CROWN PUBLICATIONS

MODERN MINING

January 2016
Vol 12 No 1
www.crown.co.za

IN THIS ISSUE...

SOUTHERN AFRICA'S TOP MINING PROJECTS

- Cullinan's new processing plant
- The Venetia Underground Project
- Khoemacau Copper
- Palabora Lift II
- Shondoni coal mine

Mining is here to stay.

But that doesn't mean it has to stand still.

Joy Global is committed to productive mining and always working on new ways to help our customers optimize performance, lower costs per ton and improve efficiency. Our proven solutions and worldwide partnerships are helping customers achieve record-setting production levels and **solving mining's toughest challenges**.

Joy Global (Africa) (Pty) Ltd, A BEE Level 3 Contributor
Wadeville, Johannesburg, South Africa
Tel: +27 11 872 4000 or info@joyglobal.com

JoyGlobal.com

JOYGLOBAL

MODERN MINING

Editor
Arthur Tassell

Advertising Manager
Bennie Venter
e-mail: benniev@crown.co.za

Design & Layout
Darryl James

Circulation
Karen Pearson

Publisher
Karen Grant

Printed by:
Shumani Mills Communications

The views expressed in this publication are not necessarily those of the editor or the publisher.

Published monthly by:
Crown Publications cc
P O Box 140,
Bedfordview, 2008
Tel: (011) 622-4770
Fax: (011) 615-6108
e-mail: mining@crown.co.za
www.modernminingmagazine.co.za

Cover

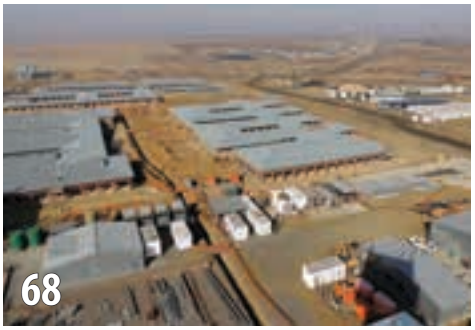
BME engineers undertaking technical services on the block. Through its blasting services group, BME has a global reputation for technical support, with best-in-class tools to ensure real downstream benefits for clients. See page 18 for further details.

Average circulation
(July–September 2015)
4 352

CONTENTS

JANUARY 2016

ARTICLES



REGULARS

Cutting-edge technology. Ultimate commitment.

Innovative and flexible analysis for the mining industry

Axios^{mAX}-Minerals: offers a dedicated solution to the industry and includes a complete set of traceable standards.

Axios FAST: is the fastest simultaneous spectrometer on the market.

CubiX^3 Minerals: most accurate and fastest diffractometer for production and process control, the perfect solution for grade control of drill cores and ores.

Epsilon 3 range: range of cost-effective benchtop EDXRF spectrometers, ideal for accurate grade control and exploration materials.

In-line real-time process control
Sodern CNA cross-belt analyzers from PANalytical provide real-time elemental analysis.

Epsilon5: polarized EDXRF spectrometer. An ideal tool for geological applications.

PANalytical (Pty) Ltd
363 Oak Avenue,
Ferndale, 2194
T +27 (0) 11 577 0880
F +27 (0) 11 577 0882
rudy.del.piccolo@
panalytical.com
www.panalytical.com

The Analytical X-ray Company

PANalytical

Modern Mining on the road

One of the joys of my job is that while I'm often office bound, I also have regular excursions out of the office to visit mines and mining projects, both in South Africa and across border. One effect of the mining recession is that trips of this type are increasingly difficult to arrange, given the number of mines that have gone on to care and maintenance and the number of new projects that have either been cancelled or deferred.

Having said this, I had a good run in the closing weeks of 2015 and the first full week of this year, visiting in relatively quick succession De Beers' Venetia diamond mine in Limpopo Province, Northam's Booysendal mine, which is on the Eastern Limb of the Bushveld Complex (the property straddles the border between Mpumalanga and Limpopo provinces), and Cupric Canyon Capital's Khoemacau copper project south of Maun in Botswana in the Kalahari Copperbelt.

My Venetia trip was to view the progress being made on the US$2 billion Venetia Underground Project (VUP), which will see the current open-pit operation being phased out in several years' time and replaced by an underground mine. The project extends Venetia's life into the 2040s – by which time it could be the only remaining De Beers' mine in South Africa, given that the group's only other producing asset in the country (now that Kimberley Mines has been sold) is the much smaller Voorspoed operation in Free State Province, which has a limited life ahead. I'm not sure exactly when Voorspoed is due to close but I doubt it will go much beyond the early 2020s, at least as a De Beers operation.

The main contractor on the VUP is Murray & Roberts Cementation and in fact they organised my visit to the mine, which included an underground visit and the opportunity to talk to De Beers' Christoff Kühn, Head of the VUP.

Murray & Roberts Cementation also assisted with my visit to Booysendal, which could eventually become one of South Africa's biggest platinum mines (and certainly the biggest on the Eastern Limb), given the size of its resource. Booysendal is, of course, a relatively new operation, with milling having started in March 2013 and with more than 4,4 Mt having been milled to date.

The really interesting thing about Booysendal is that – along with Bathopele near Rustenburg (currently in the Anglo American Platinum stable but due to become part of Sibanye) – it is setting the pace in mechanisation in the underground mining sector, pointing the way forward for South Africa's embattled platinum mining industry.

My third visit – to the Khoemacau project in Botswana – was at the invitation of Sam Rasmussen, who runs Cupric Canyon's operations in Africa, and was made in the company of the Project Director, Rob Dey. Sam is an American but has considerable African experience – he managed the Tenke Fungurume copper mine in the DRC – while Rob will almost certainly be well known to many readers of *Modern Mining* as he was at one stage Group Executive: Projects with Impala Platinum.

This was a particularly interesting trip for me as I have been following developments in the Kalahari Copperbelt for several years now but without actually visiting the area – which is never an entirely satisfying situation. It was also my first visit to the bustling town of Maun in nearly 20 years, despite the fact that I frequently travel to Botswana. As luck would have it, I contrived to be in – or, more specifically, near – Maun on what was apparently the hottest day in its history since records began! The mercury hit 42 deg on the day in question and I'm convinced that where I was – an hour's drive to the south – was at least two or three degrees hotter still.

The focus of Cupric Canyon's efforts – through its subsidiary in Botswana, Khoemacau Copper Mining – is its Zone 5 deposit, which lies roughly halfway between Maun to the north and the northern boundary of the Central Kalahari Game Reserve to the south. With most copper operations in Southern Africa struggling with a low copper price, it's good to see that at least one new copper mine is due to go ahead in our region. Construction of the new mine – which will be an underground operation – has not yet started but Cupric Canyon has no intention of dragging its feet and, all going well, is hoping to be in production around the middle of 2018.

For readers wanting to know more about these projects, Khoemacau's Zone 5, as well as the VUP, feature in this month's round-up of 'Top Southern African Mining Projects' (see our coverage starting on page 32) while the Booysendal mine will be covered in our February issue, in which we will have a special focus on mechanisation in mining.

Arthur Tassell

Construction of the new mine has not yet started but Cupric Canyon has no intention of dragging its feet and, all going well, is hoping to be in production around the middle of 2018.

Feasibility Study supports underground mine at Prestea

Headgear at the Prestea mine. The mine has been in existence for over 100 years and has historically produced an estimated 9 million ounces of gold (photo: Golden Star Resources).

Golden Star Resources (GSR), which has offices in Toronto and Accra, has announced the results of its Feasibility Study (FS) regarding the development of its Prestea underground mine in Ghana.

Prestea is an underground mine which has been in existence for over 100 years and has historically produced an estimated 9 million ounces of gold. It was acquired by Golden Star in 2002 and placed on care and maintenance while evaluation and exploration activities continued. The mine, located 16 km south of the Bogoso processing plant (owned by GSR) along a dedicated haul road and adjacent to the town of Prestea, is accessible by road from Accra as well as via the port city of Takoradi 150 km to the south.

In November 2014 the company released a Preliminary Economic Assessment (PEA) based on the development of a non-mechanised mining operation in the West Reef deposit at Prestea. The FS includes additional geotechnical, hydrogeological and metallurgical test work on samples from additional underground drilling. The drilling results have contributed to an updated resource block model which is the basis for the 2015 mine design and estimation of mineral reserves.

The FS is based upon mineral reserves of 1,04 Mt at a diluted mined grade of 14,0 g/t Au for 469 000 ounces of contained gold. The initial capital outlay is estimated at US$63 million with a development timeline of approximately 19 months to commercial production with a life of mine of five-and-a-half years (excluding the ramp up to commercial production). The post-tax IRR is put at 42 % at a US$1 150 per ounce gold price and the project has an NPV, assuming a 5 % discount rate, of US$124 million. The life of mine all-in costs are estimated at US$756 per ounce and the payback period at 2,9 years.

At Prestea there is an extensive infrastructure of surface and underground vertical shafts, inclined shafts, horizontal development, raises and stopes developed along the 9 km of strike length of the gold mineralisation. The primary access shaft for the West Reef is the Central Shaft located in the town of Prestea and the secondary shaft is the Bondaye Shaft, 5 km to the south. The Central Shaft will be used for personnel access, materials transport, dewatering and hoisting. The Bondaye Shaft will act as the secondary means of egress as well as for dewatering.

The West Reef mineralisation lies approximately 2 km south of Central Shaft and 3 km north of the Bondaye Shaft at a depth of between 550 and 1 025 m below surface. The mineralisation dips at approximately 60 to 85 deg to the west and varies in width from 0,5 to 3,5 m with an average width of approximately 1,8 m.

The FS proposes shrinkage stoping – which was the mining method historically used at Prestea – but with the application of rock bolts and timber props to support the stope walls to maintain stope stability and control waste dilution. The main haulage level will be established on the existing 24 level to move mineralised and waste rock to the Central Shaft for hoisting to surface. An incline/decline system will be developed in the footwall of the mineralisation to access sublevels at a vertical spacing of approximately 35-40 m between existing levels 17 and 24 and 140 m below level 24.

Shrinkage stopes will be developed between open raises spaced 60 m on strike. Drawcones will be developed out of the sublevels into the stopes and will be equipped with chutes for controlled shrinkage mucking into rail cars in the sublevels. The stopes will be advanced up dip with only the swell material (30 % of total blasted) removed from the stopes during the mining phase.

The metallurgical test work results indicate that the Prestea West Reef material is free milling with approximately 96 % metallurgical recovery using gravity followed by CIL processing. The proportion of gravity recoverable gold identified in the test work is high at between 50 % and 90 %. The processing facility will comprise a 500 tonnes per day standalone plant utilising a standard comminution circuit, followed by gravity and CIL sections. The recovered gravity concentrate will be treated in the existing Acacia circuit. Gold recovered from the CIL circuit will be further processed in the existing elution circuit. Doré will be smelted in the existing gold room.

Sam Coetzer, President and CEO of Golden Star, commented: "This Feasibility Study confirms our expectations from the PEA and I am very encouraged by the increase in reserves as a result of the additional drilling that was completed. The increase in mine life allows us to consider additional upside resource development going forward.

"The FS considers a new standalone plant; however, the company is reviewing the option of modifying its currently installed processing infrastructure to reduce capital spending. Under these conditions the FS indicates a robust project with significant upside. Additionally, with the current production from the Prestea South open pits, we believe there are further synergies to be unlocked by the deferral of plant modification capital without negatively impacting upon the production profile. Prestea Underground will be viable in the current gold price environment and, with the funding we have arranged, we expect to bring it into production by early 2017." ■

Kumba to reconfigure Sishen pit

In a statement released in December, Kumba Iron Ore says that the deteriorating price environment has necessitated a further optimisation of the Sishen mine plan that was set out at the Group's interim results on 21 July 2015.

Kumba has decided to reconfigure the Sishen pit to a lower cost shell configuration in order to optimise margins. This is in line with its strategy to focus on value (cash generation) over volume, thereby safeguarding the mine's viability at lower prices.

"Our industry is under tremendous pressure with the market now pricing in a more muted trend for the iron ore price over the medium to longer term. This is driven mainly by the expectation that supply growth will remain strong, against the backdrop of an ever more cautious outlook on China's economic growth trajectory. These circumstances have reinforced the need to make tough decisions for our business that will enable it to withstand a longer period of much lower prices," said CEO Norman Mbazima.

The new pit shell configuration will allow for a more flexible approach, reduce execution risk and lower capital cost over the life of mine. The mine will target FOB unit costs of approximately US$30/t and a breakeven price of US$40/t CFR for 2016. Waste movement is expected to be materially below previous guidance of approximately 230 Mt at 135 Mt and production is expected to be reduced from previous guidance of 36 Mt for 2016 to roughly 26 Mt.

In respect of its Kolomela mine, Kumba says this has been transitioned from three pits to two in the short to medium term in order to save costs. The mine is targeting a 2016 FOB unit cost of approximately US$27/t and a breakeven price of US$38/t CFR for 2016. The production target remains at 13 Mt by 2017. ■

Heavy mining equipment lined up at Sishen. Kumba reports that it is adopting a new pit shell configuration that will allow for a more flexible approach, reduce execution risk and lower capital cost over the life of mine (photo: Kumba Iron Ore).

Diacar starts operations at Kareevlei

BlueRock Diamonds, listed on London's AIM, has issued an update on its Kareevlei diamond project, located approximately 100 km north west of Kimberley in the Northern Cape

The company says it is now operating two shifts a day at the Kareevlei treatment plant. "Production levels remain below capacity as we continue to bed in the plant and deal with the challenges that arise from operating at far higher levels than hitherto and from the increased demands placed on the infrastructure from the commencement of operations by Diacar; in particular, water supply which has been exacerbated by the particularly dry summer," states the company. "Accordingly, we processed approximately 9 000 tonnes of mined kimberlite in November 2015. We expect that plant throughput will increase over the next two or three months as we continue with the bedding-in process.

"Our subcontractor, Diacar, has commenced operations and processed approximately 5 000 tonnes in November 2015. Diacar is continuing with the planned improvements to its plant and it is expected that production levels will increase towards expected levels during Q1 2016."

BlueRock says the quality of its stones remains high and that it is seeing an increase in the coarseness and quality of its output. "As a result, despite the weak prices at the lower end of the diamond market, our average prices remain higher than estimated in the CPR; our output since production recommenced after the recent upgrade was sold at an average price of US$273 compared to the US$232 per carat indicated in our CPR.

"We remain comfortable that the grade estimated in the CPR of 5,5 cpht is supported by results to date and we will provide further detail in this regard towards the end of the first quarter of 2016." ■

Avenira further de-risks Baobab phosphate project

Australia's Avenira Limited – previously Minemakers – reports that the Baobab phosphate project in Senegal has been further de-risked with the release of a maiden indicated mineral resource estimate. The decision to commence mining was made in mid-November which allowed long lead time items to be ordered and water drilling to commence.

The indicated mineral resource estimate has been completed for much of the eastern half of the Small Mine Permit at Gadde Bissik East, and represents the first phase of the resource status upgrade planned to advance the project to mining status.

The Baobab project area covers a total area of approximately 1 553 km^2. Within the area, the Gadde Bissik prospect of approximately 90 km^2 was identified during excavation of water wells in the 1950s. Avenira has managed the exploration of the Gadde Bissik area since early 2014, building up a comprehensive knowledge of the Baobab project and its potential. ■

Maiden ore reserves declared for Yanfolila

AIM-listed Hummingbird Resources has announced its maiden ore reserves at the Yanfolila gold project in Mali. The Reserve Report is based on the resources at the Komana East and West pits as these will be mined first (Phase 1).

The project has significant resources at other nearby deposits including Guiren West, Gonka, Sanioumale East and Sanioumale West which will be mined at a later stage (Phase 2).

The report puts probable reserves at 6,82 Mt at 3,03 g/t for 665 600 oz Au. This is an increase of 118 600 oz Au from the in-pit mineral resource inventory reported in the March 2015 Optimisation Study mine plan of 547 000 oz Au, with the grade increasing by 15 %, using a US$1 100 pit shell. According to Hummingbird, 100 % of in-pit indicated resources have converted into reserves.

Comments Dan Betts, CEO of Hummingbird Resources: "Achieving a maiden ore reserve at Yanfolila is a significant milestone for the company. With an increased gold grade of 3,03 g/t, it confirms Yanfolila as a quality, high-grade, low cost project.

"We have increased the size of our processing plant to process up to 1,24 Mt/a, as well as processing harder, fresh ore types. The ability to process greater volumes of fresh ore has allowed us to expand and deepen the open pits of our maiden ore reserve, resulting in more recoverable gold. Together with a more flexible operating plan, it also gives us scope to further expand our ore reserves from our existing deposits. The 24 % increase in throughput will also significantly enhance annual gold production.

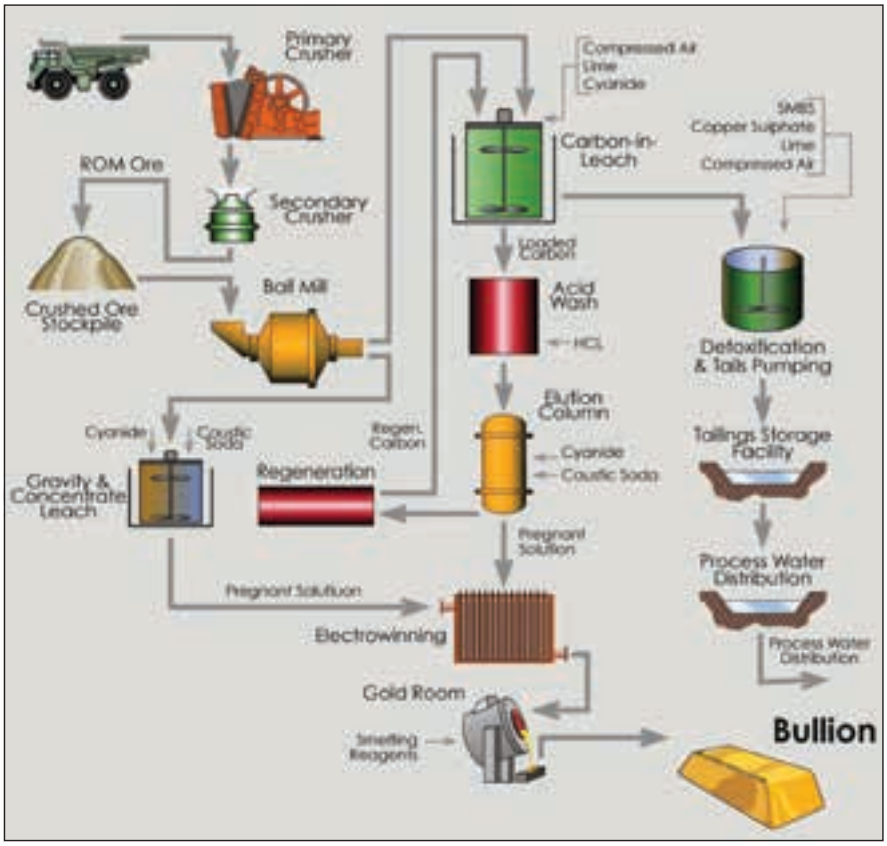
"Additionally, the plant has been designed with the ability to further increase capacity to 1,5 Mt/a. With so many indicated ounces outside the mine plan at nearby deposits and high-grade underground potential at Gonka, the company believes there remains significant production upside at Yanfolila."

The project has undergone an extensive amount of development since the last technical update given in June 2015. This work has focused on maximising the returns of the project, an ability to withstand a sustained low gold price environment and satisfy the independent technical consultants undertaking due diligence on behalf of Taurus Funds Management.

Announcing the maiden ore reserves is the first step to finalising an updated mine schedule and economic analysis for the project. Increasing the plant capacity to 1,24 Mt/a from the previously reported 1 Mt/a (Optimisation Study, March 2015) has increased annual gold production and improved the ability of the plant to process fresh ore material.

The processing route has been modified to handle greater volumes of fresh material and now includes a conventional two-stage crushing circuit. Significant work has been done on ore stockpiling to enhance the mine schedule. Average recoveries show 94 % recovery in oxide, 92 % in transitional and 91 % in fresh material.

Hummingbird says that detailed due diligence on the project and technical improvements have taken longer than was anticipated by the company – a function of the revised plant flow sheet and economic assumptions in a declining gold price environment. It stresses, however, that the project itself continues to improve in all areas and that the construction time remains constant. The extended due diligence period will have a knock-on effect to first gold pour and this will now most likely occur during 2017. ■



The new process flow sheet for the Yanfolila project.

Update on BMR Mining's Kabwe tailings project

In our October issue on page 5, we published a news item entitled 'Peer Review validates process route for Kabwe project'. This stated that BMR Mining, which is developing the Kabwe treatment project in Zambia, had entered into an agreement with Sable Zinc Kabwe, a subsidiary of Glencore, in respect of land adjacent to BMR's tailings dump and certain key items of equipment. The intention was that BMR Mining would lease the land from Sable Zinc Kabwe and site its pilot plant on it.

While our news story was correct at the time of going to print, BMR Mining has subsequently decided to construct its plant on land owned solely by Enviro Processing Ltd, Kabwe (EPL), its wholly owned subsidiary, and we have been asked to point this out to readers. As a result, BMR Mining will not be proceeding with the leasing of land and equipment from Sable Zinc Kabwe. ■

Wits School of Mining Engineering notches up a new record

The School of Mining Engineering at the University of the Witwatersrand reports that it awarded seven doctoral degrees in 2015 – a record surpassing previous years' achievements.

"This achievement indicates the School's commitment to our strategic goal of raising research productivity, which aligns with the Wits Vision 2022 of being a global top-100 university within the next seven years," said Head of School Professor Cuthbert Musingwini.

Kenneth Rhodes – known to many as the 'father of hardrock mechanisation' in South Africa – focused his DEng on the implementation of mechanisation efforts in gold and platinum mines between 1983 and 2008.

PJ le Roux's thesis investigated instability in open stope mining, developing a new design criterion to calculate, with certainty, the stability of open stopes.

Hennie Grobler, Head of the Department of Mine Surveying at the University of Johannesburg, proposed an alternative method of mine surveying to improve the safety and accuracy of primary survey network control in a narrow tunnel environment.

Bekir Genc, senior lecturer at the Wits School of Mining Engineering, used his PhD to understand how mine planning software can be utilised strategically for optimal benefit – developing a methodology for evaluating the use of this software and predicting future utilisation.

