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- Hummingbird Resources ready to roll at Yanfolila
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- Synclinorium Shaft enters the home straight



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COVER

A Komatsu 960E-2KT dump truck on site at the Husab uranium mine in Namibia. Komatsu is supplying 23 of these huge machines to the project. See page 22 for further details.



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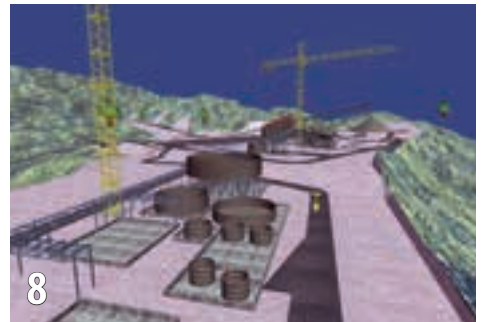
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The fluctuating fortunes of Zambian copper mining

A recent visit to the Zambian Copperbelt has led me to reflect on Zambia's status as a global producer of copper – and the 'highs' and 'lows' of its copper mining industry over the years.

Back in the 1960s, Zambia (known, of course, as Northern Rhodesia until 1964 when it became independent) ranked as the world's third biggest copper producer after the US and the then Soviet Union. The effects of the copper boom were such that Zambia was regarded as having one of the healthiest economies in Africa with a GDP that was ahead of other developing countries such as Brazil, Malaysia, Turkey and – incredibly – South Korea.

At that stage the copper mines were all owned by either Anglo American or Roan Selection Trust but the Zambian government announced in 1969 that they would be nationalised. The effects of this decision were predictable. By the late 1990s copper production had fallen from a peak of just over 700 000 tonnes a year (achieved in 1970 or thereabouts) to little more than a third of this figure – with Zambia, as a result, falling out of the list of the top ten global copper producers.

The mines deteriorated to such an extent under nationalisation – and were proving such a drain on the state, which was subsidising them to the tune of a million US dollars a day at one point – that the Zambian government decided in the mid-1990s to privatise the industry. By 2000 all the mines were once again in private hands and, since then, Zambian copper mining has experienced a renaissance of sorts. Production has climbed back to where it was in 1970 and, in fact, is even slightly higher. Figures vary depending on the source but the just released *Copper Survey 2015* from Thomson Reuters GFMS puts 2014 production at 725 000 tonnes (down from 757 000 tonnes in 2013).

Notwithstanding the huge improvement in copper output from the mines, Zambia is still a long way from recovering its top tier status of the 1960s. Chile is now the world's biggest copper producer by far (producing an amazing 5,7 Mt of the metal in 2014, over a million tonnes of this from a single mine, Escondida) followed by China (1,6 Mt for the same year) and the US (1,3 Mt, also in 2014). Zambia only comes in at No 8 and is no longer even Africa's biggest producer,

having recently been overtaken by the DRC, which in 2014 was just 95 000 tonnes short of the million tonne-a-year mark.

Although much of the Zambian copper mining industry is currently performing sub-optimally (neither Lumwana nor the Konkola mine, for example, is doing well), the ramp up of First Quantum's new open-pit Sentinel mine in the far north-west of the country should see Zambia's output climbing over the next couple of years. Sentinel is designed to be another Kansanshi and at full production should lift the country's output by at least 270 000 tonnes of copper a year.

While I was in Zambia recently, I sensed a negative mood in most people I spoke to about prospects for the country's copper mining industry – a result of a dip in the copper price combined with an increase in the level of royalties (from 6 % to 20 % in the case of open-pit mines and from 6 % to 8 % for underground mines), which was imposed in January this year.

In respect of the royalty issue, it seems that a compromise will be hammered out and – as I write this – it is being reported that the Zambian government has decided to reverse course and set royalties at 9 % for both open-pit and underground mines. This decision should placate First Quantum and Barrick, who are the main surface miners, but is probably not going to sit well with Mopani Copper Mines (MCM) and Konkola Copper mines (KCM), who are both dependent on underground production.

As regards the copper price, the prospects for a revival in the short term are not great, with the Thomson Reuters GFMS survey I referred to above predicting a nearly 400 000 tonne surplus of copper in the market this year. "We are forecasting an average copper price for 2015 of US\$5 975 tonne, a 12 % drop from the previous year," says the report.

Despite the poor business conditions surrounding copper mining, the Zambian mining scene is not without its bright spots, one of them being the major investment by MCM in new shaft systems at its Nkana and Mufulira mines on the Copperbelt and another the stunning turnaround at the Kagem emerald mine of Gemfields. Both these stories are covered in this issue, in which we have a 'country focus' on Zambia.

Arthur Tassell



Notwithstanding the huge improvement in copper output from the mines, Zambia is still a long way from recovering its top tier status of the 1960s. Chile is now the world's biggest copper producer by far (producing an amazing 5,7 Mt of the metal in 2014,) followed by China (1,6 Mt for the same year) and the US (1,3 Mt, also in 2014).



Wassa has a carbon-in-leach processing plant with a rated capacity of 2,7 Mt/a (photo: GSR).

Wassa gold mine in Ghana to go underground

Golden Star Resources (GSR), which has offices in Toronto and Accra, has announced the results of its Feasibility Study (FS) on the development of an underground mining operation (Wassa Underground) at its currently operating Wassa open-pit mine in Ghana. The FS estimates the Wassa mine (underground and open pit) will produce an average of 163 000 ounces of gold per annum over its production life with average cash operating costs of US\$780 per ounce.

The FS indicates an IRR of 83 % for the Wassa mine at a US\$1 200 per ounce gold price and an NPV, assuming a 5 % discount rate, of US\$176 million. Pre-production incremental capital expenditure for Wassa Underground is estimated at US\$39 million with first production from the underground project expected in early 2016 and estimated to continue into 2024.

The total proven and probable mineral reserves for Wassa as of December 31, 2014 are 24,1 Mt at 2,04 g/t for 1,6 million ounces of gold. The Wassa Underground mineral reserves are estimated at 5,4 Mt at

4,26 g/t for 745 000 ounces of gold.

“We are excited to announce this positive Feasibility Study on the combined existing Wassa open-pit operation and the Wassa Underground extension,” comments Sam Coetzer, President and CEO of GSR. “The strong rate of return on investment suggested by the study validates the Preliminary Economic Assessment of Wassa Underground we published in 2014 and is a confirmation of the decisions made for the expenditures on drilling and the studies of the last few years.

“The Wassa Underground project has been underway since December 2014 when we purchased certain underground mining equipment and received the exploration decline permit. The Wassa Underground deposit remains open down plunge and has great potential to grow and the company plans to extend development. The Wassa mine will help transform Golden Star into a lower cost gold producer going forward.”

The mine is in the Western Region of Ghana. It has a carbon-in-leach process-

ing plant with a rated capacity of 2,7 Mt/a. Golden Star has been mining the Wassa open pits since commissioning the plant in 2005. Mining is currently at the Wassa open pit, which is within 500 m of the plant.

In November 2014, SRK Consulting (UK) was awarded the contract to prepare a Feasibility Study to determine the economic viability of an underground mine beneath the Wassa open pit.

Open-pit mining is expected to continue in the Wassa open pit area at a total material mined rate of approximately 1,2 Mt per month until 2021 when the strip ratio is expected to start to decrease. On average, GSR anticipates that the open pit will produce approximately 2,0 Mt/a of ore feed, with the balance of the total plant capacity of 2,7 Mt/a being supplied by Wassa Underground.

Access development to the underground stoping areas will be via a twin decline system from the north-east wall of the current Wassa open pit. The twin decline system will enable efficient ventilation during the early stages of the

underground life and will remove the requirement for a raisebore ventilation raise and escape way close to the start of the decline. The main decline will be 5,8 m high and 5,2 m wide and will be developed using standard trackless mechanised mining methods.

The upper stopes will be mined using longitudinal longhole open stoping with waste rock fill. This will enable efficient early production before a cemented rock fill preparation and delivery system is installed. The open pit will eventually mine down to the top of these upper stopes, but only towards the end of the life of mine.

In the deeper, wider areas of the deposit a transverse longhole open stoping method will be used. A primary-secondary mining sequence will be implemented with the primary stopes filled with cemented rock fill and the secondary stopes with waste rock fill. The overall stoping sequence will be bottom-up to reduce the incidence of sill pillar development.

New surface infrastructure to support the underground mining will be con-



Ore loading in the Wassa main pit (photo: GSR).

structed including electrical power supply from the grid with backup genset support and surface mechanical and electrical workshops.

At steady state production, the Wassa Underground is expected to produce an

average of approximately 2 000 tonnes per day across the life of mine.

GSR holds a 90 % interest in the Wassa, Prestea and Bogoso gold mines in Ghana. In 2014, the company produced 261 000 ounces of gold. ■

Leach processing selected for Kabwe pilot plant

London-based Berkeley Mineral Resources (BMR) announced on 11 December 2014 that it was undertaking a peer review of the definitive feasibility study (DFS) for processing the washplant tailings (WPT) at Kabwe in Zambia

The company subsequently reported on 2 February 2015 that related test work on the WPT was well advanced and that preliminary metallurgical and mineralogical test work was about to start on the leach plant residue (LPR) tailings at Kabwe, the company's largest JORC-compliant resource.

Dr Geoff Casson, the GM of the company's Zambian operations, was in attendance throughout the test work referred to above. In the light of his findings, BMR says it has now selected a leach processing methodology for the pilot plant processing of the WPT and LPR.

BMR arranged for a 5-t sample of WPT to be subjected to a full multi-spiral, gravity separation pilot test by spiral process specialists in South Africa to establish the potential recovery and grade of zinc and lead under simulated plant operating conditions.

Notwithstanding BMR's initial preference for multi-spiral gravity separation, the results of this test work ultimately did not replicate either the potential recov-

eries or grades of the zinc and lead in the final product claimed in the DFS, and metal recoveries were materially inferior to those reported in the DFS. In summary, the volume of fine material generated after scrubbing exceeded 50 % of the ore feed, which proved untreatable by multi-spiral gravity separation.

The alternative multi-gravity separation technology proposed in the DFS, which is often better suited to fine material, was also considered. BMR, after carefully examining previous test work results and taking into account the high proportion of finer feed, rejected this technology as impractical and more costly, without offering a commensurate improvement in zinc and lead recoveries.

A further attempt to improve zinc and lead recoveries by pre-treating the spiral feed was undertaken using Wet High Intensity Magnetic Separation. The objective was to reduce the high percentage of iron (ferrite) competing with the zinc. Whilst some iron was removed, the losses of zinc and lead, locked within the iron minerals was unacceptable and led to low recoveries of both.

Says BMR: "The Directors therefore concluded that the DFS, which had been

commissioned in August 2013 and the results of which were accepted without sufficient challenge by the former Board chaired by Masoud Alikhani, does not provide an acceptable basis for selecting an appropriate processing methodology for the Kabwe tailings.

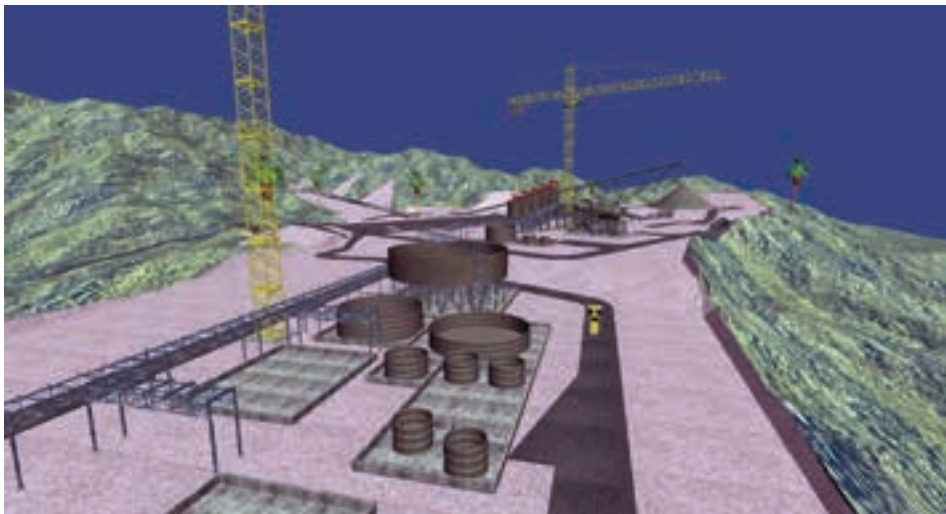
"Furthermore, the Directors resolved ... not to pursue gravity separation as a potential methodology for metal recovery and the DFS has been removed from the company's website."

BMR says the metallurgical and mineralogical test work on the LPR tailings using leach processing, which was resurrected by the new Board earlier this year, has now advanced to mini-pilot stage.

It adds that this proprietary process, which is being developed by BMR working with technical partners, provides a credible alternative for the recovery of zinc and lead from both the WPT and LPR tailings. Results to date are encouraging in that the zinc and lead recoveries achieved are approximately 55 % and 85 % respectively, each of which represents an improvement on the previously claimed recoveries from gravity processing in the DFS. Furthermore, the process generates no toxic effluents.

BMR says it expects to finalise the design parameters for a pilot plant in the next few weeks. ■

WorleyParsons applies virtual reality to mine design



WorleyParsons is harnessing virtual reality technology on a number of current projects.

WorleyParsons RSA reports it is achieving ground-breaking results by harnessing virtual reality technology from the gaming industry and applying it to mine design in the conceptual stage, with the potential to realise significant cost savings for its customers. The technology builds on WorleyParsons' heritage expertise and capabilities in mining through its Johannesburg-based Mining Centre of Excellence.

"From the conventional drawing board and later CAD that served this purpose for many years, mine design technology has suddenly taken a quantum leap forward, firstly to a 3D design environment and now to virtual reality driven in part by the strong R&D support it is receiving

from the nation's major institutions and the industry," says Stuart Doran, the WorleyParsons structural engineer who has helped drive the introduction of this technology to WorleyParsons. "This technology complements our conventional methods and makes it possible to generate detailed, labelled drawings from the dynamic model that the customer has fully reviewed and approved. This has the potential to reduce drawing time and minimise revisions."

Digby Glover, CEO of WorleyParsons RSA, adds that WorleyParsons has made this investment to offer its customers a superior product at a relatively affordable price. "Virtual reality technology seamlessly complements our standard

methods and allows us to fine-tune mine design with the customer before any drawings are generated," he says. "Using virtual reality goggles, an entire multi-disciplinary team from the customer's company is now able to take a 'virtual walk' through the actual site, reviewing mine and plant layout, function of moving objects, roads and associated infrastructure, as well as the risk and safety aspects of the entire layout.

"Any design changes requested by the customer can be instantly applied and since customer personnel are involved from the start, by the end of the process they have exactly what they want," continues Glover. "The product we're offering has the potential to help reduce miscommunication between the customer and the draughtsman during reviews and has so far consistently exceeded customers' expectations."

While this is still in its early stages, WorleyParsons is harnessing virtual reality technology on a number of current projects such as reviewing the models for the greenfield Golpu project in Papua New Guinea, for JV clients Newcrest Mining Limited of Australia and Harmony Gold Mining Company Limited of South Africa.

Doran and his team began researching the application of virtual reality technology to mine design towards the end of 2014 and demonstrated its capabilities to visitors to the WorleyParsons stand at the recently held Mining Indaba in Cape Town. ■

Chinese mining group takes stake in Ivanhoe Mines

Robert Friedland, Executive Chairman of TSX-listed Ivanhoe Mines, and Chen Jinghe, Chairman of Zijin Mining Group Co, Ltd, have jointly announced that Zijin has agreed to make a major investment in acquiring a significant minority stake in Ivanhoe Mines.

Under the terms of the agreement signed in Hong Kong, Ivanhoe Mines will issue 76,82 million common shares to Zijin through a private placement, yielding gross proceeds of approximately C\$105 million (US\$82 million). Ivanhoe Mines will use the proceeds for working capital and general corporate purposes, including the advancement of the company's projects in Southern Africa.

Approximately 9,9 % of Ivanhoe Mines' issued and outstanding common shares will become owned by a wholly-owned subsidiary of Zijin when the placement is completed.

Friedland said Zijin's decision represents the first major commitment by an international mining company to provide support for all of Ivanhoe's development-stage projects in South Africa and the DRC.

"We are delighted to welcome Zijin Mining both as an old friend of Ivanhoe Mines and a strategic investor that shares our long-term vision. We also have agreed to continue to explore additional opportunities to collaborate on the advancement of all three of our world-class

projects," Friedland commented.

"In particular, Ivanhoe and Zijin are in detailed, friendly discussions about the strategic co-development of our Kamao copper discovery in the Democratic Republic of Congo. Kamao's significance was further affirmed earlier this month (March) when Ivanhoe's Kamao Discovery Team received the prestigious 2015 Thayer Lindsley Award from the Prospectors & Developers Association of Canada, recognising Kamao's distinction as the year's top global mineral discovery."

