

MINING

REVIEW AFRICA



MINING REVIEW AFRICA | NOVEMBER | DECEMBER 2020

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P4

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“ We simply cannot relax because the number of COVID-19 cases reported is decreasing. ”

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It has been another stellar year for minerals concentration specialist GCA which continues to build on decades of success, providing concentration equipment and services to some of the world's largest mines and project firms. **P4**

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Managing Director – Africa

David Ashdown

e: david.ashdown@clarionevents.com

Group Director – Media

Ross Hastie

e: ross.hastie@clarionevents.com

Deputy Director – Media

Bernice Bredenkamp

e: bernice.bredenkamp@clarionevents.com

Editor-in-Chief

Laura Cornish

e: laura.cornish@clarionevents.com

Senior Editor

Gerard Peter

e: gerard.peter@clarionevents.com

Senior Deputy Editor

Chantelle Kotze

e: chantelle.kotze@clarionevents.com

Online Editor

Richard Jansen van Vuuren

e: richard.jansen@clarionevents.com

Brand & Advertising Specialists

Rochelle Botha

e: Rochelle.Botha@clarionevents.com

Vuyisa Mfobo

e: Vuyisa.mfoba@clarionevents.com

Kudakwashe Tsingano

e: Kudakwashe.Tsingano@clarionevents.com

Production Manager

Mandy Rust

e: Mandy.Rust@clarionevents.com

Design & Layout

Catherine van Dyk

e: clearimpressions@outlook.com

Head Office

2nd floor, North Wing, Great Westerford,

240 Main Road, Rondebosch, 7700

PO Box 321, Steenberg, 7947,

South Africa

t +27 21 700 3500

f +27 21 700 3501

info@clarionevents.com

www.clarionevents.com

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EDITOR'S COMMENT

FEBRUARY 2021

Where will you be?

It is with great sadness that I write my last editor's note for 2020 off the back of hearing that the *Investing in African Mining Indaba* for next year has been cancelled.

It was to be expected, I suppose – a second wave of COVID-19 cases in Europe has delivered unprecedented new numbers, climbing with rapid speed, while other regions such as South America, North America, India and Russia have (at this stage) yet to find a way to curb the pandemic.

What this equates to is essentially a travelling nightmare – COVID-19 testing and self-isolation windows are a lot to absorb when catching a long haul flight for a conference – and I guess for most of us it is just not feasible or financially viable.

The event's formal statement said the following:

"For the last 27 years, Investing in African Mining Indaba has been about bringing the global mining community together and delivering world-class, face-to-face events. In our commitment and passion for the industry, we really hoped to make Mining Indaba happen early next year. Unfortunately, after discussions with our partners in South Africa and key stakeholders in the mining industry, we have made the difficult decision to cancel the 2021 edition of Mining Indaba. The event will

now take place on 7-10 February 2022."

So, while it's a sad day in our history to officially record the cancellation of Mining Indaba in 2021, I believe the organisers have made the right call and I know the industry respects this decision.

Fortunately, there is light at the end of this tunnel for those of us who block out that week in February every year. In line with global trends, Mining Indaba will

take to the internet waves to deliver a virtual event on 2 and 3 February 2021. "We recognise the role that Mining Indaba plays in connecting the global mining community and its significance in shaping the industry for the year ahead. This strategic

event will feature free high-level content streamed online, including pioneering insights from the industry's heavyweights, multi-stakeholder strategic conversations, keynote addresses and more."

That gives me confidence that the month of February will still be our 'Mining Indaba month', all be it from the comfort of our homes or office desks. I will miss the networking, the cocktails, the lovely Cape Town weather and just connecting with new and familiar faces to chat about our industry. However, as they say, the show must go on – and so it will!

Conference aside, I hope the year has been palatable for you and that December will provide you with the time

to rest, recover and reset for the new year ahead – no matter what we will face, I have every confidence that our industry will continue to prove its resilience and adaptability, setting us in good stead for whatever lies ahead. **MRA**



Mining Indaba will take to the internet waves to deliver a virtual event on 2 and 3 February 2021



Remembering one of my favourite Mining Indabas - with senior deputy editor Chantelle Kotze



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Quality and customer centricity

Driving GCA's long-standing success

Despite the disruptions brought about by COVID-19, it has been another stellar year for minerals concentration specialist **GCA** which continues to build on decades of success in providing concentration equipment and services to some of the world's largest mines and project firms.



GCA specialises in a range of different gravity concentrators, from lab scale alluvial projects to large-scale multiple unit installations to suit feed rates from 45 kg/hr to 1 000 tph per concentrator. Its range of products includes the proven and tested FLSmidth Knelson Concentrator. For more than 40 years, the Knelson Concentrator has been regarded as the benchmark when it comes to centrifugal concentrators. GCA has been representing the Knelson brand since 1997 and has been an integral part of more than 400 large-scale Knelson installations on the African continent. GCA has continued to represent the technology after the acquisition of Knelson by FLSmidth in 2012. Due to

its long-standing representation of the brand, the company is confidently able to advise clients on exactly which models they need to suit their ore type, and technical and financial needs.

FLSmidth Knelson Concentrators are well suited for the secure recovery of gravity recoverable gold (GRG) and other heavy metals and minerals from both alluvial and hard-rock plants. Using centrifugal force and water injection processes, they create enhanced gravitational forces of up to 200 Gs to recover free gold, fine gold and any other precious metals or minerals with high specific gravities.

GCA is also the agent for Consep Acacia, a range of intensive cyanidation leach reactors. The Consep Acacia Reactor is a complete

intense leaching plant that maximises the recovery of gold from gravity concentrates. Often used downstream from FLSmidth Knelson Concentrators, the Acacia produces the optimum solid-liquid interaction for maximised gold leaching kinetics by using an up flow fluidised reactor as opposed to complex mechanical agitation. It encompasses a complete process solution for the safe, reliable and maximum recovery of gold from high grade gravity concentrates. With approximately 200 units installed, GCA estimates that in excess of 15% of the world's gold production is recovered using Consep Acacia's around the world.

Across Africa alone there are more than 35 Consep Acacia systems installed. Recent African gold projects include Goldfields' Tarkwa, Teranga Gold Corporations Sabodala, Thor Explorations' Segilola, Delta Gold's Eureka, Resolute Mining's Syama and Golden Star Resources' Wassa mines.

The Consep Acacia features robust and reliable reaction chemistry, high-quality solids handling techniques, compact design and simple operating philosophy. It is a highly flexible solution that allows it to be customised to fit into any flow sheet and any location.

GCA is also a leader in the supply of shaking tables. Like many of the products sold and commissioned by GCA, shaking tables are gravity-based concentrators, using only power and water to produce gold, or other heavy metals and minerals, from ore concentrates or primary feeds.

Shaking tables are generally used to produce bullion-grade concentrate on smaller mines or mines where cyanide leaching cannot be used. To deal with security issues, GCA offers an Automated Table System (ATS), which operates independently or in conjunction with automated Knelson Concentrators to provide a hands-off concentrate treatment solution. The ATS maximises secondary recovery by continuously recycling table middlings and tails between primary machine flushes, and ejecting the spent products at the end of each cycle before receiving fresh concentrates.

The simplicity, reliability and cost effectiveness of these shaking tables are what makes them attractive to many sites. In its current form it is by no means as good as the Consep Acacia in terms of recovery, but if one takes into account the huge capital cost difference and the fact that it's a 100% chemical free process, it sometimes makes sense giving what is considered to be "old technology" a second look.

Furthermore, GCA is also the agent for the Filtaworx range of self-cleaning industrial filters. Regarded as one of the most important products in the company's range, the filters are particularly helpful in African regions that have poor quality water. The easily replaceable screens range from 50 to 800 microns, and the extensive range of filters can handle between 25 and 900 cubic meters of water per hour in a single unit. They come in a variety of sizes and can be fitted with different screen apertures to suit the application.

The filters are ideal for ensuring better quality fluidisation water for FLSmidth Knelson Concentrators as well as other mineral processors. The completely stainless steel filters can withstand the harshest corrosive environments, and minimise plant downtime in any mine. The clean water supply can be used in many applications, from pump gland water supply right through to the water supply to the Knelson Concentrators. In fact, these filters are even used to filter the entire plant water supply.

While GCA is an agent for a trusted and proven product range, the primary driving force behind the company's success is customer satisfaction. The company is keenly focused on offering the highest quality mineral concentration products and techniques to suit the specific needs and budget of its clientele.

With decades of experience, the GCA team always goes the extra mile for its clients. In fact, GCA staff routinely traverse Africa – and indeed the world – in order to ensure that equipment commissioning, circuit audits, machine health checks, operation and maintenance training, and spares-holding checks run perfectly.



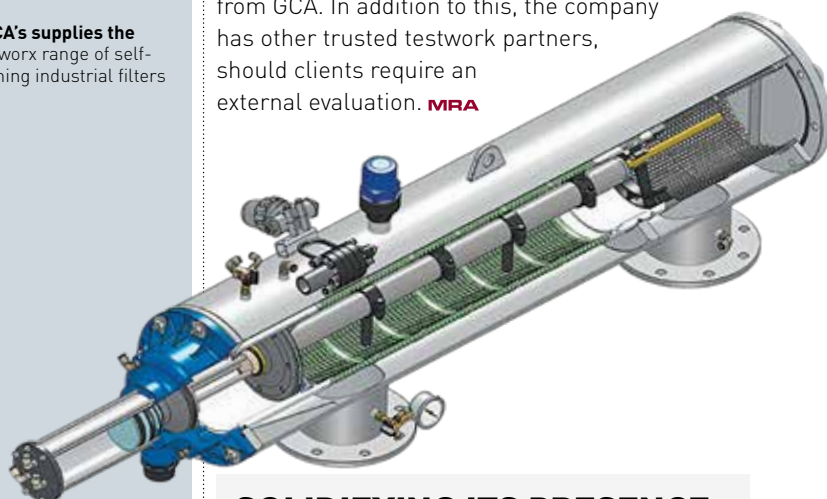
↑ **Gravity-based** concentrators are cost-effective and suitable for smaller mining operations

← **Consep Acacia's 100** and 101 bound for a mine in Tanzania

↓ **GCA's supplies the** Filtaworx range of self-cleaning industrial filters

In addition, staff are able to offer support and advice from their desks. GCA is capable of recommending and supervising mineral testwork on behalf of its clients in order to have a better understanding of ore capabilities before providing guidance on the best equipment for the job at hand.

GCA owns facilities for bench and pilot-scale testing of Knelson semi-batch and continuous technology as well as Consep Acacia intense cyanidation. These test machines are housed at and operated by Maelgwn Mineral Services Africa in Johannesburg, with supervision and advice from GCA. In addition to this, the company has other trusted testwork partners, should clients require an external evaluation. **MRA**



SOLIDIFYING ITS PRESENCE IN AFRICA

It's been a busy year for GCA with the company supplying:

- 12 FLSmidth Knelson Concentrators into Zimbabwe, South Africa, Burkina Faso and Kazakhstan via a South African project house;
- 25 Shaking tables into South Africa, New Zealand and Zimbabwe; and
- 31 Filtaworks filters into South Africa, Ghana, Mauritania, Tanzania, Zambia, Kazakhstan and Guinea.

“

The primary driving force behind the company's success is customer satisfaction.”



Image: 123rf.com

Dr Thuthula Balfour

Fighting the unrecognised pandemic

It's been a testing year for **Dr Thuthula Balfour**, head of health at **Minerals Council South Africa**. Not only is the organisation playing an active role in flattening the COVID-19 curve but Dr Balfour is also leading the fight to combat diseases that existed before the coronavirus pandemic. **Gerard Peter** reports.

As mining companies slowly start adjusting to working in the 'new normal', it begs the question if the worst is over as far as the pandemic is concerned. According to Balfour, most mining operations experienced their peak around the third week of July. "We still have cases and deaths being reported but this is the tail end of the pandemic. There is

also talk of a second wave that is being experienced in many countries but we hope it does not come to that here in South Africa," she states.

Balfour states that the only way to stem the spread of COVID-19 boils down to behaviour. "Let us behave in the same way as when there was a hard lockdown. We need to wear masks and maintain social distancing. In many cases, this is not happening and we simply cannot afford to have another hard lockdown. So people need to live as if COVID-19 is still around."

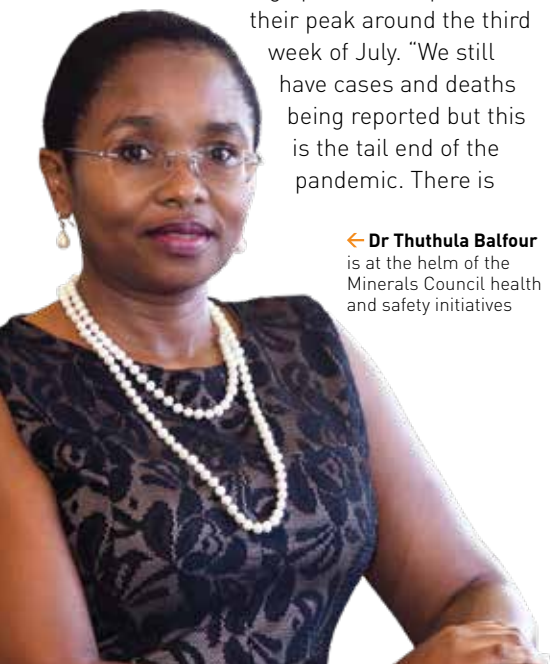
Thankfully, the mining industry is taking heed of Balfour's advice. Recently, the CEOs of coal companies resolved to maintain the same preventative measures as they did during Level 5 of lockdown. "Generally, that is going to be the approach going forward; we simply cannot relax because the number of cases reported is decreasing," Balfour adds.

Adhering to stringent health and safety measures is part and parcel of the mining industry. To that end, the Minerals Council is part of a tripartite forum that includes the Department of

Minerals and Energy, mining companies and labour unions.

At a local level, companies are actively engaging with communities and health authorities to prevent the spread of COVID-19. "It's no use putting 100% effort into preventing COVID-19 cases on mines without also ensuring that measures are in place in surrounding communities. That's because people who work on the mines live in these communities. So if there is transmission in these communities, it will spread to the mines," she states.

Now, while the Minerals Council has been proactive in fighting the coronavirus pandemic, the pandemic has posted a threat to global health systems and forced the restructuring of health care resources the world over. It has also impacted on the mining industry's continued efforts to fight TB, HIV/AIDS and non-communicable diseases. "We have a reporting system for these types of diseases. Usually, we have a reporting rate of more than 90% per quarter and now we are sitting on a rate of 60%. By the end of the second quarter of the year, we aim to screen about 50% of the



← **Dr Thuthula Balfour** is at the helm of the Minerals Council health and safety initiatives

workforce for these diseases per quarter. This year, that figure is around 30%.”

Another major consideration is that occupational health programmes now have to be changed because of social distancing measures. Previously, such programmes entailed having a room filled with workers who came for their annual medical check-ups. “For example, where previously we would have 60 people in a room, we now can only accommodate 30 people. We are also unable to perform certain tests such as lung function tests as these are perceived to contribute to a high rate of transmission,” Balfour adds.

According to Balfour, the fear of being in places where there is a high risk of COVID-19 transmission is also a concerning factor. “No one wants to go to any place where there are sick people, because they’re fearful that they might contract the virus. That is why we have had to put extra measures in place to ensure that people receive treatment for diseases such as TB.”

Dealing with the silent killer

It is for this reason that last month the Masoyise Health Programme held a seminar that focused on the reprioritisation of pre-existing occupational health threats, such as TB, HIV and non-communicable diseases (diseases that are not transmitted from person-to-person including cancer, diabetes, auto-immune diseases and



Mine workers are slowly getting used to working in the new normal

mental health conditions) in the era of COVID-19.

The Masoyise Health Programme traces its origins back to 2016 when the mining industry, labour, the Mine Health and Safety Council (MHSC) and other government health institutions, first launched the Masoyise iTB campaign, under the auspices of the Minerals Council, to address the impact of TB on industry employees and communities. In 2019, Masoyise iTB became the more broadly focused Masoyise Health Programme.

Balfour states that the issue of mental health is gaining increasing awareness. “Even before COVID-19, mental health was recognised as being very important

for employee wellness. For instance, in mining we have observed that in many instances people are not able to manage their finances and that is serious, because it can result in suicide and safety incidents because people are under stress. So, we have had an appreciation of the importance of mental health in the industry. Additionally, with COVID-19, there are additional psychosocial and mental problems people suffer from such as dealing with the loss of a loved one.

“That is why the Masoyise programme is so important. As a collective, we can organise and reprioritise other medical conditions in the era of COVID-19,” she concludes. **MRA**





The South African mining industry has proven to be resilient and has fared better than other sectors

Image: 123rf.com

South Africa's mining industry

Opportunity to build back better

South Africa's mining industry may have shown resilience and weathered the COVID-19 storm but companies will need to focus on their strategies, particularly when it comes to environmental, social and governance (ESG) matters. **GERARD PETER** reports.

This is according to a recent report by PwC on the state of country's mining industry. The report paints the sector in a positive light, stating that despite an extremely challenging year, mining companies have remained resilient and performed well on all fronts.

Stakeholders benefited from the improved profitability with mining companies strengthening their true social licence to operate in supporting their employees and the communities in which they operate. The mining industry weathered the COVID-19 storm, mostly unscathed, and certainly better than many other sectors.

It must be noted that the South African economy was already in a recession prior to the COVID-19 pandemic with the country's GDP contracting for three straight quarters ending March 2020. During this time, the mining sector's contribution to GDP declined year-on-year (YOY) in each of the recession's three quarters.

The second quarter of 2020 started with a hard lockdown. This saw mining production decline by 51.2% and sales by 28.8% YOY in April as government regulations limited economic activity to essential services only, with only coal mines operating at full capacity.

The decline in mineral output and sales eased to 27.6% YOY and 12.2%

YOY respectively under Lockdown Level 4 as more mines were allowed to open. The majority of mines were allowed to return to 100% capacity in June under Lockdown Level 3. However, production and sales were still down 28.2% YOY and 14.2% YOY respectively, due to logistical constraints and international market conditions.

Despite a somewhat bleak outlook, mining companies have continued to enjoy the gains in commodity prices, assisted by a weaker rand, as platinum basket prices increased and investors turned to gold as a safe haven investment amid concerns about the COVID-19 pandemic and global trade tensions. PwC's key points include:

Market capitalisation

In 2020, total market capitalisation increased to R1 280 billion from R840 billion. This total is a R439 billion (52%) YOY increase from 2019, largely attributed to the increase in market capitalisation of companies within the gold and PGM sectors. Gold and PGM accounted for 80% of the market capitalisation of the companies analysed this year and continue to dominate the sector.

Financial performance

The total revenue generated by the South African mining industry for the year ended 30 June 2020 grew by 4%. This was mainly driven by PGMs, gold and iron ore, which saw increases in revenue for the 12-month period. PGM generated the largest portion of revenue (28%), demonstrating a 56% increase from the previous year, overtaking coal for the first time since 2010. Gold mining companies had an increase of 35% in revenue. Revenue for the 'other mining' segments increased by 7%.

The impact of the COVID-19 pandemic was evident from April 2020, with reductions in revenue being seen across the industry. South African PGMs and gold are mainly mined in deep-level underground mines and were therefore hardest hit. PGM and gold producers indicated that they expect to reach full production levels by the end of the year.

Production

Production decreased by 8% YOY, with a 44% decrease in production noted in April 2020 as a result of the pandemic – the most significant of which was due to

reductions in gold, diamonds and PGM outputs. Production levels increased in May 2020 following the easing of lockdown restrictions.

The hydrogen alternative

The report states that in South African mining, hydrogen has been receiving attention for quite some time. There have been several transport initiatives in the sector that are heavily focused on the use of PGMs in the catalysts of fuel cells. Although these pilot projects are a good start to bringing hydrogen technology into mining, the focus of their application is quite narrow, looking at decarbonising only the transport portion of a mining operation.

As such, there exists a far larger opportunity to leverage the cross-sector benefits of hydrogen on a microgrid scale, creating a fully green and resilient mining operation. "Now may be the opportune time for mining companies to consider the vast benefits of hydrogen given that the cost of renewable hydrogen production is expected to fall by up to 60% over the next decade," the report states.