Seen here at a breakfast held to celebrate the award of the seven doctoral degrees are (standing, left to right) Gafar Oniyide, Markus Mathey, Victor Akinbinu and Dr Bekir Genc and (seated, left to right) Dr Halil Yilmaz, Prof Emeritus Dick Stacey, Prof Emeritus Huw Phillips, Prof Cuthbert Musingwini (Head of School), Kenneth Rhodes and Prof Fred Cawood.

Victor Akinbinu conducted research into the links between fragmentation and brittleness of Class II rock types, and successfully proved the relationship that will find application in blasting design in mining and civil construction work.

Markus Mathey conducted research into the strength of coal mining pillars at high width-to-height ratios, demonstrating that while an exponential strength increase may be applicable to other rock types, it cannot be justified for coal; he argued that application of the largely theoretically-based formula currently in use in South Africa should be discontinued.

Gafar Oniyide earned his PhD by investigating the increasing rock temperatures that arise with deeper mining operations; his thesis improves the understanding of the mechanical response of rock masses under high temperatures and stresses, as well as mining-induced cooling around excavations. ■

Jubilee executes agreement to process Hernic tailings

Jubilee, the Mine-to-Metals company, has announced the execution, on 15 December 2015, of a 'Co-Operation Agreement' with Hernic Ferrochrome on the turning to account of the platinum containing surface chrome tailings currently stockpiled and generated by Hernic to produce chromite and PGM concentrate.

"I am delighted that we have concluded this final agreement and we are honoured to be appointed as exclusive partner in what will be the largest PGM beneficiation plant of surface chrome tailings in South Africa," comments Jubilee's CEO, Leon Coetzer. "The Jubilee team is looking forward to moving from design into implementation."

The agreement replaces the heads of agreement, as announced on 19 January 2015, in terms of which Jubilee was selected as the exclusive party to beneficiate the chromite and PGMs contained in the Hernic surface material. Hernic is the world's fourth largest integrated ferrochrome producer with an estimated 3 million tons of platinum containing material at surface and continues to add further material to the surface stock.

The project is the second of Jubilee's platinum projects, the first of which is to be commissioned in early Q1 2016. The company has targeted a combined processing of platinum containing surface material over the two projects in excess of 900 000 tons per annum.

The agreement appoints Jubilee as the exclusive party to beneficiate the chromite and PGMs contained in the Hernic surface material and addresses the project execution methodology, as well as the operational and financial performance targets.

The Hernic surface material has been independently fully drilled and assayed for chrome and PGM content. This has resulted in an independent resource statement of 1,7 million tons, of which approximately 90 % of the resource is classified in the measured category under the internationally recognised SAMREC code. Hernic also has access to secondary surface stocks, which it has internally identified, and could increase the surface stocks to in excess of 3 million tons through further drilling programmes. The total project is estimated to contain in excess of 224 000 (3PGM + Au) oz.

The project will be capable of producing annual revenues of £18,2 million at an average metal basket price of US$906 per (3PGM + Au) oz. ■

MDM Engineering is a minerals process and project management company that sets itself apart from the rest. Our technical team has the experience to design and build cost-effective, functional and efficient plants, across a range of minerals.

MDM ENGINEERING

MDM Group
Le Montaigne
De Grande Bretagne
Monte Carlo

MDM South Africa
2nd Floor
382 Jan Smuts Avenue
Craighall, Johannesburg

Tel: +27 11 993 4300
Fax: +27 11 886 9306
Email: info@mdm-engineering.com
www.mdm-engineering.com

amec foster wheeler

Part of the Amec Foster Wheeler Group

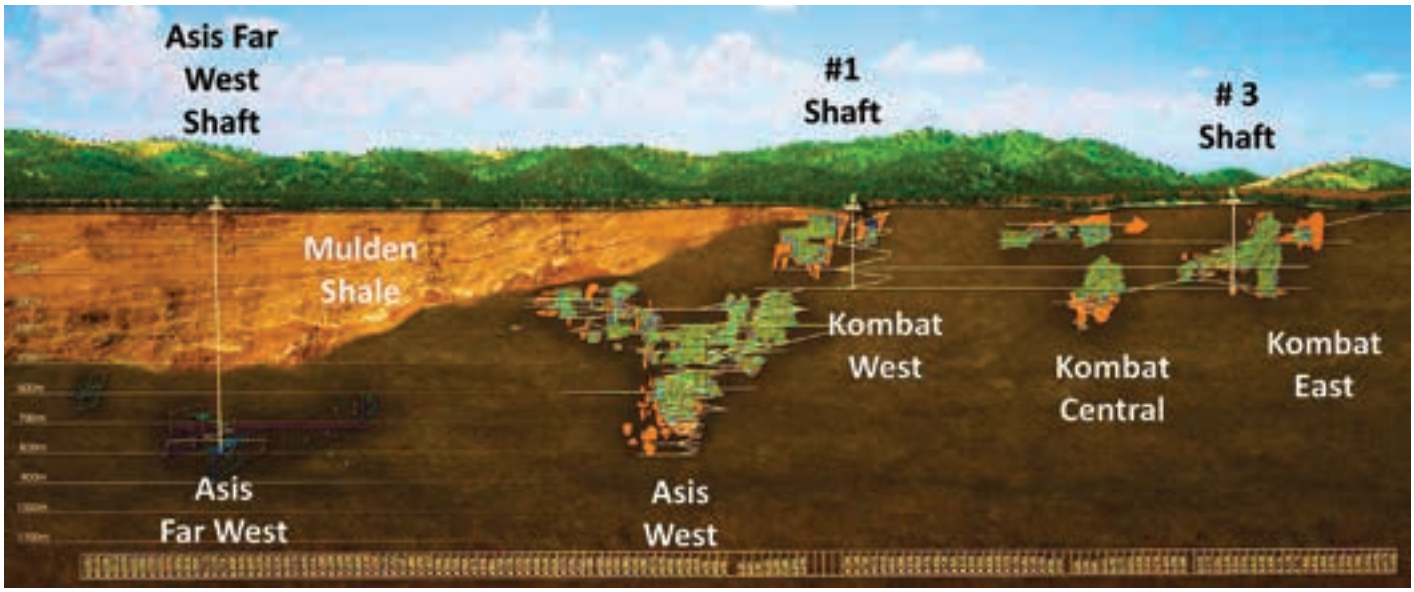
Agreement envisages lead production at Kombat

Kombat Copper Inc, listed on the TSX-V, has signed a Memorandum of Agreement with a Namibian-based company to fast track scaled production of lead mineralisation from the Kombat mine in northern Namibia. A due diligence period is in effect.

Bill Nielsen, President and CEO of Kombat Copper, commented: "This agreement represents a positive step forward for the company in what has been a challenging sector leading to a low commodity price environment. We will benefit from this partnership as we now have the potential to start generating income from the Kombat property as our partner starts a scaled mining approach while we support the project with our extensive infrastructure and knowledge of the Kombat deposit.

"It will also be setting the stage for the company to be in a sound financial position to enter detailed technical engineering studies on other areas of the Kombat mine. As well, this agreement maintains activity on the mine site, facilitates our mining licence and brings local employment and labour to the area."

Kombat Copper expects that its partner will focus on the Kombat East area looking at both underground and surface mining of known occurrences of significant lead mineralisation. They will also be assessing the Gross Otavi deposit located 10 km to the west of the Kombat mine. The Kombat East area has shaft and ramp access, which will allow for a relatively quick start up of operations. The Kombat mill is to be refurbished by its partner to produce lead concentrates. ■



A section through the Kombat mine. Kombat Copper expects that its partner will focus on the Kombat East area looking at both underground and surface mining of known occurrences of significant lead mineralisation.

West Africa back to business at WAMPEX 2016

The West African Mining and Power Exhibition (WAMPEX) and Conference 2016, an international expo for suppliers of equipment, technology, services and consumables to West Africa's rapidly growing power and mining sectors, is to take place from 1 to 3 June 2016 at the Accra International Conference Centre in Accra, Ghana.

Held every two years, the last Wampex in 2014 hosted an impressive 140 exhibitors from 16 countries, and the organisers believe the 2016 event could be even bigger.

"West Africa is still one of the biggest and fastest-growing industrial, mining and power generation markets in the world," says John Thomson of Exhibition Management Services, the company which organises WAMPEX (in association with EPI Events and Projects International Limited). "The region has massive gold, copper and iron ore deposits and hundreds of mining projects underway at any given time, all with heavy electricity demands. The Toronto Stock Exchange currently lists about 150 mining projects in the area."

Regional governments, private sector companies, investors and entrepreneurs use WAMPEX as a platform to broaden business links, expand supplier and customer networks and access the ever-growing opportunities in West African countries.

"WAMPEX enables all stakeholders to develop and strengthen relationships, stay up-to-date with the latest products, services and technologies – and sign deals! This extraordinary expo has a successful 22-year history of delivering results," adds Thomson.

"WAMPEX is certainly the largest and most effective business platform available for the mining and power sectors in the sub region," says Sivnesh Kuma, General Manager of Interplast Ghana, which has exhibited at every WAMPEX for over a decade. "In addition, the collaboration between WAMPEX and the Ghana Chamber of Mines gives exhibitors such as Interplast the advantage of direct contact with specific mining projects and the professionals involved."

The Ghana Chamber of Mines is one of several organisations that actively endorse and support WAMPEX. Ghana's Ministry of Energy and Ministry of Lands and Natural Resources, the Minerals Commission of Ghana, the Volta River Authority and the Electricity Company of Ghana are also active endorsers of the event.

Further information is available from Serean at Exhibition Management Services, tel (+27 11) 783-7250, e-mail: *marketing@exhibitionsafrica.com* or from website *www.exhibitionsafrica.com.* ■

Asanko Gold Mine in Ghana starts commissioning

Mills installed at the Asanko Gold Mine (photo: Asanko Gold).

Asanko Gold Inc, listed on the TSX and NYSE, reports that commissioning of Phase 1 of the Asanko Gold Mine (AGM) in Ghana has begun with first gold expected this month (January 2016). Phase 1 is a low cost, long life mine that will produce an average of 190 000 ounces of gold annually at steady state over 12 years.

The crusher was commissioned on waste on December 10, 2015 and ore is now being fed from the run of mine (ROM) ore stockpile in preparation for the commencement of milling operations. Water commissioning of the pre-leach thickener and carbon-in-leach (CIL) circuits has begun. The installation of the mill motors and lining of the ball and SAG mills has been completed and their commissioning with ore was expected in the last week of December 2015, one month ahead of schedule.

Mining operations are performing according to plan and there are now approximately 290 000 tonnes (+30 days steady state production) of ore on the stockpile. The majority of this was mined from resources that were classified as inferred mineral resources encountered during the pre-strip and as such were not part of the Definitive Project Plan (DPP) announced on November 13, 2014. Over 90 000 tonnes of this ore has been stockpiled separately with an average grade of 2,16 g/t gold.

The main Nkran mineral reserves are now being opened up as the pre-strip nears completion and approximately 1,2 Mt of ore have been further delineated by RC grade control drilling. The grade control model is comparing well to the mineral resource estimate. Grade reconciliation will start following the commencement of ore processing in Q1 2016.

Peter Breese, President and CEO, commented: "We continue to track within our capital budget of US$295 million and have strengthened the balance sheet heading into commissioning against a backdrop of uncertainty for the gold price. We remain confident of our ability to reach commercial production and generate positive cash flows by Q2 2016." ■

Next Graphite receives Aukam sample results

Next Graphite, Inc, a graphite exploration and development stage company operating in Namibia, has announced testing and grading results of a 1 000-kg underground sample from its Aukam property lower adit. Next Graphite's recent rounds of testing and grading have been funded by the company's joint venture with Caribou Carbon Corp (CKR), listed on the TSX-V.

"The 96 % grading from our lower adit aligns with sample grading from the140 000 tonnes of heaps on our property and is representative of what we can immediately mine in our lower adit," states Cliff Bream, CEO of Next Graphite. "The expertise provided to us from our joint-venture with CKR has helped us extract and validate the calibre of natural flake graphite we anticipated."

The test samples were taken as part of a 25-ton bulk sampling programme from the lower adit at the Aukam project. Samples were delivered and tested by Lilhof Enterprises, formerly Gecko Laboratories, of Swakopmund, Namibia.

The Aukam property, which was mined on a small scale for graphite from the 1940s through to the 1970s, is located 50 km south-west of Goageb in southern Namibia. During its years of operation, the Aukam mine produced 25 000 t of graphite. ■

Randgold Resources passes on Obuasi opportunity

On 16 September 2015, Randgold Resources and AngloGold Ashanti announced their intention to form a joint venture to redevelop AngloGold Ashanti's Obuasi mine in Ghana, subject among other things to the completion of satisfactory due diligence by Randgold and the agreement of a revised development plan.

After undertaking the due diligence exercise into the mine and the redevelopment opportunity the mine affords, and following the work undertaken on the revised development plan, Randgold says it has determined that the development plan will not satisfy its internal investment requirements.

Accordingly, it has decided to terminate the investment agreement entered into with AngloGold Ashanti, with immediate effect. ■

Weatherly contemplates expanding Tschudi project

AIM-listed Weatherly International has produced an updated JORC (2012) reserve and resource update for its Tschudi copper mine in northern Namibia. The company has also provided updated mining and processing schedule options for a potential low-cost expansion of Tschudi to produce 20 000 tonnes of copper cathode per annum.

According to the update, Tschudi has ore reserves of 24,4 Mt at 0,85 % copper for 214 000 tonnes of contained copper metal after mining depletion of 8 000 tonnes. This is an increase over the previous reserve estimate of 215 650 tonnes contained copper before mining commenced. Weatherly says the increase in contained copper despite lower copper prices being used for the reserve update exercise indicates the robustness of the reserve to the significant decrease in copper price.

Regarding the mining operation, pit optimisation work has decreased the strip ratio by 10 % from 7,5:1 (waste to ore) to 6,5:1. Weatherly has also issued updated C1 cash costs. The LOM C1 costs are expected to be reduced by 9 % to US$3 865 per tonne of copper cathode while current FY2016 C1 cash costs are projected to be in the range from US$4 250 to US$4 350 per tonne.

Elaborating on the potential expansion of Tschudi, Weatherly says it has identified an opportunity to increase processing capacity from 17 000 to 20 000 tonnes per annum of copper cathode.

Expenditure of approximately US$1,2 million would be required for such an expansion of the processing facilities. This would be required for increased solution pumping capacity, replacement alternative-technology mixers in the solvent extraction plant, and various components of the site electrical systems.

Life of mine scheduling work for such a scenario indicates reduced unit costs over the life of mine due primarily to certain costs remaining fixed despite the output volume increase.

Life of mine operating cost savings obtained from operating at 20 kt/a instead of 17 kt/a are currently estimated at approximately US$10,6 million. Weatherly will now undertake further detailed work to support any potential investment decision, as well as evaluation of funding options. ■

Mining contractor wins major award

MCC, the contract mining and plant rental division of Eqstra, has been awarded a significant new contract with Sedibelo Platinum Mines. The five-year contract commences in April 2016 with a value of R4 billion. The project will utilise an initial R150 million worth of standing equipment.

"This is a significant win for us given the current environment facing the commodity sector and the pressure this has placed on mining firms," comments Justin Colling, Chief Executive Officer of MCC. "I believe our unique approach to shaping our contracts to our clients' needs and partnering with them during these demanding times allows us to deliver the best possible results."

The contract increases MCC's order book to approximately R15 billion. This also reduces the division's excess assets to less than 10 % of its total asset base. ■

Banro has declared commercial production at its Namoya gold mine in the DRC, effective January 1, 2016 (photo: Banro Corp).

Namoya achieves commercial production

Canada's Banro Corporation reports that continuing progress at its Namoya gold mine in the DRC in the fourth quarter of 2015, in particular the sustained production achieved during December when the full mining fleet was operational, has enabled it to declare commercial production, effective January 1, 2016.

Namoya also experienced significantly above average rainfall conditions in the fourth quarter of 2015 due to the arrival of El Nino. Mining activities progressively improved through the quarter as the new fleet made incremental contributions. The Cat 777 mining fleet, which was fully commissioned in early December, moved over 700 000 tonnes of material for the month, as compared with an average of approximately 369 000 tonnes for the first 11 months of 2015.

The commissioning of the larger mining fleet represented the final step toward Namoya being able to operate in a manner consistent with management expectations. With continued increases in mining activity, Banro says it expects that monthly stacking levels will quickly advance to design capacity levels.

Designed as a hybrid gravity/CIL and heap leach operation, the Namoya mine poured its first gold in Q4 2014. The property lies at the southern end of the Twangiza-Namoya gold belt in Maniema Province, 225 km south-west of Bukavu, and consists of one PE (Exploitation Permit) covering an area of 174 km^2.

Alluvial gold was first discovered in the area in 1930 and was mined between 1931 and 1947. Primary gold was also discovered during this period and underground mining on the Filon 'B' deposit began in 1947. Formal mining ceased in the 1960s, only recommencing with Banro's development of the present mine. ■

Senior appointment by Peak Resources

ASX-listed Peak Resources Limited reports that Rocky Smith is joining the company as Chief Operating Officer – Development, effective from 5 January 2016.

Smith was previously the MD of Molycorp's Mountain Pass rare earth complex from July 2009 to August 2015. As such, says Peak, he brings a great depth of practical, specialist and technical rare earth operations experience as the company continues to advance development of the Ngualla rare earth project north of Mbeya in Tanzania.

Responsible for operations at Molycorp's rare earth mining and processing site in California, USA, Smith managed 500 employees and an annual operational budget of in excess of US$150 million. He recruited, developed and led the team responsible for the implementation of the redesigned and expanded Mountain Pass operation. His work included the establishment of sophisticated management systems, the reduction of bottlenecks and the delivery of successful expansions resulting in a 230 % increase in production capacity over three years.

Smith holds a BSc degree in Chemistry and has over 35 years of operations and senior management experience in the mineral processing sector. He is expected to relocate from the US to Perth in Western Australia early in 2016 on completion of work visa requirements.

Comments Darren Townsend, Peak's MD: "We are extremely pleased that Rocky has chosen to join Peak Resources in this vital role. The appointment of an experienced chemical/mining executive of Rocky's calibre is a strong endorsement of the technical strengths of the Ngualla project. Rocky joins Peak Resources at a key phase in the project's development as we progress Ngualla through the Bankable Feasibility Study. The unique rare earth operating experience Rocky brings to the team is another important building block towards a successful operation. 2016 will be an important year for the project and the company and we look forward to continuing to deliver key project milestones."

Ngualla is a large high grade rare earth deposit, particularly rich in the high growth magnet metals neodymium and praseodymium. Peak has appointed AMEC Foster Wheeler as the lead engineer for the study. ■

South Africa to host Geological Congress

South Africa will be hosting the 35th 'World Cup of Geosciences' in 2016, the prestigious International Geological Congress (IGC), which is generally regarded as the most important activity of the International Union of Geological Sciences (IUGS). The South African event – which is expected to attract several thousand delegates – will take place at the Cape Town International Convention Centre from 27 August to 4 September 2016.

The Council for Geoscience, together with the Geological Society of South Africa and other collaborators from academia and industry, is currently spearheading the preparations for the 35th IGC in South Africa.

The objectives of the IGC are as follows:

- ❏ Contribute, in collaboration with and under the sponsorship of the IUGS, to the advancement of fundamental and applied research in the geological sciences.
- ❏ Provide a general assembly of geoscientists, spanning a wide range of geoscience disciplines, where ideas and information can be freely exchanged.
- ❏ Emphasise the geological specialities or challenges of the host country or region.
- ❏ Provide the opportunity, by way of geological excursions, to examine geological problems and features in the field.

Only two of these prestigious conferences have been held in Africa before. The first was hosted by South Africa in Pretoria in 1929 and was instrumental in advancing the study of geology and the earth sciences in South Africa and on the continent. The other was held in Algeria in 1952.

Delegates will have the opportunity to participate in a number of pre-congress and post-congress field trips, many of them into Africa. One of the 'flagship' field trips will be 'The Great Southern African Train Geo-Safari'. Directly after the congress, the luxury Shongololo Express train will depart from Cape Town and will arrive at Victoria Falls (Zimbabwe) seven days later. En route there will be geological and general interest day excursions to a variety of sites in South Africa and Zimbabwe.

Further details are available from website *www.35IGC.org*. ■

Bauba halts operations at Moeijelijk chrome mine

Bauba Platinum says the last quarter of 2015 saw the market price of chrome ore experience severe pressure with the price dropping from US$175 to US$120 per tonne.

The adverse changes in the chrome ore market, specifically those pertaining to price, have resulted in the company's chrome project becoming financially unviable at present. As a result, the board of directors of Bauba has decided to cease current operations and place the Moeijelijk mine under care-and-maintenance with effect from 11 January 2016.

The mine is located on the Eastern Limb of the Bushveld Complex. ■

Industrial strike action. Lost time due to rain. Project delivered 6 months ahead of schedule.

