why safety is a global priority

16 Mechanized scaling at Tara Mines

18 Perfect crushing in Korea

22 Reborn drill rig becomes Asian favorite

28 Center of competence for large/deep holes

32 Grouting success at Turkey's Boyabat dam

PRODUCTS & PROGRESS

8 A look at the new cab for Pit Viper 351

27 Exploration drilling with Explorac 100

30 Scooptram rolls out new electric loader

31 Opportunities for rotary and PDC drilling

TECHNICALLY SPEAKING

20 How to get ventilation costs under control

MARKETPLACE & IN BRIEF

34 Marketplace – In Brief.

MINING & CONSTRUCTION is published by Atlas Copco. The magazine focuses on the company's know-how, products and methods used for drilling, boring, rock reinforcement and loading worldwide.

PUBLISHED BY Atlas Copco Rock Drills AB, SE-701 91 Örebro, Sweden. www.atlascopco.com Tel: +46 (0)19 670 70 00.

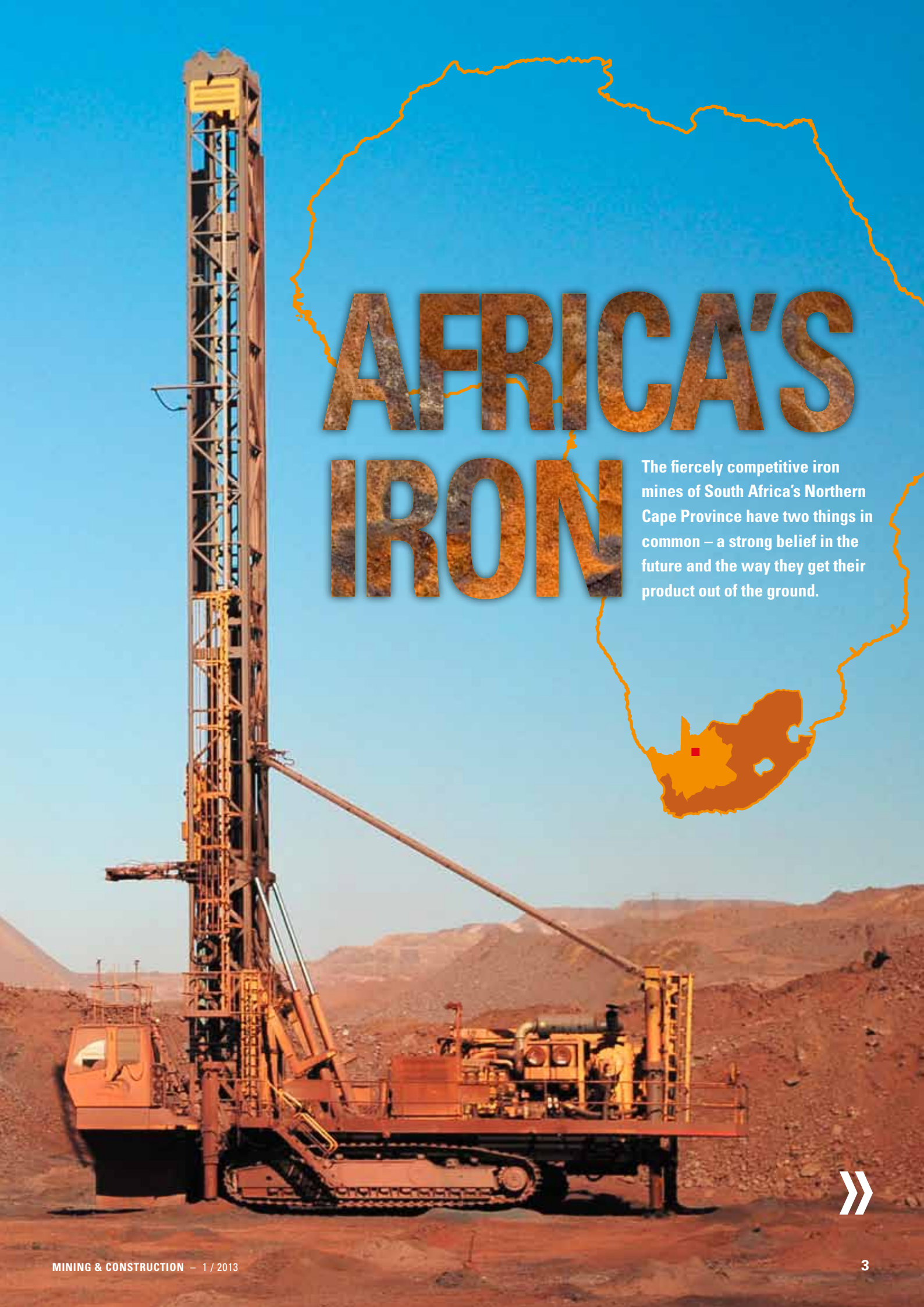
PUBLISHER Paula Blamberg, e-mail: paula.blamberg@se.atlascopco.com

EDITOR Terry Greenwood, e-mail: terry@greenwood.se

ADVISORY BOARD Ulf Linder, Lars Bergqvist

EDITORIAL PRODUCTION & DESIGN Greenwood Communications AB, Box 5813, SE-102 48 Stockholm, Sweden. Tel: +46 (0)8 411 85 11. www.greenwood.se

PRINTED BY Modintryckoffset AB, Sweden 2013.
WEBSITE www.miningandconstruction.com



AFRICA'S IRON

The fiercely competitive iron mines of South Africa's Northern Cape Province have two things in common – a strong belief in the future and the way they get their product out of the ground.

Working the iron benches of South Africa: Pit Viper 351 rotary drill rigs at the Kumba Iron Ore mine, and right, a Pit Viper 271 at King mine.

Drillers in South Africa's Northern Cape Province use rotary and DTH technology to maintain high productivity and efficiency on the iron mines' hard rock benches.

When Jacob Zuma, President of South Africa, announced a major infrastructure upgrade for the west coast it was good news for the iron ore producers of the Northern Cape. When complete, the program will boost freight transport in the region to 100 million tonnes per year which means a substantial increase in the capacity of the roads and railways used by the mines to get their products to ports for worldwide export.

This development will also greatly benefit the nation. Practically all of South Africa's iron ore is mined from the large open pit operations in the Northern Cape where competition is fierce and high productivity and efficiency are essential, particularly in view of the present economic downturn.

Against this background, the equipment being used to drill the blast holes – Pit Viper and ROC L8 rigs from Atlas Copco – is a key element for both the mines themselves as well as mining contractors. Dennis Stonefield, Applications Manager with Atlas Copco in Gauteng, points out that there are more than 30 Pit Viper rigs as well as ROC L8 units at work in the region with more Atlas Copco blasthole drills on order.

"For many mines the Pit Viper has become the equipment of choice and this is due to a combination of three things," explains Stonefield. "They are very robust, they represent the latest drilling technology and they come with strong technical support. I also think it is true to say that the Pit Viper series has set a new standard in the industry."

In the Kalahari area, the iron is dominated by the blood red mineral hematite between the towns of Kuruman and Postmasburg in the north of the province. The comparative purity of the ore here makes it exceptionally hard which presents a major challenge for high productivity drill and blast operations.

To tackle these conditions on the benches, the mines in this area as well as elsewhere in the province, are using the ROC L8 mainly for presplit drilling equipped with DTH (Down-the-Hole) hammers and Pit Viper rigs alternatively, using rotary drilling or high pressure DTH drilling.

Iron clad optimism

Despite the recent decline in the global market for iron ore, largely due to a slowdown in China, the iron producers of the Northern Cape are optimistic and investing in increased efficiency for the future.

Kumba Iron Ore at Sishen, near Kathu, is a typical example. Owned by Anglo American, Africa's largest iron ore producer and the tenth largest in the world, Kumba operates a massive, single-pit, open cast mine that stretches 13 km north to south, and 2.5 km across at its widest point. As the mine deepens, the width is expected to reach 5 km.

Opened in 1947, the Sishen pit is now big enough to house most of the mine's ore preparation plant and ancillary facilities. More importantly for the market, Kumba claims the most consistent and highest quality iron ore in the world with the Sishen operation producing some 40 million tonnes per year.

Further to the south is Sishen's sister mine, Kolomela. Formerly known as Sishen South, this site officially opened in 2012 but started shipping ore five months ahead of schedule. When the Kolomela pit reaches full production in 2013, it will increase Kumba's ore output by 9 Mt per year.

Another major operator in the area is Assmang. Jointly owned by African Rainbow Minerals (ARM) and Assore, Assmang is a steel industry specialist supplier whose iron ore resources complement its manganese operations, both north and south of Sishen.

The company's Khumani complex, with a mining lease covering some 7 300 hectares (formerly known as BMK), includes three main properties; "Bruce" which started operating in 2007 and "King" which opened in 2011. There is also a development property, Mokaning, as well as two farm properties that have not yet been exploited.

The Kumba operation

In common with most other mining operations in the area, Kumba's Sishen pit operates 24 hours a day which places high demands on all of the equipment and especially the drill rigs. Expected availability and utilization figures are high, so maintenance is carefully planned to avoid downtime.

The huge open pit is normally worked with single-pass rotary drilling on benches 18 m high. The drilling fleet, including up to 17 Pit Viper 351 rigs, drills 311 mm vertical blast holes using Secoroc tricone bits and Teamalloy pipes. This is achieved with a burden of 7.2 m and a spacing of 8.3 m.

The Atlas Copco Pit Viper 351 drill rig with the management and marketing team of Atlas Copco Drilling Solutions in Texas while visiting the Sishen mine together with representatives from Atlas Copco South Africa. From left, Daniel Manin, Dennis Stonefield, Willie Botha, Peter Salditt, Johan Goosen, Ben de Beer and Chris van den Heever.

Overview of the massive iron ore mine at Sishen: Pit Viper 351 rigs drill the blastholes while ROC L8 rigs take care of crest drilling at the Sishen mine.

In addition, the rigs are equipped with navigation systems and a laser-based, high wall detection device on the side of the cabins for added visibility and safety.

One feature of the PV-351 that is particularly appreciated is its easy and rapid tramming capability which contributes to the mine's flexibility. For short moves between hole positions, the tower can be kept in the upright position but can also be lowered for longer tramming. In each case, this so-called "live" tower system enables it to be raised or lowered with the complete drillstring in place.

Atlas Copco will provide support to the service and maintainance team of Sishen through product specialists with field service technicians available on an "as needed" basis. Efficient parts supply and minimum downtime is ensured by having established a parts store in Sishen. A fully equipped assembly yard, dedicated to the assembly of seven PV-351 rigs has also been established and at one point in time here, three PV-351 units were at different stages of assembly. The first rig assembled by the Atlas Copco team reached commissioning in just nine days.

These new rigs will join ten PV-351 rigs already in operation at the site and as each one is assembled it is trammed to the mine's test area and put though its paces until the mine management is satisfied.

All of the rigs are equipped with Atlas Copco's RCS (Rig Control System), which facilitates a wide range of functions such as safety interlocks, auto-leveling, drill performance monitoring and drilling data collection.

Kumba's latest rigs also include Ansul fire protection, a drillstring thread greasing system, a modified electrical isolation system, emergency shutdown, wraparound decking for easy access to all service areas together with hydraulically retractable surface-to-walkway stairways.

Once all of the rigs have been delivered, Kumba will have the largest fleet of Pit Viper 351 rigs in the world. The rigs are delivered totally encased on special low-bed trailers directly to the site from Cape Town.

The development of Kolomela Mine, located 9 km southwest of Postmasburg and 85 km south of Sishen, is one of Anglo American's "big four" expansion projects (the other three being in South America). Unlike Sishen, the multi-pit Kolomela complex is applying the DTH drilling method using Atlas Copco DML as well as two ROC L8 rigs.

Here, the rigs work on 12 m high benches and drill 203 mm holes to depths of 13–14 m with a pattern of 5 x 5 m. Depending on

Northern Cape miners display their strong belief in the future. Here, Pit Viper 271 drill rigs hard at work at Khumani's King mine.

the type of formation, peneration rate varies widely from 10–20 m per hour.