Responsible mining

According to the report, companies and investors have increasingly been recognising the importance of prioritising environmental, social and governance (ESG) matters on the corporate agenda.

The report identifies four key ESG focus areas that should be top of mind for any company that wants to build back better, ensure a just transition to a new economy and enhance their social licence to operate. These are:

1) supply chain resilience; 2) measuring impact; 3) climate-related risks; and 4) resource efficiency.

However, the analysis shows that while mining companies are often at the forefront of ESG efforts, they are weak on their reporting when it comes to setting targets and measuring themselves. The COVID-19 pandemic called for a renewed focus from government and business to better peoples' lives and support local communities. As such, this shows a need for ESG to be considered in its entirety.

The pandemic highlighted the absolute need to 'build back better'. Mining will play a key role in that recovery. It is therefore unfortunate that despite the increased profitability, capital expenditure only increased marginally. Whilst a cautious approach is understandable, impediments to investment need to be removed. Liberalisation of the energy market to ensure reliable and cost competitive electricity is essential for mining and potential beneficiation opportunities.

Furthermore, progress in the regulatory environment should continue with a need to streamline processes and improve transparency for existing and potential investors.

The PwC report states further: "The mining tax environment should be considered as a whole, with an opportunity to incentivise exploration expenditure. Enabling infrastructure, supporting supply chain and mine-to-market logistics would provide immediate recovery benefits and enhance long-term sustainability. Investment can only be attracted if the SA mining industry can be cost competitive with its global peers." **MBA**



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Manufacturers such as Tesla will drive the demand for technology metals



Image: 123rf.com

Tech talk

Mining metals of the future

While gold may be attracting the attention of investors, **JONATHAN BROOKS**, head of mining and metals and partner at European law firm **Fieldfisher**, believes that the underlying trend and interest going forward is in technology metals. **GERARD PETER** reports.

Brooks states that the COVID-19 pandemic has brought to the fore climate change and humankind's impact on natural resources. "During the pandemic people have become more conscious of climate change and the need to move towards a zero carbon economy. Therefore, as a firm, we are receiving lots of enquiries from companies that have technology metals projects, whether they be lithium, tin or other more exotic items on the technology metals list," he states.

Now, while there is considerable interest in technology metals, Brooks

avers that it is still a tough ask to get investors interested in these projects. "There is still a flight to gold at the moment but beyond the headlines around gold, there will be long-term interest in technology metals as projects come into play and reach production status," he says.

Brooks explains that one of the reasons why it is a challenge to attract investors to these projects is that some of the technology metals are quite 'esoteric'. "Little is known about the markets for some of these metals: their pricing and trading and where prices are heading. This puts equity investors and debt providers off some of them.

"Also, technology moves on. For example, Tesla wants to cut cobalt out of the production of the batteries in its electric vehicles. So, if people are taking Elon Musk seriously when he says that he can develop a viable technology without using cobalt, then that obviously has an effect on cobalt prices."

Securing investors' interest

Therefore, Brooks states that it takes a lot of education for investors to understand the technology metals market. "The price of a number of such metals are fixed by over-the-counter trading or between a producer and a particular off-taker. As such, price

transparency is difficult to determine and this does hold back investment from the traditional institutional investors.”

When it comes to securing investment for technology metals projects, Brooks advises that a mining company should first educate investors about its market and also secure an off-take agreement. “Firstly, it is important to understand how the pricing of these metals works and to pass this education onto potential investors. Secondly, it is best to get at least an expression of interest from an off-taker. The expression of interest might be heavily caveated by the off-taker, but it is important to demonstrate to potential investors the guaranteed quantity and price of future sales and how this price will be calculated. A company needs to look, if possible, at well-known benchmark pricing mechanisms to understand how these prices will be calculated.”

Furthermore, Brooks states that ESG will be a determining factor when mining such metals in a responsible and ethical manner. “The whole discussion around ESG matters has really gathered pace this year, no doubt encouraged by the COVID-19 pandemic.

“

We are receiving lots of enquiries from companies that have technology metals projects,

”

JONATHAN BROOKS



“For example, there is a lot of attention being given to conflict minerals from the likes of the DRC: manufacturers and investors want to ensure that supplies are properly sourced and that all international standards are followed, right from production all the way through the supply chain,” he concludes. **MRA**

METALS WATCH

According to Jonathan Brooks, the technology metals that are currently being tipped for growth are tin, copper and lithium. “While the tin price has actually not done that well recently, the long-term outlook is considered good, driven by new applications in electronics. For example, Rio Tinto has stated tin will be the metal most impacted by new technology.

“Meanwhile copper will also be in great demand because you need the metal for wiring in electric vehicles and for renewable projects. Another commodity that we see UK investors looking at is lithium.



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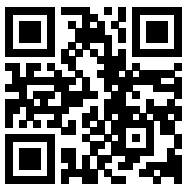
2020

Top 10 stories on miningreview.com



Minimum US\$95 million compensation claim lodged against Tanzania

"We have worked diligently over the past six months to lodge our request for arbitration with the International Centre for Settlement of Investment Disputes and place an estimate on the value of the claim for compensation for the expropriation of the project." – Indiana Resources' executive chairman Bronwyn Barnes.



Uranium: A bull market is under way

The growing uranium supply deficit, currently being accelerated by the COVID-19 pandemic



related production cuts, has seen the price for uranium skyrocket – making it the world's best-performing major commodity right now.



Top-quality 64 carat type IIa diamond recovered from Mothae

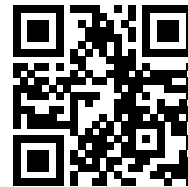
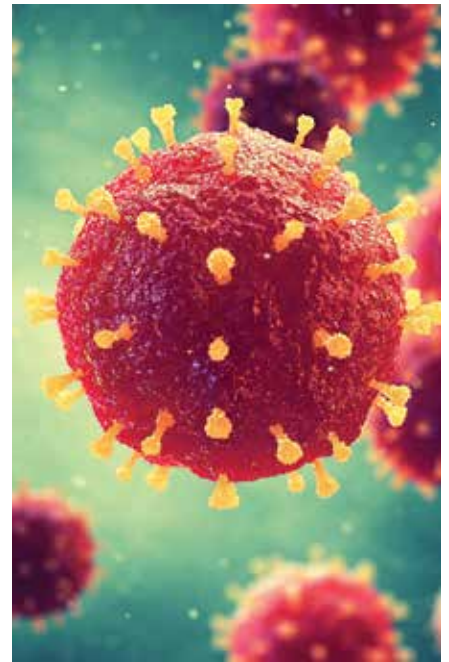
The 64 carat diamond is the 12th +50 carat diamond recovered from Mothae since commercial production commenced in January 2019 and further underlines Mothae's status as a source of large and premium-value diamonds. Other significant recoveries include a 0.3 carat blue gem, proving Mothae also hosts rare Type IIb diamonds, which account for less than 0.1% of global diamond production.



The impact of COVID-19 on the mining sector

Mining companies are feeling the pressure, despite recent positive

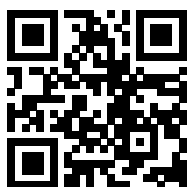
results brought about by surging commodity prices and various cost-cutting initiatives.



Zimbabwe's gold potential

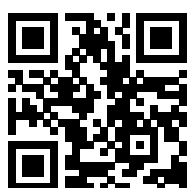
With over 6 000 small gold deposits having been exploited in Zimbabwe, there are huge opportunities to investigate many of them for potential for large mines. Gold exploration in Zimbabwe has been largely biased towards rediscovering quartz veins at old workings at the expense of virgin areas.





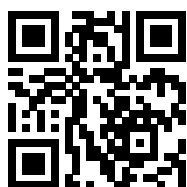
Mike Teke's Seriti Resources gives dignity back to South Africa

"I still believe in the value of coal, particularly in developing countries like South Africa that still depend on this commodity for the majority of its power generation. The world's drive to reduce its carbon footprint and clean up the environment is an absolute necessity but we cannot eliminate our dependence on coal overnight." – Mike Teke, CEO of Seriti Resources.



The simple truth about the gender pay gap in South Africa

An industry report has covered 70 countries and 80% of wage employees worldwide. An even more alarming statistic is that South Africa has the world's highest wage inequality overall.



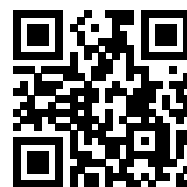
Silicosis settlement: First claimant payouts expected in Q2, 2020

The compensation for workers suffering from occupational lung diseases is the outcome of a three-year long negotiation process between Richard Spoor Inc, Abrahams Kiewitz and the Legal Resources Centre. The agreement provides for compensation to all eligible gold mineworkers (or their dependants) who suffer from silicosis and/or have contracted work-related tuberculosis.



Electric-powered earthmoving trucks: A revolution has begun

What may be unknown to most on the African continent is that companies have already been operating and delivering EV batteries for large-scale equipment for about 10 years.



Rough diamond prices affected by COVID-19 crisis

Larger diamond miners that sell

most production via contract have limited client/buyer requirements and in general seem to be progressing with a "price over volume strategy in managing supply to market" – meaning favouring reducing sales volume and maintaining prices versus maintaining sales volume and reducing prices. Once the diamond supply chain begins to reopen, which will require the opening of boarders, retail outlets and manufacturing and trading hubs globally, trading volume will gradually begin to normalize and prices will likely find a more sustainable and reliable price level. **MRA**



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Osino Resources

Uncovering Namibia's gold prospects

TSX-listed **Osino Resources** had one vision when it was founded: To find Namibia's next significant gold deposit. Now that it has achieved this objective, the company is focused on advancing its Twin Hills discovery, which is part of the company's larger Karibib gold project.

GERARD PETER finds out more from CEO **HEYE DAUN**.



Daun is the founder of Auryx Gold Corp. which was formed in 2010 after he, along with a few Canadian colleagues, acquired the well-known Otjikoto gold project in Namibia. "Otjikoto was considered marginal and problematic and not very interesting at the time. But being a mining engineer and having built and operated gold mines before, I recognised its opportunity," he starts.

"We raised money in Canada, drilled out the project and conducted a feasibility study. Having defined it and validated its viability, it was then acquired by B2Gold. Subsequently, B2Gold built a highly successful gold mine which is now one of Namibia's most profitable mines."

Daun weighed in on the success and started to explore the opportunity to discover more lucrative gold projects in

IN SHORT
Osino Resources will more than double its drilling programme at Twin Hills this year.

the country. In 2015, when very little attention was being given to Namibia, he formed Osino Resources to explore further opportunities. "We always had a vision to find the next significant gold deposit in the country.

And so, we then brought in quality financiers like Ross Beaty and RCF and with that money and determination, we executed a large-scale, systematic exploration programme, which resulted in the discovery at Twin Hills. Now that we've made the discovery, we are fast-tracking it to get it to the project stage," Daun adds.

The Twin Hills discovery forms part of Osino's Karibib gold project, which is made up of 12 contiguous licences to the north-east of Karibib town. Currently, it is in the advanced exploration stage. The company is now drilling to define a maiden resource at Twin Hills Central and is planning a rapid follow-on Preliminary Economic Assessment, both of which are expected

to be completed during the first half of 2021. Osino is thus on a fast track from being an exploration company to becoming a junior developer. Daun states that the project still has substantial exploration upside which will be tested with ongoing, intensive drilling over the next six months.

Exploration progressing well

Earlier this year, Osino Resources embarked on Phase 2 of its exploration at Twin Hills Central which comprised an aggressive, 8-rig reverse circulation and diamond drill programme which is ongoing. The objective of the second phase was to further define the Twin Hills discovery and drill test some of the other newly defined gold prospects within its cluster. The programme entailed approximately 40 000 m of in-fill and step-out drilling aimed at expanding the mineralised horizon along strike and down dip and testing some of the other targets. This drilling was generally done on 50 x 50 m spacing, with an average hole depth of 200 m. However,



The company expects to drill around 45 000 m this year



↓ An all Namibian team are undertaking the exploration



We always had a vision to find the next significant gold deposit in the country,

HEYE DAUN



it went down to 400 m in places and should result in a code-compliant maiden inferred resource statement by the end of Q1 2021.

While many mining operations have been hampered by COVID-19 lockdown restrictions, Daun states that it has been a good year for the company and that its operations have not been significantly impacted by restrictions. "Namibia took a similar approach to South Africa but was less draconian. So, we were mainly affected by the international travel restrictions. Mining was

regarded as an essential service so we were able to continue operations. Essentially, we had a two-month lockdown where we stopped all operations in March or April. And then in May we were able to start drilling again. Luckily, we have an all Namibian team and are well financed. As such, we were able to drill almost continuously, which means that we have progressed the projects substantially and we have thus had a great year, despite Covid-19."

With gold prices reaching their highest level, Daun admits that interest in the precious metal has necessitated a speed-up in operations. "At the beginning of the year, we announced a drilling programme of 20 000 m. We're going to double that and in fact, we will be drilling about 45 000 m this year. We started off with three rigs and now have got eight on the property. And we will just continue like that."

Furthermore, at the same time, Osino Resources has been very proactive and has enlisted Cape Town based Lycopodium, which is a respected Australian study specialist and mine builder, to assist Osino in completing a preliminary economic assessment on Twin Hills, during which Osino expects to report on in Q2, 2021.

While Twin Hills holds much promise, Osino Resources is certainly not putting all its eggs in one basket when it comes to exploration in the country. "We have an integrated exploration programme across our licences with a range of discoveries, prospects, and targets. And we are developing all of those at the same time.

"Clearly, the focus is on the more advanced projects so that's where most of our spending and attention is currently going. But we are doing Brownfields and Greenfields exploration on the other licences. In fact, we've been having some good success and I think there's a good chance we might make additional discoveries elsewhere in Namibia," Daun concludes. **MRA**



Mammoth and mechanised

IN SHORT

The mid-2021 start-up of Khoemacau, southern Africa's first fully mechanised underground mine, will be a milestone achievement for the company, the country and the industry as well.

The beauty of Botswana's Khoemacau copper/silver project

2021 marks a significant milestone for the **Khoemacau copper and silver project** in Botswana – production start-up. While it represents the introduction of a new, large-scale and fully mechanised operation into the country, the long-term vision is to double production, at the very least, **JOHAN FERREIRA**, CEO at Khoemacau Copper Mining, tells **LAURA CORNISH**.



Zone 5 mine

The 100% owned Khoemaçau copper project is situated within the widespread Kalahari Copperbelt and forms part of a 4 040 km² land package that Khoemaçau Copper Mining owns.

This area is home to what has already been proven to contain significant quantities of copper and silver and represents what Ferreira believes will in time become a significant copper producing mining complex, diversifying the Botswana mining industry.

For now, the privately owned company is focusing on the development of the "Starter Project" which includes Zone 5, a Greenfield underground complex, supplying ore to the existing Boseto processing facility, currently undergoing an upgrade.

Comprising a measured, indicated and inferred resource of 92 Mt of copper containing high-grade 2.2% copper and +22 g/t of silver, Zone 5 will deliver 3.65 Mtpa of ore to the Boseto processing facility which will produce +60 000 tpa of copper and 2 Mozpa of silver (in concentrate). "We are on track to commission and deliver first concentrate towards the middle of 2021 and will ramp up to steady-state within six months," says Ferreira. "At this point, we are in a position to produce comfortably at these quantities for 24 years, just from Zone 5."

Firing on all cylinders

With a critical timeframe that required full steam construction activity in 2020, Khoemaçau has only been modestly impacted by the COVID-19 restrictions

introduced by government in Botswana. "Despite a reduced workforce and need to observe safety protocols, we have managed to keep the mine development on track and had seen modest impacts on the process plant upgrade schedule. Fortunately, we have been declared an essential service in the country, enabling us to proceed with development and construction activities," Ferreira notes.

Looking at the mining operation itself, Zone 5 comprises three adjacent underground mines that are divided into specific corridors and referred to as north, central and south mines – each designed to deliver on average 1.2 Mtpa of ore to the plant. The ore body's sulphide material starts 100 m below surface and extends for 1.2 km downwards – as far as Khoemaçau has drilled for now.



“Each mine comprises an innovative twin decline system which provides a wider strike length exposure to the ore body, and facilitates the production flexibility we require, but also offers independent ventilation, power supply, etc. This equates to three independently operating mines,” Ferreira outlines.

From a development perspective, Khoemaçau has made quick work of its development targets. Having commenced with box cut excavation in 2019, the CEO confirms (as of mid-2020) that all box cut construction was complete and over 5 000 m of development concluded since the start of underground mining in February 2020. Subsequent to this, development of the first ore blocks is in process and first ore is already on surface. A small amount of supporting surface infrastructure work is scheduled to be completed by the end of 2020.

Australia-based mining contractor Barmenco is not only undertaking all development work for the project but will mine all three underground mines as well – using fully mechanised processes. “This will be the first highly mechanised operation in Botswana, unlike anything southern Africa

f
 We are on track to safely commission and deliver first concentrate towards the middle of 2021,

JOHAN FERREIRA



has seen before. All ore from our stopes will be remotely loaded without any person in the operating cabins and our jumbo drill rigs will operate without any direct human interface – an investment driven by our objective to run a safe, healthy, sustainable and productive mine,” Ferreira states.

The company’s commitment to safety is further illustrated by the performance to date, with only one LTI since commencement of construction and mine development, despite a very large construction workforce of over 2 500 people on site.

“Through the delivery of a large-scale, underground mechanised mine, Khoemaçau will start to build a long-lasting legacy in Botswana.”

The existing Boseto processing plant, which formed part of the acquisition of the Boseto mining operation, which Khoemaçau acquired out of provisional liquidation in 2015, is the other critical path area. It is being volumetrically and metallurgically upgraded with demolition, civil, structural, mechanical, sand blasting and painting construction activities in progress. Electrical and instrumentation works are ready to start. “Once

Boseto process plant



completed, the plant's capacity will increase from 3 Mtpa to 3.65 Mtpa and will offer an enhanced flotation circuit, a new HIG mill, Jameson cells and filtration plant as well as refurbishment to the entire facility," says Ferreira.

Through the Boseto acquisition, Khoemaçau also gained access to an existing tailings storage facility which will be upgraded as part of the project and then utilised once the process facility is in production, and a large package of prospecting licences.

The supporting infrastructure required for Khoemaçau's development and production requirements includes the Zone 5 infrastructure (offices and workshops), emergency diesel power generation, 50 km of a 132 kV overhead transmission line that distributes the power requirements to the mine site, from the Botswana Power Corporation national grid, two new sub-stations, a 40 km water pipeline that supplies borehole

water to Zone 5, the occupation of the first phase of the permanent Zone 5 accommodation camp and the 35 km haul and access road that links the neighbouring Boseto processing plant to Zone 5 mine – all of which have been substantially completed.

The direct capital cost of the project is forecast at some US\$400 million, in line with the company's original budget, offering capital efficiency of \$6 700/annual ton of copper, well below industry averages. With a LOM average C1 cash cost of \$1.47/lb copper and net silver credits, this is a very competitive copper operation. The company raised some \$650 million in 2019 to fund project development, retirement of pre-construction loans, financing and overhead costs as well as working capital.

The greater potential

With a +4 000 km² land package, 100% owned by Khoemaçau, the vision

for a substantial expansion is already on the cards.

"In the medium term we aim to expand our production to over 100 000 tpa of copper and 5 Mozpa of silver in concentrate and in the long term increase this even further to +150 000 tpa of copper and +6 Mozpa of silver by developing further resources," Ferreira confirms.

Infill drilling and studies are already underway for three additional deposits including Zeta North East (15 km from Zone 5 but close to the Boseto plant), Zone 5 North (2.5 – 3 km north of Zone 5) and Mango (4 km south-west of Zone 5), along with a potential expansion of mining at Zone 5.

"Our thinking at this stage is to establish a new mill at Zone 5 – taking our total milling throughput capacity to between 8.5 and 9 Mtpa. From this point, we will feed higher volumes of ore from Zone 5 directly to the new mill and the



Boseto concentrate shed



Zone 5 Mine water dams



Zone 5 warehouse and workshops



Zone 5 south box cut



Zone 5 mining equipment and workshops



Zone 5 accommodation village

ore from our three additional ore bodies into the Boseto process plant. Funding could come almost, if not entirely, from cash flow, but the best funding strategy will be determined," Ferreira reveals.

