

# MODERN MINING

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- Mining in Botswana on the back foot
- Shumba to fast-track Mabesekwa







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**Cover**

The new generation Sandvik DD422i mining jumbo. Black Mountain Mine in the Northern Cape is to take delivery of one of these advanced machines later this year. See page 18 for further details.



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# More body blows to an already embattled industry

**S**adly, the state of South African mining is such that every positive development is soon balanced out by bad news. Like many others, I was heartened by the announcement recently by SepFluor that it had decided to proceed with the construction of the R1,7 billion Nokeng fluorspar mine north-east of Pretoria. True, R1,7 billion is hardly a mega-project but new mines are so thin on the ground these days that this is a highly welcome initiative.

Consider, though, that SepFluor's announcement has come at a time when the mining industry has been shaken to the core by the government's ill-conceived and, as the Chamber of Mines puts it, "unilaterally developed" Mining Charter and by the recent news that AngloGold Ashanti is going to be restructuring its South African operations, with a possible loss of 8 500 jobs – pretty much a third of its current South African workforce.

If this were not bad enough, we now have worrying news coming out of Platinum Group Metals (PTM), which is struggling with the ramp-up of its new Maseve mine in the Sun City area. The operation is currently being 'restructured' – again that doom-laden word – with the aim of transitioning from higher volume bord-and-pillar mining to a hybrid mining method. According to PTM, active mining has now been suspended but is expected to resume within a few weeks.

The impact of the mine's under-performance on PTM's 'financials' has been severe, with the company recording a net loss of US\$287 million for the nine months ended May 31, 2017. During the nine-month period, it recorded a US\$280 million impairment of the mine, which was taken "primarily to recognise the effect of missed production targets and the transition to a more gradual production rate from the hybrid mining method."

The travails of South Africa's mining industry have not, of course, gone unnoticed overseas. *The Economist*, for example, recently published an article entitled 'Deep Trouble – South African mining is in crisis'. As it says, "South Africa's mining industry is shrinking. At its peak in 1980, mining accounted for a fifth of the country's GDP; the number now stands at 7,3 %. High costs, low commodity prices, labour strife and falling productivity have all taken their toll. Mines have shed 70 000 jobs over the past five years. More cuts are coming."

None of these facts are new to anyone acquainted with our local mining industry and,

indeed, the full extent of the crisis has been detailed by the Chamber of Mines. According to the Chamber, the mining sector is now smaller in real terms than it was in 1994 and it notes that over the past five years, mining's contribution to GDP shrank by 0,2 % per annum, while the rest of the economy grew at 1,6 % per annum.

It gets worse. In 2015, the mining industry made a R31 billion loss and, at current prices, an estimated 60 % of the platinum mining sector is loss making. Profitability is well down and, over the past five years, has declined by a reported 8 %. As for employment, jobs in mining are disappearing at an alarming rate of about 1 500 a month.

Given these bleak metrics, it is little wonder that the Chamber has responded so pugnaciously to what it calls the 'DMR charter'. It says that should the revised Charter be implemented in its present form, between 50 000 and 100 000 direct jobs are at risk in the sector. It continues: "The mining sector's net fixed investment is already negative, with the sector not even covering depreciation. Given the deleterious impact of the Charter, this will result in declining production going forward which will negatively affect investment, production, GDP, employment, export earnings, taxes to the state and will undermine all the multiplier effects of mining into the rest of the economy."

As just one example of how unbalanced the proposed new Charter is, the Chamber notes that one of its provisions mandates that holders of new mining rights will have to pay 1 % of turnover to the 30 % BEE shareholders. "It is fair to ensure that BEE shareholders receive a dividend stream – as the industry agreed in the 2010 charter," says the Chamber. "But, using as an example national 2016 data, the total dividends paid by mining companies to shareholders was R6 billion. One per cent of revenues was R5,7 billion. Once the R5,7 billion is paid preferentially to the 30 % BEE holders, it would leave almost nothing for the remaining shareholders."

As we all know, implementation of the Charter has now been suspended pending various legal processes. But that doesn't mean that the battle has been won. One can only pray that reason ultimately prevails. Our industry is already on its knees. Implementation of the Charter could be a death blow, destroying the viability of an industry that for well over 100 years – and for all its faults – has been the main driver of South Africa's economic growth.

**Arthur Tassell**



*In 2015, the mining industry made a R31 billion loss and, at current prices, an estimated 60 % of the platinum mining sector is loss making.*

## Pre-Feasibility Study completed for Arcadia lithium project

ASX-listed Prospect Resources has announced that its Pre-Feasibility Study (PFS) over the Arcadia lithium project in Zimbabwe has been completed. The company says the results of the PFS confirm and validate its objective of developing Arcadia to become a significant producer of high quality spodumene, petalite and tantalite concentrates in the near term.

The project is located approximately 38 km east of Harare and occupies an area of more than 9 km<sup>2</sup> of granted mining rights and consists of several historical lithium and beryl workings within an existing agricultural area.

The PFS supports the declaration of a maiden probable ore reserve estimate of 15,8 Mt grading at 1,34 % Li<sub>2</sub>O and 125 ppm Ta<sub>2</sub>O<sub>5</sub>. Arcadia's probable ore reserves form the basis of a standalone 1,2 Mt/a mining and processing operation over a 15-year Life of Mine (LoM). The PFS further examines a mine plan, which includes a pit inventory of probable ore reserves and inferred mineral resources within the pit outlines, giving a pit inventory of 23 Mt at 1,34 % Li<sub>2</sub>O and 124 ppm Ta<sub>2</sub>O<sub>5</sub>, a LoM of 20 years and an average strip ratio of 2,79 to 1.



An on-site briefing at Arcadia showing members of the Prospect team and some investors (photo: Prospect Resources).

According to the PFS, the project has a 39 % IRR and a pre-tax NPV<sub>10</sub> of US\$139 million. The estimated capex is US\$52,5 million. It will generate LoM revenues of approximately US\$2 billion from production of a variety of lithia and tantalite products targeting the battery (chemical) and glass/ceramics (technical) lithium markets along with traditional tantalite end

consumers in the electronics markets.

Prospect is currently evaluating the establishment of a lithium carbonate and hydroxide chemical plant at Arcadia to produce high end specialty lithium chemical products, with a PFS due to be completed during Q3 2017.

Commenting on the PFS results, Prospect's Chairman, Hugh Warner, said:



A drill site at the Arcadia project (photo: Prospect Resources).



"This result is a phenomenal outcome for Arcadia, our project team and importantly our shareholders. In the space of less than a year, we have developed Arcadia to a stage where we have defined a globally significant deposit containing highly sought-after lithium products in spodumene and petalite.

"We decided to extend the PFS period to ensure our extensive metallurgical test-work programmes were completed in order to properly support these aspects of the PFS. We are now confident that Arcadia will have the ability to produce battery grade lithium, glass and ceramic grade lithium and tantalite products to the market by late 2018.

"Following government environmental and financial approvals and coupled with the excellent results of this PFS, the development of Arcadia can now be fast tracked. This is undoubtedly supported by the very low start-up costs, which further places Prospect at an advantage to its peers. Prospect can now actively pursue and execute offtake agreements and pursue funding options to develop this quality asset."

Prospect commissioned BioMetallurgical Zimbabwe (BMZ) to undertake the PFS on the project. The PFS represents the culmination of technical and financial inputs from the company's in-house team

and was supported by several independent consultants and contractors.

The findings of the PFS define a mining and processing operation producing 75 000 t/a spodumene and 155 000 t/a petalite concentrates destined for the battery (chemical) and glass/ceramics (technical) markets.

Run of Mine (ROM) material will be extracted via a single open-pit operation that will serve a process facility that will recover spodumene, petalite and tantalite concentrates as well as silica sand and mica as by-products. Lithia and tantalite concentrates will be bulk transported to Beira in Mozambique for onward shipping to downstream customers, whilst by-products will supply the domestic industrial markets in Zimbabwe.

Conventional open-pit mining is proposed for the delivery of 100 000 t/month or 1,2 Mt/a of ROM material to the comminution and processing facilities. In order to develop the pit design for the Arcadia deposit, an optimised pit shell was first prepared using Dassault System Surpac® software. The mining method is based on six nested sequential open pits (1a, 1b, 2, 3, 4 and 5). The final pit (5) will measure some 1,1 km by 750 m, with a maximum depth of 130 m on the final high-wall. The total surface area of the final pit 5 will be approximately 0,55 km<sup>2</sup>.

Mining operations will be conducted utilising a contracted fleet for key equipment with some ancillary vehicles being supplied by the company. Ore and waste will be handled by diesel hydraulic excavators and articulated dump trucks. Ore will be trucked to the crushing station where it will be directly dumped to the primary crusher, or stockpiled prior to front-end loader feeding. Waste material comprising meta basalt and some pegmatites will require blasting except for some of the very upper weathered rocks.

The concentrator plant will utilise conventional DMS and froth flotation technology. The processing route will include three-stage crushing, grinding, dense media separation, mica-flotation, spodumene flotation, petalite flotation, magnetic separation, concentrate dewatering and drying, and tailings filtering.

The plant will produce >6 % Li<sub>2</sub>O and >4,1 % Li<sub>2</sub>O concentrates suitable for lithium hydroxide and carbonate plants that supply feed-stock to the lithium battery manufacturers and the glass/ceramics markets. Tantalite concentrate (>25 % Ta<sub>2</sub>O<sub>5</sub>) will also be produced to serve the downstream electronics markets. Further metallurgical optimisation and enhancement to improve the metallurgical recoveries and concentrate grades is now underway. ■

## SCT courses aimed at mining engineers

The Concrete Institute's School of Concrete Technology (SCT) offers two training courses that provide essential knowledge for mining engineers seeking their Certificates of Competency, more commonly known as 'Mining Tickets', says John Roxburgh, lecturer at the School in Midrand.

The courses, SCT 20 Concrete Practice (four days), and SCT 30 Concrete Technology (five days), both include practical laboratory tuition.

Roxburgh says SCT 20 Concrete Practice should be the first target of those seeking Mining Tickets. "The course provides essential initial training for mining, as well as electrical and mechanical engineers, and earns students four CPD points. The syllabus includes training in a wide variety of concrete-related topics including the production and properties of both fresh, early age, and hardened concrete; materials and

mix proportions; as well as various types of concrete such as low-density, prestressed, precast as well as off-shutter and architectural finishes.

"SCT 30 Concrete Technology would be the next step and is more intensive and advanced with in-depth tuition on how cement and concrete works. This is training specifically aimed at engineers as well as experienced technicians and technologists. It is recommended for electrical, mechanical and mining engineers to meet their mining qualification requirements," he states.

Included in the syllabus of this course (five CPD points) are more detailed training on topics covered in SCT 20 as well as tuition on cement extenders, aggregates, concrete mix design and mixes for specialised applications, as well as defects, blemishes and repairs.

The minimum entrance requirement for SCT 20 is Grade 10, and the ability to read

and write English and do basic arithmetic calculations. For SCT 30, students should have passed Grade 12.

The dates and venues of these two courses for the second half of 2017 are:

- ❑ SCT 20: Midrand from 27-30 November, and Cape Town from 5-8 September;
- ❑ SCT 30: Midrand from 18-22 September, Durban 16-20 October, and Cape Town 20-24 November.

Roxburgh says an option of on-site courses run at a company's premises, for a minimum of 10 delegates, is also offered. "SCT lecturers are available to travel throughout Africa to provide this service. For on-site training, standard courses can also be adapted to make these more appropriate for the specific needs of the client," he explains.

Further information is available from [rennishes@theconcreteinstitute.org.za](mailto:rennishes@theconcreteinstitute.org.za) or by phoning (+27 11) 315-0300. Details can also be obtained from the Institute's website [www.theconcreteinstitute.org.za](http://www.theconcreteinstitute.org.za) ■

## Tharisa delivers record chrome production

Tharisa, the PGM and chrome co-producer, has reported record chrome production of 333,9 kt for the three months to end June 2017. Records were also achieved for PGM and chrome recoveries, as the Group made incremental improvements to both its mining and processing operations.

Reef mined from Tharisa's shallow open pit on the Western Limb of the Bushveld Complex totalled a record 1 275,2 kt, a 5 % improvement on the previous quarter as the mining team focused on continuous improvement initiatives particularly in the drill-and-blast operations.

The processing plants continued to perform well with continuous improvement initiatives focused on crusher throughput and improved crusher run time beginning to deliver results. The overall performance across both plants saw increases in PGM and chrome output. PGM production of 35,4 koz on a 6E basis was up 3,2 % quarter on quarter while chrome production at 333,9 kt, was 6,1 % higher than the previous quarter.

Both PGM and chrome recoveries exceeded target with chrome recoveries at 66,0 %, against a target of 65 %, and PGM recoveries at 81,3 %, against a target of 80 %.

The high energy flotation successfully implemented at the Voyager PGM recovery

circuit has been incorporated into the PGM recovery circuit of the Genesis plant and is scheduled to be completed by the end of July 2017. This will contribute to improved PGM production in Q4.

Specialty chrome production increased 15,5 % quarter on quarter to a record 87,1 kt. Specialty chrome concentrates make up 26,1 % of Tharisa's total chrome production, and are sold into the chemical and foundry markets globally. These grades continue to attract a premium above the metallurgical chrome concentrate prices, contributing to maintaining margins when metallurgical chrome prices fall.

Contracted metallurgical grade chrome concentrate prices decreased to US\$147 per tonne from US\$338 per tonne in Q3. There are, however, signs that prices have found a floor and there is increased price stability within the chrome concentrate market, says Tharisa.

The continuous improvement initiatives put in place during the quarter are expected to continue delivering into Q4. In particular, the incorporation of high energy flotation into the PGM recovery circuit of the Genesis plant will yield improvements in PGM production.

"Tharisa Minerals has again shown incremental improvements in production volumes and recoveries. We continue

to examine ways to further optimise our operations and look forward to achieving our targeted recoveries and production outlook for the financial year," said Tharisa CEO Phoevos Pouroulis.

PGM and chrome production remains on track to meet the FY2017 production guidance of approximately 147,4 koz PGMs on a 6E basis and 1,3 Mt chrome concentrates, of which 300 kt will be specialty grade chrome concentrates.

Post the quarter end, South African Competition Commission approval for the planned purchase of certain of MCC Contracts' existing equipment, strategic components, site infrastructure and spare parts was obtained. The 'one stop' date for fulfilment of the remaining conditions precedent is 30 September 2017.

Tharisa Minerals announced in May this year that it had entered into a binding term sheet with MCC, the mining contractor at the Tharisa mine, to purchase MCC's mining fleet and that it would transition to an owner-operator model.

The 153 'yellow fleet' machines being purchased include excavators, off highway dump trucks, articulated dump trucks and support vehicles, being substantially all of the equipment at the Tharisa mine, as well as 17 additional machines from another MCC site. ■



Open-pit operations at the Tharisa mine (photo: Tharisa Minerals).



## Platinum Group to restructure Maseve platinum mine

Platinum Group Metals (Platinum Group), listed on the TSX and NYSE MKT, says it is taking steps to restructure its mining operations at its Maseve mine, located 35 km from Rustenburg in the Sun City area.

The restructuring will involve a change in primary mining method and cost reductions to create a sustainable future for the mine. The changes are operationally driven to align costs with a more gradual ramp-up of production using more selective mining methods.

As a result of the anticipated restructuring process, there are a large number of employees in the service of independent contractors and staff of Maseve who could be affected. Platinum Group will work closely with all its contractors, including Redpath Mining South Africa, the largest mining contractor on site, to minimise job losses while making the operation self-sustainable. It is likely that Redpath will continue to be the main contractor at the mine.

"We see good potential for a sustainable mine at Maseve. The South African government and the local community have been very supportive of the Maseve mine, and we deeply value their assistance and support," said R. Michael Jones, CEO of Platinum Group. "We will work with our contractors, employees and other stakeholders in a climate of mutual respect, as we transition through the proposed restructuring process."

The restructuring aims to reduce ongoing costs and achieve positive, sustainable cash flows as soon as possible, utilising already-established infrastructure. A 'hybrid' mining method is under consideration, which would result in a transition from the current higher volume, mechanised bord-and-pillar mining method. Hybrid mining involves mechanised access drives using the mine's current equipment as well as conventional manual methods for stoping. Both bord-and-pillar and hybrid methods were included in the mine's feasibility study.

Face grades at the Maseve mine have generally met estimates, but the fully

mechanised mining method has resulted in excess dilution and therefore lower grades to the plant. The Maseve concentrator plant has performed in excess of design criteria. Completed underground conveyor infrastructure will help reduce the trucking fleet required for mining from Block 11, the target for immediate mining.

Platinum Group has notified the Department of Mineral Resources that a restructuring is required to create a viable operation and to ensure optimal mining of the resource, and that it will comply with the applicable provisions of Section 52 of the Mineral and Petroleum Resources Development Act (MPRDA). ■



Platinum Group has announced it is taking steps to restructure the mining operations at its Maseve mine (photo: Platinum Group).

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## Balama graphite project in the finishing straight



The flotation section of the Balama plant under construction (photo: Syrah Resources).