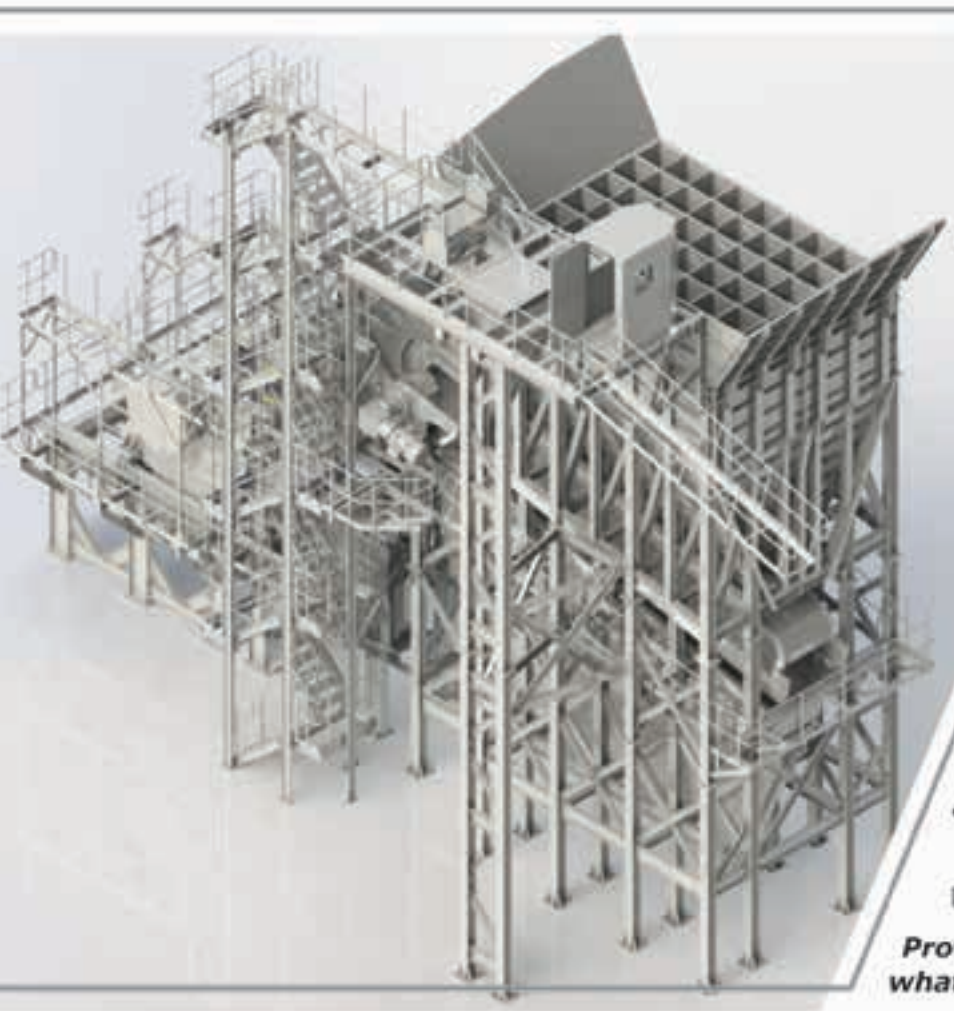
Impossible? Not for DRA.

Not only did our Tweefontein Coal Project achieve unbelievable safety statistics, by using a virtual construction simulation process, we were able to cut down on our actual construction procedure and deliver six months ahead of schedule, fast-tracking our client's revenue stream. Beyond all the obstacles, it's just another possibility realised by DRA.


100102 Hitchcock Michalski
DRA
Extraordinary Possibilities

Providing Superior Plant & Engineering Services

We have 40 years worth



B&E International *Plant & Engineering Services* offers turnkey design, manufacture and operation of mineral processing plants for the mining industry, both locally and internationally.

What we do best:

- Mineral processing plant design
- Performance optimisation of existing mineral processing plants
- Project management for mineral processing plants
- Contract/Sub-contract management and administration of mineral processing facilities

Providing Superior Services. Isn't that what you'd expect from the experts?

B&E international

93-94 Maple Street, Pomona, Kempton Park, 1619
Telephone: +27 11 966 4300
Kenneth Basson: +27 82 603 7183
www.beinternational.co.za

crushing | mining | mineral processing

Providing Superior Services

Kibo Mining advances Mbeya project

Kibo Mining has announced that it is busy finalising a Memorandum of Understanding (MOU) with Tanzania Electric Supply Company Limited (TANESCO) on a Power Purchase Agreement (PPA) for the Mbeya Coal to Power Project (MCPP).

Over the past twelve months Kibo says it has been engaged in a very constructive dialogue with TANESCO and the Tanzanian Ministry of Energy and Minerals (MEM). During this process the parties identified an agreed set of principles to guide and direct the development of a PPA for the MCPP. These principles seek to recognise, balance and protect the interests of all MCPP stakeholders in a manner that ensures that the best interests of the MCPP are served at all times.

Louis Coetzee, CEO of Kibo Mining, said: "The MCPP continues to make significant progress, with this latest breakthrough being one of the most important milestones in the development of the MCPP to date. Finalising critical commercial arrangements on the MCPP – to ensure optimal value creation and realisation on the company's flagship asset – is crucial at this stage of the project's development. This announcement also shows that the company is diligently and successfully attending to the MCPP's key commercial development objectives. These efforts are in turn strongly supported by the ongoing technical feasibility work that is rapidly advancing in parallel."

Kibo Mining is listed on the AIM market in London and the AltX in Johannesburg. The company is focused on exploration and development of mineral projects in Tanzania, and controls one of Tanzania's largest mineral rights portfolios. It holds a thermal coal deposit at Rukwa, which is the basis of the MCPP. ■

Diamcor installs XRT technology at diamond operation

Diamcor Mining Inc, listed on the TSX-V, has announced the installation of a deposit-specific crushing circuit, along with Tomra XRT diamond recovery technology, for the processing of material in the +26,0 mm size fractions at its Krone-Endora at Venetia project in Limpopo Province.

The selection and installation of this equipment is aimed at achieving the effective liberation of oversized materials, while reducing the potential breakage of larger diamonds through a selective crushing system. The Tomra system was chosen – says Diamcor – based on its demonstrated operational benefits and the exceptional results demonstrated at various other projects testing and using this new diamond recovery system.

The Tomra XRT diamond recovery technology provides the added benefit of being a 'dry system', and thus does not require water like many other X-ray final recovery systems. The company believes this technology may ultimately enhance overall processing capacities, increase efficiencies, and is the optimum solution for the effective treatment of the oversize material at the project.

The initial installation of this equipment will enable it to operate independently from the current processing underway at the project, thereby providing for an incremental analysis of the benefits of its utilisation for a period of approximately 90 days. ■

BME primed to deliver

Joseph Keenan, Managing Director at BME.

Although it has for long been an excellent performer within the JSE-listed Omnia Group, explosives supplier BME – like all its peers – is starting to feel the effects of the recession in mining. BME's newly appointed MD, Joseph Keenan, is not overly concerned. "We're still profitable and still in excellent financial shape," he says. "The commodities downturn is a given and beyond our control but we are addressing the current challenges of the market with a range of initiatives which are increasing our efficiency and productivity and the quality of our product and service offering to customers."

The impact of the sharply reduced activity in mining was revealed in Omnia's recently released interim results for the six months ended 30 September. While Omnia's Mining division (which consists of BME and Protea Mining Chemicals, with BME being much the bigger of the two companies) recorded an operating profit of R305 million, this was 28,1 % down on the R424 million achieved in the equivalent period in FY2014. The revenue of the mining division over the six-month period was R2,2 billion, a 16,1% drop over the equivalent 2014 figure, while volumes were 21 % down.

"The results turned in by the Mining division were extremely creditable given the state of the market and we're still on track to deliver reasonable results for the full year," comments Keenan. "But there's no denying that times are difficult and that there is little relief in sight. Our view is that the mining sector globally will continue to struggle – certainly in the short term and probably in the medium term as well. Nevertheless, we remain very positive in BME. We believe that we are maintaining – and in

ANCN storage tanks for BME's emulsions production.

some areas increasing – our share of a declining market and we have a firm strategy in place to cope with the downturn."

Keenan, a Canadian, has only been with BME for a few months, having taken over the reins from his well-respected predecessor, Francois Hay, in September 2015. He has a BSc Geology from Laurentian University in Canada, an MBA from Edinburgh Business School in the UK, and has completed post-graduate programmes at Insead (at its Singapore campus) and Harvard Business School in the US. His background has primarily been in either the explosives or petro-chemical industries, with his most recent appointments having been with Columbine Group in the US, Pacific Hydro in Australia and Orica in Chile.

Although he has carried out assignments in Africa in the past, his present position with BME marks the first time he has been permanently positioned on the continent. Already he is impressed by what he has seen. "I've noticed a tendency on the part of South Africans to downplay their achievements and to assume that they're followers rather than leaders in terms of technology," he says. "I think they're selling themselves short. Certainly if we look at the field of blasting and explosives, South Africa is at the forefront of developments and I've seen innovative and effective products and systems at BME which I've seen nowhere else in the world."

Outlining BME's current strategies, he says a prime area of focus is customer engagement. "We've been speaking to our customers to gauge what they want from us and the message we're getting is that they want to have a risk-free relationship with their explosives supplier," he notes. "Many of them are either big companies, which have cut-back on their in-house technical capability as a result of downsizing and no longer have any significant expertise internally when it comes to blasting, while others are junior companies too small to have had any blasting expertise in the first place. Increasingly, they are looking to companies such as BME to fill the knowledge gap. We've always been strong on the technical support we can offer but now we're going to put an even greater emphasis on it.

"Our blasting services group, headed by Tony Rorke, has a world reputation and we also have best-in-class tools that we can deploy to ensure that we achieve real downstream benefits for our clients. There are a number of companies who can put explosives in the ground but customers want more than this and BME is primed to deliver."

AXXIS offers two-way communication between the blasting box and detonators.

Keenan notes that another point to emerge from its customer-facing strategy is that there is a need for consistency of service. "We have taken up this particular challenge and we are determined to ensure that the BME experience for customers is the same, regardless of their size or their geographic location. They're looking for a certain outcome and we must be up to the task of delivering that outcome, over and over again, whatever the challenges we ourselves face."

He adds that just as BME is looking outwards to its customer-base, so too is it engaging internally with its own employees. "They're one of our greatest assets with a vast collective experience which we can tap into," he explains. "So we're asking them how we can be a better company. We want them to drive the company forward and this process has already started."

Staying on the theme of efficiency, Keenan points out that BME invested R200 million into automating its bulk emulsion plants and its detonator assembly facility in FY2015. "Many companies cut back on investment during a downturn but we see it as essential," he maintains. "We need to be lean and trim and automation also drives improved quality."

Reviewing BME's technology lineup, Keenan says the company is looking in particular at increasing the market penetration of its AXXIS® digital initiation system which – used in conjunction with BME's industry-leading BlastMap™ software – is capable of achieving high accuracy blasts that far exceed anything that can be achieved using traditional non-electric detonator designs. "Many of our competitors have digital systems but I think AXXIS stands out due to its intuitive interface which makes for ease of operation. We find that once a mine has adopted the system, its personnel – after training by BME – find it easy to use without the need for any 'hand-holding'.

"We've been speaking to our customers to gauge what they want from us and the message we're getting is that they want to have a risk-free relationship with their explosives supplier."

WE'LL TAKE CARE OF IT

With our innovative and quality products.

Komatsu is a leading international supplier of earth moving equipment, parts and services to the **mining, construction and utility markets.**

DRIVEN BY YOUR SUCCESS

PARTS | SERVICE | PRODUCTS | MACHINE MANAGEMENT

KOMATSU

Komatsu South Africa (Pty) Ltd,
Cnr Diesel and Isando Roads, Isando.
Tel: 011 923 1000 | Fax: 011 923 1111
Customer Care Line: 0860 566 2878
www.komatsu.co.za

Our philosophy is that there's no point in us developing sophisticated technology if it's too complicated for the customer to use unassisted."

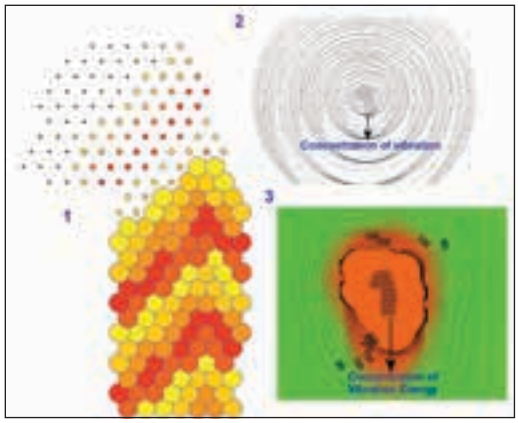
While there has been an excellent take-up of AXXIS in the African mining industry, the technology is also making market inroads in Australia (where BME has a JV with an Australian partner). A major Australian coal producer – noted for its demanding standards – recently awarded the JV a 12-month contract to supply AXXIS detonators.

In an illustration of AXXIS's abilities, a coal mine in Queensland on 11 December 2015 achieved what is believed to be a world record for the largest single remote initiation shot with electronic detonators. A total of 5 665 AXXIS detonators were utilised in 2 683 blast holes. The blast was designed in BlastMap III utilising vector timing and two points of initiation and in excess of 2,4 million cubes were blasted in this single shot.

BME also has an AXXIS joint venture in Colombia in South America while in Singapore the AXXIS system has recently been deployed on a contract – which requires blasting with the least possible vibration – for the city's rapid transit system.

In another technological breakthrough, Keenan mentions that BME is now using drones, 3D photos and GPS to take the field of blast design further. Working in a number of South African mining operations (in collaboration with US expert Robert McClure of RAM Inc and Terracam), BME has been combining these technologies to more effectively quantify blast parameters including drilling quality, block geometry, back damage, heave profile and fragmentation evaluation. "The deployment of this technology illustrates BME's willingness to embrace innovation and new thinking," says Keenan.

BME is also making progress in the underground field, particularly with its recently launched underground mobile pumping system, which brings the benefits of emulsion blasting to narrow reef environments. "Traditionally, BME has derived the bulk of its turnover from the opencast mining field – and indeed we believe we are the largest supplier in Africa in this market," states Keenan. "Nevertheless, we are making steady inroads into underground mining and have all the technologies in place that our competitors can offer. We've had some good orders recently from the gold, platinum and diamond sectors and are excited by the progress we're making. We're the smallest of the 'Big Three' in South Africa in terms of the underground market but our market share is definitely increasing."



Above: *AXXIS' flexibility together with BlastMap allows blast practitioners to design a blast according to accurate and finely-timed parameters.*

Left: *BlastMap, a powerful, easy-to-use blast design software package. This is an example of the timing simulation and concentration of vibration energy.*

He adds that in 2015 BME commissioned a record-breaking 318 m vertical pipeline at a South African mine to deliver emulsion to the underground workplace, replacing the more cumbersome system of transfer cassettes.

Finally, and on the subject of geographic diversification, Keenan says that Africa remains the focus for BME. "We are, as I've mentioned, pushing AXXIS into selected overseas markets and will continue to internationalise the system while in Indonesia we are offering a full bulk emulsion service which is proving very successful and could lead to our testing other overseas markets," he says. "But our focus remains Africa.

"We are unquestionably one of the continent's leading explosives suppliers and we intend maintaining this position going forward. At the moment, mining across the continent is depressed but the long-term outlook for the African mining sector is incredibly positive. We have a footprint – and a reputation – that extends across the continent and are well placed to take maximum advantage of the upturn when it comes, as it surely will." ■

World Class

Manufactured in South Africa

WEG TRANSFORMERS AFRICA

5 x 1 600 kVA 11 kV/433 V and 1 x 2 000 kVA 11 kV/720 V Transformers Export to Ghana

Local Manufacturer of Transformers and Mini-Substations

- **Custom Designed Oil Filled Transformers**
  Distribution 100 kVA to 3 150 kVA
  Power 3 150 kVA to 40 MVA up to 132 kV
  Windings: Copper or Aluminium
- **Transformer Repairs and Maintenance**
  Up to 100 MVA 132 kV
- **Mini-Substations**
  Enclosure Type A, B and C
  Up to and including 2 000 kVA 22 kV
  (specials up to 33 kV for the African market)

WEG Global Manufacturing Operations

- Custom Designed Oil Filled Transformers
- Power 40 MVA to 350 MVA up to 550 kV

100 MVA 132 kV Testing Bay

Newly Commissioned Vacuum Drying Oven

Mini-Substations

011 827 3458
info@wegtransformersafrica.co.za

ZEST
WEG Group

US$412 million **invested in Kamoa**

Robert Friedland, Executive Chairman of TSX-listed Ivanhoe Mines, and Lars-Eric Johansson, CEO, recently announced the completion of the investment by China-based Zijin Mining Group Co, Ltd in Ivanhoe's Kamoa copper project in the DRC. Kamoa is located west of the town of Kolwezi in Katanga.

Representatives of Zijin Mining view the Kamoa boxcut in November 2015 (photo: Ivanhoe Mines).

Zijin, through a subsidiary company, has acquired a 49,5 % interest in Kamoa Holding Limited for a total of US$412 million in a series of payments. These funds will be paid into Ivanhoe's corporate treasury and will be utilised by the company for general corporate purposes.

The Zijin investment, combined with Ivanhoe's cash, cash equivalents and short-term deposits, will make a total of approximately US$530 million, exclusive of current liabilities, available to advance Ivanhoe's tier one projects in South Africa and the DRC. Of this total, approximately US$61 million is reserved for use at Ivanhoe's Platreef project in South Africa.

Kamoa Holding is an Ivanhoe Mines subsidiary that presently holds the company's interest in the Kamoa project. Ivanhoe has also sold 1 % of its share interest in Kamoa Holding to Crystal River Global Limited, which is operated from Hong Kong.

"It is satisfying to complete this transaction with Zijin amid these interesting market conditions," said Friedland. "Our partnership with Zijin will allow us to develop Kamoa into a major, tier one copper mine at a time when conditions in commodity markets are compelling virtually all others to run in the opposite direction.

"When the consistent, downward trend in head grades at the world's major copper mines is combined with the current drastic curtailment in exploration and development spending, as well as cutbacks in sustaining capital, we are highly confident we will see a significant copper-supply deficit and a sharp rise in copper prices as this decade draws to a close – at approximately the same time as we expect Kamoa to begin decades of commercial production. The old adage again is proving to be very true: The best cure for low prices is low prices."

Johansson added that Ivanhoe was confident that Kamoa would become one of the world's truly great copper mines. "Together with Zijin, we will work hard to ensure that Kamoa provides significant benefits to all of the stakeholders of Ivanhoe and Zijin, as well as for the Congolese people, for generations to come," he said.

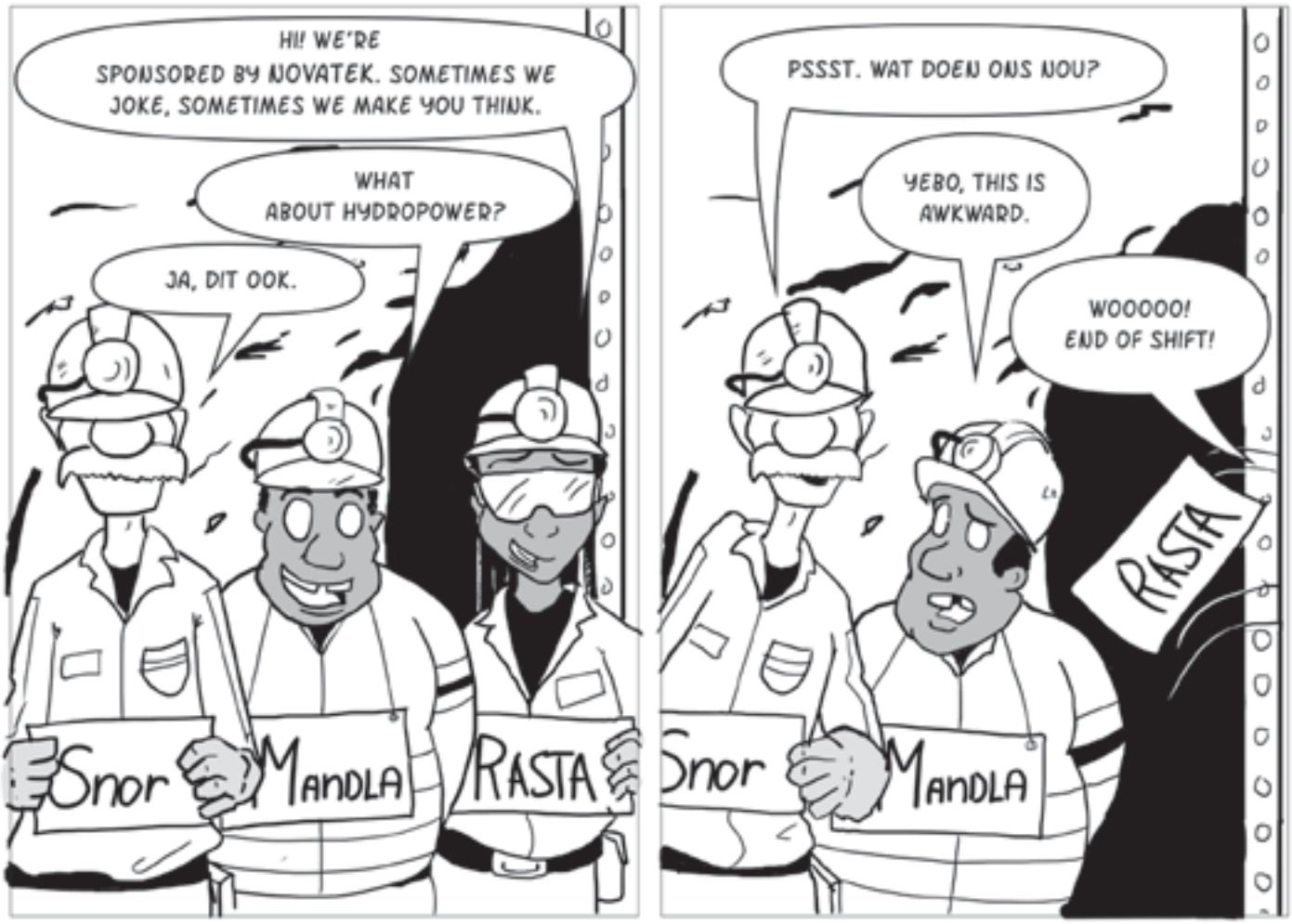
With indicated mineral resources of 739 Mt grading 2,67 % copper, containing 43,5 billion pounds of copper, and inferred mineral resources of 227 Mt grading 1,96 % copper, containing 9,8 billion pounds of copper (at a 1 % copper cut off), Kamoa is independently regarded as Africa's largest, high-grade copper discovery and the world's biggest, undeveloped high-grade copper deposit.

The 2013 Kamoa Preliminary Economic Assessment (PEA) presented a two-phased approach to development of the Kamoa project The first phase of mining will target high-grade copper mineralisation from shallow, underground resources to produce approximately 100 000 tonnes of contained copper per year in a high-value concentrate. The Kamoa PEA estimated that the pre-production capital required for Kamoa's first phase of development would be approximately US$1,4 billion.

The proposed second phase will entail a major expansion of the mine and mill and construction of a smelter to produce approximately 300 000 tonnes of blister copper each year.

The Kamoa pre-feasibility study is progressing and the completed report is expected to be finalised in early 2016. ■

The first phase of mining will target high-grade copper mineralisation from shallow, underground resources.



Wesizwe's Bakubung Platinum Mine (BPM), one of WorleyParsons' current South African projects.