"In addition to our expansion plans, we will also continue to explore our prospecting licences further."

Lastly, considering the large-scale plans Khoemacau has in the pipeline, the company may consider elevating its status, and through an initial public offering transition from a privately-owned company to a public listed entity. **MRA**

SUSTAINABILITY KEY

Delivering economic sustainability to Botswana, and the region within which the Khoemacau mine will operate, is key for the company.

The mine will employ between 1 000 and 1 200 employees sustainably for 24 years (including contractors), with priority given to recruiting employees from nearby communities. Initiatives have also been put in place to assist local residents through community development initiatives that will not only enable mine support but also create sustainable careers beyond the mine.

From an environmental perspective, a lot of care and effort has been undertaken. The adoption of clean technologies such as solar power is being evaluated to reduce the mine's carbon footprint. The haul and access roads, to be bitumen sealed, were routed to avoid interference with the native Baobab trees. An extensive study of regional water resources was undertaken and a holistic water strategy developed including recycling and reusing water, to minimise the impact on water resources.

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Caledonia Mining Corporation

Brownfield expansion at Blanket mine to boost production

AIM and NYSE-listed gold producer **Caledonia Mining Corporation** is approaching the end of a multi-year, +US\$70 million investment in establishing a new shaft at the historic Blanket gold mine in Zimbabwe. When the Central Shaft project is completed later this year, Blanket's gold production is expected to increase from its current level of approximately 55 000 ozpa to 80 000 ozpa from 2022 onwards, CEO **STEVE CURTIS** tells **CHANTELLE KOTZE**.

IN SHORT

The Central Shaft project, which will ultimately add four additional production levels to the Blanket mine, is instrumental in increasing production, improving operating efficiencies and extending the life of the 116-year-old mine even further.

The Central Shaft project will drive the development of the sub-750 m zones at the Blanket mine



The Central Shaft project, which aims to unlock additional resources from deep underground, forms an integral part of the company's life of mine extension plan at Blanket and has been in progress since early 2015. Upon completion of the project, gold production at Blanket mine is expected to progressively increase to 80 000 ozpa of gold by 2022.

Caledonia has demonstrated significant business resilience in the face of the COVID-19 pandemic but due to government imposed lockdown restrictions and not being able to get the required specialist contractors and equipment to the mine at the right time, the Central Shaft project is tracking three months behind schedule. Notwithstanding the negative effect of the coronavirus pandemic on supply chains and operating arrangements, Blanket managed to deliver robust production results for the first nine months of 2020 (42 896 oz of gold) and managed to increase its gold production by 11% year-on-year to 15 164 oz during the quarter ended 30 September 2020.

Demonstrating the strength of the business, Caledonia increased its production guidance for 2020 from 53 000 – 56 000 oz to 55 000 – 58 000 oz.

On the back of stable production, a high gold price and good cost control, the company also paid three quarterly dividends this year – all of which were an increase on the last, totalling a cumulative 45% increase in dividends in the past year. The latest dividend paid to shareholders in October of US\$0.10 is an 18% increase from the previous quarterly dividend of 8.5 cents paid in July 2020, and 7.5 cents in May – all of which are up from the 6.8 cents paid in October 2019.

As the company approaches the end of the six-year investment programme at Blanket, Curtis has confidence in the sustainability of the higher level of dividend distribution as the rate of capital expenditure starts decreasing in 2021. The combination of rising production and declining capital investment will provide the company with greater flexibility to consider further increases in the dividend.

Central Shaft nears completion

The Central Shaft, sunk to a depth of 1 208 m at shaft bottom in July 2019, is currently being equipped. Shaft equipping on track is to be completed in Q4, 2020, followed by commissioning by the end of Q1, 2021.

Prior to the execution of the Central Shaft project, Blanket mine operated to a depth of 750 m, accessed via No.4 Shaft. The Central Shaft project will allow the addition of three new production levels to the mine below the current



↑ **Construction work** underway on the Central Shaft project

↑ **Production at Blanket** mine will increase to 80 000 ozpa from 2022 following completion of the Central Shaft project

“Caledonia is well placed to identify other gold opportunities in Zimbabwe that could be as efficiently run as the Blanket mine and which could deliver good returns for shareholders.”

STEVE CURTIS



750 m level – on 26 (870 m), 30 (990 m) and 34 (1 110 m) levels – as well as a fourth production level on 38 level (1 230 m below surface) which will be accessed via a decline shaft.

The Blanket mine comprises five significantly independent near vertical ore bodies and is currently operated from the single No.4 shaft. The establishment of Central Shaft – aptly named because of its central location in relation to the five ore bodies – will enable the access of deeper ore bodies more efficiently.

Curtis explains that No.4 Shaft is located on the extremity of the ore bodies, which only allows mining to take place in one direction. The positioning of the Central Shaft will allow mining to take place in both directions along the 3 km strike on all three levels – reducing worker's travelling time significantly and enabling more efficient mining to take place.

The greater capacity of the Central Shaft, with a hoisting capacity of 3 000 tpd, will enable more ore to be mined, hoisted to surface and resultantly processed at the existing 3 500 tpd CIL processing plant. Curtis explains that while additional crushing and milling capacity will need to be installed, the overall mining and processing flowsheet will be better balanced once Central Shaft is in operation and allow for further operational efficiencies to be achieved going forward at the already low-cost mining operation.

Moreover, the expected tons that need to be hoisted to achieve 80 000 ozpa of gold production is in the region of 2 100 to 2 200 tpd, which means



Caledonia increased its production
guidance for 2020 from 53 000 –
56 000 oz to 55 000 – 58 000 oz

Zimbabwe remains highly prospective for gold

Caledonia believes Zimbabwe is a highly-prospective region for gold discoveries and has assessed and continues to assess investment opportunities in the Zimbabwe gold sector.

As a single asset company in a cash position and with an appetite to acquire additional Brownfield assets, Caledonia signed an agreement with the Zimbabwean government under which Caledonia will evaluate mining rights, properties and/or projects in the gold sector that are controlled by the government with a view to assessing the potential to advance development on these properties or projects.

Curtis believes that the signing of this agreement is very timely as Blanket mine is approaching the end of the investment in the Central Shaft. “The increased level of production which will be realised from the Central Shaft project, in conjunction with the higher gold price, means that we should have the financial capacity to consider further meaningful investments in the Zimbabwean gold sector,” says Curtis.

The signing of this agreement with the Zimbabwean government was welcomed by Winston Chitando, Minister for Mines and Mine Development, who supported the notion of Caledonia applying its experience, technical expertise and financial capacity to evaluate the portfolio of gold assets that are held by the government.

As a low-cost gold producer in Zimbabwe, Caledonia is well placed to identify other gold opportunities in the country that could be as efficiently run as Blanket and which could deliver good returns for shareholders – a priority for Caledonia, Curtis explains. He further notes that any investment into acquiring a new project would have to be value-enhancing for its shareholders. **MRA**

there will still be spare capacity, which bodes well for the long-term life of the mine and its machinery, says Curtis.

Strengthening the energy mix at Blanket

Despite having access to grid power in Zimbabwe, Caledonia is at an advanced stage in the implementation of a 12 MW solar photovoltaic power plant at Blanket, which could supply the mine’s baseload demand during peak sunlight hours. This would help further reduce the mine’s dependence on the country’s vulnerable electricity grid, reduce operating costs incurred when using diesel-generated power and ensure a more environment-friendly and sustainable electricity supply.

Having raised the required funds to construct the solar power plant to supply electricity to the Blanket mine, Caledonia appointed experienced renewable energy provider Voltalia as the engineering, procurement and construction (EPC) contractor for the project – a company with experience in the development, construction, operation and maintenance of solar power plants in Burundi, Malawi and South Africa.

The proposed solar project will supply approximately 27% of the mine’s total electricity demand during daylight hours, significantly reducing the risk to the mine of any further deterioration in the quality of grid power which would necessitate increased use of diesel generators.

The solar plant will only be for daylight usage, but as the owner of the solar plant, Caledonia has the option to install battery storage in future should it become economically feasible to do so, which would enable 24-hour operation, explains Curtis.

The company has received a generating licence and the necessary approvals from the Zimbabwe Investment Authority, while Caledonia and Voltalia have agreed an initial design phase for the project. Subject to the conclusion of an EPC contract, procurement and construction are expected to begin with current indicated commissioning for the solar plant in the last quarter of 2021.

A proposed second phase, which could increase the size of the solar power plant to 18 MW, may be on the table if required in future.

Proposed site for the solar
project at Blanket, which will
supply approximately 27% of the
mine’s total electricity demand

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Matla 1 relocation

A breakthrough for South Africa's power supply

Four years after being placed on care and maintenance, the relocation of **Exxaro's** Matla 1 coal mine is finally underway. Project and technology executive head **JOHAN MEYER** explains to **GERARD PETER** the need for the relocation as well as what the project means for Eskom's constrained power grid.

Located in Mpumalanga, the Matla project has been in existence for 42 years and comprises three mines that provide coal via conveyor belt to the Matla Power Station. Together, they contribute to 9% of Eskom's baseload electricity. Matla 1 has been on care and maintenance since 2016.

Funded by Eskom, the primary objective of the R3.3 billion relocation project is to provide safe access to the remaining coal reserves and to improve efficiency after the original Mine 1 entrance was closed due to safety concerns. "The coal resource is spread amongst a very vast property below the power station. Five years ago, the three mines had access to different parts of the coal resource and jointly fed the power station with about 10 million tons of coal," starts Meyer.

"After 42 years, Matla 1's shaft is too far away from a safety point of view. It took nearly half a shift just to get the workers to the mining face. So, the purpose of the relocation is primarily a safety one and also ensuring that we can get workers and equipment closer to the mining phase to do the work."

When the Board made the decision to stop mining Matla 1, it meant that it could only supply about 6 Mtpa of coal to the power station via Mines 2 and 3. "As a result, the additional coal required has to be trucked in from alternative sources and it is destroying roads, consuming diesel and causing a lot of other challenges from a social and economic point of view. Once Mine 1 is back in commission, it will produce about 4 Mtpa and we will be able to supply the 10 Mtpa to the power station," explains Meyer.

An integrated mine

The project entails the construction of new surface infrastructure, including pollution control dams, offices, overland conveyors, and crushing and screening equipment. The project also entails the construction of a decline shaft to access the current reserves underground; and with that, Meyer explains, a set of continuous miners and equipment and supporting infrastructure is required to do the actual mining work. "The previous equipment is being utilised in Mines 2 and 3, so it's time we had new equipment," he adds.

In addition, Exxaro will also sink a ventilation shaft in order to provide fresh air for workers. Lastly, the mine will be connected to the other two mines so that coal from these mines can also be moved. "The project is driven by these key inputs and once

Matla 1 is ready, it will create an integrated unit that can supply 10 Mtpa of coal again," explains Meyer.

Meyer adds that Exxaro is keenly focused on implementing the latest digital technology to ensure that it can mine in the most cost-effective manner. "In every project that we implement, we do so with the intention of using the best technology to improve input and lower cost. It will be the same for Matla 1; we will implement the best equipment we can."


However, the type of equipment to be used is reliant on Eskom fulfilling its funding commitments for the project. Meyer states that Exxaro is yet to receive the full amount of R3.3 billion from the power utility. "We are still awaiting further funds to be released by Eskom for the project. It is a challenge regarding capital but we will put in the framework to ensure that we get to the coal. We also acknowledge that we don't have enough capital to put in all the bells and whistles to have a fully connected model like we've done at our Belfast mine but we will ensure that we get the job done."

Given the fact that coal is now being seen as the pariah of the mining industry, is it a good decision to relocate the mine? Meyer believes it is the correct decision in order to drive South Africa's economic growth. "At this point in time, we need energy in the country to grow. And currently we are still dependent on our coal resources to drive this.

"Yes, Exxaro is expanding its renewal initiatives such as building wind farms but that is not enough in the short term. Without energy we cannot grow the country;. So, we are in that unfortunate situation that we still need to feed the energy grid with coal."

Matla 1 will create an integrated unit that can supply 10 Mtpa of coal



 The R3.3 billion project is funded by Eskom



“ We will ensure that the mine is in production by 2023, ”

JOHAN MEYER



What's more, the relocation has enormous socio-economic benefits for the surrounding communities. There are 2 000 people and 2 500 contractors that work full-time on the three mines. In addition to providing employment, the mine also benefits both formal and informal businesses in the area. Furthermore, as the project progresses, Exxaro is committed to ensuring that it employs local contractors and manpower to undertake the operation.

Exxaro realised the need to relocate Matla 1 as far back as 2009 but faced challenges with regard to Eskom funding the project. However, Meyer is optimistic that the project will now gain momentum. The company expects the mine to be operational by 2023, producing 4 Mtpa which will feed directly into the Matla Power Station via an underground conveyor belt. It will also extend Matla life of mine to 2042.

"So I am very positive about the current governance and decision-making around the project and we will be able to ensure that the mine is in production by 2023," he concludes. **MRA**

Segilola will be Nigeria's first significant mine in decades



Nigeria's mining potential

Leaders buoyant about progress

Despite the COVID-19 pandemic and the increasing climate change awareness by investors, 2020 has proven to be a landmark year for Nigeria.

This is the view of Emma Priestley, CEO of Goldstone Resources and moderator of the London Investors Roundtable that took place during the successful five-day *Nigeria Mining Week Digital Event* in October.

The live discussion explored how the market views Nigeria, now that the country's mining and minerals sector is showing signs of a resurgence as authorities seek to responsibly diversify the economy.

"With Thor Explorations getting all of its permits and the funding required to develop its Segilola deposit into a mine, this is the first mine since the 1930s in Nigeria," Priestley stated.

She said she had witnessed "the positive efforts of the Ministry of Mines and Steel Development for the last few years to set themselves apart from the legacy of the exploitation of oil". Supported by the World Bank, the ministry is committed to its roadmap and has met milestones to improve the ease of doing business in Nigeria.

Meanwhile, Lek Van Cruyningen, MD of merchant bankers Strand Hanson, shared: "We have been regular visitors to Nigeria over the last decade. We know the country very well and are very comfortable on the oil and gas side. We've been upscaling our mining activities and plan to open an office in Abuja."

According to Van Cruyningen, "Nigeria is the last treasure trove in Africa for wealth and job creation. We understand the risks of doing business in Nigeria and West Africa and are comfortable with it. The biggest hurdle we always have is explaining the situation on the ground about how investors and foreign corporates actually view Nigeria. That is a big hurdle to get over."

It's about the project, not the country

Bert Koth, MD and partner of Denham Capital, said in terms of mining project finance, prospective investors will always first look at the overall market and that has nothing to do with the country.

Denham Capital is a shareholder in the Bisie tin project in eastern DRC and Panda Hill, a niobium project in Tanzania.

He stated that currently, outside the gold market, the mining financing environment is actually extremely distressed. "In the last 12 months, the mining industry raised over US\$6 billion in equity. Of that amount, over two thirds went into gold – of that amount, only 25% went into development and development comprises everything, including de-risking, exploration, and physical development," he explained.

Later in the discussion Koth stated that the structural reforms in Nigeria over the last few years are definitely going in the right direction.

In conclusion, Kevin Pietersen, partner in law firm Hogan Lovells, said: "There is an appetite for new countries, new projects, particularly in relation to the gold price ... But Nigeria has to prove that it can enforce anti-corruption policies."

This year marked the fifth edition of *Nigeria Mining Week* (held as a digital event), which is organised by the Miners Association of Nigeria (MAN) in collaboration with PwC and Clarion Events Africa and is supported by the Ministry of Mines and Steel Development. For more information visit www.nigeriaminingweek.com. **MRA**

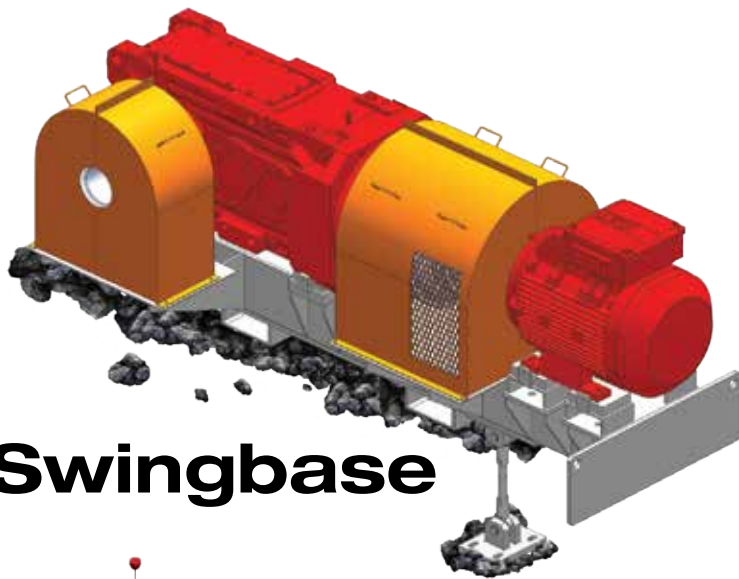
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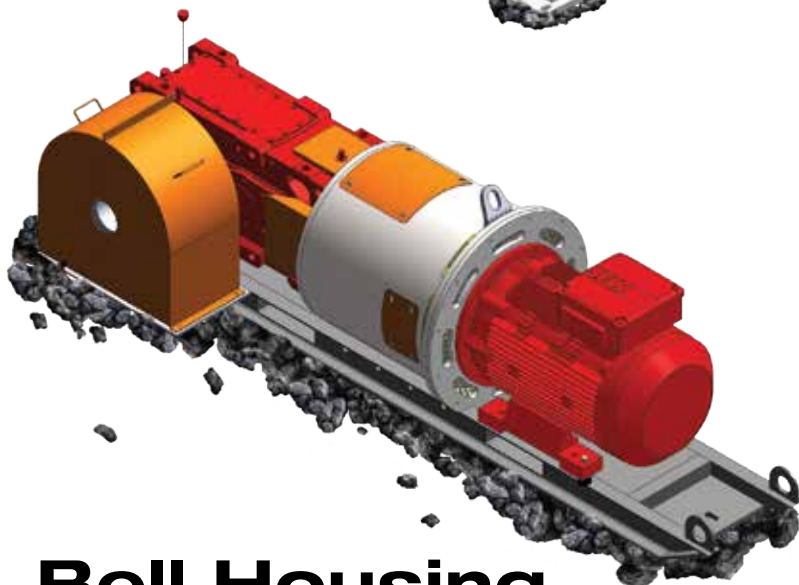
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The AutoMine concept vehicle is based on the latest technologies



Sandvik Mining & Rock Technology

A new digital revolution has begun

Automation and digitalisation technologies are no stranger to **Sandvik Mining & Rock Technology** (Sandvik) – and have been applied into the company's solutions offerings for in excess of 10 years. While this positions the company as a leader in the digital revolution field, it has also made significant strides in advancing these areas of the business further, driven by the need to overcome COVID-19 challenges, writes **LAURA CORNISH**.

No company could have prepared for the challenges associated with COVID-19. But every problem has a solution and this was the approach Sandvik adopted. This has consequently seen us performing well, despite travel restrictions and the subsequent inability to meet with clients on site," says Sandvik's Southern Africa sales vice-president, Simon Andrews.

Naturally, the pandemic has accelerated mining companies' willingness to adopt and invest in technologies aimed at overcoming restricted movement, putting Sandvik front and centre in its quest to embrace the digital world.

"There are a few essentials however in helping the industry deliver on its digital technology ambitions, the first of which is ensuring technologies improve the effectiveness and efficiency of a mine. If modernisation techniques are not being implemented to make mining simpler, safer and faster, then the end goal is not being achieved," Andrews continues. "Customers must get value and a high return on their investment to warrant the spend and execution," adds Sandvik's business line manager for automation and digitalisation, Niel McCoy.

The company's modernisation in mining approach is two-tiered, with technology solutions offerings in the field of information management

(digitalisation) and remote control equipment (automation).