ASX-listed Syrah Resources, which is developing the Balama graphite project in northern Mozambique, reports that overall construction progress completion was 90 % as at 30 June 2017. Processing plant commissioning activities commenced in May and continue as planned, including energisation of the primary crusher substation, and completion of function testing for some material handling equipment.

The majority of supporting infrastructure for the plant site is complete, aside from the water pipeline which is well advanced. The main pipeline corridor has been cleared and trenched (13,5 km) and welding of the pipeline has begun.

Operational readiness for production ramp up is also progressing well, says Syrah, with most of the key operational management, supervision and personnel having been recruited and initial mine development complete with stockpiling of mineralised ore onto the ROM stockpile, ready for production. The laboratory has been fully fitted out with state-of-the-art equipment and is fully functional with Bureau Veritas technical personnel already mobilised to site. The laboratory is being used in advance of production to train personnel in processing and performing ore characterisation work.

The project remains on schedule for first production in August 2017 and the project capital cost is US\$193 million (plus a project contingency of US\$7 million).

Syrah says that the Mozambique Minister for Mineral Resources and Energy, Leticia Klemens, undertook a very detailed visit to the Balama operation on June 26. The visit focused on health and safety, environmental compliance, the

mine, processing plant and infrastructure, the training and development systems in place, and the high proportion of Mozambican national employees, particularly from the local communities.

The strong commitment Syrah has already shown towards social responsibility in advance of production was noted, and the Minister subsequently requested that the company share the established standards and processes with other resources projects in Cabo Delgado province and nationally.

The project has reserves of 114,5 Mt at 16,6 % Total Graphitic Content (TGC) (18,6 Mt contained graphite) and resources of 1 191 Mt at 11,0 % TGC (128,5 Mt of contained graphite), sufficient for a life of mine of almost 60 years.

Balama will be a simple open-pit operation with a low strip ratio. It will employ a processing route consisting of conventional processes including crushing, grinding, flotation, filtration, drying, screening and bagging. The plant will produce a 95 % to >98 % TGC concentrate across a range of flake sizes.

The processing rate is 2 Mt/a with the nameplate capacity of the plant being 380 000 t/a of graphite concentrate. It is envisaged that the operation will initially achieve a C1 production cash cost of less than US\$400 per tonne in the first 12 months, with this later reducing to less than US\$300 per tonne. ■



Looking south over the Balama site. This photo is from May this year (photo: Syrah Resources).



## Bell implements CEO succession plans

Bell Equipment's board of directors has announced the appointment of the company's Chief Operational Officer and Executive Director, Leon Goosen, as Chief Executive Officer designate to succeed Gary Bell upon his planned retirement.

The appointment follows an extensive internal, local and international search process by an external service provider to identify candidates, who were assessed by a sub-committee of the board.

Goosen, aged 45, was a partner at Deloitte & Touche in South Africa and Namibia prior to joining Bell in 2007. He has held the position of Executive Director since January 2009 and has been COO since December 2014.

Bell Equipment Limited's Chairman, John Barton, said: "We are delighted to be able to appoint at the helm of Bell Equipment a successor of Leon's calibre. As Chief Operating Officer, Leon has worked very closely with the Board and Gary over the past eight years, and has made a considerable contribution to the strategic direction of the group.

"By announcing the successor now, we will have the benefit of a smooth handover in the Chief Executive's office during the transition period. My board colleagues join me in wishing Leon every success during this transition phase and in his new role as Chief Executive of Bell Equipment Limited."

Bell's Chief Executive Officer, Gary Bell,



Leon Goosen, CEO designate of Bell Equipment.

added: "In the past years Leon has stepped up to his operational role and his knowledge and understanding of what is a very complex business has developed particularly well, and the executive team at Bell is very supportive of his appointment.

"I take this opportunity to congratulate Leon on his appointment and I have every confidence that he will lead the business to greater heights in the years ahead as we roll out our agreed plans.

"In an effort to ensure a smooth transition and retain the Bell family linkages, it is envisaged that I will continue to play a meaningful role on the Board and, along with Ashley Bell's presence on the Board, we can steer the business and retain the all-important family culture and sentiment that is core to the Bell business today." ■



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## GSR reports on Prestea Underground drilling

Golden Star Resources (GSR) has reported results from 14 diamond drill (DD) holes from the 2017 in-fill drilling programme at its Prestea underground gold mine (Prestea Underground) in Ghana.

The focus of this programme was to further define the West Reef ore body, where Prestea Underground's high-grade mineral reserves (1,09 Mt at 13,93 g/t of gold (Au) are located.

The 14 DD holes comprised 2 323 m of drilling and were drilled from within Prestea Underground's workings. Significant intercepts included: 1,1 m grading 75,7 g/t Au from 147,0 m in hole WR17-24-274S05A; and 3,2 m grading 14,4 g/t Au from 146,8 m in hole WR17-24-274S04A, including 0,9 m grading 39,5 g/t Au from 146,8 m.

These results confirm the previously modelled high-grade nature, strong continuity of gold mineralisation and thickness of the West Reef orebody (averaging 1,5 m). Assay results for five holes are pending and a further three holes remain to be drilled in the 2017 Prestea Underground in-fill drilling programme – all remaining results are expected during the third quarter of 2017.

GSR operates both the Prestea and Wassa mines in Ghana, which together produced approximately 194 000 ounces in 2016. Both are developing underground operations. Wassa Underground is in its ramp-up phase while Prestea Underground is expected to enter commercial production during the third quarter of this year. ■

## Maiden mineral resource estimate for DRC deposit



Geologists in discussion at the Giro project core yard (photo: Amani Gold).

ASX-listed Amani Gold (previously Burey Gold) has delivered a maiden indicated and inferred mineral resource estimate of 3 Moz for Kebabigada on its Giro gold project in the north-east of the DRC. The resource is defined over a strike length of 1,3 km and a maximum width of 350 m, tapering off to the north and south.

Amani is currently planning an additional infill diamond and RC drilling programme where a selected area will be drilled down to 25 x 25 m centres to define measured mineral resources for inclusion in pre-feasibility studies. A selection of diamond drill cores, as well as bulk samples from the lateritic and saprolitic lithological profiles, will also be submitted

for detailed metallurgical testwork.

Three deep diamond holes to test the continuation of high grade shoots have been completed with results pending. Additional drilling will be carried out for resource definition at Douze Match and will follow up on high grade soil anomalies in the immediate surrounds at Kebabigada where there is potential to delineate satellite resources which could add materially to the current Kebabigada mineral resource.

Comments Amani's Chairman, Klaus Eckhof: "We are extremely pleased in reaching an initial milestone of 3 million ounces at 1,2 g/t gold (at a 0,60 g/t Au cut off) in our maiden mineral resource

for Kebabigada, which confirms our belief that Kebabigada and, of course, the greater Giro gold project, has always had potential to host multi million ounces of gold. We are also confident of increasing the grade with further infill drilling which is supported by the better grades reported in the indicated resource where we have closer drill spacing.

"One of the highly pleasing aspects of the initial gold department study is that recoveries in excess of 90 % can be expected which further confirms the robustness of the deposit.

"Kebabigada has now moved to the next level as we move towards pre-feasibility and feasibility studies with consideration to be given to possible commencement of early production. There are significant under explored areas within the Giro project, requiring further attention and providing potential for new discoveries.

"Giro Goldfields sarl, Amani's in-country JV company with Sokimo, has received the full support of the Governor of Haute Uele who has encouraged the company to be the second producer behind Randgold/AngloGold Ashanti's Kibali project within his Province."

The Giro project comprises two exploitation permits covering a surface area of 497 km<sup>2</sup> and lies within the Kilo-Moto Belt, a significant greenstone belt which hosts the 17-million ounce Kibali group of deposits, lying within 30 km of Giro.

Historically, Belgian colonials mined high grade gold veins and laterite at Giro, Peteku, Douze Match, Mangote and Kai-Kai, all of which lie within an interpreted 30 km structural corridor which transgresses both licences from the SE to the NW. ■





## Wash plant opened at Zululand Anthracite Colliery

Zululand Anthracite Colliery (ZAC) has opened its new wash plant in an opening ceremony attended by King Goodwill Zwelithini kaBhekuzulu. ZAC is located on the border of the Hluhluwe-Umfolozi Game Reserve, close to Ulundi, and is reportedly the sole producer of prime anthracite in South Africa.

In a ribbon-cutting ceremony held at the new plant, King Goodwill and the MD of ZAC, Vuslat Bayoglu, together declared the wash plant open. Afterwards, the opening ceremony continued with a number of speeches being delivered by, amongst others, Sihle Zikalala, Chairperson of the ANC in KZN, Judge Ngwenya from the Ingonyama Trust Board, and Thabo Mokoena, the Director General of the DMR.

The new coal processing plant has a 50-ton per hour capacity and is expected to wash 3 million tons of discard over the next five years. This reclamation of the long-standing discard dump will decrease the rehabilitation footprint of ZAC and

produce 1 million tons of saleable product which will be made available for the export market.

The ZAC resource was discovered in 1985 by BHP Billiton and mining operations were started in 1987. Over the years the mine's owners have included Riversdale Mining and Rio Tinto. Rio Tinto sold its 74 % stake in the operation to

Luxembourg-based Menar Holding last year. Menar also controls Canyon Coal, which has three collieries in Mpumalanga.

ZAC, which has a current life of mine to 2027, is an underground, deep level, narrow seam operation, using both continuous miners and drill-and-blast mining techniques. Several shafts are currently operated. ■



The new coal processing plant has a 50-ton per hour capacity.

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## Walkabout signs 'Heads of Agreement' with Jinpeng

Walkabout Resources, an Australian junior listed on the ASX, has signed a Heads of Agreement (HoA) with a private mid-sized engineering company, Yantai Jinpeng Mining Machinery Co Ltd (Jinpeng) in China, to engineer, manage and build the Lindi Jumbo process plant and shared infrastructure package on site in Tanzania. Jinpeng has extensive experience in designing, manufacturing and building graphite flotation facilities in China and building plants in Africa.

The Engineering, Procurement and Construction Management (EPCM) service contract will include a Deferred Payment Option by means of a fast-track application already underway, which provides access to funding provided through the Chinese

Governments' new US\$1 trillion 'Silk Road – One Belt, One Road' (Silk Road) initiative.

Detailed engineering and design services are to commence immediately while the EPCM agreement, a final estimate and funding is progressed. Selected and critical equipment is to be sourced from BGRIMM, an internationally recognised flotation equipment engineer.

Walkabout's technical input and interests will be managed under an Owners Representation Agreement by Dr Evan Kirby, and a South African based engineering group.

Walkabout is fast tracking the development of the Lindi Jumbo project to take advantage of forecast market conditions for flake graphite deposits with high ratios of Large and Jumbo flakes. The company currently holds 70 % of four licences at Lindi Jumbo with an option to acquire the remaining 30 % share.

"Jinpeng is a highly competent and experienced engineering company," comments Trevor Benson, Executive Chairman of Walkabout Resources. "This EPCM and deferred payment funding is an optimal outcome for our fast-tracked development strategy. This funding model should significantly reduce the project capital required by the company."

The project is located in south-east Tanzania approximately 60 km inland from the coast and 200 km from the Port of Mtwara. It adjoins the Nachu graphite project of Magnis Resources, also listed on the ASX.

Mining will be by open-pit methods. Weathered ore and waste will be excavated using a hydraulic shovel and loaded onto 30-t dump trucks for hauling out of the pit to the ROM stockpile, low grade stockpiles or waste dumps. Where the weathered material requires ripping by dozer before excavating, this will be done using a tracked dozer. Fresh ore and waste will be drilled and blasted before being loaded and hauled in a similar manner.

A graphite processing flowsheet has been developed based on an extensive metallurgical test work programme. The proposed flowsheet includes primary and secondary crushing, scrubbing, milling (via a primary rod mill), sequential rougher/scavenger flotation, regrind cleaner flotation, filtration and concentrate drying,

screening of final product concentrate and bagging of concentrate.

The plant has been sized for a feed of 300 kt/a of ore with a grade of >16 % TGC to produce a graphite flake concentrate with an average grade of 97 % TGC.

A Definitive Feasibility Study (DFS) centrally managed from Johannesburg by independent mining consultancy Bara International was completed in February 2017. It confirmed the project to be technically sound with excellent economic returns even at potential softening price regimes for premium graphite flake material. Payback period for the project – which has an estimated upfront capex of US\$38,7 million – is less than two years. The DFS was based on an annual production of 40 000 tonnes of graphite concentrate. ■



Drilling at Lindi Jumbo in 2016 (photo: Walkabout Resources).

### Helio acquisition will boost New Luika's resources

AIM-listed Shanta Gold and TSX-V-listed Helio Resource Corp have entered into a definitive arm's-length arrangement agreement which, subject to Helio shareholder approval and British Columbia Supreme Court approval, will see Shanta acquiring all of the issued and outstanding common shares of Helio.

The deal will mean that Shanta will acquire Helio's SMP project which is immediately adjacent to Shanta's operating New Luika Gold Mine (NLGM) near Mbeya in Tanzania.

Helio's resource consists of an NI 43-101 compliant gold resource totalling 635 koz of gold at an average grade of 2,4 g/t. All of

these resources are located within 20 km of the existing NLGM processing plant.

The JORC-compliant resources include: an open-pit indicated gold resource of 332 koz at 1,8 g/t and an inferred resource of 17 koz at 1,6 g/t; and an underground indicated gold resource of 258 koz at 4,9 g/t and an inferred resource of 27 koz at 3,8 g/t.

The acquisition will result in an increase in Shanta's gold resource ounces of 77 % from 824 koz at 1,9 g/t to 1 459 koz at 2,09 g/t.

Shanta intends to incorporate these resources into its future mine plan and explore the potential to expand the NLGM production rate incorporating these additional resources as soon as possible. ■



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- High drilling speed.





## Construction starts on R1,7 billion fluorspar mine

Nokeng Fluorspar Mine (RF) (Pty) Limited, a wholly owned subsidiary of SepFluor Limited, has announced the start of construction of the R1,7 billion Nokeng open-pit fluorspar mine and concentrator at Rust de Winter, 80 km north-east of Pretoria.

Project finance has been raised through a mixture of debt and shareholder equity.

Key equity participants include: the African Minerals Exploration and Development Fund II SICAR (AMED II), a private equity fund managed by Explora (Luxembourg); Ixofluor, backed by the Lelau Mohuba Trust and headed by Sephaku Holdings founder and CEO Dr Lelau Mohuba; Traxys Projects LP, the projects division of commodities trader Traxys Europe SA (Traxys); and funds managed by two of AMED II's investors, Kuramo Capital and Tribus Capital.

The finance component of the project was arranged by Fieldstone Africa (Pty) Limited and comprises a consortium of three primary lenders: Nedbank Limited as lender and facility agent; Nederlandse Financierings-Maatschappij Voor Ontwikkelingslanden NV (FMO); and Deutsche Investitions Und Entwicklungsgesellschaft mbH (DEG).

In addition, Concentrate Capital Partners (CCP), a small investment fund associated with the EPC contractor, DRA, has provided a small tranche of mezzanine debt.

The Department of Trade and Industry

(DTI) has approved an infrastructure grant of R21 million under its Critical Infrastructure Programme (CIP), primarily as a contribution towards power supply and road works.

A joint venture comprising DRA Projects SA and Group Five Construction has been awarded the EPC contract for the mine, which includes the concentrator, access roads and the 'self-build' portion of a power supply agreement concluded with Eskom. This involves the construction of a new 14 km, 132 kV overhead power line. Water supply to the site will be from a newly established wellfield.

Construction is expected to be concluded within a 21-month period, with commissioning beginning in November 2018 and first production in January/February 2019. At an average run-of-mine rate of 630 000 t/a, the mine will produce 180 000 t/a of acid grade fluorspar and 30 000 t/a of metallurgical grade fluorspar.

With a total SAMREC-compliant reserve of 12,18 Mt, Nokeng has an estimated life of mine of 19 years.



A geologist examines an ore specimen on site at Nokeng (photo: SepFluor).

More than 300 fixed-term jobs will be created in the construction phase and some 200 permanent jobs once the mine is in operation.

A significant portion of the early production has been pre-sold to several international fluorspar consumers who have been strongly supportive of the project and its development. A long-term agreement has been concluded with Traxys, which has a significant presence in South Africa, for the marketing and distribution of Nokeng's production. ■

### Pilot hole drilling at BK16 kimberlite completed

Tsodilo Resources, listed on the TSX-V, has completed a Pilot Hole Drill (PHD) programme at its wholly owned BK16 kimberlite project in Botswana. The purpose of the programme was to drill pilot holes on the sites which have been earmarked for the Large Diameter Drill (LDD) drilling programme.

The BK16 kimberlite project is located within the Orapa Kimberlite Field (OKF). In 2016 the OKF area produced 8,85 million carats. Of the 83 known kimberlite bodies in the OKF, 11 have been or are currently being mined.

The diamondiferous BK16 kimberlite pipe – discovered in 1970 – is approximately 6 hectares in size at surface, and is known to contain rare and valuable Type IIa

diamonds. Kimberlite phases VK2 and VK3 are volumetrically the most important and will be the focus of the LDD programme.

