CROWN PUBLICATIONS

MODERN MINING

June 2017
Vol 13 No 6
www.crown.co.za

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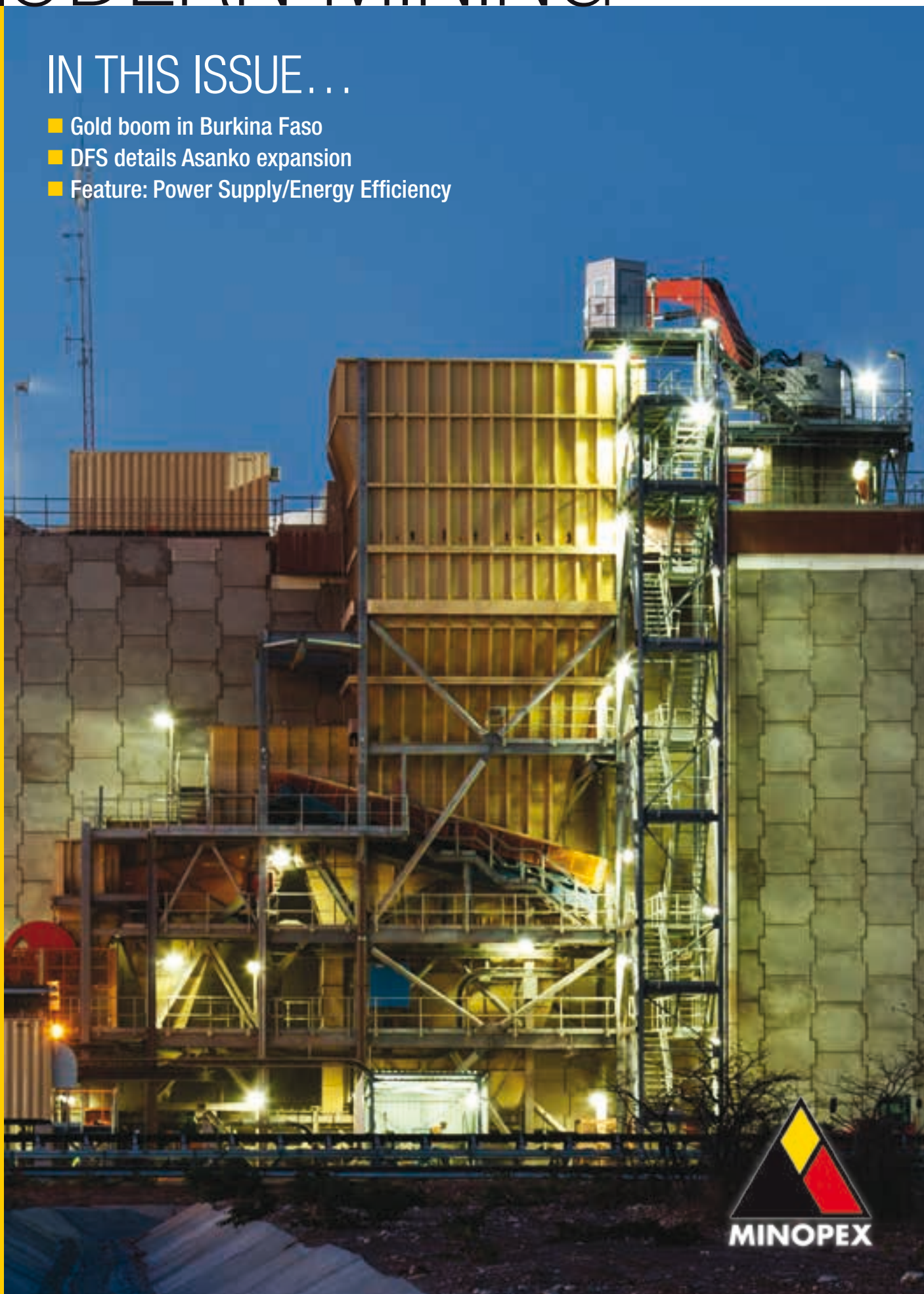

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MODERN MINING

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Printed by:
Shumani Mills Communications

Published monthly by:
Crown Publications cc
P O Box 140,
Bedfordview, 2008
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Cover
The primary crusher at a diamond mine. The processing plant at the mine is just one of 15 plants that Minopex, part of the DRA Group, operates under contract. See page 18 for an in-depth story on the company's activities.

Average circulation
(January–March 2017)
4373

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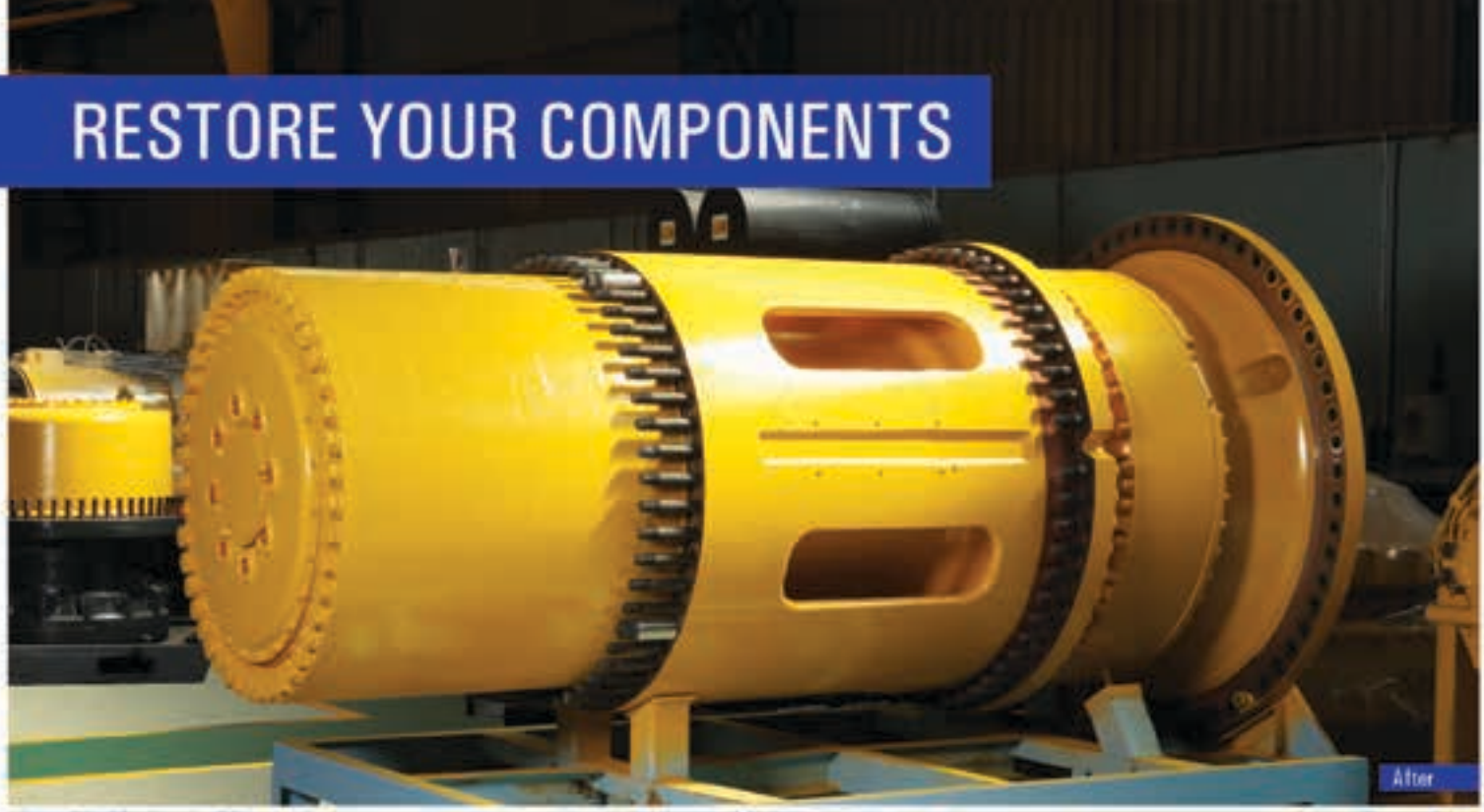

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The story behind AK6 and the Karowe diamond mine

For my money one of the most interesting presentations at the recent Junior Indaba held at the Country Club was the one delivered by James Campbell, which recounted the history of the AK6 kimberlite in Botswana. Entitled *How a junior developed a billion dollar asset and a major walked away*, James's talk provided an insider's view of the development of AK6, which is now the foundation of the incredibly successful Karowe mine.

James made a similar presentation a few weeks prior to the Junior Indaba when he was one of the speakers at the Botswana Diamond Explorers Conference, held at the Orapa mine – located not too far from AK6 – in late April. This conference coincided with the 50th anniversary of the discovery of Orapa in 1967 by a De Beers team that was led by Dr Gavin Lamont and included Jim Gibson and Manfred Marx (with Marx being the one to actually make the find).

I think most readers will be aware that De Beers sold its share in the AK6 project in 2009 to Vancouver-based Lucara for a paltry US$49 million and that Lucara then went on to develop a mine that has thus far (as at December 2016) yielded 1,8 million carats, generating revenue of US$1,02 billion at an average price of US$566 per carat. Perhaps less well-known is the sharp divisions between De Beers and its joint venture partner on the project, junior explorer African Diamonds (AFD), which ended up in court in 2008 when De Beers tried to put the project on hold – by applying for a retention licence – in the face of AFD's objections.

AK6, as it happens, was discovered in 1969, two years after Orapa, in the same year as Letlhakane, and several years before Jwaneng. It was assessed by De Beers between 1972 and 1975 but was dismissed as being sub-economic because of its small size (circa 3,4 ha), its poor mineral chemistry and its low grade (3,5 cpht). Although all these assumptions proved to be wrong, it is perhaps understandable that De Beers – which by then had the two most valuable kimberlites in history in the bag in the shape of Orapa and Jwaneng – should have decided not to pursue AK6 further.

James, whose own career has included a long stint at De Beers which saw him serving as GM for Advanced Exploration and Resource Delivery and as Personal Assistant to Nicky Oppenheimer, attributes De Beers' failure to appreciate the potential of AK6 back in the 1970s to a number of factors. Among them was the company's failure to sample the kimberlite sufficiently and the excessive diamond breakage which occurred as a result of using cable tool (jumper) drilling.

Fast forward 30 or so years and AK6 was again under assessment, with De Beers and AFD forming a joint venture in 2004 to explore their contiguous ground holdings in the Orapa area, including AK6, using modern technology.

In 2007 AFD – which by this time had James as its MD – produced a pre-feasibility on AK6 which showed healthy economics. A feasibility study completed the following year by De Beers reached a different conclusion, determining that the project had a negative NPV and would, in any event, cost a whopping US$380 million to develop. AFD responded in 2009 with an Alternative Value Engineering Study which essentially confirmed its earlier pre-feasibility study, which had indicated that the project was viable and could be built for much less than the figure estimated by De Beers.

As I've already mentioned, AFD fought tooth and nail to advance the project in the face of De Beers' opposition. Space doesn't allow me to go into all the ins and outs of what happened but suffice it to say that by 2010 Lucara had taken over both De Beers' and AFD's shares in the project. It proceeded to develop AK6 as the Karowe mine along the lines suggested by AFD – with the capex being roughly a third of the De Beers estimate – with first production being achieved in 2012.

The rest, as they say, is history. Karowe has proved to be a truly exceptional diamond mine, producing a seemingly endless flow of outsized stones including the plus-1 100-carat *Lesedi la Rona*, the second biggest diamond ever found.

In his presentations, James looks at the reasons why AFD and De Beers perceived AK6 so differently. At the risk of over-simplifying his views, he clearly believes that juniors are far more suited to developing projects such as AK6 than behemoths such as De Beers, which have high 'hurdle rates' for new developments, a low appetite for risk, veer towards being technologically conservative and, in addition, can be bureaucratic and slow moving.

James, by the way, is now the MD of Botswana Diamonds, which is essentially the successor company to AFD, and is once again teamed up with his old colleague in AFD, Irish mining entrepreneur John Teeling. I recently interviewed James in Gaborone and will be reporting at length on the activities of Botswana Diamonds in our next issue.

Arthur Tassell

AK6 was assessed by De Beers between 1972 and 1975 but was dismissed as being sub-economic because of its small size (circa 3,4 ha), its poor mineral chemistry and its low grade (3,5 cpht).

Birrell Mining reopens Klipwal gold mine in KZN

The Klipwal gold mine is situated in the Pongola area of KwaZulu-Natal, some 70 km from the Swaziland border.

Birrell Mining International (BMI) has announced the re-opening of the recently acquired Bosveld Mining's Klipwal gold mine in KwaZulu-Natal.

BMI completed the purchase of Bosveld Mines from Stonewall Mining earlier this year, after having been responsible for the care and maintenance programme since early 2016. The transaction retains the BEE ownership structure whereby 26 % is owned by predominantly community-based BEE partners.

The BMI board, under the chairmanship of Graham Briggs (former Harmony Gold CEO), approved the transaction following in-depth reviews of resource and operational potential across the mine. The mine has had an extensive operational history with substantial surface and underground infrastructure, providing a platform for both current operations and further underground development.

BMI has completed nine months of recommissioning of the plant and several levels underground as well as bulk test work. Production began last month (May). Initial results indicate stable production at reasonable grades with good levels of recovery. An experienced management team, headed by Tony Knight, will allow rapid expansion. Under Briggs's guidance, this will include the expansion of the mine and deeper level underground mining and development, as well as the recommissioning of lower levels from July 2017 onward.

Of critical importance is the operation's management of the illegal mining activity which had plagued the safety and future viability of the Klipwal underground workings in recent months. "Due to the high levels of illegal activity at Klipwal, it was decided to utilise the local illegal miners as the main workforce and keep the sophistication of mining at very low levels. This meant many ex-illegal miners could operate safely, within our strict safety regulations and managerial control, while earning a regular income and adhering to legislative requirements around contractor employment," says Briggs.

The ex-illegal miners (zama zamas) now form co-operatives. They are contracted as legal entities by the mine to complete hand-lashing and tramming within portions of the mine that are rendered safe by the company.

The co-operatives are trained and mentored and remunerated based on each ton lashed and trammed to a collection point. "This method has had a profound effect on several levels. The operation reverts to mining methodologies of several years ago and the co-operatives (miners) are paid according to their production levels. Management and control is now relatively easy as the co-operatives are motivated and self-disciplined," states Briggs.

Bosveld has a long-term target production of between 12 and 15 thousand ounces of gold per annum. ■

Bulk sampling starts on new Mustang licence area

ASX-listed Mustang Resources says it has taken another significant step in its strategy to ramp up processing at the Montepuez ruby project in Mozambique with the start of bulk sampling on the recently-acquired Licence 8245L area.

Mustang says the licence is highly strategic because it borders the existing Montepuez licence areas of Mustang on one side and the lucrative ruby project owned by London-listed Gemfields on the other. Importantly, it lies along the south-east, north-west ruby mineralisation trend, which also transects the adjacent Gemfields licences.

A February 2017 site visit by Mustang consultant Paul Allan confirmed that artisanal miners are recovering high-quality rubies from this licence area.

Mustang has made a strong start to the bulk sampling at 8245L, with more than 10 000 tonnes of gravel already delivered to the Montepuez processing plant from Pit NT01. Mineralisation within the pit is shallow with a very low strip ratio.

Initial manual test pitting by Mustang across a broader area of 8245L has generated strong results, with 11,75 ct (a 9,45 ct ruby and a 2,30 ct corundum) recovered from 2 726 kg of gravel (from seven manually dug pits) processed through Bushman jigs, highlighting the high-grade potential of the area.

Mustang reports that the commissioning of the upgraded processing plant at Montepuez has been highly successful and processing rates are now ramping up.