McCoy highlights the areas of digitalisation Sandvik specialises in:

- Remote monitoring – telemetry of equipment;
- Situation awareness – where equipment and people are underground;
- Task management and sharing – issuing tasks and feedback from underground;
- Providing insights into specific areas in the mine – highlights problem areas in the mine with regard to equipment performance, traffic jams, etc.
- Analytics – predictive insights to prevent equipment failures, predict production profiles, etc.

THE EVOLUTION OF EVOLUTION

There are two clear technology evolution standouts for the Sandvik 2020 history book.

Implementing technologies during lockdown

"Adoption and incorporation of technologies has quickly become the secondary consideration in this new world we find ourselves in. It is the practicalities of teaching customers how to implement and use these technologies when we cannot connect with them on site," Andrews points out.

Sandvik has truly applied itself to overcoming this lockdown-associated challenge – introducing a headset which enables it to walk and talk anyone through the process of commissioning a machine and associated software without ever having seen it before. "This offering removes all barriers associated with the inability to connect physically on the ground and is a mechanism of training in itself," McCoy adds.

The added benefit of remote communication is the ability for Sandvik to better utilise its highly skilled personnel. "Removing travel time from our diaries means we are able to spend more quality time with a greater number of clients, on a more regular basis. Our experts form part of the greater Sandvik value proposition and this is now being more effectively spread across our clients' sites. This is also not a temporary measure introduced to manage COVID-19 restrictions but is a new approach we intend to maintain moving forwards," says McCoy.

An extension of this is the deeper communication connection Sandvik has made with its clients generally. "Never before have we communicated so effectively or as frequently as we do now. We know more about our sites now than we ever did before, which naturally provides us with the ability to better advise and assist our clients where needed," Andrews highlights.

Virtual event a virtual success

In September Sandvik also hosted its first *Innovation in Mining Virtual Event*. Hosted over two days, it offered training sessions, a demonstration of the company's test mine and new products and solutions offered to market.

"A key component of our event was creating a platform to share experiences, challenges and practicalities, enabling us to come together as an industry to move forward collectively and apply solutions that solve greater challenges," Andrews notes.

Connectivity in remote regions was identified as another challenge but McCoy notes that this is quickly changing as the industry is working with

If modernisation techniques are not being implemented to make mining simpler, safer and faster, then the end goal is not being achieved,

SIMON ANDREWS



↓ **OptiMine modules** include task management, location tracking, drill plan visualizer, 3D mine visualizer, scheduler and analytics

partners to install the correct infrastructure to overcome this boundary. "It is refreshing to see mines now taking ownership of the solutions they need to advance their mines and ensure they are digitally relevant," he states.

Interoperability is another key component required to deliver a truly modernised mine – equipment systems must talk to each other and not work in silos. This is an area that requires dialogue and transparency, McCoy continues. Sandvik has already placed its interoperability IP in the public domain – and is the first underground equipment provider to do so. Both Andrews and McCoy hopes to see more of the industry follow suit.

Sandvik also revealed its future vision and concept for autonomous mining equipment at the event, with a first-hand glimpse of its next-generation intelligent technologies shown during a live reveal.

The fully working and autonomous AutoMine concept vehicle is based on the latest technologies and equipped with completely new sensing capabilities and artificial intelligence to enhance mining operations. The AutoMine concept perceives its surroundings and environment in 3D and reacts to it in real-time. These technologies provide clear customer advantages by allowing vehicles to adapt and plan their own routes, and to find the most suitable paths, even in continuously changing environments. The obstacle detection, collision avoidance and 3D online mapping capabilities improve adaptability and increase flexibility.

"The AutoMine concept is unique, because it has been designed ground-up for autonomous use. It is the world's first fully autonomous underground mining machine built specifically for automation," says Riku Pulli, vice-president, automation at Sandvik.



AutoMine Multi-Lite is an automation system which enables each system operator to remotely and simultaneously supervise multiple automated Sandvik underground loaders and trucks



AutoMine Access API facilitates compatibility with non-Sandvik equipment



This game-changing platform is a foundation for using the AutoMine technology in various equipment types and can be applied to any vehicle. The AutoMine Concept vehicle also has a completely new industrial design without a cabin, and with built-in components for high reliability and productivity. This autonomy platform allows for equipment design that is optimised for its primary production tasks without compromises. Furthermore, being fully battery-electric, it drives sustainability in mining without carbon emissions.

Sandvik also introduced its new battery-electric loader, the 18 t LH518B. The all-new loader is the result of the company's decades of engineering expertise, matched with Artisan Vehicle's innovative powertrain technology and battery system expertise.

The LH518B battery-electric loader comes with an exceptional capacity for its size: Its design solutions allow the loader to fit in a 4.5 x 4.5 m tunnel and carry 18 t loads. In addition to an innovative boom and bucket system, the LH518B features independent front and rear drivetrains, allowing high payload capacity while keeping a low overall height.

For superior productivity, the LH518B is equipped with three 2000 Nm permanent magnet motors. With no torque converter, transmission or engine to rev up, the loader is fast and agile. There are no

emission restrictions based on installed power to limit the electric motor selection, which enables the use of the most powerful motors available that are suited for the underground conditions.

The LH518B is also equipped with AutoSwap, a patented self-swapping system for the Artisan battery pack. Battery swapping is made fast and easy with a minimum amount of manual handling: changing the battery only takes about six minutes, and it can be done in a passing bay or old re-muck bay with no overhead cranes or external infrastructure needed. The brand new AutoConnect feature available for the first time on the LH518B is making swapping even easier and faster by automatically connecting and disconnecting the battery pack to the machine. Aside from unplugging and plugging in the charger, the operator doesn't need to leave the cabin, which saves minutes on the swapping procedure and decreases effort and risk in the swapping process.

The purely battery-powered loader helps to reduce heat and emissions underground, helping mines reach their sustainability targets and reduce ventilation costs. The robust battery pack uses Lithium Iron Phosphate chemistry (LiFePO₄) and is purpose-designed for use in underground mining.

Technology jet lag

There are a lot of mines who have not started on their digital journey and those in that position need to realise that implementing and using technologies does not happen with the flick of a switch.

"Mines need to focus on their current requirements and implement those digital tools that can assist in specific areas that need immediate attention. From that point, you can begin to scale up and expand your digital footprint. Change management however is essential, as is the buy-in from the top – these are two critical areas that must accompany any mine on their path to modernisation," McCoy concludes. **MRA**

“

It is refreshing to see mines now taking ownership of the solutions they need to advance their mines and ensure they are digitally relevant,

NEIL MCCOY



A Sandvik LH518B
underground loader



Data analysis

Helping to improve efficiency

By Paul Morgan, Altron Karabina

The acceptance of data and analytics is heralding in a new era of business change better suited to the digital world.

A consolidated view of data can unlock more mining potential

Cost-conscious sectors, such as mining houses, often start with efficiency improvement, centred on risk reduction analytics, equipment performance, logistics, and the supply chain. For all these companies, understanding the types of data available to them can significantly assist in becoming more productive and return better value for stakeholders.

A better approach to leveraging insights from the data generated is making the existing workforce more efficient and optimising the performance of equipment, especially when it comes to the mining sector.

When paired with the needed infrastructure and skills for innovation and technology use, data and analytics can deliver significant opportunities for growth. By better analysing their data, mining companies can now integrate their existing pockets of efficiency spread out across a disparate environment.

This consolidated view of their data can improve business overall and unlock more potential by combining the best of labour forces and digital innovation. **MRA**

ABOUT THE AUTHOR

Paul Morgan is business united lead for data, planning, and analytics at Altron Karabina.

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Experts say policy will determine the success of AI in mining

AI in mining

Are we there yet?

While Artificial Intelligence (AI) is a much touted technology in mining, it would seem that the sector is yet to fully embrace this advanced technology. Why is this and how can we ensure that AI can be beneficial to mining in Africa? **GERARD PETER** reports.

According to Professor Frederick Cawood, Director of Wits Mining Institute at the University of the Witwatersrand, it will take a policy change to ensure that AI can benefit mining in Africa. Cawood was a panellist on a recent *Mining Review Africa* webinar titled *Mining 2025: A 5-year vision for AI in mining*. Cawood was joined on the panel by Eric Croeser, MD for Africa at Accenture Industry X, and Jean-

Jacques Verhaeghe, programme manager for real-time information management systems at Mandela Mining Precinct. The webinar focused on understanding AI, its benefits and how to incorporate it into operations.

When asked whether Africa was ready for the implementation of AI, Cawood said that the starting point is policy innovation. "The big issue for Africa is poverty. AI is something that has to be incorporated into the continent's mining vision. Because

of the perceived threat to job losses, one has to find a balance between the introduction of technology and the poverty reality of the continent. You can't avoid AI; it's coming.

"The secret is policy innovation and adopting technology with minimal disruption to the workplace without increasing the cost of business, and also without increasing the cost of consumer goods at the end of the line."

Since AI is a relatively new concept in the mining industry, the sector is yet to

fully understand what it truly means and how to incorporate it. Verhaeghe stated that the definition of AI is very broad. "At its highest level, AI is part of digital transformation. It simply boils down to the fact that a machine has the cognitive abilities that we normally associate with humans such as sensing things, learning, reasoning and problem solving. The fact is that AI seems so attractive to everyone because it can do things more quickly and better than a human would typically be able to do," he explained.

Verhaeghe added that the COVID-19 pandemic has accelerated the implementation of AI but at the same time it is hard to determine just where the industry is when it comes to adopting this technology. "There are varying scales of the adoption of AI in our mines. There are pockets of excellence but it's so disparate in terms of where people and companies are at with it. At this point in time most companies are probably just experimenting with the concept," he explained.

He further stated that there seems to be a lack of a cohesive vision across the industry. As such, what is needed is a digitalisation journey that is mapped out and very clearly and deliberately and intentionally drawn up at board level.

Man and machine collaboration

Addressing the subject of the current state of AI in mining and where it will be by 2025, Verhaeghe explained that when looking for any forward projection, we need to distinguish between the normal trends that we see in the economy and the structural shifts. "There are two structural shifts that have affected the mining industry.



Those are big shifts that require deep innovation and deep thinking. One is the issue of decarbonisation and the other is how technology is affecting the mining workforce; more specifically how it leads to a new world of mining where machines and human beings need to collaborate in the workplace," he stated.

Verhaeghe said that AI enables novel production methods where machines do the hard work and humans can use sensors to do observations. "Of course, this affects how we collaborate in the workplace and it also effects roles and functions of people in the workplace. Furthermore, we still have a lot to do in order to get to zero harm as an industry and artificial intelligence can be the next step in working towards this zero harm."

He added that by 2025, AI will be visible in most work processes

along the entire mining value chain. However, he cautioned that governments would have to put in place relevant policies and laws to protect the human workforce.

Meanwhile, Croeser stated that a lot of the AI technology that is implemented in mining has been tested in other industries such as oil and gas. "If you just think about a continuous process, like oil and gas where you start from an exploration perspective. So essentially we have looked at the processes within that industry and have then started applying them to a mining process."

He pointed to the fact that recent research shows that there is R28 billion of value in artificial intelligence in mining. "People stand in the way of value. So you need to take the people along. I believe that AI is the only way to a fundamental step change in terms of how we run mines from an optimisation, safety and environmental sustainability perspective," he concluded. **MBA**



↑ Left to right: Prof. Frederick Cawood, Jean-Jacques Verhaeghe, Eric Croeser

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The mining industry is undergoing a transformation. Margins are being squeezed as mines advance deeper, face more challenging geologies, and adapt to societal pressures. In order to remain competitive, innovative miners are leveraging digital technologies to improve recoveries, increase throughput, and reduce energy consumption.

Digital technologies, such as advanced analytics, provide a powerful set of tools to improve and optimise process control within beneficiation plants.

Part of this opportunity stems from the fact that many plant operators lack an optimised control methodology to help them select appropriate process set points. These operators rely solely on their years of experience, and on their gut feel, to make control decisions. Their decisions are based on a loose approximation of the intricacies of the process. The result is suboptimal performance, and increased day-to-day variance in the plant's metrics.

While theoretically possible, the exercise of optimising a beneficiation process based on an accurate and complex mathematical model is expensive and time-consuming – if not impracticable. It requires a team of domain specialists to painstakingly model the intricate relationships between process parameters and output metrics. Many of the second and third-order interdependencies involved, would, in all likelihood, not be documented in the scientific literature.

The field of advanced analytics has opened up effective alternative methods of process optimisation that unlock the potential of historical process data. These

include expert systems, which yield insights from snapshots of historical data, as well as the more recent and sophisticated expert execution systems (EES), which inductively discover the complex relationships between process parameters and plant metrics in order to generate prescriptive remedial actions.

The older expert system is a form of advanced analytics that, for years, has assisted plant operators by inferring improved control decisions from historical plant data. While expert systems have yielded significant efficiencies over the years, in industries that range from manufacturing to mining, they also have important limitations.

In particular, expert systems sought to provide operators with inputs that had been predetermined from a set of observable prior conditions. These were inherently analytically modelled from a set of first-order equations reflecting the state of knowledge about the system at the time.

Even when these systems were augmented with some learned decision logic, they remained inflexible around the domain of the observed science. Some expert systems took incredibly long to compile, as the underlying models were excessively complex. Accurate, dynamic, analytical expressions were absent for many of the processes. Meanwhile, engineers

needed time to interpret the expert system's results, adding to their inability to keep up with changing plant dynamics.

Expert execution systems

The EES overcomes the limitations of classical expert systems in two important ways. First, an EES harnesses advanced machine learning algorithms to extract a deeper and more holistic model of the industrial process in a short space of time. Second, the EES leverages this model through an intelligent interface that delivers prescriptive remedial actions to the plant operator, thereby optimising the process ahead of real-time

Award-winning technology

DataProphet PRESCRIBE is an award-winning EES that enables beneficiation plants to improve plant metrics through advanced, real-time prescriptions. DataProphet has won a number of awards such as being recognised as a 2019 Tech Pioneer by the World Economic Forum, listed as one of the 100 AI Startups of 2020 by CB Insights, winner of the Best Innovation in Deep Learning by Alconics – as well as being recognised by Frost & Sullivan as the winner of their Technology Innovation Leadership Award 2020, amongst many others. [MBA](#)



Robotics can lead to improved safety underground

Modernising South Africa's mining industry

A journey started, and accelerated

How is South Africa faring in the move towards developing more digitally transformed mines? Has COVID-19 accelerated this process and what is needed to take the industry forward in delivering stakeholder value through the adoption of modern techniques? **LAURA CORNISH** sat down with **SIETSE VAN DER WOUDE**, senior executive: modernisation and safety at the **Minerals Council South Africa**, to find out.

The Minerals Council, together with PWC and the Mandela Mining Precinct, will soon launch an in-depth modernisation report that showcases where the South African mining industry stands at present in terms of technology adoption and how this is predicted to increase in the coming years.

"Like all industries in the world, the mining sector is in the midst of the Fourth Industrial Revolution (4IR). Today there is on average about 28% implementation of various 4IR technologies – artificial intelligence, the Internet of Things, extended reality, etc – in South Africa. We also estimate, conservatively, that this



↑ Miners can derive significant value from improved production monitoring through digital technologies

figure will at least double in the next five years," Van der Woude indicates.

COVID-19 has certainly pushed the fast forward button in bringing 4IR to the fore for most mining companies. But those that had started their digitisation and modernisation journeys before were certainly best positioned to cope with the challenges presented by the pandemic.

The senior executive highlights some standout examples:

As a result of the COVID-19 screening and pre-health checks required for its personnel at Kumba Iron Ore's Sishen mine, it was taking around four hours to get into the mine. By automating this process using an app, done largely at home, Kumba Iron Ore has been able to reduce this time to about 35 minutes

and is looking to cut this down further to around 20 minutes – with site requiring only verification of the screening result before entrance to the mine is granted.

The pandemic also saw coal miner Seriti create an engagement app, enabling CEO Mike Teke to engage with every employee directly by sending out a message every week providing motivation and encouragement for his workforce. Having ensured every person has sufficient data to use the app, Seriti has seen upwards of 80% adoption and use of the app which now includes additional communication around employment opportunities, health topics, etc. "This is a remarkable commitment by the company, enabling the CEO to connect with every employee with the push of a button. This technology will long outlive COVID-19," Van der Woude enthuses.

The pandemic also saw Impala Platinum adopt a double drill shift in some of its shafts – the result of operating with 50% of its workforce. "When operations resumed at 100% capacity, this new drill shift model was retained – and showcases that objectives that have long been in the pipeline can become a reality."

"Generally speaking, our response to adapting in the face of a global pandemic has certainly



Technologies typically create better paid and more fulfilling jobs. We must use technology as an ally that can help us rather than threaten to destroy or replace us,

SIETSE VAN DER WOUDE



The mining industry in South Africa is well underway with looking at robotics



been encouraging as the industry has shown its resilience, ingenuity and courage. Mining has always been a pioneering industry throughout the decades – and this crisis has shown this even more clearly. But any progress we make as an industry moving forward must be matched by safer and more sustainable operations that create more value for all of stakeholders," Van der Woude highlights.

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Where to from here?

South Africa needs to invest more in innovation, Van der Woude emphasises. "Our productivity has decreased by 7.6% over the last decade while costs have been increasing by 2 to 3% per annum above inflation. This is not sustainable and is preventing us from being globally competitive as an industry."

In the context of South Africa's challenges – particularly around high unemployment levels and inequality – the country's innovation must be people centric and technology must remove barriers and improve the relationship between people, equipment, materials and now data as well. "Every individual and every community must benefit from modernisation practices and this is the ambition of the Minerals Council."

According to Van der Woude, South Africa faces two primary challenges with regards to technology adoption: the need to innovate further and the need to ensure a socially just, inclusive and ecologically sustainable industry.

In this regard, he highlights five practical interventions that require action, as quickly as possible, namely:



Automation techniques
in research practice
at Sibanye-Stillwater
operations

1. At a strategic level South Africa needs people-centric, 4IR-enabled solutions that make it more globally competitive;
2. This links to innovation capacity – the country needs to dramatically accelerate and transform capacity building programmes to bring it back to a global leadership position;
3. The industry requires proactive engagement with public-private partnerships like the Mandela Mining Precinct to help facilitate modernisation and bridge the gaps between all the stakeholders of mining;
4. The industry needs innovation infrastructure where innovators can test their research and work to produce globally competitive products; and
5. All these areas need multi-source investment with the delivery of financial benefits. **MBA**



↑ Automation can be delivered across the mining value chain, above ground as well

TECHNOLOGY REMOVES PHYSICAL BARRIERS

"Innovation enables inclusivity and this is another objective the mining industry can realise through the adoption of technology," Van der Woude highlights.

A rock drill operator for example – the anchor occupation in the industry – requires more than 50% of their skills set to be physical. Because males are typically stronger than females, naturally owing to a higher muscle mass to body mass ratio and testosterone level, they are the physical preference for this particular job.

"Physical strength disqualifies women, people with disabilities and even older people from undertaking more physically demanding work – which is often the case for many work streams on a mine. But automation can remove these barriers."

Through the use of automated equipment, operated remotely, the physical strength that was historically needed to operate heavy machinery has become obsolete and barriers for all genders, ages and physical strength abilities need no longer exist.

And while technology does require different skills sets, particularly more cognitive and digital skills, this should allow people to enhance their interpersonal skills and develop inspirational leadership (where women are known to excel), leaving the physically demanding and repetitive work to the machines.

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Microsoft SA's Mining Core

Converting AI dreams into reality

Microsoft South Africa is working with its partner ecosystem and customers to showcase the power of technology, particularly AI (artificial intelligence) and cloud technologies, in helping the mining industry accelerate digital transformation and uncover solutions through the adoption of new technologies, writes **LAURA CORNISH**.

This follows the launch of Microsoft's Mining Core – AI Centre of Excellence for Mining facility in Johannesburg, South Africa in early September.

The Mining Core, which is the first of its kind in the country, makes use of Microsoft's extensive partner ecosystem, and in so doing allows customers to immerse themselves in emerging technologies to build and create solutions that not only overcome specific business challenges but also broadly enable the sector to reimagine new and better ways of working, drive sustainable recovery and transform mining communities.