The Khumani operation

At the King Mine on the Khumani complex, the drilling fleet is dominated by Atlas Copco's diesel powered Pit Viper 271 rigs. Unlike at Sishen, Khumani chooses to use the high pressure version of the PV-271 with DTH (Down-The-Hole) hammers to tackle the ore beds that are well known for their extreme hardness.

However, the ore here is generally well exposed and the mine benefits from a low stripping ratio of 0.7–0.9 whereas other mines in the area need to manage a ratio of around 2.7. The benches are 10.4 m high and holes are drilled vertically to a depth of 11.4 m including 1 m of sub-drilling. In drilling the overburden the usual drill pattern is 5.5 m x 6.5 m as allowed by the rock type such as sandstone, shale and weathered material.

The underlying ore is often very hard here and some drill bits last only two hours. DTH drilling is used with 165 mm bits and Secoroc 64 hammers and others, but the mine is continuously trying to reduce drilling costs.

Gerrit Loedolff, Manager of Mining Operations at Khumani, explains that a current priority is to examine rotary drilling options for 251 mm holes. "Large diameter holes reduce drilling cost and, used in conjunction with electronic blasting, reduces blasting cost as well.

"We will be using the converted PV-271 because of sufficient compressor capacity to ensure adequate chip flushing. The biggest enemy of a tricone bit is drill chippings in the hole, and incorrect bailing velocities can have an impact on drill rod life."

In switching from 165 mm to 251 mm holes, it is expected that the drill pattern will change to 6 m x 6 m and that the volume of blasted rock per hole will increase from 16 m^3 to approximately 36 m^3.

In addition to changing drill pipes the conversion will require lowering the pressure of the compressor to the minimum level, as well as changing the carousel, rod support, the breakout systems and tool handling accessories. The tricone bits will initially be from Secoroc, but Loedolff says that the mine will test a variety of products including bits used by neighbouring mines.

Drill rig availability at Khumani is increasing. "Availability of the PV-271 rigs is in excess of 85 percent and ROC L8 rigs are above 75 percent," reports Loedolff. "As expertise and maintenance practices »

improve, so does availability – remember, both machines are fairly new to the maintenance crew and most of the operators are in the learning phase."

In the past couple of months, the availabilities of both machines have increased. The ROC L8 operates mostly on outcrops and is exposed to difficult drilling conditions such as uneven floors and weathered rock. Although Khumani's Bruce Mine is already in full production, and King Mine will reach it this year (2013), Loedolff says that the ROC L8 rigs will still be used in some drilling of virgin ground as well as pre-splitting holes. The latter are only drilled at final pit limits with a 1.8 m spacing, according to the conditions.

Procedures guided by safety

The drillers have to tackle three main ore types; laminated iron ore, drilled at 120–130 m per shift (using the PV-271 and single-pass DTH drilling), loose conglomerate, and compact conglomerate. Very abrasive phyllites and quartzites are also encountered as well as "soft" iron on the Mokaning development property.

In the more difficult conglomerates, the typical drill pattern of 5.5 m x 6.5 m is reduced to 3.5 m x 4.0 m. The holes are charged near the stem to reduce oversize material at the top of the holes.

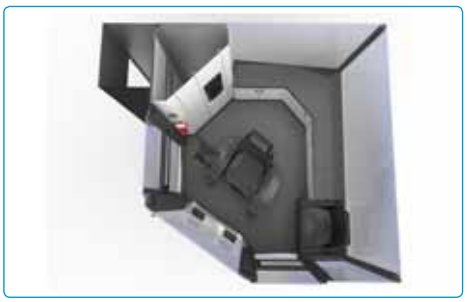
The frequent reviews of drilling para–meters also require complete reviews of procedures. "New drilling procedures will always be done with safety as the guiding factor," says Loedolff. "A complete risk assessment will be done, which will be the guide for the new procedure to ensure that the hazards are eliminated or reduced. Hole spacing and hole diameter are factors that will be considered to ensure the correct powder factor can be applied practically."

He also emphasises the importance of good operators in reducing the cost of drilling consumables, as well as unit cost versus durability. "A good operator will be able to extract more meters out of his consumables. That's why we spend a huge amount of time and money on training drill rig operators. Good operators equal a huge saving in consumables."

The Atlas Copco equipment, which also includes breakers and stationery compressors, is clearly contributing to efficiency, but the search for further improvement continues. "The mining industry as a whole will never stop looking at blasthole procedures," says Loedolff, "and if we can do it more safely, faster and cheaper, we will pursue these options."

New "supercab" for the Pit Viper 351

A new high-tech cab with first class comforts: Designed to withstand extreme temperatures, its tinted windows are also extra large for increased visibility...



...and an excavator-type chair with integrated RCS controls and a trainee seat. Deliveries of PV-351 drills equipped with the new cab will start from August this year.

The operator and the working environment was given top priority when Atlas Copco designed the new cab for the Pit Viper 351-series. This is an ergonomically designed high-tech "supercab" that is safe and extremely comfortable.

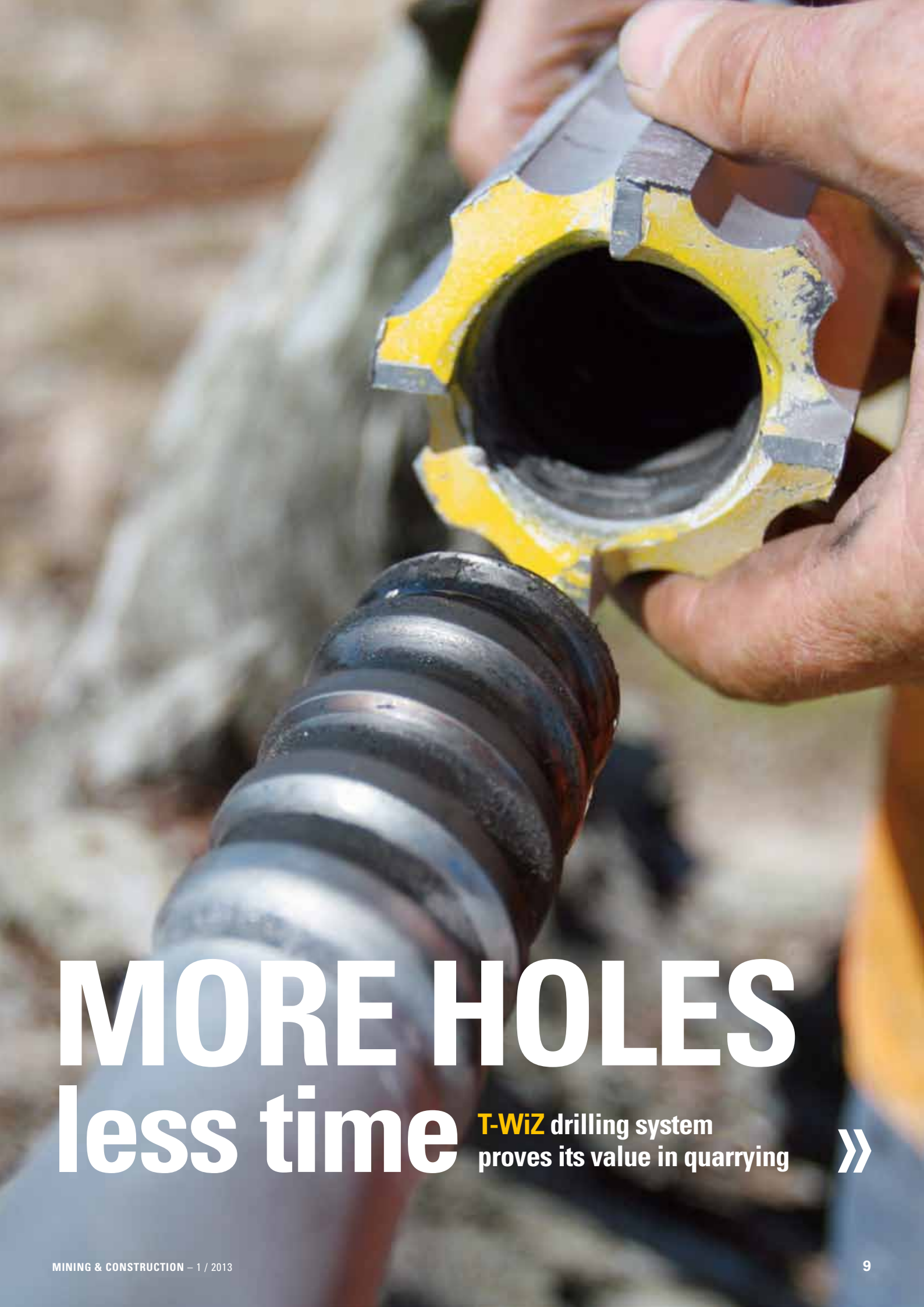
Designed to withstand excessive heat as well as intensely cold climates, the new cab is also larger than its predecessors, providing space for several people at the same time.

The tinted windows are also large for increased visibility and the excavator-type chair has integrated RCS (Rig Control System) controls.

Among the many other advanced features are infrared touch screens that feed the drilling data to the operator and safety optional monitors that can show movement from a ground surveillance system and video feeds from safety cameras mounted on the rig.

There's a dedicated trainee seat with seatbelt and plenty of room for storage with options for refrigerator, microwave and a heated operator's seat.

Operators will also be delighted to know that drilling noise inside the cabin has also been greatly reduced thanks to improved pressurization, door sealing and insulation.



MORE HOLES less time

T-WiZ drilling system proves its value in quarrying

New benchmark: The T-WiZ drilling system gives up to 30 per cent longer service life in the Marbäck quarry.

All round improvement: Less wear on the threads, easy uncoupling of the rods and fewer rod changes makes the job simple and efficient.

At the Marbäck stone quarry in Sweden, the newly arrived T-WiZ drilling system is helping Voglers AB to boost productivity.

A steep and narrow track runs along the ridge of the Marbäck stone quarry in southern Sweden, leading to the highest point overlooking a crushing facility, an aggregate plant and forests and lakes in the far distance.

Perched on fractured rock just before the edge of an 80 meter drop, a SmartROC D7C is performing tophammer bench drilling equipped with the latest rock drilling tools with T-thread technology from Atlas Copco Secoroc that is helping to drill blast holes as deep as 28.5 m.

Huge savings

Launched at the end of 2011, T-WiZ has set a new benchmark for performance in surface and underground mining operations. The system consists of drill rods and shank adapters that offer greater stability and up to 30 per cent longer service life, which means that fewer rod changes are required.

"The longer life span of the T-WiZ rods converts into huge savings on time, materials and effort," says Frederick Winroth of Swedish drill and blast contractor Voglers AB, who was among the first drillers to try out the new T-WiZ system

The Marbäck quarry site, some 4 km south of the town of Ulricehamn, provided an ideal environment for demonstrating the patented T-WiZ drill system. Since 1994, when the site opened, Marbäck has been producing hard, grey gneiss aggregate to be used for concrete ballast in road construction applications.

"I first got the new T-WiZ rods while working at sites in the Gothenburg region, before the shank adapters were even available," says Winroth. "When I had the full system, it all worked perfectly and the benefits were impressive."

Having kept a close track on the performance of T-WiZ and comparing with previous equipment, Winroth shows the documented data using different drill bits where he notes an average penetration rate of 1.5 m/min.

He explained: "Normally it takes at least 30 minutes to back away from the blast hole, set up the rod collector and change drill rods. So minimizing the number of rod replacements makes a big difference to bottom-line production. Previously, I would also count on having to struggle to uncouple the drill rods. Now you just press the release button and the T-WiZ rods break away easily."

No margin for error

When M&C visited the site, a first section of 76 mm diameter blast holes had just been completed using the T-WiZ system. "It was a challenge," said Winroth and pointed out the sloping terrain and difficult rock formations. To position the drill rig he used an anchor and winch.

"At these depths there is no margin for error. You have to achieve as close as possible to 100 per cent straightness so that the explosives match the hole. Getting it right makes all the difference between giant boulders or gravel when blasting," he said.