Established in 1986, Zijin has extensive interests across a broad range of commodities. It is one of the largest gold producers in China, the country's second largest primary copper producer and a major zinc producer. ■

Bannerman's Etango heap leach demonstration plant opened

Bannerman Resources has announced the successful completion of construction and the official opening on 24 March 2015 of the Etango heap leach demonstration plant by Patrick Elungu, Chief Inspector – Regional Services, Ministry of Mines and Energy, Namibia, and Dr Wotan Swiegers, Director of the Namibian Uranium Institute.

Bannerman says the commissioning of the plant is a significant milestone as it continues to progress the development of the Etango uranium project. The new facility, an integral step of the detailed engineering and financing phases, specifically enables: demonstrating the design and projected performance reflected in the DFS; maintaining and building project knowledge; and pursuing value engineering.

Bannerman's Chief Executive Office, Len Jubber, said: "The commissioning of the demonstration plant coincides with the Chinese government approving construction of two more units at the Hongyanhe nuclear power plant in Liaoning province,

marking the first approval for new reactors in four years.

"China, currently the largest constructor of new reactors, clearly continues to ramp up its nuclear energy programme in line with its stated goal of increasing electricity generated from nuclear plants from 21 GW currently to 58 GW by 2020 and 150 GW by 2030. In terms of reactors, China now has 24 reactors in operation, 25 under construction and 189 on order, planned or proposed.

"In the face of this growing demand, Bannerman's advancing Etango project remains one of the very few globally significant uranium projects that can realistically be brought into production in the medium term."

Owned 80% by Bannerman, the Etango project is located on the Namib Desert sands approximately 38 km (by road) east of Swakopmund and has proved and probable reserves totalling 279,6 Mt at an average grade of 194 ppm for 119,3 Mlb of contained U_3O_8 . ■



The opening of the Etango heap leach demonstration plant (photo: Bannerman).

Feasibility on Namibian uranium project completed

Forsys Metals Corp has announced the results of a Feasibility Study (FS) for its wholly-owned Norasa uranium project located in the Erongo region of Namibia. The FS, completed by engineering consultants, Amec Foster Wheeler, together with reliance on other experts in the fields of mining and environment and company qualified persons, has confirmed the robustness and economics of Norasa.

Highlights of the FS include a material increase in mineral reserve estimates to 90,7 million lb of U_3O_8 , up 14,8% from 79,0 million lb as of October 2013. The changes to the mineral reserve estimates are primarily as a result of the addition of 10,7 million lb of U_3O_8 of reserves from the Namibplaas deposit, using a 140 ppm cut-off grade.

The operating costs per pound are estimated to average US\$32,96/lb U_3O_8 over the first five years of production and US\$34,72/lb over the life of the mine. The updated cost estimates represent a significant reduction from the 2013 Engineering Cost Study (ECS) estimates of US\$34,76 and US\$38,20/lb U_3O_8 , respectively.

The economic analysis results in an estimated pre-tax net present value (NPV) at a discount rate of 8% of US\$622,6 million (post-tax NPV US\$383,4 million). Using the initial investment and operating cash flows from inception, the pre-tax internal rate of return is estimated to be 32%.

The Norasa production schedule has been modified to incorporate the updated mineral reserves and to include a processing rate increase to 11,2 Mt/a, up from 8,2 Mt/a in 2010. Estimated annual production over the 15-year life of mine (LoM) is approximately 5,2 million lb of U_3O_8 . ■

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Bentley Park teaches latest shaft-sinking methodology

The Murray & Roberts Cementation Training Academy at Bentley Park on the West Rand has adapted its conventional shaft-sinking infrastructure to accommodate the latest shaft-sinking methodology introduced to the South African mining industry from Cementation Canada.

"We are currently equipped to provide 95 % of all shaft-sinking activities, having taken a unique look into what is required in terms of unpacking the cycles and the related activities, and then actually looking at cost-effective ways of being able to simulate the practical demonstrations,"

says Tony Pretorius, Risk Manager.

Murray & Roberts Cementation, in conjunction with Cementation Canada, has adopted the new shaft-sinking methodology, which is safer and features reduced cycle times. The traditional approach to shaft sinking, in terms of using cactus grabs and jumbo drill rigs, has been updated, with all activities in the sinking cycle now handled sequentially.

The traditional sinking methodology requires more than 20 employees to be in the shaft performing concurrent work whereas the latest methodology has dras-

tically reduced this number to a third. The secret lies in the revised cycle arrangements, use of safer and more effective technology and the multi-skilling of workers.

"Our programme is actually an intensive three-month programme, whereby learners are trained in all shaft-sinking-related activities, and not just the select few that we cover traditionally in South Africa. It is very comprehensive, with learners typically having the capability to drill, charge, load and line the shaft," Pretorius says.

Prior to learners engaging with the mock-ups, they pass through a comprehensive theoretical training programme on an e-learning platform, in conjunction with multimedia such as video, diagrams and picture, narration and literature. "Then they move into a visual-based training environment, where they get to understand why they need to carry out tasks in a certain manner. Once they pass through the mock-ups, they are licensed to practice. Usually within a period of 60 days, having been given workplace exposure and experience, they are assessed again in terms of their competence, whereupon they will be issued a licence to operate."

The Murray & Roberts Cementation Training Academy at Bentley Park commenced with the updated training in mid-2014. "Our first crew, which is busy with the production shaft at the Venetia Underground Project for De Beers, graduated from the Academy towards the end of last year," says Pretorius. "Currently we are only assisting with our own needs and have not gone into the external market."

Bentley Park has a capacity for 450 learners, with accommodation for just over 400 on-site. "Our capacity in terms of shaft-sinking training alone can be anything up to 80 learners at a time."

The service offering at Bentley Park includes trackless mechanised mining, mining services, conventional mining and basic engineering. The shaft-sinking component encompasses the presink as well as the main sink. In terms of the physical set-up at Bentley Park, Pretorius explains that the existing shaft-sinking infrastructure has been "changed over" from the conventional set-up. There are four shaft mock-ups, with an average diameter of 8 m, varying from 14 m to 18 m in depth. ■



The shaft-sinking component at the Murray & Roberts Cementation Training Academy encompasses the pre-sink as well as the main sink.

New Chief Executive Officer in place at Shanta Gold

Shanta Gold, which owns and operates the New Luika Gold Mine near Mbeya in Tanzania, has announced the appointment of Dr Toby Bradbury and Patrick Maseva-Shaywabaya to its board of directors, effective from 1 April 2015.

As announced by Shanta in December 2014, Mike Houston stepped down as CEO on 31 March 2015 and has been succeeded by Dr Bradbury with immediate effect. Patrick Maseva-Shaywabaya will continue in his role as Shanta Gold's CFO.

Bradbury, aged 55, was appointed Chief Operating Officer of Shanta Gold on 1 January 2015 and has 30 years' experience in corporate, strategic and operational roles across a broad range of commodities and geographies. His previous executive roles have included being COO for Anvil Mining in the DRC and Senior VP at AngloGold Ashanti in Ghana. He has a BSc and PhD in Mining Engineering and a Masters degree in Business Leadership and is a Fellow of IMMM and AusIMM. ■

Implats unveils fuel cell plans for refinery

Impala Platinum Holdings Limited (Implats) announced recently further plans to use fuel cells to provide energy at its platinum group metals refinery in Springs, east of Johannesburg, from early 2016.

Implats, which is the world's second largest platinum producer, continues to play a critical role in the development of markets for platinum fuel cells and intends using fuel cells for stationary power at its refineries.

Implats CEO Terence Goodlace says this is a very exciting and timely initiative given the current power constraints in the country. Platinum fuel cells provide an effective alternative energy supply for mining and industrial companies in South Africa.

The company has partnered with Mitochondria Energy, a local business, to develop and deliver fuel cell solutions which provide sustainable economic returns. The first phase of the project will see the mining company installing cells using phosphoric acid fuel cell technology

from Fuji Electric in Japan. The fuel cells will operate off excess hydrogen piped in for the metal reduction process. They will supply an initial 1,8 MW of power in two tranches and will also produce heat that will be integrated into the operation. The chemical reaction by the fuel cells produces zero emissions except for clean water that can be utilised within the plant.

The second phase of the project will involve the installation of a fuel cell facility producing up to 22 MW operating on natural gas and hydrogen that will enable Implats' refinery to realise its aim of operating off the national electricity grid.

In the future, Implats will also consider opportunities to deploy stationary power plants with the ultimate aim of using fuel cells as the core energy source for its underground mining equipment. This could also provide an opportunity to significantly enhance mine ventilation requirements and reduce heat, as well as noxious and sulphurous emissions. ■

True Gold appoints CEO

True Gold Mining Inc, listed on the TSX-V, has appointed Christian Milau as its Chief Executive Officer, effective 27 April 2015.

Milau joins True Gold from Endeavour Mining Corporation, where he has served as Executive Vice President and CFO, playing a leading role in Endeavour's acquisition, financing, development, and operation of four gold mines (expected to produce almost 500 000 ounces in 2015) in Burkina Faso, Côte d'Ivoire, Ghana and Mali.

True Gold is developing the Karma gold mine (an open-pit, heap leach operation) in Burkina Faso, which will produce 97 000 ounces of gold a year on average over an eight-and-a-half-year mine life. The EPCM contractor is SENET of South Africa.

The project has been temporarily shut down after a demonstration at the mine in January led to damage to equipment and property. True Gold says it is currently working on renewing its ties with the community with a view to putting community relations on a firm footing prior to resuming construction. ■

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Stellar Diamonds applies for mining licence for Tongo

London-headquartered Stellar Diamonds says it has commenced the application process for a mining licence at its 100 %-owned, 1.45 million carat Tongo Dyke-1 kimberlite project in eastern Sierra Leone. This is as a result of the company's decision to fast-track Tongo to production following recent positive resource definition work, mining studies and financial modelling undertaken by Paradigm Project Management (PPM) of South Africa.

Chief Executive Karl Smithson commented: "Moving Tongo to the mining licence application stage is a major milestone for the project. Having recently

defined a faster route to production cash flow by the assessment of surface mining studies and based on the extensive resource and financial modelling completed to date, Tongo has clear economic potential. The application for a mining licence will be accompanied by updated mining and financial reports under a Preliminary Economic Assessment instead of a previously planned Definitive Feasibility Study in order to cut costs and seek to fast-track Tongo to production. Simultaneous to this, we intend to establish a suitable financing structure to access debt funding for the majority of the US\$20

million of capital expenditure which is estimated to be required to bring the project into production."

PPM will consolidate and update all previous technical reporting into a single PEA. This will include an updated mine plan for both surface and underground mining, re-budgeting of all previous operating and capital expenditure figures and the generation of an up-to-date financial model.

Stellar is targeting a production of 120 000 carats at Tongo via surface mining in the first three years of operation and over 1 million carats over an estimated 16-year mine life. ■



The 5 t/h bulk sampling plant at the Tongo Dyke-1 kimberlite project (photo: Stellar Diamonds).

Construction starts on Yaramoko gold project

Roxgold Inc, listed on the TSX Venture Exchange, has begun construction at its Yaramoko gold project in Burkina Faso, advancing towards production in Q2 2016. The project is designed to produce 99 500 ounces of gold a year – with an initial life of mine of over seven years – from an underground mining operation.

Construction has commenced on the 190-person camp at Yaramoko and bulk earthworks are underway. The fixed price, lump sum EPC contractors, DRA/Group Five, are expected to mobilise and commence construction of the processing plant in the current quarter (Q2 2015). The underground contractor, AUMS, is also mobilising and is due to begin establishment of the

portal to access the deposit in Q2 2015.

"We are delighted to announce that we have officially broken ground at Yaramoko. In less than three years, Roxgold has advanced the project from a maiden resource through feasibility and permitting and now into construction," said John Dorward, Roxgold's President and CEO. "We remain well-funded and expect to be pouring gold at our high grade, low cost operation in the second quarter of next year."

The expected pre-production capital costs for the project stand at US\$110.8 million, an increase of approximately 4 % from the amount in the Feasibility Study published in April 2014. The increase is pri-

marily attributable to scope changes. These include the adoption of a plastic liner for the project's tailings storage facility, which was a new requirement outlined by Burkina Faso's environmental permitting authority.

In addition, the SAG mill and associated equipment have been upsized to facilitate a future expansion of the processing plant's capacity and the backup (diesel) power station capacity has also been increased, which will provide Yaramoko with full standby capability in support of the grid connected power line.

To date, US\$10.8 million has been spent on long lead project items such as the SAG mill, detailed engineering design, the Armtec tunnel for the underground mine access, as well as tower steel and a transformer for the 90 kV power line. ■

DRA Pacific awarded DFS by Triton Minerals

DRA has announced that it has been appointed as Lead Study Manager for the definitive feasibility study (DFS) of the Triton Mozambique Graphite (TMG) project by ASX-listed Triton Minerals. The project incorporates the Nicanda Hill/Cobra Plains, Ancuabe and Balama projects located in Cabo Delgado Province.

Nicanda Hill is reportedly the world's largest known graphite deposit, comprising 1 457 Mt at 10,7 % total graphitic carbon (TGC) and 0,27 % vanadium pentoxide, classified as indicated and inferred. Metallurgical testwork has shown that high purity graphite concentrate of 94 to 97 % may be produced by simple flotation. Both Ancuabe and Balama South contain some of the world's highest quality jumbo flake graphite.

DRA's Perth office will coordinate and manage the overall DFS, complemented by its Perth-based mining engineering partner ORElogy. In addition, services will be provided by several groups within the

Johannesburg office of DRA, covering areas such as infrastructure, logistics, transportation and regional cost estimation. Other specialist consultants have been

appointed directly by Triton, including Environmental Coastal Services for environmental studies and Golder Associates for tailings storage facility studies. ■

Sipho Nkosi to retire as Chief Executive of Exxaro

Exxaro has announced that its CEO, Sipho Nkosi, will retire on 31 March 2016. He was instrumental in the formation of Exxaro which involved the merger of Kumba's coal, mineral sands and base metals assets with Eyesizwe Coal, a company he had previously formed with others. Nkosi has led Exxaro since November 2007, a year after it listed on the JSE. Under his leadership, Exxaro has developed into one of the largest and foremost black-owned, South African-based diversified resources companies.

Mxolisi Mgojo, currently Exxaro's executive responsible for carbon operations, has been appointed to serve as CEO-designate in a transition period effective from 1 May 2015 until 31 March 2016 when his appoint-

ment as CEO will become effective.

Prior to assuming his current position in August 2008, Mgojo was an Executive GM responsible for Exxaro's base metals and industrial minerals commodity business. Leading up to the formation of Exxaro, he was a founding member of Eyesizwe Coal, and served as marketing and logistics director at the company.

He is 54 years of age and has more than 20 years of experience in the operational, financial, logistics and marketing arenas, predominantly in the investment banking and resources sectors. He holds a BSc in computer science, an honours degree in energy studies and an MBA and has completed an Advanced Management Programme. ■

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Construction on schedule at RHA tungsten project

Premier African Minerals Limited, listed on AIM, reports that construction of its flagship RHA tungsten project (RHA) in Zimbabwe remains on course. Premier is the operator of RHA and holds a 49% interest.

According to the company, earthworks are ahead of schedule at 21% actual completion versus 8% planned, waste stripping has begun at the open-pit mining area and the plant, which is being fabricated in South Africa by Appropriate Process Technologies (APT), is due for shipment to site in May. Infrastructure development

(power and water supply and reticulation) is in progress with all trenching for water supply lines completed.

The modular plant is designed to meet a throughput of 16 t/h or 8 000 tonnes per month and achieve a wolframite recovery of 82,8%. The stated production rate excludes any consideration of a pre-concentration circuit which, if implemented in future, could increase the plant throughput fivefold at a 20% recovery loss as determined in the metallurgical test work announced in September 2014.

The RHA project is located in the Kamativi tin belt of north-western Zimbabwe and Premier is planning two stages of development – a first phase, low capex (US\$4,8 million) open pit, which provides an 18-month life of mine, followed by an underground mine (capex estimate – US\$14,7 million) based on mechanised long-hole open stoping. The open-pit annual production will be 96 000 t (ROM) while the underground production rate will be between 192 000 and 288 000 t (ROM). ■



ROM pad construction at the RHA project nearing completion (photo: Premier African Minerals).

Twangiza gold production hits a new record

Canada's Banro Corporation, listed on the TSX and NYSE, reports that its Twangiza mine in the DRC produced 35 943 ounces of gold in the first quarter of 2015, a 78% increase over Q1 2014, successfully managing the adverse impact of the rainy season.