The positioning of the initial 14 LDD holes is designed to provide grade estimates for the main kimberlite phases as well as initial grade distribution across the kimberlite. Z Star Mineral Resource Consultants of Cape Town were retained to optimise these objectives. The hole diameter of the LDD holes will be 24-inch and the planned 14 holes will provide some 2 000 tons of kimberlite.

In order to correlate the diamond recoveries directly to the geological model and to ensure that the intersection of the LDD holes are maximised, it was necessary to

probe all LDD sites with NQ size diamond core holes. The PHD programme, as well as earlier delineation drilling, was conducted utilising Tsodilo's Atlas Copco CT14 diamond core drill rigs. All bits used were of a Wuxi-Tsodilo design and contained only synthetic industrial diamond.

All pilot and delineation core holes were logged in the field in detail according to a standard operating procedure, describing each kimberlitic unit, measuring contacts between various units as well as kimberlite/country rock contacts and brief descriptions of country rock.

Core recovered from the pilot hole drilling is stored at Tsodilo's Letlhakane exploration camp. The core has been labelled, photographed and the information captured in the company's database. ■



## Endeavour to acquire Avnel for US\$122 million

Endeavour Mining Corporation and Avnel Gold Mining, both listed on the TSX, have announced that they have reached an agreement under which Endeavour will acquire Avnel in an all-share transaction for a total consideration of approximately US\$122 million.

Avnel holds an 80 % interest in the Kalana gold project in Mali and holds significant exploration permits in the surrounding area. Kalana is a fully permitted, feasibility-stage project based on a 1,2 Mt/a carbon-in-leach (CIL) plant and a single open-pit constrained reserve of approximately 2,0 Moz grading 2,8 g/t.

According to the feasibility study, Kalana has an 18-year mine life and an expected production of 101 000 ounces per year at an average All-in Sustaining Cost (AISC) of US\$784/oz (with 148 000 ounces on average during the first five years at an average AISC of US\$589/oz).

The initial capital cost is forecast at US\$196,3 million and Kalana demonstrates

robust economics with an after-tax NPV<sub>5</sub> of US\$257 million, an after-tax IRR of 38 % and a payback of 1,2 years based on a gold price of US\$1 200/oz.

Avnel has pursued optimisation scenarios that, if adopted, could provide Kalana with an after-tax NPV<sub>5</sub> of US\$321 million and an after-tax IRR of 50 %. In addition, such optimisation scenarios could reduce average AISC to US\$730/oz over the 18-year mine life and to US\$561/oz over the first five years.

Endeavour intends taking advantage of its construction expertise, operating synergies and exploration experience to re-design and optimise the current feasibility study, which is expected to increase the annual production profile and improve the project economics.

Comments Sébastien de Montessus, President & CEO of Endeavour: "We are delighted to have reached this agreement with Avnel. We believe that Kalana fits well within our strategy of building a high-quality

portfolio of long-life, low AISC assets with exploration upside. Furthermore, this acquisition expands our footprint in Mali and reinforces our project pipeline, which will allow us to continue to leverage our in-house construction expertise.

"Kalana adds a third high-quality project to our portfolio, which we intend to develop following the completion of our Houndé and Ity CIL projects. In the interim, we look forward to optimising the current feasibility study which should unlock further value for both Endeavour and Avnel shareholders, as well as benefiting our partners, the State of Mali and the local communities around Kalana."

Kalana is currently the site of small, Soviet-era, underground mine. It is a very modest operation, with Avnel reporting a gold production of just 1 765 ounces in the quarter to March 31, 2017.

The proposed open-pit mine covers the full footprint of the existing Kalana mine underground infrastructure. ■



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## Massive sulphides in deep drill hole at Prieska

Orion Minerals, listed on the ASX, has provided an update on drilling activities at its Prieska Zinc-Copper Project (PC Project), in South Africa, where its maiden drill hole into the Deep Sulphide Target successfully intersected a 21 m zone of massive sulphides.

Orion completed the acquisition of the PC Project in March 2017 for an effective 73,33 % ownership, with the balance held by BEE partners as required by South African mining legislation.

Orion is targeting dip and strike extensions to historical under-

ground mining areas at the PC Project, with mineralisation having previously been delineated by extensive drilling and geophysics by previous owners. The existing underground infrastructure and access to existing services allows Orion to aggressively pursue re-entry to the PC Project.

The Deep Sulphide Target is the down-dip extension to mineralisation previously mined at the Prieska copper mine, which is the cornerstone of Orion's development strategy.

The current programme is scoped to systematically test and confirm the extensive historical drilling data with the aim of underpinning a maiden JORC-compliant mineral resource estimate by cQ1 2018.

The first diamond drill hole testing the Deep Sulphide Target (OCOD048) has successfully intersected massive sulphides from 1 061 m. The drill hole has effectively 'twinned' historical drill hole F2007, located 8 m along strike from OCOD048, which returned a reported intersection of 12,05 m at 4,05 % Zn and 2,10 % Cu.

The OCOD048 sulphide intersection is predominantly pyrrhotite and pyrite with chalcopyrite and sphalerite, similar to the sulphides reported in historical drill logs.

Once OCOD048 has reached its target depth of 1 200 m, a number of deflections, or daughter holes, will be completed to enable mineralisation to be tested at distances of between 30 m and 40 m from the current intersection (or 'mother' hole).

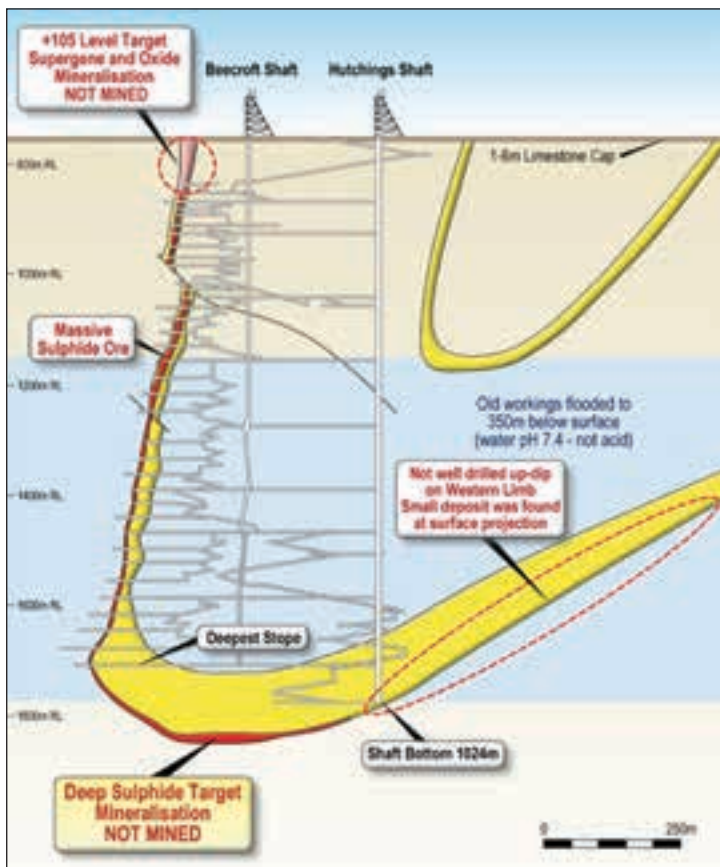
A further six holes are currently in progress to provide statistical validation of historic drilling that intersected unmined mineralisation zones in the area. Of these, hole OCOD051 has intersected mineralisation along strike from historical stoping, characteristic of mineralisation in the hanging wall to massive sulphide zones. This provides encouragement that historical mining did not completely extract the mineralisation along strike, but rather focused on contiguous massive sulphide ore.

Encouragingly, says Orion, the geotechnical competency of the recovered core in OCOD048 and other holes currently in progress is excellent.

Referring to the +105 Target Area, Orion says that encouragement for additional strike extension of the area has been gained from underground inspection of ore drives and draw points on the 105 Level by Orion's geological and mining team.

Painted survey lines on the hanging wall of excavations dating back to the time of first mining activities in 1971 confirm that no ground failure has occurred. This is in proximity to the remaining supergene enriched sulphide ore that remains vertically below areas of mining subsidence at surface, over the northern half of the historic mining area.

Orion plans to mobilise two underground drill rigs to infill drill and extend mineralisation drilled from surface at the +105 Target. This drilling is intended to expand the area covered by a maiden mineral resource estimate, which is now anticipated in the September 2017 quarter. ■



Section showing underground workings and mineralisation at the PC Project.

## South32 awards mining contract to BEE company

South32 has awarded a core mining contract to Modi Mining, a Broad Based Black Economic Empowerment company. The three-year, R158 million contract will see Modi Mining engaged at South32's Wolvekrans Middleburg Complex.

Modi Mining will work closely with the Wolvekrans mining and planning teams to plan and deliver various sub-processes, including top soiling and stripping overburden.

South32's President and Chief Operating Officer Africa Region, Mike Fraser, said the award was particularly significant as it was the first core mining contract awarded to a 100 per cent black-owned company.

"It marks a significant step forward in our plans to deliver a more inclusive supplier landscape," Fraser said. "We welcome Modi Mining as a strategic mining partner of South32. We are impressed with their focus on safety, their commitment to continuous improvement, and their support for the local communities in which they operate. We look forward to working together to successfully deliver our projects at Wolvekrans."

Modi Mining has also committed to creating downstream opportunities for local labour and sub-contracting, aiming to source 80 to 90 per cent of its labour from the nearby local communities. ■



## Sofia discovery enhances viability of Massawa

The feasibility study on Randgold Resources' Massawa gold project in Senegal is scheduled for completion by the middle of next year, when a final decision on its development will be made, Chief Executive Mark Bristow said in Dakar recently.

Speaking at a media briefing to mark the start of the annual three-week review of Randgold's exploration projects in Senegal, Mali, Côte d'Ivoire and the DRC, Bristow said the company's recent discovery of the nearby Sofia deposit, which has been incorporated in the project, had significantly increased Massawa's viability, as its low-cost, high-recovery ore would enhance the overall economics.

"As things stand today, Massawa has a mineable reserve of 2.6 million ounces and the project has an internal rate of return (IRR) of 18% at a gold price of US\$1 000 per ounce, which is a little short of our investment criteria of a 3 million ounce reserve and a 20% IRR. The detailed drill-

ing required for the feasibility study as well as our continuing exploration of extensions to and satellites around the known orebodies should get the project across the line," he said.

"In that case, Massawa will become the sixth mine Randgold has developed and our first in Senegal. It will also be the first of the three new projects we plan to deliver over the next five years."

Bristow pointed to Massawa as a further example of Randgold's long-term planning and perseverance. The company started exploring in Senegal in 1995, the year Randgold was established, discovered Massawa in 2004 and then spent a long time getting to grips with the geological and metallurgical complexities of the orebody. It has spent US\$85 million to date evaluating and advancing its Senegal portfolio. While developing Loulou, Tongon, Goukoto



Geologists in the core yard at Massawa. Located in eastern Senegal, the deposit was discovered in 2004 (photo: Randgold Resources).

and Kibali, Randgold kept the work on Massawa going as well, and the project finally moved to centre stage with the discovery of Sofia in 2016.

"We are also looking beyond Massawa with our sights set on expanding our exploration portfolio and continuing our search for additional discoveries and development opportunities in Senegal." ■

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# Next generation jumbo for Black Mountain

*Vedanta's Black Mountain Mine in the Northern Cape will become the first local mine to adopt a new generation jumbo Sandvik DD422i with the new control system technology for tunnelling and blasting of a new decline shaft development.*

The delivery of the automated Sandvik DD422i mining jumbo to the mine later this year once again propels it to the forefront of mining technology. According to Saltiel Pule, Sandvik Mining and Rock Technology's Business Line Manager – Underground Drills Southern Africa, Black Moun-

tain has been eager to adopt new technologies for drills. The addition of the automated jumbo at the mine will deliver higher development rates and increased production.

“Black Mountain Mine was always going to be the right partner, the right cause and the right application. The rig will be breaking new ground in a defined



*Sandvik Mining and Rock Technology's Saltiel Pule.*





decline development and shaping the course of the mine for the next few years. This will be a giant leap similar to the AutoMine, automated truck loop system used at Finsch mine since 2005, which has provided an incredible 12 years of automation demonstrating the technology leading role of mines in the Northern Cape,” says Pule.

“We believe that the Northern Cape is the jewel in the crown when it comes to technology and breaking ground in the South African industry. Because of its geology and remoteness, it has that something special when it comes to adapting and attracting high level technologies.”

### Global trends

Pule explains that the Sandvik DD422i has the widest range of automatic drilling functions available which allows significantly improved productivity and reduced costs. This dovetails with global trends that reveal that mining houses and mining contractors are looking for more cost-effective ways to mine and develop declines effectively.



The challenges arise from Environmental, Health and Safety (EHS) pressures on both the mining suppliers and the owners for lower emissions, improved ergonomics and reduced noise, while deeper orebodies pose increased environmental challenges, combined with a worldwide shortage of skilled operators. The Sandvik new generation mining jumbos and technology overcome these challenges.

While a shortage of skills may be relevant in South Africa, the use of the AutoMine platform and other technologies demonstrates that Sandvik has the skills and expertise available to address this challenge and ensure that these technologically advanced mines remain in a position to achieve production objectives.

Sandvik’s training of mine personnel to perform advanced operator functions is widely recognised as providing a competitive advantage to its clients.

### New generation

“Mines are able to make use of skilled staff from Sandvik on this unit as it requires in depth training. In fact, we will support the unit from global and local resources in the initial phase and hand over to the mine at the appropriate time,” says Pule.

“We invested in career paths of our local technicians and operational facilitators within the Sandvik Training Academy to ensure operator instructors are developed into drill masters over time. This requires individuals to attain certain milestones to be recognised as competent and able to effectively undertake the job that is required at customers’ sites. Our internal talent identification process is focused on the passion that these individuals show when working on the equipment and on the technical aspects of the job. We are fortunate that we have

*Above: Inside the cab of the D422i showing the iSURE monitor.*

*Left: The Sandvik DD422i mining jumbo features new control system technology.*





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access to many talented individuals within our entire organisation and are preparing them for next generation roles within customer mines.

“Similarly, for the new Sandvik DD422i we send our teams to Finland for training. The same training programme will then be rolled-out to mine operational teams to upskill them accordingly. Who knows, in the future we might be exporting our drill rig supervisors globally,” Pule adds.

### Technical advantages

According to Pule, many of the performance characteristics are made possible directly as a result of the Sandvik DD422i machine’s integrated iSURE software for optimised drilling and blasting parameters, as it allows absolute precision in drilling, charging and blasting which leads to better pull-out with less overbreaking per blast. It also assists in achieving the critical requirement for optimum end of the hole drill patterns.

Pattern optimisation is based directly on feedback from actual blasting performance and allows improvements to be made on specific charges ( $\text{kg}/\text{m}^3$ ), burden and hole spacing. This is a unique feature that is patented by Sandvik. The rig can also self-navigate to ensure the drill plan has the correct sets of holes and that each hole has two sets of x, y, z coordinates (start and end position). This corresponds with the mine’s own coordinate system that defines where tunnels, drifts and the like are located. To achieve this, the DD422i uses either drill bit navigation, laser line navigation or total station navigation.

As its classification suggests, this next generation jumbo can provide a comprehensive list of available data, including hole position, angles and rollover info, drilled metres, average penetration rate (m/min), gross penetration rate (m/h) and various time counters (boom movements, drilling in full power, collaring, idle).

### Across the globe

Mine management teams from Black Mountain, accompanied by Sandvik teams, visited best practice mine sites to evaluate the new technology before introducing it into South Africa. Their findings were that apart from improved drilling ergonomics, the Sandvik DD422i has the widest range of automation functions.

The fully automated version that Black Mountain opted for has operator assistance



features and fully automatic face drilling that enables it to drill the whole face automatically while handling boom movements and hole drilling automatically. Hole sequences imported from drill plans or created onboard with well-functioning hole sequences and roll-overs can be retrieved from previous rounds. While booms have self-collision avoidance, they can still be supervised by an operator.

Case studies revealed that the machine had vastly improved throughput time per face compared to standard DD421 drilling control with minimised jamming and reduced tool consumption. This has been underpinned in tests lasting 105 days that revealed that 51 000 drill metres were achieved with less jamming and major improvements in shank and rod lifecycle.

### More impressive

In addition, the system maintained good penetration rates even when drilling with worn bits. The new touch screen display was said to be easy to use while the boom control system was exceptional. Another customer verified these benefits reporting improved productivity with the new drilling control system, less overbreaking with instrumented drilling plus improved safety and ergonomics.