When each hole is completed it is sealed with a cone plug to prevent rain, snow and dirt from entering. To minimize downtime, a back-up set of T-WiZ drill rods are stored at the site, as well as extension rods that can be used for an additional 3–4 m of drilling. During drilling, the majority of wear and tear is placed on the drill rod, and although the operation is monitored through the rig's Measure While Drilling system (MWD), Winroth was relying on his experience to manually inspect the equipment and the seven drill rods in the rod handling magazine.

"Blue smoke or percussion with a hollow sound are typical signs of drill rod faults as a result of loose joints, overheating or both. With T-WiZ, I haven't noticed any of that," he said. "This batch of T-WiZ equipment has completed about 7–8 000 drillmeters and is still performing well."

Cutting downtime and boosting productivity is what T-WiZ was designed for, and with automatic rod changing and less manual work involved, Winroth was confident that the next three rows of blast holes would be completed within three weeks.

"Thanks to the long lifespan of T-WiZ, 300 drillmeters per day is not a problem," he added. "Downtime has also been minimized which means that the company achieves more holes in less time and that's also positive for me."

THE MAGIC OF T-WIZ

T-WiZ is a tough and patented T-thread drilling system offering:

- Up to 30 % longer service life
- Greater stability, easy break-out
- More holes per shift and drill rig
- Three dimensions: T-WiZ 38, T-WiZ 45, T-WiZ 51
- Reduced total drilling cost

"T-WiZ represents a huge saving on time, material and effort," says Frederick Winroth, one of the first drillers in the world to test the new T-thread system.

bauma 2013 - Springtime IN MUNICH

Construction professionals from around the world will gather in Munich, Germany this April for Bauma 2013 – the 30th trade show devoted to the international construction industry. The show at the New Munich Trade Fair Centre (April 15–21), promises to draw some 400 000 visitors from more than 200 nations – and there's one booth they will not want to miss.

With more than half a million square meters of exhibition space, the Bauma trade shows in Munich are the largest in the world.

The upcoming construction show will see more than 3 000 companies competing for attention – but *Mining & Construction's* tip is to look for Booth 1108 in the outdoor area.

Here, Atlas Copco will be displaying its range of drill rigs and much more designed to make construction easier and faster, but above all more cost efficient.

FlexiROC T45 slashes fuel bills

Star of the Atlas Copco show will be the FlexiROC T45, a new tophammer surface drill rig equipped with the latest rock drill, COP 3060. Like its predecessor, the ROC F9, the FlexiROC T45 is a great production workhorse but now offers higher production capacity as well as outstanding fuel efficiency.

Field studies show that, depending on the rock conditions, the rig consumes only half as much fuel as the ROC F9 using the same rock drill. And the COP 3060 rock drill, using the T60 drill string, drills large diameter holes with top performance and reliability.

Mario Santillan, Product Manager at Atlas Copco Surface Drilling Equipment, says: "It is a great accomplishment to increase productivity and drilling capacity while reducing fuel consumption so dramatically."

The key to this achievement lies in a number of innovative solutions which effectively reduce unnecessary energy losses and increase productivity. For example, the airflow and the dust collector fan speed can all be adjusted by the operator during drilling, according to actual working demands. The speed of the engine and compressor are then adjusted automatically.

In addition, the number of hoses and couplings have been drastically reduced, the smaller hydraulic tank makes it possible to use biodegradable hydraulic oil and the rig is also easier to service and maintain. Added to this, the Tier 4 engine (Tier 3 optional) reduces particle emissions by 90 percent.

Where the smart money goes

Next in the spotlight is the SmartROC T40, a drill rig which made its debut at the Intermat show in Paris in 2012 and like the FlexiROC T45 has also been highly praised for its low fuel consumption.

During tests in five European countries this rig also proved that it is capable of reducing fuel costs by up to 50 percent compared to previous models and under normal drilling conditions.

This is thanks to a completely new design platform which automatically regulates the amount of energy required for any given function, optimizing the power supply to vital components and decreasing the risk of waste through hydraulic leakage.

As a result, the engine always runs at optimum efficiency which not only reduces fuel consumption but also reduces the number of times the rig has to stop work in order to be refuelled. The rig can also be equipped with a silence kit and radio remote control.

Tough crusher makes an impact

As Atlas Copco is now a major supplier of stone crushing equipment, this aspect of the construction business will also be well represented in the display with the Atlas Copco Powercrusher PC5 impact crusher.

The PC5 is an extremely robust crushing machine designed to withstand the toughest of conditions while maintaining a high output capacity. It is ideal for processing soft to medium-hard natural stone for road building and construction and demolition materials. In certain applications it can be used as a primary unit, eliminating up to two crushing stages.

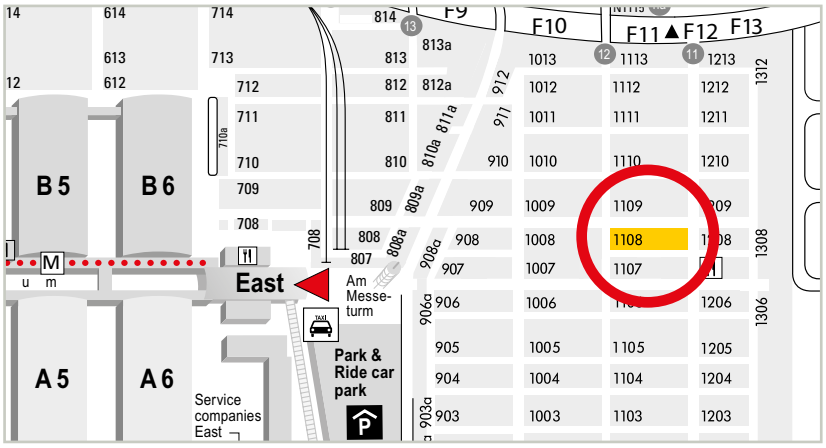
Cutting edge way to remove rock

Another area in which Atlas Copco has recently taken a strong position is the dimension stone industry with the SpeedCut range of diamond wire saw rock cutters.

Originally designed exclusively for dimension stone quarrying, the versatile SpeedCut has proven to be equally at home on urban construction sites. As infrastructure projects increase in inner city areas which are sensitive to noise and vibration, the ability to carefully cut and remove large slabs of rock by cutting is one alternative to drilling and blasting.

A case in point is the City Line project

Star of Bauma: The FlexiROC T45 surface drill rig which drills 89–140 mm diameter holes with fixed boom and 89–127 mm holes with folding boom.



Location of Atlas Copco at Bauma.

Powercrusher PC5: A robust and productive way to produce perfect stone aggregates.

in Stockholm, Sweden, where SpeedCut has been used in a major upgrade of the city's commuter transport system. SpeedCut can cut both vertically and horizontally and with a cutting speed of 45 m²/h is claimed to be the fastest diamond wire saw on the market. It is also exceptionally quiet which makes it a valuable resource for contractors as it means that rock cutting work can be carried out during the night.

SpeedCut wire saw cutter: An interesting alternative for urban construction.

Boomer XE3 C: Computerized and unbeatable for driving road and rail tunnels. At Bauma it will feature the new COP 4038 rock drill.

Top class tunneler stays in front

When it comes to tunneling there are few face drilling rigs to compete with the Boomer XE3 C. This three-boom, computerized rig is well known around the world and will be on show at Bauma equipped for the first time with Atlas Copco's new, superfast rock drill COP 4038.

The Bauma show represents the global launch for this high frequency, 40 kW rock drill which is designed to drill 43–64 mm holes, 20–30 percent faster than its predecessor in hard rock conditions.

In addition, the rig's heavy duty, hydraulically controlled BUT 45 booms, high-reach console and advanced Rig Control System (RCS), reaffirms the Boomer E-series' reputation for superior productivity.

New technique for fresh air

Proper ventilation in tunnels and mines is essential – but is also an expensive item in terms of energy consumption. At the Bauma show, visitors will be introduced to

The SwedVent solution: A smart way to ventilate tunnels and mines while reducing energy costs to a minimum.

Atlas Copco's SwedVent system. This solution offers a new design and management philosophy which enables the selective distribution of fresh air resulting in significantly lower ventilation costs for contractors.

But these innovations are not the only reasons while visitors to Munich should head for Booth 1108. The Atlas Copco area will be packed full of other equipment and tools for every conceivable task in construction, demolition and mining.

The SmartROC T40 for drilling 76–127 mm diameter holes. This rig cuts fuel costs in half.

Insight On SAFETY

In the hazardous worlds of mining and construction, safety is never taken for granted. M&C talks to Anna Eklind for a status report on the safety challenge.

Q: ***It is often said that the mining and construction industries are safer now than ever before. Do you agree?***
A: Absolutely. Great improvements have been made in many different areas and the statistics suggest that the number of accidents and lost time injuries are in decline. But that doesn't mean we can relax. Safety is not something to be focused on now and again, or whenever it seems appropriate. It is a never-ending process based on a desire for continuous improvement. At the same time, the rules and regulations governing safety are changing all the time and becoming more and more demanding so the focus on safety is now stronger than ever.

Q: ***Who is responsible for the progress that has been made so far?***
A: A lot of the credit must go to the mining companies. They have been the drivers of the working environment and have made enormous contributions to safety. I think the people who work for these companies have a lot to thank them for. At the same time, many of these companies are international which means they have been able to implement good working practices around the globe. Global equipment suppliers like Atlas Copco have also played an important role through the development of safety-focused product design.

Q: ***What Atlas Copco products have made a big difference to safety?***
A: Remote controlled equipment, rod handling systems that eliminate heavy lifting, drill rig cabins that give all-round visibility... there are just too many to mention. One product which is getting a lot of attention lately is the Scaletec, a mechanized rig which eliminates manual scaling which is one of the most hazardous jobs in underground rock excavation.

Q: ***What priority does Atlas Copco give to safety today?***
A: Safety gets top priority here. It is a way of life, a mindset that permeates everything we do. No meeting involving product design, training or service and maintenance takes place without safety issues being an integral part of the discussion. In this way, safety is part of Atlas Copco's DNA. Our policies are strict and we constantly strive to achieve the highest standards for our products and for the people who use them and service them.

Q: ***What's the biggest issue that needs to be addressed?***
A: That's not an easy question to answer. Health and safety is such a huge subject and there are improvements to be made at every level. Of course, as a manufacturer of equipment that will be used by human beings, our first duty is to ensure that they are as safe as possible. Secondly, we do everything in our power to make sure that they are used correctly, which means emphasizing safety in all our instruction manuals, training courses, and customer seminars... and still it is not enough. We also have to make sure that safety is constantly in the spotlight so that it remains at the forefront of product development.

Q: ***Atlas Copco celebrates its 140th jubilee this year. Will the event be marked by highlighting its safety record?***
A: Throughout its history, safety and the working environment has been a priority at Atlas Copco. Today, it is stronger than ever and is an ongoing and natural part of the way we work. However, this year we will be intensifying our efforts to emphasize the importance of personal safety in our contacts with our customers. We want to raise the awareness of how personal safety impacts on productivity. Even though the accident statistics seem positive, many incidents are not reported and there are still many countries where safety is still unsatisfactory and where productivity is low.

Q: ***What obstacles prevent personal safety from being improved?***
A: One of the main problems is communication and awareness. If we are to succeed

Anna Eklind is Global Safety, Health, Environment and Quality Manager at Atlas Copco's service division within Mining and Rock Excavation Technique.

in spreading the safety message across the globe we have to use every technique at our disposal. Languages can be a hurdle because written translations and even verbal instructions can be misunderstood, or wrongly interpreted.

In an attempt to avoid this we are moving more and more towards finding ways of visualizing the messages we need to get across. The airline industry is a typical example where animations and symbols are used for safety instructions. We will see more of this type of communication in our industry in the coming years.