Given this excellent progress, Mustang says it is confident that it will achieve its targeted processing rate of 1 500 tonnes a day within weeks. ■

Redpath breaks record on Impumelelo contract

A Redbore 90EX deployed by Redpath Mining (South Africa) at Sasol's Impumelelo mine completed the reaming phase of a 7,3 m diameter hole on 13 April 2017. This reportedly equals the African record for the largest diameter hole reamed to date.

"The reaming performance of the Redbore 90EX surpassed our expectations," comments Redpath Mining 's General Manager of Raiseboring, Johan Davel.

The Redpath site management team comprises Project Manager Werner Schwartz, Site Manager Francois von Landsberg, Site Foreman Danie Kruger, and Safety Officer Bianca von Landsberg. The highly skilled operators on the project have at least 15 years' experience in large-diameter drilling.

The company was awarded a contract for two ventilation shafts by Sasol for Impumelelo. The scope of the work entailed the piloting and reaming of two 186 m deep, 7,3 m diameter ventilation shafts, including the lining of both shafts by means of a Remote Shaft Liner. The first shaft is the up-cast shaft and the second will be the down-cast shaft. The Redbore 90EX is being used to raise-bore the shafts.

Mobilisation commenced on 19 December 2016 and piloting of the first shaft in early January. The pilot hole was directional drilled, using the Rotary Vertical Drilling System (RVDS), down to a depth of 82 m, from where conventional piloting continued until breakthrough on 28 January. The reamer chamber had to be prepared, with reaming commencing on 16 February. The reamer was designed jointly by Redpath and Atlas Copco.

The Redbore 90EX deployed by Redpath at Sasol's Impumelelo mine (photo Redpath Mining).

Currently the Redbore 90EX is being mobilised at the down-cast shaft, while the Remote Shaft Liner is being set up at the up-cast shaft. Shaft lining will be carried out by spraying a 100-mm-thick, 30 MPa fibrecrete lining onto the sidewall of the reamed hole in order to prevent the shaft from caving in. This will be carried out via a remote-controlled unit from the surface down the hole. This means that workers will be out of harm's way at all times. ■

Ball mill and mining fleet arrive at Yanfolila

The ball mill arrives at the Yanfolila site (photo: Hummingbird).

Hummingbird Resources, quoted on London's AIM, reported recently that the ball mill for its Yanfolila gold project in Mali has arrived on site following shipment from Europe. In addition, the mining fleet has arrived at Yanfolila and will begin pre-production mining in Q3 2017. Commissioning of the project and the first gold pour are due before the end of 2017.

Comments Dan Betts, CEO of Hummingbird: "As the longest lead item, the delivery of the ball mill is a significant milestone for Hummingbird and further de-risks the delivery of the project's critical path. Construction is progressing well, and I would like to thank our operations team and our construction partners for their continued hard work and dedication on site."

The EPCM contractor for the plant and associated infrastructure is South African project house SENET while IMAGRI SARL, a Malian contractor, is responsible for the civil works and SMPP work. African Mining Services (AMS), a subsidiary of ASX-listed Ausdrill, has been appointed as mining contractor.

Construction of the plant is now well advanced while work has started on the Tailings Storage Facility (TSF). The contractor responsible for the TSF is Inter Mining Services (IMF), a Malian contractor, although AMS will assist.

AMS's mining fleet at Yanfolila will include four Liebherr 9150 excavators, one Liebherr 9250 excavator and 18 Cat 777F dump trucks.

Hummingbird is developing Yanfolila as a low-cost, high-grade, multi-pit mining operation allied to a simple gravity and CIL processing route which is expected to deliver recoveries of 92,8 %. The plant will have a capacity of 1,24 Mt/a.

Yanfolila will have an average annual production over a life of mine (LOM) of

Updated Feasibility Study improves Molo's metrics

NextSource Materials Inc, a company listed on the TSX (and previously known as Energizer Resources), has reported the positive results of its updated Feasibility Study (updated FS) for its 100 %-owned Molo graphite project in Madagascar.

The updated FS was undertaken to reflect the company's decision to revise Phase 1 of its Molo mine plan from a demonstration plant to a fully operational and sustainable graphite mine with a permanent processing plant capable of producing approximately 17 000 t/a of high-quality SuperFlake™ concentrate per year over a mine life of 30 years.

The updated FS for Phase 1 of the Molo project was based on a Front End Engineering and Design study (FEED), and subsequent Detailed Engineering studies. The updated FS incorporates the procurement of all mining equipment, off-site modular fabrication and assembly, factory acceptance testing (FAT), module disassembly, shipping, plant infrastructure construction, onsite module re-assembly and commissioning.

The updated FS estimates a build cost of US$18,4 million. The Phase 1 pre-tax IRR is estimated at 25,2 % and the post-tax IRR at 21,6 %.

Comments Craig Scherba, President and CEO of NextSource: "We are very pleased with the results of the updated Feasibility Study. It verifies that Phase 1 of our Molo mine plan is economically viable using an industry first, fully modular build approach under current and realistic market conditions and reaffirms the company's strategy of using a two-phased approach to establish the Molo project as a world-class producer of high-quality flake graphite. Phase 1 will be implemented with an incredibly low capital cost, competitive operating costs and with an initial production volume that can be easily absorbed into the current market. This will allow us to quickly penetrate the market, generate revenue and establish strong relationships with key buyers."

He adds that based on the positive results of the updated FS, NextSource will be initiating an economic analysis that will incorporate its "unique modular approach" for Phase 2 expansion. Phase 2 will produce approximately 50 000 t/a of SuperFlake™.

The Molo project is situated in the Tulear region of south-western Madagascar and is located 11,5 km east of the town of Fotadrevo, covering an area of 62,5 hectares within the company's overall property claim position of 425 km^2. The Molo deposit itself is 220 km by road from the port city of Fort Dauphin, where the Port of Ehoala, a modern deep-water port built by the World Bank and Rio Tinto in 2009, is located.

The updated FS considers an open-

CIL tank construction at Yanfolila earlier this year (photo: Hummingbird).

eight years of 107 000 ounces although the first full year of operation will see 132 000 ounces being produced. In all, some 8,7 Mt of ore (at an average grade of 2,95 g/t and a LOM strip ratio of 11,9 to 1) will be mined over the mine life to produce a total of 770 000 ounces. According to Hummingbird, there are over 1 Moz of gold outside the current mine plan.

Located in the Sikasso region of southwest Mali close to the border with Guinea, Yanfolila was acquired by Hummingbird from Gold Fields in 2014 in a deal worth US$20 million (with Gold Fields accepting payment in Hummingbird shares). Gold Fields was planning a 3 Mt/a operation at Yanfolila. Hummingbird has scaled this back considerably to 1,24 Mt/a, in the process bringing down the capex to a remarkably low US$79 million. ■

pit, fully-modularised mining operation using a 100 % owner-operated fleet that will process an average of 240 000 tonnes of ore per year of mill feed that will be processed on site. The processing plant will produce an average of 17 000 tonnes per year of finished SuperFlake™ concentrate.

The Phase 1 modular mine will utilise two 1,4 MW diesel generators, with one running and one on standby. Water will be supplied from a well field that has been defined by drilling and geohydrological modelling. The processing plant will consist of conventional crushing, milling and flotation circuits followed by concentrate filtering, drying and screening.

Phase 1 will employ dry-stack tailings, which will forfeit the need for a wet tailings facility and is designed to accommodate the run-of-mine tonnage for the 30-year life of mine. This is based on a co-disposal strategy where the finer tails are deposited with a coarse mining waste product that optimises the waste footprint and environmental impact. A wet tailings facility is not required at the Phase 1 tonnage but feasibility level designs have been completed for a tailings dam, which will be required at higher tonnages.

For the 30-year mine life of the project, the ore mined is expected to yield an average grade of 8,1 % C. The ore will go through a process involving grinding, flotation, dewatering, drying and sieving/classification. The process flow sheet has been designed for the standard purity of 96 % C for all flake sizes, and will be capable of reaching purities in excess of 98 % C (as demonstrated in the 2015 Molo FS technical report). The final products will be bagged and shipped in containers to various markets via the ocean shipping port of Fort Dauphin. ■

Base Resources approves Kwale Phase 2 project

ASX-listed mineral sands producer Base Resources has announced that, following completion of the Definitive Feasibility Study (DFS), its board has approved implementation of the Kwale Phase 2 project (KP2) at its Kwale Mineral Sands Operations (Kwale Operations) in Kenya. The incremental capital to implement KP2 is – says Base – a modest US$13,1 million, which will be fully funded from operating cashflows.

The DFS has confirmed the opportunity for significant improvement in the financial returns for Kwale Operations through further optimisation of the remaining mine life. The DFS was completed internally by Base's project development team, supported by several specialist consulting firms, and included an independent peer review process.

The objective of the KP2 project is to maximise the overall economic returns of the Kwale Operations by implementing a solution to maintain maximum concentrate feed to the Mineral Separation Plant (MSP), and therefore final production volumes, in the face of declining ore grades expected from mid-2018 onwards. The KP2 DFS has established that this objective can be effectively and efficiently achieved.

The hydraulic mining unit (HMU) in operation at Kwale Central Dune (photo: Base Resources).

Mining at the Kwale Operations was originally based on a conventional dozer trap mining unit (DMU), using Caterpillar D11T dozers to feed the DMU. Historically, when mining the high-grade areas of the Kwale Central Dune, DMU mining rates of up to 1 400 tonnes per hour (tph) have been required to ensure the wet concentrator plant (WCP) is fully utilised. To offset the declining ore grades expected from mid-2018, the KP1 mine plan assumed an increase in the mining rate to 1 800 tph. To achieve this higher mining rate with the DMU alone requires the addition of a third D11T dozer.

The KP2 pre-feasibility study determined that the optimal mining rate to maximise the economic returns of Kwale Operations was 2 400 tph. The KP2 pre-feasibility study identified hydraulic mining as the preferred method to complement the DMU to achieve the targeted 2 400 tph mining rate. Operating dual mining units has the additional benefit of allowing concurrent mining of both the high and low grade ore, which assists in smoothing the grade profile to create a more consistent feed to the WCP.

In August 2016, as part of the DFS, a 400 tph hydraulic mining unit (HMU) was commissioned to trial the concept. The HMU has proven to be extremely well suited to mining Kwale ore, achieving higher availabilities and at lower unit operating costs than the DMU. Following

New MD for Khoemacau Copper Mining

Cupric Canyon Capital has announced the appointment of Johan Ferreira as Head of African Operations and Managing Director of Khoemacau Copper Mining. Ferreira will lead the development of the Khoemacau copper/silver project in the Kalahari Copperbelt of north-west Botswana with construction beginning towards the end of this year. Initial production from the new mine will average 50 000 tonnes of copper and 1,4 Moz of silver per year over a mine life that exceeds 25 years. Future expansions are expected to increase annual production to over 100 000 tonnes of copper and 3 Moz of silver.

Ferreira began his mining career with Anglo American in 1986, and from 2005 to 2011 he was General Manager of the Moab Khotsong and Great Noligwa gold mines. Subsequently, he was appointed Senior Vice President, South Africa Operations for AngloGold Ashanti. In 2014, he accepted an opportunity in Ghana with Newmont Mining Corporation as Regional Group Executive Operations and was soon promoted to Regional Senior Vice President – Africa Region, assuming executive responsibility for that region. While in Ghana, he was President of the Ghana Chamber of Mines and a Director of the American Chamber of Commerce. He holds a Bachelor of Engineering (Mining) degree from the University of Pretoria and several other professional certifications and diplomas.

Dennis Bartlett, Cupric's Chief Executive Officer, said, "We are excited to welcome Johan to the Cupric team. He is a highly experienced and accomplished mining executive who brings the underground mining expertise necessary to transition the project from studies to mine development and operations. Johan is assuming the role previously held by Sam Rasmussen, who completed his three-year contract in December. Sam was instrumental in leading our efforts to complete not only the resource drilling campaign and feasibility study, but also to obtain the Khoemacau mining licence. We wish Sam all the best in his future endeavours."

The new mine will be a mechanised underground operation at the company's Zone 5 deposit. Ore will be treated at the existing Boseto process plant, which is located 35 km to the north-west.

the success of the HMU trial, the DFS concluded that the optimal mining setup for Kwale Operations was three HMUs mining at an average rate of 800 tph each to give a combined total of 2 400 tph.

At the lower ore feed grades and higher mining rates anticipated from mid-2018, the WCP must be upgraded to maintain optimal heavy mineral recoveries. A comprehensive pilot plant programme and spiral modelling work undertaken by mineral sands industry specialist consultants, Mineral Technologies, was employed to determine the optimal equipment configuration for different mining rates and ore grades.

The modelling established that an increase in the number of spirals is required to accommodate the mining rates contemplated under the KP1 (15 % increase) and KP2 (69 % increase) mining plans. In addition, modifications and equipment upgrades are required to the primary screens, feed de-sliming circuit, tailings cyclones, various pumps and piping. Other than increasing the capacity of the overflow pipework, tests confirm the capability of the two existing thickeners to manage the increased solids loading at the higher KP2 mining rate.

Following finalisation of the front end engineering design, a nine-month implementation period will see construction completed in the June quarter of 2018. Upgrading of the existing HMU from 400 tph to 800 tph and commissioning of two additional 800 tph HMUs will be undertaken in FY 2018, gradually ramping up to the target 2 400 tph mining rate through the course of the 2018 year with the DMU production slowly phased out over the same period. The transition of mining from the Central Dune to the South Dune is scheduled for the second half of 2019. ■

New Luika produces first stope ore

First stope ore has been produced from the New Luika Gold Mine (NLGM) underground operation. Owned by AIM-listed Shanta Gold, the mine is located in the Lupa goldfield near Mbeya in south-western Tanzania.

The underground ore is being sourced from a long-hole open stope between the 900 and 880 metre levels in the Bauhinia Creek orebody. Establishment of further stopes will continue throughout 2017 to support the increasing production scheduled from the underground operations.

Coincidentally, on 19 May 2017, ore was intersected in the Luika orebody on the 937 metre level, ahead of schedule, with first production ore from Luika scheduled in Q4 2017.

Over 3 000 m of total underground development, including the portal development from the 960 metre level, has been completed since 24 June 2016 while a total of 37 000 tonnes of development ore at 7,70 g/t has been produced from Bauhinia Creek undergound to date.

The Bauhinia Creek main fan was commissioned in early May 2017 and the final ventilation raise bore shaft for the Luika orebody is on track for completion this quarter. The cement rock fill plant construction is underway to commence operation this quarter. Two loaders have been equipped with tele-remote operation, with training completed, and the underground workforce now stands at 138.

Toby Bradbury, Chief Executive Officer, commented: "In September 2015, Shanta announced its Base Case Mine Plan with a commitment to commence underground production from Bauhinia Creek in Q2 2017 at the New Luika Gold Mine. Every material milestone has been achieved in the delivery of this project, which is a credit to the entire Shanta team." ■

Lucapa secures funding package for Mothae

ASX-listed Lucapa Diamond Company has concluded a funding package of up to A$19 million to fund the acquisition and advancement of the high-value Mothae kimberlite diamond project in Lesotho.

The funding package leaves Lucapa on track to commence commissioning Mothae in the first quarter of 2018 under a staged, low-risk development plan.

Mothae's production will complement the high-value production from the Lulo alluvial diamond mine in Angola, which delivered the world's highest average US$ per carat prices in 2016.

Lucapa considers Mothae to be a premium-quality diamond asset. Mothae has recovered large and valuable diamonds from historical bulk sampling and is located in the heart of the highest-price cluster of kimberlite diamond mines in the world. It is within 5 km of Letšeng (the highest dollar per carat kimberlite mine in the world) and close to the Liqhobong and Kao mines.