In tests at another mine that lasted 72 days, the unit was used in a total of 210 faces with over 50 000 drill metres being achieved. With three faces per day, it matched the production target level for 2015–2016 and contributed to a record-breaking month in UG development drilling. The current record for the DD422i as of May 2017 sits at around 1 000 m per month. ■

*The DD422i allows absolute precision in drilling, charging and blasting.*

*Pattern optimisation is based directly on feedback from actual blasting performance.*

# Junior diamond explorer looks

*The team that can claim much of the credit for having recognised the potential of Botswana's AK6 kimberlite and devising a low-cost development strategy to bring it into production has been reunited at junior explorer Botswana Diamonds. The company currently has a portfolio of tenements covering not just highly prospective areas in its traditional stamping ground of Botswana but also in South Africa. **Modern Mining's** Arthur Tassell recently spoke to Managing Director James Campbell about the company's strategy and its prospects of duplicating the AK6 success.*



*James Campbell.*

One of the diamond mining industry's best-known personalities, Campbell joined Botswana Diamonds in December last year after serving for roughly five years as CEO of South African alluvial diamond miner Rockwell Diamonds. In his new position, he has been reunited with his old colleague, John Teeling, a Dublin-based mining entrepreneur who is Chairman of the company.

The two men were at the helm of Botswana Diamonds' predecessor, African Diamonds (AFD), during much of the period (2004 to 2010) when AK6 was under re-evaluation by De Beers and AFD after originally having been discovered in 1969 by De Beers. After AFD's stake in AK6 was sold in 2010 to Lucara Diamond Corporation, its exploration assets were spun off into Botswana Diamonds (BOD), a company now dual listed in London and Botswana. Teeling became Chairman of the

new company but Campbell (after a relatively short stint with Lucara) moved on to Rockwell.

Says Campbell: "AFD was in joint venture with De Beers on AK6 and – as I think is well known – there was a difference of opinion on the merits of developing AK6. We in AFD wanted to go ahead with the construction of a new mine but De Beers was deterred by the cost, which it estimated at US\$380 million, and what it perceived as poor market conditions. We totally disagreed and came up with a Value Engineering Study, which indicated a very much lower capex and which had a very different view of diamond value. It also proposed an innovative processing route,

*A drill site in the Maibwe JV project area in the Kalahari. The drilling contractor is Discovery Drilling.*





# to repeat past success

including the use of autogenous milling. De Beers rejected this study.

“In 2009, we proposed buying out De Beers’ stake in the project but were unable to raise the funds. We did, however, find an alternative investor in the form of Lucara, which later also bought out AFD and proceeded to build a mine – now known as Karowe – based on the technical solution we devised. Karowe, of course, has since established itself as one of the most remarkable mines the diamond mining industry has ever seen, and is particularly noted for the abundance of large gem-quality diamonds it has produced.”

Campbell believes there are a number of lessons to be drawn from the AK6 story. “Perhaps the most important is that re-assessment of kimberlites found decades ago is vital, given the advances made in exploration techniques,” he says. “De Beers initially evaluated AK6 in the early 1970s and concluded that it was sub-economic – which we now know was very far from the truth. A second lesson is that juniors can often out-perform majors when it comes to exploration and mine development. At their best, they tend to be innovative, agile and fast whereas majors – no matter their overall competence, which is generally very good – are often bureaucratic, slow moving and risk averse.”

It should be mentioned that Campbell, who earned his BSc (Hons) degree in Mining & Exploration Geology from London’s Imperial College, has seen both sides of the fence, as prior to joining AFD in 2006 he had enjoyed a



*Drill cuttings from percussion drilling at Maibwe.*



*Members of the Botswana Diamonds team on site at Frischgewaagt.*

long and distinguished career with De Beers, a group which he holds in high regard.

The chances of anyone finding another kimberlite quite like AK6 are relatively remote, as Campbell readily acknowledges. “Nothing can ever be excluded but it could be that AK6 is unique, at least in terms of its large stone population. What is clear though is that there is still considerable potential for economic kimberlites to be identified in Southern Africa, by applying ‘third generation’ exploration technology – and this is exactly our strategy.”

In Botswana, BOD has two joint ventures (JVs). One is a 50/50 JV – known as Sunland Minerals – with Russia’s Alrosa, which is exploring in both the Central Kalahari Game Reserve (CKGR) and the Orapa area, and the other is the Maibwe JV owned by BCL (51 %), Future Minerals (20 %) and Siseko (29 %). BOD’s participation in Maibwe is via Siseko, in which it has a 51 % share. Sunland has 19 exploration licences (nine in the Orapa area





Preparing for percussion drilling at Frischgewaagt.

*“Our main reason for investing on a personal basis in Vutomi was to persuade the BOD board that this was a good project.”*

and 10 in the CKGR) while Maibwe has 10 licences, all in the CKGR.

The Sunland JV is in healthy shape. “Our partner Alrosa operates 19 mines and is the largest diamond producer in the world,” says Campbell. “The JV brings together their technological expertise with our own geological skills and our deep knowledge of the Botswana scene. The JV generally runs two campaigns a year, with up to 15 Alrosa personnel working with the local BOD team. Our latest field programme started in April and our joint exploration budget for the year is US\$1,75 million.”

Turning to the Maibwe JV, Campbell describes this as an “exciting” project which is at an advanced rather than a grassroots stage. “The licences are all in the CKGR but generally close to the border with the adjoining Khutse Game Reserve,” he says. “A 2015 drill programme on PL186 discovered – or ‘rediscovered’ – six kimberlites containing significant quantities of diamonds. The problem we have with this JV is that BCL is now in provisional liquidation and has therefore been unable to finance an agreed work programme. So effectively the project is stalled. We are, however, in discussions with the liquidator and have put forward some proposals that could see work being restarted.”

Campbell makes the point that BOD’s tenements in the CKGR are in a region which includes Gem Diamonds’ Ghaghoo mine, which exploits the Gope kimberlite, and Petra’s KX-36 discovery, 60 km to the south-east of Ghaghoo.

While BOD for most of its existence has been focused on Botswana, this changed earlier this year when the company announced in February that it had sealed an option and earn-in agreement with Vutomi Mining and Razorbill Properties 12 (collectively known as Vutomi). The deal gives BOD access to a portfolio of

over 20 high-interest kimberlites, many of them diamondiferous, spanning three provinces in South Africa – Limpopo, North West and Free State. The kimberlites are housed in ten prospecting rights encompassing over 50 000 ha of ground.

A sizeable chunk of Vutomi (30 %) is owned by Campbell and his long-time colleague John Shelton (ex-De Beers and Rockwell). “Our main reason for investing on a personal basis in Vutomi was to persuade the BOD board that this was a good project,” he explains. “Nothing talks louder than putting your own money into a venture.”

Although one might think that most of the prospective diamond ground in South Africa has already been intensively explored, Campbell says this is only partly true. “The barriers to entry into South Africa in terms of exploration are perceived as being very high,” he maintains. “This has meant that no one – De Beers apart – has really been exploring for kimberlites for years and even De Beers has been relatively quiet over the past decade, concentrating its exploration efforts mainly outside of Africa. The result is that much of the ground we have – and many of the kimberlites previously discovered – have not been looked at with modern technology.”

The flagship project within the Vutomi package is Frischgewaagt. This is located in Limpopo Province to the east of Mokopane, south of Eersteling, the site of South Africa’s first gold discovery, and immediately adjacent to the Marsfontein mine. Although short lived (it was operated between 1998 and 2000 by a De Beers/SouthernEra joint venture), Marsfontein – a blow of 0,4 ha in size – was a phenomenally successful operation producing around 1,9 million carats over its life and, famously, achieving payback of capital in just 3,4 working days. Also in the same area to the south-west of Marsfontein is the Klipspringer diamond mine, owned by ASA Resources but currently on care and maintenance.

Campbell says that the Frischgewaagt project consists of an approximately 7,5 km long kimberlite dyke/blow system extending to the east of – and on strike with – Marsfontein. “This is an area I know well as I was involved in the De Beers exploration programme which led to the discovery of both Marsfontein and Klipspringer in the 1980s, although neither was immediately followed up. I’ve always wanted to go back and the Vutomi deal makes that possible.”

BOD has wasted no time in getting to grips with Frischgewaagt and in April reported that it had completed the first phase of drilling



comprising 34 percussion and nine diamond drill holes, in the process discovering two blows on the kimberlite dyke system. It followed up in June with an announcement that 223 microdiamonds had been recovered from 160 kg of drill core from the drill programme, indicating an estimated grade range of between 20 and 270 cpht (since updated to a medium grade of 78 cpht in a range of 64 to 110 cpht at a bottom cut-off of +1 mm). The MSA Group in Johannesburg undertook the microdiamonds analyses and the modelling was undertaken by Dr JJ Ferreira, an expert in micro diamond assessment with an international reputation.

Comments Campbell: “These results are excellent although we need more drill samples so that we can refine the grade estimate. We’ve also virtually completed a very detailed ground geophysics programme which is intended to delineate the further lateral extension of the system and which will underpin a second phase of drilling starting shortly. Our goal is to produce an inferred resource by the end of the year.”

Although Frischgewaagt is currently receiving the bulk of BOD’s attention, the other projects within the Vutomi package are highly prospective and take in ground in the vicinity of current or past producing mines, including the Cullinan diamond mine near Tshwane in Gauteng and the Helam fissure mine near Swartruggens in North West Province. In the Free State, Vutomi has six contiguous prospecting areas. Mines in the area include Koffiefontein and Jagersfontein in the Free State and the Kimberley mine in the Northern Cape.

As befits a junior explorer, BOD is a very lean operation, with Campbell being the only full-time employee. As he says, “The appetite for grassroots exploration is currently very low so it is not easy to raise money and what is raised has to be used very effectively – certainly one cannot have the luxury of a large staff complement. Our strategy is to raise money for six to eight months, demonstrate delivery on that and then go back to the market for further funding



to take us forward again. While I’m the only person working full-time for BOD, this does not have any downside. We have a huge network of consultants and contractors who assist us and who, in most cases, rank among the leaders in their respective fields.”

Among the experts that Campbell mentions are Bjorn Havemann, who at one stage was Head of Geophysics at De Beers, Dr Kurt Petersen, a world-renowned diamond metallurgist, and Dr Gargi Mishra, who has a stellar reputation in the field of kimberlite petrography.

Summing up, Campbell notes that apart from AK6 in Botswana and Luaxe in Angola, there have been no significant kimberlite discoveries over the past 15 or so years in Africa or, for that matter, worldwide. “We’re hoping to reverse that. Obviously, diamond exploration is inherently an uncertain business and no diamond explorer can ever guarantee success. Having said that, Botswana Diamonds has the right people, the right ground and the right technology to find a mine – if indeed there is a mine to be found. We’re very excited by the company’s potential and have high hopes that it will, in time, deliver one or more kimberlite projects that can be developed into viable commercial mining operations.”

*Photos courtesy of Botswana Diamonds*

*The Marsfontein pipe or blow as it looks today. It was mined between 1998 and 2000.*

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# Study reveals low capex and opex for Malingunde

*Australia's Sovereign Metals, an ASX-listed company, has announced the results of the Scoping Study for its Malingunde saprolite-hosted graphite project in Malawi. Preliminary economics show the project has capital and operating costs per unit at the very bottom of the graphite supply cost-curve, at production rates supported by existing market fundamentals.*



Drill rig at Malingunde during Sovereign's December 2016 resource drilling campaign.

The results of the Scoping Study demonstrate the potential for the project to support a very low capital and operating cost operation with annual graphite concentrate production of approximately 44 000 tonnes over an initial mine life of 17 years. Total operating costs are estimated at approximately US\$301 per tonne concentrate (FOB Nacala Port) – the lowest of any reported ASX-listed peer company of scale <300 kt/a. The total capital cost is US\$29 million (including a 35 % contingency) with a payback of under two years using conservative graphite pricing assumptions.

Very low mining costs are anticipated with the soft saprolite being free-dig with a low strip ratio of 0,5:1. In addition, the process flow sheet is simple, leading to low processing costs and lower capital requirements. The plant design uses 'off the shelf' equipment allowing rapid and cost effective initial construction whilst allowing for future expansion options.

The project will deliver a high-quality product with excellent concentrate grades and a very large proportion in the SuperJumbo and Jumbo categories.

"The Scoping Study clearly demonstrates the project's very strong commercial potential which is centred on very low operating and capital costs, and revenues derived from a premium product," comments Sovereign's MD, Dr Julian Stephens. "Importantly, the project is not reliant on an unrealistically large scale to reduce operating costs and/or overly optimistic graphite pricing forecasts. The very low operating cost nature of the project provides protection even against extreme downside pricing scenarios."

The deposit is located at Malingunde, just 15 km south-west of Lilongwe, Malawi's capital city, with access – says Sovereign – to "enviable infrastructure". It is 25 km from operating rail, 20 km from a major power sub-station and has plentiful fresh water sources nearby.

The discovery was made in 2015 by Sovereign's in-country geological team using hand auger drilling techniques in an area of

*Continued on page 31*



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The Africa division of Babcock International Group has been supplying the mining, quarrying, materials handling, construction and road building industries for more than six decades.

In 2000, Babcock was appointed as the exclusive regional distributor for Volvo Construction Equipment. According to Ben Buys, Technical Director - Equipment, it was the partnership with Volvo CE that grew the Babcock brand and its footprint significantly.

"Support for the machines was considered paramount - even in the early days



"As the business matured and support for our brands continued and expanded, so Babcock has repaid the trust that our customers placed in us by continuously improving the support we have available for them," says Buys.

so great emphasis was placed and significant investment made in parts inventory and technical support," explains Buys. Due to local and international support received, the company was able to make significant investment in stock machines in all the major centres around South Africa enabling Babcock to further support their construction and mining customer base.

This year Babcock hosted the Africa launch of the Volvo A60H, the biggest articulated dump truck in the world and the EC950E, the largest excavator that Volvo has ever produced.

*Pictured: Gravel Charlie, Volvo's first ever articulated hauler*

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Babcock's exceptional service record has cemented our position in the construction equipment market. Despite the current challenging economic climate,

we are fortunate to enjoy continued customer support.

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Africa and close relationships with our OEMs. With high levels of customer service, efficient fleet management and a commitment to ongoing training it's easy to understand why Babcock is a partner that is trusted to deliver.

*David Vaughan  
MD - Equipment,  
Babcock International  
Group*



Babcock is the exclusive regional distributor of Volvo and SDLG construction equipment, Terex Trucks rigid and articulated haulers, Tadano and SENNEBOGEN cranes and Winget concrete machinery.



## Investing in people

Babcock's sales and technical team is distributed across three regions in South Africa and headed up by regional service managers.

The Northern region, largely consisting of heavy mining areas are headed up by Vincent Botha and Neil Sanday.

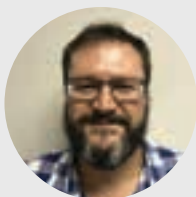
"Our people are trusted to deliver to the highest standards and we place utmost importance on the long-term relationships established between

Babcock employees and our customers", says David Vaughan.

Training is also key and to ensure continuity, Babcock train up to 100 apprentices over a four-year period who will become future service technicians for the company. As manufacturers strive to improve fuel consumption and efficiencies and machines become more sophisticated, it is paramount that the service team is kept abreast of technological advancements. A constant flow

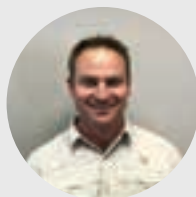
of trainers and staff migrating between the OEMs in Europe and Babcock ensures that technical skills are kept on the cutting edge and ahead of our customers' requirements.

“ Our people are trusted to deliver to the highest standards... ”



**Vincent Botha**  
Bartlett branch

*As the regional manager for Gauteng, Vincent ensures that the teams have the resources required to back Babcock's customers. His areas of focus include health, safety and relationship building.*



**Neil Sanday**  
Middelburg branch

*Neil is responsible for all aftermarket support from workshop to field service in the Mpumalanga region, which includes Middelburg, Nelspruit & Steelpoort.*

## Aftermarket services

Babcock is currently ranked among the top three companies in southern Africa in terms of servicing facilities and technological training. Our Equipment business offers full aftermarket support services and facilities for the brands it represents. Services such as long-term replacement strategies, fleet maintenance and associated technologically advanced services are proving to be increasingly attractive options to customers. This is especially true for the mining industry, where machines operate long hours and any downtime

translates into lost revenue. Babcock's comprehensive aftermarket support capabilities offers customers access to:

**Power by the Hour** A fixed maintenance cost over an extended period of time assures owners an accurate cost projection, largely avoiding the costs associated with breakdowns.

**Re-build** Specifically geared towards the mining sector where machinery rapidly clocks up high production hours. Once a machine's warranty has lapsed, customers have the option of refurbishment where possible.

**CareTrack** A Volvo CE telematics system which transfers data from the machines to Babcock's dedicated internal service department. This remote monitoring system can be used to set service reminders in advance allowing sufficient time for necessary resources to be deployed, and as an early warning system for potential component breakdown. Technicians can identify when components need to be replaced or repaired and address any maintenance issues before they become costly problems later.





“The excellent commitment from all our OEMs enables us to provide parts and support wherever needed.”

### Parts

A comprehensive range of parts are readily available at Babcock branches and dealerships throughout southern Africa. Babcock also provides countrywide, 24-hour service and breakdown assistance to ensure that customer's machines are up and running as soon as possible.