Q: ***How does service and maintenance fit into this?***

A: Our service and maintenance personnel are vitally important because they are the people at the forefront. They visit the customers' sites on a regular basis, they know the operators personally, they see how our equipment is being used and can identify the risk areas. They are perfectly placed to ensure that safety standards in relation to our equipment are maintained. They make sure that our products comply with regulations and they feed information back to our Customer Centers so that our products can be continuously improved.

The Scaletec effect at Tara Mines

Mining equipment that makes a significant contribution to safety as well as productivity is in increasing demand. A good example is Boliden's Tara Mines in Ireland – Europe's largest zinc mine – where an investment in mechanized scaling has had a dramatic effect.

With safety as a key issue in the international mining industry, mines are increasingly looking for innovations that can help to reduce accidents and lost time injuries.

Although there is an element of danger in all stages of the mining process, whether on the surface or under ground, some operations are clearly more hazardous than others.

A safe alternative: The Scaletec rig, now routinely used at Tara Mines for scaling.

One of these is the manual scaling of walls, roofs and faces after blasting. This is often carried out with a hand-held scaling bar working from a platform on a utility vehicle in order to reach the areas to be scaled.

It is a physically demanding task involving considerable risk. In many parts of the world, miners use steel bars or even simpler tools to remove loose rock, which is even more demanding and dangerous.

However, mechanized scaling is being increasingly introduced worldwide and is having a positive impact on safety.

From manual to mechanized

A case in point is Boliden Tara Mines in Navan, Ireland, located some 50 km northwest of Dublin. Owned and operated by Boliden, the Nordic international mining group since 2004, the Tara mine produces approximately 2.5 million tonnes of ore for zinc and lead concentrate per year.

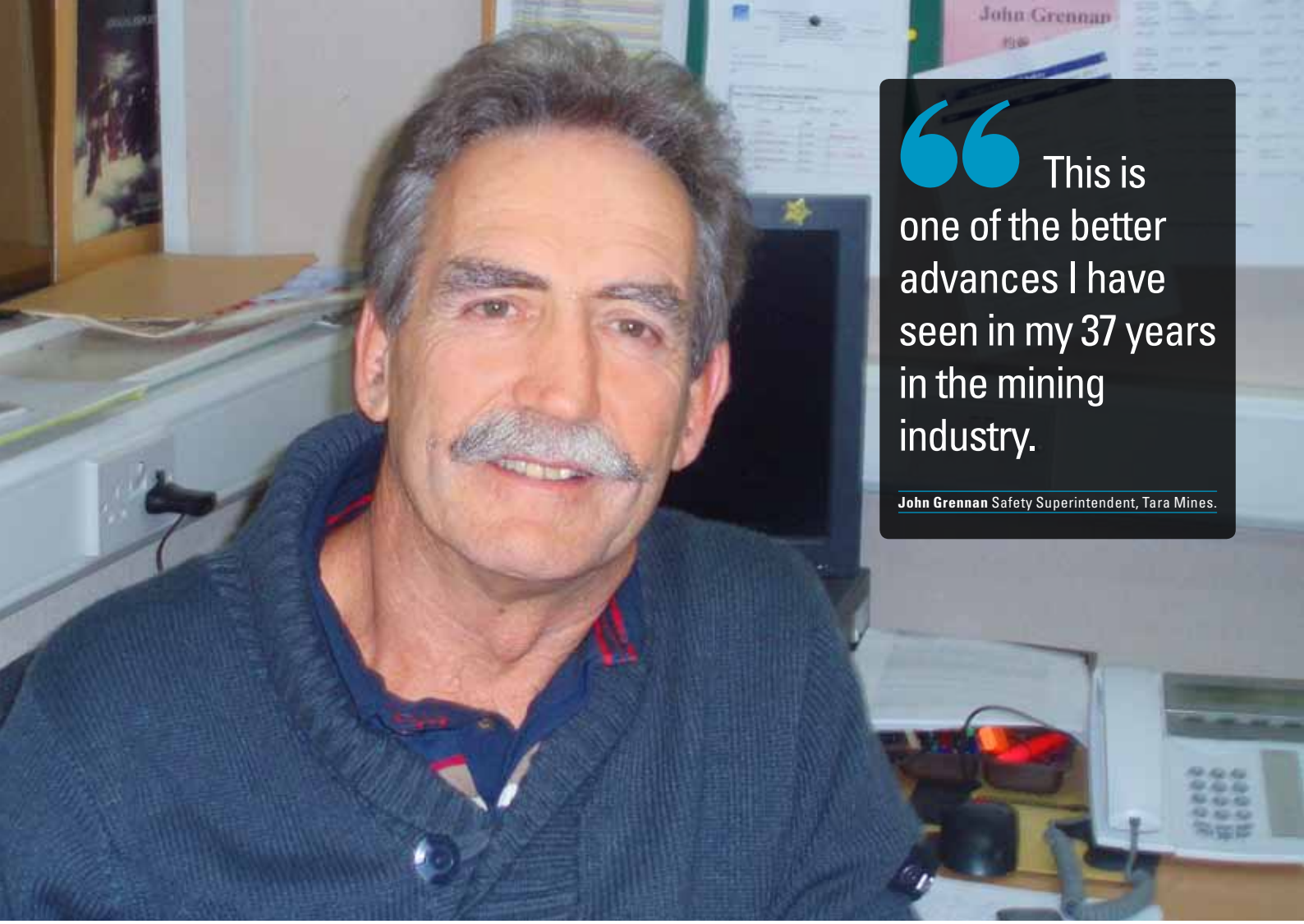
To improve productivity and also reduce the risks associated with manual scaling, the mine management introduced mechanized scaling as early as 2007. It came in the form of a Scaletec mechanized scaling rig from Atlas Copco.

The reason for choosing this unit was its high performance, but also the potential improvement it could make in terms of personal safety for the mine's 10-man scaling crew.

Today, Tara Mines has four Scaletec units in operation and Safety Superintendent John Grennan says the effect has been dramatic. In the four years since the Scaletec has been in operation, the number of incidents and injuries related to manual scaling have dropped to zero.

Says Grennan: "Mechanical scaling has been a huge advancement for us at Boliden Tara Mines. In the past, there have been serious injuries as a result of scaling off the muck pile, but these are now gone. We don't have the exact statistics yet, but in my view this has been one of the better advances I have seen in my 37 years in the mining industry."

In the normal working cycle, the Scaletec is routinely used after every development blast and also other times when required. Service and maintenance is easy and



> This is one of the better advances I have seen in my 37 years in the mining industry.
>
> **John Grennan** Safety Superintendent, Tara Mines.

performed on site by the Tara Mines engineers. Prior to the arrival of the first Scaletec, scaling was mostly done by working either from the bucket of a scoop, the platform of a utility vehicle, or by standing on the slippery muckpile.

A 'no brainer'

According to Peter Brewitt, Atlas Copco's Business Line Manager for the UK & Ireland, the operators were doubtful but are now positive to mechanical scaling in their work places. "This is a major shift in attitude and confirms that they want to reduce the number of incidents between face drilling and bolting," he says.

"In addition," Grennan adds, "risk assessments that have been done indicate that mechanical scaling is a no brainer."

Brewitt confirms that the Tara Mines operators like the ergonomically designed cabin and that Atlas Copco is making further improvements. Besides the Scaletec, the Tara mine has a fleet of Atlas Copco equipment including Boomer M2C twin-boom face drilling rigs, Simba long hole production rigs, Cabletec cable bolters and MT6020 Minetruck trucks.

Taking the risk out of scaling

The Atlas Copco Scaletec scaling rig was developed in 2005 to enable miners and tunnelers to tackle the hazardous task of scaling roofs and walls after blasting with maximum protection.

Not only does the Scaletec improve safety for the scaling crew, it also improves the quality of the scaling result which benefits overall productivity.

The rig consists of world proven components, notably the carrier, the hydraulic breaker and the comfortable, well protected operators' cabin.

The breaker is designed specifically for scaling. It is constructed from a solid, one piece body that does not require side bolts, making it a much stronger unit. To optimize it for scaling operations, the breaker's strike frequency has been increased at the same time as the impact energy has been decreased.

The boom covers an area of 9 m high and 11 m wide, enabling it to effectively follow the contour of the face, the roof and walls in most drifts and tunnels. In addition, the cab comes with a 375 mm vertical lift and a 15 degree tilt to provide the operator with optimum visibility. Positioning and control with RCS (Rig Control System), is fast and easy and an integrated water channel provides the hammer with water flushing for dust suppression. Scan the code to see the Scaletec in action.

Quarrying for the future: Wonjin Construction puts the Powercrusher PC 4 to work to supply aggregate for Korean infrastructure expansion, pictured at a site in Andong along the construction route of the new Highway 30.

CRUSHING SUC

Quarrying contractors and construction companies in South Korea have improved their businesses by introducing the latest technology for mobile stone crushing. Here, two companies share their experiences with M&C.

State-of-the-art mobile stone crushing equipment was introduced to South Korea in 2011 and has subsequently been making contributions to productivity in a variety of construction applications.

One of the companies that has benefited greatly from this is Wonjin Construction. Wonjin specializes in producing aggregate for major infrastructure projects and is currently supplying materials to Ultra Construction Corporation for building the new Kyougsang–Do Highway 30.

This important new road will connect the western and central cities of Dongjin, Sonju and Andong with the eastern coastal city of Yeongdeok, in Gyeongsang province.

Eungi Park, Site Manager for Wonjin, explains that his company has operated several types of crushers since starting up in 2007, but adds that the performance and service arrangements associated with these machines has been "disappointing".

As a result, when Atlas Copco's mobile crusher Powercrusher arrived on the market, Wonjin was among the first in line to upgrade its equipment. Wonjin chose a Powercrusher PC 4 model which has been making a strong contribution to the company's productivity ever since.

> "We have had several machines before but the Powercrusher gave us the productivity we were looking for."
>
> **Eungi Park** Site Manager, Wonjin Construction

Service and savings

The first consideration that convinced Wonjin to switch to the Powercrusher was the service that Atlas Copco is able to provide in this part of the country. Its team of local service technicians are never more than a couple of hours away from Wonjin's operations.

The second decisive factor was low cost, or to be more precise, savings. Han sung Oh, Atlas Copco's local representative, explains: "We always give our customers a good price, but more importantly we offer them continuous savings.

"The Powercrusher PC 4 has the Cat C9 324 hp engine, which is bigger than other models and therefore uses about 27 liters of fuel per hour. But at the same time, the machine saves money by giving up to 20 percent more product."

One feature of the Powercrusher that is especially appreciated by Wonjin is its crush box inlet. This opening, which measures 1 250 x 650 mm, allows material that is larger, or inconsistent in size, to be worked

Recycling for sustainability: Here, the impact crusher Powercrusher PC 3 is used by Samwoo Recon at Chilwon to recycle road construction material into new base stone.

CESS IN KOREA

through the jaw crusher. Another example is the machine's Quattro Movement which produces a figure-8 motion in the machine's moving jaw which enables precisely the right size and shape of the aggregates required.

The perfect sized aggregate for Wonjin is 600 mm – although the actual size produced is, on average, 400 to 500 mm – and the size is changed with a simple adjustment to the gap setting on the crusher box.

The machine produces 1 000 – 1 200 tonnes of aggregate in an eight-hour shift each day. This production rate, and the fact that Korean contractors typically work a six-day week, enables Wonjin to easily meet its target of 30 000 tonnes per month. Operator, Doohaeng Heo, points out that the 1.2 m-wide conveyor on the PC 4 also contributes to productivity.

Recyling and sustainability

Another company that has improved its stone crushing operations is Samwoo Recon Company Ltd. Samwoo Recon was established in 2002 and now specializes in recycling road building and construction materials for three large communities in the southeast of the country.

The company wanted a mobile crusher that could be easily maneuvered around its large, 7.5 km^2 site as well as meet the demands of its sustainability policy. In this case, the Powercrusher PC 3 impact crusher was the ideal choice.

Wookju Sung, Managing Director at Samwoo Recon, told M&C: "We are proud of our sustainable practices and of our mission to provide quality recycled material to the local communities.