Twangiza and Banro's second mine, Namoya, are both located on the Twangiza-Namoya gold belt in the South Kivu and Maniema provinces of the DRC to the south-west of Bukavu.

"Twangiza is performing well and achieved its third consecutive record quarterly gold production. Twangiza will be optimised in Q2 for operational improvement. Namoya is positioned to improve during Q2 2015 as we are ramping up ore production following the installation of the agglomeration stage (with cement added as a binder) into the Namoya heap leach cir-

cuit. The agglomeration drum is expected to allow for more efficient processing of the fines content of the Namoya ore and ensure more efficient reagent percolation in the heap process, leading to better gold recovery," commented Banro CEO and President John Clarke.

At Twangiza, larger mine production allowed the operation to prioritise higher grade for processing, while ample dry stockpiles allowed for consistent throughput to optimise the quarterly plant throughput (428 844 t), reaching the annualised design throughput of 1,7 Mt/a. Management plans, over the next two quarters, to continue to debottleneck the process to ensure this capacity can be maintained permanently before pursuing higher targets.

At Namoya, Banro reports a significant improvement in heap leach stacked

tonnes during the first quarter with 64 720 tonnes stacked in January, 87 441 tonnes in February and 103 162 tonnes in March for a first quarter 2015 total of 255 323 tonnes. Namoya poured 3 260 ounces in January, 2 687 ounces in February and 3 307 ounces in March for a first quarter 2015 total of 9 254 ounces of gold.

With the commissioning of the agglomeration circuit and debottlenecking during Q1 2015, it is anticipated that the gold production profile for the Namoya operations will rise incrementally from its current level of approximately 3 000 ounces per month achieved. With heap leach operations taking several months of continuous percolation to fully recover the leachable gold, the full benefits of the improvements to the heap leach circuit are expected to build up during Q2 2015 to a monthly gold production rate of 9 000 to 11 000 ounces per month during H2 2015. ■



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New Namibian mine achieves commercial production

Canada's B2Gold Corp has announced that its new Otjikoto gold mine in Namibia achieved commercial production, ahead of schedule, on 28 February 2015. The ramp up of production continues well ahead of budget.

The open-pit mine poured its first gold on 11 December 2014, one week ahead of schedule. In January 2015, the project continued its strong ramp up to commercial production ahead of schedule and produced 8 587 ounces against a budget of 8 267 ounces. Better than budgeted performance was attributed to additional mill availability (89,6 % versus budget of 70 %) and better than anticipated throughput (34 % above budget). February 2015 also saw gold production ahead of target (10 228 ounces produced versus 8 863 ounces budgeted).

Operating cash costs for the month of January were US\$612 per ounce versus a budget of US\$705 ounce.

For 2015, Otjikoto is expected to produce between 140 000 and 150 000 ounces of gold at a cash operating cost of approximately US\$500-525 per ounce and all in sustaining costs of approximately US\$700 per ounce. The company expects annual gold production to increase to approximately 200 000 ounces in 2016 and 2017.



The Otjikoto mine poured its first gold on 11 December 2014, one week ahead of schedule (photo: B2Gold Corp).

Expansion of the Otjikoto mill from 2,5 Mt/a to 3,0 Mt/a continues on schedule with the installation of the first additional leach tank to be completed during the first quarter of 2015. Major additional work that must be completed includes installation of a second leach tank, construction of a pebble crusher and associated piping

and pumping components. It is anticipated that this work will be completed by August 31, 2015. This will support additional throughput initially from the Otjikoto mine and subsequently from the fully permitted Wolfshag deposit that is located immediately adjacent to the main Otjikoto deposit. ■

Mine location identified after drilling

Ferrum Crescent, the direct reduction iron (DRI) pellet project developer, says it has determined the final location for infill drilling and ore reserve development over Zones A, B and C of the Moonlight deposit, located in Limpopo Province, South Africa. These zones have now been selected for the primary development model over the first 10 years of mine life.

Drilling over Zone D was the final phase of comprehensive area drilling undertaken to identify where the next stage of the bankable feasibility study (BFS) will be focused. Zone D drilling confirmed comparable grades to those previously identified within the inferred resource, and consequently the adjacent zones with shallower intersections, higher grades and better stripping economics will progress first into development. A new mineralised zone outside the limits of the current JORC (2012) mineral

resource was also identified in Zone E.

The drilling programme was a component part in the mine design, location and costing element of the Moonlight BFS. The BFS was recommenced in Q4 2014 with the detailed mine plan identified as being the next core element scheduled for completion. Following analysis of the 10 RC drill holes, the first 10-year development model will be based on Zones A, B and C and further infill drilling will commence next to establish a JORC (2012) ore reserve and for advanced beneficiation work to be undertaken as part of the DRI plant design process. The success of infill drilling will also determine whether bulk sampling is necessary to complete the full mine design and plant costings.

Commenting recently Tom Revy, CEO of Ferrum Crescent, said: "Following completion of this phase of mine design drilling,

we have now selected the key zones for first mine development. Ferrum will work to establish a full ore reserve and complete advanced metallurgical test work at Moonlight. Because we are looking to establish a mining/beneficiation-DRI pellet manufacturing operation to supply a premium, high-grade iron product, the current design phase is especially important as we progress talks with a number of parties. As we continue to de-risk Moonlight, by narrowing development parameters, I believe that the company is well positioned to take advantage of the significant changes now occurring within the iron supply market.

"Given the positive advancement of the BFS and the advanced discussions we have entered into with three separate parties, the market looks positive for us to achieve cash flow by 2019/20."

Ferrum Crescent is an Australian company listed on the ASX, London's AIM and the JSE. ■

AEL and ELB to collaborate on blasting initiative

AEL Mining Services has entered into an agreement with ELB Engineering Services for the installation of turnkey Vertical Drop infrastructure that will enable deeper, safe and efficient delivery of emulsions for blasting in underground mining operations.

A Memorandum of Understanding between the two parties was signed at AEL's head office in Johannesburg recently by Dr Stephen Meijers, CEO of ELB, and Sepadi Mohlabeng, AEL Executive Director: Global Operations. This agreement will see ELB exclusively installing the AEL-patented infrastructure at customers' sites as required, while AEL will sign off on completion of the projects, commissioning and supply of emulsion.

The Vertical Drop enables safer deep level mining by allowing emulsion and sensitiser to be delivered to storage tanks underground, thereby offering the requi-

site explosive energy on tap. The system, described as "revolutionary", enhances safety, improves logistics and saves costs.

The agreement between AEL and ELB is the culmination of work carried out over five years and will, as a first for the industry, provide mines with access to emulsion at levels as deep as 700 m. According to AEL and ELB, this is leaps and bounds above the current depths that have traditionally been achieved of approximately 225 m.

"This innovation addresses the challenge facing mines of delivering explosives

as deep as possible, without compromising on safety," says AEL's Mohlabeng. "This also removes our customer's burden of conducting another, separate project which would require a re-allocation of their resources."

ELB's work will include the establishment of the pertinent roadways, surface delivery point, the drilling of the borehole, installation of all piping and underground storage tanks, as well as the respective piping and ancillary equipment and required safety and control devices. ■

IMX raises money to fast-track Chilalo

Australian-based exploration company IMX Resources, listed on the ASX and TSX, has successfully raised A\$1,57 million (before costs) via a share placement to fast-track its 100%-owned Chilalo graphite

project in the south-east of Tanzania.

IMX will use the proceeds from the placement to undertake metallurgical optimisation testwork and to commence a Pre-Feasibility Study (PFS) on the development of Chilalo.

IMX Chief Executive Officer Phil Hoskins said: "We are delighted to have received strong support from investors, including a number of new institutions, for this share placement, which is a vote of confidence in the company and the quality of our Chilalo project.

"We are confident that Chilalo, with its excellent metallurgical characteristics and high-grade resource, is a world-class graphite asset that represents an outstanding near-term development opportunity.

"We look forward to fast tracking the Chilalo project, with pre-feasibility work on a graphite mining operation in the order of 25 000–50 000 tonnes per annum to commence immediately. The results to date have been sufficiently encouraging to justify various study projects to be undertaken in parallel, rather than in sequence, which we expect to significantly shorten the feasibility study process."

IMX recently declared a maiden inferred mineral resource for the high-grade Shimba deposit at Chilalo, in accordance with JORC 2012. The estimate comprises 7,4 Mt grading 10,7 % Total Graphitic Carbon (TGC) for 792 000 tonnes of contained graphite (within the >5 % TGC high grade zone). The high-grade resource is part of the total Shimba mineral resource estimate of 18,1 Mt grading 6,2 % TGC for 1,11 Mt of contained graphite. ■

New Liberty gold project in Liberia forges ahead

This recent photo – showing the thickener tank, ball mill and mill building – of Aureus Mining Inc's New Liberty Gold Mine (NLGM) illustrates the progress being made on the project. The first gold pour at New Liberty – an open-pit operation – is expected by the end of May 2015. Further plant optimisation and final commissioning is only expected to occur in June and July, leading to steady state production at the end of July 2015.

The EPCM contractor is DRA Mineral

Projects, which was also responsible for the studies on the project, including the PEA and the DFS. Aureus will undertake the mining itself with MonuRent contracted to provide and maintain the mining fleet.

Aureus recently announced that an additional 28 000 ounces of gold is expected to be produced in the first year of production through the mining of an additional starter pit, which brings the total Year 1 target production to 122 000 ounces of gold. ■



Jig plant installed at Namibian manganese project

Shaw River Manganese, listed on the ASX, reports that Otjonzondu Mining (Pty) Ltd (OM), its wholly owned subsidiary, has installed a new 100 t/h jig plant at its Otjonzondu (Otjo) manganese project in Namibia.

The company said in a recent statement that plant commissioning and material trials had commenced and that it was expected to take up to four weeks to complete trials and optimise programming for various ore types and grade profiles.

Observations from the first trials indicate beneficiation on the jig beds is extremely efficient and both product grade and yield exceeded expectations.

Trial mining at the three Labusrus pits to a depth of 5 m as planned has been completed and the material intended for beneficiation through the new plant has been stockpiled. It is estimated that stocks at this point total approximately 80 000 tonnes.

Shaw River purchased 75,5 % of the



The new 100 t/h jig plant on site at the Otjo project (photo: Shaw River).

Otjo project in early 2011 and has now increased its share to 100 %. The project is located 150 km north-east of the Namibian capital of Windhoek and lies in an histori-

cal manganese field which has produced in aggregate approximately 550 000 tonnes of high grade (approximately 48 %) manganese since the 1950s. ■

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Tsodilo acquires mobile DMS plant for BK16 sampling

Tsodilo Resources is completing a diamond core drilling programme of 15 holes to a cumulative depth of 2 621 m on both the main and satellite bodies at its BK16 kimberlite project located within the Orapa Kimberlite Field (OKF) in Botswana



The 10 t/h DMS plant acquired by Tsodilo Resources for the BK16 project.

in order to develop an advanced geological model.

In anticipation of the bulk sampling programme which is scheduled to start during the second half of this year, the company has purchased a DMS mobile plant from De Beers Botswana. The plant is capable of handling a 10 t/h head feed throughput and was used in the evaluation of AK6 (Karowe diamond mine) owned by Lucara Diamond Corp. It is set up and located just outside Lethlakane village approximately 15 km directly WNW from the BK16 pipe.

The plant includes primary and secondary crushers (cone and jaw), de-sliming screens, conveyors, a scrubber with 12 mm trommel screen, a DMS preparation screen and a DMS cyclone (250 mm/57 mm). It is equipped with a laboratory, security office and concentrate storage units.

Tsodilo intends to spend some time

refurbishing the plant in order to start treatment of the diamondiferous BK16 kimberlite during Phase 1 of the evaluation programme towards the end of this year. Using very conservative estimated grades, the company intends to extract and treat some 3 500 tons in order to recover in excess of 200 carats during the evaluation programme.

"Tsodilo continues to advance its projects in an expedient and cost effective fashion by utilising its company-owned drill rigs, geophysical equipment and now the DMS processing plant. This allows us to evaluate the potential of our projects in a fast and cost effective fashion which is crucial at any time but especially in today's economic environment. The outlook for diamonds is very positive and we want to move BK16 along as fast as we can," says Tsodilo's Chairman and CEO, James M Bruchs. ■

PFS demonstrates a "world class" niobium project

ASX-listed Cradle Resources has announced the results of a Preliminary Feasibility Study (PFS) for the Panda Hill niobium project in south-western Tanzania.

Grant Davey, the MD of Cradle, commented: "We are very pleased with the results of the PFS, which demonstrate a highly economic, world class project. The PFS substantially de-risks the project fol-

lowing on from excellent results achieved with the resource drilling and the metallurgical test work last year. We focused the study on a higher grade mining schedule that delivers the optimal early cash flow for the project. With the Definitive Feasibility Study already underway, and an updated mineral resource due out shortly, we are well advanced in ensuring that Panda Hill

will be the next niobium producer."

The PFS was prepared by MDM Engineering Projects (MDM) who also undertook plant design and cost estimates. It incorporates technical aspects from Coffey Mining for the mineral resource estimate, SRK Consulting (Australasia) for the geotechnical analysis and mine planning, SGS Canada Inc for metallurgical test work, SLR Consulting (Africa) for tailings and water studies and MTL Consulting Company Ltd for environmental and social studies.

The 'Base Case' for the PFS is centred upon an open-pit mining operation providing 2 Mt/a mill feed over a 30-year life of mine (LOM). This is the same scale of operation that was considered in the Scoping Study and is the current size of Magris Resources' Niobec operation in Canada, thus allowing useful comparative analysis.

With the success achieved in the PFS in both mill feed grade and metallurgical recoveries, the initial ferroniobium production from a 2 Mt/a plant now approximates 8 to 10 % of world production. For this reason, and to simplify financing arrangements, the Definitive Feasibility Study will be scoped so as to achieve a more modest entry into the market (i.e. throughput commencing at 1 Mt/a). ■

Mineral resource exceeds target at Mahumo

ASX-listed MOD Resources has announced a high grade mineral resource of 2,68 Mt at 2 % Cu and 50 g/t Ag (at a 1 % cut-off) for Stage One of its 100 %-owned Mahumo copper/silver project in Botswana. The tonnes and grade are well above MOD's target of 2 Mt at 1,8 % Cu and 45 g/t Ag.

The resource has a copper equivalent grade of approximately 2,5 % – which MOD understands is the highest announced grade for any copper/silver deposit in Botswana. It adds that the silver grade is approximately three times the average silver grade of other announced resources in the Kalahari Copperbelt.

Due to the high grades at Mahumo, MOD is now proceeding with a scoping study to evaluate a range of options for potential

mining and ore processing at Mahumo. Metallurgical test work has already commenced to validate preliminary results announced on 29 September 2014. The scoping study is due for completion in the June quarter.

"The Stage One mineral resource at Mahumo has exceeded our expectations," comments Julian Hanna, MD of MOD Resources. "Importantly, the high copper and silver grades are continuous from near surface to the deepest intersections in drilling completed to date. Mahumo remains open ended below the current resource and it appears that further drilling may result in a significant increase in the size of the resource." ■

DRA lands its first-ever phosphate project

DRA has been awarded the implementation phase of the Elandsfontein phosphate project, located on the west coast of South Africa, by Elandsfontein Exploration and Mining (Pty) Ltd. The EPCM contract was awarded to DRA, and follows the recent completion of the definitive feasibility study of the project, also carried out by DRA.

A major component of the scope of the project will be the processing facility and its associated infrastructure, designed to produce approximately 1,35 Mt/a of phosphate concentrate. Included in the process plant will be screening, classification, milling, reverse flotation, dewatering and product handling. Tailings will be dewatered by belt filter prior to dry stacking.

DRA's in-house mining division carried out the design and production scheduling of the open-pit mining operation, which will be contracted out by Elandsfontein.

Paul Thomson, CEO of the DRA Group, comments: "We are especially pleased and proud to be awarded the Elandsfontein phosphate project. The award follows more than 15 months of working closely with the Elandsfontein team on the study of the project, during which a wide range of testwork and trials were carried out to develop the optimum flowsheet.

"This is a unique project for South Africa, as the first sedimentary type phosphate project carried out in the country as opposed to igneous phosphate. In addition, it's the first phosphate project awarded to DRA in our 30-year history, demonstrating our versatility in minerals processing and successful project delivery. Its award is also a testament to the ability of our study teams in jointly solving technical challenges in close cooperation with our clients."

The project will be managed from the Cape Town office of DRA, with commissioning due in August 2016. ■

Rockwell Diamonds sells non-core Tirisano mine

Rockwell Diamonds Inc, listed on the TSX and JSE, has reached an agreement to sell its non-core Tirisano project for a cash consideration of C\$6,3 million. Located in North West Province some 500 km from the company's Middle Orange River (MOR) operations, Tirisano was identified some time ago as a non-core asset and a sale process was initiated.