Under the Phase 1 Mothae development plan, Lucapa plans to process approximately 2 Mt of mainly weathered, near-surface kimberlite material at 720 000 t/a over the first three years. This material is primarily free-dig, which means it will require limited drilling and blasting. Lucapa will scope the Phase 2 development plan for Mothae once Phase 1 is fully commissioned. ■

Savannah completes positive Scoping Study on Mutamba

AIM-listed Savannah Resources has completed a Scoping Study on its Mutamba mineral sands project in Mozambique that indicates excellent life of mine financial returns with relatively modest capital requirements. The company is targeting first production from Mutamba in 2020.

The project is being developed by Savannah and Rio Tinto as part of a consortium agreement between the two parties. Savannah has the right to earn up to a 51 % interest in the project, subject to key milestones being met. As a result of delivering the Scoping Study, Savannah now holds a 20 % interest.

The project is located in the Inhambane province of Mozambique about 35 km south-east of the city of Inhambane and 300 km north-east of Maputo.

The mining inventory that forms the basis of the Scoping Study was derived from an optimised pit shell giving a 30-year mine life and comprises 451 Mt averaging 6 % Total Heavy Minerals (THM) in indicated and inferred resources.

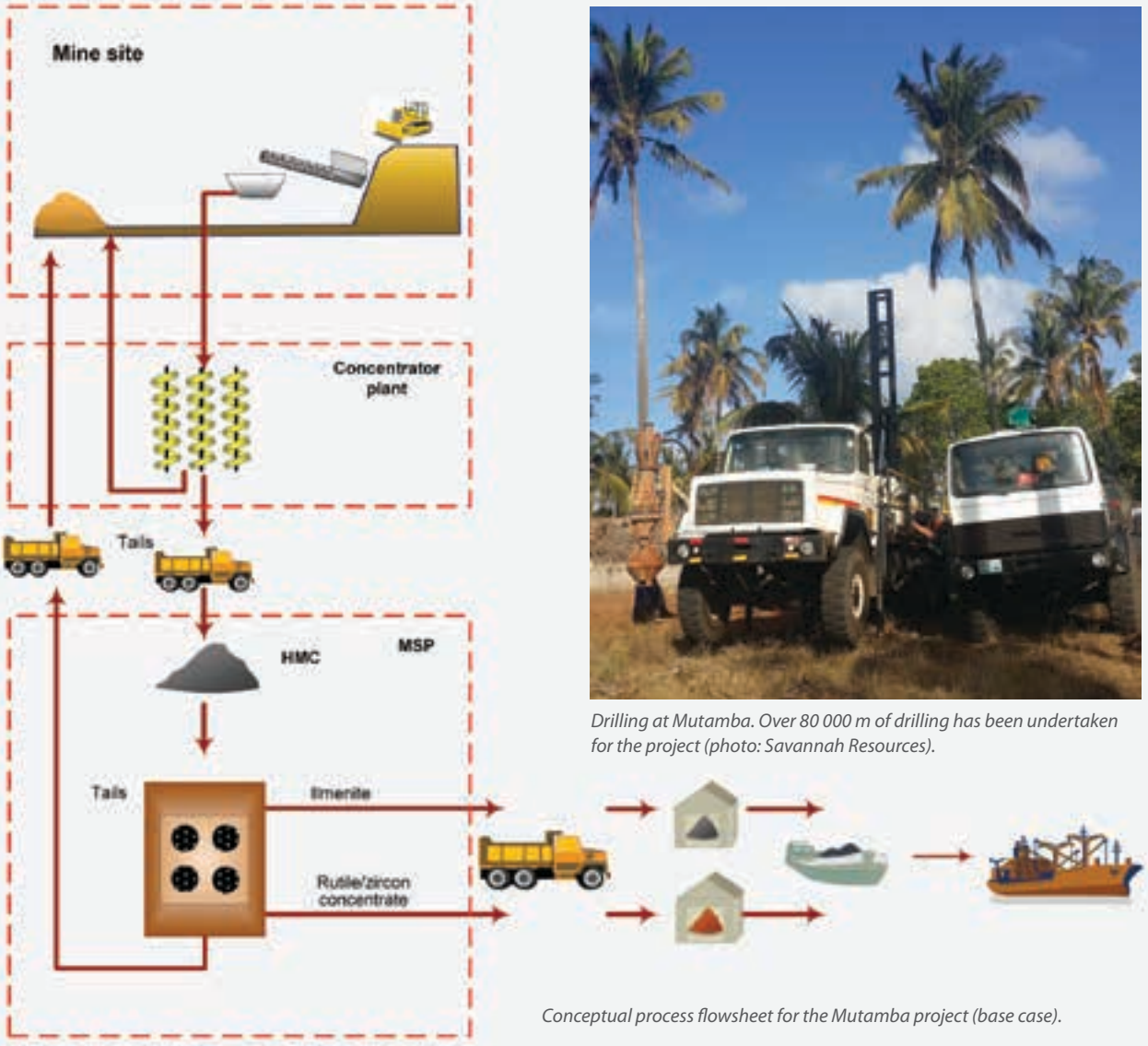
Average annual production following ramp-up to a 15 Mt/a mining rate is estimated to be 456 000 tonnes of roasted ilmenite and 118 000 tonnes of non-magnetic concentrate (rutile and zircon) over an initial mine life of 30 years, which will position the Mutamba project as a globally significant ilmenite producer.

At the assumed base case pricing of US$185/t for ilmenite and US$250 for non-magnetic concentrate (rutile and zircon) over the project life, the project is anticipated to generate average pre-tax cash flows of US$40 million per annum. The life of mine revenue is forecast to be US$3,53 billion and cash operating costs over the life of mine are US$2,16 billion.

Developing the project will involve a pre-production capital expenditure of US$152 million plus US$74 million of contingency, EPCM and spares, with identified opportunities that may reduce capital expenditure with a payback of five years.

Mutamba includes three separate mineral sand deposits: Jangamo, Dongane and Ravene. The Dongane and Ravene deposits are dominated by the high dune topography. However, at Jangamo, high dunes only occur to the south where it approaches Dongane.

Several mining methods were reviewed for applicability to the project. These



Conceptual process flowsheet for the Mutamba project (base case).

Drilling at Mutamba. Over 80 000 m of drilling has been undertaken for the project (photo: Savannah Resources).

included the dredge wet mining method as well as the front-end loader (FEL)/truck and dozer trap dry mining methods. Of the dry mining options considered, dozer trap mining is preferred over the FEL/ truck mining method.

Mined ore will be slurried and pumped to the nearby primary concentrator plant (PCP). Processing in the PCP consists of desliming to remove fines and gravity separation using spiral circuits. The PCP has been sized for a nominal feed rate of 2 000 t/h in order to produce approximately 800 000 t/a of heavy mineral concentrate (HMC) with a heavy mineral grade in the order of >90 %.

The HMC produced will trucked to the mineral separation plant (MSP). The concentrate will be fed into the mineral separation circuit where it will be processed to produce a magnetic roasted ilmenite product and a zircon-rich non-magnetic concentrate. For the base case, the MSP has been sized to produce approximately 70 t/h of roasted ilmenite and 15 t/h of non-magnetic concentrate.

Full-time production achieved at Mowana

AIM-quoted Alecto Minerals reports that production is now ongoing on a full-time basis at the Mowana copper mine in Botswana following completion of the first blast on 29 April 2017 and a successful trial period, which saw the company produce saleable concentrate of up to 28 % copper.

To date, over 1 900 tonnes of copper concentrate has been produced, which is being sold to Alecto's offtake partner, Fujax Minerals and Energy Limited.

Alecto continues to advance the acquisition of the project by way of a reverse takeover and says that the Competent Persons Report (CPR) on Alecto's African assets and the producing Mowana mine has now been completed by Wardell Armstrong International. This represents an important milestone towards the publication of the admission document required to enable Alecto to recommence trading on AIM.

The CPR reports a current resource of circa 172 Mt at 0,84 % Cu, of which 26 Mt sits within two existing pre-stripped 350 m-deep pits. These pits represent the main areas of current operation. Allowing for an element of overlap in the original modelling on which the CPR is based, Alecto estimates the resource at 162 Mt at 0,84 % Cu (equating to 481 kt Cu in the measured and indicated categories and a 732 kt Cu in the inferred category).

Alecto intends to ramp up to an annualised rate of 12 000 tonnes Cu in Q3 2017. Production costs are expected to average US$1,5/lb over the mine life based on an average metallurgical recovery of 91 %. The CPR reports an NPV of US$87,5 million for the initial 12 000 tonnes Cu production scenario.

In tandem with its current mining activities, Alecto intends to undertake additional test work over the coming months to finalise its decision on the installation of a DMS unit at the project. If pursued, this technology is anticipated to facilitate an increase in throughput to 2,6 Mt/a for approximately 23 000 tonnes Cu by Q3 2019, which – says Alecto – will dramatically enhance the mine's economics.

New strategic plan for phosphate mine

ASX-listed Avenira, owner of the Baobab phosphate project in Senegal, has submitted an application to convert its Small Mine Permit (SMP) into a full Exploitation Permit (previously referred to as a 'Large Mine Permit' or 'LMP'). The LMP, if granted, will provide the right foundation for a production capacity expansion, and will ensure an extended project tenure (up to 20 years, with further renewals allowed).

This follows Avenira's announcement in March this year of an inferred mineral resource estimate of 114 Mt at 19 % P_2O_5 at a 15 % cut-off and an indicated mineral resource estimate of 31,7 Mt at 20,6 % P_2O_5 at that same 15 % cut-off at Baobab.

In the light of the resource estimates and the company's experience with its existing facility at Baobab, Avenira's board has approved a new Strategic Plan developed by Managing Director Louis Calvarin and his team. The Strategic Plan includes two stages: firstly, the optimisation of the existing ore beneficiation unit to bring it to a fully sustainable operational level; and, secondly, the implementation of next step investments towards the long-term objective of Avenira becoming a leading supplier to the fertiliser industry and a leading fertiliser producer for West African and international markets.

Stage 1 will deliver a capacity and performance expansion of the existing Baobab processing facility. A flotation line will be added to improve P_2O_5 recovery from around 50 % currently to around 70 %, and to reduce the silica assay of the Gadde Bissik phosphate rock concentrate product. A drying process unit will also be added to control product moisture at the commercially required level, including during the annual wet season.

"Stage 1 is intended to increase current production to the 0,5 Mt per annum level and to improve product quality, opening a wider segment of the market to our product," explains Calvarin.

Stage 2 will be the construction of a second production line delivering around 1 Mt/a of additional capacity.

The resulting combined capacity of 1,5 Mt/a will provide sufficient product for Avenira to supply a dedicated phosphoric acid facility – this being the company's long term strategic objective – while continuing to grow its relationships with its phosphate rock customers.

Engineering studies are under way to provide a detailed design as well as capital and operating cost estimates for Stage 1. The expanded plant is expected to be fully commissioned in stages within 12 to 18 months of funding. Pre-feasibility work for Stage 2 is projected to start before the end of 2017. ■

Avenira has approved a Strategic Plan which will see production capacity at its Baobab project being expanded to 1,5 Mt/a (photo: Avenira).

Senior appointment by Wits School of Mining

As a leading school in the field of rock engineering, the Wits School of Mining Engineering has recently appointed Professor Rudrajit Mitra as Centennial Chair of Rock Engineering.

Professor Mitra joins Wits from the University of New South Wales (UNSW) in Sydney, Australia, where his positions included Director of Undergraduate Studies in the School of Mining Engineering since 2012.

"Building on the progress made by previous incumbents in this Chair, there is great scope to use the experience of other countries and various disciplines – such as computer science, geophysics, metallurgy, chemistry and finance – to collaboratively develop solutions," said Professor Mitra.

Previous holders of the Chair include well-known local experts in the field such as Professor Dick Stacey and Professor Nielen van der Merwe.

"The Chair had been vacant for two years before the appointment of Professor Mitra, because we needed to make the right appointment," says the Head of the Wits School of Mining Engineering, Professor Cuthbert Musingwini.

The Chair is supported by the Centennial Trust, established by the school in its centenary year of 1996. The research activities of the Chair are supported by a 2014 donation of R1,9 million by global miner Gold Fields.

Professor Mitra earned his first degree in mining engineering from BE College in Shibpur, India, and went on to do his Master of Science in Mining Engineering at Pennsylvania State University in the US, and his Doctorate at the Virginia Polytechnic Institute and State University, also in the US.

He has published widely in the field of rock mechanics and rock engineering, particularly focusing on underground coal mining. With a particular interest in visualisation technology and simulation, he was the co-founder of the 'Future Mining' conference that promotes innovation in mining and considers lessons and opportunities from other industries. The initiative is a forum for scientists, mine management, engineers, government, academics and other stakeholders to visualise and work towards positive future scenarios for mining.

He also co-developed ViMINE, a scenario-based mine planning tool that helps mining engineering students to experience various aspects of a mining operation working together, integrating several types of simulation into one environment. ■

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Mining starts at Gakara's first production site

AIM-listed Rainbow has provided a further update on its Gakara rare earth project in Burundi. Gakara is one of the highest grade rare earth element mining projects globally with an estimated in-situ grade of 47-67 % Total Rare Earth Oxide (TREO).

Mining work at Gakara commenced in April 2017, focusing on the initial mining site at Gasagwe. This will be Rainbow's primary source of ROM ore during 2017/18. The labour force has concentrated on stripping overburden at the surface of Gasagwe, thereby exposing the targeted 'main vein' to a height of at least 1 m along its current exposed strike length. The uncovered vein will be relatively simple to extract and stockpile as required.

There have also been discoveries of several previously unrecorded veins which will also be extracted and added to the ROM stockpile prior to the commissioning of the processing plant at Kabezi.

Rainbow reports that work continues on the improvements to the approximately 2,3 km long Gasagwe access road from the nearest town of Mutambu using local contractors. The road upgrade is required for the haul trucks to transport ROM ore to the processing plant, hence there is no impact on current mining operations during its construction.

By the end of May 2017, the number of local workers trained and inducted by Rainbow's team had doubled to 80 from the initial 40. As well as being trained to assist with mining activities, the new workers will also be assigned to exploration and road maintenance roles.

Rainbow's planned exploration activities over the coming months will incorporate both greenfield and brownfield areas. The focus of the greenfield work will be on areas within the company's existing exploration licence, which have previously not been explored. The company will use techniques that have proved successful during previous work in other areas.

Brownfield work will focus on areas within Rainbow's mining licence where significant rare earth discoveries have already been made, with the purpose of delineating further tonnage for future mining. Tasks to be undertaken include trenching, mapping, gravity surveying, and a trenching/terracing prospecting programme with a view to uncovering, accurately mapping, and sampling the in-situ sources of large bastnaesite blocks previously discovered on the surface in the Kiyenzi area.

Rainbow's ROM ore processing plant will be situated at Kabezi, 10 km due south of Bujumbura and approximately 20 km from the company's mining areas. The site comprises relatively flat ground, close to the shore of Lake Tanganyika, and is located on a main asphalt road. This will provide ease of access for the container trucks collecting rare earth concentrate for export.

Rainbow's selected EPCM contractor, Obsideo Consulting of South Africa, continues to make good progress with equipment procurement and expects the first shipment of containers to leave South Africa during June. ■

Mining work at Gakara began in April 2017, focusing on the initial mining site at Gasagwe (photo: Rainbow Rare Earths).

Big increase in output at Frontier operation

Frontier mine, owned by Eurasian Resources Group (ERG), delivered more than 107 kt of contained copper in concentrate in 2016, an increase of 35 % on 2015 output.

Frontier – originally built by First Quantum – is ERG's flagship mine in the DRC and is the cornerstone of the Group's copper business in Africa. In 2016 the plant improved its performance across many key indicators.

A revised production plan was launched by ERG in late 2015 to increase long-term copper production at Frontier by improving the efficiency and effectiveness of its operating model.

The growth was the outcome of considerable operational improvements and investment while the mine also changed the way it deployed contractors. Major benefits were realised from Q2 2016 onwards, resulting in a steady supply of copper ore, improved plant feed grades and plant throughput tonnages.