"Considering the industry's increasing acceptance to embrace digital transformation, our engagement with the sector has subsequently evolved," says Lerato Mathabatha, lead for mining, energy & resources at Microsoft South Africa. "The industry recognises our ability to improve productivity through our cloud-based solutions, but we in fact are working to showcase to the industry that our strength extends far beyond that – helping customers in the sector deliver mines of the future today – by driving innovation, not in the IT space, but at a business operational level."

Combined with the impact of the COVID-19 pandemic, it has become clear that the sector

needs solutions that can help it regain its competitiveness and become a key contributor and driver of economic recovery in the wake of the pandemic.

"Technology holds the key to achieving those goals. Accelerated digital transformation and the introduction of solutions through emerging technologies such as AI, the Internet of Things and data analytics, have the power to help the industry adapt, reinvent and transform in a sustainable and responsible way," echoes Amr Kamel, enterprise director at Microsoft South Africa.

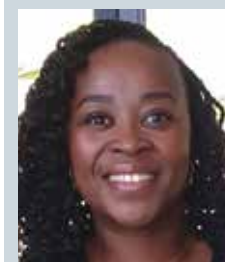
Microsoft South Africa's Mining Core – housed within the company's head office – is about working 'outside of the box', together with its partner ecosystem and customers to imagine what their mines could do and become, without any restrictions, and how we can use and/or develop technology solutions to realise this vision, Mathabatha highlights. "Through our facility we have created an environment and ecosystem where we can develop those solutions and enable the industry to interact with the technologies in different scenarios in order to unpack the benefits they can deliver," she continues.

While the impacts of COVID-19 have prevented the company from physically engaging with the facility, customers have

“

The establishment of Microsoft's Mining Core in South Africa falls on the back of our recognition that the country is one of the top mining jurisdictions in the world,

LERATO MATHABATHA



already had the opportunity to interact with some of the technologies through virtual demonstrations, already a step in the right direction as well as a stepping stone in truly connecting with the technologies.

Discussing the company's Mining Core ecosystem partners, Mathabatha notes this network is rich with a variety of skills sets across the mining value chain. The founding partners include Accenture, PwC, Bentley Systems, Schneider Electric and ABB. "These companies alone already demonstrate the depth and extent of knowledge we are bringing to our AI offering."

"Through our Mining Core we are walking the mining industry through the adoption of technologies available today and looking at how we can deliver complementary solution technologies that transform their needs and improve their performance in the future. This facility will become the key stepping stone to building a future transformation roadmap," Mathabatha highlights.

Beyond production

Together with its partner ecosystem, Microsoft South Africa is looking to help its customers navigate three phases – response, recovery, and reimagine – in order to maintain continuity, remain open, drive operational performance and create new business models even in the most difficult of circumstances," says Kamel.

Solutions, which are conceptualised and built collaboratively, are anchored in four main areas: Community services and social impact; health and safety; sustainability; and responsible digital transformation.

Community involvement and engagement is vital for mining companies, and these organisations can use technology to play an important part in empowering surrounding communities. This includes building critical digital literacy skills that will help the employability of community members, as well as introducing solutions in

Accelerated digital transformation, and the introduction of solutions through emerging technologies... have the power to help the industry adapt, reinvent and transform in a sustainable and responsible way,

AMR KAMEL



Microsoft datacentre

areas like healthcare, education, agriculture and community support services.

Emerging technologies can also help with health and safety, which is always a priority but particularly so in the face of a pandemic. Introducing solutions using technologies like autonomous systems such as drones, drills and vehicles, cognitive services and video analytics for safety management, such as detecting if a worker is wearing a hard hat or protective clothing, can make an impact. These kinds of technologies can also be used to support and manage health and safety protocols related to the pandemic, including social distancing and hygiene measures.

Mining companies are also increasingly using digital solutions to enable sustainable recovery and decrease their environmental footprint, using them to reduce water consumption, waste and work towards being carbon neutral or even carbon negative.

Above all, solutions that are introduced need to have responsible digital transformation and AI at their heart. "Responsible AI needs good guiding principles to ensure that systems are fair, reliable and safe, private and secure, inclusive, transparent and accountable, and we use our rich partner ecosystem to help with this.

"Digital is the future of mining, and the question now is how quickly companies in the sector can transform to drive growth," concludes Kamel. [MRA](#)



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Effective risk management requires good information

But endless data may be the downfall

By Simon Barry, lead consultant: risk and standards, The Advisory Group, and Hedley Tomlyn, director of programmes at Minerva Advisory Group

Like most responsible mining companies, Vale invested heavily in data collection and management, yet the CEO still faces charges of homicide by the Brazilian government, arising from the Brumadinho Dam disaster – a risk that could have been prevented.

With ever more data available to decision makers in the industry – sensors, trackers, the Internet of Things, cloud data compilation, etc – there are unprecedented amounts of time, effort and money being invested in delivering technical solutions on 'how' to monitor the data, yet we're still getting it wrong. This is because much less investment is currently going into 'what' or 'why' companies are collecting and managing data. The result is a selection of highly technical and expensive solutions that do not necessarily enable

risks to be successfully identified and mitigated, and for opportunities to be exploited. Therefore, they do not fulfil their potential of contributing to quality decision making or profit. Instead, the resultant overcomplication runs the risk of drowning organisations in a data deluge.

This, the first of a two-part article in a three-part series that unpacks how

to more effectively manage some of the foremost risks in the mining sector, argues that using data to manage risk and make good decisions is not about just wiring up the enterprise. It's about understanding why you're doing it and what it's all for. It draws upon hard-learned lessons from the financial sector and the battlefield – where failure to maintain the information edge has directly impacted on profit and lives.

It starts with the premise that decision makers must clearly articulate their critical information requirements and only collect the data they need. This should then be followed by the

Collecting data on slope stability



appointment of professionals that understand the operating context to ensure that the data is effectively processed – most likely using artificial intelligence (AI) and machine learning – to deliver relevant and assessed information that enables effective decision making. More on this in the second article, though.

Separating the wheat from the chaff

The adage “All that glitters is not gold” is particularly pertinent with information. Decision makers and data providers can often fixate on the source and presentation of data rather than its “true worth” – its contribution to profitability. This is not new. Hugh Trevor-Roper, one of the greatest intelligencers of World War II, said that his strategic decision makers displayed a misplaced preference for “...some nonsense smuggled out of Sofia in the fly-buttons of a vagabond Romanian pimp to what they could learn from

a prudent reading of the foreign press”. The modern manifestation is a fixation with plasma screens, the latest technical cutting-edge capability, sensors, drones and trackers.

This is not to say that technical cutting-edge capability does not have a part to play; its role is critical. However, decision makers must start with ‘The What?’ in order to minimise risk and maximise output, not ‘The How?’ as is currently being done. The lure of technology can come later. The financial sector learnt this lesson after the 2008 global financial crisis, where a lack of understanding of the aggregated effect of subprime lending, housing bubble, deregulation, and so on, led to a catastrophic misappreciation of risk. Likewise, the military in Afghanistan discovered halfway through a campaign that was leaching blood and treasure that their intelligence organisation was, according to the seminal report *Fixing Intel!*, “token and ineffective”.



↑ Drones are increasingly able to carry a wide range of sensors

In both cases, the problem wasn't a lack of data – quite the opposite. Afghanistan was the first digitalised battlespace; even by the late 1980s the finance sector was largely a digital industry. In both cases, there were two flaws: a lack of analysis, which we will discuss in the next article, and a lack of direction.

Direction is about a decision maker clearly articulating the requirement.



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↑ **CCTV is omnipresent and an important collector of data**

What is really needed for effective decision making? These requirements must relate to an opportunity that the organisation is able to exploit or to a threat that it is able to mitigate. Too often they do not, and therefore are meaningless to the business, incur unnecessary costs, create data deluge, with its attendant confusion, poor decisions, poor risk appreciation and management and a hit on output.

It is therefore imperative that setting the requirement is not driven by technology or the sources of available information, however seductive they may be. Often, having the technical service providers in the room at this stage only serves to offer them an opportunity to oversell their capabilities, which incurs unnecessary costs and creates data deluge. This is why the financial sector and the military both now employ specialists who lead the process from the direction and requirement setting, right through collection, analysis and presentation – very closely supported by technology, but not driven by it.

Once clear requirements have been set, the business can look at 'The How' – how it is going to collect the data. Technology plays a part, but – as the financial sector and the military have found – it isn't all about sensors and satellites. People are always important. Social trends, the movement of populations, even animals, may be just as important to a business' social licence to operate as HSE and asset tracking. Collection is about working out how to get sufficiently reliable and timely



↑ **Data can be received almost anywhere**

data that meets the decision-making requirement as quickly and simply as possible – maximising its utility. As the US military in Afghanistan found, despite its vast technical intelligence apparatus, it was "unable to answer fundamental questions about the environment in which US and allied forces operate and the people they seek to persuade" (*Fixing Intel*). The same might be said in the case of many recent difficulties in mining across the globe.

So, careful consideration must be given to the balance of technical sources and old-fashioned community engagement, social and social-media interactions, profiles and presences to make sure the business is collecting the

data that it actually needs in the most efficient way possible – with emphasis on the collection of only the data that it really needs.

In the next article, we will look at the challenges of bringing diverse data sources together, analysing and presenting the output to the decision maker and how that should, in turn, drive a review of requirements – the blueprint for a more cost-effective way of making decisions and managing risk. [MRA](#)

Flynn, Michael T.; Pottinger, Matt; Batchelor, Paul D. (January 2010). *Fixing Intel: A Blueprint for Making Intelligence Relevant in Afghanistan* (PDF) (Report). Center for a New American Security.

ABOUT THE AUTHORS



Simon Barry

Barry holds an MSc in Risk Management from the University of Leicester and is a specialist member of the UK Institute of Risk Management and an ISO 9001 lead auditor. With extensive experience in aviation, logistics and management development he is a firm proponent of the team-based integrated approach to problem solving, addressing the hard questions early.



Hedley Tomlyn

Tomlyn is a former military intelligence officer and diplomat with wide-ranging experience working with multi-national and boutique consultancies. He is the Director of Programmes at Minerva Advisory Group.



Buy local

New online mining equipment database supports localisation

In a bid to foster the modernisation and mechanisation of the South African mining industry, the **Mandela Mining Precinct**, together with the **Mining Equipment Manufacturers of South Africa (MEMSA)** have launched the **Technology Availability and Readiness Atlas (TARA)**. TARA is an online database of locally-manufactured products and technologies that not only aims to serve the future needs of the ever-evolving mining industry, but which will showcase the local innovation and technological breakthroughs taking place in the country, writes **CHANTELLE KOTZE**.

Envisaged to become the leading online directory of South African mining equipment and systems, similar to *AutoTrader*, TARA

aims to connect local original equipment manufacturers (OEMs) with mining companies, making the purchase of local mining equipment from the local supply chain a seamless process.

The Precinct, through its Real-Time Information Management Systems (RTIMS) research programme, together with MEMSA, has developed the TARA online database. The

platform has been designed to allow OEMs to upload their own equipment and systems, with their technical specifications and images, according to set data fields: namely mine cycle activities pertaining to drilling, blasting, cleaning and supporting as well as the required mining method.

There are currently 113 pieces of equipment from 13 companies listed on TARA, including equipment from MEMSA members AARD Mining Equipment, Dezzi, Fermel, Hydro Power Equipment (HPE), Novatek and Rham Equipment.

In light of the local procurement requirements of Mining Charter 3, published in September 2018, MEMSA CEO Ossie Carstens believes that the South African mining industry is in a unique position to assist in the country's reindustrialisation drive, through the growth and transformation of the local mining supply chain. This will in turn bolster the competitiveness of the country's mining and manufacturing sectors, which will bode well for the country's economic growth, development and recovery post-COVID-19.

The emphasis that has been placed on local procurement in the latest iteration of the Mining Charter means that mining companies have been given the difficult task of finding locally-manufactured equipment that meets local content requirements. "This is a minefield that one could easily get lost in," says Carstens, noting that this is how the development of TARA came about.

With the intention of becoming the go-to online database that connects mining houses with mining OEMs, the database also serves as a collaboration platform allowing mining companies and OEMs to join forces on the development of solutions that could be commercialised for the benefit of the broader mining industry. "This is where the real value in TARA lies," says Carstens, noting that this technology development could have growth and competitiveness advantages for both parties.

Concept and commercialisation custodians

Together, the Mandela Mining Precinct and MEMSA are the custodians of conceptualising and commercialising the innovative technologies and solutions needed to create a healthy, safe, innovative, transformative and economically-viable mining industry in South Africa.

Any requests for new mining technology development via TARA could be incorporated within one of the Mandela Mining Precinct's research programmes where it could be developed into a solution to address one of the many challenges that beset the South African mining industry.

The needs of the local mining industry have been captured in the South African Mining Extraction, Research, Development and Innovation (SAMERDI) Strategy, from which the Mandela Mining Precinct's research programmes have been informed. The current research programmes include Mechanised Mining Systems, Longevity of Current Mining, Advanced Orebody Knowledge, Real-Time Information Management Systems and Successful Application of Technologies Centred Around People.

Any technological developments that stem from this could be used to further populate TARA in future, says Carstens, undoubtedly making it the go-to platform for cutting-edge, locally developed and manufactured technology.

Preparing the mining industry for the fourth industrial revolution and beyond

According to Jean-Jacques Verhaeghe, programme manager for Real-Time Information Management Systems at the Mandela Mining Precinct, the RTIMS programme aims to improve data transmission, storage, dissemination, and information management tools, practices, and procedures for mining companies. The real thrust of the research has therefore been towards managing and interpreting data to achieve a real-time decision-making framework to enable smarter and more accurate decision making that can improve the safety and efficiency of mining operations, explains Verhaeghe.

In doing so, the Precinct has been hard at work in merging the distinct (but mutually-dependent) worlds of research, testing, creating a solution and manufacturing, and has thus designed and implemented TARA with this in mind.

While still very much focused on developing solutions to address the challenges currently faced by the mining sector, TARA also aims to support the advancements being made in the mining industry from a digital technology point of view. Therefore, Verhaeghe says that future development plans for TARA involve expanding the product and services offering to include not only local mining equipment from OEMs, but also local real-time information management system solutions from local original technology manufacturers (OTMs). These include digital technologies such as underground network communications, cyber physical systems, software and systems integration options, artificial intelligence, edge computing solutions, and positioning and tracking systems.

“This is a minefield that one could easily get lost in,”

OSSIE CARSTENS





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INDUSTRY-DRIVEN SOLUTIONS

Research and Development (R&D) is, by nature, very often faced with the challenge of being seen as academic rather than industry-focused. At the outset, the South African Mining Extraction, Research, Development and Innovation (SAMERDI) strategy was established as such that the R&D was focused and directed towards addressing the challenges facing the industry.

In 2020, the narrative for SAMERDI was altered in consultation with industry to more closely illustrate its industry focus while the research focus at the Mandela Mining Precinct will be on integration towards implementable solutions.

Mechanised Mining Systems

One of the big changes in SAMERDI during 2020 was the merger of the Non-Explosive Rock Breaking and Mechanised Drill and Blast research programmes into the Mechanised Mining Systems research programme. The Mechanised Mining Systems programme will focus on the continuation of key projects such as diamond wire cutting and thermal spalling. New initiatives under this research programme include rapid orebody development and the development of a guideline for equipment selection, maintenance and replacement. This new research programme is led by Martin Pretorius.

A further focus is on developing and demonstrating opportunities for using alternative energy sources in mining. "Through this research theme, we are investigating current systems in the industry, with the aim to structure alternative energy sources and optimise energy supply strategies with efficient energy utilisation," explains Pretorius.

Longevity of Current Mining

The main aim of the Longevity of Current Mining research programme is to conduct directed R&D in the development of a modern conventional stope. A key initiative under this programme is aimed at undertaking underground testing of the Isidingo Drill prototypes, developing alternative elongate support, and developing and demonstrating opportunities for using alternative energy sources in mining.

Other areas of focus is the development of prototypes to remotely charge shot holes as well as investigating opportunities to introduce less hazardous explosives to minimise re-entry and a safer product to effect blasting. "A key focus for this programme is on developing solutions that will lead to the increase of economically feasible platinum and gold orebodies through new approaches," says Pretorius, who also currently leads this programme.

Advanced Orebody Knowledge

The Advanced Orebody Knowledge research programme has over the years become synonymous with creating a "Glass Rock" environment underground. Whilst widely accepted, this theme has been seen as an academic exercise rather than responding to current challenges facing the industry. The focus has now shifted to achieving optimal mineral asset management, says Michelle Pienaar, who is responsible for this research programme. The programme is aimed at ensuring that the orebody is proactively managed through improved geological information ahead of the face, which will assist in the amelioration of risks associated with geological complexities and allow for optimal extraction with minimal waste. A key initiative within this programme is to refine the Au and PGM Resource Atlas.

"Enhancing our knowledge of the location and characteristics of available reef, coupled with its depth and surrounding infrastructure, puts us in a position to better understand why it was not mined and then lobby South Africa's original equipment manufacturers to design appropriate technologies that will enable its extraction," says Pienaar.

Real-Time Information Management Systems

The Real-Time Information Management Systems research programme is centered on providing 'the right information to the right place, at the right time'. This involves the design, development, and implementation of 4IR technologies unlike ever before and offers new approaches to creating a smart-connected mine, thereby leveraging current and newer technologies into an overarching and integrated framework for mining's Internet of Things.



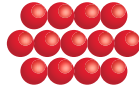
↑ Information will be available in real-time

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Traditional mining mindsets need to be enhanced with digital mining mindsets,

JEAN-JACQUES VERHAEGHE





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“The research outputs and recommended approaches achieved to-date challenge current thinking and are being defined into an end-to-end data systems design and engineered platform. The aim is to be in a position to apply the solution to most mining use cases,” says Jean-Jacques Verhaeghe, who heads up this research programme.

Successful Application of Technologies Centered Around People

The Successful Application of Technologies Centered Around People research programme cuts across the other research programmes at the Mandela Mining Precinct and answers the difficult questions involving people facing change in the modernising industry, while providing a platform for stakeholders, including organised labour to gain an understanding of the change processes required for modernisation.

“As mining modernises, how are mining stakeholders affected and impacted by mining modernisation systems, processes and technologies? This is the key question framing our research agenda,” says Dr Sherin Ramparsad, programme manager responsible for the SATCAP research programme.

SATCAP has, to date completed several literature reviews, delved into case studies and impact assessments, and developed guiding frameworks to support modernisation in mining, taking into account all affected stakeholders in the minerals sector. The research work supports the SATCAP 2030 anticipated vision, with an ultimate objective of ‘a modern workforce for modern mining’.

A project is already underway within the RTIMS research programme and the outcomes of this work, expected around February 2021, will provide a clearer understanding of the local OEM/OTM landscape and will assist in further populating TARA with digital products and services, in addition to the mining equipment currently listed.

According to Verhaeghe, for the South African mining industry to truly adopt digital technologies, it is imperative that research and development institutions highlight the critical need for these technologies but then also develop a common framework to help guide mining companies on how to adopt digital technologies.

“Traditional mining mindsets need to be enhanced with digital mining mindsets. It is not mining as usual anymore, and this can no longer be the case as digital technology adoption will ensure that mining operations remain sustainable in future,” says Verhaeghe.

One of the areas in which Verhaeghe believes the mining industry requires the most work is the upskilling of the South African mining industry workforce to become more digitally-savvy. “With an increasing shift towards mechanisation and the use of autonomous machines and systems, there is need for people, such as data scientists and engineers, who understand data and coding,” he notes.

Benefits for OEMs

Christina Zondi, vice chairperson of MEMSA and co-director of local, empowered drill rod manufacturer Drill Rod Specialist, says that TARA has the potential to become a comprehensive buyers’ guide for mining equipment in South Africa – serving the role of a one-stop-shop with all the necessary information and specifications on a



A common framework is needed to help transition to digital technologies

“

TARA has the potential to become a comprehensive buyers’ guide for mining equipment in South Africa,”

CHRISTINA ZONDI



particular product on one platform that is easy to access and navigate.

As one of the OEMs that has uploaded equipment to TARA, Drill Rod Specialist believes the benefit in being listed on TARA is that it provides a significant marketing benefit for companies in that buyers from all across Africa – particularly markets that most local suppliers do not have access to – will have access to view, compare and enquire about the equipment listed on TARA. This may stimulate the manufacture, procurement and even export of local content, she says.