The mine was placed on care and maintenance in December 2012 and subsequently royalty contract miners were brought in to continue mining operations on the property. During the subsequent period the contract mining operations processed an average of 160 000 m³ per month producing between 1 500 and 2 000 carats per month.

After evaluating a number of proposals as part of the sale process, Rockwell reached an agreement with a consortium made up of the royalty miners, who have operated at Tirisano for the past two years.

Rockwell also reports that it is expanding its exploration activities in the MOR, initially focusing on the Lanyonvale and contiguous Wouterspan properties. ■

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Komatsu 960E-2KT drives

Komatsu's mechanical might is being harnessed in the development of Swakop Uranium's massive Husab mine, arguably Namibia's largest ever commercial undertaking. While the Komatsu fleet will total in excess of 50 products on completion of delivery, the most powerful and visually impressive will be its string of 23 Komatsu 960E-2KT electric dump trucks (EDTs), some of which are already engaged in the development of the mine's pit areas.

The 960E series is currently the largest off-road mining vehicle produced by Komatsu and despite its size, power output and payload capability is outstandingly fuel efficient.

Komatsu's long road to Husab began around five years ago, when the mine's project team conducted a global survey of heavy-duty mining equipment to identify which suppliers and products would be best suited to the operation's needs.

Husab Engineering and Maintenance Manager Jaco Duvenhage explains that during an exhaustive research and technical evaluation process, particular attention was paid to turnaround times – the key to the cost-effectiveness of an operation the size and scope of which will make it the world's second-largest uranium mine.

"The development team realised at the outset that the right machinery for its purpose would deliver a combination of rapid cycle times and fuel efficiency while at the same time incurring low maintenance and running costs," says Komatsu South Africa Manager Mining Business Frikkie Booyens.

Another given was the ability of the equipment to work in the intense heat of the Namib Desert, with temperatures reaching up to 40°C during the summer months.

What followed was a travel marathon involving several visits to Komatsu's truck manufacturing headquarters in Peoria, Illinois, in the United States and mining sites around the world to see products in action at the sharp edge of the industry.

Trolley system

The quest to find the ideal EDT was accomplished when Komatsu presented its electric



trolley system which delivers an alternative form of energy to propel trucks.

"The system was developed in conjunction with the Siemens Group and operates within the mining environment in basically the same way as an inner city commuter tramway," says Booyens.

Trolley assist infrastructure comprising overhead cables, transformers and related equipment is established along the operation's haul roads and transmits power to the truck via pantographs.

"This has the dual effect of increasing outright performance in terms of speed while decreasing the consumption of diesel by as much as 40 % or more. The effect on cycle times is dramatic," he adds.

And it's not difficult to see why.

At Husab, heavily laden haul trucks will wind their way from the bottom of the pit to the stockpile area over a difference in elevation of in excess of 400 m. A fully laden truck packing an all-up weight of well over 500 metric tonnes is a very thirsty machine, but not so with the Siemens trolley option.

Husab mining operation



Above: A Komatsu 960E-2KT electric dump truck (EDT) at Husab, one of a fleet of 23 of the units deployed at the mine.

Right: A Komatsu 960E-2KT tips its load. The payload of the 960E-2KT is 327 tonnes.

Below right: An 85 000-litre capacity Komatsu water tanker refills at Husab. The total size of the Komatsu fleet at the mine is in excess of 50 machines.

“Using electrical power on gradients will reduce a truck’s total fuel consumption by a factor of 40 % or more. But what is hugely significant in terms of improved cycle times is that – by switching to trolley assist – trucks can haul at speeds of up to 26 km/h instead of 12 km/h in diesel mode.”

The installation of the trolley system at Husab will be completed by 2017, when the mine is scheduled to be fully operational.

The might of the 960E-2KT

The 960E-2KT in use at Husab is visually impressive. The unit stands 9,3 m tall, is 15,3 m long and 10 m wide, making it hardly surprising that it will carry payloads of up to 327 metric tonnes from the pit.

Bulk is however deceptive as the truck



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bristles with a host of advanced features which ensure a high degree of tractability and manoeuvrability while, at the same time, providing a safe and comfortable working environment for the operator.

The heart of any truck is its power plant and the engine developed by Industrial Power Alliance, a joint venture between Komatsu and Cummins, does not disappoint, delivering a resounding 3 500 horsepower (hp) at 1 900 rpm.

Using technology to provide in-pit solutions

The mining environment is a challenging one as haul roads are often characterised by punishing gradients and tight turns which test the concentration and skills of operators. The 960E-2KT, however, provides Husab with some very practical solutions to in-pit obstacles.

By using double-acting hydraulic steering cylinders with a six-point articulated linkage, the 960E-2KT power steering system provides steering control with minimal operator effort. In addition, the turning radius of the 960E-2KT is 16 m, which provides excellent manoeuvrability. These features not only facilitate seamless transition around tight corners but help avoid delays when the trucks operate in restricted loading and dumping conditions.

The cost effective operation of each of these mega vehicles is aided by the use of its built-in Payload Meter 111®, which helps to optimise payloads, deliver optimum performance and reduce the life cycle cost of these capital intensive machines. Data captured includes information related to payloads, carry back, haul cycle loading and dumping times, distances travelled and average and maximum speeds reached within designated time periods.

Effective control of a 580 tonne plus vehicle traversing steep gradients is of paramount importance, not only in ensuring operator safety but the safety of everyone working in the operational area. Continuous dynamic retarding capability rated at 6 196 hp helps the operator control the vehicle while travelling downhill, providing constant speed control.

Conversely, the Komatsu drive system is programmed with hill start logic to mitigate the risk of a roll back should the vehicle be stationary on a ramp. It also governs the truck's braking function when the operator decides to continue his journey and employs traction control technology which automatically corrects wheel spin or lateral sliding



motions in slippery or wet conditions. This operates independently of the vehicle's main braking system.

Assembly and commissioning

The assembly and commissioning process started with the well-timed arrival of equipment from three continents to a 200 m² strip of sand some 65 km from Swakopmund.

Bowsers, wheeled dozers, wheel loaders and graders were shipped from Japan direct to Walvis Bay located close to the project site, while the haul trucks made their way from Komatsu's manufacturing facility in the United States.

The transportation of the trucks' dump bodies, however, proved to be a more complex undertaking. "To reduce freight costs these items were manufactured to Komatsu standards by a Johannesburg-based company; however, the original plan to ship them directly to Walvis Bay was thwarted because a short section of road from the docks to the assembly point was impassable owing to the sheer size of these units," says Booyens. The final decision was to truck twenty-three 10-m-wide bowls 2 100 km from Johannesburg to Husab.

So far, eleven 960E-2KTs have entered service at the mine and currently transport overburden from the operation's two developing pits under diesel power. These pits are estimated to be around 2,5 km long and up to 1,3 km wide.

Operator training, skills transfer and evaluation is also being conducted using specially imported simulators, a clear indication of the sophisticated nature of the modern mining industry.

When ramped up to nameplate capacity, Husab will produce in excess of 150 million lb of uranium oxide a year. ■

Komatsu 960E-2KTs at Husab. Eventually the trucks will utilise an electric trolley system in order to reduce fuel consumption.

Continuous dynamic retarding capability rated at 6 196 hp helps the operator control the vehicle while travelling downhill, providing constant speed control.

Yanfolila gold project on

Since acquiring the Yanfolila gold project in the Sikasso region of south-west Mali from Gold Fields in July last year, London-based, AIM-quoted Hummingbird Resources has moved with remarkable speed to advance the asset and is now on the brink of starting construction. Production from the new open-pit mine is expected to start in H1 2016 and will average 79 000 ounces of gold a year over an initial mine life of six-and-a-half years. The capital cost is estimated at US\$71,6 million. Hummingbird's engineers for the plant are SENET, based in Johannesburg but active throughout Africa.

Hummingbird's founder and MD, Dan Betts, believes that Yanfolila represents an "incredible investment proposition" and points out that Gold Fields spent in the region of US\$100 million on exploration and development studies during the several years it owned the project (which it acquired from Glencar Mining in late 2009). "In essence, we took over a project that had been taken – to all intents and purposes – to the Definitive Feasibility Study stage and was development ready," he says.

An interesting point is why Gold Fields



Dan Betts of Hummingbird Resources pictured at the recent Mining Indaba in Cape Town (photo: Arthur Tassell).

relinquished the project. "Yanfolila was too small for their portfolio but they believe in the project and sold it to us for 'paper' in

Grade control drilling at the Yanfolila project in Mali.



the brink of construction

Hummingbird in a deal worth US\$20 million,” Betts says. “They’re now the biggest shareholder in Hummingbird, with a stake of approximately 25 %. They could have taken cash but they’ve chosen to retain a significant interest in the project.”

Hummingbird is planning a smaller development than Gold Fields envisaged. “They were proposing a 3 Mt/a operation but we’ve scaled it down as we’re targeting the low strip ratio oxide resources,” Betts explains. “Our strategy is to get into production fast with a low cost, low technical risk project which can – if necessary – be expanded at a later stage. We’ve optimised all the previous work undertaken on the project and our Optimisation Study, which we’ve recently released, indicates very robust economics for the planned development.”

The optimised project targets 100 000 ounces of gold production in the first full year after ramp up and 79 000 ounces a year (on average) for the balance of the mine life. C1 cash operating costs are estimated at US\$641/oz and all-in sustaining costs at US\$733/oz. Assuming a gold price of US\$1 250/oz, the project will deliver a post-tax NPV (8 %) of US\$72,4 million and an

IRR of 35,1 %. The payback period (after tax) is put at three years.

Yanfolila has a total gold inventory of 1,8 million ounces, contained in an indicated resource of 8,2 Mt at a grade of 3,3 g/t and an inferred resource of 11,9 Mt at 2,5 g/t. The current mine plan, however, includes only 6,3 Mt of ore and is based on progressively mining five deposits (some of which consist of several pits): Komana East, Komana West, Guirin West, Sanioumale East and Sanioumale West.

The plant has been designed to process 1 Mt/a of a 50:50 blend of oxide and fresh ore giving a likely higher capacity when processing softer oxide ore and offering the potential to extend the LOM through processing fresh ore. Hummingbird will contract a mining service provider to apply industry standard open-pit mining methods according to its mine production schedule. A competitive tender is underway for awarding this contract.

Mining methods will include excavating the soft oxidised ore near the surface, and drilling and blasting harder transitional and some fresh rock – 67 % of ore processed during the LOM is oxide ore. Drilling and blasting

The Hummingbird camp at the Dugbe project in Liberia.



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requirements will vary by year as most of the saprolitic (oxide) material is free-digging, while all of the unweathered material (sulphide/fresh) requires drilling and blasting. Loading will be done with a combination of excavators and front-end loaders. Material will be loaded into 50-t to 90-t capacity trucks depending on the deposit's location and pit size. Where possible, material will be taken directly to the plant but, at satellite deposits, material will be placed in stockpiles near the pits. This material will then be reclaimed with front-end loaders and loaded into 50-t trucks and hauled to the crushing facility.

Soft run-of-mine ore will initially be crushed by a mineral sizer and passed through 18 mm and 180 mm screens. The ball mill will grind the feed into finer particle size (80 % passing through a 106 µm screen) to enable gold recovery via gravity concentration or carbon in leach (CIL). Approximately 40 % of the gold is gravity recoverable.

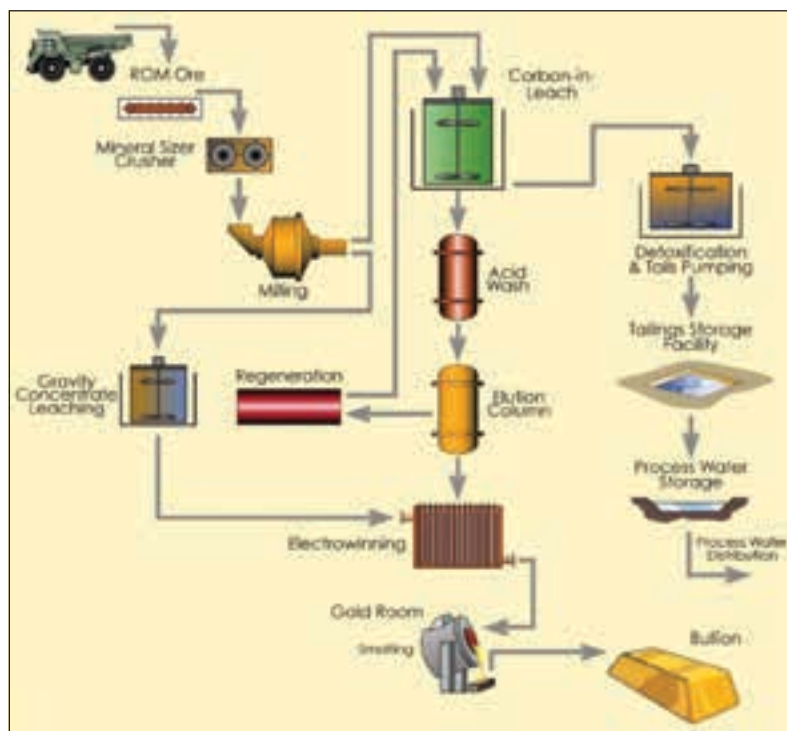
The main mill product will flow to the CIL process but a select fraction of the mill output will be separated and fed into a gravity gold circuit applying centrifugal force to concentrate heavy, gold bearing particles for intensive leaching. Once leached, the gold bearing pregnant leach solution will be piped into an electrowinning cell. The gravity tails will be returned to the mill stream.

The gold solids recovered from the gravity and CIL circuits will be transported into the secure gold room, where they will be smelted at a high temperature to produce molten gold, which will be poured into gold doré bullion and shipped to a refinery.

The project is estimated to require an initial 2,6 MW of base load power to operate, with 5,6 MW installed power, and Hummingbird intends contracting out the power generation on a diesel rental basis. Installation of 1 MW of solar PV power on a turnkey rental basis is under consideration to reduce opex.

Summing up the project, Betts describes the planned mine as being capable of turning a profit in a varying gold price environment. "The metallurgy of our resource is excellent, our power requirement is low and we have a plentiful supply of water. We have an experienced team ready to start on construction and also all funding – primarily a US\$75 million debt facility agreed with Taurus Fund Management – in place. There really is no downside to the project and we are looking forward to pouring our first gold next year after a 12-month build period," he says.

While Yanfolila will be Hummingbird's



Flowsheet for the Yanfolila gold project.

first mine it is unlikely to be its last. The company also holds the Dugbe 1 gold project in south-east Liberia which has the potential to be bigger than Yanfolila. "Dugbe represents a virgin discovery by our geologists and now boasts a resource of just over 4 million ounces of gold at an average grade of 1,4 g/t," he says. "This certainly ranks as Liberia's biggest gold deposit and, in fact, is impressive by global standards. We completed a PEA in 2013 which demonstrated the viability of a 20-year project producing up to 125 000 ounces a year in its early years and we're now well advanced with our DFS – which is currently under optimisation." He adds that the DFS is being prepared by a team of consultants led by South Africa's MDM Engineering.

In a significant development for Dugbe, Hummingbird recently announced that it had signed a collaboration agreement to embark on the planning and development of a 20 to 30 MW hydro-electric power plant in the Dugbe area. The agreement is with IFC InfraVentures, part of the IFC Global Infrastructure Project Development Fund, and energy company Aldwych International. To test the viability of the project, a Pre-Feasibility Study (PFS) is to be undertaken by Knight Piesold Consulting (Vancouver) and should be completed by April next year. The PFS is being funded by IFC InfraVentures.

Comments Betts: "The hydro-project – assuming it goes ahead – will not only enhance the economics of Dugbe 1 by reducing the operating costs but will also act as a more general

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catalyst for development in this relatively remote and undeveloped part of Liberia. We regard it as an extremely exciting opportunity for Hummingbird.”

With Yanfolila about to enter construction and Dugbe 1 at a very advanced stage, Betts can take satisfaction from the progress he has made with Hummingbird since he founded it in 2005. His achievement is all the more remarkable given that he is neither a geologist nor a mining engineer and that prior to establishing Hummingbird he had no experience in either exploration or mining (although his family has a metals trading business, which he is still associated with).

Although he is based in the UK (he splits his time between Birmingham and London), he has spent large amounts of time in West Africa over the years, particularly in Liberia, which is where Hummingbird first focused its efforts. He has taken to the exploration and mining game with enthusiasm and insists that Hummingbird should be seen as a mine-builder rather than as a company which takes deposits up the value curve with a view to selling them off once they've progressed to the point where they are attractive to majors.

As he says, “We very definitely want to mine and this ambition will soon be realised with Yanfolila. Once that's up and running, it will provide a platform for us to develop Dugbe 1, which is likely to be a more complex and expensive task given the size of our deposits in the Dugbe Shear Zone – and their capacity to grow. Ultimately, we want to be a mid-tier gold producer focused on the Birimian deposits of West Africa and I believe we are well on our way to achieving this goal.”