John Robertson, Frontier Mine President – General Manager, said: "The production figures at our flagship Frontier mine are very encouraging and I am proud of what the team has achieved. This is a major step forward for the Group and supports ERG Africa's strategy to become a regional copper and cobalt champion. Our people are ERG's greatest asset and their ability to plan, embrace change and deliver solid results is commendable.

"The achievements at Frontier mine play a key part in forming a balanced production system alongside ERG's copper and cobalt asset portfolio in Africa, which also includes Boss Mining, Comide, Chambishi Metals, and the Metalkol Roan Tailings Reclamation project." ■

DRA appointed as lead contractor for Elikhulu

Multi-disciplinary international engineering group DRA has been appointed by JSE-listed Pan African Resources to deliver a detailed design and construction supervision service for the Elikhulu gold tailings retreatment plant facility planned for Pan African's Evander operation in Mpumalanga.

This is a substantial project relative to the size of Pan African Resources' operations in the Evander area and will reportedly be a game-changer for Evander. The project is equally important to DRA as the lead contractor.

"This is DRA's first gold tailings retreatment plant development and it includes all aspects of the construction, including hydraulic mining, processing and tailings deposition," says Paul Howard at DRA. "The Elikhulu project is valued at circa R1,6 billion and entails the construction of facilities and infrastructure at Evander to retreat gold plant tailings at the rate of 1 million tonnes per month."

DRA's scope of services through all stages of the project encompasses the reclamation of the three existing storage facilities, namely Kinross, Leslie and Winkelhaak. Furthermore, the project scope includes the water supply to the project as a whole and the water supply to each of the reclamation sites; the hydraulic mining infrastructure; and a new carbon in leach (CIL) gold recovery process plant.

DRA will also be responsible for the pump and piping systems to transfer the hydraulically mined tailings slurry to the new CIL process plant; the residue disposal pumps and piping systems to deposit the tailings on a new Tailing Storage Facility (TSF); and the construction of the new TSF.

According to DRA, its competitive advantage over other bidders for the project lay in the fact that the engineering firm was involved with Pan African Resources from a Definitive Feasibility Study phase and was able to ensure a cost effective, fit-for-purpose, technically appropriate solution.

"The team involved in the study phase (and who will also be executing the project) have managed many projects with an array of challenges including schedule and capital expenditure constraints as well as limited water availability, all of which were overcome to implement the project plans successfully," says Howard.

He adds that DRA has developed a good working relationship with all team members, both on an executive and operational level, and will leverage this alliance to further establish a long-term partnership with Pan African Resources.

The new CIL process plant will be commissioned in the fourth quarter of 2018 and the final phase of the TSF will be complete in the first quarter of 2019. ■

Preferred power provider selected for Colluli

Danakali, listed on the ASX, and its joint venture partner, the Eritrean National Mining Corporation (ENAMCO), have announced that Inglett and Stubbs International (ISI) has been appointed as the preferred power provider for the Colluli Sulphate of Potash (SOP) project. The appointment follows a competitive tendering process utilising a build-own-operate-transfer (BOOT) model.

In January 2017, expressions of interest were received from power providers based in the Middle East, Australia, Africa, the US and the UK. The shortlisted parties submitted bids in a competitive tendering process based on the technical specifications determined in the definitive feasibility study. The bids were received in April and subsequent evaluation of the proposals received demonstrated very close alignment with the power generation costs determined in the definitive feasibility study.

ISI, based in Atlanta in the US, is a highly experienced, global provider of power generation, distribution and communications facilities. With a long-term partnering approach, ISI provides turnkey solutions, facilities and critical infrastructure, operations and maintenance services, and full service electrical and communications services.

The Colluli deposit is located in the Danakil region of Eritrea and is approximately 177 km (350 km by road) south-east of the capital, Asmara, and 180 km from the port of Massawa (230 km by road), which is Eritrea's key import/export facility.

The Colluli mineralisation commences at just 16 m below surface, reportedly making it one of the most accessible potash deposits globally and highly amenable to open-cut mining. This provides higher resource recoveries relative to underground and solution mining methods, is generally safer, and can be more easily expanded.

A definitive feasibility study (DFS) for the production of potassium sulphate was completed in November 2015. The DFS utilises a modular development approach which mitigates risk while enhancing fundability and economic return. Phase I is expected to produce approximately 425 kt/a of premium SOP product with commissioning currently targeted for Q4 2018. Phase II, commencing production in year 6, will increase total SOP production to 850 kt/a. ■

The exploration camp at Orca's Block 14 gold project in Sudan (photo: Orca Gold).

Discovery of water resource enhances Block 14 project

Orca Gold Inc, listed on the TSX-V, has announced that an extensive airborne geophysical survey carried out to the west of the company's 70 %-owned Block 14 gold project in Sudan has resulted in the discovery of a new and larger water resource for the project.

The company's hydrogeological consultants, GCS Water & Environmental Consultants (GCS) of South Africa, have recently confirmed the new water discovery and reported that it has a high probability of supplying the quantity of water required to enable production of 3,4 Mt/a. Further, this water has significantly better quality than the saline HA8 aquifer, which will reduce reagent consumption.

The discovery of this water supply has enabled the process plant throughput to be significantly increased, thus reducing unit process operating costs. A number of throughput scenarios were evaluated, with 3,4 Mt/a showing the best potential economic result with current resources. The reduced process costs have led to a material increase in 'in-pit' resources at the Galat Sufar South (GSS) and Wadi Doum deposits.

Based on the engineering studies completed to date, Orca has determined that it has sufficient information to proceed immediately to a definitive feasibility study, which will expedite reaching a development decision while avoiding a delay and the costs associated with finalising the previously planned pre-feasibility study.

Accordingly, the company has elected to update its preliminary economic assessment on the Block 14 project (Revised PEA) with the new information which has been generated throughout the recent phase of engineering studies.

The Revised PEA demonstrates a strong project at a gold price of US$1 200/oz, with in-pit indicated resources of 1 928 koz, inferred resources of 173 koz, a pre-tax NPV_7 of US$278,2 million, a pre-tax IRR of 26,5 %, an after-tax NPV_7 of US$ 227,7 million and an after-tax IRR of 23,1 %.

The Revised PEA is based on contract mining and a CIL processing plant at GSS. A mine life of 13,2 years is envisaged with an average annual LOM production of 135 000 ounces of gold at all-in sustaining costs of US$752/oz for the LOM. Pre-production capital costs are estimated at US$211 million.

Commenting on the material change in the scope at Block 14, Rick Clark, Chief Executive Officer and Director, said: "The results of the exciting new water discovery and recent engineering work undertaken at Block 14 have completely changed the scope of the project. We are very excited about having the ability to reach a 3,4 Mt/a throughput, which nearly doubles the 1,8 Mt/a capacity contemplated in the July 2016 PEA." ■

Makhado coal project now ready to proceed

Coal of Africa Limited (CoAL) recently reported that the suspension of the Integrated Water Use Licence (IWUL) for the Makhado project has been lifted by the South African Minister of Water and Sanitation, Nomvula Mokonyane.

"The lifting of the suspension of the IWUL by the Minister is welcomed as this decision completes the suite of regulatory authorisations required for the Makhado project," comments David Brown, Chief Executive Officer of CoAL. "It further confirms government's support for the Makhado project and its potential to drive sustainable socio-economic transformation. We will continue to work with all parties to ensure that the matter is completed satisfactorily, and furthermore to secure the remaining surface rights."

In May 2015, the Department of Mineral Resources granted a New Order Mining Right (NOMR) for Makhado, which ranks as the company's flagship project. It represents CoAL's first project within the Soutpansberg coalfield. In June 2013, the company released an independently verified Class II Definitive Feasibility Study on Makhado and in November 2015 appointed DRA to conduct the Front End Engineering Design (FEED).

The project is located in Limpopo Province. The nearest town, Makhado (Louis Trichardt), is situated 35 km south of the project area, with Musina located 50 km to the north.

Makhado will produce hard coking and thermal coal through opencast mining. There are currently 172,73 Mt ROM reserves in situ which will be mined over the life of mine of 16 years at an average rate of 12,6 Mt/a ROM.

There is the potential for expansion underground at Makhado. The reserve and resource statements have been independently reviewed by Venmyn Deloitte. At steady state production, 2,3 Mt/a of hard coking coal and 3,2 Mt/a of thermal coal will be produced. ■

Ivanhoe updates mineral resource estimate for Kakula

Robert Friedland, Executive Chairman of TSX-listed Ivanhoe Mines, and Lars-Eric Johansson, CEO, have announced that the company has completed an independently verified, updated mineral resource estimate for the extremely high-grade Kakula Discovery on the tier one Kamoa-Kakula copper project. Located near the mining centre of Kolwezi in the DRC's Katanga Province, the Kamoa-Kakula project is a joint venture between Ivanhoe Mines, Zijin Mining and the Government of the DRC.

The new mineral resource estimate covers a strike length of approximately 7,7 km along the eastern section of the Kakula Discovery. It boosts the tonnage of Kakula's estimated indicated resources by 75 % compared to the October 2016 resource estimate – which covered a strike length of 4,1 km.

Kakula's indicated resources have increased by 50 Mt, to the current total of 116 Mt at 6,09 % copper, at a 3 % cut-off grade. This compares to 66 Mt at 6,59 % copper estimated in October 2016, also at a 3 % cut-off grade.

Kakula's new estimated inferred resources are an additional 12 Mt at 4,45 % copper, at a 3 % cut-off.

"With 12 rigs currently drilling at Kakula and Kakula West and another two rigs about to begin testing important new targets in the licence area, Kakula is an international story of discovery that has earned the mining world's attention," said Friedland. "To keep the mine-planning process driving forward, we need to provide the mining engineers with updated resource numbers for the expanded-case preliminary economic assessment due to be issued in the third quarter."

Johansson said that the copper grades at Kakula are significantly higher than the average grades found at the adjacent, earlier Kamoa Discovery. "We're highly confident that fast-tracking mine development at Kakula will have a profound, positive impact on the economics of the overall Kamoa-Kakula project.

"Kakula alone already has enough resources, grading 6 % copper or higher, to maintain approximately 20 years of mining at a rate of six million tonnes per year. We're also confident that Kakula West has similar potential."

The new Kakula resource estimate covers approximately two thirds of the known strike extent of the high-grade, chalcocite-rich Kakula trend, which is approaching 12 km in length, and remains open along strike in both directions.

Kamoa-Kakula geologists now are planning for a resource estimate at the newly discovered Kakula West area, located approximately 3 km west of the new Kakula resource boundary.

The Kakula Discovery is approximately 10 km south-west of Kamoa's initial Kansoko mine development. An aggressive drilling programme has been underway at Kakula since April 2016 and more than 85 000 m of drilling have been completed. ■

Diversified Minopex looks

Established in 1996 to undertake the operation of processing plants on a contract basis, Minopex – part of the DRA Group – has since grown its skill-set dramatically and has also expanded its geographical footprint outside of its traditional Southern African area of operation. Says the company's Vice President: Business Development, Rafael Abela: "We're becoming a multi-disciplinary, international business although the bulk of our turnover is still derived from South Africa and its neighbouring states." He adds that Minopex's goal – despite current weak market conditions – is to double in size by 2020 in step with the broader DRA Group.

Rafael Abela, VP: Business Development of Minopex.

Plant operation and maintenance on a long-term, contract basis remains at the heart of Minopex's offering and the company currently has 15 contracts running. While this is an impressive total, it is down on the peak of 23 contracts in 2010. "The drop reflects the long downturn we've seen in mining rather than any other factors such as increased competition by competitors," says Abela. "Most of the contracts we've lost have been purely as a result of mining operations going onto care and maintenance."

Abela makes the point that Minopex's main competitors are its clients as it is not unusual for mines to outsource plant operation initially but later take the function in-house. "This most often occurs when a mine has completed its ramp-up phase and the plant has reached stable operation, at which point the mine's management feels confident enough to transition to owner operation. More often than not, we assist with this process by providing the necessary training to the mine's personnel."

"We have two contracts that have now been in place for around 18 years."

In practice, most contracts have a three or five-year term although they are frequently renewed and run for much longer. "We have two contracts that have now been in place for around 18 years," says Abela. "You can only achieve this type of longevity if you are doing things right and putting in the type of performance that clients know they can't match. No one is going to make use of our services unless we can deliver lower costs and improved productivity, all to the highest standards of safety and environmental care."

Current contracts cover a range of metals and minerals including gold, diamonds, iron ore, platinum and coal. The majority are in South Africa but Minopex is also running plants in Lesotho, Botswana and Mozambique. Comments Abela: "At one stage we had three coal contracts in the Tete area but Mozambique's coal mining industry has taken some hard knocks with the result that most of the mines have either closed or are running at very low throughput levels."

Outside of Africa, Minopex has one major current contract – this is for a gold mine in Saudi Arabia. "We were awarded this at the beginning of 2015 and we're very excited by it as it has taken us into a region – the Middle

to double in size

East – which we regard as having excellent growth potential," says Abela. "Our client is using for the first time the outsourcing model for plant operation and maintenance and prior to the award of the contract we demonstrated to our client several of our South African contract sites to give them exposure to the outsourcing concept."

The company has established an office in Riyadh which oversees its operations contract and which will also act as a base of operations for further growth by the group in the Middle East. As Abela points out, several countries in the region are intent on reducing their dependence on oil and have active programmes in place to develop their mineral resources.

On the subject of geographical diversification generally, Abela says that, in principle, Minopex is happy to work anywhere in the world. "Obviously, we would weigh up any opportunity on an individual basis and assess the level of risk and reward." He also points out that Minopex works closely with DRA and will often commission and operate the plants that its sister company designs and builds. "If DRA enters a new geographical area, then there is every chance that we will as well."

This coal plant was built by DRA and is run by Minopex.

Abela notes that DRA's and Minopex's recent involvement in a gold project in Africa coincided with the Ebola outbreak in West Africa. "The fact that the DRA Group was able to build and commission the plant on schedule under such difficult conditions while at the same time contending with the logistical problems of working on a remote site bears testimony to its overall competence and its familiarity with the challenges that mine

The operation of this processing plant at a diamond mine is one of Minopex's current contracts.

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development in Africa can present," he observes.

Minopex's commissioning work is in the hands of a specialised SWAT (Specialised Work and Training) team, established to assist clients with the start-up of new plants. "The team is very experienced in achieving the efficient ramp up to nameplate capacity of any plant and team members will include shift superintendents, process engineers and operators and control room operators," explains Abela.

Detailing Minopex's diversification into areas beyond the contract operation of process plants, Abela says that a relatively recent addition to the Minopex portfolio is Engineering Services South Africa (ENSERSA), which is a company which can provide clients with teams of experts for planned and unplanned maintenance shut downs and emergency breakdown support. It is also able to undertake small projects from the initial planning stage through to final commissioning, whether the project be a repair, an upgrade or a complete replacement of an existing system or installation.

In addition, Minopex's conditioning monitoring services come under the ENSERSA banner. These services include thermal imaging, vibration analysis, acoustic ultrasound, laser alignment, non-destructive testing and bearing inspection.

Similar in nature to ENSERSA is Engineering Services Mozambique (ENSERMO), which was originally established in 2014 to provide a maintenance service to the coal mines in the Tete area. It has since broadened its offering substantially and now provides quality engineering services to a range of clients in mining, agriculture, general industry, the power sector and ports and harbours. Based in the Tete area, ENSERMO has more than 100 employees and its workshop can undertake sophisticated steel fabrication, electric motor rewinds and some machining work.

Yet another recent diversification is Minopex Mining Operations, which was previously a division of DRA. It is mainly focused on the maintenance of trackless underground equipment. "There is definitely a demand for a service of this nature and we've already completed two contracts," notes Abela. "We see opportunities not only in South Africa but across border, particularly in Zambia which has a number of underground copper mines." He adds that the Minopex Mining Operations offering could be extended in future into areas such as contract mining but says this will depend on market conditions. "We certainly have the skills to engage in virtually every aspect of underground mining from the operation by Minopex to mine design by the DRA Group mining specialists so this option is definitely open to us."