"By recycling road and construction material, the aggregates we produce allow contractors to rebuild roads using recycled material in three of the required four layers of the base."

Sung explains that recycling material reduces quarrying costs and that the Powercrusher is able to produce the perfectly sized aggregate which its road construction customers regard as optimal for efficient road compaction. And he also regards low fuel consumption as a sustainable practice that pairs well with his recycling mission. "It is important to us to save energy and have low CO^2 emissions," he says.

Powered by a 287 kW engine, the crusher achieves a production of 150 tonnes per hour and can process as much as 250 t/h. Part of this is due to the feed design with its hydraulically adjustable swing beam.

Samwoo Recon previously used stationary crushers and these will remain in operation. But the Powercrusher's ability to move around the site, and offsite if necessary, has made the operation more productive as well as more efficient.

> "Recyling is an important part of our business and this machine helps us meet our goals for sustainability.
>
> **Wookju Sung** Managing Director, Samwoo Recon

The smart way to ventilate

Simple solutions to complex challenges

Ventilation systems for underground applications are mainly intended to provide human beings with a good working environment. However, to supply the right amount of fresh air to the right place at the right time and at the lowest possible cost is easier said than done.

By Tomas Otterberg, Product Manager, Underground Ventilation Systems

Few people think about ventilation as they go about their daily lives in our modern society. The fact that our offices, department stores, schools, museums, cinemas and so on are all well ventilated is something we take for granted.

Below ground, however, it's a completely different story. Here, ventilation is critical – and can never be taken for granted. Without proper ventilation, human beings cannot survive below the earth's surface and excavation work of any kind is simply impossible.

Compared to most industrial applications, the ventilation systems required for underground activities such as tunneling or mining, present a range of different and often complex challenges.

There are two main obstacles that have to be overcome. Firstly, substances that are hazardous to health, such as diesel fumes from equipment and gases from explosives, must be prevented from contaminating the fresh air that humans breathe. Secondly, today's underground environment is in a permanent state of evolution as our tunnels and mines continuously expand and this requires solutions that not only provide a good environment for workers, but that also supply constant ventilation for tunneling and mining areas as cost-effectively as possible.

For simple tunnel projects, the economics of constructing the most suitable ventilation system can be divided into three parts; the investment required for a fan station, the investment for ducting and the total operating cost – and it is interesting to see that a higher investment will not always lower the operating cost. The right combination of investment and running cost will contribute to reducing the overall cost for a project.

In order to optimize both the investment and the running cost it is essential to choose the right equipment combination. This is most important when choosing the size of the ducting. A larger duct reduces the risk of pressure loss, which, in turn, lowers the fan investment as well as the running cost.

But it's not that simple. How can a large diameter duct be installed in a hydropower tunnel, for example, if all of the available space is taken up by other installations, or where the size of the tunnel cross section is so limited that a large duct will obstruct machinery and disturb the excavation sequence.

The solution is to be able to select from a range of fan stations and ducting, not only in terms of diameters, but also in terms of the amount of pressure required. In addition, it should be possible to install one or more ducts in parallel.

The SwedVent solution

In this respect, the SwedVent underground ventilation solution is worth examining. This system, which was introduced at the MINExpo show in September last year, features high pressure fans which deliver air along extensive lengths of tunneling with a capacity of 2.5 – 175 m^3/sec. The system also includes flexible ducting and control systems and is equipped with efficient noise reduction. However, the biggest advantage of the system is that it offers a range of different diameters as well as variable angles of the impeller blades that can be set up in series. Together, these features enable the air flow to be optimized for each individual application and the required power can be adjusted simply by changing the motor size.

Pitch and balance

This leads us to the all-important pitch setting of the impeller blade angle. With a non-adjustable impeller we would need as many impellers as there are motors for each given diameter. To solve this problem, Atlas Copco has equipped the impellers with adjustable blades and also carries out static and dynamic balancing of each impeller before use.

By balancing the required pressure and airflow, the system will always provide the optimal solution. There are currently nine different diameters and a total of 19 motor alternatives in the SwedVent range and the required pressure can be obtained by setting up three to five fans in a multi-fan system.

For these units, high pressure means up to 4 200 Pa for one impeller. This is achieved due to small tolerances in a robust design. For example, the distance between the tip of the blade and the inside of the housing must be between 1 and 3 mm. That may seem wide, but considering the largest diameter for a fan housing is 2 240 mm it

is a technical challenge. The next step is wide, short blades with precise spacing, and to ensure that the same angle is set for all blades.

The cost of air

Since ventilation is a major cost factor (in a mine, for example, it can account for 35–45% of energy consumption) the energy source and the cost of powering the system are important considerations.

Operating costs differ depending on the choice of fan station, ducting and the electrical operating system. In mining applications where ventilation is a complex issue to solve, a one-speed solution is commonly used to provide a given airflow. In tunneling, the system should be designed to cope with the maximum load, i.e. to provide sufficient air to the face just prior to breakthrough and using the longest ducting. This means that it will not be necessary to run the fan station system at full capacity, 24 hours a day.

By using a frequency inverter, the speed of the fan will not be higher than necessary and the air flow during excavation will be optimized, increasing directly after a blast to evacuate the fumes as soon as possible, and then reverting to normal running mode. This technique saves money and avoids unnecessarily high air speed in the tunnel (*see Fig 1*).

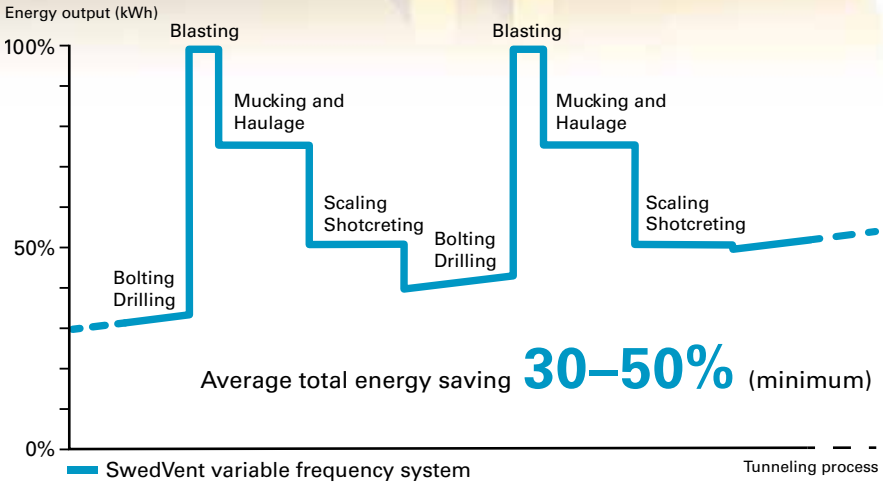


Fig 1. In tunneling, conventional ventilation systems are operated at full capacity from beginning to end. With the SwedVent variable frequency system, full capacity is used only when required, i.e. after blasting. As the tunnel progresses, air consumption increases but overall 30 to 50% of the energy normally consumed is saved, thereby reducing the total cost of the project.

Easy ducting

Ducting has one purpose – to get the air from the fan station to the tunnel face or into a mining area where excavation is taking place. The ducting, which consists of PVC-coated fabric must be light and strong, easy to mount, replace and remove. Although large diameter ducting equates with good ventilation, the larger the diameter the greater the risk of damage. A damaged duct loses its function rapidly due to pressure drop and is easy to tear if it is too large for the tunnel, and no contractor likes the idea of removing more rock to provide space for a ventilation duct.

Even if the SwedVent system is, in itself, fairly simple it offers an advanced calculation method that enables the air to be delivered to wherever it is required, at the same time as it keeps investment and running costs to a minimum. By using the SwedVent solution, we estimate that the number of fans normally required for most projects can be reduced by up to 50%, which lowers both the initial investment and the energy consumption during the project time.

Most importantly of course, it ensures that quality air is always available for the people who spend their working days underground.

Tomas Otterberg is based in Sweden. He is Product Manager, Underground Ventilation Systems, at Atlas Copco's Underground Rock Excavation division.


NEW

KID ON THE BLOCK

Long-time favorite drill rig gets a worthy successor

Atlas Copco's rotary and DTH drill rig, DM30, has long been favored by small mines and quarries for blasthole drilling. Light weight and easy to handle, it has served them well. But now it's time for the DM30 to move over... there's a new kid on the block.

For more than 30 years, the DM30 drill rig – the smallest rotary and DTH model in the range – has retained its popularity among the world's smaller mines and quarries.

Specially designed for drilling blastholes in the 127–171 mm (5–6 ¾ in) range to a maximum depth of 45 m (147 ft), this multi-pass rig has been a favorite choice for its productivity, but even more so for its ease of use and flexibility.

Among its strongest fans, the DM30 will probably continue to remain a favorite for some time to come, but its popularity is fading fast as more and more drillers discover that there is a better version available – the DM30 II.

This version offers all the advantages of the basic DM30 – but comes with a range of upgrades and improvements that pave the way for new opportunities and choices.

Asien workhorse

The new "kid on the block" was born in 2011 and has been well received, notably in Asia where the DM30 is a well known workhorse in mines and quarries, but also in South Africa and Papua New Guinea.

Besides the larger hole diameter range of 152 mm–200 mm (6–7 ½ in), which enables the rig to be used for a wider variety of blastholes, the new DM30II is a straightforward, well proven rig that has now been modernized and upgraded to include:

- a larger, thermal insulated cabin with no hydraulic hoses, providing a warmer, more comfortable and safer working environment for the operator
- an electric over hydraulic control system, similar to that used on other rigs in the DM-series
- an optional walk way and enlarged deck area for improved accessibility for service and maintenance
- an optional angle drilling package which allows the tower to be positioned up to a maximum of 30 degrees from the vertical in increments of 5 degrees, allowing the rig to be used for more applications such as cast blasting
- an enlarged, hydraulically raised dust hood with skirting providing more space for the cuttings
- optional Atlas Copco screw type, low or high pressure compressors with high air temperature shut down

Chinese inspiration

The original DM30 has been widely used in China and it is here that the inspiration for the design of the DM30 II originated. It is also here that the new version is being manufactured. Hubert Luo, Product Manager for Atlas Copco in Nanjing, tells M&C: "With its small 'footprint', light weight and low cost, the DM30 has been a continuous success story and therefore very little has been done over the years in terms of product development.

"However, in the last few years we have been gathering information from our DM30 customers across China and this feedback convinced us to go for a complete design upgrade.

"The DM30 II is even easier to use. The quality is better and both the capital and operating costs are low. It also comes with many more options that will make this version even more popular than its predecessor."

Dwi Purwanto, DM30 II operator for the Indonesian contractor Nariki Minex Sajati.

The drill crew of Nariki Minex Sajati pose for the camera during drilling at the Prima Sarana Gemilang coal mine on the Indonesian island of Kalimantran.

In the coal OF INDONESIA

The majority of blasthole drill rigs in Indonesia are used in the coal industry and the Prima Sarana Gemilang mine is a typical example.

Located on the island of Kalimantan, the mine has Atlas Copco DML and DM45 drills on site and the upgraded DM30 II was recently added to the fleet.

According to drilling contractor Nariki Minex Sejati, the new addition has increased flexibility by providing more choices in the 171 mm – 200 mm (6.5–7.8 in) hole range.

Jerry Murthi, second generation owner of Nariki, says: "The ground on Kalimantan isn't too dense and doesn't need much more than a good bump to break it up."

> "Our success is based on drilling with the right equipment to provide mines with the most efficient drilling option.
>
> **Jerry Murthi** Owner of Niriki Minex Sejati drilling company

He says the 200 mm capability of the new DM30 II allows his company to drill larger holes and sufficiently sized patterns, yet smaller holes when necessary.