The database will see further development in functionality and types of equipment and services covered.

The searchable TARA database can be found at miningtara.co.za/equipment; and South African manufacturers interested in joining MEMSA and displaying mining equipment on the database may contact admin@memsa.org.za. **MRA**

Hovermap mounted to a drone, ready to take off and scan an underground area



LiDAR

Making light work of mining

LiDAR (light detection and ranging) is a mapping technology that provides accurate 3D data. How does it work and what are the benefits? **GERARD PETER** finds out more from Dr. **STEFAN HRABAR**, CEO and co-founder of **Emesent**, a specialist in drone autonomy and LiDAR mapping technology.

Founded in 2018 and represented by Dwyka Mining Services in South Africa, Emesent has built a reputation for delivering high-quality autonomous data capture solutions, particularly in underground mining operations.

Prior to forming the company, Hrabar and co-founder Farid Kendoul, along with other team members, worked for the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's equivalent of South Africa's CSIR.

Hrabar and Kendoul have PhDs in robotics, specialising in drone autonomy. They had been with the CSIRO for 13 years, during which time they developed a solution using LiDAR in real-time on a drone to do navigation and mapping and realised its commercial potential. After embarking on a fundraising initiative, they co-founded Emesent at the end of 2018.

Simply put, LiDAR sends out a pulse in the form of a laser light. That pulse bounces off

“

Technologies like LiDAR can enable many more activities to be conducted remotely in mining,

STEFAN HRABAR



whatever it hits and returns to the receiver and the time it takes to complete the return trip is calculated. Based on the speed of light, one is able to calculate how far an object is. “Traditionally, the LiDAR device was used on a tripod,” states Hrabar. “But obviously, that had its limitations as you have to keep moving this tripod around. As such, it's very hard to cover the entire area without having any kind of blind spots or shadows.”

Now, explains Hrabar, LiDAR devices can be as a handheld or put on a moving object such as a drone that covers the entire area.

Emesent's flagship product, Hovermap, is a versatile LiDAR scanning unit which can be handheld or mounted to a drone. Using Simultaneous Localisation and Mapping (SLAM) technology, it enables autonomous mapping even when GPS is unavailable, which makes it well suited for underground mining operations. “We have adapted the technology to be used on a drone and the device is firing

out 300 000 pulses per second in all directions. We then use the information to create a 360° field of view of the environment around the drone,” explains Hrabar.

The LiDAR data is used to figure out how the drone is moving and where the obstacles are in an underground environment. At the same time, all the data is being stored on board the Hovermap. After the flight, the data is processed to generate a detailed point cloud using 100% of the data and not just a small portion that’s needed for the real time navigation. In addition to using Hovermap for surveying purposes and automating the drone flight, in future the device could also be used to control autonomous vehicles underground.

Empowering working in the new normal

While LiDAR technology has enormous benefits for a mining company, it is vitally important that the technology is used in the correct way. To that end, Emesent includes training when it sells the Hovermap to clients. “We can spend up to four days on site with clients and we adapt the training depending on a person’s level of expertise, but by the second day they are flying the drone themselves underground into stopes, etc. It helps to have some knowledge of flying a drone but the beauty of Hovermap is that it is simple to use via an app; it does everything for you and keeps itself safe,” adds Hrabar.

Already, the technology has proven successful in a number of mines where it is being used. This includes Barrick’s Kibali gold mine in the Democratic Republic of Congo which has been using Hovermap for more than a year to map their stopes and will soon be deploying a second system.

In the wake of the COVID-19 pandemic, remote working and automation has been in the spotlight recently more than ever. “Traditionally, mining companies have mobilised people for field tasks, such as reconnaissance, reporting and maintenance, but the current COVID-19 crisis has demonstrated the vulnerability of that modus operandi,” Hrabar says.

“The lockdowns which have been imposed around the world have made it impossible for many mine sites to continue operating in their normal way. Technologies like LiDAR can enable many more activities to be conducted remotely in mining,” he concludes. **MBA**

↓ Weighing only 1.8 kg, Hovermap is easily deployed, and able to switch between drone-mounted, handheld, vehicles, and other data capture techniques



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↓ The sensemetrics software platform

Monitoring in mining

Partnership advances automated data management and analytics

Global Industrial IoT (IIoT) and cloud technology company **sensemetrics** has joined forces with Singapore-based wireless sensor connectivity devices provider **Ackcio** to automate data management and analytics for mutual customers automating geotechnical and structural instrumentation in underground and surface mining, and infrastructure markets.

The alignment between the two companies accelerates digital transformation for businesses in these sectors with an integrated solution that bundles sensemetrics' software-driven productivity tools and real-time data insights with Ackcio's proven wireless monitoring offerings. The combined solution gives organisations a powerful way not only to automate the collection of distributed and condition monitoring data, but also to manage and analyse it using sensemetrics' software, while aiming to mitigate risk, reduce environmental impact, and improve safety management programmes.

"From tunnel collapses, to dam breaches, infrastructure damage and financial loss, far too many tragedies have occurred," says Nimantha Baranasuriya, co-founder and CEO of Ackcio. "We share a common mission with sensemetrics around preventing these incidents; and we welcome the opportunity to combine our technological strengths to bring automated monitoring to our mutual customers to meaningfully mitigate risk for our clients," Baranasuriya adds.

With this alliance, sensemetrics is building on its strategy to expand further into underground environments. One of the biggest advantages the combined

Ackcio-sensemetrics solution addresses is the need for greater flexibility in distributed condition monitoring, allowing for increased customisation when it comes to addressing the best way to reduce risk in each unique environment, says sensemetrics CEO Cory Baldwin.

"Ackcio's long range mesh technology is widely recognised as superior for tunnelling and underground industrial environments," says Baldwin, noting that there is no other solution that is as effective.

Tailings dams risk mitigation

Offering access to real-time information and analytics for

↓ Ackcio's proven wireless monitoring products



continuous and complete monitoring for geotechnical, environmental and mining applications, sensemetrics recently introduced a tailored IIoT solution that gives mining companies and their insurers real-time, end-to-end Tailings Storage Facilities (TSF) insights.

The IIoT solution gives mining companies access to real-time information and analytics for continuous and complete surveillance across construction, operation, and closure phases of the TSF. The sensemetrics platform addresses all of the best practices outlined in the Tailings Governance Framework, published by the International Council on Mining & Metals (ICMM), which aims to minimize the risk of catastrophic TSF failures.

sensemetrics supports reinsurance companies, as well as primary insurers, to gather relevant TSF data critical to the risk underwriting process and effectively mitigate risks across the TSF's entire lifecycle.

sensemetrics platform unpacked

New features now available in the sensemetrics platform include native iOS and Android mobile apps for simplified remote sensor management; a Revision Management System (RMS) that supports chronology of events over the lifespan of a sensor, along with journaling and property management to unlock seamless data normalisation of calculated metrics. It also includes a remote sensing module with a dashboard display – powered by spatially dense datasets from ground and satellite-based systems.

The sensing module provides unparalleled tools for visualisation and corroboration of metrics gathered from in-place sensors to accurately characterise asset performance.

A plug-and-play solution, the sensemetrics platform relies on state-of-the-art visualisation tools and offers manufacturer-agnostic edge connectivity, a true cloud design, an event-driven and scalable microservices architecture, workflow enhancing apps, and an open API interface.

Featuring end-to-end sensor integration and asset management, the platform simplifies the complexities traditionally associated with sensor automation and management while also reducing costs and improving operational efficiency. **MRA**

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Often, cyber criminals are looking for personal information and not aware they have infiltrated a company



Cybersecurity

Dealing with an unseen enemy

As we get used to working in the new normal, mining companies are increasingly relying on digital technology. Now, while technology enhances productivity and increases safety, it does make companies more susceptible to cyberattacks. **GERARD PETER** finds out more from **EVGENY GONCHAROV**, a security expert at **Kaspersky**.

Because cyberattacks are not always made public, Goncharov believes that it is difficult to put an exact number on how many such breaches take place. "According to our statistical data, we are seeing that widespread attacks are decreasing as cyber criminals focus on a smaller set

of potential targets. Also, at the same time, the variety of malware is also increasing," he adds.

On the other hand, Goncharov points out that Kaspersky has noted that the number of brute-force attacks on Industrial Control Systems (ICS) related computers available via Remote Desktop Protocol (RDP) has slightly increased

as companies make provision for their employees to work remotely. "If an attacker succeeds in getting direct access to a computer inside the ICS perimeter, it can be a very dangerous thing for a company. As such, this is something that company IT and OT security needs to be aware of in order to prevent this threat," he explains.



Sole Distributor of Masimosol 2325

Masimo Chemicals Logistics (Pty) Ltd was established in 2008 as an international chemical distribution company. The main focus market has been the African Copper Belt spanning both the Democratic Republic of Congo (DRC), Zambia and mines in Namibia.

Masimosol 2325 is a hydrocarbon solvent especially developed for the Mining Industry. It is used in metallurgical solvent extraction processes where it functions as a diluent/carrier of an extractant (chelating agent) that selectively binds to a specific metal ion with the purpose of purifying dissolved metal ore solutions.

Masimosol 2325 is a proven diluent in Solvent Extraction (SX) processes, being utilised in numerous Copper, Gold & Uranium SX operations worldwide since the 1970's. Its high flash point, quick primary break times, low losses and chemical composition make it eminently suitable for SX applications. The high performing diluent Masimosol 2325 has been developed through years of Masimo working with mining customers and offers many advantages.

Parameter	Units	Masimosol 2325	D70 Imported Alternative
Appearance		Clear & Bright	Clear & Bright
Density @ 20° C	kg/l	0.814	0.790
Distillation Range	Deg C	215 - 250	198 - 242
Flash Point	Deg C	85 - 90	77
Aromatics	%vol	19	<0.05
Vapour Pressure @20° C	kPa	<0.05	0.05
Viscosity @ 25° C	cST	2.2	2

The company is poised for growth in markets and products with an excellent supply chain track record over the past 12 years.

Contacts

Rajan Naidoo - General Manager - +27 71 673 9983/ +27 31 9025390 rajan@masimochem.co.za
 Vis Govender - Operations / Sales - +27 79146 7949 / +27 31 9021790 vis@masimochem.co.za
 Siva Pillay - Managing Director - +27 11 325 2050 siva@masimochem.co.za

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- Assisting in forging domestic and international linkages
- Exploiting economies-of-scale, global competitiveness and R&D
- Market research assistance

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- Processing
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While many companies are reluctant to make it known that they have fallen prey to a cyberattack, Goncharov advises that they should not keep quiet. "Remaining silent and not disclosing information is not a good thing to do. In fact, when we deal with attacks, we try to share this information with others so that others can be made aware of these potential attacks. We don't share the information of the targets, only the technical details," he adds.

Security is everybody's responsibility

On a positive note, Goncharov states that there is an increasing awareness at boardroom level about cybersecurity. He adds that mining companies are taking this threat seriously and that companies are now starting to put budgets in place for cybersecurity. "Sometimes these measures are put in place because of legislation but in many cases we see that it is motivated by the fact that a company wants to protect itself against a cyberattack."

He further avers that the types of cyberattacks on mining companies are not unique to the sector and that similar attacks are experienced in a variety of industries. Companies are attacked for various reasons including gaining access to confidential information or to disrupt operations, says Goncharov. "The majority of cyberattacks that we detect and prevent are random attacks by different cyber criminals; some of them don't even know that they have attacked a particular company as they are aiming to access personal information such as social media profiles and bank accounts."

"These criminals use multi-purpose malware that can be used for collecting different kinds of information and for accessing different company resources. Once such a system is compromised, it can be reused by multiple criminals. For example, this information can be sold to other cyber criminals on the black market."

Goncharov expresses concern that the number of spyware and ransomware attacks on industries such as mining is on the increase. He adds that there are some cyber criminals that specifically target large enterprises with a view to extorting large amounts of money.

Even though companies such as Kaspersky are making great advances in cybersecurity, it is often believed that the criminal element is always one step ahead. So, how does a company protect itself from a cyberattack?

Goncharov states that it starts with the basics that don't cost a lot of time and money. Firstly, a company should have a security policy in place. Secondly, installing antivirus on all endpoints and making sure that automated systems are updated



↑ **Vigilance and education** are the first steps to preventing an attack

“

Remaining silent and not disclosing information is not a good thing to do, ”

EVGENY GONCHAROV



is important. Such steps do not require lots of investment or time and don't require months of training your personnel on cybersecurity.

"However, there will still be some unprotected devices," he adds.

"As such, there is some room for infecting a system with something which has not been efficiently detected by an existing solution. That's why educating personnel and making them understand how to not expose themselves and their organisations to cyberthreats is a very important thing to do."

He further explains that more advanced protection is required for mining companies that are prone to a sophisticated cyberattack or APT. This starts by establishing a continuous vulnerability assessment process which looks at all the possible threats as well as which equipment is most vulnerable to these threats. Protecting such enterprises will include implementing security measures that can detect highly targeted cyberthreats that sometimes may be missed by off the shelf products.

"In addition, you need to implement strict policies when it comes to working with contractors and suppliers. There needs to be proper procedures in place when it comes to installing equipment and software. Also, a company should look at equipment that has built-in security architecture. At the moment, these are quite rare but we are currently at the beginning of a new era and more of these types of products will soon be available," Goncharov concludes. **MBA**

Blockchain is essentially a modern, more secure and decentralised database

Image: 123RF.com

Due diligence done right

Why mining supply chains can benefit from blockchain

While blockchain may still be primarily associated with cryptocurrencies, it is increasingly being used in the mining sector to provide assurance, transparency and traceability within the raw materials supply chain, placing the spotlight on the responsible sourcing of these metals and minerals, particularly those mined in conflict or high-risk zones. **CHANTELLE KOTZE** reports.

Tracking the provenance of a particular commodity is not a new concept in the mining industry, with many mining companies using paper certificates and tags for tracking their production. However, the way in which mining companies and end users are able to track raw materials throughout the supply chain has evolved, thanks to digitalisation and technological developments such as blockchain.

Blockchain is essentially a modern, more secure and decentralised database, which makes it possible to trace the raw material back to the point of origin by means of digital certificates. These digital certificates contain data that allows companies to verify that the raw materials they receive has been mined in environmentally and socially sustainable ways. The overall aim of this is to combat corruption, human rights abuses, child labour and

environmental devastation in the raw material supply chain.

When using blockchain technology, a specific piece of data or transaction is stored to a blockchain at every point along the supply chain journey to keep track of where the metals or minerals come from and the conditions under which they were mined. From the moment that any data is stored to a blockchain, it cannot be changed. While the existing information can be improved

or amended, a transaction history of that will always remain on the blockchain – thus validating the origin of the data.

This is one of the major benefits of blockchain, in that it creates trust throughout the supply chain due to the immutable nature of the record, supporting the source of origin of the materials, particularly in the African mining sector where many minerals and metals of the future are being mined. This also allows and empowers off-takers and end users of these minerals and metals to take action based on the data available to them.

A spotlight on mining supply chains

Berlin-based technology start-up Minespider, an open blockchain protocol for responsible raw material tracking, founded in 2018, has since collaborated with Google to track the transparency within its tin supply chain; and Volkswagen to trace the supply chain for lead from the point of origin to the factory.

According to Minespider founder and CEO Nathan Williams, the Minespider blockchain protocol is a departure from supply chain tracking protocols that use private, permissioned blockchains, in that Minespider is a proprietary protocol built on a public blockchain. This means that individual companies are in control of their own data, unless access is granted to a certain party. The multilayer architecture of Minespider guarantees the security of the sensitive supply chain data despite the open source approach.

The Minespider blockchain creates digital certificates that separate data into three different layers, depending on whether the data should be publicly visible, transparent between members of the same supply chain, or private between a company and its customer. This allows sharing of sensitive transparency information with supply chain participants in a secure way, Williams explains.

The advantage of having a public blockchain versus a private blockchain is that everyone within the raw material

supply chain is able to work on one system. "This single system allows any number of responsible suppliers to join, creating a web of custody, as opposed to only an end-to-end chain of custody from mine to end user," says Williams.

The more data that exists on one blockchain, the more companies are provided with added flexibility when conducting due diligence - making the process much more straightforward.

Williams believes that the rise of electric vehicles and battery energy storage technologies has thrust the mining supply chain into the spotlight, as several of the raw materials required in the manufacture of batteries, such as cobalt, are sourced from potential conflict regions, such as the Democratic Republic of Congo.

Regulations surrounding the responsible sourcing and traceability of conflict metals and minerals have only been a decade in the making. They first came to the fore upon the signing of the Dodd-Frank Act Section 1502 in 2010, bringing to light the

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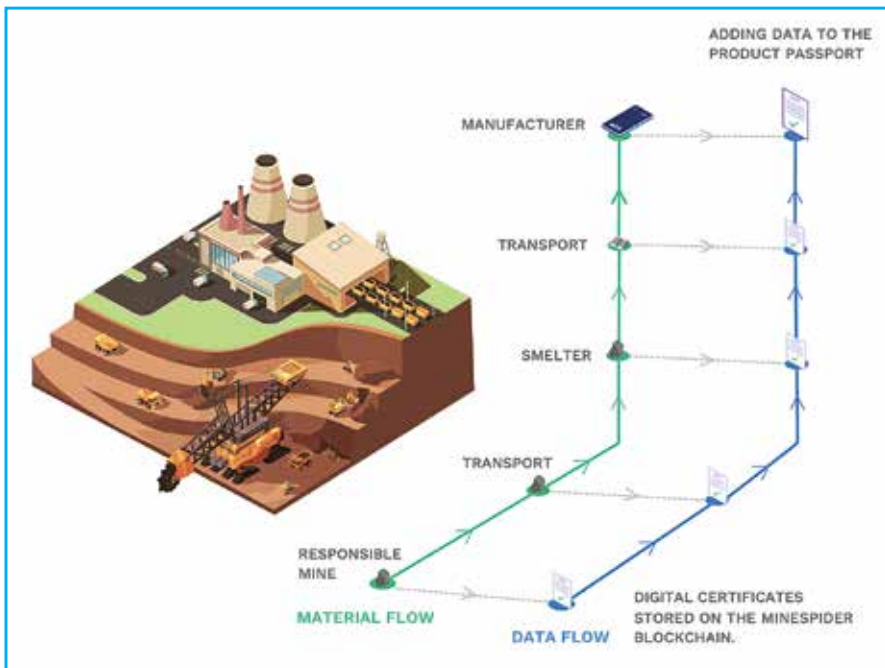
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far-reaching problem of conflict minerals. It was this, followed by the subsequent release of the SEC’s Conflict Minerals Rule and the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas, that prompted companies to start undertaking supply chain due diligence and to start investing in responsible mining and sourcing.

Moreover, in 2017, the European Union signed into law their own conflict minerals legislation, further deepening the market for minerals traceability. The EU’s Conflict Minerals Regulation, which comes into force on 1 January 2021, requires that EU importers of 3TG (tin, tungsten, tantalum and gold) perform due diligence to determine whether their material comes from a conflict affected or high-risk area. These minerals sometimes finance armed conflict or are mined using forced labour.

In September, Minespider was granted €180 000 by the EIT RawMaterials Start-up & SME Booster Programme funded by the EIT (an EU body supported under the Horizon 2020 research and innovation programme).

The OreSource minerals due diligence compliance tool

With this grant, Minespider will develop OreSource, a due diligence product (an application built on top of the Minespider blockchain) that helps mines and smelters capture key information that importers in the European Union need in order to comply with EU Conflict Mineral Regulation.

“This application will help European importers have better access to data on the materials they purchase in order to operate in this new regulatory environment,” says Williams, who adds that we

↑ The Minespider blockchain creates digital certificates adding data to the product passport



Mines and smelters who produce responsibly should be rewarded. By tracing these materials with blockchain, we can distinguish them on the world market from a sea of commodities.”

NATHAN WILLIAMS



are moving away from a world of anonymous commodities, to one of trusted products.