“The excellent commitment from all our OEMs enables us to provide parts and support wherever it is needed.” says David Vaughan.

### Customer Service Centres

Babcock's extensive branch network and aftermarket support infrastructure extends across South Africa, Namibia, Zambia, Botswana and Mozambique, with a total of 26 customer service centres in sub-Saharan Africa.

The head office branch is located in Boksburg and services customers across Gauteng. The Middelburg flag-

ship facility is an ultramodern, bespoke sales, parts and service dealership purpose-built to offer responsive regional support and service across Babcock's entire construction equipment product range.

Technicians can also be dispatched to remote locations in Africa with all the tools and diagnostics necessary to complete a service.

### Safety

“To date for 2017, our disabling injury incident rate is 0.37, well below the industry norm of 0.78, reflecting the value that Babcock places on its people.” Safety is key to Babcock and all of the company's systems and processes are fully accredited to

ISO standards 9001 and 14001 and OHSAS 18001 covering quality, environment and health and safety.





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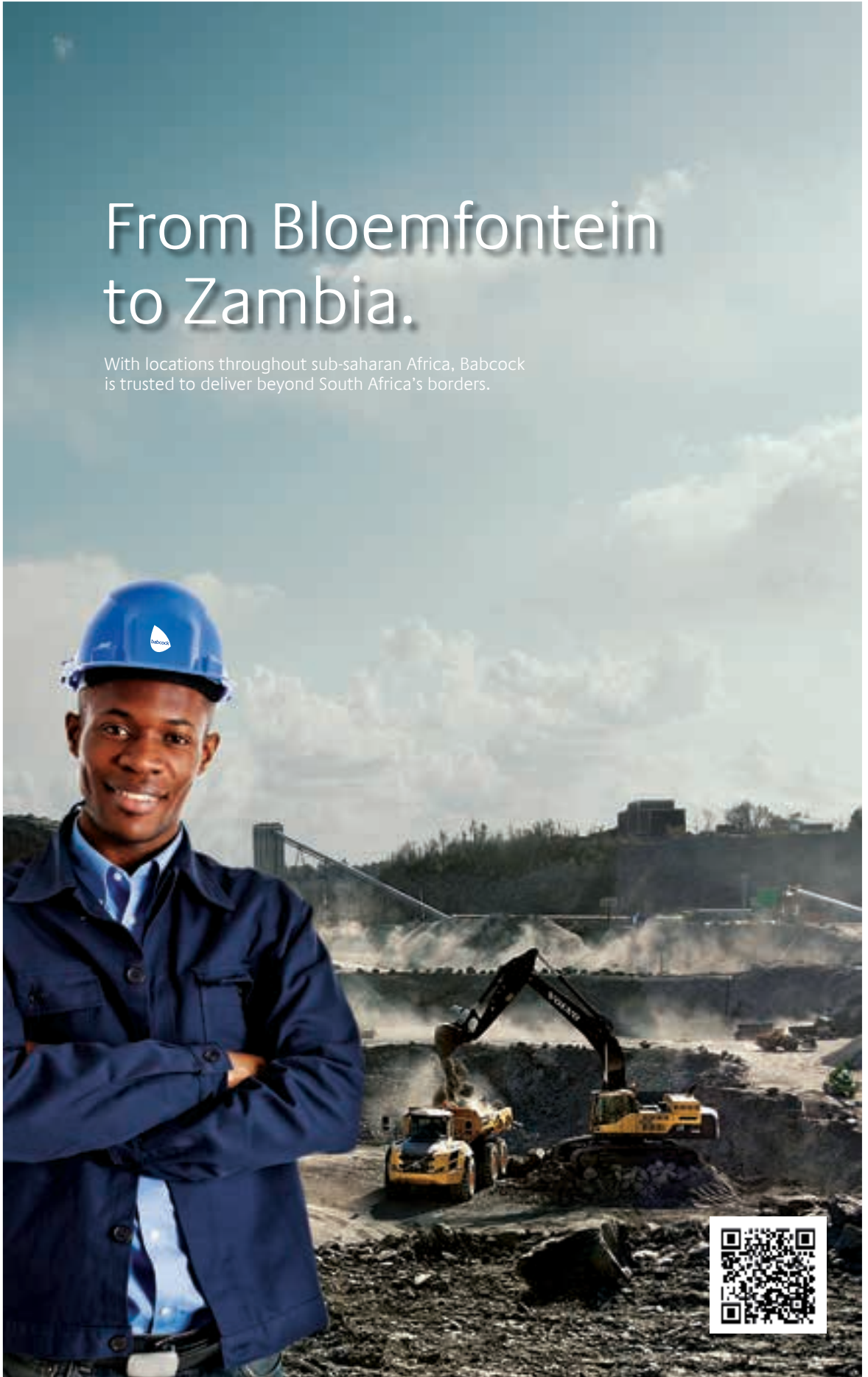
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# From Bloemfontein to Zambia.

With locations throughout sub-saharan Africa, Babcock is trusted to deliver beyond South Africa's borders.





*Continued from page 26*

no outcrop. In April 2017, Sovereign reported a maiden mineral resource estimate (MRE) of 65,1 Mt at 7,1 % TGC (Total Graphitic Content) at a 4 % TGC lower cut-off grade (saprolite, saprock and fresh rock). The MRE, prepared by CSA Global, includes a high-grade saprolite component of 8,0 Mt at 10,0 % TGC which has been the focus of the Scoping Study.

The geometry of the Malingunde deposit is one of several high-grade, shallow to moderate north-east dipping mineralised zones. Sovereign is targeting the near surface, soft saprolite portion of the resource to a maximum of approximately 25 m vertical depth. This results in a number of long, shallow open pits in the mining plan.

Pit optimisations were completed by AMEC Foster Wheeler, the study manager, based on maximum production of 45 000 tonnes of concentrate per annum rather than on an optimised throughput analysis. A cut-off grade of 7 % was selected which results in a production target of approximately 44 000 tonnes of graphite concentrate per annum over a 17-year life of mine. This equates to an average of approximately 475 000 tonnes of ore processed per year, totalling circa 8,0 Mt at 10,0 % TGC over the life of mine.

A schedule was developed that progressively mines material from north-west to south-east. Importantly, over the initial four years of production, 96 % of material processed is in the indicated category. Over the life of mine, 83 % of material processed is in this category.

A contract mining strategy was selected to mitigate project risk, although operational management will be retained by Sovereign personnel.

Sovereign engaged SGS Canada to conduct an initial bench scale laboratory flotation test-work programme on samples obtained from the Malingunde deposit. The primary objective of



*Soft, friable saprolite material from a diamond drill core sample at Malingunde.*

the programme was to investigate the metallurgical response of the shallow saprolite-hosted mineralisation as part of the early stage project evaluation.

The design of the processing plant is based on the SGS test-work and best practice in similar operations. Importantly, the process requires no upfront crushing or grinding of the ore, a material advantage over hard-rock graphite deposits.

The Tailings Management Facility (TMF) for the project is designed to safely contain the life of mine estimated tailings of 7,3 Mt. The characteristics of the tailings produced have not yet been confirmed and therefore a conservative approach to the deposited density has been adopted assuming a final settled density of 1,15 t/m<sup>3</sup>.

For the Scoping Study, it was decided to adopt a conservative strategy that includes a fully HDPE lined facility leaving the option for a non-HDPE lined facility or in pit deposition as opportunities that could be adopted should future testing of the materials prove that contamination is not an issue.

*Photos courtesy of Sovereign Metals*



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# Botswana's mining industry on

*Although it attracted an excellent turnout of delegates, the recent Botswana Resource Sector Conference (BRSC) held in Gaborone on 12 and 13 June took place at a bleak time for the country's mining industry. Several mines in the country have shut down over the past three or so years, with the biggest blow to the mining sector being the collapse of BCL last year, which has resulted not only in the closure of BCL's operations in Selebi-Phikwe but also the closure of Tati Nickel (which it was in the process of buying).*

One of the speakers at the conference, **Charles Siwawa**, CEO of the Botswana Chamber of Mines, said the country's mining sector was "not looking very good" and pointed out that mine closures had resulted in major job losses, with the closure of BCL and Tati Nickel, as well as the Boseto copper mine, having left around 10 000 people out of work – a substantial number in a country where less than 2 000 new job opportunities are created in a typical year. He also noted that four diamond mines – Damtshaa, Ghaghoo, Firestone (BK11) and Lerala – were all on care and maintenance, adding to the woes of the industry. Daamtsha and BK11 have been closed for some time but the suspension of operations at Ghaghoo and Lerala is much more recent.

Siwawa did, however, point out that negotiations were currently on-going to find a suitor for



BCL's assets – which include an underground nickel-copper mine and recently-refurbished smelter in Selebi Phikwe – and said the closure of the four diamond mines was possibly temporary as they were producers of mainly small stones, for which demand was currently weak.

Certainly one can see both Ghaghoo and Damtshaa being revived under more favourable market conditions while there is interest in the BK11 mine, with Firestone Diamonds having

*Seen here (from left) are the Phoenix pit at Tati Nickel, the processing plant at the Ghaghoo diamond mine in the Central Kalahari, and the processing facility at the Lerala diamond mine in the Martins Drift area. All three mines have suspended operations (photos by Norilsk, Gem Diamonds and Kimberley Diamonds).*





# the back foot



announced recently that Amulet – a group of private investors led by Gareth Penny and Diacore Diamond Group – has taken an option on acquiring its Botswana operations, including BK11 (see page 49). Lerala is more problematic. Its owner Kimberley Diamonds suspended operations on 1 June this year after months of problems. This represents the third time Lerala has had to close over its short – roughly nine-year – life and one wonders whether it can ever



be a viable operation, given that three different owners have now failed to run it profitably.

Looking at the future for Botswana's base metals mines, Siwawa said most of them were in the upper part of the cost curve and that efforts were needed to bring down costs to make them viable. He added that reserves were available to sustain long-term mining plans and that there was wide scope for refined base metals production in the long term.

Also giving an overview – as he does every year – of Botswana's mining industry was **Keith Jefferis** of Econsult Botswana who said Botswana's economy was now increasingly services driven, with mining more “a detractor from growth not a driver” due to the country's lower diamond output and the problems with copper and nickel. He noted that whereas mining had once accounted for over half of Botswana's GDP, it was now responsible for only 22 %. Minerals were still the largest contributor to government revenues but their share was declining – from 48 % in 2006/07 to 37 % currently.

Jefferis argued that diamonds – which accounted for 74 % of exports in 2016 – would

**Above:** Among the speakers at the BRSC were (from left): Dr Frazer Tabart of African Energy Resources; Sadique Kebonang, Botswana's Minister of Mineral Resources, Green Technology and Energy Security, who gave the keynote address; and Jonathan Berman of Fieldstone Africa.

**Left:** While Botswana's diamond mining industry has been experiencing difficult times, the Karowe diamond mine of Lucara in the Orapa Kimberlite Field (which is seen here) has continued to perform impressively and is one of the great success stories of mining in the country (photo: Lucara).



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Drilling by MOD Resources at the exciting T3 copper discovery in north-west Botswana. Further details of the project appear on page 40 of this issue (photo: MOD Resources).

continue to dominate the country's mining sector but would not provide economic growth as a production plateau had been reached. He also said that coal, contrary to some expectations, would not be able to replace diamonds, particularly with respect to exports and government revenues.

Coal was in fact the subject of several presentations at the conference, with speakers including **Alan Clegg** of Shumba Resources (see also page 44 of this issue), **Dr Frazer Tabcart** of African Energy Resources, who updated delegates on the Sese project, and **Gabaake Gabaake** of Tlou Energy, which is developing the Lesedi coal bed methane (CBM) project.

African Energy, which is listed on the ASX and has a portfolio comprising over 8,5 billion tonnes of thermal coal in Botswana, has been soldiering on for years with the Sese project, which is located 60 km south-west of Francistown. A breakthrough occurred in 2014 when the company announced a JV with copper producer First Quantum to develop the project in order to supply power to Zambia and, in particular, to First Quantum's operations which are among the biggest consumers of electricity in the country, with the new Sentinel mine and the Kansanshi mine and smelter currently drawing up to 320 MW. First Quantum is progressively increasing its

interest in Sese and now holds 55 % after having invested A\$13 million.

Tabcart told delegates that the project – comprising a power station complex with its own captive coal mine – was now well advanced, with most of the permitting in place. The mining licence was granted earlier this year and the area it covers contains enough low-cost, low-risk coal to support multiple 300 to 450 MW projects for more than 35 years.

Turning to Tlou Energy, this is an AIM- and ASX-listed company focused on delivering power through the development of CBM gas. Its most advanced CBM project – and reportedly the most advanced gas project in Botswana – is Lesedi, located to the west of Morupule. As Gabaake explained to delegates, the Government of Botswana is keen to develop the country's CBM resources and has invited proposals for the development of up to 100 MW of CBM power, with Tlou being one of the companies invited to participate in the initiative.

Since the Gaborone conference, there have been two important developments with respect to the project. On 20 June this year, Tlou reported that it had generated its first power from CBM following the installation of a gas generator at Selemo within the Lesedi project area to replace one of the diesel generators on site. The Cummins G8.3 generator can supply up to 60 kVA of power and has been customised to run on a small portion of the gas currently being produced at Selemo from the pilot wells. While the amount of power produced is small, the installation is seen as a 'proof of concept' and the power generated is the first in Botswana to be generated from CBM.

Tlou followed up on this development earlier this month when it announced it had lodged a mining licence application for the Lesedi CBM project with Botswana's Department of Mines in the Ministry of Mineral Resources, Green Technology and Energy Security. The application is the first of its kind to be lodged in Botswana.

While there was much optimism expressed at the conference about the development of Botswana's coal resources, a note of caution was sounded by **Jonathan Berman**, MD of Fieldstone Africa, who looked at the energy scene in Southern Africa. He said the region was suffering a power deficit, with peak demand sitting at 52 524 MW against an operating (as opposed to installed) capacity of just under 47 000 MW. He questioned, however, whether developing Botswana's coal resources to underpin IPP initiatives was the best course forward for the country. As he pointed out, it





is becoming increasingly difficult to fund coal projects through debt.

As an example of the way opinion was turning against coal, he quoted the following statement from Deutsche Bank, issued in January this year: “Deutsche Bank and its subsidiaries will not grant new financing for greenfield thermal coal mining and new coal-fired power plant construction. Moreover, the bank will gradually reduce its existing exposure to the thermal coal mining sector.”

Berman – who stressed that Fieldstone as a company had no animus towards coal and was involved in advising on coal projects such as Thabametsi in South Africa – expressed the view that solar energy was beginning to challenge coal as the cheapest form of electricity generation. He noted that Botswana had excellent solar resources and said it had the potential to be a regional price leader in solar power.

Coal apart, copper probably offers the best bet for Botswana to diversify its mining industry from diamonds, with the Kalahari Copperbelt extending from Maun down to Ghanzi starting to emerge as a significant copper district. Making all the running in this area are just two companies – Australia’s MOD Resources, working through its Botswanan subsidiary, Tshukudu Metals Botswana, and US-based Cupric Canyon, whose operating subsidiary in the country is known as Khoemacau Copper Mining. MOD’s flagship is the T3 deposit (covered on page 40 of this issue), which it hopes to develop as an open-pit mine, while Cupric

is intent on developing its Zone 5 deposit as an underground mine.

Presenting on behalf of Cupric in Gaborone was **Johan Ferreira**, whose appointment as Head of Cupric’s Africa Operations and MD of Khoemacau Copper Mining was announced just a few days before the start of the conference. He replaces Sam Rasmussen, whose three-year contract ended in December 2016. Charged with leading the development of the Khoemacau project, Ferreira has enjoyed a distinguished career in mining, having served most recently as Regional Senior VP – Africa Region for Newmont Mining in Ghana. Prior to joining Newmont in 2014, he was Senior VP South Africa Operations for AngloGold Ashanti.

As explained by Ferreira, Cupric is planning a starter project based on the Zone 5 deposit – which has a resource of 100 Mt at 2 % Cu and 20 g/t Ag – at a production level of 50 000 t/a of copper in concentrate and 1,4 Moz/a of silver. The starter project – on which construction could start towards the end of this year with first production in 2019/20 – makes use of the existing Boseto concentrator plant, built by the now defunct Discovery Metals. The plant, along with other Discovery assets, was acquired by Cupric in 2015 and is to be upgraded to a capacity of 3,65 Mt/a. Ferreira said the starter project would pave the way for further expansion at the Zone 5 site and in the broader area of its tenements, which could see copper production progressively increasing to as much as 150 kt/a.

Ferreira told delegates that the Zone 5

*The Boseto concentrator, which is to be upgraded and incorporated into Cupric’s Khoemacau copper project (photo: Arthur Tassell).*



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mine, which would be equipped with three 1,2 Mt/a capacity declines, would see 45 m deep boxcuts having to be developed through the Kalahari sand, with each boxcut involving 870 m<sup>3</sup> of excavation. He said the mine would be a world-class mechanised operation involving 45 km of initial development, with 200 m<sup>3</sup>/s of ventilation per decline being required initially (with the cooling requirement being 20 MW after year 5).