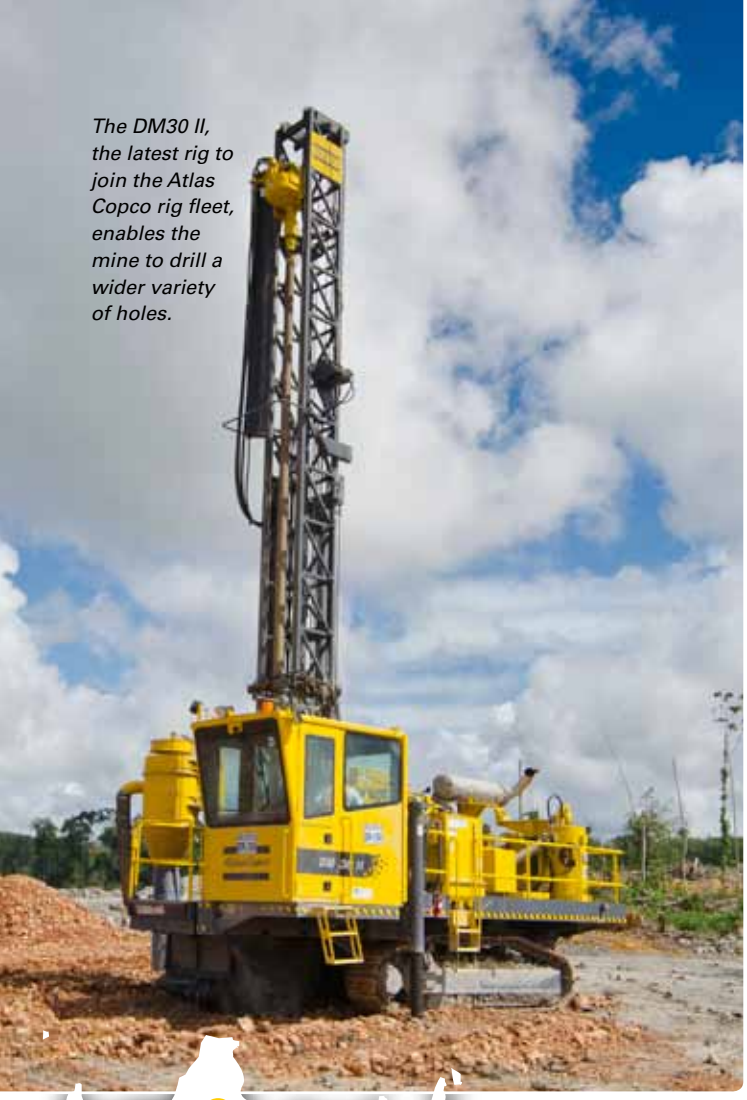
Nariki operates at about 15 mine properties in the country and Murthi says the company's success is based on "drilling with the right equipment in order to provide a mine with the most efficient drilling option".

The company has larger drills but says it almost never needs to drill a 228 mm (8 in) hole or larger.

"We drill mostly with a burden of 7–8 m and 8–9 m spacing. The maneuverability of the DM30 II is great. Having the drill rig that offers more options because of its size is a benefit to the mine and also helps with mine planning."

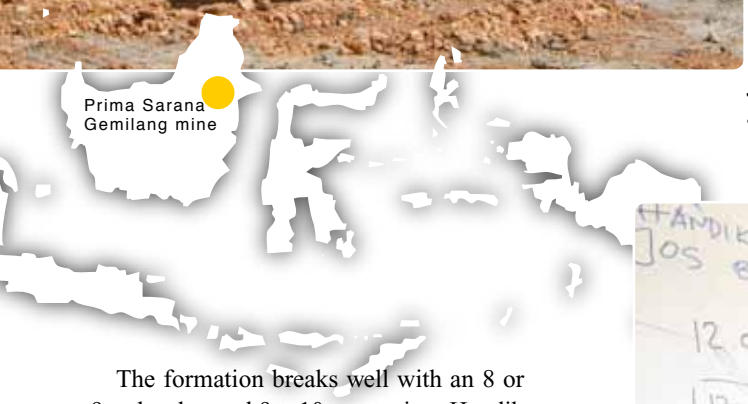
For rotary drilling, the DM30 II has a more powerful compressor delivering 29.7 m^3/min at 7.5 bar, compared to the 25.4 m^3/min at 7.6 bar of the DM30.

The mine has two pits and before drilling began, ripping was used to break up the claystone and sandstone formation. The rock is just hard enough that blasting results in more productive excavation.



The DM30 II, the latest rig to join the Atlas Copco rig fleet, enables the mine to drill a wider variety of holes.

Jerry Murthi, the second generation owner of drilling contractor Nariki Minex Sejati, says he appreciates the versatility of the new DM30 II.



Drill and Blast Supervisors Handik Setiawan and Jos Bernadus Manulanga.

The formation breaks well with an 8 or 9 m burden and 9 to10 m spacing. Handik Setiawan and Jos Bernadus Manulang, Drill and Blast Supervisors, explain that they are still adjusting the pattern based on variations in clay or sandstone rock.

In addition, they have to contend with a layer of coral in Pit 1 that lowers productivity from an average of 56 m per hour down to 40 m. Pit 2 averages 48 m per hour, drilling with the DM30 II.

There are eight seams being mined here. Drilling is generally done during a 10-hour period each day, although mining operations continue 24 hours a day in two shifts. The benches in both pits are 8 m high. The coal sits on a 30 degree incline in seams ranging from 5 to 30 m in thickness.

The coal in Pit 2 runs at 5 800 kcal whereas Pit 1 is 6 000 kcal. Although the coal in Pit 2 is of a lower quality, the seams are generally thicker and easier to mine. On a monthly basis, Pit 1 produces 700 000 tonnes, whereas Pit 2 produces 300 000 tonnes.

The stripping ratio is 7 to 1. Mining began at an elevation of 90 meters and is currently at 20 meters above sea level. Exploration is continuing to determine the total depth of the coal formation. The mine is operating on a five-year excavation plan including the opening of a third pit.

In the limestone OF CHINA

Xu Xiangrong, Director of Mining Plant at TCC Jurong Cement Co. Ltd.

Xiguoding Cement, a limestone mine in China's Yangtze River Delta region, reports increased flexibility, efficiency and operator comfort after adding the DM30 II drill rig to its fleet.

The mine, operated by Jurong TCC Cement Co. Ltd bought its first DM30 II (known in China as CDM30) in 2011. It now has four rigs in operation in addition to three CM760 and one CM695 – all from Atlas Copco.

Established in 1997, the mine has abundant resources and modern production facilities and Jurong TCC has been using Atlas Copco equipment since day one.

Chen Longbao, Deputy General Manager of TCC Jurong, says the rig was introduced to improve production efficiency. "When buying drills, we place the highest importance on brand, reliability, flexibility, function and service and maintenance cost. Atlas Copco fulfills all of our requirements. That's why all our drilling equipment is from Atlas Copco."

Xiguoding Cement's limestone is excavated in an area of 1.12 km^2. The benches are 15 m high and approximately five million tonnes are mined annually.

Xu Xiangrong, Director of Mining Plant for TCC Jurong, notes that the DM30 II is well suited for the compressive strength of the rock (10–14 MPa). Drilling 165 mm diameter holes, the rig drills vertically for six hours per shift and two shifts per day. The average drilling depth in each shift is about 160 m.

In addition, the rig needs to replace drill rods every 40 000 m and the service life of the DTH hammer is about 25 000 hours which is said to be a 30 percent increase compared to previous equipment.

"With its high drilling speed, large operating scope and high efficiency, the drill is laying the foundation for us to improve production efficiency, decrease production cost and reduce safety risk," says Xiangrong.

Atlas Copco in Nanjing has supplied all of the equipment and has also helped train the DM30II operators.

Going green

Chen Longbao adds that the mine is environmentally conscious and during 2012 was granted permission to work towards "greening" the limestone operation, including dust control.

"Atlas Copco equipment has high production efficiency and low operation and maintenance costs. This helps us reduce costs and dust emission by 30 000 tonnes a year, " he says. "The rig is making a great contribution to building a green mine."

The mine aims to reach a production of six million tonnes of limestone ore by 2015. Longbao concludes: "The advanced and efficient products and after sales service from Atlas Copco will be an important guarantee for us to fulfill that target."

> "The drill is laying the foundation for us to improve production efficiency, decrease production cost and reduce safety risk.
>
> **Xu Xiangrong** Director of Mining Plant for TCC Jurong

One of four DM 30 II rigs in OTCC Jurong's fleet at the Xiguoding Cement mine in the Yangtze River Delta. These are high pressure drills for DTH drilling.

Committed to RC drilling: the new Explorac 100 is compact yet powerful, featuring an automated rod handling system and benefits for personal safety in the field.

Two new exploration rigs for RC DRILLING

Global demand for Reverse Circulation drilling (RC) is rising steadily, largely thanks to the arrival of equipment that is more versatile, cost effective and far reaching in terms of exploration capacity.

Atlas Copco confirms its strong commitment to the market and RC drilling technology through the launch of two new rigs – the Explorac 100 and Explorac 235. Both rigs offer modern and unique benefits with a strong focus on improved efficiency, personal safety, reliability, service and environmental friendliness.

"The simultaneous launch of two new Explorac rigs is a firm statement of our strong commitment to the Reverse Circulation industry segment," says Martin Sommers, Vice President, Marketing, at Atlas Copco's Geotechnical Drilling and Exploration division. "They mark the beginning of an increased focus from Atlas Copco on RC drilling with more models in the pipeline over the coming years."

Compact and easy to transport from site to site, yet powerful enough to work in challenging environments, the Explorac 100 is suitable for both RC and down-the-hole drilling (DTH) applications at depths of 100–200 m.

Loaded with improved features, the Explorac 100 is presented on a crawler chassis with a new, automated rod handling system, a mechanized breakout table, remote control, and more.

The Explorac 235 is an upgraded version of the well known Explorac 220RC. Suitable for depths of 300–400 m it was developed in cooperation with the pioneers of Reverse Circulation technology in Australia. Other features include a new compressor with higher air pressure, an improved pipe handling system and the Atlas Copco Rig Control System, RCS.

Sommers concludes: "This launch is a strong response to increasing market demand for personal safety and environmental care. Both rigs offer the efficiency and performance required by contractors such as fast setup and drilling speeds, easy maintenance, reduced noise levels, a minimum of oil spillage and the high-quality samples requested by geologists."

The Explorac 100 can be seen at ExpoNor 2013, the international exhibition for Latin American mining, to be held in Antofagasta, Chile, June 17–24.

How a small group of drilling entrepreneurs in Scotland became a major player in the Atlas Copco world of drilling technology.

From Scotland with COMPETENCE

When Scottish company H&F Drilling Supplies Ltd was founded in 1986 it set out to provide large hole drilling and piling equipment for local contractors.

Specializing in overburden casing advancement and piling applications, the company soon found that its products and its expertise were in high demand, and not just in central Scotland, its home base, but throughout the UK and abroad.

By the end of the 90s, business was thriving, and over the next few years the company's manufacturing and assembly premises doubled in size. In 2004, the company became an Atlas Copco distributor, paving the way for further expansion, and in 2010 became a wholly owned subsidiary. Today, as a fully integrated part of the organization, the company's expertise has made it possible to create a Competence Center, providing equipment and services to drilling companies around the world.

Large hole and deep hole

The company still focuses on its traditional equipment, but now, as an Atlas Copco Competence Center, its emphasis is to analyze customer requirements together with its local sales engineers and provide cost effective solutions.

These solutions consist of the latest drilling equipment and accessories for large hole and deep hole applications and cover geotechnical, piling, casing advancement, water well and shallow oil and gas applications.

This involves all of the equipment required, from the drill rig drive down to the drill bit, and includes adapters, drill rods, hammers, drill shrouds, casing, compressors and pumps together with technical advice on correct use and maintenance.

The company is also building its rental capacity. Rental gives the customer the opportunity to select the most efficient method of completing the contract without having to buy the equipment. This option is especially attractive when the cost of purchasing equipment is a significant proportion of the revenue that will be earned from the contract.

A complete package

Andy Jacques, H&F's Operations Manager, points out that the company has become the supply center for all of the key components required in large diameter and deep hole drilling.