The OreSource product extends the capabilities of Minespider’s open, public blockchain protocol by allowing mines and smelters to provide information to distinguish their products from the rest of the market. Mines and smelters who use the app upload key data such as bills of lading, invoices, company policies, and third-party certifications, which are assembled into a digital certificate and linked along the supply chain. By affixing a simple QR code to a mineral shipment, or on an invoice, the recipients of the materials have all the data they need to ensure their compliance with the EU regulation, secured on Minespider’s public blockchain protocol.

“Responsible producers are often at a disadvantage in the global market,” says Williams, who notes that OreSource is a solid first step toward making responsibly sourced material the norm instead of the exception.

Companies importing material into Europe benefit from this information, as they have everything they need to conduct due diligence. This means they can view transport routes, analyse production sites responsibility, and demonstrate a chain of custody for their raw materials. OreSource will also offer analytical tools that allow material importers to identify potential conflict areas and other red flags, Williams explains, noting that this will enable them to ask further questions when needed and ensure all of their imports have been sourced responsibly.

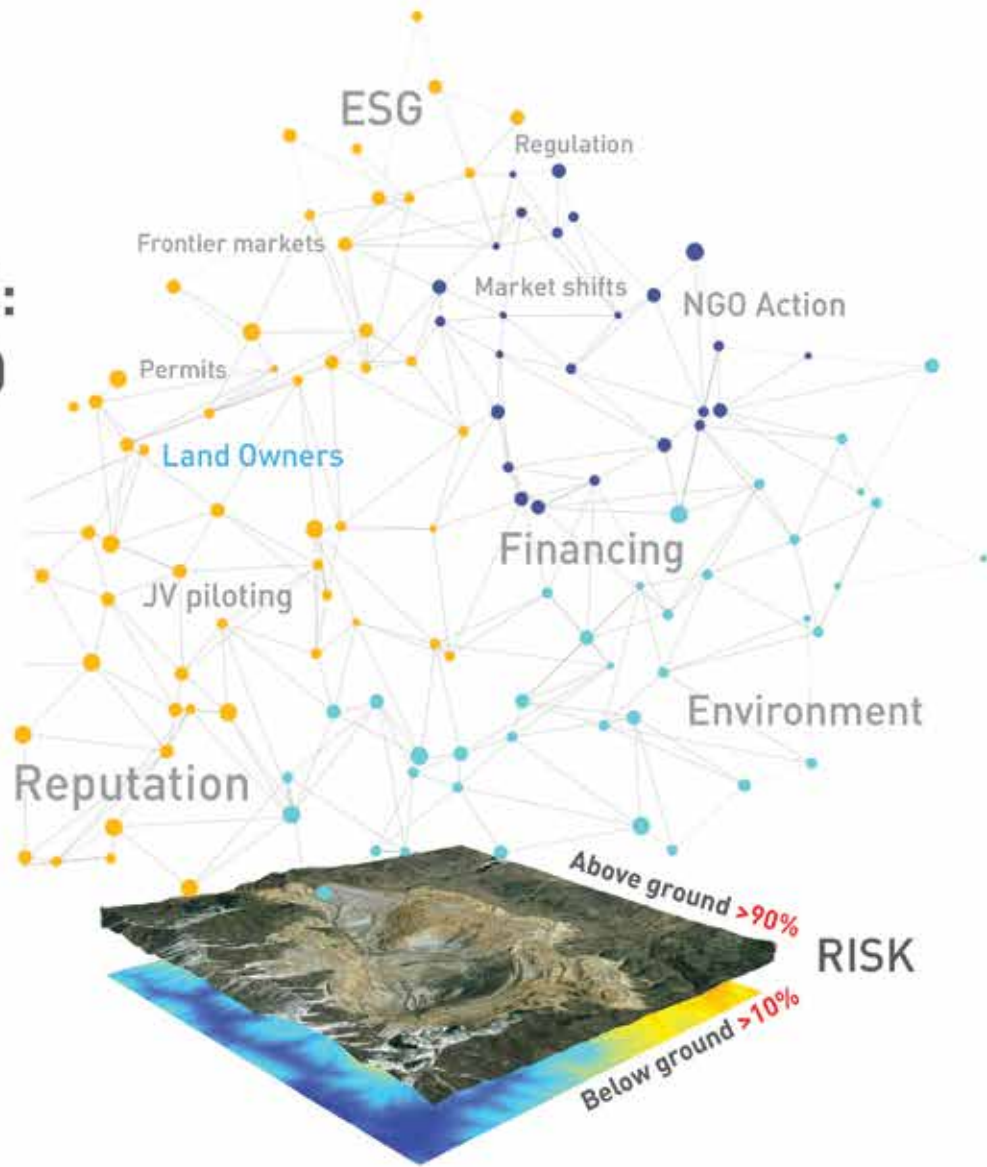
Showcasing responsibility measures

Based on the adoption of blockchain in the mining supply chain, Williams says that it will become clear which responsible supply chain actors want to participate transparently and which actors would rather remain anonymous, noting that there is no reason that minerals and metals should be bought and sold anonymously in this technologically evolving world.

Companies that currently track on blockchain tend to be those who do good work, and when they do good work, they are at a disadvantage on the global market because they have spent time and money to be responsible and compliant – an aspect of doing business that their customers do not necessarily see. It is therefore Minespider’s plan that if you provide customers with the ability to know where their raw materials come from, suddenly you start to level the playing field and the companies that do not provide data are now at a disadvantage, explains Williams. In so doing, these companies may now be incentivised to be responsible and transparent as part of the cost of doing business. **MRA**

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Loesche

Grinding meets a digital relevant era

In a modern digital world, customers are continuously looking at ways to improve productivity through digital platforms. At Loesche, this has been identified and innovative steps have been taken to improve the operation, maintenance, and productivity of the **Loesche** mill and its related circuit.

In today's technological environment, fully integrated automation systems are an absolute necessity for attaining the high-level standards of productivity, efficiency and quality. The application for industrial automation processes is indispensable for the optimum use of complex and fast-changing technologies.

Through the company's business unit Loesche Automation, the integrator of state-of-the-art machine technology and intelligent process control, it is able to combine cutting-edge machine technology and intelligent process control for optimum and efficient plant operation.

Within this digital field, the cornerstones of Loesche's competence include:

- Customised plant concepts from planning through to commissioning, based on its own experience, paired with customer requirements;
- Individual solutions to problems with optimised process technology;
- Efficient solutions through the use of proven and standardised components;
- Close cooperation with suppliers of rotary kilns to meet the customer's requirements;
- Customer service – plant optimisations and advice on further technical developments;
- Long-term commitment to deliver spare parts; and

- Certification according to EN ISO 9001:2008.

The company's more specific automation services include:

- LM Master – a stand-alone real-time optimisation solution for Loesche Grinding systems;
- LM Control – an automation solution for standardised software modules for open and closed loop control and visualisation; and
- LOMA Control – Fail safe PLC – for hot gas generators.

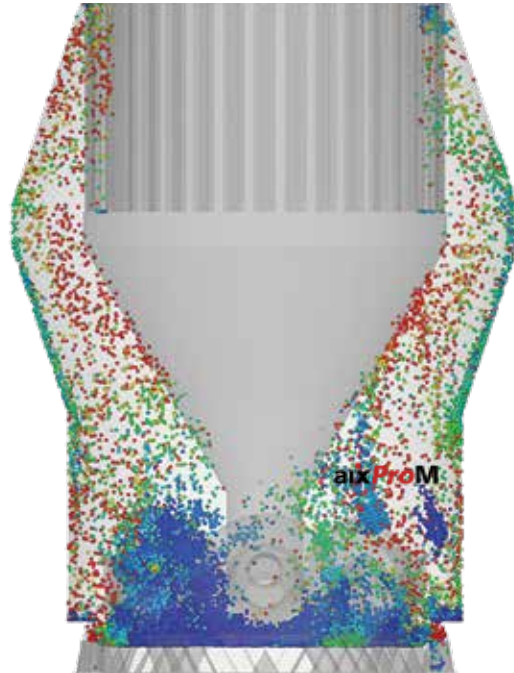
“Loesche offers its customers customised engineering services for process, hardware and software development. These services cover all



disciplines ranging from open loop and closed loop control engineering, through the full onsite electrotechnical equipment and down to service, maintenance, and customer training,” says Loesche SA sales and marketing manager Jonathan Smith.

“To ensure high margins in the face of rising energy costs, manufacturers must develop production methods which are highly efficient, and which achieve the highest values even in the case of short-term opportunities. In the eyes of the industry, the future is to safeguard and sustain economic efficiency, productivity, and a highly trained and efficient workforce,” he continues.

Through market analysis, Loesche has identified that Realtime Control is the ‘way of the future’ and will satisfy

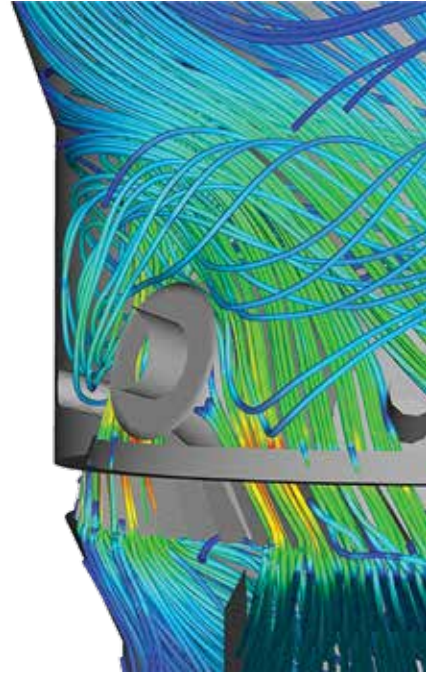


all requirements needed. “Simply put, the Loesche mill and circuit can be monitored constantly and in real time with the LM Master, making

small adjustments all the time to ensure productivity, efficiency, and profitability. This is a software that is designed to monitor and control the full process from feed materials to final product storage.”

The mill and circuit can be monitored and adjusted remotely, giving the operational manager peace of mind when not available at the control room. Through the use of this software, Loesche engineers are also able to login and conduct diagnostics on the mill and circuit remotely using a mobile device or tablet as well.

Over and above the benefits outlined already, Smith notes a new offering from Loesche as well – the offering, for large engineering companies and any Loesche customer, to register on a spare parts portal. “All new mills sold are loaded onto the Loesche spares portal. Our clients can then, through this portal, identify parts and drawings to aid in maintenance and spare part ordering. With the number of parts in a mill, and particularly the long-lead items, a customer’s needs can be identified and serviced without getting out of his office chair,” Smith says, adding: “Potential customers should talk to the elements of their business and products that incorporate digital technologies: why it is important to embrace these; what their plans are to introduce more digitalisation into the business; and what benefits their clients can expect to achieve with Loesche products that are digitally relevant.” **MBA**



Using FLSmidth's SiteConnect app is simple and allows ready access to information

Pushing technology boundaries

In minerals processing

Technology offerings from **FLSmidth** – including significant advances in digitalisation – are helping to take mining into a more productive future.

According to Terence Osborn, FLSmidth's director of product and account management for sub-Saharan Africa and the Middle East, technology is a vital pillar of the company's status as a solution-provider in mineral processing.

"Due to the COVID-19 pandemic, mines have accelerated their take-up of technology that allows remote monitoring, control and process optimisation," Osborn notes. "With our decades of product development in this space, we have been well placed to work with mines in these efforts."

He highlights the company's wealth of research and development as the lifeblood of new technologies, with over 80 such projects related to products and services for the mining sector. There is also continuous improvement of existing FLSmidth technologies.

Digital future

Central to progress in the digital space is FLSmidth's ECS/ControlCenter

cybersecure platform connected to an internet cloud solution. This is a versatile interface between the company's equipment or process and data storage in the cloud, where detailed analysis can be conducted. The ECS/ControlCenter V8 process control platform sits at the heart of FLSmidth's digital vision, a key component in its growing portfolio of digital solutions and services called ENABLR.

"ECS/ControlCenter, complemented by FLSmidth's structured implementation approach, gives customers a structured data foundation which is the fuel enabling effective advanced optimisation technologies; i.e. data analytics, machine learning and artificial intelligence. Once the data is uploaded, our SiteConnect app can visualise the performance of equipment and process plants in real time on any smart device," he says.

"For instance, we have a REFLUX Classifier modular plant on a customer site where we can view production data

on demand and in real time. We can track over 100 different operational parameters from the plant, and can see data trends over time – from hours to weeks."

Condition monitoring also becomes easier with these technologies, which can be customised to report on each piece of equipment's key operating parameters. An example is in the performance of hydrocyclones, especially measuring underflow characteristics. To identify when roping occurs – a condition where underflow is constrained, and separation efficiency reduced – FLSmidth has developed its SmartCyclone technology. A sensor in the spigot detects the condition, based on thresholds levels, and sends a signal to trigger an intervention.

Value of data

"Despite the perception that mining is often behind the curve in applying new technology, the sophistication of the sector's control systems and the amount of data already available is vast," Osborn says. "Most of the data required to make decisions remotely is in fact already there. Where there are gaps, we are working with customers to fill these by trying to identify the key

FLSmidth's offerings are helping to take mining into a more productive and connected future



Technology is a vital pillar of FLSmidth's status as a premium solution-provider in mineral processing



data required for decision making and to develop solutions around this data."

Machine-level solutions like this are offered as part of FLSmidth's broader control packages, which operate at plant control level or even at advanced process control level. Advanced process control solutions, like FLSmidth's ECS/ProcessExpert system, take control a step further by allowing continuous advanced optimisation enabled by the latest state-of-the-art AI technologies.

"The beauty of our control systems is that they are flexible to customer requirements," he says. "Where customers have their own advanced control systems already installed, we can tie our machine-level control systems into these with our extensive expertise in software engineering and machine control."

Advancing separation

Optimising separation efficiency has long been a special area of focus for the company with a focus on leveraging the value of lamella plates in separation, FLSmidth has been researching other applications of this feature.

"The lamella plates provide the customer with another opportunity

to recover entrained material that has been misplaced in the separation circuit," Osborn says. "We have therefore applied lamella plates in a flotation cell, and already have this innovation under test in a commercial application – for recovery of very fine coal."

The company is also looking at the potential of a 'hybrid' of a flotation

cell and REFLUX Classifier, constantly pushing the boundaries in separating minerals from waste. While flotation is a well-established process, there is scope for a step-change in this field, says Osborn.

Dry grinding

As concerns of water conservation grow in water-scarce countries – one of which is South Africa – so there has been steadily more interest in dry comminution. With milling being a significant water consumer, FLSmidth has applied its vertical roller mill – developed for use in the cement sector – to mining applications. The company has installed a pilot unit at its mineral testing research centre in Salt Lake City to begin application testing.

"The big difference is that minerals are more abrasive, so a number of adaptations were necessary," he says. "This mill reduces material to fine particle size, even to mineral liberation level and uses a similar principle to that of high pressure grinding rolls."

In other innovations, FLSmidth continues to extend wear life in its pumping and gravity concentrator equipment through the application of new wear-resistant polymers. It also grows its reference base of composite liners – combining rubber and steel – for better wear life and power-saving in grinding mills. **MRA**



ECS/ControlCenter, complemented by FLSmidth's structured implementation approach, gives customers a structured data foundation



New data platform

Enhances sorting efficiencies

TOMRA Insight, A cloud-based data platform which enables sorting machine users to improve operational efficiencies, is now being rolled out to the mining industry.

Following its successful launch last year by TOMRA Sorting Recycling, TOMRA Insight is now also being made available to customers of TOMRA Mining and the platform is enhanced by new features and functionalities. This makes TOMRA Insight even more capable now than it was when it was successfully launched in March 2019.

Insight is a subscription-based service that turns sorting machines into connected devices that generate valuable process data. This data is gathered in near real-time, stored securely in the cloud, and can be accessed from anywhere and across plants via a web portal available for desktop and mobile devices.

Felix Flemming, vice-president and head of digital at TOMRA Sorting, comments: "By capturing and using valuable data, Insight is

By accessing information, Insight is unlocking new opportunities."

ALBERT DU PREEZ



transforming sorting from an operational process into a strategic management tool. This tool is constantly becoming more powerful as we continuously develop it in response to customers' needs and priorities. New functionalities and features are released every three weeks – a routine during which TOMRA works closely with customers in pursuit of shared objectives."

The data captured by Insight provides valuable performance metrics that help mining companies optimise machine performance. Operating costs are reduced by simplifying spare part ordering and flexible access to data and documentation. Downtime is reduced by monitoring machine health and performance in near real-time, identifying gaps in production and analysing potential root causes, by supporting the management moving to predictive and



← **Black chrome mine** in South Africa is one of the early users of TOMRA Insight

→ **The programme can** be accessed via various platforms



condition-based maintenance, and by preventing unscheduled machine shutdowns.

Throughput is maximised by evaluating variations and optimising sorting equipment accordingly. And sorting to target quality is enhanced by having accurate material composition data which enables decisions to be based on more detailed information.

Valuable processing efficiency improvements

TOMRA Sorting Mining designs and manufactures sensor-based sorting technologies for the global mineral processing and mining industries.

As the world market leader in sensor-based ore sorting, TOMRA is responsible for developing and engineering cutting-edge technology made to withstand harsh mining environments. TOMRA maintains its rigorous focus on quality and future-oriented thinking with technology tailor-made for mining.

For the mining and mineral processing industries, Insight's ability to collect detailed data from TOMRA's sorting machines means that previously hidden information can lead to improvements in efficiencies and profitability.

Data captured by Insight is analysed on behalf of customers by TOMRA mining engineers, and key findings shared in confidential reports supplied to customers monthly. This

arrangement has the advantage of combining objective statistical analysis with the interpretive skills of a service team familiar with the customer's unique challenges.

The systems data-gathering helps mineral processors in near real-time and in retrospect. Machine operators are empowered to take prompt action in response to changes in material composition on the line and managers are empowered to make operational and business decisions based on more complete information. Comparisons between multiple sites or lines can now be made more accurately and difficult-to-reach processing operations can be remotely monitored from more convenient locations. This functionality is especially useful now that COVID-19 has brought widespread travel restrictions.

One early, pre-launch user of Insight is the Black chrome mine in South Africa, one of two mining projects that form the basis of the Sail Group's plans for long-term sustainable chrome production. Since Insight was connected to sorting machines at the start of 2020, the data platform has proven its effectiveness. Among the gains made so far, there have been improvements in process monitoring and streamlining, more efficient line-feeding and machine running times, and reduced downtime.

Albert du Preez, senior vice-president and head of TOMRA Mining, states: "By accessing information, Insight is unlocking new opportunities. Mineral processors can now move from making decisions based on experience and local observations to decisions based on experience and hard facts. This means TOMRA Insight can help reduce waste rock and downstream processing costs, enabling processors to earn more dollars per ton."

To build on these already impressive benefits, TOMRA Mining is working closely with customers to continuously develop Insight. The future will bring the addition of more features and functionalities, which customers will automatically receive as part of their service level agreement. **MRA**

“
Insight is transforming sorting from an operational process into a strategic management tool,
”

FELIX FLEMMING



The big picture

3D imaging for mining applications

Hyperspectral imaging (HSI) is a technique that allows for chemical identification, discrimination and quantification of components in a scene at a molecular level using reflected light. The resulting dataset is a three-dimensional image cube where each pixel in the image contains a full reflectance spectrum, measured over hundreds of wavelengths.