Finally, what of diamonds, the bedrock of Botswana's prosperity? At previous conferences, the diamond mining industry always featured prominently. At this year's event, the big names in Botswanan diamond mining were absent, with neither Debswana, which accounts for the lion's share of the country's diamond production, nor Lucara, which owns and operates the Karowe mine and is the only other active producer in Botswana, presenting.

Although there was some discussion of Botswana's downstream diamond sector, it was left to **James Campbell**, MD of junior explorer Botswana Diamonds, to carry the flag for the diamond mining and exploration sector. He gave an excellent presentation on the activities of Botswana Diamonds, which are covered in detail on page 22 of this issue.

Overall, the medium-term outlook for diamond mining in Botswana looks reasonably positive notwithstanding the closure of Ghaghoo and Lerala, with prices now in a recovery phase. Current production is in



the region of 20 Mct per annum but could be increased assuming better demand. Projects on the horizon include Cut 9 at Jwaneng, which would extend its life beyond 2024, and a possible move underground at Karowe, although this is still some years away. Looking further into the future, diamond production will inevitably decline as both Orapa and Jwaneng approach the end of their lives. But this eventuality lies far ahead and, for at least the next couple of decades, as Jefferis pointed out, the diamond mining industry will almost certainly retain its position as one of the main drivers of economic activity in the country.

Report by Arthur Tassell

*The core yard at the Zone 5 site. Khoemaqo Copper Mining has had up to 26 drill rigs deployed on the project, one of the largest drilling campaigns yet seen in Botswana (photo: Khoemaqo Copper Mining).*

## Australian junior to explore Kraaipan greenstone belt

Although still at a very early stage, one of the more interesting projects covered at this year's Botswana Resource Sector Conference was the Kraaipan gold-nickel-copper-PGM project of ASX-listed Laconia Resources.

Laconia's CEO, Dr Quinton Hills, told delegates that it represented a "unique and exciting opportunity to explore 866 km<sup>2</sup> of highly prospective greenstone belt in Africa's premier mining jurisdiction, Botswana". He said the project took in approximately 50 km of the Kraaipan greenstone belt, 45 km north of and along strike of Harmony's Kalgold mine in South Africa and was in the same geological terrane that hosted the Kalplats project.

It presented an opportunity, he said, to apply successful 'transported cover'/'undercover' exploration techniques that have been tried and tested in Australia to an exciting, well-endowed but poorly explored greenstone belt. ■



*Fred Nhiwatiwa, Country Manager for Laconia, on a banded iron formation (BIF) outcrop in the Kraaipan project area (photo: Laconia).*

# T3 discovery well on the way to

ASX-listed MOD Resources, in conjunction with its joint venture (JV) partner, AIM-listed Metal Tiger, is moving at speed to develop its flagship T3 deposit in the heart of Botswana's Kalahari Copperbelt and believes the project – planned as an open-pit mine – could enter production either late in 2019 or early in 2020. A presentation on the project was given at the recent Botswana Resource Sector Conference (BRSC) by Julian Hanna, MOD's Managing Director, and his colleague, Kebalemogile Tau, Exploration Manager for Tshukudu Metals, the Botswanan operating subsidiary of the joint venture.

Addressing delegates at the conference, Hanna said the JV had made excellent progress since the T3 discovery was made in March 2016 in an area with no previous drilling. By September an initial resource of 28,3 Mt at 1,24 % copper (Cu) and 16 g/t silver (Ag) had been declared while in December 2016 the results of a highly positive Scoping Study were announced. A Pre-Feasibility Study (PFS) was launched early this year and should be complete by November.

In parallel with these activities, the JV established a Botswana managed and staffed



company, Tshukudu Metals Botswana, last year as the 'in-country' operating company to develop T3 and further explore the JV's



Some of the Tshukudu team at the company's booth at the recent conference in Gaborone. They are (from left): Gaba Chinyepi, Tshukudu Director and Country Manager; KB Tau, Tshukudu Exploration Manager; Julian Hanna, Tshukudu Director and MOD Resources Managing Director; and Alastair Middleton, Metal Tiger Director.



# becoming a mine



extensive landholding within the Kalahari Copperbelt. The Chairman of the new company is Boikobo Paya, a geologist by training

and a former Permanent Secretary of Mines in Botswana's Ministry of Minerals, Energy and Water Resources, while the Country Manager is Gaba Chinyepi, a geology graduate of the University of Western Australia and owner of a geological consultancy in Botswana.

Hanna said that MOD, which holds 70 % of the JV, and Metal Tiger, which has the balance, had received strong support from the market with approximately 200 million Pula

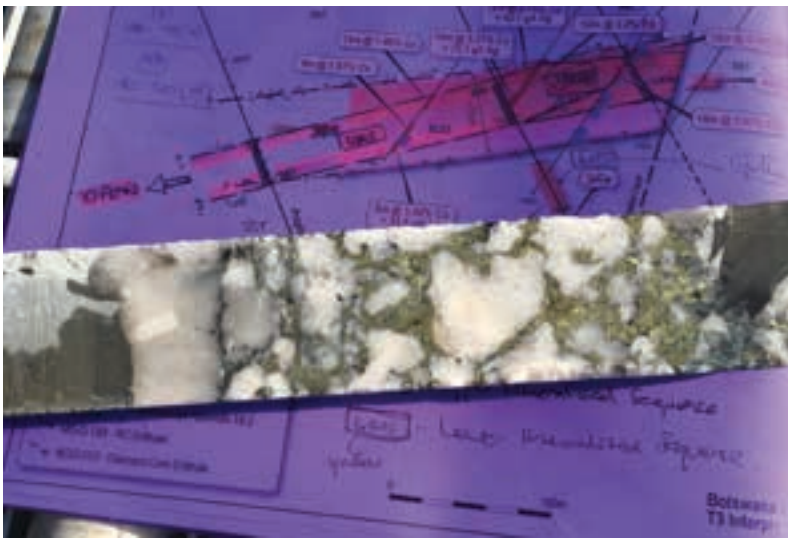
**Above:** Disseminated T3 copper ore.

**Left:** Drilling at the T3 site in Botswana. The T3 discovery was made in March last year.

*The proposed 2 Mt/a processing plant for the T3 project.*



feature



T3 vein copper ore and first interpreted cross section.

having been raised from Australian, UK and North American investors over the past several months. He added that all the money raised was “going straight into the ground here in Botswana.”

Putting the Kalahari Copperbelt in context, Hanna said the copper mineralisation in the area was sediment hosted, under shallow sand cover and similar in many respects to deposits in Zambia and the DRC on the Central African Copperbelt. He noted that the copper grade was generally in the range of 1,3 to 2 % and that testwork had indicated that the ores could produce high quality and high grade (approximately 40 % Cu) concentrates. The Kalahari Copperbelt was, he stated, a rapidly developing copper region with around 7 Mt Cu in current resources, mostly within adjacent licences held by Cupric Canyon, the US-based company which is the only other major player in the area, and at T3.

Exploration drillers play a key role in the development of any minerals project and no more so than in the case of T3. Hanna, in fact, went out of his way during his presentation to commend the efforts of Discovery Drilling, whom he described as “wonderful supporters of the project since day one”. The company has had up to seven rigs deployed at T3, employing around 100 Motswana.

Hanna also noted that the project area in the Ghanzi District of north-western Botswana was easily accessible from Maun and Ghanzi with the asphalt-surfaced, approximately 300 km long, Ghanzi highway linking the two centres running centrally through the tenements. He pointed out that electrical power was not anticipated to be a problem as the grid was expected to be extended into the area in 2019/2020.

Kebalemogile (KB) Tau elaborated on the

geological setting of T3 and the potential for satellite deposits within the 60 km long structural T3 Dome. He also noted that an airborne electromagnetic survey (AEM) had been initiated to fast track exploration along the T3 Dome. This survey, undertaken by NRG Geophysics using a state-of-the-art collection and processing system, has since been completed with MOD announcing on 6 July that preliminary results were “very encouraging”.

Tau also briefed delegates to the conference on other targets within the tenements controlled either by MOD or the JV, including: the T1 (Mahumo) deposit; the T20 prospect, a large prospective dome near Ghanzi in the south-western portion of the tenements which extends through to the Namibian border; the T4 prospect, where an early intersection returned 6,1 % Cu and 111 g/t Ag over 2 m; and T5, an approximately 10 km long interpreted magnetic intrusion.

Prior to the T3 discovery, the Mahumo deposit (discovered in 2011) was the main focus of MOD’s efforts in Botswana and a Scoping Stage on a Stage One underground mine at the site – with a projected ore production of up to 40 000 tonnes/month – was completed in 2015. MOD has now given T3 priority but remains committed to the potential to develop Mahumo, possibly as a satellite of T3, with work on a PFS expected to start in 2019.

While Mahumo is best tackled by underground methods, T3 is amenable to open-pit methods and the Scoping Study on the project noted, in fact, that the wide and continuous zones of shallow dipping mineralisation were ideal for low-cost, open-pit mining. The mining study portion of the Scoping Study was conducted by Sound Mining Solution of South Africa.

As detailed in the study, the pit design enables a staged mine development delivering an annualised ore mining rate of 2 Mt/a with the first stage targeting shallow high grade ore with the objective to pay back capital within two to three years. The production target is 18,13 Mt of ore at 1,16 % Cu and 13,9 g/t Ag for a total of 201 kt Cu and 6,1 Moz Ag. Total mine life is approximately 10 years with 9,25 years of ore production.

Perth-based engineering consultant Min-novo was responsible for reviewing processing options, which resulted in a conceptual plant design for a flotation plant and associated infrastructure constructed on site at T3. The proposed plant design is relatively simple and conventional, reflecting the favourable metallurgical characteristics of T3 ores.

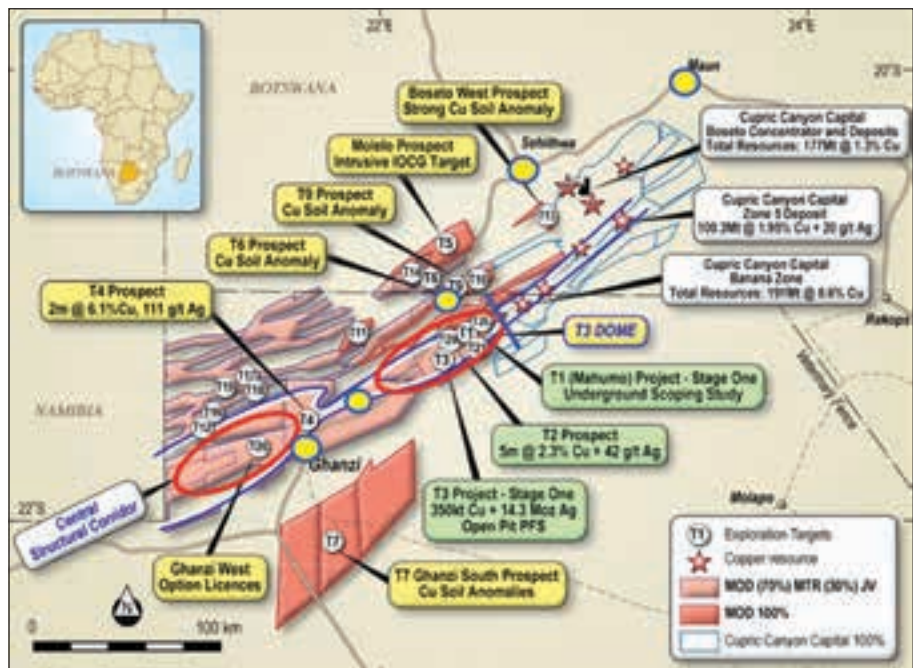


The process consists of crushing and grinding of the ore followed by sequential rougher and cleaner flotation. Concentrate will be thickened, filtered and stockpiled prior to being loaded into containers for storage and subsequent transport to smelters. The plant has the potential to be up-scaled to around 3 Mt/a in the event production is increased at T3 or additional ore is sourced from satellite deposits in the region.

According to the Scoping Study, estimated metal in concentrate production for the first three years is 22 kt/a Cu and 660 koz/a Ag, with a LOM average of 21,8 kt/a Cu and 665 koz/a Ag. The study estimated the capital cost of the project at US\$135 million.

T3 could ultimately transition into being a much bigger project than envisaged in the Scoping Study given the encouraging results from exploration in the immediate T3 area and further afield. Particularly significant was the announcement by MOD in February this year that a 75 m zone with multiple intervals of copper sulphides had been intersected at T3, starting at 247 m downhole depth, approximately 35 m below the T3 resource. A resource upgrade for T3 is expected shortly.

If T3 does become a mine, it could be the first operation – if one discounts the now defunct Boseto mine – to exploit the Kalahari Copperbelt although this is by no means a certainty as Cupric Canyon, via its subsidiary Khoemacau Copper Mining, is also looking to



start up its Zone 5 underground mine in 2019 or 2020. Between them, the two proposed mines have the potential to put the Kalahari Copperbelt on the map as a significant copper producing district, small on a world scale but important for Botswana in its attempts to diversify from its current over-reliance on diamonds.


Tshukudu's holdings in the Kalahari Copperbelt.

Report by Arthur Tassell, photos courtesy of MOD Resources



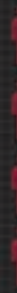
### Name change for the T3 project




Although our article here refers to the T3 deposit and T3 project, it should be pointed out that a new name for the project – as opposed to the deposit – is in the process of being adopted. The name selected – Motheo ('Foundation') – was the winning entry in a local school competition. ■




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# Shumba plans to fast-track Mabesekwa into production

*Botswana has massive coal resources but none of the current generation of coal explorers in the country has yet managed to get into production, in part because of the logistical challenges of getting coal to market from the land-locked country. Shumba Energy, which has a portfolio of advanced projects in Botswana with a total coal inventory of 4,5 billion tonnes, is intending to break the pattern with its fully permitted Mabesekwa project, as its Chairman, Alan Clegg, recently explained to **Modern Mining** in an interview on the sidelines of the Botswana Resource Sector Conference in Gaborone.*



According to Clegg, Shumba will fast-track Mabesekwa into operation with the target for first coal production being the second half of next year. “The project is ‘shovel ready’ and we’re very confident that we can supply the coal it produces into the Southern African market,” he says. “We’re also planning to establish an In-

*Alan Clegg pictured on the Shumba Energy stand at the Botswana Resource Sector Conference.*

*Coal specimen from the Sechaba project. The estimated SAMREC-compliant resource is 571 Mt GTIS (gross tons in situ).*

dependent Power Producer (IPP) operation further down the line, which would see an initial 300 MW power plant using circulating fluidised bed technology being built between 5 and 6 km from the coal mine mouth.

“The idea is that this would supply power into the South African market and we have, in fact, formally registered our intent to put in a bid to the Southern African Power Pool and related authorities in terms of the Coal Border Power Procurement Programme which is designed to secure up to 3 750 MW of power from IPPs. The results of this are still pending. In addition, the project has been short-listed in the Botswana government’s Greenfield Coal Baseload IPP Programme.” He adds that development of Mabesekwa has not been premised on the conclusion of IPP agreements and that its development as a standalone mining operation is perfectly feasible.

Located 60 km south-west of Francistown (and close to the Sese project of African Energy Resources) in an area originally drilled by Shell decades ago, Mabesekwa was acquired





by Shumba three years ago from a junior company which had basically run out of money. “Mabesekwa is a very large project with a total resource estimated at 2,4 billion tonnes and a JORC-compliant resource of 844 Mt,” notes Clegg. “The coal is at an average depth of 50 to 60 m and occurs in a single seam with an average thickness of 18 m, so it is all open-pittable. We are proposing to use an outsourced model for mine operation with a contractor handling the mining and the plant being provided on a build-own-operate-maintain basis so the capital costs of developing the mine are relatively modest.”

Mabesekwa has a water supply allocation from the Shashe Dam in place while a backup supply is available from a nearby wellfield.

If Shumba does mine at Mabesekwa, the mining contractor would in all likelihood be Basil Read Mining as the two companies recently signed a Memorandum of Understanding (MoU) which Clegg describes as “the first building block of what we hope will be a long-term relationship”. The MoU envisages that Basil Read Mining, which has considerable experience in Botswana, will provide contract mining solutions – including giving inputs to mine design, scheduling and mine planning – for Shumba’s coal projects.

While Mabesekwa is Shumba’s most advanced project, not too far behind in terms of development are its Sechaba and Morupule South projects. Sechaba, located north of the Morupule Power Station complex, was the first major project to be acquired by Shumba while Morupule South, which – as its name indicates – is located immediately to the south of the Morupule Colliery, Botswana’s sole current coal producer, has only entered the company’s stable recently, with Shumba announcing earlier this year that it had signed an option to acquire a 75 % stake from Australian junior Hodges Resources.

Like Mabesekwa, Sechaba is well advanced in terms of permitting and also has two components – coal supply (at an initial level of 1,5 Mt/a) to the local spot market and the Botswana Power Corporation (BPC) plus the export of power via an IPP arrangement (Sechaba Energy), with the prime target being Namibia. It is envisaged that the power plant would start with a 300 MW capacity (2 x 150 MW modules) and that it would be connected into BPC’s 400 kV substation, located approximately 27 km to the south of the proposed power station site.