"We have the most comprehensive range of equipment and services available under one roof," he says. "For example, we assemble and deliver complete cluster drills together with associated equipment for service and repair on site. We also

> "If the customer has a problem we examine it in detail and offer a cost effective solution.

Andy Jacques H&F's Operations Manager

A wealth of experience and knowledge: Above, the Competence Center team with a selection of Atlas Copco products for large hole and deep hole drilling. From right: A Symmetrix casing system for a road tunnel project in Norway...

...a custom-designed drill string solution for this deep hole rotary drill rig...

offer advice regarding the suitability of the products for each application based upon the geological information provided and our experience in using the product.

"In addition, we advise on and supply a selection of swivels, lifting equipment, oilers and pumps. All of this means that when equipment is delivered to a site, the drilling company can be assured that the components will fit together and that the equipment will work immediately."

In applications where the Atlas Copco Symmetrix and other casing advancement systems are supplied as a drilling system, H&F supplies all of the equipment in a package including the QL hammers, HEX drill pipe, casing, adapters and shrouds.

The QL 300 hammer and associated Symmetrix casing advancement system enables simultaneous drilling and casing of holes up to 1 200 mm in diameter. A QL 300 hammer and Symmetrix system has recently been supplied on a rental basis for the installation of casing in a horizontal drilling application.

In water well drilling applications, the customer is advised on the correct selection of drill pipe for a given hole size together with the right stabilisers, drill collars and handling systems. On top of that, the company advises on the correct volumes of air or fluid circulation for given applications and can supply or rent out the compressors or pumps required.

For oil and gas drillers, Jacques points out: "We are conscious of the importance of selecting the correct drilling equipment and accessories for a given project and we take the time to appraise projects in order to establish the correct selection of equipment."

Long term perspective

Whatever the application, H&F applies a long term perspective to the task, meaning that its experts focus on solutions that will get the best results over time and increase the customer's productivity.

The company is represented in most parts of the world via the Atlas Copco organization and no project is too far or too remote. For example, a cluster drill was recently supplied to India, hammers and cluster drills have been rented to projects in France, Sweden and Slovenia and well drilling equipment has been supplied to various projects in Africa.

Jacques concludes: "We have a real passion for drilling and for sharing our experiences.If the customer has a problem, we find a solution and provide it as a single package."

...and a cluster drill consisting of seven hammers for tunnel foundation work in the USA.

Scooptram LHD goes green

Taking loading to the next level: The new electric Scooptram EST1030 with its 10 tonne tramming capacity offers high productivity as well as significant environmental improvements.

Atlas Copco has launched a "green" LHD for underground mining. With its carbon emission-free motors, the Scooptram EST1030 loader lives up to the company's brand promise of sustainable productivity.

The latest addition to the Atlas Copco range of underground loaders is an attractive alternative to diesel equipment in underground mining.

Due to the high efficiency of its electric motors, the Scooptram EST1030 loader consumes less energy, produces less heat and has a lower noise level than an equivalent diesel powered machine. In normal operation both energy and heat are reduced by about 40%.

Franck Boudreault, Regional Business Manager, says: "The global release of the Scooptram EST1030 shows our commitment to green technology and sustainable mining solutions.

"In underground mining, ventilation has always been an issue. An electric machine requires very little ventilation, just enough to keep the dust and heat at acceptable levels as well as air for the operator."

Lars Bergkvist, Global Projects Manager adds: "As mines go deeper, heat and ventilation becomes more and more problematic. At the same time, the price of fuel is rising. We strongly believe that efficient electric vehicles will be the key in future mining operations."

The concept of cable powered electric loaders is not new. However, cable control has always been a problem. High tension causes them to wrap around corners resulting in cuts and high cable wear.

Scooptram EST1030 introduces a new and patented cable control system that minimizes the tension and wear. The loader is also very easy to operate. Any operator that has used a Scooptram ST1030 will feel right at home. All controls are the same as in the diesel version and with a minimum amount of training the operator will be fully productive.

Among the key safety features are spring-applied, hydraulically released (SAHR) brakes. The ISO and ROPS/FOPS approved cabin features the Atlas Copco foot box that provides increased leg room and ergonomic control placements. The cabin is also on rubber mounts, reducing vibrations.

Erik Svedlund, Product Manager Electric Vehicles, says: "Health and safety is always top of the agenda for us. By switching from diesel to electric, the mines gets a big improvement in air quality as well as a major noise reduction."

An added plus is that about 90% of the Scooptram EST1030's components are identical to those on the diesel Scooptram ST1030 which is sold in large numbers all over the world. This ensures spare part availability as well as product support, even in the most remote locations.

Now available from the worldwide Atlas Copco organization: Examples of premium steel body PDC bits from the Secoroc product line.

New OPPORTUNITIES for rotary PDC drilling

Atlas Copco Secoroc's acquisition of NewTech, the U.S. drill bit manufacturer, represents new opportunities for Atlas Copco customers worldwide.

The new company, headquartered in Salt Lake City, Utah, brings a new range of high quality products to the Atlas Copco offering with the focus on mining and oil and gas exploration together with considerable technical expertise in these areas.

The newly acquired company develops and manufactures rotary PDC (polycrystalline diamond compact) drill bits as well as Klaw drill bits for rotary drilling in soft rock formations. These exceptionally durable rock drilling tools are designed to withstand high impact and extreme wear and are comparable to those offered by the largest oilfield service companies.

In addition to products for mining and oil and gas drilling, the team offers bits for geothermal, construction, fiber optic and water well applications which are proven to be extremely cost effective compared to comparable roller cone bits.

The primary PDC bits ranging in size from 7.5–39 mm (3–17 ½ in) in diameter are supplied in cast tungsten carbide and steel. There is also a new line of carbide pick bits featuring field replaceable cutters, allowing one bit body to drill significantly longer than its tricone equivalent. This offers exceptional penetration rates for shallow drilling applications and are available in sizes from 98 mm to 349 mm (3 ⅞ – 13 ¾ in) in diameter.

Graeme Mckenzie, Atlas Copco Product Line Manager, Oil & Gas, says: "The NewTech range offers a wide variety of product lines providing a highly efficient, cost effective solution for most drilling applications.

"PDCs or Polycrystalline Diamond Compact, is the generic name for drilling tools commonly used in the oil and gas extraction industry. Over the last 20 years, they have become the most prevalent and effective tool in all applications, with over 70% of all oilfield drilled meters worldwide using this technology."

In addition to this, the Salt Lake City location has its own proprietary engineering, design and manufacturing systems and processes. This allows short lead times and substantial cost savings. It also provides service and repairs and the possibility to order custom-made bits and other drilling products.

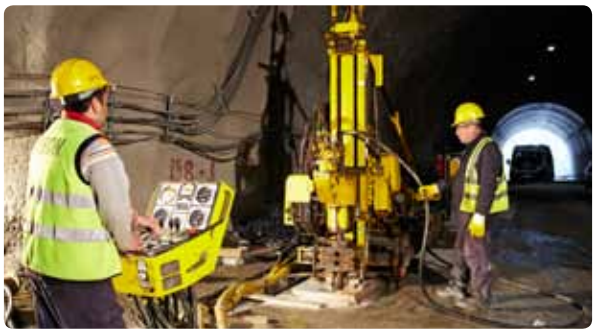
Mckenzie adds: "We can also be extremely responsive in our ability to provide new designs based on changing requirements from the field and the continuous need for improvements in drilling efficiency.

"This will become even more apparent in the very near future as the company begins to roll out new and innovative designs that will offer the industry unparalleled production capabilities."

> "This range offers highly efficient solutions for most drilling applications.

Graeme Mckenzie Product Line Manager, Oil and Gas

All systems go: at left, drilling injection holes with the Diamec U6 PHC and right, the Unigrout Smart A controls gathered in one room.



Grouting triumph at Boyabat Dam

In the Gökirmak Valley along the route of the famous Silk Road, one of Turkey's largest dams is soon to be commissioned, having eliminated leakages with an innovative drilling and grouting plan.

Completed in 2012 after just four years of construction, the nearly 200 m high Boyabat Dam is a record breaking project in Turkey. It is situated in the Gökirmak ("Blue River") Valley and features a hydropower plant that is expected to come online this year which will significantly reduce the country's dependency on imported energy.

Apart from being a landmark in itself due to its location along the Silk Road where the town of Boyabat is known as an ancient trading hub, the dam marks a milestone in regional development. The reservoir totals 60 000 km² in size with an installed capacity at the power plant of 513 MW.

The sheer size and on-time delivery are not the only achievements that make this dam remarkable. Among the biggest challenges was having to deal with unpredictable, seismic rock formations prone to water leakages.

Reinforcing the area

The Gökirmak Valley is situated just 25 km from an active fault line. The area primarily consist of sedimentary rock with high seismicity which can cause excessive water losses, putting the stability of the dam foundations and its abutments at risk.

The solution was large scale reinforcement. For contractor Dogus Insaat and its subsidiary Ayson, sealing and stabilizing the dam became a massive undertaking as well as a race against the clock.

"We had to accomplish a big project in a very short time and that's why our needs had to be fulfilled immediately," says Cumhur Tezel, Project Manager, Dogus Insaat.

Turning to its supplier Atlas Copco, an extensive drilling and grouting plan was initiated. More than 210 km of injection holes would be drilled, extending out from both sides of the dam, using 12 Diamec U6 PHC core drilling rigs equipped with the NO_2 wireline core drilling system.

The holes were drilled from three gallery levels where core drilling made it easy to continuously analyze the quality of the rock through permeability tests.

Although the SC 6–8 matrix diamond core bits that were used had an average lifelength of 1 000 m, one crew member achieved an astonishing record of 4 350 m using a single bit.

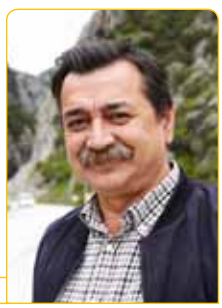
Having drilled an average of 400 m per day, or about two meters per hour, the completed holes were then injected with more than 33 000 m³ of grout, filling cracks and fissures to provide rock solid stability.

Joint venture for grouting

In addition to the fleet of Diamec rigs on site, Atlas Copco proposed an innovative modular grouting setup. This would consist of two central grouting stations installed on both banks, bringing in the versatile system, Unigrout Smart A.

Six Unigrout Smart-A22 platforms were employed, three on each bank. In a typical

> "Our needs had to be fulfilled immediately as we had to accomplish a very big project in a very short time.
>
> **Cumhur Tezel**, Project Manager, Dogus Insaat



A grouting mega-challenge: This extensive project to seal and stabilize the Boyabat Dam was part of a construction record that puts Turkey on the path toward far-reaching hydropowered energy.

drilling and grouting plan, the central station produced grout and mortar with up to six different mixes. The grout was then distributed and fed to a number of substations located in specially designed niches in the underground galleries.

Achieving the right mix, based on the weight of the components, was essential. For this reason, an automatic weight batching Dosac system was used and became critical to the operation.

Another important, though unconventional step was placing the Unigrout platforms together, with all controls gathered in one room. This enabled just one person to operate the entire system.

To inject the adapted grout mixes into holes, the substations in the galleries were equipped with Cemag agitators and Pumpac grout pumps. All parameters were carefully monitored using the portable Logac electronic recording system.

To deal with the fissures, grouting was performed using both the upstage method (drilling the full hole depth with grouting in stages) and the downstage method (both drilling and grouting in stages). This required drilling techniques of varying complexity and cost, with 5 m long sections and holes spaced three meters apart.

The right choice

According to Sahabettin Agaoglu, Drilling Section Manager at Ayson, which was awarded the grouting contract, the choice of equipment made all the difference.

"We were unable to find any other suppliers to match our expectations," he says. "We were highly satisfied with this Unigrout setup. You can't produce the quality of grout we achieved without the right equipment."

Each station produced up to 11.3 m^3 of grout and 3.3 m^3 of mortar per hour. As for the Diamec rigs, the teams achieved 48 drillmeters per day/rig, with an average of 2 m/h using the wire line drillstring, compared with 1.3 m/h using previous equipment, including permeability testing.