Report by Arthur Tassell, photos courtesy of Hummingbird Resources (unless otherwise acknowledged)



An access road under construction at the Dugbe project.



A core drill working at Dugbe. The project already has a 4,2 Moz gold resource and is said to have significant exploration upside.

Latest developments on Yanfolila

In an update on Yanfolila issued as we were going to press with this issue, Hummingbird announced that the orders for the long lead items for the project had been placed. These include the 4,3 m diameter x 6,0 m long ball mill, to be supplied by Outotec SA, and the 800 t/h mineral sizer, which is being sourced from MMD Mineral Sizing (Africa), based in Johannesburg.

It also announced that a Letter of Intent had been signed with Société de Forage et de Travaux Publics (SFTP) to commence plant earthworks and that it had concluded a binding agreement with BCM International Ltd (BCM), a well-established mining and civil earthworks contractor, whereby BCM will subscribe for up to US\$5 million of shares in Hummingbird in lieu of payment for services during the construction phase.

In addition, Hummingbird has appointed a Project Construction Manager for Yanfolila. He is Johann du Preez, who has worked for Lycopodium in Burkina Faso and who was the Construction Manager for MDM Ferroman on the construction of the Loulo gold mine for Randgold Resources and the Tabakoto gold mine for Nevsun Resources, both in Mali. ■



This panoramic view of the Chama pit gives an idea of the scale of the Kagem operation.

Kagem – a thoroughly modern gemstone mine

While Zambia is noted for its world-class copper deposits, not so well known is the fact that it now hosts the world's largest emerald mine, Kagem, which has been transformed over the past seven years from an under-funded, inefficient, loss-making operation into one of the success stories of Zambia's mining industry. Responsible for the turnaround is London-based, AIM-quoted Gemfields, which has invested well over US\$60 million in the mine since acquiring it in 2008. **Modern Mining's** Arthur Tassell recently visited the site – located about 60 km to the south of Kitwe on the Copperbelt – to see for himself the scale of the transformation.

The first thing that the visitor notes on entering the mining area at Kagem is the sheer size of the operation. Most coloured gemstone mining around the world tends to take place on a relatively small scale – often by informal miners – with mining methods typically being very labour intensive. Kagem, by contrast, is highly mechanised – at least in terms of its stripping and waste removal – and *Modern Mining* saw an impressive fleet of modern excavators, articulated dump trucks and drill rigs operating in the main pit, Chama, which is now 120 m deep and roughly a kilo-

metre in length. Totalling nearly 100 units if ancillary equipment is included, the mining fleet handles nearly a million tonnes of rock a month (considerably more in some months), a figure which is dramatically up on the approximately 125 000 tonnes a month being achieved when Gemfields acquired Kagem.

Talking to *Modern Mining* from London in a phone interview, Gemfields' CEO, Ian Harebottle, cited the problems that the company inherited in 2008: "We found a site with a huge waste removal backlog, no ore at the pit bottom for production, no effective security systems, poor health and safety



A Bell Equipment water bowser washes down the exposed ore – which assists the task of hand mining.



A sample of ore from the reaction zone.



A Cat 730C articulated dump truck (ADT) hauls its load out of the pit. ADTs are preferred to rigid trucks at Kagem due to their better manoeuvrability.

standards, no formal reporting structures, virtually no accountability, a huge environmental liability and, into the bargain, a demoralised management team and workforce,” he said. “In addition, the mining fleet was in poor shape with broken machines scattered across the property wherever they had broken down. We knew we had a big task ahead of us but we had confidence in the underlying quality of the asset – in terms of its orebody – and had no doubts that we could turn Kagem around.”

This confidence was not misplaced and Kagem Mining Limited (75 % owned by Gemfields with the Government of Zambia holding the balance) turned a loss of US\$13.5 million in its 2009 financial year into a profit of US\$2 million in its 2010 financial year. It

has remained in profit ever since and in its latest annual results (to 30 June 2014) declared a profit of US\$23.64 million. The company is expecting to produce 25 to 30 million carats of gemstones in FY2015 and accounts for a fifth of total world emerald production. Its efforts have made Zambia one of the ‘big three’ global producers of emeralds, alongside Colombia and Brazil.

Explaining the path to profitability at Kagem, Harebottle told *Modern Mining* that Gemfields had concentrated on creating a modern, well-resourced, professional mining operation. “We have a state-of-the-art Mine Planning Division which has delivered on proper benching, smooth haul roads and improved reconciliation,” he said. “Our plant fleet, in which we’ve



The high wall of the Chama pit. The fourth pushback is currently in progress.

“Kagem has enjoyed an unblemished safety record since we took over with not a single reportable injury having occurred since we assumed full operational responsibility in 2009.”

**Ian Harebottle,
CEO, Gemfields**

invested heavily, has been obtained from Caterpillar, via Barloworld Equipment Zambia, and Bell Equipment and is very well maintained. Our labour force of around 600 is now fully unionised, a development which we’ve insisted on, and all eligible employees have been placed on permanent and pensionable terms. Salaries are going up and employees have been granted a basic increment of 14 % for 2014-2015 with a further 14 % pre-negotiated for 2015-2016. We’ve also made a concerted effort to improve on health, environmental and safety standards and, in fact, Kagem has enjoyed an unblemished safety record since we took over with not a single reportable injury having occurred since we assumed full operational responsibility in 2009. We’ve now worked over 3 million injury-free shifts.”

Harebottle – who is South African born and who was COO of the then TanzaniteOne tanzanite mine in Tanzania before joining Gemfields – added that the mine had now also been connected to the Zambian electrical grid via a 33 kV line which had cost Kagem US\$0,6 million to install.

Of course, improving production and lowering costs at Kagem is only one half of the equation that Gemfields has had to solve since entering the emerald market. “The other half has been the marketing of the mine’s product,” Harebottle told *Modern Mining*. “We are working hard at this with the objective of increasing the demand for emeralds – which, incidentally, are significantly rarer than diamonds – and providing a consistent, professionally graded

supply of ‘responsibly sourced’ emeralds to world markets.

“A major step forward in this direction was taken in 2009 when we introduced a groundbreaking, fully transparent emerald grading and auction system. Today, we hold four auctions a year of Kagem’s products, some in Zambia and some overseas, and these have been overwhelmingly successful. Indeed, at our auction of predominantly higher-quality rough emeralds held in November last year we raised US\$34,9 million at an average value of US\$65,89 per carat, which is a new record for higher quality emerald auctions.” He added that further elements of the strategy have included the launch of a global emerald marketing campaign in 2011 and the appointment of American actress, Mila Kunis, as Gemfields’ global brand ambassador in 2013.

From the point of view of *Modern Mining’s* readers, the more interesting side of the overall Kagem/Gemfields operation is the mining and processing on site and this was explained during our visit by Robert Gessner, Senior Manager – Geology for Kagem Mining. A specialist in coloured gemstones (prior to joining Kagem he was also at the tanzanite mine in Tanzania), he said that the emerald and beryl mineralisation on the Kagem property occurs at the interface between two rock types – a feldspar biotite rich pegmatite and a talc chlorite magnetite schist (TMS).

“The pegmatites cross cut the TMS, forming reaction zones which host the emerald and beryl. These reaction zones, which can range

from a few centimetres up to 2 m in thickness, are what we target – everything else is waste,” he said. “In the Chama pit, the TMS dips at 16 deg to the south and south-east and is cross cut by the pegmatites vertically. The pit slowly migrates as we follow the TMS and, in fact, we’re now busy with our fourth highwall pushback, which will extend the pit by a further 75 m to the south-east.”

He pointed out that the emeralds that form within the ore (reaction zone) tended to occur in pockets. “The result is that you have good times and bad times – but they tend to even out,” he noted. Grade can vary considerably but averages out to 300 carats per tonne for the Chama pit.

Gessner added that most of the rock handling in the pit related to the waste with ore production only accounting for about 8 000 tonnes a month. “The waste stripping is a 24/7 operation carried out both in-house and with the assistance of a contractor whereas we do the ore mining ourselves and only during daylight hours – because we need good visibility to detect the emeralds, which are normally encrusted with schist, and for security reasons. Although excavators are used to open up the contact zone, essentially this is a manual operation by teams of chisel men – watched over by security personnel and geologists – who recover the exposed emerald crystals, which are then placed into lockable production boxes and taken to the sorting house. The balance of the material in the contact zone is loaded into ADTs and taken to the processing plant for recovery of emeralds – and beryl – not detected by the hand mining.”

A strip-and-fill mining method is used by Kagem. This involves stripping the high wall and filling in the exhausted footwall with the hard rock, which contains the size of the pit and keeps the environmental liability under control. Stripping ratios are enormous compared to conventional mines and are currently varying between 80 and 100 to 1 as a result of increased contractor stripping.

While the mining operation at Kagem is huge and quite complex, the processing operation – which is chemical-free – is very straightforward, involving ore crushing and washing followed by screening in a triple-deck unit, after which the material reports to a picking belt facility where the emerald crystals are picked out by hand from a series of picking belts. The picking operation goes on around the clock in three eight-hour shifts, with lower quality material being processed at night. The final part of the process involves the cleaning



Chisel men at work watched by security personnel.



A Cat 336D excavator loads a Cat 730C ADT. Kagem's mining fleet is modern and well maintained.

and grading of the emeralds in the sort house and their assembly into parcels for auction.

Interestingly, the management at Kagem is mainly composed of Indian expatriates, headed by C V Suresh, who is Director of Operations. The total number of expats is currently 59 but,

Kagem carries the flag

Kagem, which has three rivers (including the Kafue and the Kafubu) on its boundaries, is located in the central part of the Ndola Rural Emerald Restricted Area (NRERA). The discovery of beryl (emeralds are a gemstone variant of beryl) in the area dates back to 1928 although mining of emeralds on any significant scale apparently only began in the 1970s.

The Kagem mine is one of only three sizeable mines in the area but the NRERA also hosts several hundred informal miners. Kagem is by far the biggest producer and has been described by the Zambian government as “the flag-bearer company of the Zambian gemstone industry.” ■

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increasingly, Zambians are being trained to take over managerial roles.

Ore reserves are sufficient to support mining operations in the Chama pit for at least 10 years but Kagem Mining has a very active mineral resource replenishment programme ongoing within its 41 km² licence area, with two bulk sampling projects currently underway. One is the Libwente South pit in the south-east of the licence area, where bulk sampling began in July last year, while the other is the Fibolele pit, in the north of the area. The programme at Libwente South is quite sizeable and will involve 1.9 Mt of rock handling to produce 41 000 tonnes of reaction zone ore at a targeted stripping ratio of 46:1.

It is worth mentioning that Kagem has also tested the potential for underground operations, starting several years ago on a trial underground mining project which has seen the driving of a short decline, nearly 1 000 m of lateral development and the establishment of 10 m x 10 m stopes. This project, while successful (and a first in the Zambian emerald mining industry), was put on hold last year, with Gemfields saying in its recent operational review that the “continued viability of open-pit operations, supported by robust emerald prices, has provided Kagem with the flexibility to extend the open-pit operations as required and has negated the need for accelerated underground operations at this time. The results of the pilot project will be incorporated into the ongoing study of potential larger-scale underground mining operations, along with the development of a detailed underground mine plan. A project manager with extensive experience of underground mining in prevailing rock conditions within Zambia has been appointed to oversee this expansion plan.”

Finally, what of the future for Kagem? According to Harebottle, the mine will remain crucial to Gemfields’ strategy of positioning itself as the world’s leading supplier of



The picking belt facility, which is part of the washing plant, where the emerald crystals are picked out by hand from a series of picking belts.

responsibly-sourced rare coloured gemstones. “Our record at Kagem speaks for itself,” he told *Modern Mining*. “We haven’t been afraid to invest heavily in terms of people, processes and equipment and we’re now reaping the benefits. Based on current performance and trends, I see continued growth at the operation for many years to come.”

Photos by Arthur Tassell

Gemfields – more than just emeralds

Kagem is not Gemfields’ only mine. It also has a 50 % stake in Kariba Minerals in the south of Zambia, which it says is the world’s largest amethyst mine (accounting for 40 % of global production), and the Montepuez ruby deposit in Mozambique, which it claims is the world’s largest ruby mine. Additionally, it has a sapphire JV in Sri Lanka, exploration licences in Madagascar and is looking at the possibility of moving into Colombia. In keeping with its ‘mine and market’ strategy, in 2013 it acquired 100 % of Fabergé, the luxury jewellery business.

In the year to 30 June 2014, Gemfields recorded revenues of US\$160.1 million and EBITDA of US\$59.3 million. Its performance has impressed the market and it was recently named as the winner in the ‘Best Basic Resources PLC’ category at the 2015 UK Stock Market Awards.

One of its major shareholders is Brian Gilbertson’s Pallinghurst Resources, which also has investments in PGM and manganese mines in South Africa. ■

feature

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Synclinorium Shaft project

The dip in the copper price plus disputes over the level of royalties have left Zambia's copper mining industry reeling. Nevertheless, some Copperbelt players are pressing ahead with major capital projects designed to either expand production or extend mine life (or both), among them Mopani Copper Mines plc (MCM), owner of the venerable Nkana and Mufulira underground copper mines. At Nkana, one of the projects underway is the new Synclinorium Shaft, which is due to start commissioning by the end of this year. Playing a key role on delivering the new shaft is Murray & Roberts Cementation Zambia, which has completed the shaft sinking and is now busy with the equipping.

Majority owned by global giant Glencore, which is the world's third biggest copper producer, MCM was last year named as Zambia's Mining Company of the Year for 2013, in part because of its impressive investment in Zambia's copper mining industry. Commenting on the award at the time, MCM's CEO, Danny Callow, said: "We are aware that in order for us to continue operating in a more efficient and cost-effective manner, it is imperative that we invest in new technology and infrastructure. We anticipate a 30 per cent decline in ore production by 2018, therefore, we have invested almost US\$900 million in sinking three new shafts; this includes the Synclinorium Shaft at Nkana, the Mindola and the Mufulira Deeps to extend



Centre: View of 3 960 station vent cross cut. Additional support being installed at bull nose before wetcrete application.

Below: Photo taken in March this year showing the completed shaft 'barrel' with all cables installed (photo: Arthur Tassell).



mine life by over 25 years and increase annual copper production at a reduced unit cost."

The Synclinorium project, which will access 115 Mt of ore at a grade of 1,9 % copper and 0,09 % cobalt, accounts for US\$323 million of the US\$900 million referred to by Callow and involves construction of both a main shaft and a ventilation shaft. Murray & Roberts Cementation is responsible for the main shaft (including a bulk air cooler level, two electrical cubbies and two stations). The shaft is 7 m in diameter and has been blind sunk to a depth of 1 280 m. Equipment used has included a stage and kibble winder, a five-boom jumbo shaft rig, a five-deck working stage with a cactus grab, two mini-excavators and an automated batch plant. A separate shaft-sinking contractor, Redpath, is undertaking the vent shaft (using a raise borer) although Murray & Roberts Cementation handled the initial 50 m section of presinking.

Also included in Murray & Roberts Cementation's scope of work is the erection of the permanent 64 m high steel headgear which has been fabricated by Steel Services in South Africa and which was already largely on site and awaiting assembly when *Modern Mining*

heads for commissioning



visited the Synclinorium project recently. MCM is bringing in a 400-t capacity crane, which will be used in removing the temporary sinking headgear and erecting the new permanent structure. At the time of writing, the crane had arrived in Durban and was due to be transported to the Copperbelt in 23 road trucks.

Commenting on the Synclinorium project, Murray & Roberts Cementation Zambia's Executive Director, Jan Nefdt, says it has been one of three projects responsible for a huge resurgence in Murray & Roberts Cementation's activities in Zambia. "The Group has been involved with Zambia for many years but we never felt the need to establish a permanent presence in the country," he says. "This changed four years ago when we secured a major contract for the new Lubambe mine of ARM and Vale near Chililabombwe for decline construction and ore reserve development, followed shortly thereafter by the award of the Synclinorium contract. Mopani subsequently awarded us a second shaft contract – for the Mufulira Deeps project. This is a 1 500 m deep, 6,1 m diameter shaft, which we're raise-boring using a Wirth HG330 machine, together with related infrastructure. We also, incidentally, have a second



raise borer at Mufulira – a Robbins 71R which is being used for a vent hole.

"As a result of the Synclinorium and Lubambe awards, we decided to establish a permanent office here in Kitwe in the heart of the Copperbelt and this was opened in 2012. We view the office as being not only the base for our Zambian operations but also for the DRC – where we've already completed one contract at Kipushi for Ivanhoe Mines – and other countries further north in Africa. Our total employee complement in Zambia is now around 1 000,

Above: Shaft-sinking operations during the sinking phase. The sinking was undertaken using traditional South African shaft-sinking methods.