WorleyParsons to showcase its skills at **Mining Indaba**

Professional services provider WorleyParsons will be joining mining stakeholders from over 100 countries in Cape Town from 8 to 11 February this year for the annual Investing in African Mining Indaba. Part of the global Worley-Parsons group, the South African operations act as a primary execution hub for mining activities and provide the expertise needed to support full pit-to-port development activities.

Henry Jonker, GM – Minerals, Metals & Chemicals, WorleyParsons RSA.

The company's Mining Centre of Excellence in Johannesburg will be showcasing services reflecting all the mining disciplines and capabilities for developing mining projects, including orebody assessment (encompassing geology and geotechnical assessment), mine design, mine planning, mineral processing, engineering and design, as well as project management, incorporating quality, risk and safety management.

The project delivery company will also be demonstrating its ability to assist in mitigating risks inherent in African projects. "Of course Africa is attractive with all its mineral resources but there is still an element of risk of investing in Africa," says Serge Ngandu, Business Development Africa Portfolio for WorleyParsons RSA. "We can assist in reducing those risks by drawing on our deep level expertise and experience gained over many projects, while also providing technical solutions that will bring projects to fruition quicker, with reduced costs to the customer, as well as addressing environmental issues."

Ngandu cites a feasibility study for an iron ore plant in Mauritania which posed an

Committed to Quality. Committed to You.

Brands You can Trust

Static & Mobile Crushers, Screens & Washing Plants
Trommel Screens • Rock Drills • Rubber Conveyor Belting
Heavy Duty Static & Mobile Barrel Screens
Hydraulic Breakers • Modular Plants
Tracked Telescopic Conveyor Systems • Blockmakers
Excavator Attachments • Recycling Systems
Minerals Processing Plants • Bulldozers
Front-end Loaders • Excavators • Skid-steer Loaders
Backhoe Loaders • Motor Graders
Chain Trenchers • Trenchless Technology
Pneumatic Pipe Bursting Systems • Telescopic Handlers
Compaction Equipment • V.S.I. Crushers

Rugged and Reliable

ELB EQUIPMENT
A Member of the ELB Group

HEAD OFFICE:
14 Atlas Road, Anderbolt, Boksburg
Tel: (011) 306-0700 • **Fax:** (011) 918-7208
e-mail: Elb@elbquip.co.za
Website: www.elbequipment.com

BRANCHES & DEALERS RSA AND EAST AFRICA: BRITS: (012) 250-1565 • CAPE TOWN: (021) 933-2383 • DURBAN: (031) 464-6522 • EAST LONDON: (043) 740-4530
GEORGE: (044) 878-0874 • KIMBERLEY & KATHU : (053) 841-0040 • MIDDELBURG: (013) 246-2312 • NAIROBI: (00254) (0) 20 807-0728 • POLOKWANE: (081) 329-8529

BRANCHES & DEALERS SOUTHERN AFRICA: BOTSWANA: (00267) 240-4320 • LESOTHO (00266) 2831-3926 • NAMIBIA: (00264) 61-234-052
SWAZILAND: (00268) 518-5348 • ZAMBIA: (00260) 212-210-642 • ZIMBABWE: (00263) 448-5771/5

MMD IPSC SOLUTIONS

For over 30 years MMD have been at the forefront of Mineral Sizing and In-Pit Sizing & Conveying (IPSC) technology.

To cater for today's variety of modern mining methods, MMD has deployed successful modular semi-mobile Sizing stations worldwide to take advantage of cost effective short haul truck and shovel operations.

The MMD Atlas 500T transporter is the latest technology from MMD, enabling semi-mobile structures to be relocated both quickly and safely. A transporter can serve numerous Sizer stations and additional plant equipment around the mine providing a cost effective solution to enhance systems availability and productivity.

+27 11 608 4801 **sizers@mmdafrica.co.za**

For more information please visit WWW.MMDSIZERS.COM

Green Mining Solutions
Sizers | Feeders | IPSC

environmental risk to the workers on site, for which the company came up with a technological solution to capture and reduce dust emissions and reduce carbon footprint.

Henry Jonker, General Manager – Minerals, Metals & Chemicals for WorleyParsons RSA, explains that the company is continuously evolving with technology and that it is becoming the norm for all new projects to utilise technical advancements in order to work more efficiently and cost effectively.

"We want to demonstrate to our customers that we can add value by doing things differently through technology, and we encourage them to take more of an intellectual design view which will ensure that a project will be executed in a more effective and quicker way. We are also deploying integrated and intelligent design engineering systems such as SmartPlant on a number of projects, which uses 3D technology to gain intelligence that will streamline efficiencies. For example, for a feasibility study for a new gold mine and plant in Papua New Guinea, we have fully incorporated SmartPlant technology to improve recovery and plant efficiency."

As part of a global project delivery company with expertise in engineering, procurement and construction across multiple sectors including hydrocarbons, mineral, metals, chemicals and infrastructure, Jonkers says WorleyParsons has the advantage of experience in the oil and gas sectors and can apply this knowledge to the mining space to increase the company's ability to execute projects more safely. Furthermore, this multisector expertise and experience means that WorleyParsons can provide a one-stop solution – from geotechnical to associated infrastructure.

"A lot of the new projects in Africa are not necessarily purely mining, but infrastructure work to enable mining activities," says Jonker. "Our ability to work in different sectors, as well as being able to draw on different resources thanks to our global footprint, is a key differentiator for WorleyParsons. We have access to low cost Global Design Centres in China and India, and can easily integrate our international resources as the entire company works on the same platform. A case in point is the Lake Turkana Wind Power Project in Kenya, where we are bringing a combination of local and international knowledge and experience which will establish the biggest wind farm of its kind in sub-Saharan Africa."

Jonker also points out that the company is able to help customers select the right project through Advisian, a WorleyParsons global business providing high level strategic and management consulting services as well as concept and prefeasibility studies across all sectors.

While the bulk of its service delivery is still in South Africa for its flagship projects such as the Shondoni project (coal), the Black Rock expansion project (manganese), the Bakubung Platinum Mine, the Venetia diamond mine and Impala 17 Shaft (platinum), Jonker says WorleyParsons RSA is also working on a number of prestigious projects in Africa, including the DRC, Mali, Tanzania and Mauritania, and expects to see more of a shift in the next two years as more projects in Africa become viable, particularly in the copper, gold, base metals and fertiliser spheres.

Jonker and Ngandu will be part of a local and global WorleyParsons contingent of delegates who will be attending the 2016 Mining Indaba to highlight the company's technological solutions, safety methodologies, environmental considerations and global experience across multiple sectors as key factors in partnering for projects in Africa. ■

Master Drilling to launch new technology at Indaba

JSE-listed Master Drilling (MD), a global, specialised drilling service solution provider to the mining, energy and civil industries, will be using the Mining Indaba as the platform to launch its new Blind Shaft Boring System (BSBS).

MD says it has spent 2015 engineering and perfecting BSBS, which it describes as its solution to mechanising conventional drill-and-blast shaft sinking in hard rock.

The BSBS addresses the need for a safer, faster, flexible and lower cost method to access underground orebodies without existing underground access, and enables production sooner while still providing efficient infrastructure to support life of mine production and logistics.

The system can be used for the establishing of ventilation, rock hoisting and man-and-material shafts in varying sizes between 10 m and 13 m lined diameter, and up to 2 000 m in depth. The system does not require a presink, allowing for the breakaway of levels, simultaneous shaft lining and diameter/depth changes without major modification.

Founded in the late 1980s by present CEO Danie Pretorius and based in Fochville on the West Rand, Master Drilling is thought to be the largest operator of raise borers in the world with its fleet numbering over 100 machines, roughly three times the number operated by each of its two closest competitors. It operates not only in South Africa but also in several other African countries (notably Zambia) and also has a strong presence in South and Central America, a region which accounts for roughly half of its revenues.

Its international arm, Master Drilling International Limited (MDI), recently announced the acquisition of a 40 % stake in a major raise bore drilling operator in Scandinavia, Bergteamet Raiseboring Europe AB, effective 1 December 2015. The deal provides a platform to diversify into the Scandinavian region and brings an additional 18 raise bore machines into Master Drilling's fleet. ■

BARA CONSULTING

Providing engineering support to the mining industry

Bara Consulting is an engineering consultancy established in 2013 by experienced industry professionals to offer high quality consulting and project services to the global mining industry.

The company has a wide range of engineering skills available to meet clients requirements both locally and internationally, which include:

- Mining engineering.
- Geotechnical engineering.
- Ventilation engineering.
- Mechanical engineering.
- Electrical engineering.
- Metallurgical and process engineering.

Jim Pooley
Managing Director SA Office
jim@baraconsulting.co.za
+27 82 373 0796
www.baraconsulting.co.za

Pat Willis
Managing Director UK Office
pat@baraconsulting.co.uk
+44 7810 182 169
www.baraconsulting.co.uk

Waiting for the resources upturn will be too late

Ahead of the upcoming Investing in African Mining Indaba, Roger Dixon and Andrew van Zyl of SRK Consulting urge miners to look beyond the gloom of the current commodities slump and to start planning their next projects without delay. SRK will be one of many companies exhibiting at the Indaba.

Roger Dixon, corporate consultant, SRK Consulting (SA).

According to Dixon, Africa's growing population and its demand for commodities and energy is a positive underlying factor that will promote future economic growth as soon as global conditions improve. "But it will require mining companies to plan now, while investing in skills and technology to improve operational efficiencies and to meet growing challenges such as energy supply and water quality," he says.

Dixon's comments coincide with a recent report from leading management consultancy McKinsey & Company, which argues that declining ore quality and the limited accessibility of new deposits will squeeze mineral supply between now and 2020, potentially driving a commodity-price rebound.

"The commodities likely to be the most severely affected by ore quality decline are copper, gold and phosphate rock," states McKinsey. "We expect the level of geological cost inflation will continue to be the main determinant of cost increase, and that total inflation will average 4-7 % per year going forward."

This forecast would support Dixon's point that – while the commodity cycle is in a downturn – there are many commodities which could see a change in fortunes in the not-too-distant future – catching many companies ill-prepared.

Dixon believes South Africa's mining sector missed out on the last commodity boom due to minerals policy uncertainty and to the reticence of companies to commit to projects early enough.

"It has been a difficult period for most mining companies, and cutting costs has been the order of the day," he observes. "But shareholders are soon going to be asking where their future returns are going to come from, and exactly what plans have been put in place to build their business up again."

Waiting until the recovery is on the doorstep has the danger of placing undue time pressure on the process of planning and building a mine, argues Dixon. Indeed, the reasons for low returns on capital witnessed in the sector include the purchasing of assets in a rising-price environment and the attempt to accelerate projects to take advantage of price-cycle peaks.

"It is imperative that mining companies take a strategic long-term view of their business, so they can invest timeously in well-researched studies and methodical implementation," Dixon continues. "They need to plan for how best to survive the downturns – while also considering how to invest in the future even when revenue is down. Africa is resource-rich and has much to offer the global economy, so the productive capacity of our mining sector must be preserved for better times."

Neither will it be business as usual. There are growing risks to mining projects – from tightening environmental regulations to more mobilised communities – which could frequently lengthen lead-times and complicate the planning process, says Dixon's colleague, SRK principal consultant Andrew van Zyl.

Leveraging technology will be imperative – not just to make mining more efficient but to reduce pollution, conserve water and generate electricity sustainably in remote locations.

"With climate change increasingly on the global agenda, mines will need to become more carbon-efficient, and more electricity could be generated from renewable sources," says Van Zyl. "As population increases and living standards in Africa rise, competition for water in certain areas will also increase between mines and communities."

He adds that mines today are called upon to observe the highest levels of regulatory compliance and technical performance while, at the same time, building robust relationships with stakeholders so they can maintain their 'social licence' to operate – as this has become the most fundamental risk to mining everywhere. ■

"It has been a difficult period for most mining companies, and cutting costs has been the order of the day."

SOUTHERN AFRICA'S TOP MINING

In our regular Top Mining Projects feature we look at projects distinguished by their size, innovation or pioneering spirit. This year we have identified five that meet these criteria. Two are diamond projects, two are copper while the fifth is a new underground coal mine. In contrast to previous years where many were located across border, this year all but one are located in South Africa.

The first of our diamond projects is the new **processing plant** at Petra Diamonds' iconic **Cullinan mine** near Pretoria. The state-of-the-art facility is already in the construction phase and will be commissioned by mid-2017. It will replace the current plant which has been in operation for around 70 years, in the process reducing the 'footprint' of the mine's treatment facilities from around 26 ha to a much more compact 5 ha. To reduce breakage of stones to a minimum, the plant will use autogenous milling and HPGR technology. It will also use XRF (X-ray fluorescence) to replace Dense Media Separation with only the -25 mm material reporting to the DMS circuit. Petra estimates that operating costs will be lowered by as much as R20 to R25 per tonne as compared to the existing plant.

Our second diamond project is De Beers' **Venetia Underground Project (VUP)**, which will see the Venetia mine in Limpopo transitioning into an underground operation by the early 2020s – with the life of mine being extended to the 2040s. The US$2 billion project, said to be the biggest diamond mining project currently underway anywhere in the world, will involve development of around 80 km of shafts, tunnels, chambers, workshops and water and ventilation systems – with this figure rising to 220 km over the life of mine. An innovative approach has been adopted for

PROJECTS

the sinking of the VUP's two vertical shafts, with contractor Murray & Roberts Cementation deploying new shaft-sinking technology developed by its sister company in Canada.

Turning to copper, the first of the two projects we cover is Cupric Canyon Capital's **Khoemacau** or **Zone 5 mine** in Botswana, which will initially support a production of around 50 000 tonnes of copper and 1,4 Moz of silver a year, although the size of the resource is such that this will probably be increased substantially in a further phase of the project. Cupric Canyon is opting for an underground mining approach, which it anticipates will allow it to avoid the problems which bedevilled the neighbouring Boseto open-pit operation, developed by Discovery Metals Limited (DML). With the demise of DML, Cupric Canyon has acquired most of the assets of Boseto, including the 3 Mt/a concentrator, which will be used to treat the Zone 5 ore.

Back in South Africa, another copper project underway is the **Lift II expansion** at **Palabora**, which will provide the mine with another two decades of life via the development of a new block cave. The R9 billion project will deliver a 33 500 t/d operation which will replace Lift I, which produced its first ore in 2001. Lift II will have to deal with virgin rock temperatures of over 57 deg C. Such is the ventilation challenge that over 30 ventilation passes have been planned, with two passes being among the largest in the industry at 6,1 m diameter and 1 200 m deep – from the Lift II footprint to surface. The development of Lift II is involving extensive use of raise boring, with one of the contractors – Master Drilling – deploying its new 120-ton RD8 rig on the project.

Our final project is Sasol Mining's R5,5 billion **Shondoni coal mine** near Secunda, which will replace Middelbult. It forms part of a trio of replacement projects (the others are Thubelisha and Impumelelo) which between them will be capable of supplying Sasol's Synfuels complex with 42 Mt/a of coal.

The Shondoni infrastructure includes a record-breaking (in terms of length) overland conveyor and a 15 000-ton capacity surface bunker, which recently received a commendation in the 2015 Fulton Awards of the Concrete Society of Southern Africa for being "an excellent example of 'hybrid' or 'composite' reinforced concrete structures as the benefits of precast are combined with in-situ concrete."

In another innovation, the winder house for the new vertical shaft was lifted into position on top of the headgear in one piece with the Koepe winders already installed. The lifting and mounting of the winder house was a crucial stage in the surface infrastructure development and required intricate planning due to the high risk implications associated with this extreme hoist and the level of accuracy needed to align the winder house onto the existing headgear. ■

New Cullinan plant will

One of South Africa's oldest and most famous diamond mines is to get an entirely new, state-of-the-art processing plant which will replace the current sprawling treatment complex which dates back to 1947. Petra Diamonds, the owner of Cullinan, estimates that the energy-efficient facility – which will incorporate autogenous (AG) milling and X-ray fluorescence (XRF) technology – will improve revenue per tonne by 6-8 % and will pay for itself within about three years. The cost of the project is estimated at R1,65 billion.

Petra announced the approval for the project in April 2015. The contractor charged with delivering the plant is MDM Engineering and work on site has been on-going over the past several months, although the peak of construction is only due later this year (2016). The plant will be commissioned and enter operation in Petra's H2 FY 2017 (i.e. by June 2017). Orders for all the long lead items – such as the AG mill and the High Pressure Grinding Rolls (HPGRs), which will both be supplied by Polysius – were in place by September 2015.

The current plant, although it has undergone various refurbishments since being commissioned nearly 70 years ago, has become increasingly expensive to maintain due to its age and operational complexity and has required the commitment of significant stay-in-business capex in recent years. Moreover, it is also based on old crushing technology, which Petra believes does not offer the best potential for optimal diamond recoveries.

A feature of the new plant will be a much reduced footprint compared to the existing facility – it will cover just 5 ha compared to 26 ha. This will result in a commensurate reduction of the 'infrastructure' required. For example, only 22 conveyor belts totalling 3 km in length compared to the 151 conveyor belts used at present, which extend over a total distance of 15 km, will be required. There will be only 22 screens compared to four times that number in the existing plant while the number of pumps will reduce from 121 to just seven and electric motors from 589 to 84. Moreover, only two substations will be needed as opposed to 17 currently.

The plant – which will feature a high level of automation and a total 'hands-off' final recovery section – will have a throughput capacity of 6 Mt/a with the initial feed comprising 4 Mt/a of ROM and 2,3 to 2,5 Mt/a of tailings.

The base for the XRL (X-ray luminescence) plant at Cullinan.

boost revenue per tonne

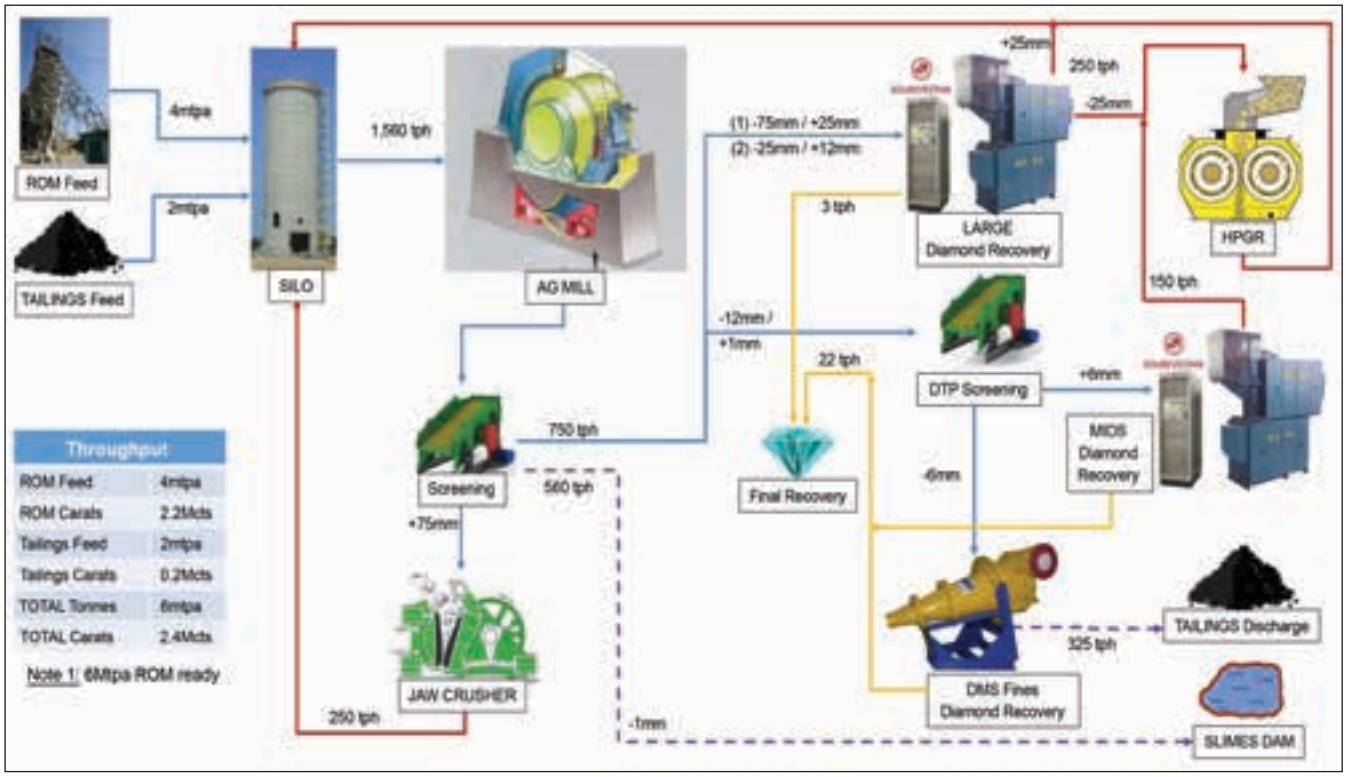
It is expected to improve the recovery of the full spectrum of diamonds and improve the efficiency of the material flow, thereby significantly lowering operating cost by as much as R20 to R25 per tonne. The grade will effectively be increased by approximately 10 % (ROM and tailings). The +1 mm unliberated kimberlite particles in tailings will reduce from the current 60 % to 40 % (post AG mill) while the -1 mm slimes will increase from the current 40 % to 60 % (post AG mill).

One of the guiding principles behind the design of the facility is that it should reduce diamond breakage, thereby increasing revenue from larger/exceptional diamonds. This reflects the fact that Cullinan – which produced the 3 160-carat Cullinan diamond, the largest gem diamond ever recovered, more than a century ago – is known for its prodigious output of large, high quality stones. At the time it was taken over by Petra in 2008, it had produced a quarter of all the world's diamonds greater than 400 carats. The trend has continued since then and significant recoveries under Petra's management have included the *Cullinan Heritage*, a 507-carat stone recovered in 2009 (which was sold for a world record US$35 million); an exceptional 232-carat white diamond in 2014 (which was subsequently sold for just over US$15 million); a 29-carat blue diamond which was sold in the rough for US$25,6 million (a world record +US$860 000 per carat) and which was subsequently cut into the perfect 12-carat *Blue Moon of Josephine* and sold for a world record US$48,5 million; and a 122-carat blue diamond (which was sold for US$27,6 million, with Petra retaining a 15 % share in the polished yield).

The bases for the mills under construction.