Although there is an open-pit opportunity for start-up in the early years, Sechaba would



*Shumba’s MD, Mashale Phumaphi (left), on site at Sechaba with a drilling team.*

primarily be an underground mine. The estimated SAMREC-compliant resource is 571 Mt GTIS (gross tons in situ) with the coal being hosted by three identified coal seams separated by mudstone, coal shales and sandstones. The two main seams are the deeper export quality Taukome Bright Seam (TBS), which has an average thickness of 2,6 m, and the Morupule Main Seam (MMS), with an average thickness of 3,7 m, with the coal being found at average depths of 30 to 100 m.

Turning to the Morupule South project, Clegg says that – at this stage – it is intended to develop it purely as a mining operation supplying coal to domestic and regional markets. “Hodges Resources worked on the project for several years, taking it though to an advanced stage and defining a JORC-compliant resource of 2,45 billion tons of thermal coal, with 380 million tons in the measured and indicated categories,” he states. “Around 1,2 billion tons is exploitable by opencast strip mining at initial



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waste to coal strip ratios of under 2 to 1. The project is located just 5 km from an operating rail siding and, like its sister projects, can be brought into production in a short timeframe.” He adds that the project has the capacity to produce export quality coal for overseas markets.

With exports in mind, Shumba has recently formed a partnership with HMS Bergbau Africa, a full subsidiary of German-listed HMS Bergbau AG, a leading independent global trading house. Bergbau will work closely with Shumba Coal Trading (SCT), a subsidiary of Shumba Energy which was established in 2015 to manage the trade of coal from Shumba’s projects. Shumba believes that Bergbau’s marketing and logistics expertise will be invaluable in supplementing SCT’s established trade structure.

Although Shumba is a junior company, its project development pipeline from a mining standpoint is supported by credible and experienced technical partners, who include Ukwazi (mining engineering), ECMA Consulting (owner’s engineer), GEMECS (geology and resources) and Ecosurv (environmental and social). The power supply component of its projects is similarly well supported, notably by GS E & C, a Korean-based EPC contractor which owns 2 597 MW of generating assets, and PB Power, which is undertaking power station design and selection.

An interesting point is whether Shumba’s strategy of exporting power to regional markets is as viable now as it was several years ago, when Eskom’s generating capacity shortfall resulted in widespread power cuts in South Africa. With the shortfall having now all but disappeared as the units at the massive Medupi Power Station progressively come on line, one could argue that the need for cross-border IPPs, at least from a South African viewpoint, has been greatly diminished.

Clegg sharply disagrees with this argument. “The fact of the matter is that every country in the SADC region is running a power supply deficit,” he maintains. “In the case of South Africa, this has been temporarily masked by an economic downturn which has greatly reduced demand and which has resulted in many mines and smelters, which are major consumers of electricity, being closed. The reality is that there is an underlying 30 GW deficit in the SADC countries. So whoever has the power will have no difficulty in selling it.”

Finally, one of the strengths of Shumba that Clegg points to is its identity as a fully Botswana-based company. “Most of our highly experienced executive team, including our MD, Mashale Phumaphi, are either citizens of



*Establishing a core drill at the Sechaba project.*

Botswana or closely acquainted with the country and our sole listing is on the Botswana Stock Exchange. Our entire focus since we started up in 2009 is on energy projects in Botswana and I believe that we can now claim to have the biggest and most significant portfolio of advanced energy projects in the country. We’ve spent around 200 million Pula on our projects to date and we’re now on the brink of transitioning from being an explorer to a producer,” he concludes. ■

## A plus 40-year career in mining

Alan Clegg is a mining engineer who started his career with the National Coal Board in the UK in the early 1970s. In 1975 he moved his career base to South Africa and subsequently worked at Gold Fields, JCI Platinum and its successor Anglo American Platinum, and Impala’s Gazelle Platinum (where he was closely involved with the establishment of the Karee mine). He has also worked globally since 1975 on mining projects in over 150 countries.

He has an in-depth knowledge of mining equipment and related technologies (having served as CEO of Tamrock Africa for a period) and also of mining consulting and EPCM contracting (having worked as a partner, co-founder and the senior executive for mining engineering at TWP Holdings from 2001 through to its listing in 2007). He was subsequently based in Turkey for several years from mid-2008 after executing an MBO of the TWP Eurasia division, running a mining consultancy, but returned to South Africa in 2014. He is now based on South Africa’s Wild Coast.

Among other things, he is an independent non-executive director of resource companies and currently advises Samruk-Kasnya Invest, the Kazakhstan government’s sovereign wealth fund, and is on the board of Syrymbet JSC, which is developing the world’s largest undeveloped tin deposit. He is also on the board of Alexander Mining, an AIM-listed company engaged in developing and commercialising what he describes as “ground-breaking leaching technology” for the extraction of base metals from high acid consuming oxide ores, in particular cobalt, copper, and zinc. ■



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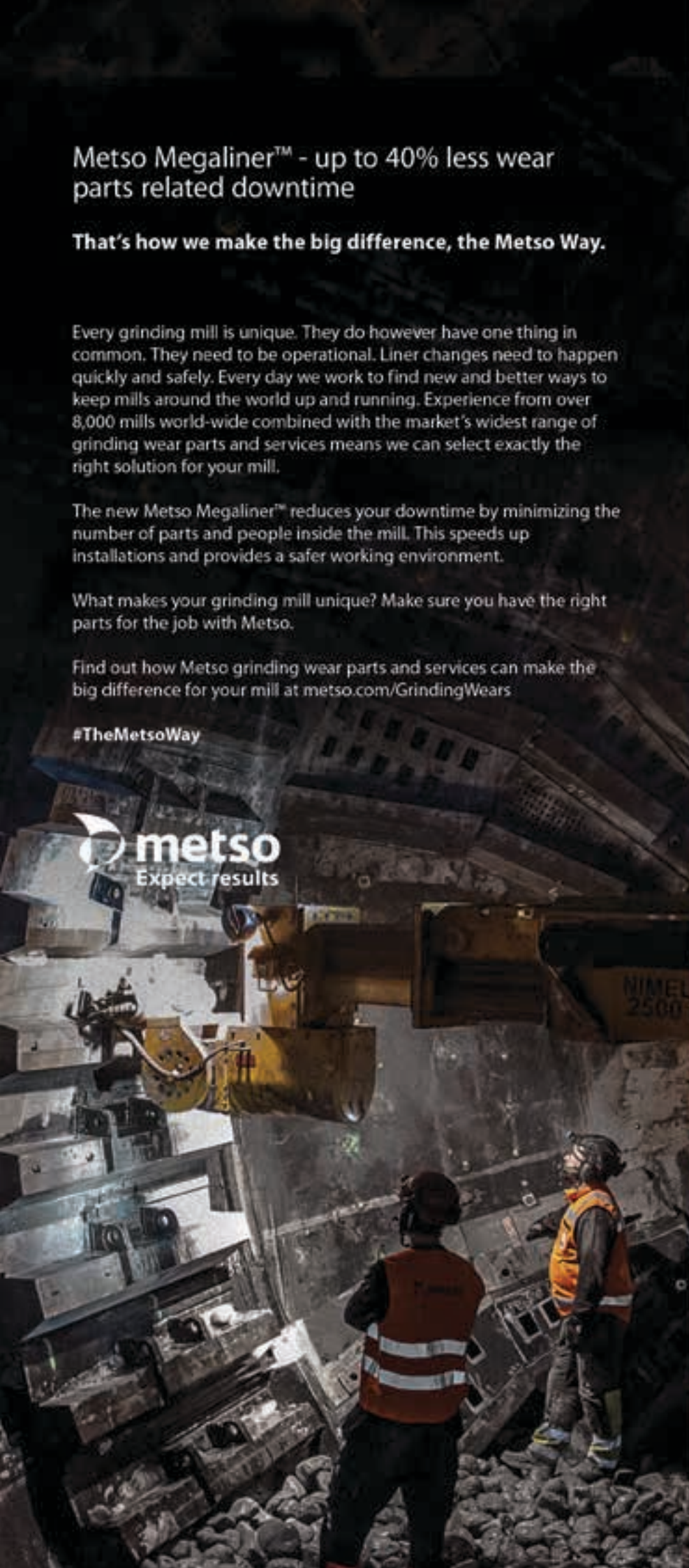
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## Firestone in fresh bid to sell BK11 mine

**A**IM-quoted Firestone Diamonds has announced that it has entered into a conditional option agreement for the potential disposal of its Botswana operations, which include its interest in the BK11 mine, to Amulet Diamond Corporation for a total potential consideration of US\$5.1 million in cash.

Amulet is a Canadian special purpose vehicle formed for the purpose of the transaction by a group of private investors led by Gareth Penny (a former CEO of De Beers) and Diacore Diamond Group, a multinational diamond company with diversified interests in the diamond industry.

Amulet will fund the construction and operation of a bulk sample plant and the carrying out of a bulk sample programme at the BK11 mine during the 14-month option period to further assess the deposit. In addition, it will, during the option period, pay the ongoing cost of BK11's care and maintenance programme up to a maximum of US\$30 000 per month.

BK11 is located in the Orapa Kimberlite Field in northern Botswana, approximately

10 km west and 20 km south-east of Debswana's Letlhakane and Orapa mines, respectively. It is also within 5 km of Lucara's Karowe mine.

Phase 1 of the BK11 production plant commenced in August 2010 but was placed on care and maintenance in February 2012 as a result of the plant's inability to successfully liberate diamonds. Phase 2, which included secondary and tertiary crushing circuits and connection to the existing electrical power infrastructure, remains to be implemented.

An agreement to sell BK11 to Vancouver-based junior, Tango Mining, was signed in 2015 but the deal fell through last year when Tango was unable to secure funding for the acquisition.

Tango did, however, complete a PEA on the project which examined the establishment of an open-pit mining operation producing an average of 90 000 carats per annum (excluding the final year) over a seven-year mine life. The PEA estimated the life of mine revenues at US\$188 million and the development capex at US\$15 million. ■

feature

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## Cutting-edge solution for exploiting fines and sludges

Mineral Agglomeration Solutions (MAS) is offering the mining industry a new cutting-edge solution for the beneficiation and commercialisation of its mineral fines and sludges, also known as waste. The South African-based company has developed a highly efficient pelletising process that transforms mineral fines and sludges into compressed pellets for sale or beneficiation.

MAS has successfully completed bulk trials at a major miner's smelting operation in South Africa, which proved that its process of extruding mineral fines produces yields of higher than 95 % and the pellets exceed a cold strength of 1 200 N. This is a dramatic improvement on the yields of

existing beneficiation processes for fines and sludges, which generally produce yields of about 65 %.

Executive Chairman of MAS, Eddie Mballo, says the company is set to work with miners and smelters of manganese, chrome, coal, nickel, iron ore and magnetite. The process is also available for the manufacturing of fuel pellets.

"MAS's highly efficient process involves the evacuation of air from the various materials and the extrusion of mineral fines, sludges and granular materials under very high pressure, applying binders and stabilisers," says Mballo.

Mballo explains that the company developed the solution in South Africa over the past four years. The company spent this period investigating, modifying and testing the extrusion process in order to provide the international mining industry with an excellent solution for its mineral waste and by-products.

MAS believes its solution is a vast improvement on existing briquetting methods, as it is able to process higher volumes, produces a significantly higher yield at 95 %, involves lower capital and production costs and is compatible with a wide range of recipes used by clients.

The company's success with its bulk trials has already resulted in the selection of its technology by a major manganese smelter based in Malaysia, which is owned by major international and South African stakeholders.

MAS has more than 40 years' experience in stiff extrusion gained in the produc-

tion of heavy clays for brickmaking. The company is 52 % BEE-owned and boasts a management team of qualified experts in plant design, engineering, business development, financial management and general management.

MAS uses machinery manufactured by J.C. Steele and Sons, which is supported by BMMS. Together they are world leaders in the stiff extrusion of fine dusts, wet sludges and fine granular materials. J.C. Steele supplies a range of extrusion machines, which can process up to 70 t of mineral materials per hour.

"MAS is delighted to offer the international mining industry a solution that adds commercial value to stockpiles and specified by-products of mining operations and significantly mitigates the environmental impact of mining.

"We offer mining and smelting companies the full service of competent management and operational teams running extrusion plants on the ground for a period of three to seven years. Each project is structured according to the specific business and socio-economic environment, which for example allows the customer to own the plant or take ownership of the plant after a specified period."

Mballo added optimistically that a further bulk trial is underway in Mpumalanga where MAS is making strides in proving that a smart pellet, incorporating carbon, can be successfully produced for smelting or sale on the international market.

Mineral Agglomeration Solutions, tel (+27 11) 462-0572, website: [www.brex.co.za](http://www.brex.co.za)



MAS has developed a pelletising process that transforms mineral fines and sludges into compressed pellets for sale or beneficiation.

## Supplier moves to unify its global efforts

Engineered mining solutions provider Tega Industries has embarked on an extensive globalisation drive to standardise production across its six manufacturing plants in India, Australia, South Africa and Chile.

With the aim of standardising its production practices and ensuring uniform quality across all corners of the globe, the move has been a long time in the making with plants, such as the South African factory, receiving considerable capital inputs to ensure they are up-to-date with the latest manufacturing techniques.

Having reached the required milestone, the local plant has also been brought under

the wing of the global organisation with three new members of Tega Industries' international head office taking over management of the company to steer it towards its global objectives. The new Tega Industries management in South Africa is led by Vishal Gautam, Sales and Marketing Manager, Ajay Pandey, Head of Finance, and Punit Kalra, Operations Manager.

According to Gautam, the groundwork has been done and sets the stage for Tega to renew its drive into the marketplace in a bid to grow its footprint and win over new customers and improve upon the performance of products and services of

existing customers. "We are already well known throughout Africa as a supplier of quality products such as our mill liners and engineered rubber products, but not for all the solutions that we can provide from our global plants and this is what we need to highlight going forward," he says.

"Apart from rubber products, mill liners, conveyor and wear parts, we are also able to provide a wider variety of products such as hydrocyclones, slurry pumps and other specialised equipment and services. Our technical teams are also available to undertake optimisation programmes to improve the efficiency and lifespan of processing and conveyance equipment."

Vishal Gautam, Tega Industries tel (+27 11) 421-9916



## Weba uses 3D scanning to optimise chute solutions

Equipped with the technical expertise to engineer tailored solutions in transfer point and chute systems, Weba Chute Systems uses three-dimensional (3D) scanning technology to ensure high quality results. This minimises rework costs in design and manufacturing, and reduces downtime during installation.

Managing Director Mark Baller says Weba's 3D scanning capability is the ideal solution for predetermining new equipment design for accurate integration into existing infrastructure, as well as for creating an accurate preliminary design and costing in the early feasibility stages of a project.

"Being able to obtain accurate measurements from a safe distance with minimal time duration, this technology allows us to inspect and survey large infrastructure in detail and allows us to consider all elements in play when replacing and repairing customers' equipment," says Baller. "From this data, we can generate 3D models from on-site conditions and conduct accurate reverse-engineering."

Baller says that 3D scanning offers far greater accuracy than manual measuring. With their high levels of precision, robustness and portability, modern laser scanners have become invaluable in the designing, building, restructuring and extending technical facilities; they are now able to create graphic and dimensioned reproductions of large, complex structures in great detail.

Design engineers can then superimpose the scan on their design intent and pick up any interference, existing defects, redundant elements, structural deformation and undocumented historical alterations made to the site's infrastructure that may lead to problems during the design and execution phases. However, a scan on its own is not enough to engineer a customer solution.

"Many companies offer 3D scanning, but do not have the in-house ability to then process and effectively utilise this data in a mining engineering environment," he says. "As a market leader, that is one of our strengths; and comes from our continuous investment in upgrading our systems and work flow processes to ensure that we stay abreast of best practice."

Engineering know-how is critical to the optimal application and integration of 3D scanning to the design and manufacturing processes, which improves planning and scheduling through the provision of precise and reliable data. This, in turn, reduces project risks and contingency costs, especially in time sensitive conditions that demand a low margin of error.

Weba Chute System's investment in this technology enables the company to offer the most appropriate solution with the lowest risk of encountering any unforeseen issues during installation.

Mark Baller, Weba Chute Systems, tel (+27 11) 827-9372



Weba Chute Systems uses three-dimensional (3D) scanning technology to ensure high quality results.

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## No recirculation with Krebs slurryMAX™

The elimination of recirculation within a slurry pump not only lowers power consumption but significantly reduces uneven wear on parts, and this, according to Morane Potgieter, Sales and Customer Service Manager of FLSmidth Krebs, equates directly into an overall improved wear life of the pump, lowering spare parts stockholding, downtime and labour costs.

The Krebs slurryMAX™ pump incorporates a unique patented feature which enables online adjustment of the critical impeller to suction side clearance and counters the primary leak path that occurs

across the suction face of the impeller on conventional designs. The externally adjustable wear ring allows adjustments to be made while the pump is running. This reduces the suction side recirculation and maintains the design flow while maintaining large clearances near the impeller shroud.