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roughly 10 % being expatriates. Obviously we want to reduce the proportion of expatriates and we are therefore putting a great deal of effort into training. We have set up an e-learning centre and we also send trainees to our Bentley Park training facility in South Africa.”

Nefdt says that with Murray & Roberts Cementation’s Lubambe contract about to finally finish (the company will be off-site shortly) and the Synclinorium having only months to run, the challenge now is to build up the order book. “This is not an easy task in the present market but we are currently tendering on projects in the DRC and Ghana,” he says.

Commenting on the Synclinorium contract, he says that this could rank as the last shaft to be undertaken by Murray & Roberts Cementation using conventional, South African-style shaft-sinking methods. “The Group is moving towards adoption of the model pioneered by our Canadian company in which all activities in the shaft-sinking cycle are undertaken in-line, with no jobs taking place simultaneously, which we believe will make for greater safety and more efficiency,” he explains. “Having said this, the traditional methods have served us well on the Synclinorium, which has generally progressed well after some initial delays relating to some problems with the civils and also poor ground conditions for the first 200 m, which proved tricky to negotiate and which required extra support.”

The shaft sinking was completed at the end of September last year, with one of the successes along the way being a record 96 m of sinking and lining during the month of August 2013 and one of the challenges the very wet conditions, which required up to 24 000 litres of groundwater a day to be pumped out of the shaft. Nefdt’s colleague, Wyllie Pearson, who is Senior Project Manager, also mentions that the



company intersected a 28 m dyke at one point. “We sank through it without incident, a notable achievement given that the rock was very hard and susceptible to scaling. This necessitated support to within 1 m of the shaft bottom in order to increase worker safety.”

Innovations in the field of safety on the Synclinorium contract by Murray & Roberts Cementation have included the introduction of a new system to replace the old system of hand

Above: The sinking headgear which is due to be dismantled shortly (photo: Arthur Tassell).

Top left: Loading box installation during equipping phase.

Top right: Mini-excavator working on the 1 231 m loading station level.



Above: Pictured here (from left) are Fred Durand, Project Manager, Synclinorium Shaft, Jan Nefdt, Executive Director, and Wyllie Pearson, Senior Project Manager, all of Murray & Roberts Cementation Zambia (photo: Arthur Tassell).

Right: An early stage of the contract showing erection of the sinking headgear.



signals and pull bells to communicate from the shaft bottom to the working stage platform. The new system consists of a radio installed in a worker's hardhat, with a built-in speaker and microphone to enable hands-free operation. Another first has been the introduction of directional rope lights to indicate to all workers which kibble is where at any given time and its direction of movement. Finally, electronic alcohol testing equipment has been deployed which is linked to an entrance turnstile and denies access to the site to anyone in transgression of the preset parameters.

While on site at the Synclinorium project, *Modern Mining* also had the opportunity to talk to Piet Grundling, Manager Projects for MCM, who is overseeing all the new shaft projects at Nkana and Mufulira. He pointed out that the two mines are old (both were established in the 1930s) and deep and, as a result, at the higher end of the cost spectrum in world terms. "Not only are the new shafts giving us access to deeper levels of the orebodies at the two mines, but they will be far more efficient in terms of rock handling, thus allowing MCM to contain costs," he said. He said that the simultaneous construction of three major shaft systems by MCM was "unprecedented".

All three shafts, including the headgears, have been designed by Hatch Goba, the South African arm of the Hatch group, which has enjoyed a long relationship with MCM.

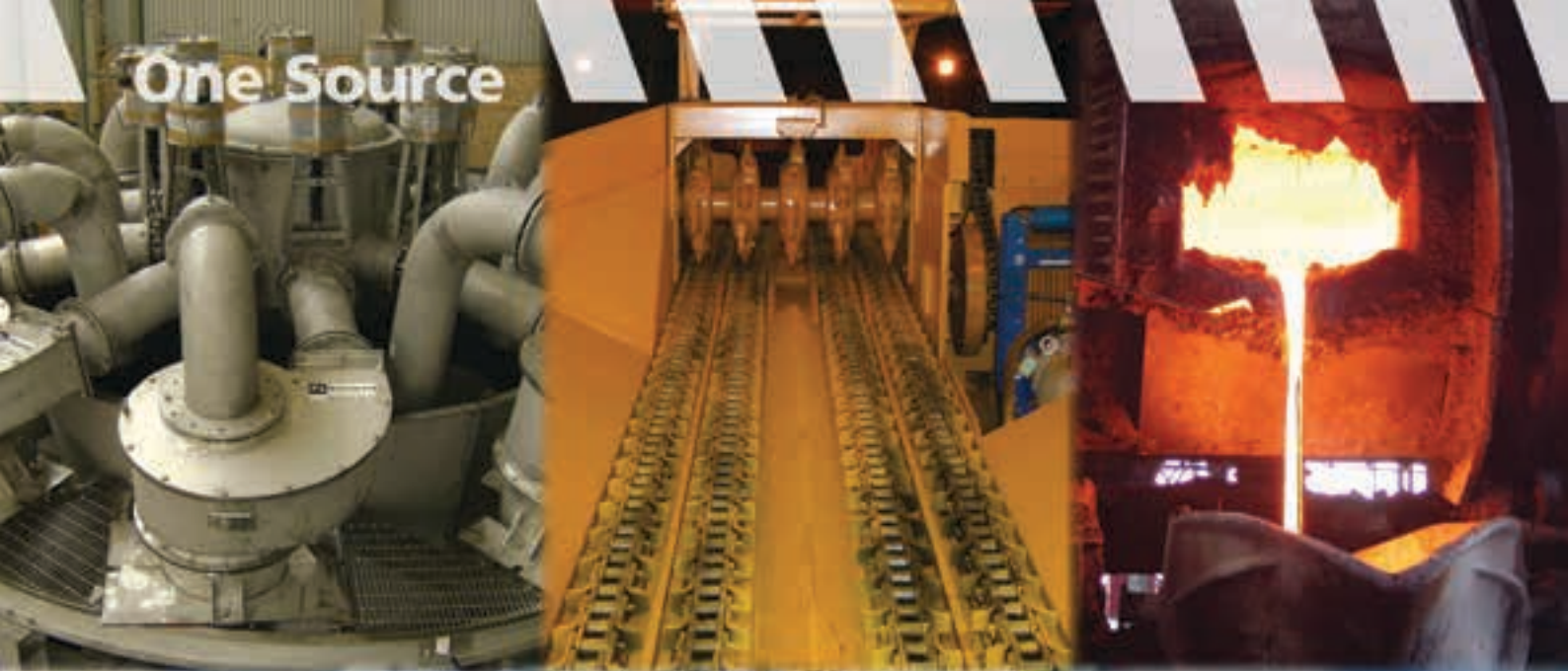
Referring to the hoisting arrangements at the Synclinorium, Grundling said the winder to be used – and which has already been installed – is a 5,5 m by 1,5 m, quadruple-drum Blair Multi Rope (BMR) winder for rock duty. It will operate at up to 15 m/s and is able to handle a payload of 26,5 t. It was sourced from FLSmidth, which is also supplying the BMR man and rock winders (four in all) for the Mindola and Mufulira

Deeps projects. FLSmidth will start delivering the units towards the end of this year, allowing installation well in advance of the 2017 commissioning dates for both shaft systems.

According to Grundling, the total copper output of Nkana and Mufulira should be around 140 000 tonnes in 2015, split almost evenly between the two mines, with 95 % of it coming from underground operations. This probably makes it a bigger underground producer than Konkola Copper Mines (KCM), which owns the Konkola and Nchanga mines and which is only expecting to produce 120 000 tonnes in its 2015 financial year. Zambian government figures for 2014 indicate that MCM is responsible for approximately 15 % of Zambia's copper production.

Summing up, Grundling said the Synclinorium Shaft, together with the companion shafts being sunk at Mindola and Mufulira, would secure the future of MCM's mines to 2040 and beyond. "Between them, and including contractors, Nkana and Mufulira employ 20 000 people and MCM in fact ranks as one of the single biggest employers on the Copperbelt. The development of these new shaft systems is thus critical to the region's future and a measure of MCM's commitment to Zambia," he concluded.

Report by Arthur Tassell, photos courtesy of Murray & Roberts Cementation (unless otherwise acknowledged)



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AMC – a consultancy with a long Copperbelt track record



Edwin Mukonka, GM of African Mining Consultants (AMC).

*While it would probably be true to say that the greatest concentration of mining consultancy skills in Africa resides in South Africa, and specifically Johannesburg, this is not to say that some African countries do not have their own home-grown expertise. Serving the Copperbelt in Zambia, for example, is African Mining Consultants (AMC), a company which has created a formidable reputation since being formed in 1994 and which has worked over the past 21 years for just about every mine in Zambia. **Modern Mining's** Arthur Tassell recently spoke to AMC's General Manager, Edwin Mukonka, at the company's offices in Kitwe.*

Explaining the background to AMC, Mukonka says it was founded by Martin Broome in 1994. "Martin came to Zambia in the 1970s," he says. "He was an MSc graduate in Rock Mechanics of Imperial College, London, and – after arriving on the Copperbelt – enjoyed a long career with ZCCM, the state mining company, which saw him eventually becoming Group Rock Mechanic Engineer. He founded AMC in 1994 and his timing was nearly perfect. The second half of the 1990s saw the privatisation of ZCCM's assets and this process generated a steady flow of work for the new consultancy, enabling it to expand quite rapidly."

Broome retired in 2009 (he now lives in Australia) and Mukonka – who joined AMC in 2002 and is one of its shareholders – has led the company since his departure. A Mining Engineering graduate of the University of Zambia, he started his career with Zambia's Mines Safety Department, which saw him being seconded to the Luanshya copper mine near Ndola, now defunct but, in its day, one of the pillars of the Copperbelt. He heads AMC's mining division (AMC Mining Services) and has expertise in – among other disciplines – mine planning and design, open-pit optimisation, drill-and-blast design, geological and resource modelling, mine audits and mine studies (from the scoping study stage through to full feasibility).

Mukonka is also an expert in Geovia's Surpac and Whittle software. "We are, in fact, the distributor for Geovia in Zambia and this constitutes a very healthy side of our business," he says. "Our relationships with the mines means that we are well suited to marketing the Geovia range. Apart from sales, we also provide

training on the software and this keeps us very busy as there is hardly a mine in Zambia which does not make use of the products."

Although it started as a mining consultancy, AMC has subsequently branched out into exploration (AMC Exploration Services) and environmental work (AMC Environmental Services). It has also diversified geographically since its founding. Although the bulk of its workload has been – and remains – in Zambia and the neighbouring DRC (in particular Katanga Province), it has undertaken contracts all over the continent – as far south as Richards Bay in South Africa and as far north as Mauritania, Eritrea and Sudan. It operates over all commodities but, given its history and location, is especially recognised for its expertise in copper.

Interestingly, AMC Exploration Services is headed by Thomas Rogers, who is based between Gaborone in Botswana and Kitwe in Zambia. He received his BSc (Hons) in Geology from St Andrews University in Scotland. He has extensive experience in Africa, having worked in over 10 countries on the continent, and played a prominent role – while representing AMC – in the world class Kamoia copper discovery near Kolwezi in the DRC – reputedly the largest newly discovered undeveloped copper deposit on the planet! Rogers, along with Dr David Broughton, Executive VP of Exploration at Ivanhoe Mines Ltd (the owner of Kamoia), and other members of the discovery team were honoured earlier this year when they received the prestigious Thayer Lindsley Award from the Prospectors & Developers Association of Canada (PDAC). The award, which is presented annually by the PDAC, recognises an individual or a team of explorationists credited with a recent significant mineral discovery or series of

discoveries anywhere in the world.

Mukonka says that with the global dip in exploration spending, work for AMC Exploration Services has become more difficult to secure but points out that it has several active assignments in Zambia and the DRC, one being the Lumwana West project for Argonaut Resources. “Exploration is obviously a very cyclical business and we’re confident that it will turn up again in due course,” he says. He adds that AMC can claim to be one of the leading geological consultancies when it comes to the Central African Copperbelt, with an unrivalled knowledge base that has been built up over many years and over a multitude of projects.

While AMC does not involve itself in process plant design, it can consult on metallurgy, its lead expert in this field being Dr Chris John, who is currently based in South Africa. He has over 30 years’ experience in minerals processing on the Copperbelt. A graduate of the University of Birmingham (with a PhD from the University of Newcastle), he enjoyed a long career with ZCCM before entering the consulting field, most recently with AMC.

On the environmental side, AMC remains

busy. This division of the company offers a full range of services including the preparation of baseline studies and ESIA’s, the design and establishment of environmental monitoring systems, environmental management, tailings design, monitoring and management and government reporting and compliance. It has in the past partnered with Golder Associates in South Africa, with which it has an informal alliance. Says Mukonka: “Given that much of the work of AMC Environmental Services revolves around statutory requirements in the field of health, safety and the environment on the mines, our environmental side has held up very well in the face of the global mining recession.”

As regards AMC Mining Services, Mukonka says it has enjoyed a healthy workload over the past several years but acknowledges that the dip in the copper price is now starting to be felt on the Copperbelt. “Certainly we’re expecting more challenging business conditions as we move forward. We have several contracts in place both in Zambia and the DRC but replenishing the pipeline of projects is going to become increasingly difficult until commodity prices recover,” he concludes. ■

“Certainly we’re expecting more challenging business conditions as we move forward.”

Edwin Mukonka

feature

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Boniface Mwila, principal mining engineering consultant, SRK Consulting.

Royalty debate in Zambia raises stakeholder issues

According to SRK Consulting, the recent raising of mining royalties by the Zambian government – to replace the 30 % corporate income tax on mines – and the vociferous reaction to this move by the country’s mining companies is an indicator that stakeholder relationships are not what they should be.

Although it seems almost certain that the Zambian government will reduce the royalty increase (and may well have done so by the time this article is in print), the royalty issue has raised important questions. “Partnerships between governments, mining companies, communities and other stakeholders are increasingly an important focus for consulting engineers,” said SRK principal mining engineering consultant Boniface Mwila, “as these relationships form the foundation for mine viability and sustainability.

“Our services in providing pre-feasibility, feasibility and due diligence reports for clients – which focus on the viability and value of mineral projects – must make predictions about future conditions affecting an operation. Clearly, this is made more difficult if there is the possibility that royalties or taxes will change substantially over the life of the mine.”

At the same time, said Mwila, countries

reserve the right to change these rates as part of their national economic policies.

“In the case of Zambia, government has justified the move as a bid to achieve a more equitable distribution of the mineral wealth between government and the mining companies,” he stated. “It also says the royalty is easier to implement than corporate tax; it has in the past expressed concerns that many companies understate their profits by using off-shore corporate structures that charge the local company high fees for services like management and marketing.”

Industry has in return warned that jobs will be lost, arguing that most Zambian mines are not profitable due to the low commodity prices.

This is clearly a high-stakes clash, as copper mining contributes a direct 9 % of GDP and almost 70 % of the country’s export earnings, said Mwila; this is important revenue for government, which is keen to narrow the fiscal deficit which doubled in 2013 due to more

Dust suppression solution provided at Kansanshi

The largest copper mine in Africa is reportedly making a measurable contribution to environmental sustainability and the health and safety of nearby communities through the adoption of an innovative dust suppression solution developed by I-CAT Environmental Solutions.

First Quantum Minerals’ Kansanshi mine is located approximately 10 km north of the town of Solwezi. The mine has undergone several expansions since it began operating in 2005. From an initial production capacity of 110 000 tonnes of copper, Kansanshi is now capable of producing 340 000 tonnes of copper and more than 120 000 ounces of gold per year.

A multi-stage expansion project aims to increase copper output capacity to approximately 400 000 tonnes by 2015. This considerable expansion offers numerous financial and socio-economic benefits

to nearby communities. However, a disadvantage is an increase in dust – which impacts negatively on human health and safety, the surrounding environment and reduces the lifespan of machinery.

In order to proactively overcome this challenge, Kansanshi mine has been making use of the RDC 20 dust solution since 2011. I-CAT Operations Director Anton van der Merwe explains that RDC 20 is a water soluble anionic polyelectrolyte polymer comprising an exclusive formulation of blended emulsified co-polymers and ionic modifiers. “RDC 20 is produced from natural substances and features no petrochemical or hydrocarbon ingredients, making it 100 per cent eco-friendly,” he says.

The high volumes of heavy duty and standard commercial vehicle traffic on dirt roads generate excessive dust, which severely reduces visibility. The implemen-

tation of RDC 20 on temporary roads, particularly around pit areas, has minimised this potentially catastrophic hazard. “When sprayed onto a gravel road surface, RDC 20 forms a durable cross linked matrix that binds fine soil particles into larger heavier particles, which are less prone to become airborne,” van der Merwe says.