Mechanised development at a gold mine. Minopex Mining Operations can provide a full maintenance service for trackless underground equipment.

Completing the Minopex line-up is a company called Quality Laboratory Services (QLS), which operates from Rustenburg. Its expertise encompasses everything from the analysis of mineral samples through to wastewater and potable water treatment. Its facilities are SANAS 17025 accredited, which ensures that strict procedures are in place to prevent contamination. Currently QLS works as far afield as Tanzania, where it operates the laboratory near the Shanta Gold Mine near Mbeya.

Summing up, Abela says that Minopex – which is Level 4 BBB-EE compliant – is a multi-skilled company able to supply short or long-term solutions to clients operating in mining and related industries. "When we started up just over 20 years ago, the core of our business was the operation and maintenance of minerals processing plants in South Africa. We've taken that original and highly successful formula and built upon it – taking it global and, at the same time, vastly extending the scope of our activities. My slogan is that 'If it's operable and maintainable, we can do it' and we stand by that. As I've said, conditions are currently tough but we are operating profitably and efficiently and are well positioned to take full advantage of the next upturn in mining, which will surely come within the next year or two, if not sooner." ■

"We see opportunities not only in South Africa but across border, particularly in Zambia which has a number of underground copper mines."

Liquidation of BCL leaves Norilsk Nickel in limbo

The dispute between Russia's Norilsk Nickel and the Botswana government and other parties over the commitment made by BCL – now in provisional liquidation – in 2014 to purchase Norilsk's African assets seems to be developing into one of the messiest disagreements over mining assets yet seen in the Southern African region. According to Norilsk, it even threatens Botswana's reputation as being one of the best mining 'destinations' in Africa.

Michael Marriott, CEO of Norilsk Nickel Africa.

Norilsk maintains that the Botswana government, the ultimate owner of BCL, has deliberately walked away from a 2014 deal in terms of which BCL agreed to purchase Norilsk's 85 %-owned Tati Nickel operation east of Francistown, as well as Norilsk's 50 % share in South Africa's Nkomati nickel mine in the Barberton area. As part of the deal, BCL also undertook to smelt concentrate from Nkomati in its smelter at Selebi-Phikwe.

BCL's motivation for concluding the deal was the clear synergies between its operations centered on the town of Selebi-Phikwe, which include an underground nickel/copper mine and the smelter (neither now functioning), and Norilsk's operations at Tati Nickel and Nkomati. The proposed acquisition formed part of BCL's 'Polaris II' diversification and investment strategy designed to secure the long-term future of the company.

For its part, Norilsk was keen to sell Tati Nickel and Nkomati following a decision by its management in 2012 that the group would withdraw from all its foreign investments (with the exception of an enterprise in Finland) and focus on its core Russian operations.

Commenting on the turn of events since the transaction was agreed in 2014, Michael Marriott, Norilsk Nickel Africa's CEO, says the deal appeared to be proceeding according to plan until the second half of 2016. "We thought the deal was in the bag and indeed BCL, prior to its being put into liquidation in October last year, had already taken occupation of the Tati Nickel mine and, at least for a period, continued mining and processing operations as normal. In August last year the final approvals necessary for the agreement to become unconditional were received from the DMR in South Africa and we were confident that the sale process had effectively been concluded," he states.

"In September we asked for payment from BCL, citing the terms of the Sales and Purchase Agreement (SPA), but this was not forthcoming and then in October we heard via the media that the government had decided to liquidate BCL. Since then, despite repeated contact with the various parties involved with the transaction, including the liquidator, Nigel Dixon-Warren, and the authorities in Botswana, all our attempts to resolve the matter have been unsuccessful."

The amount that Norilsk claims it is owed is substantial. The purchase pride agreed to by BCL in 2014 was US$337 million (the bulk of it for the Nkomati shareholding) although this was later renegotiated downwards to approximately US$277 million – a concession made by Norilsk at the urging of BCL and the Botswana government.

In December last year Norilsk filed an application with the Gaborone High Court seeking leave to have its claim in terms of the SPA to be referred to arbitration and to prevent any liquidation order being made final until the conclusion of such arbitration. Under the terms of the SPA, all disputes between the parties are to be referred to the London Court of International Arbitration.

The results of this legal process are still pending. In the meantime, the liquidator of BCL has filed in the South African courts for a judicial review of the South African government's approval of the SPA on the grounds that such authorisation should not have been granted as BCL did not fulfil the requirements to be a shareholder in the Nkomati mine. Norilsk, for its part, has served notice that it intends to sue the Government of Botswana in the Botswanan courts for its involvement in the "reckless trading" of BCL.

The Phoenix pit of Tati Nickel near Francistown. Operations at the mine have now reportedly ceased.

To complicate matters even further, the liquidator has reportedly received expressions of interest in BCL's assets from at least two parties – one being Emirates Investment House (EIH), an Abu Dhabi-based group, and the other, according to the media in Botswana, an unnamed company from within the SADC region.

Marriott says the conduct of the liquidator has given Norilsk cause for concern. "In theory, the liquidator should be protecting the interests of creditors. We are BCL's biggest creditor but we most certainly don't believe that the liquidator is looking after our interests."

The BCL assets potentially have considerable life left in them. The underground nickel/copper mine at Selebi-Phikwe still has exploitable reserves and would probably be viable at a higher nickel price while the BCL smelter in the town is an extremely valuable, regionally significant asset, the more so since it was recently refurbished at a cost of around 700 million Pula.

"This, incidentally, is another puzzling feature of this whole affair," comments Marriott. "Why was this major refurbishment programme undertaken if BCL was in financial trouble? Indeed, the fact that it did proceed, presumably with the approval of the Government of Botswana, was one of the things that led us to believe – right until the point that BCL was put into liquidation – that we had a sound deal in place with BCL."

He adds that throughout the process – from 2014 on – Norilsk's understanding has been that the Government of Botswana was fully supportive of the transaction and was the de facto guarantor of it.

Marriott also points out that the Tati Nickel assets are in good shape. "The Phoenix pit needs a cutback to continue on a long-term basis but the Tati Nickel property also hosts the Selkirk orebody, which represents a major open-pit resource, as well as some valuable exploration targets that could add to the overall resource base. In addition, the mine has a superb processing plant which includes a modern DMS pre-concentrator."

BCL initiated a full Bankable Feasibility Study (BFS) on the Selkirk orebody in February 2016. Selkirk was originally the site of an underground mine, which started up in 1989. The high-grade massive sulphide orebody was exhausted by 2002 and Selkirk was closed. The purpose of the BFS was to examine a restart of operations based on the open-pit mining of the disseminated sulphides which were not exploited by the underground mine.

As regards Nkomati, Marriott says that operations there have been unaffected by the liquidation of BCL. "In the absence of the BCL deal being concluded, our 50:50 joint venture with ARM remains in place and the mine continues to perform very efficiently although it is challenged by the current nickel price. It's a fine asset although we remain committed to selling our stake."

Summing up, Marriott says the entire saga has been extremely disappointing for Norilsk, which only invested in Botswana because it regarded the country as a sound mining jurisdiction. "Botswana has long been regarded as one of Africa's most desirable mining destinations and over the years it has consistently scored very highly in the Fraser Institute survey, which ranks countries around the world in terms of their attractiveness to mining investors," he observes. "I fear, however, that this reputation, based on Norilsk's experience over the past few months, is very much at risk. We nevertheless remain hopeful that a positive outcome can be achieved and we are certainly open to constructive negotiations with the Government of Botswana and other interested parties."

Report by Arthur Tassell, photos courtesy of Norilsk Nickel Africa

"In August last year the final approvals necessary for the agreement to become unconditional were received from the DMR in South Africa and we were confident that the sale process had effectively been concluded."

PPM appointed to undertake

Stellar Diamonds, the London-quoted diamond exploration and development company focused on West Africa, reports it has entered into a contract for the Front End Engineering and Design study (FEED) to be conducted for the underground mine development of the Tongo-Tonguma kimberlite dyke project in eastern Sierra Leone. Paradigm Project Management (PPM) of Johannesburg has been appointed to prepare the FEED study.

This latest development follows Stellar's announcement in April this year that it had signed a Tribute Mining Agreement with Octea Mining Limited in respect of the project. Commenting on the tribute agreement, Stellar's Chief Executive, Karl Smithson, said it would allow Stellar to build a single mine for the simultaneous commercial production from the contiguous Tongo (owned by Stellar) and Tonguma (owned by Octea) kimberlite deposits.

"The combined project has an initial 4,5 million carat resource which, due to the high grade (100 cpht to 260 cpht at +1,18 mm) and high quality diamonds (US$209/ct to US$310/ct), is considered to be one of the highest value kimberlite ore bodies in Africa on a dollar per tonne basis," he stated. "The 21-year mine plan with a consistent output of over 200 000 carats per year at full production would quantify this development as the second largest kimberlite diamond mine in West Africa.

"The project also has a very modest two-year capital requirement of just under US$32 million to get into full scale commercial production. Stellar has the strong support of all main stakeholder groups in Sierra Leone for this mine development, which would have a very positive impact in terms of employment, local infrastructure development and future taxation revenue for the country."

Stellar announced in August last year that it had agreed a proposed transaction with Octea that would result in Tongo and Tonguma being developed as a single project under the same production infrastructure, with operational management invested in Stellar. The Tongo and Tonguma licences cover the entire historical Tongo alluvial diamond field, the sources of which have been identified as high-grade kimberlite dykes.

A Preliminary Economic Assessment (PEA)

Drilling at the Tongo property. Around 66 000 m of drilling have been carried out for the combined project.

feature

Tongo-Tonguma FEED study

on the combined project was published in October last year. It was prepared by PPM and SRK, both previously involved not only at Tongo but also Tonguma. As detailed in the PEA, Tongo-Tonguma will be developed by underground mining methods with access provided by a series of declines from surface at Kundu, Lando and Tongo Dyke-1. The declines will be 4 m x 4 m in cross section and will be developed at an angle of 8 deg.

Mining levels will be interspaced at 35 m depth with the first levels being developed at 40 m below surface. Based on the current resource models, Tongo will have a planned 11 levels, Lando 10 levels and Kundu five levels during the life of mine. The ore bodies will be accessed by 2 m x 2 m drives and cross-cuts into stopes that are mined by traditional overhand shrinkage stoping mining methods, with the ore being drawn from access points and transported on underground locos and tipped into bins on an ore pass system. These ore bins will feed haulage trucks that will transport the ore to surface and on to the processing plant.

The existing 50 t/h processing plant at Octea's Koidu mine is to be relocated to Tonguma and be further upgraded to serve as the processing plant for the new mine. This will save considerable time in getting the project to production.

The mine will treat a total of 6,06 Mt over its life of mine (LOM) to recover approximately 3,9 million carats. The starting operating cost is US$74 per tonne with the escalated average operating cost over the LOM estimated at approximately US$140 per tonne treated. Although the capex to production is only US$31,8 million, the escalated capital expenditure over the LOM will be approximately US$90,2 million. The full equity pre-tax NPV_{10} for the project is approximately US$172 million while the project pre-tax IRR is calculated to be 49 %.

Smithson describes the FEED as a very important first step in the mine development process. "PPM are highly experienced in the delivery of diamond mine projects and together with SRK Consulting they will refine all elements of the mine plan as determined in the PEA to higher levels of confidence in order to reduce the project delivery risk. With over 66 000 m of drilling completed at the project to date, we will undertake mine plan related drilling for the first two levels of mining to a depth of 75 m concurrent with the FEED study," he said.

"Once work commences on the FEED, it is expected to take approximately four to five months to deliver (including drilling) and will mark the onset of the mine development programme. I look forward to updating shareholders on our progress as we work to transform Stellar into a long term, high value diamond producer."

Once funded for the FEED, Stellar expects first production to be achieved within 12 months of commencement. Stellar considers this achievable by virtue of the advanced nature of the project, the already considerable surface infrastructure in place and the proximity of an in-country processing plant. ■

Top: *The Kundu West dyke – seen here – is one of the dykes in the resource.*

Above: *Exploration at Tongo has included extensive bulk sampling. Tongo Dyke-1 was exposed by excavating a trench through the weathered kimberlite and eventually into fresh, competent kimberlite that had to be drilled and blasted to unearth it from the trench. Note the competent granite side walls (which should translate into low dilution once mining starts).*

feature

Burkina Faso emerges as a

One of the most extraordinary developments seen in West Africa in recent years has been the emergence of Burkina Faso as a major gold producer. Roughly a decade ago the country did not have a single modern commercial-scale gold mine – the government-operated Poura mine having closed in 1999 – and cotton was the country's main export commodity. Today there are 10 gold-mining operations in the country with another two gold mines under construction and gold now accounts for over 60 % of total exports. In this article, ***Modern Mining's*** *Arthur Tassell looks at the gold mining scene in the country, including the prospects for further growth in the sector.*

According to the country's Ministry of Mines, Burkina Faso is predicted to produce around 45 tonnes (1,44 Moz) of gold in 2017. If this is achieved, it could possibly make the country Africa's fourth biggest gold producer after South Africa, Ghana and Mali given that Tanzania (which normally holds the fourth ranking) produced 1,42 Moz in 2016 and may not exceed this figure in 2017. Prospects for Burkina Faso's production to grow even further over the next several years are good with several projects already at an advanced stage of development and in some cases deemed to be 'shovel ready'.

The country scores reasonably well in the Fraser Institute's annual survey of mining jurisdictions around the world, being rated (in the 2016 survey) as the eighth most attractive investment destination in Africa – below some other West African countries such as Mali, Ivory Coast and Ghana but above Namibia, Tanzania and South Africa. The mining code of Burkina Faso entitles the state to a 10 % ownership of all mining operations on a free carry basis.

Of the existing mines, the biggest single producer is **Essakane** with an annual gold production in the 370 000 to 380 000 ounce range. Owned by Canada's IAMGOLD Corp, it is located in the far north-east of the country (and close to the border with Niger). IAMGOLD's involvement with Essakane dates back to its acquisition of Orezone Resources in 2009, when the project was in its development phase. Essakane began commercial production in July 2010. Mining is carried out using conventional open-pit methods by an owner fleet with the annual mining rate being in the

Nordgold's Bouly mine, seen here, started production in September 2016 and has performed above expectations (photo: Nordgold).

feature

gold-mining powerhouse

vicinity of 50 Mt. In the first quarter of this year, the mine's production was 93 000 ounces at an AISC of US$973/oz.

IAMGOLD announced earlier this year that the mine had entered into an agreement for the development of a 15 MW solar power plant to complement the existing 57 MW heavy fuel oil power plant on site. Commissioning is expected by the end of this year.

Essakane has no major expansion on the horizon but is currently drilling and evaluating the **Falagountou East** deposit, which has the potential to deliver low-cost, high-grade saprolite ore. A resource estimate is expected later this year.

Another major player in Burkina Faso's gold mining industry is Nordgold, now delisted from the LSE, which operates nine gold mines around the world including four in Russia. It has three mines in Burkina Faso – Taparko,

The GG2 pit at Endeavour Mining's Karma mine, which was commissioned last year (photo: Endeavour Mining).

The Taparko mine of Nordgold, opened in 2007, was the first of Burkina Faso's 'new generation' mines (photo: Nordgold).

feature

Above: *A very recent view of SEMAFO's Boungou project, which represents a US$231 million investment by the Canadian company (photo: SEMAFO).*

Right: *Endeavour Mining's Houndé project showing the 3,0 Mt/a processing facility under construction (photo: Endeavour Mining).*

Bissa and Bouly (although Bouly functions as a satellite of Bissa). The three operations produced around 324 000 ounces of gold in 2016 but this figure will grow in 2017 when a full year's production is registered by Bouly (which only came on line in September last year).