To prevent breakage, the new plant will

Simplified process flow diagram of the new Cullinan plant.



The existing plant at Cullinan (seen here) covers 26 ha. It will eventually be dismantled, removed and mostly sold for scrap.

utilise AG milling, which Petra describes as a gentler recovery process that breaks down ore via attrition rather than crushing, and HPGR technology, which employs inter-particle crushing. The +25 mm material will only be exposed to AG milling while the -25 mm material will be liberated through the HPGRs, eliminating the need for high impact cone crushing.

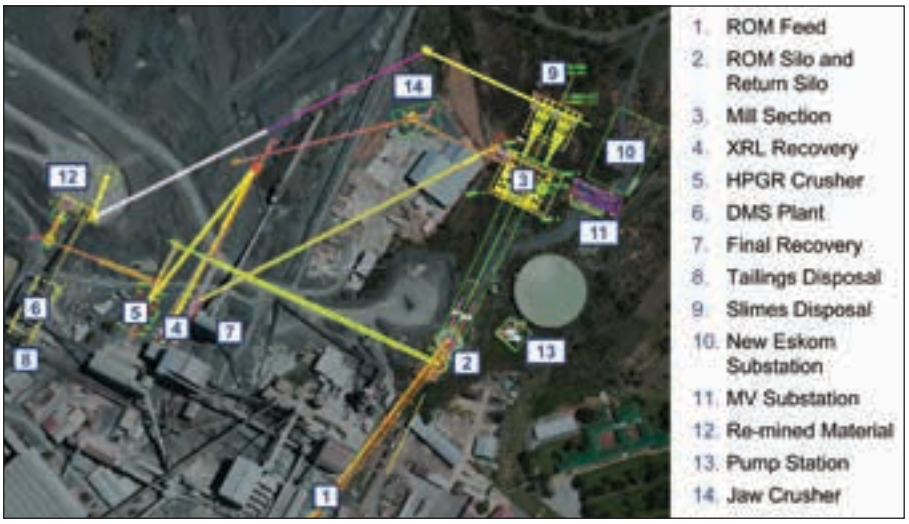
The plant will also make use of XRF to replace Dense Media Separation with only the -12 mm material reporting to the DMS circuit. The XRF machines are being supplied by Russia's Bourevestnik, one of the pioneers in the XRF field.

While some of the technology being deployed in the new plant is relatively new to Southern Africa, it is nevertheless well proven. Jim Davidson, Petra's Technical Director, comments: "AG milling is new to South Africa – and to Petra – but AG mills have been used by Russia's Alrosa for many years and their capability in the processing of kimberlite ore is well established. In Africa AG mills are installed at the Catoca mine in Angola and more recently the technology has been adopted for two diamond projects in Botswana – the new Karowe mine near Orapa and the Ghaghoo mine in the Central Kalahari.

"As regards HPGR machines, they were first introduced at Cullinan more than 15 years ago – in fact, Cullinan was the first kimberlite mine to make use of the technology. XRF is also well proven, both in concentrating and final recovery roles."

The new plant will be extremely energy efficient – Petra estimates that it will deliver a 12 % increased energy efficiency per tonne compared to the existing plant. IE3 Top Premium motors, enabling an almost constant efficiency in the 75-100 % load range, will be used throughout the facility while variable speed drives will drive conveyors and pumps. Motor Control Centres (MCCs) will be equipped with multi-step, low voltage power factor correction units, significantly enhancing the ability to manage current load, and all lighting will be energy efficient. In addition, the use of a gravity-feed slimes disposal system will reduce the need to pump slimes. Total power consumption will be 25 MW compared to the 22,5 MW of the existing plant but the new plant will treat 6 Mt/a as opposed to the 5,3 Mt/a handled at present.

Schematic of the new processing plant.



Water consumption will also improve – by a massive 66 %. Present water consumption is 3,5 m^3 per tonne treated while the new plant will only require 1,2 m^3 per tonne treated.

While 'brownfields' projects can sometimes be problematic, Davidson says that Petra is confident that construction will proceed smoothly. "There are integration

Barloworld Equipment CAT


46 780 HOURS
OF FIELD SERVICE.
Buy a CAT® and get Shaun Harding's
thousands of hours of service expertise.

Barloworld Equipment CAT®

68 640 HOURS OF FIELD SERVICE.

Buy a CAT® and get Richard Ament's thousands of hours of service expertise.

BUILT FOR IT.™

Barloworld Equipment

CAT®

When you buy a CAT, you don't just get the machine. You also get the priceless knowledge of our experienced service team, who can keep your machine running up to three times its normal lifespan.

Our team's knowledge combined with our EMSolutions technology means that we know exactly what's happening with your CAT on a daily basis.

Through EMSolutions data, Richard and his team will be able to prevent any problems with your CAT before they arise, and they will be able to help you improve your productivity and efficiency. Buy a CAT now and get EMSolutions Level 3 for free for the next 2 years. For more details about purchasing a Cat contact 010 040 3283 or visit Barloworld-equipment.com.

Barloworld Equipment CAT

and 'switch-over' challenges which are typically associated with projects of this nature but these are known to us and have been properly planned for," he says. "We do not anticipate any impact on day-to-day operations or throughput at Cullinan while the new plant is being constructed as it is being built separately to the existing plant."

The new processing plant is not the only new investment underway at Cullinan. Petra is also currently busy establishing a new block cave (C-Cut Phase 1) on the western side of the orebody in the upper portion of the major C-Cut resource (estimated to contain some 133 Mct in total). The project is reportedly progressing well, with the first rings in the undercut having been blasted in June 2015, the deepening of the men-and-material shaft completed and the deepening of the ore shaft on track for commissioning during H1 FY 2017 (i.e. July to December 2016).

The C-Cut project, together with a large tailings operation being developed, will take annual production at the mine from 0,7 Mct in FY 2015 to around 2,4 Mct by FY 2019, with 2,2 Mct being derived from ROM and the balance from tailings. Petra's current mine plan extends to 2030 but major residual resources indicate that mine life could be in excess of 50 years. Whatever the case, the new plant will ensure that Cullinan's needs are catered for in terms of processing through to the end of its life.

Photos courtesy of Petra Diamonds

Early stage of construction on the recycle silo.

Canadian-style shaft sinking

What is believed to be the biggest diamond mining project currently underway anywhere in the world, the US$2 billion Venetia Underground Project (VUP) at De Beers' Venetia mine in Limpopo Province, is making excellent progress, as ***Modern Mining's*** *Arthur Tassell recently witnessed on a visit to the site. He spoke to Graham Chamberlain, Project Executive with Murray & Roberts Cementation (MRC), and De Beers' Christoff Kühn, Head of the VUP. The project – MRC's biggest current contract – is seeing the deployment – for the first time in South Africa – of a new shaft-sinking methodology derived from MRC's sister company, Cementation Canada.*

Explaining the background to the VUP, Kühn says the project will extend Venetia's life to 2043. "Venetia mine was opened in August 1992 and ranks as a Tier One mine and De Beers' flagship operation in South Africa, producing 3,2 million carats in 2014," he states. "It currently mines three orebodies – K01, K02 and K03 – via open-pit methods. The open pit is heading towards its economic limits and has to be replaced in 2021 by an underground mine – hence the need for the VUP. The project represents the biggest ever investment by De Beers in South Africa and – very importantly – will ensure that Venetia continues as one of the main employers and generators of economic activity in an area where work opportunities are in short supply."

Projects such as the VUP require years of planning and the first concept study on the development of an underground mine at Venetia was undertaken in 2003. A pre-feasibility study

The steel headgears of the service shaft and the production shaft. They were erected by Genrec using a 750-ton mobile crane (photo: De Beers).

makes its debut at **Venetia**

followed in 2009/10 and a full feasibility in 2011, with board approval for the project being given in late 2012. The construction phase of the VUP was launched in October 2013, when President Jacob Zuma turned the first sod on site. As Kühn points out, "Given that the construction phase extends through to 2021, when Venetia transitions into an underground mine, the entire VUP is almost a 20-year enterprise from concept to commissioning."

De Beers is managing the VUP itself with the assistance of WorleyParsons RSA, which has been involved since the feasibility stage and was appointed as engineering consultant for the project. WorleyParsons RSA was commissioned to execute the detailed engineering design for both the surface and underground infrastructure, as well as provide support to the Owners Project Management Team and Site Project Management Team related to procurement, fabrication, logistics and construction.

Giving an indication of the scale of the project, Kühn says it will involve the development of around 80 km of shafts, tunnels, chambers, workshops and water and ventilation systems – with this figure rising to 220 km over the life of mine. Once in production, the underground mine will produce approximately 96 million carats over its life from the treatment of 130 Mt of ore. The current processing plant on site has the ability to treat this volume of material. Says Kühn: "At the moment, the plant is typically handling 5,5 Mt annually whereas the underground mine will deliver around 5,9 Mt/a to the facility. To cater for this increase, some minor

A Sandvik DD421 twin boom jumbo working in the decline.

Pictured here (from left) are De Beers' Christoff Kühn, Head of the VUP, and Japie du Plessis and Graham Chamberlain, both of Murray & Roberts Cementation.

The portal of the decline. Ultimately the decline will have a length of 7 km.

modification and expansion of the plant will be required but the capex involved is minimal."

The underground resource will be mined by means of the Sub Level Caving (SLC) mining method in the case of the bigger K01 orebody with a modified SLC system being used for K02. The K01 cave will produce 4 Mt/a and the K02 cave 1,9 Mt/a. "The mining methods are conventional and well proven, so there's no pioneering involved," says Kühn. "What could, however, be unusual is the possible use of an automated trucking loop on the lines of what De Beers put in at the Finsch mine in the Northern Cape roughly ten years ago when it owned the operation. We're already in preliminary discussions with a couple of the OEMs on this, although it must be stressed that at this stage the use of driverless trucks is no more than a possibility." He adds that semi-automated drilling is also under consideration.

While a project the size of the VUP will typically have many different contractors, subcontractors and suppliers involved, Murray & Roberts Cementation is handling the lion's share of the work. "Essentially, they're responsible for delivering the project to De Beers in terms of the shafts and underground infrastructure required," Kühn says.

Elaborating, he notes that Murray & Roberts Cementation is responsible for the two vertical shafts the project requires, both 7 m in diameter and 1 080 m deep, one a production shaft and the other a service shaft, as well as a decline for trackless equipment which will ultimately be 7 km long and provide access to 900 m below surface. In addition, the company will undertake horizontal tunnel development to access and establish the two caves and provide associated infrastructure, including two large crusher chambers near shaft bottom.

According to Graham Chamberlain, Project Executive with Murray & Roberts Cementation, the VUP also marks a watershed inasmuch as it is the first project where the Canadian shaft-sinking methodology is being adopted in its entirety.

"We have deployed aspects of the system on some of our other current or recent projects but the VUP will see it being used from start to finish in a systematic manner," he says. "The main motivation for adopting the method is its inherent safety as all activities in the shaft-sinking cycle now occur sequentially. At no point do you have personnel working simultaneously at different levels within the shaft – as you do with conventional techniques – with all the safety risks that this brings and there are fewer people working in the shaft barrel at any one time. Teams are multi-skilled and perform all required tasks. This compares to the old system where you had one crew to drill, another to lash, a third to support and so on. Now we use a single 'super-crew'.

"To develop the necessary skills here in South Africa, we've built shaft mock-ups at our Bentley Park training academy near Carletonville on the West Rand where trainees are given total exposure to both the techniques and equipment – and, importantly, the 'mind-set' – required to implement the Canadian

The high-capacity batch plant serving both the vertical shafts and the decline. It has a capacity of 110 m³/h.

system," he continues. "The facility represents a major investment by Murray & Roberts Cementation but a very necessary one, as the intention is that all the company's future shaft-sinking contracts – and not just Venetia – will be executed using the methodology."

In terms of equipment, the new system involves the use of 'sling down' jumbo drill rigs and vertical shaft muckers (VSMs) accommodated in the sinking stage. The sling-down rigs, apart from dramatically reducing the number of workers required on the shaft floor during drilling, offer greater drilling precision than the jumbo rigs used in the past. As for the VSMs, they are equipped with long, extendable booms with jaws on the end and are operated from the stage in a remote-controlled manner. They will clean the shaft floor faster and more effectively than conventional cactus grabs, at the same time providing far greater safety. The VSMs are also able to manoeuvre the kibbles – which can weigh a ton or more – into position, eliminating the potentially dangerous practice of handling them manually.

Both the drill rigs and the VSMs being used at Venetia were originally developed by a Canadian company, MTI, now part of Joy Global. Each shaft at Venetia will be served by two sling-down rigs and two VSMs and these have already been delivered to site by Joy Global. A further VSM is in use at Bentley Park.

Delivery of explosives has also changed in the new method, with pumpable bulk emulsions being used – a more efficient way of charging holes than the stick-type explosives previously employed. It is expected that the

The Venetia site in October 2015, with headgear erection at an advanced stage (photo: De Beers).

MURRAY & ROBERTS CEMENTATION

IS OUR 1ST CHOICE

MAKE IT YOURS!

Murray & Roberts

Murray & Roberts Cementation

World Class Mining Contractors

www.cementation.murrob.com

SHAFT SINKING • RAISEBORING • DEVELOPMENT • CONTRACT MINING • MINE ENGINEERING

Ventilation system for the service shaft.

sensitised emulsion will give a better break, which in turn will make the task of the cleaning crew easier. For the VUP, the explosives are being supplied by AEL Mining Services.

According to Chamberlain's colleague, Japie du Plessis, Senior Project Manager with Murray & Roberts Cementation, a major advantage of the new sling-down drill rig design is that – once the rig has drilled the blast holes – the stage only has to be raised 50 or 60 m prior to blasting compared to 80 m using a conventional rig. He also notes that the new rigs can drill a burn-cut round (as opposed to a wedge cut), which improves the advance and reduces fly rock.

On the question of whether the new Canadian method will deliver faster advance rates than traditional methods, Du Plessis says the true test will be when the shaft sinking moves into the full sink mode. "The main motivation for Murray & Roberts Cementation in adopting the new approach is that it is much safer than the traditional approach, and our Canadian sister company has in fact delivered an entire shaft without suffering a single LTI," he says. "Having said this, we believe that the method is also potentially faster than the conventional approach and Cementation Canada has demonstrated this on contracts it has undertaken. Certainly we believe that productivity will be higher with fewer workers required in the sinking team."

The Canadian method is not the only innovation in the shaft sinking for the VUP and Chamberlain points out that the pre-sinks on the two shafts were both completed ahead of schedule, thanks to new technology devised by Murray & Roberts Cementation at the request of De Beers. Says Chamberlain: "At the tendering stage for the VUP, De Beers asked that bids should include proposals for achieving greater safety during pre-sink operations without compromising productivity. To meet this requirement our engineers designed a movable gantry system, able to carry and manoeuvre a movable suspended stage, together with a mucking hoist able to roll over and away from the shaft during pre-sink operations. The gantry was installed and tested at our Bentley Park facility before being transferred to the Venetia site."

Using the gantry system – which was operated by a multi-skilled crew – Murray & Roberts Cementation was able to successfully complete the pre-sinks with only half the workers that would normally have been needed.

The main gantry girders were designed to accommodate the loads from the main hoist (used for kibble hoisting and stage suspension), which allowed for a maximum pre-sink of 80 m (an actual depth of 60 m below collar elevation was sunk), as well as the stage winders (used to raise and lower the pre-sink stage). The height of the gantry structure was matched to the height of the stage to enable the stage to clear the collar once raised to the upper limit. Once the stage had been raised in this upper position, the long travel wheel drive motors were energised to move the gantry, complete with suspended stage, away from the shaft, drawing a blast cover over the excavation. When in use,

Wagon unloading stations

For more than 100 years, our customers have benefitted from our unique know-how in the field of bulk materials handling. We supply complete solutions for transporting and handling raw materials in stockyards and port terminals, from individual machines to turnkey plants.

32,000 t/h transshipment capacity

We offer complete wagon unloading stations from single discharge tipplers to quadruple car dumpers with fully automated side arm chargers. In China, we supplied 8 lines of tandem tippler stations, each with 4,000 t/h coal transfer.

Engineering Excellence 3

ThyssenKrupp Industrial Solutions

ThyssenKrupp

info.tkmh@thyssenkrupp.com
www.thyssenkrupp-industrial-solutions.co.za

the blast cover effectively prevented fly rock from leaving the shaft barrel when the blast was set off.

In contrast to the vertical shafts, the 6 x 5 m decline is being developed using standard methods. "The decline – which, like the shafts, is being excavated through very competent rock – has thus far progressed smoothly and we're now 1,2 km in from the portal," Chamberlain observes. "We have, incidentally, adopted our Australian sister company's policy of using highly-skilled machine operators and we've had Australian coaches over here to assist with training. Part of this training takes place at Bentley Park and the machine simulators we've installed there are bench-marked to Australian standards."

The primary mining fleet deployed for the decline comprises Sandvik machines. Two Sandvik DD421 twin boom electro-hydraulic jumbos are used for drilling the face and for rock support and work in conjunction with Sandvik LH514 LHDs and Sandvik 40-t capacity underground haul trucks. The auxiliary equipment fleet – for example, utility vehicles, concrete mixers and shotcreters – includes machines from Getman and Normet. All the equipment is owned by De Beers but operated and maintained by Murray & Roberts Cementation.

Reviewing the progress thus far on the contract and the road ahead, Christoff Kühn says that the VUP is currently on schedule and within budget. "We're pleased at the way the project is unfolding. Soon we will be in the full sink mode which will continue through to 2018 when both shafts will have reached their final depth, when the focus will move to equipping the shafts and lateral development," he says. "By 2021 – when the open pit will have reached its final depth of approximately 450 m – we will be commissioning the new mine and potentially this will be one of the most challenging parts of the project, as there is very limited opportunity to overlap open-pit operations with the start-up of the underground mine. All the options for the transition are currently under intensive study with a view to avoiding a significant dip in production during the change-over."

One of the winders being used in the sinking of the production shaft. The permanent winders for the project – two ground-mounted Koepe winders for the production shaft and a double-drum winder and a single-drum winder for the service shaft – have been ordered from ABB.

Finally, an interesting point is whether the underground mine currently being developed will be the final phase of Venetia. The kimberlite resource extends well below the maximum depth of mining allowed for in the VUP and there is therefore a clear possibility that the mine life could be extended even further. Comments Kühn: "Obviously this is a decision which is years away and which will be taken by the De Beers board and its shareholders at the appropriate time in the light of market conditions and other relevant factors. What I can say with confidence, however, is the mine we are currently creating will be a world-class operation which assures De Beers' future in South Africa for years to come and will produce diamonds for our grandchildren besides, if necessary, providing the platform for a further extension of Venetia's life beyond what is currently envisaged."

Photos by Arthur Tassell (unless otherwise acknowledged)

Khoemacau to put Botswana on

While Botswana has been a copper producer for many years (mainly through BCL's Selebi-Phikwe nickel/copper mine), production has typically been very small, almost insignificant, on a world scale. This is set to change as mines are established in the country's emerging new copper province, the 'Kalahari Copperbelt', which extends from south-west of Maun through to Ghanzi and beyond. The company which can claim prime mover status in this area is US-based Cupric Canyon Capital (Cupric) which – through its wholly owned subsidiary in Botswana, Khoemacau Copper Mining (Pty) Ltd (Khoemacau) – is planning to develop a substantial underground copper/silver mining operation at its Zone 5 site.

Set to come into production in mid-2018, the Zone 5 mine will not be the first mine in the Kalahari Copperbelt. This distinction belongs to the nearby Boseto open-pit mine, developed by Australia's Discovery Metals Limited (DML) that opened in 2012. Burdened by a huge strip ratio of 13 to 1 (this is life of mine average although some mining phases would have been as high as 50 to 1) and challenged by a declining copper price, Boseto failed to meet its ore production targets from the start, leading to it being put on care and maintenance in early 2015. There is now consensus amongst experts that DML – in choosing to adopt open-pit methods – made the wrong decision and that underground mining is the optimal route for most deposits in the area.

Certainly this is the view of Cupric which has been emphatic since 2013 – when it first became involved in the Kalahari Copperbelt after acquiring the assets of Canadian junior Hana Mining – that it would pursue an underground mining solution at its Zone 5 deposit.

When *Modern Mining* last covered Khoemacau in detail a year ago, the company was planning a 10 000 tonne per day (t/d) operation able to produce about 50 000 t of copper annually. While this plan has not changed substantially in the intervening 12 months, the development strategy for the mine and the 'blue sky' potential of the project have evolved considerably as a result of two major developments during 2015.

"The first of these occurred several months ago when we acquired the assets of DML's subsidiary, Discovery Copper Botswana, including the 3 Mt/a Boseto concentrator, the water system, the mine housing estate (at Toteng village) and associated infrastructure, as well as additional ore resources and targets," explains Cupric's CEO for Africa, Sam Rasmussen. "The concentrator probably ranks as the most important of these assets and our intention is to

the map as a copper producer

incorporate it into our Zone 5 project.

"The second development is that we have updated our Zone 5 resource, which now stands at just over 100 Mt of ore in the measured, indicated and inferred categories grading 1,95 % copper and 20 g/t silver. To get to this point we've undertaken one of the most intensive drilling exercises ever seen in Africa with

Top: *The Boseto plant. It was designed to treat 3 Mt/a of 20 % oxide ore and 80 % sulphide ore. The Khoemacau team is confident that – with upgrades – its capacity can be increased to 3,6 Mt/a of sulphide ore.*

Left: *Drill sites at Zone 5. The drilling campaign undertaken last year saw up to 27 rigs on site simultaneously. Although the mineralisation in the Zone 5 area was discovered in 1962, the definition of the Zone 5 resource is almost entirely due to Cupric Canyon. Hana Mining also drilled extensively when it owned the Khoemacau properties but its efforts were primarily focused on the Banana Zone much further south (photo: Khoemacau).*

Right: *Just some of the core stored at the Zone 5 site.*

Above: *Pictured at the Zone 5 core shed are geotechnical engineer Puso Akanyang (left) and Mompati Babusi, acting Operations Manager, Khoemacau.*

Centre: *Another view of the Boseto plant looking towards the ROM pad and primary and secondary crushers.*

up to 27 diamond drilling rigs – sourced from Capital Drilling, Remote Drilling Services, Geosearch and Rotsdrill – on site over the past year. We completed around 70 000 m of drilling in 2015 – which means that, all told, we've now put around 194 000 m of drilling into Zone 5 since acquiring the property. The key point about this new resource – which contains 2 Mt of copper and 64 Moz of silver – is that it will enable Zone 5 to support a much bigger mine than originally anticipated."