The nearby town of Solwezi has a population of around 65 000 people, and RDC 20 has significantly reduced the threat of illnesses caused by dust pollution.

In addition to the proven success at Kansanshi, I-CAT reports it has received overwhelmingly positive feedback from other Southern African mines where the product is applied, and especially where I-CAT is contracted to manage the dust control on mine roads. “The overall ambient dust at our largest operation in the Northern Cape has improved by more than 40 per cent, when compared to the readings prior to I-CAT managing

infrastructure spending and higher public sector wages.

“As serious as these disagreements over royalties are, however, they are certainly not uncommon – nor are they specific to Africa,” he pointed out. “In fact, the global mining sector has in recent decades made considerable progress in addressing these sorts of issues, having recognised the importance of stakeholder engagement in working towards long-term sustainability.”

He said one industry body, the International Council on Mining and Metals, was formed nearly 15 years ago to focus on the role of mining in a sustainable future. Among its 10 guiding principles is “effective and transparent engagement, communication and independently verified reporting arrangements with our stakeholders”.

Another important initiative is the Extractive Industries Transparency Initiative (EITI), set up as a coalition of governments, companies and civil society to provide a global standard for accountable management of natural resources. Working in various mining countries – including Zambia – the EITI seeks to strengthen government and company reporting systems, inform public debate and enhance trust.

“In much the same vein, the range of our work as consulting engineers has expanded beyond the traditional disciplines (such as geological, geotechnical, mining, hydrology and environmental services) into the increasingly vital sphere of

stakeholder engagement,” said Mwila.

“This includes a company’s mine-level engagement with communities and interest groups, as well as interactions with different levels of government. And it is not just the number and diversity of relationships that is important; it is the quality and robustness of the partnerships that is key to sustainability – whether at mine level or at corporate level.”

Mwila emphasised the positive steps that have been made in the mining sector toward continuous engagement between stakeholders, as they worked out the best ways to achieve mutually constructive goals. “Despite the rocky patches,” he said, “it is a path to which all parties must remain committed.” ■

the secondary roads at the mine,” van der Merwe notes.

As part of the study, a haulage road was divided into equal sections to be treated with water only and with RDC 20 for comparative purposes. The results revealed that the use of RDC 20 as a replacement dust suppressant solution for water resulted in an almost twofold improvement in every variable, including dust fallout, fuel usage, water usage and carbon footprint.

According to van der Merwe, I-CAT’s mission is to prevent environmentally harmful products from affecting and contaminating runoff streams and dams. “I-CAT Zambia has been registered with the Zambian Environmental Management Agency (ZEMA) since 2012, and our entire product line has been tested and declared as environment-friendly by ZEMA. Bearing this in mind, I am confident of increasing future market share in the Zambian mining industry,” he concludes. ■

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Johnson beefs up its heavy lift capability

Johnson Crane Hire has bolstered its crane fleet in terms of its heavy lift capability on both the crawler and hydraulic side. It now owns and operates the largest crane fleet in South Africa, with a total of 270 cranes, having completed a four-year fleet replacement programme in 2014 at a total investment of R600 million.

"We have added some major equipment into the top end of the fleet, with a strong focus on keeping our fleet modern

and up-to-date. This is to ensure we can meet the growing demand of our core client base and to support our philosophy of providing new and reliable equipment," says Peter Yaman, Executive, Johnson Crane Hire.

Established in 1976 as a crane hire company, Johnson Crane Hire is now firmly established as a total lifting services provider. "We can supply a full scope of project services, from crawler and hydraulic cranes to ancillary services," Yaman says. "We are not only a crane company; we are a projects company."

"We are up there with the major players in terms of equipment and engineering and services," says Cornelis Grotius, General Manager: Heavy Lift Division. "The fact that we are a South African company operating alongside major multinationals in this highly competitive market is a testament to our home-grown success story."

Johnson Crane Hire's heavy lift crane fleet consists of some of the largest cranes available in the South African market. These range from lattice boom crawler cranes (200 t to 750 t) to a 750 t lattice boom truck-mounted crane specifically for the wind-energy industry and hydraulic boom crawler cranes (100 t to 220 t).

In terms of a total package, Johnson Crane Hire is able to offer upfront engineering, project management, heavy transport and heavy rigging services. Part and parcel of its total lifting solutions capability is a focus on alternative lifting technologies. While Johnson Crane

Hire has already used jacking and sliding techniques with great success on some projects, other complementary technologies include hydraulic gantries and strand jacking. The latest trend in this regard is Self-Propelled Modular Trailers (SPMTs).

Johnson Crane Hire has branches in all the strategic regions of South Africa, from Cape Town and Durban on the coast to the heavy industrial areas of Secunda, Vanderbijlpark, Rustenburg and Middelburg, and then specific project areas such as the Medupi and Kusile power stations. "We have a branch at Lephalale in Limpopo, east of the Waterberg coalfield, and have a newly-established branch in the Northern Cape at Deben, close to Kathu," Yaman explains.

Johnson Crane Hire also operates successfully in Southern Africa. It has an operation in Botswana and has recently completed work in Mozambique and Zimbabwe. "We currently carry out projects on an ad hoc basis in Africa as a whole, dependent on the risk-versus-reward ratio," Yaman says.

At present some of the most technically challenging lifts being undertaken by Johnson Crane Hire are for the wind-energy industry, where up to 100 t have to be lifted to as high as 80 m. Current projects include a new headgear installation at a major diamond mine in South Africa, as well as a 143 t lift at a 43 m radius for a planned refinery shutdown in Durban in May, which will see the impressive deployment of a range of cranes supplied from Johnson Crane Hire.

Peter Yaman, Johnson Crane Hire, tel (+27 11) 455-9242



Some of the most technically challenging lifts being undertaken currently by Johnson Crane Hire are for the wind-energy industry, where loads of up to 100 t have to be lifted as high as 80 m.

Shell unveils its latest grease truck

Shell South Africa unveiled its latest Shell grease truck at its Bryanston offices recently. It describes the truck as an innovative solution that improves efficiency and safety in the mining sector.

According to Shell South Africa's General Manager for Lubricants, Jan Willem Zuidema, the introduction of the second Shell grease truck – which is the first to be designed in South Africa for local conditions – is a result of Shell's experience with grease pumping services in the mining industry where the company continues to deliver value through partnering with the sector.

A South African mining operation is expected to save up to R40 million over a

five-year period as a result of the introduction of this additional innovation from Shell in conjunction with existing value added services.

The six-wheel drive (6x6) truck is equipped with rockets, hydraulic driven grease pumps, grease flow meters and hose reels. It enables open pit, plant and underground support on heavy duty equipment such as draglines, excavators/shovels, mills and kilns.

An additional benefit is that it creates a closed lube system, reducing potential for contamination and safety hazards.

"Safety is a key consideration in the handling of lubricants," explains Zuidema. "The



The six-wheel drive Shell grease truck on display at Shell's Bryanston premises.

truck enables us to meet the safety standards we set for ourselves and support our customers to be fully compliant with the latest mining safety regulations."

Hentie Spangeberg, Shell South Africa, tel (+27 11) 996-7000

Miners look for mill liner efficiency

Cost pressure brought about as a result of lower commodity prices has given rise to a rush of demand for well-priced mining equipment and parts to fulfil the role of similar but more expensive counterparts.

Mill linings are one area where many mines in Africa, especially in the central copper regions, as well as gold and platinum producers, are re-examining their requirements and opting for new, more modern liners that offer cost benefits both in terms of initial procurement price and the total cost of ownership.

According to Bobby Stevens, Tega Industries SA Sales Engineer, considering the high capital cost and mission critical role of mills in the beneficiation of commodities, mines cannot afford to cut corners while cutting costs. As a result, he says, many of the more progressive technical teams on the continent's mines are choosing to opt for locally manufactured products that are individually engineered to suit the mines' own requirements by Tega Industries South Africa.

"Tega Industries has played an important role in the provision of rubber, as well as combination steel, rubber and ceramic linings since 1989," says Stevens. "These modern polymer and combination liners (PM) have given miners two to five times better life over the usual steel liners with a product that is lighter for maintenance and installation purposes.

"Having been widely accepted into the mainstream market fairly recently, sales still hinge largely on convincing mine engineers that a better way exists and working with them to change specifications and replace metal liners. In such instances we usually put in a trial ring for our clients and

generally this is sufficient to convert clients from steel liners to PM.

"Other new products such as our recently tested Combi liner for SAG and AG mill applications combine the lifter bar and shell plate to spread impacts across the mill surface and vastly improve the efficiency of the mill," he continues. "Other innovations improve the performance of a mill such as the introduction of a special rubber base to assist in unstable mill applications (or in aggressive applications) where it is able to deal with larger fluctuations in operating parameters.

"Through the correct selection of liners and the use of powerful new mill optimisation and efficiency software our liners are able to drive down the cost per ton of processing and thereby counteract the effect of lower commodity prices. Also, by improving the grinding capability of the mill and thus the feed rate, our lining can play a large role in improving the quality and quantity of the end product.

"Although our liners are cost effective, we cut no corners and rather choose to



Bobby Stevens of Tega Industries SA.

undertake studies of the attributes of each grinding mill to improve productivity of each client's operation individually. We use key software programs such as Mill Traj, Tega Soft, Steve Morell and Bond power models to assist with mill liner developments and apply it to both the design and application of liners for individual mills. Programs like Mill Traj and Tega Soft even help us to predict the motion of media in the mill with great accuracy, thereby allowing us to optimise everything from media to power consumption and wear properties," says Stevens.

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

Fast work on screening plant by ELB

ELB Engineering Services (ELB) reports it has completed the design, fabrication and construction of a 250 t/h iron ore wet screening plant for Sedibeng Iron Ore (SIO).

For Sedibeng to comply with restrictions which limit the maximum percentage of fines allowed in its products, a wet screening plant was required. ELB was approached to implement a solution for washed product with very short project duration.

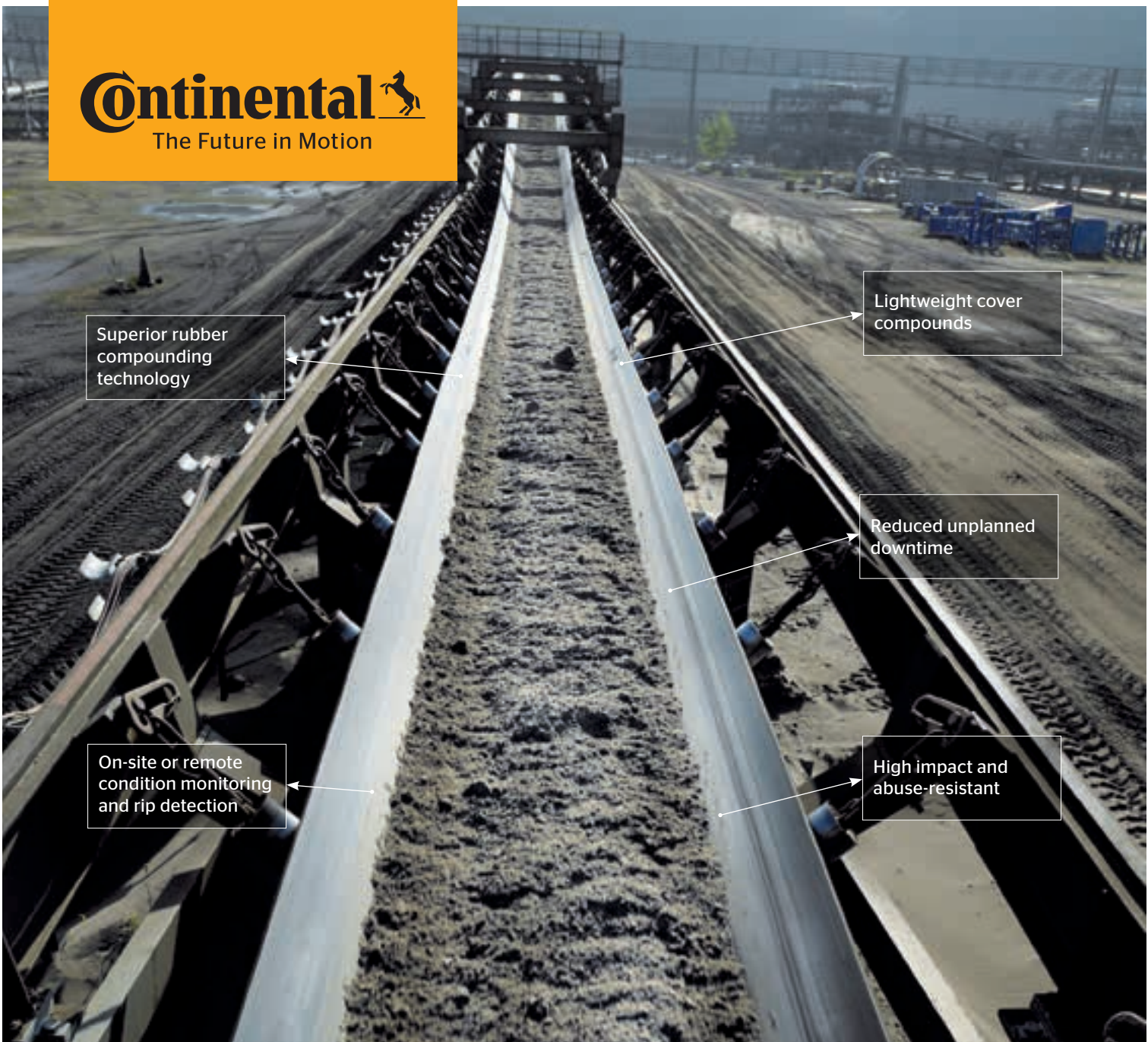
ELB worked closely with the client's

team and a mere two months after contract award the team introduced ore into the plant.

ELB Engineering Services describes itself as "an internationally recognised technology driven holistic solutions provider to the mining, power, port, construction and industrial sectors in the field of materials handling and beneficiation plants."

Cornel Charlton, ELB Engineering Services, tel (+27 11) 772-1509

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Mini crawler cranes can work in restricted spaces

Eazi Sales and Service, which markets JLG access equipment and telehandlers and Magni telescopic handlers, has recently introduced the Maeda Mini crawler crane range into the local market.

Maeda is by far one of the largest construction and equipment manufacturing companies in Japan and with its Mini crawler cranes rates as the larger of the two leaders in the global markets.

The range extends to nine different models, starting from the MC104 with a capacity of 0,995 tons and 5,5 m lift height to the larger LC1385B with a capacity of 6,0 tons and a lift height of 16,7 m.

Maeda cranes – some narrow enough to fit through a standard doorway – allow working safely both indoors and outdoors without compromise, says Eazi Sales and Service. Adding to the versatility of the units is their power source with the option of petrol, LPG, diesel and electric. A further advantage in some models is the diesel/electric alternating power source.

The range consists of two model types with the MC and LC designations. Units in the MC range, starting with the small-

est MC104, are all driven by a hydrostatic transmission from their respective power sources but have differing options which enable each unit to perform the particular application for which it has been designed.

The track system on each model enables the unit to be driven to virtually any location over uneven terrain whilst the outriggers keep the vehicle stable while performing its tasks. The MC 104 and the MC 178 have the option of white rubber tracks which make them suitable for work inside factories or warehouses where floors are required to be protected against marking from conventional tyres or tracks.

A major feature of the Maeda Mini crawler cranes is the boom construction. The pentagonal shape of the boom increases the strength and prevents unnecessary flexing in extreme conditions. The smaller units are fitted with a four-stage boom while the larger units have the additional fifth stage.

The LC range has been developed mainly for the city centres or for use in areas where space is restricted. The highly compact tracked footprint has dispensed



Eazi Sales and Service has recently introduced the Maeda Mini crawler crane range to the local market.

with the requirement for outriggers and this is combined with a zero tail swing. With a long list of options, the LC range can be adapted to suit any site requirement.

Eazi Sales and Service, website: www.eazisales.co.za

Booyco installs PDS at surface mining operation

Booyco Electronics, which has been at the forefront of Pedestrian Detection Systems (PDS) in the South African mining industry since 2006, is currently installing its PDS technology at a surface mining operation.

"We have completed the mining operation side and are currently busy with the mineral processing side, wherein lie more challenges and definitely a lot more applications. We have standardised the PDS deployment, i.e. specific zone shaping per vehicle type, which took time analysing the operational requirements," says Anton Lourens, MD of Booyco Electronics.

The company would typically recommend a 10 m wide warning zone, for example, whereas the client would request that this zone be made smaller. "One of the definite advantages of our technology is that it is inherently flexible, enabling us to adapt it according to specific requirements and vehicle type," Lourens explains.