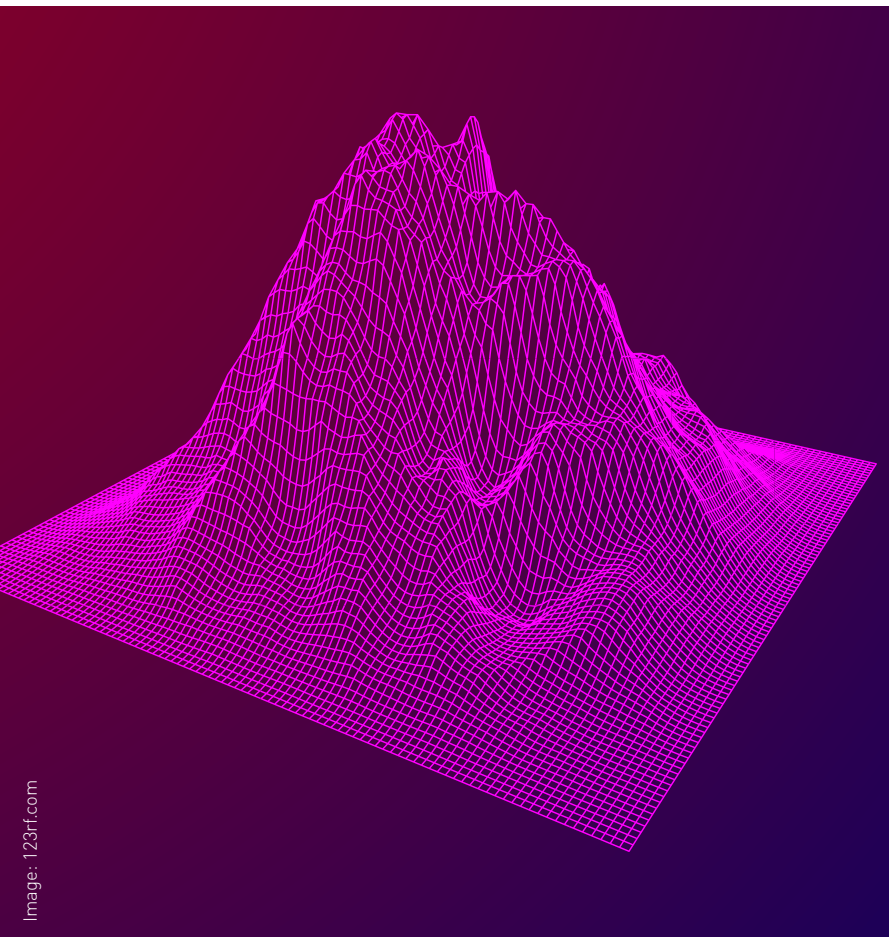


Image: 123rf.com

Each spectrum contains information about the composition of the material imaged. While HSI can be utilised for a multitude of applications, geology and mineralogy – and therefore mining – are applications where its utility shines. HSI was born out of the need to validate satellite data from Landsat 1 (ERTS at the time). The Jet Propulsion Laboratory in Pasadena, California was tasked to develop the first imaging spectrometer for Earth and mineralogy-related applications, making geology one of the most well-studied HSI applications.

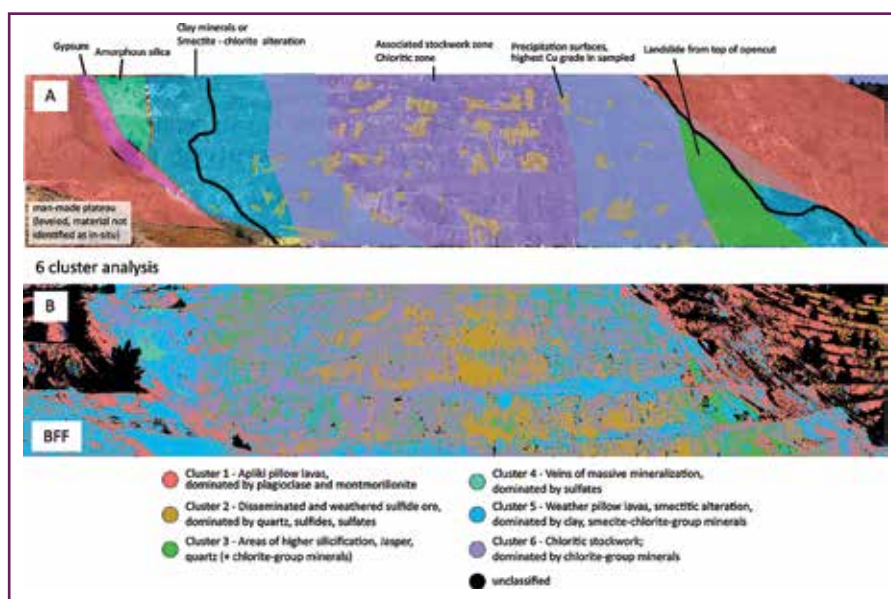
Commercialisation of the technology has reduced costs significantly and increased access. Additionally, HSI is a non-destructive, non-contact method, in contrast to traditional laboratory/chemical testing. Combined with its ability to be fully automated, a significant time and cost savings is gained by implementing HSI.

From mine to processing

HSI is an exceptional tool in all aspects of mining from mine to end-product and can decipher complex mineralogy

in areas where the landscape is always changing. Material distribution within a mine face typically varies over a small scale and within daily assigned extraction segments. These changes are not always visually identifiable, but are relevant for ore quality from an extracted build and for adjusting the subsequent processing steps.

HSI of the surface can identify these geological variations in the mine face prior to extraction to minimize misclassifications or false material allocations, thereby minimizing energy-intensive material rehandling. Imaging spectroscopy can help to identify and evaluate relevant minerals or deposit-specific geologic surface material



↑ (A) Expected zonation of the mine faces (B) Hyperspectral mapping of the Apliki mine face (Koerting, in prep.) by utilizing ReSens+ classification algorithms

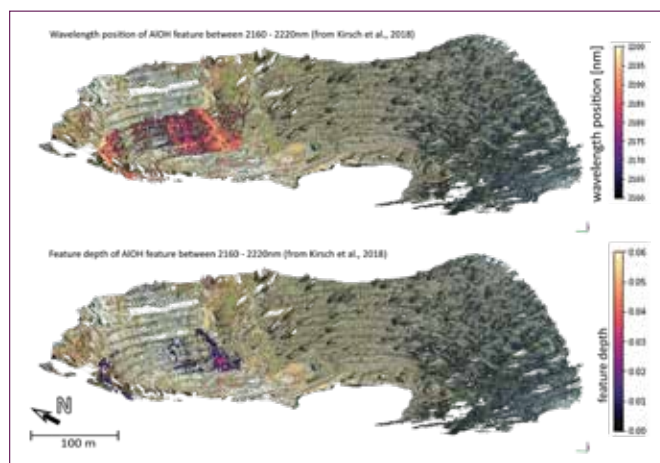
changes within a mine face before extraction. It also allows for streamlining extraction and subsequent material transport to processing facilities.

HySpex instruments excel in mining applications, offering turnkey solutions with completely integrated components containing LiDAR, stereoimaging, HSI, and/or custom integrations. HySpex customers have the ability to collect high-quality data while bridging the gap between data and end-user results with a user-friendly software solution which builds and runs models in real-time for automatic classification/grading/communication to downstream personnel or devices in the mine or in processing facilities.

Case Study

One example is data from the former copper-gold-pyrite mine Apliki in the Republic of Cyprus that is used to illustrate HSI for mineral identification in open pit mines. The data analysis was performed with material classification algorithms distributed within the ReSens+ product family by Rad. Data Spectral Analytics UG (Ltd). These algorithms provide fast, high-precision geoinformation about quality, quantity, and location of minerals and materials from spectral imagery.

According to Dr. Christian Mielke, CTO at Rad. Data Spectral Analytics, "There is demand for high quality hyperspectral sensor data in daily mine site operations, such as basic mineralogical mapping, geological block modelling,



↑ SfM 3D model with hyperspectral classification overlay (top) and central wavelength distribution map for specific absorption features (bottom) computed by open source HypPy toolbox. The high spatial resolution of HySpex cameras allows for efficient onsite material localization based on spectral signatures; high spectral resolution facilitates detailed absorption feature ID.

geochemical mapping, and stability monitoring. We are convinced the easy to use HySpex cameras by NEO are pivotal to efficiency increase and cost reduction at mines worldwide, with the reduction of the environmental footprint of the overall mining operation as an invaluable additional result of the HySpex system." **MRA**



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Vibramech recently landed its biggest order in its 47-year history



Improved robustness

Leads to ongoing success

Vibramech recently secured its largest single order in the company's history. This is the supply of over 30 units of vibrating equipment to the latest state-of-the-art marine diamond processing vessel in 2020.

The equipment in question ranges from heavy duty/high capacity primary scalping screens to diamond recovery feeders. The large primary scalping screens (the largest operational on seagoing processing plants) have been methodically designed and tailor-made for this specific application, and have been designed using the latest finite element and strain gauge techniques.

These particular exciters are specially adapted for marine conditions, in that the exciter weights are protected with stainless steel guards, the studs are given additional anti-corrosion protections, provision is made to monitor the oil levels and the client is able to adapt the quality of the lubrication, in an easily accessible manner.

The order is an indication of the success that company enjoys as a result of continuous engineering developments that provide improved robustness.

Vibramech's engineering developments have led to substantially improved wear resistance (on its range of vibrating equipment supplied to the marine diamond processing industry), by the use of special features such as huck collar protection, abundant use of stainless steel and galvanised

components, thicker side plates, rubber lining on the complete internal surface of the side plates and ceramic coating on all internal exposed surfaces that are not wear protected by rubber lining.

Worldwide reach

Vibramech is southern Africa's largest manufacturer of vibrating mineral processing equipment. The company furthermore supplies its equipment to mining and minerals processing industries throughout Africa, Eurasia, Australasia, North and South America. The company's equipment is operating in processing plants, ocean vessels and mining operations world-wide, and it has extensive experience in gold, diamond, coal, iron ore, manganese, platinum, chrome, nickel, uranium, copper, mineral sands and aggregate operations.

Vibramech has developed a proven and comprehensive range of vibrating equipment, including, but not limited to: multislope (or banana) screens, horizontal and inclined screens, dewatering screens, primary and secondary sizing screens, crusher product screens, degrit screens, floats and sinks screens, classifying screens, XRT and X-ray prep screens and feeders, DMS feeders, grizzly feeders, pan feeders, tubular feeders and grease tables.

As sound dynamic behaviour is essential to ensure vibrating equipment reliability, all equipment is built to perform within strict dynamic parameters. All internal mating surfaces are machined in order to maintain stringent dimensional tolerances. In addition, the company's quality assurance programme makes provision for a full 3D vibration analysis to be conducted on all equipment prior to release. This is used as a benchmark for the life of the equipment.

All equipment is manufactured in-house by Vibramech, in its factory in Chamdor, 35 km west of Johannesburg. Almost every piece of equipment is tailor-made to suit a client's specific requirements, from both a plant layout viewpoint and process considerations. A present staff complement of over 200 control all activities from sales through to engineering and manufacturing.

Vibramech's field services department continues to service all equipment supplied into the field. It has established regional offices in eMalahleni and Lephalale to service new and existing clients in the Limpopo and Mpumalanga Provinces. It also has a permanent sales engineer stationed in Letlhakane, Botswana to provide support throughout Botswana. **MRA**



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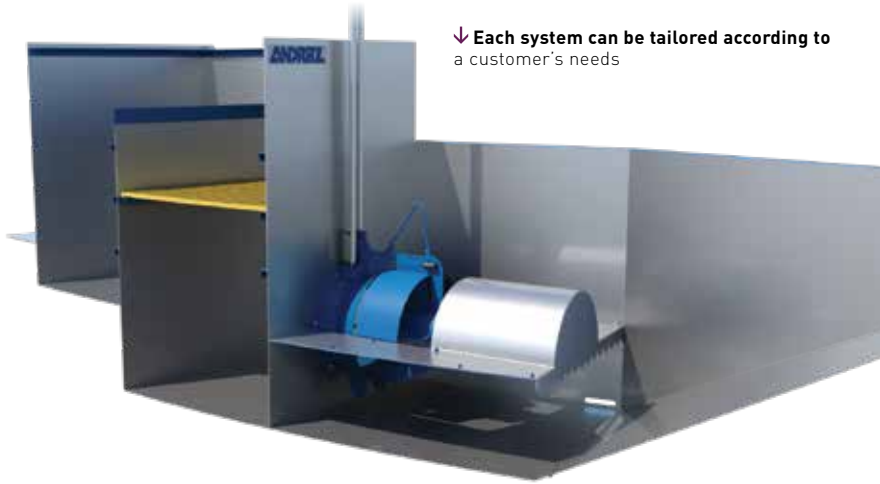
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Going with the flow

New dilution system for thickeners

International technology group **ANDRITZ** has developed the EvoLute NT dilution system, a new solution for diluting thickener feed that uses the overflow liquid from the thickener to dilute incoming slurries or suspensions to the optimum solid-liquid ratio.

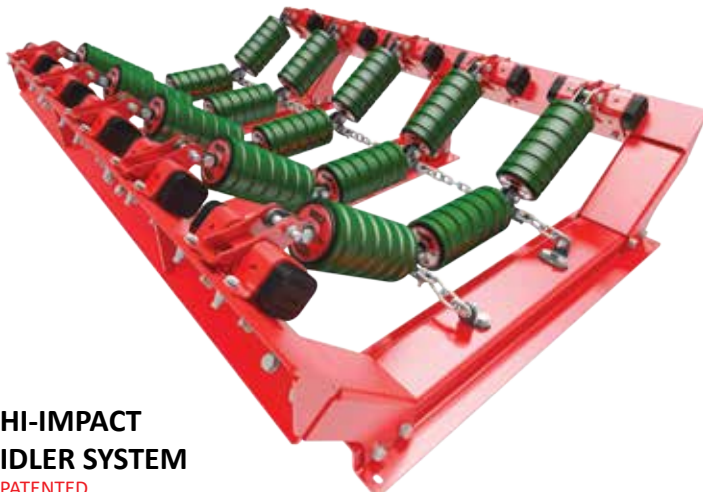


↓ Each system can be tailored according to a customer's needs

This new, patented system is designed for flow rates of between 600 and 9 000 m³/h. The dilution system does not interfere with the thickener settling process and can also accommodate slurries with low pH values. With the different flow rate configurations available, each system can be adjusted flexibly to the individual customer's needs.

The high dilution flow rates that the ANDRITZ EvoLute NT dilution system achieves translate into considerable

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cost savings through lower power consumption. It has also been optimised in terms of maintenance as a result of interchangeable parts that do not require the thickener to be shut down. In addition, the system can be integrated into the thickener automation processes.

In the most challenging applications, reliable clarification and thickening are critical to maintaining continuous production. That is why ANDRITZ has invested decades of expertise with thickening and clarification systems to develop an efficient and cost-effective solid/liquid separation system with a crystal-clear overflow.

The dilution process, where liquid is added to the incoming material and the solids concentration is reduced by adding more solvent, is a critical step. Dilution guarantees a perfect solid-liquid ratio in the thickener feed, which in turn enhances the settling rate of particles in the suspension when flocculants are added.

Innovation at the helm

ANDRITZ offers many more dilution systems covering flow rates of up to 15 000 m³/h for a wide variety of applications. With their unique design features, the thickeners – including the ANDRITZ EvoLute NT dilution system – are considered as highly effective and technologically viable systems.

Publicly listed ANDRITZ offers a broad portfolio of innovative plants, equipment, systems and services for the pulp and paper industry, the hydropower sector, the

metals processing and forming industry, pumps, solid/liquid separation in the municipal and industrial sectors, as well as animal feed and biomass pelleting. The global product and service portfolio is rounded off with plants for power generation, recycling, the production of non-wovens and panelboards, as well as automation and digital solutions offered under the brand name of Metris.

In addition, ANDRITZ Separation provides mechanical and thermal technologies and services for solid/liquid separation, serving the chemical, environmental, food, mining and minerals industries. The customised, innovative solutions focus on minimising the use of resources and achieving the highest process efficiency, thus making a substantial contribution towards sustainable environmental protection. **MRA**

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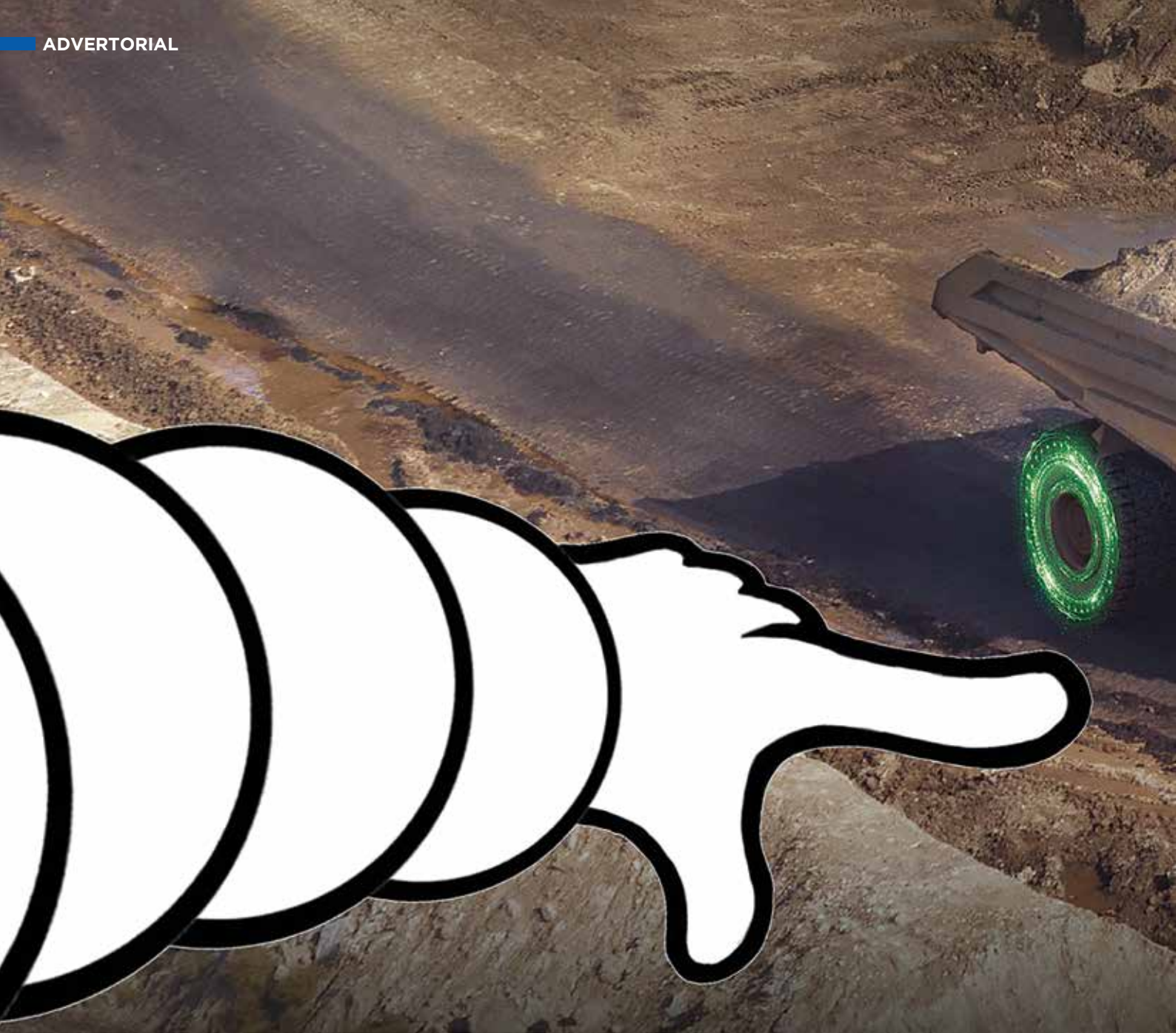


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SEPARATION

RECOVERY OF HIGHLY CLARIFIED LIQUID WITH ANDRITZ THICKENERS

In the most challenging applications, reliable liquid clarification and slurry recovery are critical to maintaining continuous production. ANDRITZ has put decades of expertise into thickening and clarification systems to provide efficient and cost-effective solid/liquid separation with a crystal clear overflow. Now ANDRITZ is taking another step forward by introducing its new dilution system on the market – ANDRITZ OptiFLO dilution.

OptiFLO is an internal dilution system inside the thickener tank that makes use of internal overflow liquid to dilute incoming slurry to the required solid-liquid ratio. This flexible system can handle flow rates from 600 to 9,000 m³/h, it does not interfere with the thickener settling process, and it can accommodate slurries with low pH values. Other dilution systems are also available from ANDRITZ to cover flow rates from 0 to 15,000 m³/h.

With their unique design features, ANDRITZ thickeners are considered the most effective and technically viable systems, hence they are the most recommended equipment for recovery of highly clarified liquid.



ENGINEERED SUCCESS

ANDRITZ Delkor (Pty) Ltd. / South Africa / +27 11 012 7300 / separation.za@andritz.com / andritz.com/separation

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