Detailing how Cupric will bring Zone 5 to account, Rasmussen says the mine will start off very much as was envisaged a year ago. "In essence, we're looking at a 10 000 t/d 'starter' or phase one operation producing 50 000 t of copper and 1,4 Moz of silver a year – contained in a concentrate grading 42 % copper – from three decline systems along strike in Zone 5 with the ore being treated at the Boseto concentrator. Since this facility is approximately 35 km from the Zone 5 site we will need an ore transportation system. Currently, we are undertaking trade off-studies between the two preferred solutions – road trucking or a rail system – to see which would be optimal for the project."

He adds that the Boseto process plant is entirely suitable for treating Zone 5 ores, provided some circuit modifications are made. "We carried out an intensive due diligence process before acquiring the DML assets and concluded that the concentrator was an exceptionally good facility that worked very well during the period it was in operation," he notes. "Boseto's problems – in our opinion – were all related to the mining approach and had nothing to do with the process plant.

"We've also concluded that the nameplate capacity of the mill can easily be increased from 3 Mt/a to 3,6 Mt/a – or from 8 200 t/d to 10 000 t/d. This is sufficient for the phase one project and means that our capex reduces quite considerably from a year back when we were still contemplating building our own mill for the first phase of Zone 5. In fact, we estimate capex reduces by as much as US$120 million to US$150 million."

The proposed modifications to the Boseto plant will include the installation of a new higher throughput secondary cone crusher, an IsaMill (to enable the fine grinding that the Zone 5 ore requires) and a Larox filter to replace the existing plate and frame filter which is unable to produce a concentrate within the required moisture level. The tailings facility will also have to be expanded. It was designed by DML to take 3 Mt of tailings per annum over a design life of 10 years whereas the new requirement will be 3,6 Mt/a.

Cupric has retained Sedgman, the designer and builder of the Boseto concentrator, as one of its engineering advisers. Along with other professional consultants, Sedgman has contributed to the 'Combined Case' feasibility study which has now been completed. Cupric completed a feasibility study on a standalone project at Zone 5 last year and the Combined Case study essentially updates this to take into account the availability of all the Boseto assets, most importantly the Boseto plant.

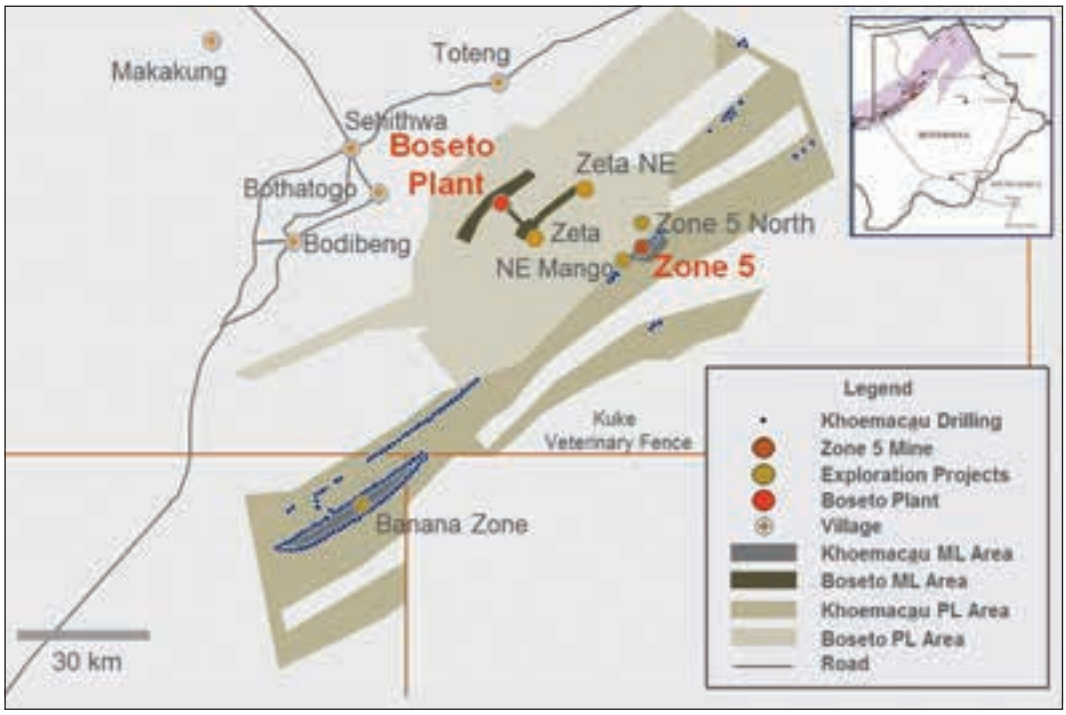
Of course, additional processing capacity is going to be necessary if Zone 5 is to be fully exploited. Says Rasmussen: "Based on our resource and on our recently completed pre-feasibility study, Zone 5 can easily support a

Stewart Wallace (left), acting Operations Manager at Boseto, pictured with electrical engineer Emmanuel Ntshwarang.

production rate of 16 800 t/d – 6,1 Mt/a – and our aim will be to move to this level of production – which would deliver about 89 000 t/a of copper and 2,5 Moz/a of silver – once we have our initial operation up and running and once market conditions warrant it. We are looking at various options that would allow us to achieve the capacity to treat this additional tonnage. One possibility would be to construct a dedicated processing facility at Zone 5, which would then free up the Boseto plant to treat ore from other deposits within the combined licence area."

Elaborating, Rasmussen says that Cupric could pursue DML's planned underground operation at Zeta (one of the deposits on the Boseto property) but points out that the company only defined a 7 Mt M&I reserve for the project. "We will need to undertake further exploration to see if we can get this figure up to a more viable level," he notes. "Looking beyond Boseto, our tenements cover a vast area of 4 000 km^2 and include a number of high-grade mineral targets. We believe there is every possibility that ultimately the entire district could support an ore production rate of up to 30 000 t/d – which translates into 140 000 t/a of copper.

"Given these considerations, you can see that we have some important decisions to make in terms of how we provide the required



The Khoemacau tenements lie to the south-west of Maun, with Zone 5 being roughly 90 km – as the crow flies – from the town.

From Concept

To Solution

Boseto Copper Project
Client: Discovery Metals Limited
Location: Botswana

Global Minerals

Moatize Coal Handling and Preparation Plant
Client: Vale

Design

Drawing on over 35 years of experience, we use our engineering expertise to unlock the full potential of every resource.

Kinsevere Copper Plant
Client: Anvil Mining Limited

Construction & Delivery

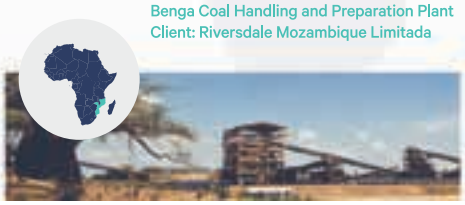
We have a proven history of local, on the ground delivery in Africa, utilising global technology and innovative methods to develop solutions which best suit your needs.

Sedgman, active across Africa, across all commodities

Across All Commodities

We are recognised globally for our capability across all conditions and commodities, including base metals, precious metals coal and iron ore.

With you for the Journey



Benga Coal Handling and Preparation Plant
Client: Riversdale Mozambique Limitada

Create

Through concept development, pre-feasibility and planning, we partner with our clients to create world class solutions.

Guelb Moghrein Copper Gold Plant
Client: First Quantum Minerals

Build

We can deliver your project anywhere, on time and on budget, from low-cost modular custom designed plants through to the word's largest materials handling and minerals processing plants.

Sedgman, ramp up operations in Africa

Operate

Optimizing recovery and maximising availability is the key focus of our Operations capability. Our unique, whole-of-life understanding of your project enables us to extend its value for years to come.

Part of the Zone 5 camp, where currently approximately 60 employees of Khoemacau are housed (photo: Khoemacau).

processing capability. The Boseto facility will service the 'starter' project but what do we do when we need to move up to 16 000 t/d and eventually – depending on our exploration success – to as much as 30 000 t/d? Clearly there are multiple permutations we could adopt combining existing and new capacity and they're all currently being intensively studied."

Moving to the proposed mining operation at Zone 5, the deposit is a sedimentary rock-hosted stratiform body with an average width of 10 m, a strike length of 4,2 km, a dip of 56 to 60 degrees and competent stratigraphy. "It's an orebody that lends itself to low cost, mechanised underground mining using the sub-level open stoping mining method," says Rasmussen. "No backfilling of the stopes would be required. While the sulphide ore – and the Khoemacau mine will be a sulphide ore-only operation – is first encountered at 70 m below surface, the orebody is open at depth and along strike and recent deep drilling to 1 200 m continues to show high grades and wide intercepts. In its initial phases, the mine will be relatively shallow, with mining starting at about 150 m below surface, with decline access being sufficient but consideration will be given to a vertical shaft as the mining depth increases."

According to Rasmussen, Cupric will initially make use of a mining contractor to establish the footprint of the mine but will transition to owner mining with the goal of achieving an operation which maximises employment opportunities for Botswanan citizens. "Botswana does not have many underground mines – in fact only four, namely the Morupule coal mine, BCL, the Ghaghoo diamond mine and the Mupane gold mine – so underground mining skills are not abundant, hence our preference for a contractor-mining operation initially. An effective programme of skills transfer will, however, be an important aspect of the mining contract."

The economics of the Zone 5 mine are compelling with the latest feasibility results indicating a C1 cash cost in the range of US$1,05 to US$1,20 per pound of copper, which is in the lowest quartile of the industry cost curve. The capex to achieve a 10 000 t/d operation is estimated at US$350 million, which gives a capital intensity of US$6 460 per tonne of annual copper equivalent production. This is less than half of the industry average for brownfield projects of US$12 000 per tonne.

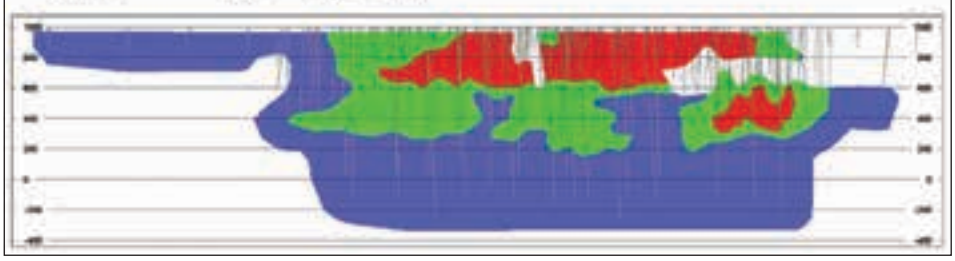
Water for the mine will be supplied from a nearby wellfield which has already been permitted for 12 000 m^3/d, and whose capacity can be doubled without negatively affecting the aquifer. In addition, the Boseto plant is supplied by its own wellfield. As regards electric power, Boseto already has an 18 MVA diesel genset facility (which Cupric is planning to expand to 22 MVA) and additional genset capacity will be installed at Zone 5.

Says Rasmussen: "The Botswana Power Corporation (BPC) has indicated to us that we will have a grid connection by mid-2018, which will coincide with the commissioning of the Zone 5 mine. Should there be any delays

November 2015 resource tabulation for Zone 5 (1 % cut-off, sulphide only).

	M tonnes	Cu%	Ag g/t
Measured	17.0	2.17	20.0
Indicated	26.4	1.93	19.1
Total MI	43.4	2.02	19.5

	M tonnes	Cu%	Ag g/t
Inferred	56.9	1.90	20.2
Total MII	100.3	1.95	19.9



metso
Expect results

World renowned equipment

Allis Chalmers • Strachan & Henshaw • Nordberg • Svedala • Denver • Barmac • Skega • Trellex • Symons • Boliden Allis • Superior • Cable Belt • McNally Wellman • DR Flotation • Hewitt-Robins • Allis Mineral Systems • Kennedy Van Saun • Omnicone • Grate Kiln • Dravo • Lokomo • Pyrotherm • Stephens-Adamson • Marcy

Adding value to your operation with Metso's world renowned equipment

One name linked to many brands!

Metso offers OEM guaranteed spares for optimal plant reliability and extended lifecycle. Training and dedicated service teams with global competence and hand-on experience, for all our recognised brands, ensures peak performance.

BEE Ownership Compliant

metso.com – email: mrnsa.info.za@metso.com

to the grid power connection, we will be able to start-up the mine on the gensets. However, we see them having mainly a standby role. As you know, genset power is extremely expensive – probably four or five times the cost of grid power in the case of this particular project – so we will want to minimise its use."

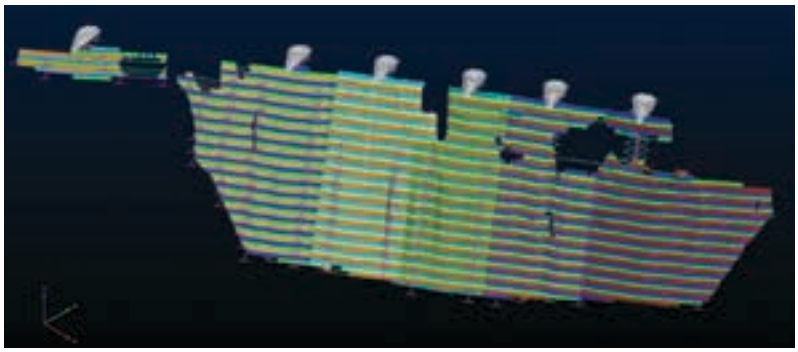
Khoemacau received its mining licence in March 2015 – covering not only Zone 5 but the NEF deposit in the Banana Zone, another promising deposit roughly 60 km south-west of Zone 5 – and now has all the permitting necessary to proceed into mine development. To implement the project, Rasmussen has assembled a highly competent team which now consists of around 115 full time employees (including around 30 key people inherited from Boseto). In South Africa the team includes Rob Dey (Project Director), John Deane (Head of Exploration), Clare Calver (Head of Human Resources) and Dale Quaker (CFO).

The key figures in Botswana are Mompati Babusi, who is acting Operations Manager of Khoemacau with special responsibility for the Zone 5 site, and Stewart Wallace, who is acting Operations Manager at the Boseto site. Babusi, who has a BEng (Minerals Processing) from the University of Queensland in Australia, is a highly experienced metallurgist (he was previously Manager Ore Processing at Tati Nickel) while Wallace, who has a BEng (Mechanical Engineering) from the University of Botswana and an MSc from the University of Salford in the UK, was Engineering Manager at Boseto prior to its acquisition by Cupric. Johannes Tsimako, the Country Manager, continues to represent the company from the Gaborone office.

Looking at the road ahead, Rasmussen says that construction of the mine could start in late 2016. "We are still busy with studies and, of course, we still have to tie up the financing, in which task we are being assisted by Citi," he states. "We have, however, given the government an understanding that we will start on construction by January 2017, and there is every possibility that we might bring this date forward.

"Whatever the case, we are targeting first production, as I've said, by mid-2018. We're very excited and believe the commissioning of the mine will be a milestone event for Botswana, signifying the opening up of a new copper-producing province and reducing the country's current high dependence on diamond mining."

Photos by Arthur Tassell (unless otherwise acknowledged)



Mine design for Zone 5. Eventually the mine will feature six boxcuts and an extensive spiral decline system. The boxcuts will be excavated through 30 m of Kalahari sand. The large profile mine will be capable of accepting the largest underground haul trucks.

Copper mining industry veterans lead Cupric

Based in Scottsdale, Arizona in the US, Cupric Canyon Capital was founded in 2010 by several copper mining industry executives, all with a background with Phelps Dodge or its successor company, Freeport-McMoRan Copper. The new company was backed from the start by the Barclays National Resources Investment division of Barclays (which has now become Global Natural Resources Investments (GNRI) after a recent management buyout).

The company is chaired by Tim Snider, who has over 45 years of experience of copper mining (and who ended his career, prior to starting Cupric, as President and COO of Freeport-McMoRan), while the CEO is Dennis Bartlett, a 30-year veteran of the industry, who spent most of his career with Phelps Dodge, eventually serving as a Senior Vice President.

Sam Rasmussen, CEO of Cupric's African operation, also has a background with Phelps Dodge and Freeport-McMoRan. He was GM of Freeport's Tenke-Fugurume copper mine in Katanga in the DRC (from 2006 to 2009) before moving on to become first the MD of Lundin's Zinkgruvan mine in Sweden and then GM of Los Bronces copper mine in Chile.

Yet another lease on life for

Taking over where its Lift I project left off, Palabora Copper's R9 billion Lift II expansion is giving the well-known South African mine another two decades of life – by developing one of the world's deepest and largest block-cave operations. ***Modern Mining*** *contributor Paul Crankshaw reports on the project.*

Having gained experience from its initial transition to underground mining nearly 20 years ago, Palabora is taking advantage of similar conditions and grades to forge a 33 500 tonne per day (t/d) operation from a production level at 1 650 m below surface. The aim is produce ore by late 2017.

Plans to mine underneath Africa's widest open pit – some 2 000 m in diameter at surface and over 800 m deep – were first put into action in 1997, when shaft construction began on the Lift I project at 1 200 m deep. First ore was drawn from Lift I in 2001, well-timed to overlap with the open pit's closure in 2002, although it took until May 2005 to reach target production of 30 000 t/d.

Mainly due to the competence of the rock mass – leading to insufficient fragmentation of blasted ore and later the subsidence of the pit's north-west wall – the lifespan of Lift I was shorter than expected, and a base-case pre-feasibility study was therefore conducted for Lift II and approved in June 2012.

A bankable feasibility study followed in May 2014, providing a positive business case to proceed, based on a grade of 0,64 per cent copper and an orebody very similar in size, shape and grade to the one exploited by Lift I.

"Key to the confidence underlying the Lift II project has been the geological certainty around the deposit," said Nick Fouche, General Manager for Palabora's Growth Division, responsible for Lift II. "We had the benefit of all the initial drilling results for the opencast pit, followed by about 26 000 m of drilling for Lift I, and then another extensive programme totalling 72 000 m of core drilling data, more recently for Lift II."

This, he said, gave them a better understanding of how the cave would develop and how the ore grades would transfer to the production level, giving more certainty about what ore values would report to the drawbells at every stage. By the time the go-ahead for the project was given in November 2014, shareholders had allowed about R2 billion to be invested in the

Celebrating a new record at Palabora. The machine in the background is Master Drilling's 120-ton RD8 raise borer. The brand new machine – the largest manufactured by Master Drilling to date and one of the biggest in the world – is being used to bore two 6,1 m diameter ventilation shafts for the Lift II project to a depth 1,2 km.

SA's grand copper heritage

'early works' – the vital development of a twin decline and supporting engineering infrastructure from Lift I down to the new orebody.

"This was a significant investment by shareholders, showing the confidence they had in the project, even in the early stages," said Fouche.

Conducted as a close collaboration between the mine and contractor Byrnecut South Africa, the twin declines of 3,6 km each preceded apace, achieving rates of advance of 10,5 m per day; the process also allowed for an upgrade of electrical infrastructure, services and ventilation. One decline will be for services, while the other will house the switchback rock conveyor carrying ore to the base of the vertical shaft at Lift I level. A temporary crusher is to be installed at the base of the conveyor to be used for development tonnages and first production; at the other end, ore will be lifted to surface in the shaft.

The Lift II mining footprint is now being developed from the twin decline, with access drives based on the classic herring-bone block-cave design used in Lift I. Three levels will be developed, linked to each other by connecting ramps:

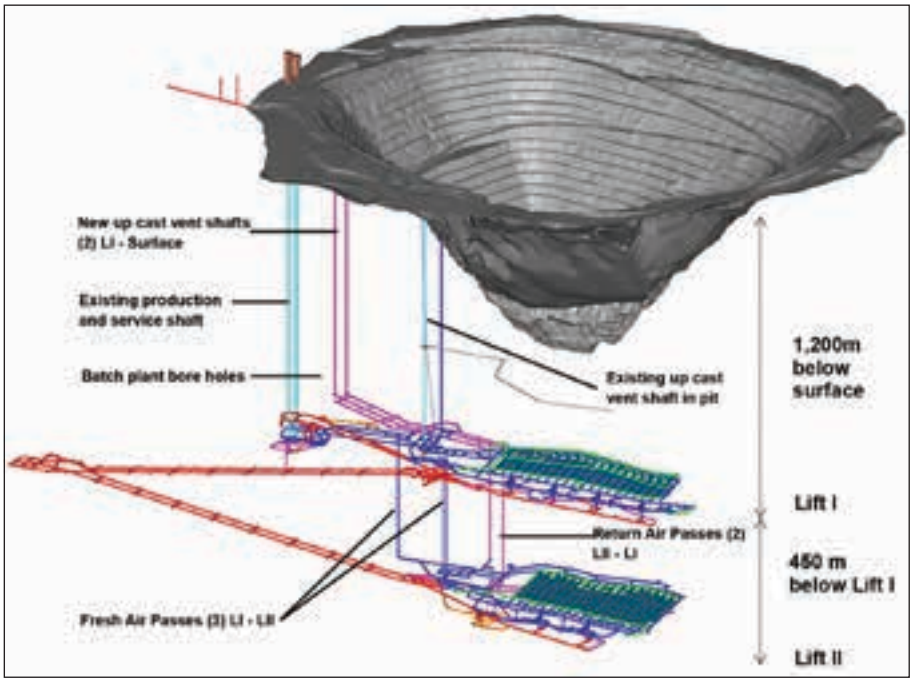
- the undercut level is where the orebody is drilled and blasted so that it 'caves' into the drawbells;
- the extraction or production level about 18 m below, which receives the fragmented rock through the drawbells; and
- the ventilation level, 25 m below the production level.

While Palabora's carbonatite rock mass has the advantage of well-delineated ore, it is also considerably harder than the kind of rock normally mined by the block-cave method – in the kimberlite of diamond mines, for instance.