Taparko, located 200 km north-east of Ouagadougou, was the first 'new generation' gold mine to be built in Burkina Faso and poured its first gold in late 2007. Mining operations currently consist of three separate open pits located at Taparko and one satellite pit at **Bouroum** with the ore being processed in a conventional plant which includes three stages of crushing, ball milling and CIL circuits. Its gold production in 2016 totalled approximately 111 000 ounces – well up on the 2015 figure – at an AISC of US$1 045/oz. The mine is currently working on the permitting of the satellite **Goengo** deposit in order to start its development and mining in H2 2017.

Nordgold's **Bissa** mine is its flagship operation in the country and is located 85 km north of Ouagadougou, Burkina Faso's capital. In production since early 2013, it is a multi-pit operation served by a straightforward CIL plant. In 2016 it produced just short of 186 000 ounces, well down on the 2015 figure of 235 000 ounces with Nordgold attributing the decrease to lower ore mined volumes and head grade mainly related to higher waste stripping activities performed in order to facilitate open pit cutbacks for higher grade ore supply in 2017.

The Bissa complex was expanded in 2016 with the launch of a heap leach operation at the nearby **Bouly** deposit. According to Nordgold, the project – representing an investment of US$140 million – has been a huge success and has "delivered well ahead of expectations". It was built in 13 months, on schedule and under budget, and reached its full capacity within two months of commissioning. Bouly's average annual production will be approximately 120 koz over a mine life of 10 years. It produced 31,4 koz of gold in 2016, ahead of production guidance of 20 koz.

A company which is growing its footprint in Burkina Faso is Canada's SEMAFO, which operates the **Mana** mine, located 260 km south-west of Ouagadougou. Mana is reportedly the third largest mine in the country and has produced some 1,6 Moz since its first gold pour in 2008. The gold plant has been expanded four times since commissioning to a current capacity of over 7 200 tonnes per day. In 2016 Mana's gold production totalled 240 200 ounces.

A second mine in Burkina Faso for SEMAFO is on the way in the shape of **Boungou** (previously known as the **Natougou** project), which involves a capex of US$231 million – which will be paid back in just 18 months. Located in the south-east of the country, Boungou will be a high-grade open-pit mine with the processing facility consisting of a 4 000 tonnes per day CIP plant.

It is expected to produce approximately 1,2 Moz over a projected life of mine in excess of seven years with average annual production of more than 226 000 ounces in the first three years. During these three years, the average total cash cost is estimated at US$283/oz and the AISC at US$374/oz with the average head grade being 5,72 g/t. The mine is set for commissioning in the second half of 2018.

Acquired by SEMAFO from Orbis Gold in 2015, Boungou is already in construction,

This map of Burkina Faso shows the location of the country's mines and some of its exploration projects. It is taken from a presentation by Orezone Gold Corp.

with the ground-breaking ceremony having been held at the end of March this year. In its quarterly report for the period ending 31 March 2017, SEMAFO said the bulk earthworks for the processing plant, water storage facility and the resettled village were underway and that both the mining contractor (African Mining Services or AMS) and EPCM contractor (Lycopodium) had mobilised to site. At the end of the reporting period, over 900 workers were active on the project.

Located in the same neck of the woods as Mana in the Houndé greenstone belt is one of the newest mines in the country, Roxgold Inc's **Yaramoko**. This is an underground operation – accessed by a dual ramp system – which poured its first gold in May last year, just a little over five years from initial discovery. According to Roxgold, a Canadian company listed on the TSX, it was built within its budget (approximately US$111 million) and ahead of schedule and is one of the highest grade gold mines in the world (with the head grade during Q1 2017 being 17,3 g/t). The EPCM contractor for the project was a DRA/Group Five JV while the mining is in the hands of a subsidiary of African Underground Mining Services (AUMS).

Yaramoko produced 112 709 ounces of gold between its first gold pour and 31 March this year at an average cash cost of US$384 per ounce produced and expects to produce between 105 000 and 115 000 ounces in 2017 at a cash operating cost of US$445 to US$490/oz (and an AISC of US$740 to US$790/oz).

Housing forming part of a resettlement project at Houndé has been completed (photo: Endeavour Mining).

The first growth project associated with Yaramoko is likely to be the development of the **Bagassi South** deposit, located 1,8 km south of the existing (Zone 55) mine and plant. A feasibility study on the project – estimated to involve a capex of US$32 million – is due for completion in Q4 2017. Assuming it gets the go-ahead, Bagassi South will deliver approximately 185 000 ounces of gold over a five-year period at an estimated average grade of 9,5 g/t from a 350 tonnes per day (tpd) underground mining operation. To treat the ore, the existing plant would need to be upgraded from 750 tpd to 1 100 tpd. At this stage, it is envisaged that mine development could commence in Q1 2018 with first ore being delivered in Q3 2018.

Another mine to come on stream last year is **Karma**, now within the stable of TSX-listed Endeavour Mining after Endeavour absorbed True Gold Mining in April 2016. Karma is a 4 Mt/a shallow open-pit, heap leach operation which now has a plus 10-year mine life (following the conversion of a major part of the previous inferred resource at the North Kao deposit into the reserve category). It is expected to produce between 100 000 and 110 000

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ounces of gold in 2017 at an AISC of US$750 to US$800/oz.

Endeavour is busy building a second mine, **Houndé**, in Burkina Faso. This will be an open-pit operation equipped with a 3,0 Mt/a gravity circuit/CIL plant and has an initial capital cost of US$328 million, inclusive of US$46 million for the owner-mining fleet. Construction – Lycopodium is the EPCM contractor – began in April 2016 and the first gold pour is expected in the fourth quarter of this year. The mine will have an average annual production of 190 000 ounces at an AISC of US$709/oz over an initial 10-year mine life and will rank as Endeavour's flagship low-cost mine.

The processing plant at Roxgold's Yaramoko mine, an underground operation accessed by a ramp system (photo: Roxgold).

Endeavour recently reported that the project was running on time and within budget. It also noted that the site had achieved 4 million hours without a lost time injury (LTI). Mining of ore has started and Endeavour is planning to have 600 000 tonnes of ore stockpiled on the ROM pad for plant commissioning.

An established mine which has encountered problems is **Inata**, located 200 km north of Ouagadougou and owned by Avocet Mining. In production since late 2009, it is a multi-pit operation served by a 1,6 Mt/a CIL plant that produced 72 485 ounces of gold in 2016. The mine has, however, faced a multitude of challenges in recent months including creditor pressure, tight margins, the seizure last year by bailiffs (acting on behalf of disaffected workers) of a 1 400-ounce gold shipment, and the mechanical availability of the mine fleet and the plant.

Avocet has said that the mine will produce between 75 000 and 85 000 ounces of gold in 2017 but it is not clear at the moment to what extent the mine is operational as Avocet announced on 10 May this year that the majority of workers had been put on what it terms "technical unemployment" for a period of three months. The company's shares on the LSE and the Oslo Børs were recently suspended after the company failed to publish its annual report within the stipulated time frame. The latest development is that the company has advised that it has reached a 'standstill' agreement with its major creditors for a two-month period.

Inata has roughly three years of reserves remaining but – should it overcome its present problems – its life could be extended via three satellite deposits. Under current plans, the first to be brought into operation would be **Souma**, located 20 km from the Inata plant, which has measured, indicated and inferred resources of 11,63 Mt at a grade of 1,81 g/t for 675 000 ounces of gold. Avocet says that to bring Souma into production would require US$5 to US$7 million of funding to cover drilling and a feasibility study and a further US$5 million in capex to cover pit works, a haul road and enhancements to the crusher.

A relatively new entrant to Burkina Faso is Avesoro Holdings (formerly MNG Gold Holdings), a Turkish group, which purchased the advanced **Balogo** project from Australia's Golden Rim Resources in 2015 and the operating **Youga** mine – which produced around 68 000 ounces in 2015 – from Endeavour Mining in 2016. Both Balogo and Youga are situated in the south of the country near the border with Ghana and are now logistically linked via a 160 km road rehabilitated in 2016 by Avesoro. Low-cost owner-operator mining began in March this year at Balogo (in the Netiana starter pit) with the ore being transported to Youga for processing by a fleet of 30 Volvo trucks purchased at a cost of US$2,5 million. The trucking costs are reported to be US$19/ton.

Both Youga and Balogo could become part of Avesoro Resources (formerly Aureus Mining), a company that runs the New Liberty gold mine in Liberia. Avesoro Resources – whose cornerstone shareholder is Avesoro Holdings – announced in May this year that it was considering a range of growth opportunities, including the acquisition of Youga and Balogo.

Moving from mines to advanced projects, a promising fully permitted, high grade, open-pit

Houndé will have an average annual production of 190 000 ounces over an initial 10-year mine life and will rank as Endeavour's flagship low-cost mine.

feature

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project is **Banfora** in the south-west of Burkina Faso, acquired by Teranga Gold Corporation last year as part of its acquisition of ASX-listed Gryphon Minerals. Teranga, a Canadian-based company which owns Sabodala, the only commercial scale gold mine in Senegal, is expecting to complete a feasibility study on Banfora by mid-year and anticipates a construction and financing decision later this year. If the project is approved, the anticipated first gold pour would be in H1 2019. Gryphon had intended to develop Banfora – which has a roughly 3 Moz resource – utilising a 2 Mt/a heap leach facility but Teranga's preferred development path is based on an optimised CIL flowsheet.

Also on line for a 2019 startup is **Sanbrado** (formerly known as **Tanlouka**), which is being developed by Perth-based West African Resources, listed on the ASX and the TSX-V. The company claims to be the largest ASX landholder in Burkina Faso controlling roughly 1 000 km² of the country's greenstone belts and recently completed an open-pit feasibility study for the project, which has probable reserves of 894 000 oz (16,8 Mt at 1,7 g/t Au) and indicated resources of 1,3 Moz (29,75 Mt at 1,4 g/t Au) using a 0,5 g/t cut-off.

Sanbrado is located approximately 90 km east-south-east of Ouagadougou. Another fully-permitted project in this area is **Bomboré**, controlled by Canada's Orezone Gold Corporation, which is listed on the TSX-V. Bomboré has a measured and indicated resource of 4,77 Moz. Orezone's plan is to develop a combined heap leach/CIL operation that does not require any grinding or cement agglomeration and should yield overall recoveries of 87 %. The initial focus would be on the shallow oxide resource although the company points out that the standard CIL circuit could be expanded to process the large underlying sulphide resource. The company is reviewing and updating the feasibility study on the project. This has been delayed slightly and is now expected in the third quarter of this year.

A drill rig working at Banfora, a promising, fully permitted, high grade, open-pit project in the south-west of Burkina Faso (photo: Teranga Gold Corporation).

Finally, it should be stressed that the country's exploration scene remains very active. Among the companies with projects in the exploration phase are Canada's Nexus Gold, Sarama Resources and B2Gold and Australia's Golden Rim Resources, Centamin Mining and Predictive Discovery. In terms of resources, probably the biggest of the projects is B2Gold's **Kiaka**, which is low in grade but has a 4,6 Moz measured, indicated and inferred inventory, and Centamin's **Konkera**, which hosts a 3,2 Moz indicated and inferred resource. Also very promising are Sarama's **South Houndé**, **Karankasso** and **Bondi** projects in the Houndé gold belt which collectively have 3,2 Moz in inferred resources. Sarama is in joint venture with Acacia (Tanzania's biggest gold miner) at South Houndé and with Savary Gold, listed on the TSX-V, at Karankasso. ■

Sanbrado project nears a development decision

As detailed in the interim open-pit feasibility study released by West African Resources earlier this year, the Sanbrado project is to be developed as an open-pit operation with processing via a conventional 2 Mt/a CIL/gravity plant. A production of plus 150 000 koz/a is anticipated over the first three years and 93 koz/a over the nine-year life of mine (LOM). The mine will have low all-in sustaining costs of US$708/oz over the first three years and US$759/oz over the LOM. The study estimates a two-year payback on the US$131 million capex (including pre-production mining and contingency).

Sanbrado is 'shovel ready' with mining and environmental permits already approved. An optimised DFS is underway which, among other things, will examine the viability of underground mining in the M1 South portion of the deposit. West African Resources is expecting to make a decision on whether to proceed with mine development shortly and anticipates that construction could start late this year, allowing the mine to commission in 2019.

Latest diamond drill results from the project have been spectacular with West African Resources reporting in mid-May that high-grade results from depth at the M1 South deposit have included 29,5 m at 20,67 g/t Au from 349,5 m including 0,5 m at 472,2 g/t Au. It said that it had five drill rigs working on site on a double shift with an additional rig on the way. ■

feature

Asanko DFS confirms robust

Asanko Gold Inc, listed on the TSX and NYSE MKT, has announced the Definitive Feasibility Study (DFS) results of a staged expansion at the Asanko Gold Mine (AGM) in Ghana, which confirms that the mine is a large scale, long life quality asset with a viable and robust two-stage organic growth plan and strong cash generation capability. The Expansion DFS comprises two growth projects, Project 5 Million and Project 10 Million, which have a combined estimated capital cost of US$350 million.

The company engaged DRA Mineral Projects to manage the Expansion Definitive Feasibility Study (DFS) of the mine. DRA were the EPCM contractors for the construction of the existing CIL processing plant and associated infrastructure, which was successfully constructed and ramped-up ahead of schedule and under budget.

Project 5 Million consists of two modules: the upgrade of the existing carbon-in-leach (CIL) processing plant from a design of 3 Mt/a to 5 Mt/a; and the development of the Esaase pit and a 27 km long overland conveyor. Project 10 Million – which maximises production over a shorter life of mine – is the construction of a second replica 5 Mt/a CIL plant to double processing capacity to a total of 10 Mt/a, with a commensurate increase in mining operations.

Under Project 5 Million, which is robust as a standalone project, production at the AGM will average 230 000 oz/a over a 20-year life of mine (LoM) at an AISC of US$968/oz. Project 10 Million increases output to an average of 450 000 oz/a at steady state for eight years at an AISC of US$890/oz.

For the purposes of the Expansion DFS, both Project 5 Million and Project 10 Million have been scheduled around the optimal NPV on a capital unconstrained basis for the AGM. This assumes commissioning of the Esaase pit and overland conveyor in Q1 2019 and commissioning of Project 10 Million in Q2 2020, reaching steady state operations in 2021.

The processing plant upgrade of Project 5 Million has already been approved and is currently under construction with completion expected in the fourth quarter of this year. It has a capital cost of US$22 million. The second module – the development of the Esaase pit and construction of the overland conveyor linking Esaase with the existing facility – has an expected capital cost of US$120 million.

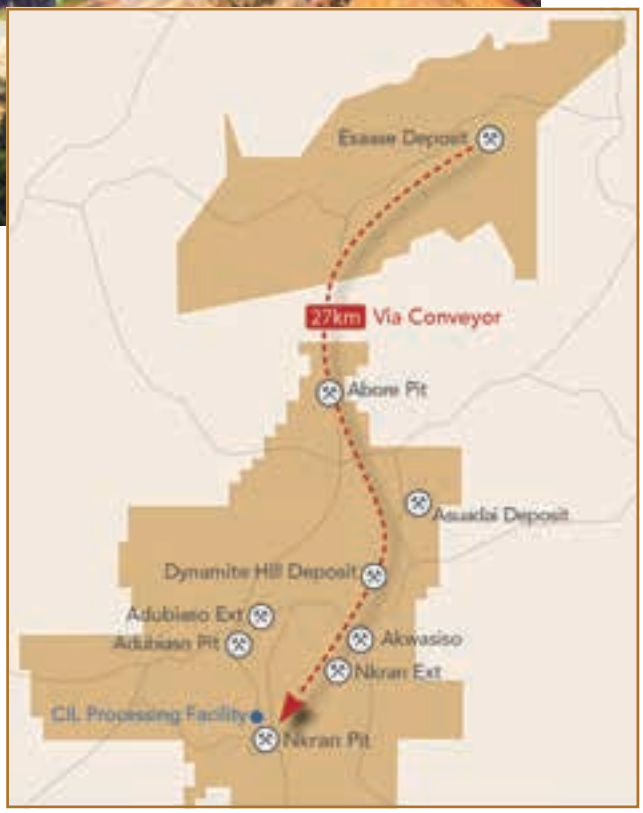
Commenting on the staged expansion, Asanko's Peter Breese, President and CEO, said: "Our growth plan has been designed to be fully flexible so that it can be advanced in modular components, according to cash flow generation, balance sheet strength, financing opportunities and market conditions.