Booyco Electronics claims to be setting the local standard in PDS technology for surface mining operations. "Currently there are quite a few systems out there that look at machine-to-machine interaction

but which are not necessarily applicable or effective on the pedestrian side. While we believe that we have the best solution available on the market, the industry-wide implementation of PDS technology remains an issue."

Lourens says that the Department of Mineral Resources (DMR) has unveiled the draft version of the mandatory Code of Practice for Trackless Mobile Machinery (TMM). "It deals with TMMs in terms of what measures are expected by the regulator and where this is going. It is already past draft stage and we believe it will change the immediate market requirements. The DMR has also specified additional testing to ensure that all the products out there comply with the same standards."

The mining industry has adopted a cautious approach to the implementation of PDS technology. "There is quite a lot of work still to be done, as we are not yet at the point where these systems can just be switched on. A major challenge is that there are so many stakeholders to deal with, from the mining house and contractor to the vehicle OEM and PDS

supplier. Ultimately, the client has a specific viewpoint in terms of his operational requirements, so we have to ensure that all these stakeholders are accommodated," Lourens says.

While Booyco Electronics is engaged in ongoing discussions with OEMs, "the biggest part of our installations right now is retrofits, as many of our mining customers wish to ensure that they are compliant. That is a challenge by itself, as we often have to relocate existing equipment installed so that the PDS is working properly. The technology is such that ID installation is specific to create a particular application."

While this market sector is highly competitive at the moment, Booyco Electronics believes that what gives it the leading edge is its ability to offer a total solution. "What we have tried to do is create a total scope of supply so that the client does not have to worry about other related safety equipment," says Lourens. "For example, we can supply our biometric licensing readers either in conjunction with PDS or as a standalone item."

Anton Lourens, Booyco Electronics, tel 0861 800YCO (266926)

Locally designed luminaire offers optimal performance



The locally designed and manufactured BEKA LEDnova luminaire.

The BEKA LEDnova is claimed to set a new benchmark in lighting for industrial applications. This locally designed and manufactured luminaire offers optimal photometric performance and high reliability to reduce energy consumption and maintenance in all types of lighting applications. It is designed to replace conventional light sources of up to 100 W HPS and MH lamps whilst achieving great energy savings and a long useful lifetime even in environments with high vibration.

This luminaire is said to be ideal for

security lighting applications, delivering instant white light with a high colour rendering index and 100 % light output. The slim and unique design optimises the thermal operating environment around the LEDs, enabling a long useful lifetime and low maintenance. The BEKA LEDnova is designed to accommodate various mounting options, as well as hazardous (Zone 2 & 21/22) and emergency lighting applications.

The unit has been designed to operate LED light sources of up to 80 W in an ambient temperature environment of at least 35 deg C, without reducing the LED lifetime of 15 years, at a lumen depreciation of not more than 20 % (L80). The correlated colour temperature (CCT) of the LEDs is neutral white (4 000 K), also available with a warm white CCT.

The intelligent design of the BEKA LEDnova makes LED luminaires particularly suitable for the challenging African environments. Electronic temperature monitoring prevents overheating of the LEDs and the power supply within the LED compartment (ThermiX®).

To maximise the reliability of the LEDs, the photometric engine and control gear compartment are completely sealed to IP 66. This ensures that the photometric performance is maintained over time (LEDSafe). The BEKA LEDnova offers flexible combinations of LED arrays, combined with various photometric distributions (LensoFlex2®) and dimming control options, to further maximise energy savings and reduce maintenance costs.

Phillip Vermeulen, Beka Schröder, tel (+27 11) 238-0016, e-mail: p.vermeulen@beka-schreder.co.za

BMG appointed to distribute Vulkan range

BMG has been appointed distributor in Southern Africa for the Vulkan Drive Tech products range, which includes couplings and braking systems.

“With the introduction of Vulkan’s fluid and engineered flexible couplings, BMG’s coupling offering is now complete,” says Carlo Beukes, BMG’s Power Transmission Product Manager. “BMG, which now carries a vast stockholding of standard Vulkan couplings, also has access to the complete range of Vulkan braking systems.

“With Vulkan’s compact fluid coupling

design, it is possible to replace existing applications, without the need for any modifications to the existing layout, therefore ensuring ease of replacement and reduced project costs.”

Important components for BMG in the Vulkan range are Flexomax GBN maintenance-free couplings, with a maximum torque of 1 288 kNm and shaft diameters up to 600 mm. These torsional flexible couplings are equipped with specially designed elastic elements which work in compression, allowing for maximum torque transfer,

heat dissipation and product longevity.

This series is designed for applications that include low speed shafts of machinery driven by electric motors – even in harsh environments – and is available with customisable options to meet the requirements of restricted applications. These compact couplings allow for compensating axial, radial and angular misalignments and also protect the drivetrain from shock loads.

Flexible Flexomax GSND couplings have design features that eliminate the need for lubrication and allow radial removal of elements without moving machinery. Furthermore, the design incorporates air circulation slits to allow for a cooler element and thus a longer life of the product.

Vulkan’s wide range of highly engineered fixed speed and variable speed fluid couplings has been designed for reliable functionality and is optimised around specific application requirements.

For more demanding applications, Vulkan shaft-to-shaft solenoid activated PSV-SP variable speed drain type fluid couplings are recommended. These couplings allow for larger heat dissipation in aggressive climate conditions.

Vulkan industrial braking systems, now available from BMG, encompass rail clamps, electromagnetic brakes and industrial emergency brakes.

Carlo Beukes, BMG’s Power Transmission Division, tel (+27 31) 576-6200

MCCs supplied to two Petra diamond mines

Leading panelbuilder JB Switchgear Solutions was recently awarded two multimillion rand contracts by Petra Diamonds for the design, manufacture and supply of motor control centres (MCCs) for Cullinan and Finsch mines respectively.

At Cullinan, where the C-Cut Phase 1 project is underway, JB Switchgear’s scope of work included ten Eagle series MCCs containing over two hundred DOL starters ranging between 10 kW and 200 kW. In addition, a number of variable speed drives (VSDs) between 18,5 kW and 160 kW were installed, as well as soft starters ranging from 160 kW to 200 kW. Incomers up to 2 500 A were provided and the

communication protocol used is Profinet.

At Finsch, where capacity is currently being expanded, JB Switchgear has supplied five Eagle series MCCs which include over 70 DOL starters between 0,37 kW and 200 kW, as well as a variety of variable speed drives (VSDs) and soft starters ranging between 30 kW and 220 kW. Incomers are rated at 1 600 A. Here also, the client chose Profinet as the communication protocol.

The Eagle series of assemblies carries type test certification for compliance with IEC 61439/SANS 1973-1 and IEC 61641 standards.

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

Loader buckets from Caterpillar boost payloads

Improving margins and boosting production gains, Caterpillar's new Performance Series bucket range (designed for the Cat 950 to Cat 980 wheel loaders) features advanced designs that take full advantage of machine power and linkages to boost payloads, with more efficient digging contributing to lower diesel burn rates.

Materials handling, general purpose and rock buckets are all available in heavy duty specification. A standard equipped spill guard prevents possible spillage over the linkage.

Additionally, Caterpillar also offers a wide range of special application Performance Series buckets. Examples include coal, slag, skeleton (for separating rocks from sand and for applications where medium breakout forces are required), high dump, and serrated edge (for loading rocky material into stationary crushers).

Factors to consider in choosing the right bucket are the operational role (digging or re-handling), the material fragmentation type (bank, shot/broken, crushed/piled, or loose), the material (for example, bank gravel, granite or sand), and the level of impact and abrasion (low to moderate, moderate to high, or low).

"To ensure optimum performance, always match the bucket to the machine based on material density and wheel loader size," explains Barloworld Equipment Group Product Specialist Deon Delpont. (Barloworld Equipment is the Cat dealer for Southern Africa.)

Materials handling buckets incorporate a flat floor design and are intended for loose material re-handling, making them well-suited for a variety of stockpile loading applications. These buckets provide maximum material retention and can be equipped with bolt-on adapters and segments, or bolt-on-cutting edges with corner guard for versatility and longer life.

General purpose buckets incorporate a wedge floor design and are built with a shell tine construction to increase strength and rigidity in their typical excavation and bank applications. Their structure efficiently transmits cutting edge loads back to the lift arms, shielding the bucket shell from distortion and keeping it up, out of the dirt.

These buckets are designed to accept the standard Cat bolt-on edge with corner guard or tooth group with bolt-on segments. For high abrasion aggregate applications, heavy duty general purpose buckets are the perfect choice, says Barloworld Equipment.

Also available are **rock buckets**. Specifically

designed for quarry, aggregates and mining operations in high impact and/or high abrasion applications, these buckets are factory modified with additional protection.

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

More payload: the bucket shape, strike plane and angle of Cat Performance Series buckets are designed for material retention and consistent load sizes.



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Powerful genset range available from Cummins

Industrial operations across Africa can lower their fuel costs and minimise their impact on the environment with the new range of high horsepower QSK95 Series generator sets launched locally by the African division of Cummins.

The QSK95 gensets are Cummins Power Generation's most powerful diesel generator sets to date, offering up to 3,5 MW 60 Hz and 3,75 MVA 50 Hz. They are engineered with the highest kilowatt

per square foot ratio in their class, says Cummins, resulting in a smaller footprint that achieves a 20 per cent improvement in power density.

The durable and robust QSK95 Series is said to be ideally suited for mining, oil and gas applications or any projects where harsh conditions, challenging environments and the demand for reliable, continuous remote power exist.

Cummins Southern Africa Power Generation Director Kobus Coetzer points out that the new generator sets boast

more power and best-in-class fuel economy. "Over the course of 8 000 hours of operation, the QSK95 can achieve fuel savings of more than US\$400 000 (R4 million plus). The QSK95 Series

is designed to lower the total cost of ownership by reducing installation expenses, fuel costs and maintenance requirements – all while maintaining Cummins' high standards of reliability."

Fewer maintenance requirements, longer service intervals and 25 000 hours to major overhaul make the range well suited to prime power applications. The gensets accept 100 per cent of rated load in a single step and are ready to accept facility load in less than 10 seconds. With a smaller footprint, the QSK95 Series requires less space to install and, in multiple-generator set applications, fewer generators are required to achieve the necessary power output.

The QSK95 Series gensets are available in multiple rating options for specific power generation applications, including: continuous, prime power, mission critical and standby. Cummins also offers a data centre continuous (DCC) rating specifically tailored for data centre requirements.

Cummins Southern Africa, tel (+27 11) 321-8700



The QSK95 gensets are Cummins Power Generation's most powerful to date.

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Multotec trommel screens built to last

Preventative maintenance is essential to ensure the longevity of trommel screens. "Multotec has had trommel screens running for over ten years that are still operational," says Anthony Yell, Screening Product Manager.

Customers can return trommel screens for refurbishment. The rubber lining is stripped off the steel structure, inspected for wear and then non-destructive testing is carried out to determine the integrity of the structure. "If it is still within specification, it can be shot-blasted and re-rubber lined, whereupon it will be good to go for many more years," Yell explains.

"One of the biggest problems we have today with the larger trommel screens is the high wear rates of the screen media due to the high peripheral speed of the trommel screen itself." In addition, the trend towards larger mills means higher flow rates and velocities. "Double the velocity on a polyurethane screen equates to an increase in the wear rate by a factor of five," Yell notes.

"We have invested extensive research and development into producing panels that last longer, as with large copper processing plants where the large tonnages mean an average run time of 12 to 14 weeks without any stoppages for panel change outs. It has been our objective to develop panels that will last that length of time," Yell says.

Multotec has the added advantage of being able to supply polyurethane panels for smaller feed sizes, where the main wear criterion is sliding abrasion, and rubber panels,



A SAG mill trommel frame with cast polyurethane screen panels and a pinless fastening system.

where impact is the main cause of wear. "We design and manufacture both rubber and polyurethane panels in house," Yell points out. A recent trend in mineral processing has been that mills are tending to get bigger and therefore trommel screens are becoming larger as well. "This can pose challenges in terms of acceptable life of screen media. However, we do have solutions for this," Yell says.

"The most important factor for us is understanding the trommel duty and the load coming off the end, because we have to design the front end of the trommel to be able to take this load," Yell points out. "We have focused investment in developing designs for many years and our trommel screen designs have proven themselves to be exceptionally reliable. As long as they are maintained properly in terms of the rubber lining and panel replacement, then they will last a long time."

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

Aury targets increased sales of cylinder screens

Following impressive 2014 performance figures, screening and vibrating equipment solutions supplier Aury Africa plans to consolidate on this success by placing increased focus on the sales of the company's range of intertank cylinder screens.

Aury Africa's Managing Director, Mark Houchin, notes that the company plans to penetrate the lucrative gold market through the range. "Our stainless steel wedge wire intertank cylinder screens are self-supporting structures that boast a high open area to recover gold-bearing carbon," he explains.

Units in the Aury Africa range of intertank cylinder screens are available in SS430, SS316 and SS316L stainless steel grades, with apertures ranging from 0,25 mm to 12 mm. Houchin highlights the fact that the range can be modified and

customised to exact client specifications.

"The flanges are available in ranges from 5 mm to 10 mm. Flanges can be made to any size according to clients' requirements, while the wire profiles include 47 CMI, 60 CMI, 69 CMI and 91 CMI. The minimum radius is 500 mm, with no limits on maximum radius. This customisation ensures that there is an Aury intertank cylinder screen for all applications," he adds.

Looking to the future, Houchin is optimistic of gaining market share in Africa through the intertank cylinder screen range. "Landing one large gold mining client in Ghana alone could increase our revenue by as much as R2 million per year. We are not limiting ourselves to the gold sector and will also be targeting uranium mines and sugar refineries," he concludes.

Aury Africa, tel (+27 11) 026-6642



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Joest introduces new exciter gearbox

Specialist vibrating equipment supplier Joest South Africa has introduced an exciter gearbox that has been completely redesigned by its in-house research and development team, taking into account input from mining customers with regard to increased uptime and reliability resulting in greater tonnage throughput.



Specialist vibrating equipment supplier Joest South Africa has introduced a new exciter gearbox.

“Joest South Africa’s philosophy of ‘Engineered Solutions’ ensures that we fully understand each customer’s specific needs, delivering a customised solution, which ensures that downtime is reduced dramatically,” says Kim Schoepflin, MD of the company.

A significant advantage of the new exciter gearbox is that it is fully compatible with the previous model sold by Joest South Africa. “In fact, it is important to note that the old and new model can both be included on a single piece of vibrating equipment,” Theresa Walton, General Manager: Service, says.

Major design improvements include an enhanced housing design that provides for longer in-service life. This is in addition to thicker mounting feet and stiffener ribs, as well as rigid weight cover mountings. The internal components feature improved tolerances and surface finishes.

The material is cast specifically to Joest South Africa’s specifications for robustness. “Joest South Africa places a major emphasis on engineering and manufacturing its products to the most stringent quality standards,” Schoepflin adds. Joest’s new exciter gearbox is assembled in-house at its newly expanded exciter gearbox assembly and refurbishment facility.

Furthermore, a double-flange configuration reduces installation time and configuration errors on site. This also simplifies spare parts requirements, as previously both left-hand and right-hand configurations had to be kept in stock.

The exciter gearbox range reaches noise levels of less than 85 dB.

Joest South Africa is a locally owned OEM that designs and fabricates vibrating screens and feeders in-house. It has a 39-year track record of developing and supplying products for the African mining bulk materials handling market.

Kim Schoepflin, Joest South Africa, tel (+27 11) 923-9000

Loco management system from Becker Mining

Becker Mining South Africa’s collision avoidance system (CAS) now encompasses the newly launched loco management system (LMS) with advanced communication features designed to provide additional safety monitoring and functionality.

“Becker Mining’s loco management system, which combines all guard and loco signals on the user displays, acts as a driver and guard communications system to enforce operational procedures for improved safety during operation of underground trains,” says Andrew Trentelman, Senior General Manager: Electronics at Becker Mining South Africa. “This LMS system allows the flow of traffic during safe operating condi-

tions and has programmable parameters that automatically intervene in potentially dangerous conditions.

“Although the loco driver is always responsible for controlling the locomotive, the LMS is programmed to check the operator, acting as a driving aid to prevent tramming accidents. This system is equipped with a global emergency stop facility and is able to halt other locomotives within radio range remotely from the guard car, loco or via handheld units. The LMS advises drivers when to slow down, bring the loco to a halt or do an emergency stop. Parameters which measure true speed are programmed for different areas of haulage and for various

speed limitations as required.”

The LMS also provides reliable proximity detection and collision avoidance warnings between locomotives, trackless machines and pedestrians. Various events during operation and important parameters are logged as real time data and downloaded for analysis and evaluation.

The user interface, which comprises an LCD screen and six function buttons, connects to the main unit via an umbilical cord. A colour display indicates relevant information, including the speed of the locomotive in km/h, battery conditions and proximity detections, as well as errors and events.

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

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