Adding new energy to the national grid and jobs to the economy, a lot of people in Turkey relied on the success of the dam. Cumhur Tezel was pleased to meet the deadline in a fast and efficient way.

"We can always contact Atlas Copco for any issue and get a suitable response, whether related to design or configuration – so we are very happy."

Major mining companies gear up

AMERICAS Two mining companies in South and Central America are to upgrade their equipment fleets with new equipment from Atlas Copco. Minera Panama, a subsidiary of Canada's Inmet Mining, has ordered a package of new drilling equipment and services for its Cobre Panama open pit copper project. The order includes Pit Viper rotary blast hole drill rigs, FlexiROC surface drill rigs, related services and simulator training. Most of the equipment will be delivered in 2014 and 2015.

The second order has been placed by the Minerven gold mining corporation of Venezuela and involves underground drill rigs, loading equipment and core drilling rigs, as well as portable and stationary compressors, to be delivered during 2013.

A Pit Viper 271, of the type that will be used at the Cobre Panama copper mine.

PowerROC T45 gains ground in Russia

RUSSIA Atlas Copco's PowerROC T45 drill rig, formerly known as ECM 660, is rapidly gaining ground in the Russian construction and mining industries.

In Chelyabinsk, about 150 km north of the border with Kazahstan, the rig is being used to produce aggregates for the state-owned company Chelyabinskavtodor which is responsible for maintaining 18 000 km of roads in the area.

The rig typically drills 115 mm holes to depth of 10–15 m and is said to be three times as fast as other drilling equipment used by Chelyabinskavtodor.

The PowerROC T45 is also proving to be a valuable asset at the Matrosov gold mine in the Magadan region where drill and blast contractor Kolymavzryvprom uses two units to drill large diameter holes (102, 115, and 127 mm) in medium hard rock at the rate of 0.6 m per minute.

Aleksey V. Olshevsky, General Director of Kolymavzryvprom, says: "After four months using the PowerROC T45 we think the performance is very good. The rig is easy to use, has good maneuverability and moderate fuel consumption."

The ability to move the rig easily and quickly around the drill site is considered a big advantage. This is due to the PowerROC T45's triple grouser in combination with two-speed drive and the hydraulic track oscillation.

Stanislav Resheten, Business Line Manager for Atlas Copco in Russia, says: "The combination of ease of operation, mobility and reliability are the three main reasons why the PowerROC range is growing significantly in popularity. Another feature that is appreciated here is the rig's ability to perform in permafrost such as in Siberia where the average temperature is never higher than – 15 degrees."

PowerROC T45 and the Kolymavzrycprom drilling team in the Magadan region.

Atlas Copco celebrates 140 years of innovation

WORLD Atlas Copco is celebrating its 140th anniversary this year by turning the spotlight on its many achievements and milestones. The company was founded in Sweden in 1873 and is now a global supplier of mining and construction equipment with an organization across more than 90 countries.

The celebration officially commenced in February as Atlas Copco's President and CEO Ronnie Leton rang the opening bell at the Nasdaq Stock Exchange in New York. To mark the 140th anniversary, a commemorative book and website have been launched, providing a rare opportunity to explore the company's rich history and the developments that have shaped its industrial success.

With archive photographs, a complete timeline, rare advertisements, historical footage and podcasts, the website spans everything from the introduction of the first rock drills and portable air compressors in 1905 to the world's first serial-produced hydraulic breakers in 1966.

The landmark projects that Atlas Copco has been involved in are almost too numerous to mention. Among the more notable ones are the Mont Blanc Tunnel across the France-Italy border, the Abu Simbel relocation project in Egypt which saved ancient temples from the waters of the Nile and the discovery in the 1980s of a new dinosaur species in Australia, which now bears the name Atlascopcosaurus Lourdsi.

Visit the site at atlascopco.com/history

New rig in the FlexiROC family

SWEDEN. A new surface drill rig has joined the Atlas Copco FlexiROC series. Powerful enough for hard rock, yet compact and flexible enough to move from site to site, the new FlexiROC T30 R tophammer rig is designed for tough jobs in small yet demanding environments in construction and quarrying.

New in the family: The FlexiROC T30 R for small but demanding work sites.

Based on the popular ROC D3 RRC platform, the rig has an extended boom coverage of 5 200 mm through an 80-degree radius, which means more holes can be achieved with fewer setups, saving contractors time and money. The rig's low center of gravity and high ground clearance provides good mobility in rugged terrain.

But there are other benefits, too. "Radio remote control comes as standard which gives the operator full control of the rig from a safe working distance," says Mats Birkestål, Product Manager, Atlas Copco Surface Drilling. "It's an ideal choice for work at confined sites or in unstable terrain." The new rig is particularly suitable for specialist tasks such as boulder blasting and installing self-drilling anchors. It is also available with both Tier 3 and Tier 4 diesel engines which means improved fuel consumption and lower emissions.

Birkestål adds: "The compact size of the FlexiROC T30 R means the rig can easily be transported, allowing contractors to maximize the utilization of their equipment."

PV-311 is a winner!

USA Atlas Copco's Pit Viper 311 rotary blasthole drill rig has been voted innovation of the year by the readers of the international journal *Mining Magazine*. As a result, the rig has been awarded the magazine's Surface Mining Award 2012 (hard rock category). The award was presented by the magazine's editor Carly Lovejoy to Jon Torpy, newly appointed Vice President of Marketing at Atlas Copco Drilling Solutions, and his predecessor Brian Fox at a ceremony in Denver in February. The PV-311 was introduced to the mining industry at last year's MinExpo in Las Vegas where it was a star attraction.

WHERE TO FIND US

Please contact your local Atlas Copco Customer Center.

ALBANIA, Tirana, +355 682 061 618. **ALGERIA,** Zeralda, +213 (0) 21 32 83 25 / 26/27. **ANGOLA,** Luanda, +244 929 303 139. **ARGENTINA,** Buenos Aires, +54 (0)11 47172200. **AUSTRALIA,** Blacktown, +61 (0)2 9621 9700. **AUSTRIA**, Vienna, +43 (0)1 760120. **BELGIUM,** Brussels, +32 (0)2 689 0511. **BOLIVIA,** La Paz, +591 (0)2 21 12000. **BOSNIA AND HERZEGOVINA,** Sarajevo, +387 33 674 391. **BOTSWANA,** Gaborone, +267 395 9155. **BRAZIL,** São Paolo, +55 (11) 3478 8200. **BULGARIA,** Sofia, +359 (0)2 489 3178. **BURKINA FASO,** Ouagadougou, +226 5036 5610. **CAMEROUN** Douala, +237 76308451. **CANADA,** Sudbury, +1 (0)705 673 6711, North Bay, +1 (0)705 4723320 **CHILE,** Santiago, +56 (0)2 4423600. **CROATIA,** Zagreb, +385 (0)1 611 1288. **CHINA,** Beijing office, +86 (0)10 6528 0517, Nanjing, +86 (0)25 8696 7600. **HONG KONG,** +852 2797 6600, **COLOMBIA,** Bogotá, +57 (0)1 419 9200. **CYPRUS,** Nicosia, +357 (0)22 480740. **CZECH REPUBLIC**, Praha, +420 225 434 000. **DR OF CONGO,** Lubumbashi, +243 (0) 991 004 430. **DENMARK,** Glostrup, +45 4345 4611. **EGYPT,** Cairo, +202 461 01 770. **ESTONIA,** Vantaa (Finland) +358 (0)20 718 9300. **FINLAND,** Vantaa, +358 (0)20 718 9300. **FRANCE,** Saint Ouen l'Aumône, +33 (0)1 3909 3222. **GERMANY,** Essen, +49 (0)201 21770. **GHANA,** Accra, +233 0302 7745 12. **GREAT BRITAIN,** Hemel Hempstead, +44 (0)1442 22 2100. **GREECE,** Koropi, Athens, +30 (0)210 349 9600. **INDIA,** Pune, +91 (0)20 3072 2222. **INDONESIA,** Jakarta, +62 (0)21 7801 008. **IRAN,** Tehran, +98 (0)21 6693 7711. **IRELAND,** Dublin, +353 (0)1 4505 978. **ITALY,** Milan, +39 02 617 991. **JAPAN,** Tokyo, +81 (0)3 5765 7890. **KAZAKHSTAN,** Almaty, +7 727 2588 534. **KENYA,** Nairobi, +254 (0)20 6605 000. **KUWAIT,** East Ahmadi, +956 2398 7952. **SOUTH KOREA,** Seoul, +82 (0)2 2189 4000. **LATVIA,** Vantaa (Finland), +358 (0)20 718 9300. **LITHUANIA,** Vantaa (Finland), +358 (0)20 718 9300. **MACEDONIA,** Skopje, +389 (0)2 3112 383. **MALAYSIA,** Selangor, +60 (0)3 5123 8888. **MALI,** Barmako, +223 73 29 00 00. **MEXICO,** Tlalnepantla, +52 55 2282 0600. **MONGOLIA,** Ulan Bator, +976 (0)11 344 991. **MOROCCO,** Casablanca, +212 522 63 4000. **MOZAMBIQUE,** Maputo, +258 823 08 2478. **NAMIBIA,** Windhoek, +264 (0)61 2613 96. **NETHERLANDS,** Zwijndrecht, +31 (0)78 6230 230. **NEW ZEALAND,** Auckland, +64 (0)9 5794 069. **NIGERIA,** Abuja, +234 7068 6212 53. **NORWAY,** Oslo, +47 6486 0300. **PAKISTAN,** Lahore, +92 4235 749 406. **PANAMA,** Panama City, +507 2695 808, 09. **PERU,** Lima, +511 4116 100. **PHILIPPINES,** Manila, +63 (0)2 8430 535 to 39. **POLAND,** Raszyn, +48 (0)22 5726 800. **PORTUGAL**, Lisbon, +351 214 168 500. **ROMANIA,** Baia Mare and Bucharest, +40 262 218212. **RUSSIA,** Moscow, +7 (495) 9335 552. **SAUDI ARABIA,** Jeddah, +966 (0)2 6933 357. **SERBIA,** Belgrade, Phone: +381 11 220 1640. **SINGAPORE,** Jurong, +65 6210 8000. **SLOVENIA,** Trzin, +386 (0)1 5600 710. **SOUTH AFRICA,** Witfield, +27 (0)11 8219 000. **SPAIN,** Madrid, +34 (0)9 162 79100. **SWEDEN,** Stockholm, +46 (0)8 7439 230. **SWITZERLAND,** Studen/ Biel, +41 (0)32 3741 581. **TAIWAN,** Taoyuan Hsien, +886 (0)3 4796 838. **TANZANIA,** Dar es Salaam, +255 222 86 1570. **THAILAND,** Bangkok, +66 (0) 3856 2900. **TURKEY,** Istanbul, +90 (0)216 5810 581. **UNITED ARAB EMIRATES,** Dubai, +971 4 8861 996. **UKRAINE,** Kiev, +380 44 499 1870. **USA,** Denver, Colorado, +1 800 7326 762. **UZBEKISTAN,**Tashkent, +998 71 120 4635. **VENEZUELA,** Caracas, +58 (0)212 2562 311. **VIETNAM,** Binh Duong, +84 650 373 8484. **ZAMBIA,** Chingola, +260 212 31 1281. **ZIMBABWE,** Harare, +263 (0)4 621 761.

For more information visit www.atlascopco.com or contact Atlas Copco AB, SE-105 23 Stockholm, Sweden. Telephone: +46 (0)8 743 80 00. www.miningandconstruction.com

Thank you for your business

Atlas Copco owes its successful history to customers in more than170 countries who have continuously challenged and inspired us to innovate and improve our products and services, year after year. We would like to thank you for your loyalty and trust, as well as your cooperation. You can rely on your local Atlas Copco team to continue doing everything we can to ensure your sustainable productivity.

For at least the next 140 years. That's a promise.

1873 140 2013

Sustainable Productivity

Atlas Copco

9853 8190 01