"Our first expansion module, the plant upgrade to 5 Mt/a, is a great low cost capital efficient project which is fully funded, delivering a 40 % increase in throughput. We expect to see some volumetric increases in Q3 2017, ahead of full commissioning in Q4 2017.

"The Board is reviewing the optimal timing for the development of Esaase and the conveyor, as well as Project 10 Million, and the respective investment decisions will be dependent on the company's cash position and financing opportunities. This review will enable us to prudently bolster our liquidity position to over US$100

feature

two-stage expansion plan



Above: *A view of the Asanko Gold Mine (AGM). The processing plant is in the process of being upgraded to a capacity of 5 Mt/a.* ***Right:*** *Layout of the Asanko Gold Mine. Operations are currently centered on the Nkran pit but Project 5 Million will see development of the Esaase deposit, 27 km to the north of Nkran.*

million by Q2 2018 without over-extending the balance sheet or diluting shareholders, thereby securing our growth pipeline to ultimately deliver a production profile of over 450 000 oz a year, making the Asanko Gold Mine one of the largest mines in Africa."

The AGM mineral resources comprise two main pits, Nkran and Esaase and nine satellite deposits, Akwasiso, Dynamite Hill, Adubiaso, Abore, Asuadai, Nkran Extension, Adubiaso Extension, Esaase B zone and Esaase D zone.

Project 5 Million

The existing processing plant is located at the Nkran site. The Project 5 Million upgrade of the processing facility will see a number of peripheral equipment upgrades being implemented. In the milling area the cyclone cluster will be upgraded. An additional gravity screen and Knelson concentrator together with a second Intensive Leach Reactor (ILR) will be required to maintain the gravity recovery.

An increased pipeline diameter from the cyclone overflow to the pre-leach thickener will be installed while the thickener underflow pipe to the existing CIL will be replaced to a larger diameter to accommodate the increase in volumetric flowrate. The CIL intertank pump cell screens will be increased from 13 m^2 to 14,5 m^2 and an additional tailings

Another view of the processing plant site. The current capacity of the processing facilities is 3 Mt/a.

pump train and pipeline will be installed.

The original pre-oxidation tank has been converted into a leach tank, maximising residence time in the circuit. An additional electro winning cell and associated pipework will be installed in the gold room. An additional 5 tonne per day oxygen plant will also be included as part of the upgrade.

The development of the large Esaase deposit – which has mineral reserves of 62,6 Mt at 1,46 g/t gold for 2,94 Moz of gold contained – assumes contractor mining and it is envisaged that PW Ghana, the current mining contractor at the Nkran pit, will also mine the Esaase pit.

Discovered by Asanko in 2008, Esaase is the largest deposit within the AGM. It is a greenfield deposit that has not been previously mined, even by small scale miners. Located approximately 27 km from the processing facility, Esaase extends over a 3 km strike length and consists of three pits, South, Main and North, and two satellite pits (Esaase B and D zones).

Mining operations at Esaase will initially mine oxide ore to open up the deposit and then move into more competent fresh ore. The mining schedule will allow both oxide and fresh ore to be delivered to the processing facility.

During the first year of operations, ore will be mined primarily from the Southern Lobe of the main Esaase pit, resulting in a feed grade to the mill of 1,4 g/t gold at a throughput rate of 2 Mt/a of oxide/transitional ore feed. The balance of the ore will be provided by Nkran, Akwasiso and Dynamite Hill.

The Esaase deposit will be mined utilising a conventional truck-and-shovel surface mining method. The primary mining fleet will initially deliver the 2 Mt/a ore requirement and then step up to 5 Mt/a as ore sources from Nkran and the satellite pits are depleted. The fleet will ultimately comprise three 300-tonne class excavators and twenty-eight 90-tonne dump trucks, supported by ancillary equipment to maintain this mining rate.

Grade control drilling together with expanded laboratory facilities at the processing facility will be used to delineate the ore from the waste. Ore and waste will be drilled and blasted, then loaded and hauled to either the run-of-mine (ROM) pad or the waste dumps. ROM ore will be tipped onto the ROM pad stockpiles and then re-handled initially into a mobile crusher.

The permanent primary crusher and secondary crushing station will be added to the circuit once more competent fresh rock is being mined and processed. ROM ore will be primary crushed (-150 mm) and secondary crushed (-90 mm) at Esaase and then transferred to the expanded central processing facility on an industry standard, troughed overland conveyor.

The overland conveyor will transport ore from the Esaase pit to the central processing facility. The conveyor route has been designed around the optimum geotechnical considerations and the AGM's 11 pits. The conveyor will be constructed within a 12 m fenced servitude. An overhead power line will run along the conveyor route providing power to the conveyor and the Esaase site. There will be a number of

pedestrian and road crossings along the route.

The conveyor will have a maximum capacity of 1 200 t/h of ore from Esaase and will be controlled with a variable speed drive. Dust suppression, spillage control and vibration monitoring have also been incorporated into the design to be environmentally compliant.

The construction of the conveyor, including commissioning, is scheduled to take 18 months. Asanko has appointed ELB South Africa as the EPCM contractor for the conveyor. ELB recently designed, installed and successfully commissioned a coal conveyor of similar length in South Africa.

Project 10 Million

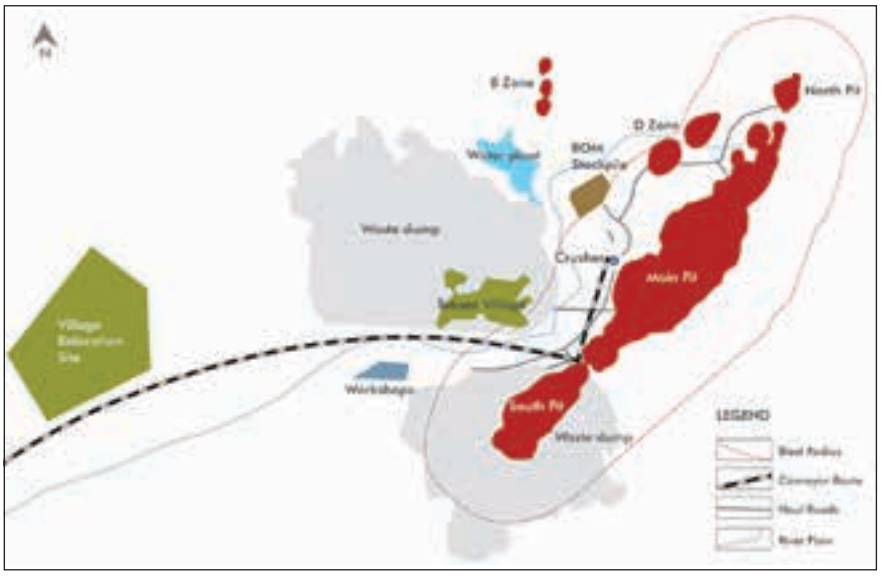
Project 10 Million consists of the construction of an additional milling, gravity, CIL circuit to treat an additional 5 Mt/a of ore from the Esaase pit, which will increase the processing facility's total capacity to 10 Mt/a. The second processing facility will be built alongside the existing plant and will leverage off the infrastructure and overheads already in place at the AGM.

The existing CIL processing facility is industry standard technology and has performed above expectations in both recovery and throughput, hence the decision to replicate this facility for Project 10 Million. This plant selection represents a very low risk option as the majority of the equipment is duplicated and the plant operators and maintenance staff are very familiar with all the equipment installed. Synergies will be realised through a common spares holding and common reagents.

The increase in ore feed to the 10 Mt/a processing facility will be sourced from the Esaase pit, which will ramp up production to an average of 7 Mt/a (approximately 2 Mt/a oxide/transitional and 5 Mt/a fresh ore). The mining fleet will be increased to accommodate the increase in tonnage from Esaase and the conveyor has been designed to accommodate the additional tonnage. A permanent primary and secondary crusher installation will be built at the Esaase site and crush material down to -90 mm. A stockpile will be constructed at Esaase to manage a consistent feed onto the conveyor belt.

The tailings from the Nkran and Esaase pits will report to a common, expanded Tailings Storage Facility (TSF). The TSF will consist of a multi-zoned downstream perimeter embankment, comprising a total footprint area of 386 ha (basin area 279 ha) in its final state.

Photos courtesy of Asanko Gold



Layout of the Esaase site. Mining will take place in three main pits – South, Main and North – and two satellite pits.

feature

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Study indicates favourable **economics** for Sanaga

While the commodities collapse has had a negative effect on West Africa's many iron ore projects, with several of them now effectively on hold, at least one is making some progress. West African Minerals Corporation (WAFM), whose shares are quoted on London's AIM, has announced the details of its recently completed Scoping Study on the Sanaga project located near the Port of Douala in Cameroon.

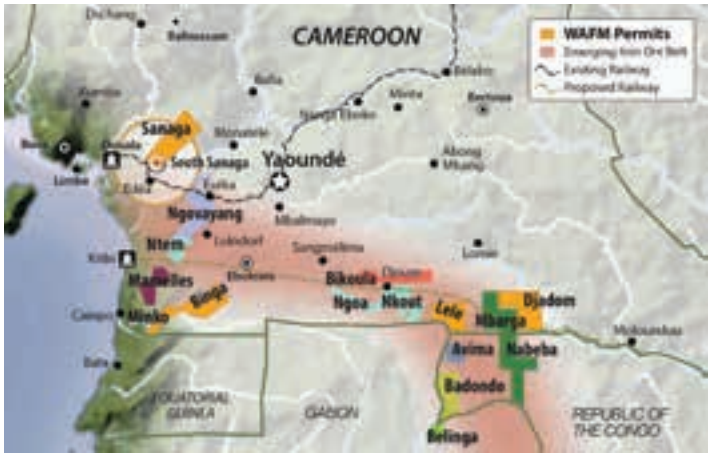
According to WAFM (formerly Emerging Metals Limited), the Scoping Study indicates robust economics and favourable capital and operating cost fundamentals for an open-pit iron ore mine and concentrator using transportation to the Cameroon coast either by barging down the Sanaga River and transhipping at sea or using a slurry pipeline to a port in the vicinity of Yoyo. The Sanaga deposit contains previously released CIM-compliant mineral resources of 82,9 Mt at 32,1 % Fe.

The Scoping Study was prepared by independent consultants, Royal HaskoningDHV (RHDHV), in accordance with the JORC Code (2012). The base case is stated on a pre-tax and royalty basis assuming 100 % project ownership and using five-year historical average iron ore prices.

Key outcomes include an NPV_{10} of US$262 million to US$292 million, an IRR of 29 to 37 % and upfront capital costs (depending on the transport option adopted) of US$194 million to US$298 million. Payback is put at 29 to 46 months and the study estimates 24 months to full production from the final investment decision.

Gerard Holden, Chairman of WAFM commented: "WAFM is very pleased to announce the results of an independent Scoping Study which has identified two potential pathways to production of 2,4 Mt/a of premium grade iron ore concentrate.

"The geometry of the mineralisation, which outcrops at surface, lends itself to low cost, low stripping ratio open-pit mining. Metallurgical testing on the primary magnetite ores indicates that the project can produce a high-quality iron ore concentrate product (69 % Fe) that will command a premium price in the market place. The Sanaga project's proximity to the ocean and access to existing road and power infrastructure allows low capital expenditures and a short timeframe to develop export infrastructure." ■



Location of WAFM's licences, including Sanaga, in Cameroon.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Bassari to start early work at Makabingui

ASX-listed Bassari Resources, which has a portfolio of exploration permits in south-eastern Senegal, has recently provided an update on its Makabingui gold project. It says in the update that the company and its JV partner have been authorised by Senegal's Minister of Mines to incorporate the exploitation company which will develop the project and to commence the pre-development stage of mining operations.

The pre-development stage will include infrastructure work such as the rehabilitation of roads, upgrade of the camp, fencing of the mining area, concreting to expand the plant area for the processing plant upgrade (there is an existing gravity plant on site) and dam reparation.

The Minister of Mines has also allocated a corridor of 20 km^2 (outside the Makabingui exploitation permit) for local villagers to recommence artisanal mining. Bassari will work with villagers and Department of Mining personnel, providing a geologist and technicians to locate gold anomalies in the proposed corridor.

The Makabingui project currently hosts a mineral resource which comprises 11,9 Mt averaging 2,6 g/t gold for a contained 1 million ounces classified into the indicated and inferred resource categories.

Phase 1 of mine development will see Bassari mining four high-grade pits within the resource, with the biggest being Pit 1 which hosts around 460 kt at 7,5 g/t gold. The open-pit project will produce an estimated 171 000 ounces at a C1 cash cost of US$683/oz over a period of just over three years. The capital costs for the open-pit stage of mining are very low, totalling approximately US$12 million. US$5,5 million of this will be required to upgrade the existing plant to incorporate a CIL circuit. Payback is estimated within 12 months of the start of production.

This initial phase of operations will be extended to mine deeper resources by open-pit or underground methods. Bassari has already completed an underground scoping study which has provided an assessment of the potential for mining the deeper resources from access declines within the pits. ■

feature

Dry-type transformers gain traction in Africa with Trafo

While oil-filled transformers have long dominated the African market, Trafo Power Solutions Managing Director David Claassen says there is growing appetite and scope for the application of dry-type transformers in the continent's mining sector.

David Claassen, MD of Trafo Power Solutions.

Trafo Power Solutions was recently launched to offer a range of dry-type, or cast-resin, transformer products from the 100-year-old Toronto-based Hammond Power Solutions (HPS), acknowledged leaders in this increasingly popular technology.

"Dry-type transformers have been around since early last century but, due to the higher cost of their traditional process of manufacture, they were not as widely used," says Claassen. "Today, this price differential is no longer significant, opening the door for users to benefit from the numerous benefits of dry-type transformers."

A dry-type transformer with cast-resin technology.

An electrical engineer with broad-ranging experience, Claassen has worked at executive level in energy-related projects including turnkey installations, high voltage sub-stations, continuous and standby power generation, transformers, and control and instrumentation. He has operated in sectors such as open-cast and underground mining, infrastructure, renewable energy, and oil and gas.

Among the advantages of dry-type transformer technology, he says, is that it is safer, so the units can be installed indoors, in basements, or in other confined spaces for the sake of convenience and cost. The dangers associated with oil in a transformer require this equipment to be located outdoors and invariably within a structure built specifically for this purpose. Even risks that are external to the unit itself, such as a fire in the building, preclude the possibility of locating an oil-cooled transformer indoors.

"This has traditionally made dry-type transformers popular in regions of extreme temperatures, where they can be installed inside buildings alongside other equipment or even in office facilities," he says. "In these environments, oil-filled units could not be used because the outside climate could negatively impact the operation."

While climate considerations in Africa's mining sector have not demanded a special solution, the dry-type transformers are now gaining traction as their design and manufacturing advances have brought about price parity.

Safety and environment issues both create extra cost when installing oil-cooled transformers, says Claassen. Oil leaks are a regular concern and a risk with oil-cooled units, so regulations require that these transformers are enclosed within a structure and a bunding wall, with a specific floor arrangement to help prevent the possibility of oil seepage into the ground. These structures – with their extra costs – are avoided when installing a dry-type unit, as these risks do not exist.

"Safety is always a concern where there is high voltage, heat and a pressurised tank filled with oil; when faults occur, there is a relatively high chance of an explosion and the consequences are often catastrophic," he says. "The safety risk with oil-filled transformers is therefore always quite high by any measure. In contrast, any failure in the operation of a dry-type transformer seldom poses any safety risks as the oil, heat and pressure elements are not present."