"We pioneered some ground-breaking technology during the Lift I phase, as this was the

Above: *The open pit at Palabora. Note the subsidence of the pit's north-west wall.*

Below: *Layout of the Palabora mine showing the open pit and Lifts I and II.*



We are moving to:
96 Loper Avenue
Aeroport, Spartan
Kempton Park, South Africa

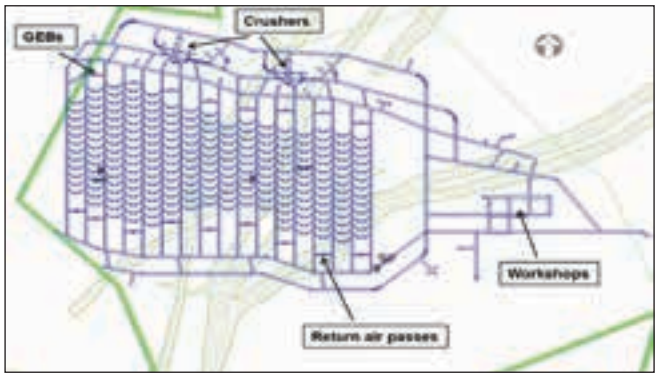
IT PAYS TO TALK TO A SPECIALIST

Tenova Delkor is an industry specialist in solid / liquid separation and mineral processing applications for the minerals, chemical and industrial markets. Offering flotation, sedimentation, filtration, screening and gravity separation systems, Tenova Delkor services range from test work, process trade-offs and flowsheet design, to installation, commissioning and aftermarket support.

tenova
DELKOR

Tenova Delkor Sub-Saharan Africa
96 Loper Avenue, Aeroport, Spartan
Kempton Park, South Africa.
+27 11 201 2300
southafrica@delkorglobal.com
www.tenova.com

TENOVA is a worldwide supplier of advanced technologies, products and engineering services for the metals and mining & minerals industries



The Lift 2 production level.

Lift 2 undercut level plan.

first block cave conducted in rock of this hardness," Fouche said. "Our implementation of Lift II will definitely benefit from that experience."

One of the issues tackled was the difficulty in getting sufficient fragmentation from blasting, leading to oversize rocks hanging up in the drawbells and interrupting smooth production flows. A range of innovations has resolved this, including water cannons and medium-reach rigs to dislodge hang-ups, and robot rigs to drill and break oversized material.

"For Lift II, we are implementing design parameters that will optimise fragmentation," said Fouche. "We have also modelled different fragmentation scenarios to prepare the breaking team for various conditions."

Continuing its pioneering ways, Palabora's Lift II fleet includes the largest Sandvik load-haul-dumper currently working underground in Africa – the 12-m, 57-t LH621, boasting a 21-t tramming capacity. This choice makes a significant difference to the rate of moving rock, according to Fouche, and has been an important contributor to the project to date; apart from the larger payload, the long wheel-base enhances grip in muddy and rough conditions. In a departure from the Lift I configuration, the new project includes 30-t haul trucks, which are loaded by the LHDs, to take ore to the crusher.

In what was probably another 'first' for the operation, the LH621 was transported underground via the vertical service shaft – requiring the partial dismantling of the vehicle and the use of a special 'skeleton' lift cage to reduce weight. There are currently three at work in the project, and there will be about 17 employed in full production; the question that now remains is: electric or diesel?

"We are finalising the trade-off between electric and diesel LHDs," said Underground Manager Aidan Schoonbee. "Electric units are slightly quicker, have a lower life-cycle cost and generate less heat – but they also have low predictability given their trailing cables and the need to move from point to point; they also need steady-state conditions and mature operations teams."

While diesel-powered LHDs offer more reliability of tonnages, they generate heat and fumes into an already hot environment: Lift II will have to deal with virgin rock temperatures of over 57 deg Celsius.

"The total heat load has been calculated at 30 MW, taking into account cooling and diesel fumes, should diesel-powered LHDs be used," said Schoonbee. "We have three ammonium refrigeration plants on surface of 6 MW each, and two chiller plants underground of 3,5 MW each. Three more 3,5 MW units will be installed underground."

Such is the ventilation challenge at Palabora that over 30 ventilation passes have been planned, with two passes being among the largest in the industry at 6,1 m diameter and 1 200 m deep – from the Lift II footprint to surface. Bored by Master Drilling's largest raise borer yet – its 120-ton SA-designed RD8 – the shafts benefit from cost, speed and safety advantages offered by this technology over the conventional blind-sinking methods.

Connecting the 450-m gap between Lift I and Lift II are another five large-diameter raises – three forced-air passes and two return-air passes. Over 25 shorter raises will be drilled between the ventilation level and production level, contributing to better heat management as well as dust control – an important consideration in the context of underground crushers. The twin decline also plays a vital ventilation role, with one decline currently carrying air down to the workings and the other carrying air up to surface.

The compound centrifugal chillers at Palabora are reportedly the first of their kind in Africa, and the first underground installations

All time highs

The Lift II project, like its predecessor, will register among the highest lifts in block caving. 'Lift' is the vertical distance from the production level to the breakthrough point on surface or in the open pit above. Generally speaking, the higher the lift, the lower the capital requirement per vertical tonne of ore mined.

DRIVING TECHNOLOGY
DELIVERING PRODUCTIVITY

Sandvik Mining is your single-source design, project construction and management provider for multi-disciplinary mining systems projects. Whatever your bulk materials handling need, we've got you covered. We specialize in underground, in-plant and long complex overland conveying systems, crushing and screening plants, total stockyard systems including stackers and reclaimers, spreader systems, IPCC systems, shiploaders and export terminals.

For enquiries, please contact +27 (0) 11 657 4600
MINING.SANDVIK.COM

SANDVIK

globally. Installing these units underground reduces the need to pump water to the surface for cooling; instead, upcast air is used to reject heat in underground cooling towers and cool air is blown down to the work face.

To match the capacity of the 17-t LHDs, the crusher configuration will be different to the four jaw crushers at Lift I. Rather, Lift II will install two jaw-gyratory crushers – essentially gyratory crushers with much larger throats – capable of taking bigger lump sizes. With a 2 000 t/h capacity and multiple tipping points, these units will avoid any unproductive queuing when being fed by the 17-t LHDs underground.

There are also to be some significant improvements in the processing plant, according to Flotation Plant Project Manager Willie Laing. Most interesting among these is the project's use of sorting as a means of pre-concentrating ore and of improving the final quality of concentrates. Palabora intends installing optical ore-sorters to separate barren dolerite – comprising 10-12 % of run-of-mine feed – from copper-bearing material, a process made possible by the distinct colour difference between these two rock types.

In addition, said Laing, tank cell technology is to be introduced into the new flotation plant, with the aim of improving recoveries from 80 % to a targeted 88 % – delivering about 30 % copper; magnetite recoveries will also improve to 63-65 % iron in the final product. He said extensive tests at mineral research group Mintek, conducted with a specially installed 10 m^3 tank, showed the technology gave positive results, especially with lower grades.

Following the green light for Lift II's implementation, employment expectations have been understandably high in communities around the mine – which have had to be carefully managed by Palabora. According to Corporate Affairs Manager Hulisani Nemaxwi, the mine has leveraged the project's employment impact by reaching agreements with contractors – where most of the new jobs have been generated – to ensure at least 80 % of non-skilled and semi-skilled job opportunities will be filled by local residents.

"We are also focused on upgrading skills of workers, as well as developing local small businesses to become reliable and sustainable providers of services – both to the mine and to other players in the local economy," said Nemaxwi. "We have spent about R160 million over the past five years, and the results are encouraging."

As one of South Africa's largest mining development projects, Lift II must rank also as one which generates considerable and much-needed confidence in a mining sector under almost unprecedented global and local stresses. Retaining its focus on innovation, and basing its decisions on solid geological, mining and metallurgical data, Fouche emphasises that any good project still relies on its people.

"Many of the people who were involved in Lift I are now part of the Lift II project team, giving the project vital intellectual memory to ensure that we can apply our lessons learnt and implement configuration changes," he said. ■

A Murray & Roberts Cementation raise borer working underground at Palabora.

Unique geology

Unlike most of the world's copper mines, which mine their copper from porphyry deposits, Palabora's ore occurs in the carbonatite formation known as the Palabora Igneous Complex. The complex also hosts a range of other minerals such as phosphates, vermiculite, phlogopite, magnetite, nickel, gold, silver, platinum and palladium.

PALABORA OVER THE YEARS

1956 – Founded as Palabora Mining Company and began opencast mining
1996 – Construction begins on Lift I underground project
2002 – Production begins from Lift I block cave
2007 – Drilling starts on Lift II orebody
2011 – Business case study starts for Lift II project
2012 – Construction begins on Lift II twin decline to orebody
2014 – Feasibility study for Lift II completed
2015 – Shareholders approve final plan to proceed with Lift II project
2017 – First production expected from Lift II block cave

Wealth of experience drives

As Sasol's Middelbult mine near Secunda in Mpumalanga reaches the end of its 35-year life, the energy and chemical giant is nearing completion of the R5,5 billion Shondoni ('Place of Wealth') replacement project. As ***Paul Crankshaw*** *explains in this article, Shondoni – being developed by Sasol Mining – is due to deliver over 9 million tons of coal per annum toSasol's synthetic fuels plant.*

Unlike the nearby greenfields Thubelisha and Impumelelo projects – taking the batons from Sasol's Twistdraai and Brandspruit operations respectively – Shondoni is a brownfields expansion that essentially continues and extends Middelbult into new reserves around the recently completed Shondoni shaft complex.

Kobus Louw, Vice President Projects & Sigma Colliery, who oversees a 32-strong owner's projects team for these expansions, said the rising cost of maintaining ageing infrastructure at Middelbult was a key reason for the transition to Shondoni, as well as the need to move closer to the new reserves.

Budgeted at over R15 billion, the three replacement projects will together aid the total production of 40 million tons and take the life-of-mine horizons to about 2050. At Shondoni, work is over 85 % complete – including an 11-m diameter man-and-materials shaft reaching a depth of 155 m, set for full operational duty early in 2016.

Among its notable achievements to date, the project has dealt with various ground and water challenges in its development stages, rolled back delays with an innovative option to complete and place the winder house, and will soon boast the world's longest single-flight overland conveyor with no mid-way drive assistance.

Headed by EPCM contractor Worley Parsons, work has been ongoing since 2012, with Aveng Mining overseeing shaft-sinking and underground development, Aveng Inland tackling the surface infrastructure and buildings, and Sandvik Mining providing the materials handling systems for both underground and surface.

Early development work on the 6-m wide, 3-m high incline shaft was bedevilled by weathered dolerite near surface and a high water table, requiring extensive cementation of the porous areas.

"We addressed this using 'tube a manchette'

The new surface infrastructure at the Shondoni shaft complex – seen here nearing completion – includes production offices (on the right hand side of the photo), change houses (left), management offices (far left) and ventilation fans (in the background).

innovation at **Shondoni**

technology to inject grouting via pipes inserted down holes drilled in front of the work area," said Louw.

The shaft inclines at 12 degrees for a distance of 980 m, housing the 3,5 m/s single incline conveyor that will extract 3 200 tons of coal per hour.

Coal will be mined mainly from the 4-m thick Number 4 seam at between 140 m and 160 m below surface, by normal bord-and-pillar methods as employed at Middelbult. Continuous miners break the coal and load into shuttle cars, which deliver into feeder breakers; an underground crusher sizes the coal to -150 mm lump size. Section conveyers take product onto trunk conveyors, which in turn deposit it into underground bunkers; coal reports to the incline conveyor from the main underground bunker on Number 4 seam.

The 15 000-ton capacity surface bunker – constructed by Stefanutti Stocks Civils – also adopted an interesting approach by using precast 'planks' up to 20 tons in weight to facilitate a safe and efficient construction process. Cast in a dedicated precast yard nearby, the components were placed sequentially by gantry crane and stitched by concreting.

"This innovation led to a substantially safer working environment, with much less need for scaffolding and working at height during construction," said Louw.

The design went on to be commended at the Concrete Society of Southern Africa's Fulton Awards 2015, where it was described as an excellent example of hybrid or composite reinforced concrete structures – showing the benefits of precast combined with in-situ concrete.

Leading from the bunker is the record-breaking, 21-km-long conveyor. It is reportedly the longest in the world that can run this distance with drives only at the head and tail, an achievement made possible by a more energy-efficient drive system that reduces power consumption.

"It must also curve to avoid a settlement and a gold mine tailings dam and must cross roads and waterways," said Louw. "Environmental concerns also demand that the belt is spill-free and must be sealed when it crosses sensitive areas."

To minimise the environmental impact of the conveyor, it was necessary to prevent carry-back spillage along the conveyor route. This was addressed by installing belt turnovers – at head and tail – to rotate the belt 180 degrees as it turned. This ensures that the dirty side of the belt is facing up for both top and bottom strands of the conveyor, stopping residual material from falling off the belt as it passes over idlers.

The massive winder house was moved by crane across 58 m and hoisted to a height of over 30 m before finally being positioned on top of the headgear.

The conveyor is covered over its full length to prevent rain from washing coal dust off the belts, and to reduce the propagation of dust and noise; dust suppression sprays at the transfer chutes also help keep coal dust to a minimum.

The installed drive capacity on the conveyor is a substantial 5 MW, with four drives at the head and a single drive at the tail. An 80-ton counterweight puts the necessary tension on the belt to prevent slippage at either end. This element of the project will be one of the last to be finalised and will be commissioned in the second half of 2016.

Maintenance and monitoring of this ambitious conveyor design is clearly vital for smooth

Losing revenue as a result of a **power outage?**

Is your business, mine, factory or shop losing revenue as a result of a power outage?

Contact us today and we will assess your needs and determine the optimum generator or Uninterrupted Power Supply (UPS) solution for your business, factory, mine or shop.

Visit **www.barloworldpower.com** or contact **0860 898 000** and we will determine a generator solution for you.

BUILT FOR IT.

Barloworld Power

CAT

operations, so vibration monitors on critical pulleys at the head and tail end of each drive monitor vibration levels and provide early warning to prevent catastrophic failure. An alarm is raised in the control room if vibration levels exceed a certain band and a maintenance inspection is then required.

To detect any belt slip or tearing, sensors are installed on strategic non-drive pulleys to keep a close eye on belt speeds. Pull key systems along the belt allow it to be stopped in an emergency, and an intercom system facilitates communication with the control station – especially valuable during commissioning and fault-finding programmes.

Helping to return the project to schedule last year was a bold step regarding the construction and placement of the winder house on the headgear of the new vertical shaft, according to Louw; poor ground conditions had affected the schedule of not just the decline shaft but the vertical shaft as well.

"The usual process is to lift the winder house onto the top of the headgear in two parts, and then install the winder – taking several months," he said. "Instead, we installed the Koepe winders into the winder house on the ground, while shaft sinking was still underway – which has not been done before on these kinds of projects."

The completed winder house – weighing over 290 tons with rigging – was then hoisted by crane experts Sarens in an early morning lift, taking about 90 minutes to rest on the headgear some 30 m high. The lifting and mounting of the winder house required intricate planning due to the risk factors related to the mass and dimensions of the hoist, as well as the low tolerances involved in placing the winder house on the headgear.

Due to the size of the winder house, windless weather conditions were required to avoid any forces on the building and achieve precise alignment on top of the headgear. The lift's vulnerability to climatic conditions led to the employment of advanced weather forecasting technology to ensure that all risks were identified and mitigated before the day of implementation.

After the winder house was mounted, hydraulic rams were used to micro-shift the headgear until the winders were perfectly aligned with the shaft. The shaft conveyance will hold up to 200 people and carry a load of up to 65 tons; with the winder house fully licensed and operational in December, the main shaft system will be fully operational early in 2016.

Delivering air to production levels will be achieved through a 9 m diameter, concrete-lined ventilation shaft which has been sunk to a depth of 120 m, and equipped with three 750 kW fans – giving a capacity of over 1 000 m^3/s.

Bord and pillar operations at Shondoni will employ similar methods and equipment to those at Middelbult, including continuous miners like this Joy HM31.

Other facilities on surface such as offices, change houses and workshops are complete, according to Louw, and the process of moving operations from Middelbult to the new Shondoni site will begin soon.

"Underground links have been created between Middelbult and Shondoni, and some of the Middelbult sections are already mining around the new shaft," said Louw. "Early 2016 will see the migration of the workforce and equipment to the new surface facilities."

He said the numbers employed on the mine itself will not change substantially, although the number of contractors on site – standing at over 1 600 – will gradually reduce as construction winds down; he expected that all contractors would have completed their work by August 2017.

The lifting and mounting of the winder house required intricate planning.

The mine employs about 1 100 permanent staff, with the priority on employing and training local residents. The cluster of Sasol Mining operations in the Secunda area – including Brandspruit/Impumelelo and Twistdraai/Thubelisha – operate under a common Social and Labour Plan that directs their community and employment strategies.

"All our Social and Labour Plan activity is consolidated with the other Sasol mines in our area," he said. "This involves the mine in various community projects, including support for the Leandra fire station, Kinross reservoir and local sewer system upgrades. Aimed more

One Source Many Solutions

FLSmidth offers you a complete line of equipment and services with proven reliability and enhancing performance from the leading brand names of ABON, Buffalo, CEntry, Conveyor Engineering, Dawson Metallurgical Laboratories, Decanter Machine, Dorr-Oliver, EIMCO, ESSA, FFE, Fuller-Traylor, KOCH, Knelson, Krebs, Ludowici, Maag Gear, Mayer, Meshcape, MIE, Möller, MVT, PERI, Phillips Kiln Services, Pneumapress, RAHCO, Raptor, Roymec, Shriver, Summit Valley, Technequip and WEMCO.

FLSmidth is your One Source because:

- We own our **technology**
- We deliver **One Source** mineral solutions
- World renowned OEM equipment & **brands**
- We have operating references across **Africa**
- We understand Africa's challenges
- We understand our **customer's** operating needs
- We underwrite project **funding**

For more information contact us
Tel no. +27 (0)10 210 4000 • flsm-za@flsmidth.com • www.flsmidth.com

FLSmidth

Shondoni's 15 000-ton capacity surface coal bunker under construction; the design included both precast and in-situ concrete elements.

directly at staff is a home ownership scheme in eMbalenhle, providing subsidised houses which employees can invest in and own."

In line with the emphasis on employing local residents, over 620 workers of the approximately 1 800 on site in 2015 were from the surrounding Govan Mbeki, Dipaliseng and Lekwa municipalities; less than 60 were not South African citizens.

Employment at the mine has also favoured the youth – a social segment particularly hard-hit by the country's high unemployment rate; almost 530 are under the age of 35. As mining technologies and systems become more complex, so the skills demanded by the operation rise steadily. As a result, over half those on site are classified as skilled, although the requirement for semi-skilled and unskilled employees remains – comprising equal portions of the remaining workers.

Apart from direct jobs maintained by Middelbult's transition into Shondoni mine, the operation will continue to provide business for 400 to 500 service providers, said Louw, making it a vital indirect job-creator in the region. Emerging businesses are also given special consideration by the company's empowerment policies; of the R5,5 billion being spent on Shondoni, almost R3 billion is related to broad-based black economic empowerment (BBBEE) firms.

As the development of Shondoni moves towards finalisation in 2016, the range of stakeholders who have benefitted from Middelbult will be relieved to see the operation effectively rejuvenated for the next three decades – as it continues to supply baseline feed stock for Sasol Synfuels' coal-to-liquids operations. ■

Transfer points critical to successful plant operation

The Weba Chute System is a custom-engineered transfer point solution designed to address the numerous issues plants face with material movement.

Transfer points are finally being recognised as key elements in plants, and Mark Baller, MD of Weba Chute Systems, says this has seen other players enter the market as they too begin to recognise transfer points as critical to the operational success of plants.

"As the market leader with more than 4 000 Weba Chute Systems successfully operating globally, we welcome legitimate competition as it keeps companies motivated and customers are ensured of continual improvement in both product and service delivery," he says. He adds that the global benchmark for transfer points is the Weba Chute System.

Weba Chute Systems pioneered the engineered transfer point and extensive research and development by the company identified the root causes of numerous problems related to materials handling and transfer points. These include lack of material control resulting in excessive impact and poor belt loading, disproportionate wear, excessive dust emissions and spillage.

Today the Weba Chute System is a custom engineered transfer point solution designed to address the numerous issues plants face with material movement. Each chute system is engineered for the specific application and this is what accounts for the success that these transfer points have achieved worldwide.

Baller says that what makes it difficult for new entrants to get it correct is that there are so many factors which affect the material during its movement through the plant. In addition, each transfer point will have completely different requirements depending on what stage of the process flow the material is at. "Experience cannot be underestimated when it comes to correctly engineering a chute system as each application is completely different," he says.

"Weba Chute Systems has an enormous advantage over the 'newbies' given that we have over 25 years' experience and a reference base that dates back that far," Baller says. Each of the chute system solutions provided by Weba Chute Systems was a custom engineered transfer point designed to specifically deal with the exact application requirements.

During the design phase, all aspects such as belt speed, belt width, material size, shape and throughput are taken into account. The custom design allows control of the direction, flow and velocity of a calculated volume and type of material in each individual application and at the same time drastically reduces dust. Using a 'supertube' or cascade scenario, 95 % of the material runs on material in a tumbling motion which further reduces wear.

"Weba Chute Systems takes great pride in the fact that the transfer point is no longer the stepchild of the process plant and has been given its rightful position as an integral and important part of the operation," Baller says.

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

'All in one' coolant solution from Caterpillar

Although representing only a small percentage of a machine's overall maintenance expenditure, the role that an engine's coolant system plays in extending its mechanical life is critical. However, despite its importance, this remains a neglected area, reinforced by the fact that approximately 65 % of all engine failures are related to coolant system contamination.

"Today, machine owners are faced with a wide range of coolant products that vary widely in terms of quality and costs, making optimum selection difficult without an informed technical understanding of how these products will perform," explains Barloworld Equipment Group Product Specialist Reuben Phasha. "This is particularly important in these tougher economic times, when there's a temptation to select a cheaper product which may end up costing far more when an engine seizes or overheats. With either oil or fuel, performance problems are immediately apparent, but that's not the case with coolants. By the time a problem occurs, it's often too late."

Typical signs of coolant failure include engine corrosion; low water pump life; and abnormally high operating temperatures in summer.

One of the key challenges in managing a coolant system is achieving the right blend upfront. Traditionally, coolants are mixed with water in a predetermined ratio. However, what often happens is that this blend is progressively diluted when coolant system reservoirs are topped up between scheduled service intervals.

Caterpillar's engineers have responded to this challenge with the development of Cat Extended Life Coolant (ELC).