This clearance at the impeller shroud eliminates the problem that conventional rubber-lined pumps experience, namely pressure pulsations caused by the close proximity of the rotating raised expelling vanes to the suction liner, necessary to maintain flow, and the subsequently generated heat in the liner and rubber devulcanisation failure.

Potgieter says that the ability to maintain the clearance between the impeller eye and the suction side of the pump also means that a constant delivery pressure and flow is provided throughout the life of the pump, and this contributes to increasing the life of the impeller.

“Significantly, the wear ring need only

be adjusted up to eight times throughout the life of the wet end parts, contributing to low total cost of ownership for the end user,” Potgieter points out.

The extra-thick rubber lining has rigid reinforcement which prevents collapse onto the rotating impeller under upset vacuum conditions. Impellers are oversized in diameter and available in metal or elastomers. High pressure casings are available for specific application requirements such as multiple pumps in series.

The pump casing is constructed of tough spheroidal graphite iron, while both the casing and suction inlets are heavy duty rubber lined.

The Krebs slurryMAX™ pumps are suitable for applications ranging from mill discharge, SAG mill discharge recirculation, cyclone feed, general transfer of heavy duty abrasive slurries and tailings pumping. The pumps are available in sizes from 75 mm to 500 mm and are used across all commodities including copper, iron ore, gold, oil sands, sand and gravel and for industrial processing.

FLSmidth, tel (+27 10) 210-4820



A Krebs slurryMAX™ pump in a CCD thickener application.



## High-specification safety harness launched

MSA Africa has launched its V-FORM safety harness for work-at-height applications. This is a high-specification, competitively-priced fall-protection harness that gives users the comfort and knowledge that they are selecting the best PPE that will not let them down when they need it most, comments

Nicolas Abry, Business Development Manager, Fall Protection, MEAIR, MSA Middle East FZE. Such is MSA's confidence in the new harness that it carries a ten-year lifespan.

“We want to ensure that our safety solutions are available to as many users as possible, and therefore have developed a product that offers MSA's standards at the best total cost of ownership,” Alastair Hogg, Director for Fall Protection Sales

and Business Development, International, elaborates.

The V-FORM harness is the first product available in the new V product range, named after the iconic V-Gard® safety helmet developed by MSA in 1962.

Designed to be comfortable, light and easy to use, the product combines simplicity with safety in a streamlined harness that can be fastened securely, and released quickly. An intuitive design ensures correct fitting first time, every time.

The harness can be tailored to requirements, with either a three- or five-point adjustment. It features a high-visibility alert to show if the equipment has been used in a fall, and a sub-pelvic strap for more even weight distribution. Certified to take 140 kg, the new harness is said to be extremely comfortable to wear and work in all day.

A Velcro® cover protects the harness label, while end users can choose between Qwik-Fit or bayonet leg straps. The V-FORM waist belt can be attached onto a harness for work positioning.

MSA, tel (+27 11) 610-2600

## JB Switchgear MCCs selected for upgrade

JB Switchgear Solutions (Pty) Limited was recently awarded a contract by DRA Global for the design, manufacture and supply of containerised motor control centres (MCCs) destined for an upgrade project at Rosh Pinah Zinc in Namibia.

The multi-million rand contract includes JB Switchgear's specially-developed and compact 'Eagle' series container panel which allows two rows of motor control on opposite sides of the container whilst still maintaining the minimum measurement of 1,2 m (as specified in the Mines Health and Safety Act)

between the opposing fronts of the MCCs.

This design offers a number of advantages including space saving, cost savings, and the benefit of full functional testing before the container substation is dispatched to site. Busbars are easily accessible for installation, maintenance and subsequent additions and/or modifications.

JB Switchgear's 'Eagle' series carry comprehensive type test certification, and has proven over many years to be reliable, robust and user-friendly.

Johan Basson, JB Switchgear, tel (+27 11) 027-5804



## Containerised power solution for West African gold mine

Shaw Controls, a Zest WEG Group company, reports the successful completion of its contract to supply a containerised electrical solution to a gold mine in West Africa.

Kirk Moss, Medium Voltage Manager at Shaw Controls, says the containerised solution will supply power to drive a mill on this new mine. "Containerised electrical solutions are becoming increasingly popular as these allow for speed of installation and are a particularly cost effective option for mine and plants operating in Africa," Moss says.

The custom engineered sub-station comprises a medium voltage (MV) WEG Variable Speed Drive (VSD) and a dry-type phase shift transformer driving a 2 000 kW, six-pole, 6,6 kV squirrel cage WEG electric motor. The VSD is housed in the container while the oil-cooled transformer is housed outside of it to facilitate heat dissipation.

Moss says that Shaw Controls has an established reputation for engineering and manufacturing quality bespoke containerised solutions at its Johannesburg facility. The extensive facility of over 12 000 m<sup>2</sup> is manned by a team of skilled technical personnel and having the whole construction take place in one facility makes it easier for customers to do all quality and functional checks in one place. This solution underwent testing at Shaw Controls prior to being dispatched to site.

"What is particularly interesting about the solution provided is that it has been specifically engineered for this particular application and utilises specialised software for frozen charge protection," Moss says.

The software, which interfaces with the VSD, allows the objective detection of a frozen charge condition by making use of torque measurements already being monitored by the VSD.

"With the addition of an encoder fitted to the electric motor, we are now able to monitor mill angle. And with the torque and angle measurements it is possible to detect if cascading has occurred within the mill," he explains.

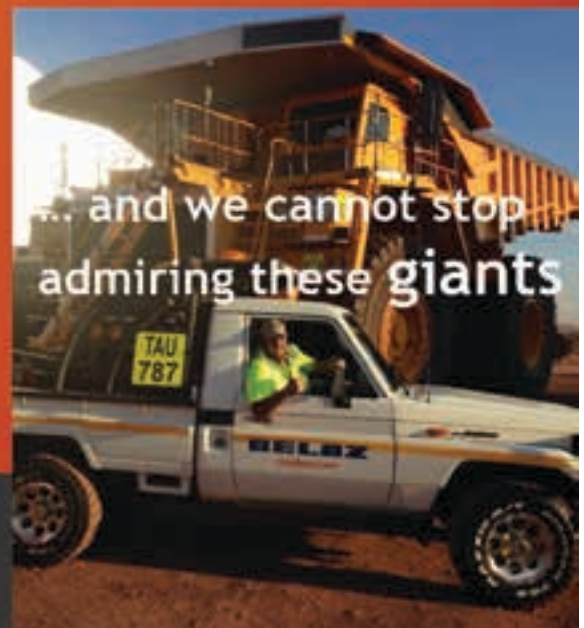
Another innovative feature of this solution is the supply of a Human Machine Interface (HMI) in the form of an interactive touch screen which has been configured to allow different levels of access.

This project made use of a WEG MVW01 VSD with 6,6 kV output. The input solution makes use of a 36 pulse rectifier and corresponding phase shift transformer. Moss explains that this combination was selected as the best option to minimise harmonics.

Zest WEG Group Africa, tel (+27 11) 723-6000



Kirk Moss of Shaw Controls in front of the containerised solution that will supply power to drive a mill on a mine in Mali.



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## Rod charger enhances safety at Black Mountain

Working with Vedanta Zinc International's Black Mountain mine in the Northern Cape to enhance safety in its milling plant, Multotec Manufacturing recently designed, manufactured and installed an automated rod charger for the mine's rod mill.

Holder of the Southern African Institute of Mining and Metallurgy's prestigious Health and Wellness Award, Black Mountain Mining had been looking for a solution that would reduce the risks associated with the manual handling of mill rods.



Front view of the rod charger showing erected boom.

Each rod measures almost 5 m in length and weighs up to 240 kg. Rod mills are used extensively as primary mills in many mines, with the rods acting as grinding media. As the rods wear down, new ones have to be introduced regularly to ensure grinding efficiency is maintained.

According to Jannie Genis, technical sales representative at Multotec Manufacturing in Cape Town, the concept for the rod charger was developed in close consultation with the plant engineering and production personnel at Black Mountain, and leveraged the substantial mechanical engineering expertise within Multotec.

"The Multotec Cape Town branch, under the leadership of Vivian Rocher, put together a team that took the concept into the design stages, customising the unit to exactly suit the site plan at Black Mountain," Genis says. "After input and suggestions from the customer, we were able

to advance the project to manufacturing stage in Cape Town, where complete construction took place."

The charger went into operation at the mine in mid-2016 and has effectively eliminated all manual handling of mill rods, successfully achieving the project goals.

"There is now no need for any person to be in the mill to guide the rods into place," Genis says. "Only two people are involved: one to operate the unit, and one to check that the rods feed smoothly into the mill."

Another significant advantage is the reduced time taken to conduct the rod charging; the complete process has been cut down from over an hour to just about 25 minutes. This means more production time and has also allowed the more frequent charging of rods, from twice a week using manual methods to three times a week now, leading to better grinding efficiency.

Bernadette Wilson, Multotec Group, tel (+27 11) 923-6193

## 'New generation' monitoring system

4B Africa, a subsidiary of the 4B Braime Group, a worldwide manufacturer of material handling and electronic components, has just released the fourth-generation Watchdog™ control unit for monitoring bucket elevators and conveyors.

The Watchdog™ Super Elite (WDC4) is reported to be easy to install and simple

to set-up. The system processes signals from up to 15 sensors for belt speed, belt misalignment, continuous bearing temperature, pulley misalignment and plug conditions on bucket elevators or conveyors. When an alarm condition is detected,



the system will log the details, sound an alarm and provide shutdown control of the elevator/conveyor and feeding system.

A new 3,5 inch colour graphic LCD screen displays the entire system status at a glance. The WDC4 model now supports

belt speed monitoring for variable frequency drives (VFDs), and belt misalignment inputs for contact, pulse and temperature (brass rub block) sensors. The unit also has jog and acceleration monitoring for detecting any equipment issues during the start-up sequence.

The controller settings are password protected, and can be set up either directly on the LCD screen, or by a free PC software application and transferred to the WDC4 via an SD card. The Watchdog™ Super Elite can be connected directly to a PLC using Modbus TCP/IP protocol, or integrated into HazardMon.com®. HazardMon.com is a secure cloud-based solution that provides live system status, graphs and historical data that is viewable on any web-enabled device.

4B Africa, website: [www.go4b.com](http://www.go4b.com)

## New satellite technology can assist mining sector

Pan African telecoms group Liquid Telecom has deployed its first Mx-DMA® satellite link for a mining company in Africa.

Mx-DMA technology, which is a new and innovative bandwidth allocation technology for satellites developed on the Newtec Dialog® VSAT platform, can lead to bandwidth efficiency gains of up to 50 %, providing more reliable and efficient high throughput connectivity for mining operations across the region.

With mines typically located in remote areas where fibre is unavailable, mining organisations are reliant on legacy satellite links that can only be configured to suit one type of traffic – such as bursty or high data rates. Mx-DMA combines the best of these qualities to offer mining customers

on-demand variable bandwidth allocation and enhanced efficiencies.

The Newtec Dialog platform is capable of supporting throughputs as high as 75 Mbps and can also be customised to withstand the harsh conditions often found at mining operations across Africa, such as heat, dust and sandstorms.

"As more mining companies pursue automation across their operations, greater focus is falling on connectivity. Newtec's Mx-DMA technology is a unique fit for the sector, offering the reliability, scalability and flexibility required by today's mining customers," says Scott Mumford, Group Managing Executive of Satellite and VSAT, Liquid Telecom.

Liquid Telecom, website: [www.liquidtelecom.com](http://www.liquidtelecom.com)



## Screen pushes production to new levels

Faster, more aggressive screening technology is allowing mine processing contractor, Two Pedestrians Mining, to push production to new levels and radically shorten processing times on behalf of its clients in the mining industry.

According to Neel Rademeyer, who is the hands-on owner of Two Pedestrians Mining, the screening process is key to optimal production and sizing for final processing or stockpiling of product. The accuracy and speed with which this is achieved results in improved profitability for its clients.

Most recently, the company has employed a newly acquired Powerscreen Warrior 1400X mobile screen to do duty in volume applications, where its heavy-duty processing power is able to make short work of run-of-mine materials even in rough terrain where its mobility simplifies the load-screen-dump cycle.

"The machine has been a revelation in terms of its versatility and work rate," says Rademeyer. "This is important as it means it can be deployed to a wide range of min-

ing types wherever there is a requirement for mobile operations to work through large volumes of materials, whether it be coal, ore or aggregates.

"At present the Warrior 1400X is operating in the coal fields surrounding Delmas where its interchangeable decks can be set in accordance with the type and size of coal required. The processing of run-of-mine to 0x50 mm product requires that the screen can handle 0x600 mm feed.

"The unique design of the 'punch plates' top decks has been a revelation to say the least. We have processed approximately 600 000 tons on one set of punch plates and see no need to replace them

yet. Amazingly, it can be offloaded and be operational on a site within 15 minutes as was proven at Wescoal recently."

Two Pedestrians Mining's Operations Manager, Arno Swart, adds that due to its high ground clearance the machine is able to tram quickly to keep up with production. The high running position also lends itself to a cleaner operation with no need for ramps to access underneath the machines.

Two Pedestrians Mining has a long and beneficial relationship with ELB Equipment, the sole distributors of Powerscreen equipment in Southern Africa. Since starting the operation more than 20 years ago, the contractor has standardised its entire fleet on ELB Equipment's machines.

ELB Equipment, tel (+27 11) 306-0700



The Warrior 1400X screen's efficiency is proving to be a drawcard for Two Pedestrians Mining's customers.



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## Parastatal takes delivery of 21 Hyundai wheel loaders

HPE Africa has delivered 21 new Hyundai wheel loaders to a leading electricity generating parastatal in South Africa during the first half of 2017.

“Robust Hyundai HL770-9S wheel loaders, designed for maximum performance and optimum productivity, offer precise operation and easy control, even in dif-



The Hyundai HL770-9S wheel loaders are well suited to the arduous terrain and handling requirements at power stations.

ficult conditions,” states Alex Ackron, MD of HPE Africa, the exclusive distributors in Southern Africa for Hyundai Construction Equipment. “These versatile machines, with an operating weight of 22 500 kg and heaped coal bucket capacity of 6,2 m<sup>3</sup>, are perfectly suited to the arduous terrain and handling requirements at power stations.”

New features of these wheel loaders include an advanced load sensing hydraulic system with efficient variable volume pump technology, automatic power shift transmission with variable shift control and a multi-stage clutch cut-off feature.

The fully automatic transmission system allows the operator to customise automatic transmission shift timing and clutch cut-off, based on operating conditions and personal preference. Variable operating modes – power, standard and economy modes – contribute to improved

productivity, reduced fuel consumption and enhanced operator comfort.

The combination of high pressure common rail system and advanced in cylinder combustion technology in the eco-friendly Cummins 3 tier engines results in increased power, improved transient response and reduced fuel consumption.

The ‘ride control system’ – an optional feature – has a shock absorbing accumulator that cushions the boom, reduces material loss and improves operator comfort.

Hyundai’s new Hi-mate remote management system enables users to track and monitor a machine’s performance and daily operation history. This system utilises GPS satellite-based technology to access accurate diagnostic information, evaluate equipment reliability and verify a machine’s location.

HPE Africa, tel (+27 11) 397-4670

## Sudor Coal implements Booyco proximity detection system

Mpumalanga miner Sudor Coal has implemented a state-of-the-art proximity detection system (PDS) from market leader Booyco Electronics at its Weltevreden operation.

The underground coal mine near Emalahleni has three sections extracting the Number 4 Seam at about 60 m below surface. The Booyco PDS system includes buzzers and flash units on mine personnel, as well as transmitters on continuous miners, shuttle cars and roof-bolters.

The system prevents dangerous situations by alerting both the pedestrian and the machine operator to each other’s proximity; an audible and visual alarm is triggered followed by retardation of the moving equipment, which is then brought to a standstill if no action is taken.

Petrus Vilakazi, underground engineer at Weltevreden, says the implementation of the system began in March 2016 and was rolled out across all three of the mine’s sections over a period of about a year.

“We initially presented our implementation plan for a collision-avoidance system (CAS) to the Principal Inspector at the Department of Mineral Resources,” says Vilakazi, “and this year we were able to report back to say the system was in place, in compliance with the new safety legislation.”

He says that commissioning of the PDS was done in two phases. Firstly, there was a cold commissioning phase in which the warning system was activated. This was followed by hot commissioning, in which an actual intervention – the retardation and the stopping of moving machinery – will

be triggered if the warning signals are not heeded for any reason.

Vilakazi says a vital part of the system’s effectiveness is the buy-in of employees; it was therefore important to communicate the rationale for the PDS clearly with the underground employees to ensure that everyone understood why it was necessary and how it would improve safety.

“Anything new takes some time getting used to, but it was not long before the system was well accepted by all stakeholders and it now works smoothly with no impact on production levels,” he says. “Employees also realised that the company had invested substantially in this system so that they could work more safely, and they have bought into the implementation process.”

Anton Lourens, Booyco Electronics, tel 0861 266926

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