"It's an 'all-in-one' solution, with no mixing required since the correct distilled water/ELC composition has already been predetermined on an exact 50/50 split," explains Phasha. "Unlike other conventional coolants, you simply keeping topping up, where required, with no concerns about mix dilution or contamination." At around 6 000 hours, the addition of a Cat extender will take ELC life to 12 000 hours.

Every Cat machine delivered is charged with Cat ELC, which is compatible with all diesel engines.

Meeting Caterpillar's EC-1 specification and exceeding ASTM standards, Cat ELC incorporates an advanced formulation containing organic additive corrosion inhibitors. Ethylene-glycol based for anti-boil and freeze protection, the absence of phosphates or silicates is another important feature as this virtually eliminates hard water deposits, significantly extending water pump seal life. Additionally, nitrates and molybdates have been added to reduce steel corrosion and cast iron liner and block pitting.

Barloworld Equipment, tel (+27 11) 929-0000

Sandvik's Zambian support centre growing

Sandvik's new support facilities in Zambia are enabling faster and more efficient turnaround times for the maintenance and repair of mining fleets throughout the central African region.

In the year since moving into the new facility from Sandvik's old premises and opening its doors in Kitwe, the operation has significantly improved throughput of repairs and rebuilds and has slashed delivery lead times for parts to ensure maximum uptime of Sandvik fleets in the region.

Sandvik invested in state-of-the-art support offices that include administrative offices, workshops, parts distribution and logistics centres. Up-to-date equipment and tooling, along with globally accepted management systems, are also in place to ensure services and support that are comparable to other Sandvik centres across the globe.

Steve Chambers, Sandvik Technical and Workshop Manager for central Africa, says burgeoning fleets in the area require the same modern facilities that are found elsewhere in the world.

"Within a year after opening our new facility, it is clear to see that the move has paid off and mines operating our machines are starting to make full use of our services," Chambers says. "With a significant amount of stock and spares parts and a complement of specially trained staff able to maintain and support our full range of machines, there is no need to look elsewhere."

Since opening, the Kitwe office has been a major success with a significant increase in the number of jobs completed and parts distributed. This includes a 60 per cent increase in rebuilds received from customers, combined with the reduction of rebuild lead times by a massive margin of 45 per cent to just 12 weeks for a complete machine rebuild.

Component rebuild times have also been vastly improved and are steadily becoming comparable with Sandvik's international standards.

Simultaneously, the company has extended its safety record to an incredible 4,24 million hours without any lost time injuries.

Mutale Chilufya, Sandvik Mining Zambia,
tel (+260) 212 241-000

Two technicians assembling a DANA 6000 series transmission used in a Sandvik TH320 dump truck for a customer.

Service level agreements maximise screen uptime

Several key issues can affect the life cycle and productivity of a screen and have an impact on the bottom line at minerals processing operations. These include the shortage of skills within the industry, which often results in sub-standard maintenance being performed. In addition, maintenance is often undertaken on a reactive rather than a proactive basis, which can lead to further costly issues.

Joest Kwatani undertakes continuous audits at predetermined intervals to measure improvements in performance as well as the condition of the screen.

"Significantly, Joest Kwatani engineers for maximised tonnage over the screen during its lifetime. However, since screens are such critical elements in the process, it is important to undertake regimented maintenance to ensure ongoing efficient operation and improved yield," says Theresa Walton, General Manager – Service at Joest Kwatani.

These issues are best addressed by the implementation of a service level agreement that is customised for individual mine requirements. The first step is to undertake a full audit covering the operating performance and the condition of the screen. "We also consider the upstream processes to ensure that the feed is within the original specifications for which the screen was engineered," says Walton.

An essential part of the audit is a review of the on-site parts stockholding to ensure that all critical components are readily available both for planned maintenance and in the event of unexpected failure. A critical parts stockholding is set up on the customer's system to facilitate seamless planning and ordering, as well as the selection of the correct part.

During the audit an historical review is also done to ascertain the level of maintenance being applied, the skill level and the available resources at the mine. This information directly impacts on the frequency at which future maintenance should be conducted. Following the audit, Joest Kwatani develops both a short term action plan and a long term sustainable service programme.

"The short term action plan is to bring the screens and feeders back to OEM specification. This will not only improve screening efficiency but could prevent potential catastrophic failure," says Walton. The structured service programme approach allows customers to select a package that will match the current needs and resources of the plant.

In the fixed term action plan, Joest Kwatani seconds one of its skilled maintenance crews to site and a full structured maintenance programme is implemented on all vibrating screens and feeders. An experienced screening technician oversees the process and information regarding the screen's operation is accumulated over its life span which assists in future planning.

The second option involves the customer performing ongoing maintenance on the vibrating machinery in line with a structured programme recommended by Joest Kwatani. "This approach involves a large training component to ensure that the customer maintenance personnel understand and can implement the requirements. This results in empowerment, upskilling and the instilling of a sense of accountability in the customer's personnel. Our supervisory crew is on hand to provide continual feedback, evaluation and assistance where necessary," Walton points out.

Under the terms of the service level agreement, Joest Kwatani undertakes continuous audits at predetermined intervals to measure improvements in performance as well as the condition of the screen. Remedial action is often recommended and could entail the proactive identification of vibrating machines which require extensive repair work or refurbishment as a result of their age.

Joest Kwatani, tel (+27 11) 923-9000

Metso develops jaw crusher maintenance platform

Metso has developed a new maintenance platform that increases safety when changing wear parts in jaw crushers. The new, ergonomic and safe maintenance platform is available on all Metso C Series jaw crushers.

Metso's new maintenance platforms consist of hand rails which are also used for lifting the platform, sturdy work platforms and related control mechanisms, enabling them to be precisely placed at the desired height of the jaw opening.

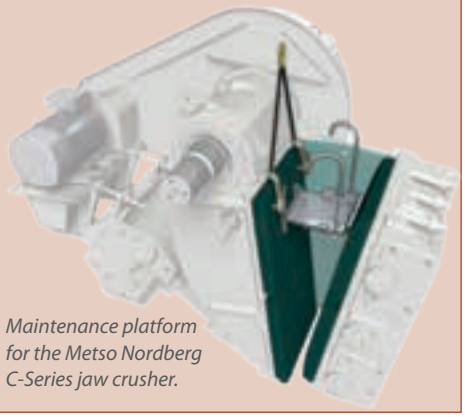
The platform constructed of aluminium is easy enough for one person to move. The maintenance platforms are available to match with either single-piece or two-piece jaw dies. Metso has applied to patent the platform.

"With a small investment, Metso's new maintenance platform offers a huge improvement in safety when making jaw changes. When the platform is installed correctly into the opening, it holds the jaw in place so that it cannot drop, even if the jaw's upper mounting hardware is loosened or even removed. The platform is lightweight and it is easy to handle and adjust to fit the desired level in the crusher cavity," explains Ilkka Somero, Product Manager of Metso's jaw crusher line.

"The textured aluminium platform is sturdy, slip resistant and covers the crusher cavity properly to prevent anyone from slipping or getting a leg wedged between the jaws. Due to its light weight, the platform is easy to lift into position and remove, speeding up the work of changing parts."

The family of maintenance platforms is available for all Metso Nordberg C Series jaw crusher models C80 through C200.

Metso, website: www.metso.com



Maintenance platform for the Metso Nordberg C-Series jaw crusher.

Granite producer adds fourth Terex truck to its fleet

Terex Trucks, a division of Volvo Construction Equipment, has supplied Davis Granite with its fourth rigid dump truck after its existing trucks proved their value, working at granite aggregate quarries in Bulawayo and Harare, Zimbabwe.

Leading Zimbabwean granite aggregate producer Davis Granite has recently added a TR45 to its fleet of four Terex Trucks rigid haulers. Now operating at its Bulawayo and Harare mines, the fleet includes two TR45s and two TR60s. The machines are hauling approximately 80 000 tonnes per month of stone products, 12 hours a day, five days a week, with the robust TR45 maximum payload of 41 tonnes reportedly proving ideal for the job at the Bulawayo quarry.

Headquartered in Bulawayo, Davis Granite has been in the business for over half a century handling the extraction, production and supply of stone, builders aggregate and sand for road building and other civil applications throughout Zimbabwe. As the nation's largest producer of granite aggregates, Davis Granite depends on Terex Trucks rigid dump trucks to haul its high-quality stone from the pit to the crusher. The addition of the second TR45 will increase productivity and uptime for the company's Bulawayo operation.

"We have operated Terex Trucks rigid haulers for three years and they consistently deliver a powerful and reliable performance," said Ben Louw, Group Production Director at Davis Granite. "When looking to purchase a new truck for our Bulawayo quarry, we were confident that an additional TR45 would be a safe bet once again."

Davis Granite has operational quarries in Bulawayo, Harare, Hwange, Marondera and Gweru, as well as a mobile mining contracting and crushing plant which can be installed as per customer requirements for larger orders.

"We've found Terex Trucks rigid haulers to be reliable and cost-effective, with very little downtime and offering good fuel efficiency," said Ken Gerrard, Chief Executive of Davis Granite Group. "What we particularly like about working with Terex Trucks is the excellent support that is available within Zimbabwe and regionally in South Africa, and this was really what made Terex Trucks stand out from the competition."

The Terex Trucks range in Southern Africa is now being marketed and supported by Babcock, which was appointed as the dealer last year. Babcock is also the Southern African dealer for Volvo Construction Equipment.

Babcock, tel (+27 11) 230-7340

A Terex truck hauls a load up a ramp at one of Davis Granite's quarries.

Sulzer provides pumping solutions for solar plants

A growing number of solar plants are making use of Sulzer Pumps' engineered solutions.

Sulzer Pumps' aim of becoming the dominant supplier of pumping solutions for concentrated solar power (CSP) is reportedly being realised with the awarding of multiple contracts across the globe.

Utilising its considerable global expertise, the company continues to design and manufacture pumping solutions for the complex processes within these plants wherever the requirement for precision manufacturing is of a primary concern.

Similarly, Sulzer Pumps South Africa has been awarded contracts to supply full solutions for local solar power plants that are currently planned or under construction. The advantages of the pumps being supplied by a local South African company are numerous and will give the local operation's design teams the ability to showcase their abilities within the global arena.

"Sulzer Pumps is a company with a global footprint and its branches from Spain, Germany and India will make a contribution to bringing these projects to a successful conclusion," says project manager Henno Raaths. "Sulzer Pumps South Africa will, however, take the full lead in terms of engineering and supply of the highly sophisticated equipment."

The recent rise in local renewable energy projects includes advanced solar power plants using CSP technology. CSP operations require a special heat transfer fluid (HTF) or molten salts to be circulated around a solar heat absorber and pumped to a special heat exchanger which converts water to steam and effectively makes up the conventional steam cycle.

HTF pumps specifically are manufactured for high temperature applications that include thermal transients and sealing of flammable and hazardous fluids under extreme cyclic operating conditions. With experience in HTF pumps dating back to 1985, Sulzer Pumps has an in-depth understanding of the requirements and operating philosophies involved to produce pumps that can perform under such strenuous conditions.

HTF and solar heat transfer pumps will be based on the company's new HZB range which is able to pump liquids at temperatures in excess of 400 deg C, pressures of more than 50 bar and flows in the region of 4 000 m^3/h. In order to provide fully engineered pumping solutions covering entire solar power plants, the company is also supplying feed water pumps, HTF overflow pumps and water condensate extraction pumps complete with sealing systems, drives, motors and instrumentation. Sulzer South Africa further has the expertise to assist with installation, commissioning and service support across the complete range of pumps.

Across the globe – in countries and regions such as Spain, India, Israel, the Middle East and the USA – a growing number of plants is making use of Sulzer Pumps' engineered solutions. Currently the fleet of CSP pumps within these areas includes nearly 250 HTF pumps, 100 feed water pumps, 40 condensate extraction pumps, as well as numerous cooling water pumps and hot water circulation pumps.

Sulzer Pumps, tel (+27 11) 820-6021

Effective slurry blasting becomes easier

Engineered using quality components, the Slurry Blaster offers mining and plant operations a cost effective cleaning tool for all applications where slurry has become an issue and needs to be washed away.

Lee Vine, MD of Integrated Pump Rental, says the company has fast established a reputation for identifying areas in process plants where an effective alternative solution is needed to cope with the day-to-day activities. "It is sometimes in the most obvious places that there is a need for more reliable equipment that is capable of withstanding the rigours of daily use," Vine says.

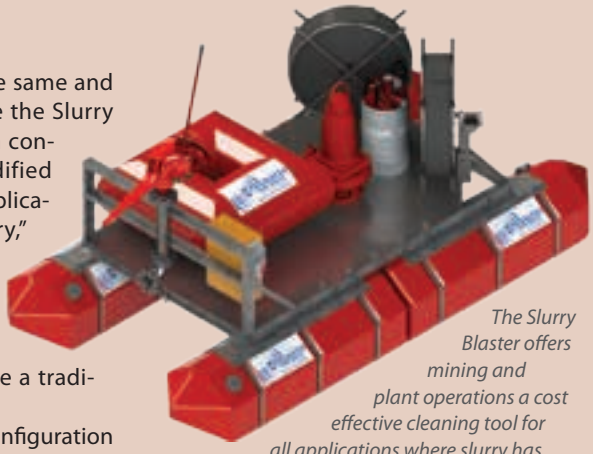
The Slurry Blaster is a hydro mining equipment solution which is said to offer optimum performance coupled with reliability. Typical applications include plant floors and sumps, drainage areas, tailings dams, process water dams and other difficult to reach areas.

"Not all applications are the same and for this reason, we have made the Slurry Blaster available in three main configurations but it can be modified to suit individual customer applications, should this be necessary," Vine says.

The Slurry Blaster can be provided on a pontoon for use on ponds and dams, it can be trailer mounted or it can be a traditional manual set up.

"The decision as to which configuration to use is based on the application at hand and our technical team has the necessary competency to assess the situation and propose the appropriate option to the customer," Vine says.

Each installation of the Slurry Blaster comes standard with a 37 kW feed pump with float, a 22 kW slurry pump for the removal of the slurry, a 200 m heavy duty layflat hose and an electric control panel.

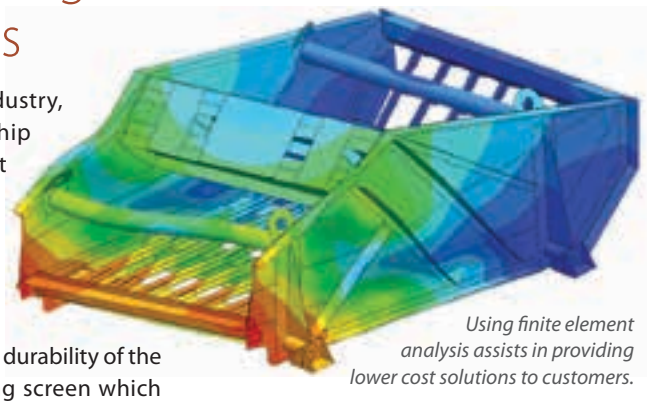


The Slurry Blaster offers mining and plant operations a cost effective cleaning tool for all applications where slurry has become an issue and needs to be washed away.

The Slurry Blaster units are available for medium or long term rental, outright purchase and on a full turnkey project basis.

Integrated Pump Rental, tel (+27 72) 627-6350

Coal dewatering solutions from Weir Minerals



Using finite element analysis assists in providing lower cost solutions to customers.

In the coal processing industry, the total cost of ownership model is heavily dependent on strategies that lower the initial capital cost of replacement screen machines. Coupled with this is an emphasis on an improvement in the overall durability of the traditional coal dewatering screen which will then facilitate lower operating costs.

According to Kurt O'Bryan, Weir Minerals Global Product Manager for Screens and Screen Media, achieving these goals is possible by carefully and strategically matching solutions to specific customer needs and applications. He notes that the company's latest developments in coal screen machine technology are focused on increasing the size and mechanical durability of its coal duty vibrating screen line. The Enduron® product range (formerly known as Linatex®) from Weir Minerals concentrates on increasing throughput and decreasing downtime.

The supply and installation of Linatex® screening equipment in the coal industry spans a number of decades. The first Linatex® dewatering screens were supplied in 1983 in a coal application in South Africa to Anglo American Coal's Kleinkopje operation. Linatex® dewatering screens have since been successfully supplied for fine coal applications where they have significantly reduced the moisture content of the fines product.

Over 450 Linatex® banana and horizontal screens in single and double deck format, sieve bend static screens and horizontal rotary screens have been supplied to the coal industry for applications ranging from primary and desliming to dewatering for final product. The customer list includes Anglo Coal, BHP Billiton (now South 32), Exxaro, JHDA and Portaclone.

"Weir Minerals Africa continues to provide support for these screens and, in a number of installations, the screens have operated for in excess of 10 years without any replacement necessary," says Winchester Maphosa, Weir Minerals Africa Product Manager for Comminution and Screens.

He explains that Weir Minerals has implemented a number of innovations to improve the design of the dewatering screens in order to increase their longevity and maintainability. An example he cites is the replacement of the corrosion resistant (3CR12) box deck frame design with a cross-beam and 3CR12 stringer (runner) design. This has eliminated the downtime and production losses which previously resulted from premature deck failures due to latent welding defects.

Another brand within the Linatex® range from Weir Minerals recently launched in the North American coal market is the high performance Fusioncast® polyurethane screen media panels. The material is designed to maximise service life through superior abrasion resistance, a critical factor in coal dewatering. The product's properties and wear characteristics are said to make it ideal for use in a number of coal applications including raw coal refuse screens and fine screening.

"In field trials it was confirmed that the product exhibits wear life advantages of up to 50 % when compared to injection moulded polyurethane screen media panels. This results in a significant time and cost saving for customers. Added operational flexibility is provided by the product being supplied with a wide range of openings for separations as coarse as up to 25 mm," says O'Bryan.

In 2014 Weir Minerals Africa aligned its screens brand with Enduron® comminution equipment, allowing the company to provide 3 to 4,3 m wide screen designs for large modular coal plants. O'Bryan says that the Enduron® VD dewatering screen range has been designed to ensure that maximum efficiency and lowest cost of ownership is achieved. Underpinned by a 40-year history in the coal dewatering sector, Enduron® products are manufactured according to ISO 9001:2010 standards.

Rene Calitz, Weir Minerals Africa, tel (+27 11) 929-2622

Steel arch systems designed for use in friable ground

Becker Mining South Africa's steel arch support systems are designed for use in friable ground in tunnel applications, including haulages, incline shaft portals and special shafts.

Becker Mining South Africa prides itself on being a company that plays a key role in ensuring optimum quality, performance and safety standards in the local mining sector.

"The company's commitment to providing a critical service to the mines and general industry encompasses the design and manufacture of products and systems, using the latest technology. A specialised consulting, training and support facility ensures optimum efficiency of a wide range of equipment and total safety for workers underground," says Tom Searle, Senior GM: Mechanical, Gold and Export, Becker Mining South Africa. "Mine safety is significantly enhanced by the implementation of one or a combination of Becker's specialised multi-technological solutions.

"Becker steel arch support systems are designed for use in friable ground in tunnel applications, including haulages, incline shaft portals and special shafts. These mine support systems are critical for the safety of any mining or tunnelling project and we expect sales growth to remain positive, as long as mines expand and new operations are opened.

"Becker Mining South Africa specialises in the manufacture of steel arch supports, while the company's German and Polish subsidiaries manufacture long wall coal mining shield support systems for European, Asian and North American coal mines. South Africa's strata conditions are not suitable for long wall mining, which is why the company only manufactures steel arch supports."

Searle says the Becker steel arch support system finds application in all types of mining due to the adaptability of the design which fits into any shape of excavation. "This engineered structure is timeless because of the characteristics of steel used and the mechanical properties derived for the shape of elements of the roof support system," he states.

"More and more applications for these well engineered and adaptable systems are being developed for customers who require long term stand-up support solutions for friable ground conditions."

Local applications for these steel arch support systems include gold and platinum mines, as well as underground civil engineering projects like the Gautrain. Becker's roof support systems have also been exported recently into Australasian and African mines, with Zambia being a key user.

Becker Mining South Africa also provides specialised training to customers for the assembly and installation of steel arch support sets.

The company says its specialist manufacturing operation at the Chamdor factory in Krugersdorp is committed to the most stringent quality control procedures during production.

Rigorous tests, which include the chemical and mechanical verification of materials, are performed throughout every production process.

Becker Mining South Africa, tel (+27 11) 617-6300

Flowrox valves supplied to uranium mine

Flowrox, a global leader in heavy-duty industrial valve manufacturing and services, has been awarded a significant project for the Husab uranium mine in Namibia.

The company has been contracted to deliver 83 hydraulically-actuated 550 mm pinch valves to the project for the tailings operation.

Delivering a complete package for its clients, Flowrox has also conducted theoretical and practical training sessions, ensuring the competence and performance of technical staff.

The pinch valves in use at the Husab mine will be operated with a unique actuator solution, whenever required, by means of two mobile gasoline-powered hydraulic power packs.

The project is being led by Henlo Blignaut, MD for Flowrox in South Africa. "Husab only partners with the premium product suppliers in this market sector and Flowrox was chosen due to our quality performance and technology," he says. "The relationship with the customer is excellent and there will be more project collaboration in the near future."

Flowrox, tel (+27 11) 590-8374

Index to advertisers

Kris Vergote - 21 years

Wilna Hoffmann - 20 years

Ernst Bekker - 23 years

Mike Dexter - 20 years

Javier Kirigin - 36 years

Mohini Singh - 11 years

Niel Lourens - 26 years

Bheka Majola - 19 years

Putting our heads together

We invest over 40 years of real-field experience and knowledge in mineral processing to create more efficient, profitable plant processes for our customers.

Achieve your mineral processing goals with Multotec.

MULTOTEC

www.multotec.com

THE RAND MAY CRASH, BUT OUR MACHINES ARE STILL PROTECTED BY THIS SPECIAL PART.

The weakening rand has pushed up the price of imports, but most Bell machinery comes straight out of our Richards Bay factory giving both our machines and our parts considerable protection against exchange rate driven import prices.

With our World Class Products and Africa's Best Support Network, there's no better time to trust Bell with all your equipment needs.

BELL

Strong Reliable Machines • Strong Reliable Support

Johannesburg - Jet Park. Tel: +27 (0)11 928 9700. E-mail: sales@bell.co.za - Web: www.bellequipment.com

Adver118310116