With the rise in awareness of safety at work – across the globe and in all sectors of the economy – there has been a trend towards safer technologies like these, he says. Dry-cooled transformers are categorised as F1 in terms of international fire resistance ratings, making

feature

them low risk as they are self-extinguishing and flame-retardant by nature.

Oil-filled transformers also require regular maintenance including oil sample analysis to ensure operational consistency and safety. Dry-type transformers are low maintenance items that could last for 25 years without significant attention.

Reduced energy consumption is another factor that has attracted attention to these units in new markets, especially as electricity prices in South Africa have rocketed over the past decade.

"The higher efficiency of the cast-resin design means lower electricity bills," he says. "It also means that heat losses are lower, so these units require only a minimal movement of air across the windings to cool them down. Forced air options can also be employed where necessary, depending on ambient temperatures."

The technology behind these advantages has been a century in the making, and has recently been augmented by a European technical heritage. The roots of Canada-based HPS reach back to 1917, and it began building specialised transformers at the start of World War II in 1939. Boosted by the surge in demand for this equipment, the company grew steadily and continuously improved its products.

Using advanced techniques and materials in its core and coil construction, HPS also makes use of high quality insulation materials to ensure long lifespans for every temperature class. It offers specific solutions for ambient conditions that present particular challenges in terms of humidity, pollution, chemical agents or other factors.

Cast-resin transformers in the test bay.

In 2013, HPS expanded its presence in Europe and broadened its product offering and manufacturing capabilities in cast-resin technology, when it acquired the Italian companies Euroelettro and Marnate Trasformatori. Focused on the design, construction and marketing of low and medium voltage magnetic components, Euroelettro operates an 18 000 m² facility in Sarego in Italy's province of Vicenza. Marnate Trasformatori produces top quality cast-resin transformers from its manufacturing facility in Marnate in the province of Varese.

Claassen says he will be leveraging his extensive experience in South Africa and other parts of the continent to create a footprint for Trafo Power Solutions, bringing HPS's world-class technologies to new and existing markets. ■

Energy efficiency can offset the high cost of self-supply

A major cost for mining ventures that start operations in remote areas is their independent power supply. This cost can be mitigated, however, if project champions look carefully – and at an early stage – at ways of utilising energy more efficiently.

From left, Alastair Gerrard, Managing Director of Zest Energy, and Louis Meiring, CEO of Zest WEG Group.

According to Zest WEG Group CEO Louis Meiring, it is vital for planners to give the same consideration to the way power is actually used on site as they traditionally devote to the power supply side of the energy equation.

"As a group, we provide power generation solutions on the one hand, but are also at the cutting edge of energy efficiency technologies," says Meiring. "So we can see the value in ensuring that all aspects of power utilisation on-site are carefully analysed; we can also quantify the benefits of saving, say, 3 to 5 % of energy consumption when specifying how mining and processing equipment will be powered."

Group company Zest Energy specialises in power supply solutions, working closely with EPCMs or directly with customers to plan and implement optimal solutions for mine sites – whether on-grid or off-grid. This approach ensures that equipment lifecycle costs are well controlled and contribute to overall project efficiency.

Among its recent power installations are

The power plant earth mat being installed on site at Syrah Resources' Balama graphite project in northern Mozambique.

feature

The custom-engineered diesel generator set solution for the Balama graphite project.

the turnkey diesel-power generation facility at the Balama graphite project in northern Mozambique.

Managing Director of Zest Energy Alastair Gerrard highlights the potential for good planning and choice of technologies to substantially reduce overall operational costs on mines that must generate their own power.

"While working with customers to ensure the right power generation solution, we can enhance our value-add by feeding our knowledge and technology into how exactly the mine uses the energy it generates," says Gerrard.

With Zest's high efficiency, WEG IE3 rated motors, for instance, the power consumed by a mine can be reduced in a range of functions from pumping and comminution to conveyor systems and ventilation.

"We can also introduce options like variable speed drives to further enhance efficiencies and reduce the consumptive demands that a standalone power plant will have to meet," says Meiring. "Minimising inefficient power consumption requirements has a significant impact on both the capital cost and the running cost of the generation facility, helping to lower the financial hurdle rate that new mining projects face."

There is often even scope for 'regeneration' strategies in the overall energy plan, where some activities on the mine's power network can feed energy back into the system under certain conditions. He says there is also potential for 'heat and power' cogeneration as an efficiency strategy, where heat can be drawn off equipment like engines to feed back into plant functions, rather than being dissipated with no benefit.

"There is certainly a trend among customers in the mining sector to be looking for higher energy efficiencies," says Gerrard. "This is important not only due to the operational cost per hour associated with running their assets, but also relates to environmental considerations and the reduction in emissions through the use of more efficient technologies. There is growing interest in hybrid solutions that can incorporate renewable energy sources like solar and wind, alongside the traditional fossil fuel sources."

Meiring emphasises the value of being engaged with customers at an early stage in the planning process, when desktop or prefeasibility studies are underway. This allows the opportunity to scope various options at a conceptual level, which can guide the more detailed costings required in the bankable feasibility studies later on.

Innovative software now helps improve the selection of equipment for the customer's

There is often even scope for 'regeneration' strategies in the overall energy plan.

feature

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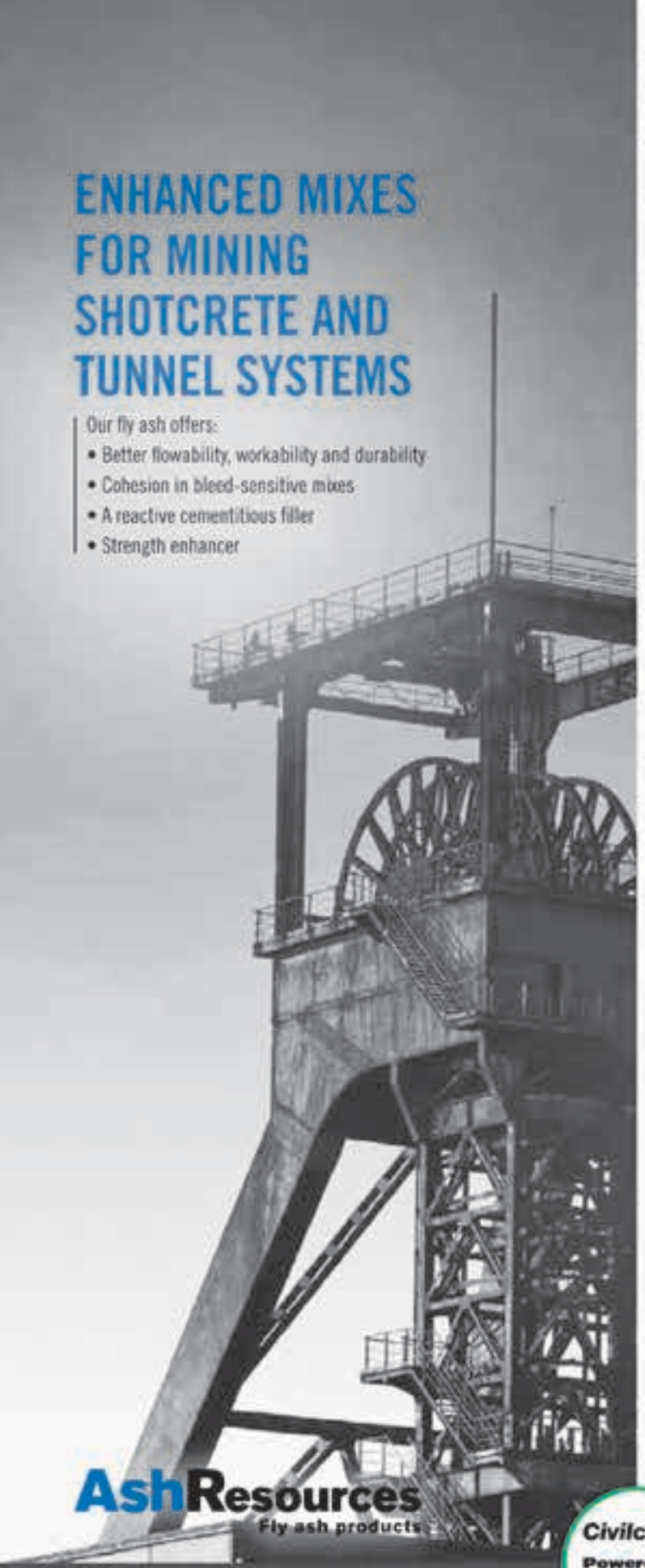

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Horizontal type radiator system fitted to the power solution supplied to Balama. It is rated for 50°C ambient temperature and comprises 10 WEG 3 kW fan motors (two cooling banks with five cooling fans per bank).

needs, allowing mine project planners to boost plant efficiency by closely matching the choice of motors with the application. There are also various refinements that can be applied to optimise the performance of this equipment.

As important as the optimal design and the enabling technology is the capacity to implement and service these efficient systems in all parts of Africa, where conditions are often difficult and locations can be remote.

"Africa is our backyard," says Meiring, "and we spent many years building dedicated teams to look after our mining customers around Africa. This is vital to ensure minimal downtime so that customers can maintain the low running costs that they expect from our products and systems."

The African footprint of the Gauteng-based Zest WEG Group includes its own entities in Namibia, Zambia, Tanzania and Mozambique as well as Ghana, from where it services 13 countries in the West African region.

"Our operating model favours local empowerment and clear communication with our partners and customers," he says. "We collaborate with local companies and ensure that customers can communicate with us in the language of the region. This means having technical staff that are fluent in French or Portuguese, and also having our range of technical documentation available in these languages."

Training on-site remains an important aspect of building local capacity in-country and on-site, so Zest WEG Group prioritises not just product training but more general skills improvement. These interventions – alongside its role as an 'advice centre' for customers – ensure high standards of after-market support.

State-of-the-art control and monitoring technology also allows for closer oversight of equipment from a distance, and for early warning of any possible performance deviations.

"In addition to our own entities, our mining customers in Africa also have access to our network of distributors, who are well-versed in our product range and its applications," says Meiring. "They provide a vital link between the end-user and the Zest WEG Group technical specialists, who are always on hand to help advise on best practice in reducing running costs and getting the most from productive assets." ■

Using WEG IE3 electric motors will reduce power consumption.

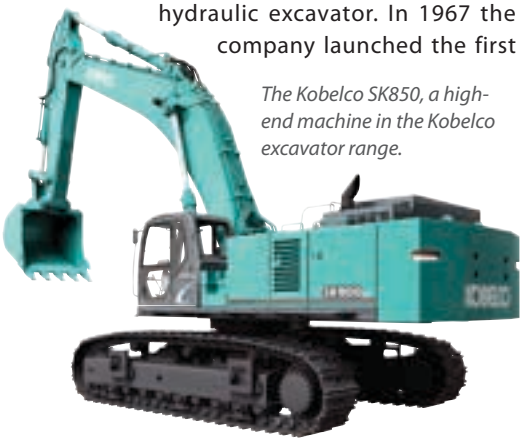
feature

Bell and Kobelco forge excavator alliance

Bell Equipment has signed an agreement with global excavator specialist Kobelco Construction Machinery Co Ltd (Kobelco) for the exclusive distribution and support of the Kobelco range of excavators in the Southern African region.

According to Bell Equipment Group Marketing Director Stephen Jones, the company is looking forward to developing a long-term relationship with Kobelco that aims to provide both companies with the stability needed to realise their growth potential in the excavator market.

A division of Japanese-based Kobe Steel, Kobelco developed Japan's first construction machine in 1930 and followed up in 1963 with Japan's first wheel-mounted hydraulic excavator. In 1967 the company launched the first crawler-type hydraulic excavator to be produced using Kobelco's proprietary technology, and in 2006 introduced the world's first hybrid excavator. The company has 10 production centres located in Japan, China, Southeast Asia, the US and India.



The Kobelco SK850, a high-end machine in the Kobelco excavator range.

"The Kobelco focus on product innovation and efficiency resonates with our own ideologies and the company also shares our passion for customer support, making it a great fit for our business. We share a number of dealers around the world and we are fully aware of how impressive these machines are and the name they have made, specifically through the choice of premium components, overall reliability and low fuel consumption delivered by the Toyota Group's Hino engines," says Jones.

"We are fortunate to have teamed up with a leading capital equipment distributor in Southern Africa, and also a like-minded company that believes in listening to its customers and reacting quickly," responds John Boyd, MD of Kobelco Construction Machinery Middle East and Africa. "With Bell Equipment's broad product range, extensive distribution network and strong reputation for strong customer support, we believe that we have found the right partner for our products in this region."

Commenting on the Kobelco machines, Boyd says the key to the Kobelco value proposition is its philosophy of pursuing the enhancement of performance capacity and improved cost efficiency with due care for the environment. "For this reason all Kobelco excavators have two digging modes – H mode for heavy duty and higher performance and S mode for normal operations with lower fuel consumption. Real life situations show that the S mode can deliver around 20 % reduction in fuel when performing the same tasks as like-sized machines while engagement of the H mode delivers 8 % more productivity at the same fuel burn as competitor machines."

Bell will be complementing its extensive product range by developing the full range of Kobelco excavators, from the small 1-t mini excavators through to the largest 85-t units.

Teams from the respective companies are currently in the process of laying the foundations to ensure that they are able to meet customer expectations. "Stocking of parts in the Bell Global Logistics Centre is underway and technical staff are being up-skilled to deal with the new products. Likewise sales and application specialists are improving their knowledge to better advise and support customers to make the best application decisions," says Jones.

Bell Equipment, tel (+27 11) 928-9700, website: www.bellequipment.com

Pump rental company desilts ponds at DRC mine

Integrated Pump Rental, in JV with EC Mining, recently secured the contract to desilt four acid ponds at a copper mine in the DRC. This project followed the successful completion of the cleaning up of two similar dams by the company at the same mine.

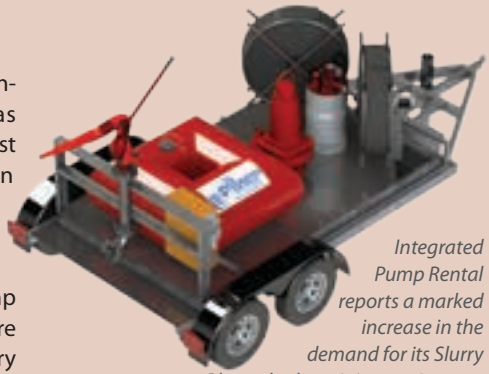
Lee Vine, MD of Integrated Pump Rental, says that acid ponds and dams that have become silted have serious repercussions for a mining operation.

"It is critical that mining operations have sufficient storage capacity for solution and water, and when reservoirs are neglected and sediment is allowed to build up the downstream and upstream processes are affected," Vine says. This can have huge implications for the productivity of an operation.

He reports that there has been a marked increase in the demand for the company's Slurry Blaster hydro mining equipment. "Locally developed to operate in the harshest environment, this equipment has proved itself in the field and even the most challenging applications have not been an issue.

"We are cognisant that not all desilting and cleaning applications are the same and for this reason Integrated Pump Rental customises the equipment to ensure an optimum outcome. Typically the Slurry Blaster is site trailer-mounted for this type of task; however, it can be pontoon-mounted if required," Vine says.

Each installation of the Slurry Blaster comes standard with a 37 kW feed pump with float, a 22 kW slurry pump for the removal of the slurry, a 200 m heavy duty layflat hose and an electric control panel. In applications where harsh abrasion is found, stainless steel components including pumps are used to facilitate optimum reliability and performance.



Integrated Pump Rental reports a marked increase in the demand for its Slurry Blaster hydro mining equipment.

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

Focused on a total desilting turnkey solution, Integrated Pump Rental's service level agreement (SLA) includes the provision of a full maintenance service. This entails regular inspections of pumps before and during the contract to ensure reliable operation with optimum uptime.

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

Producing building materials on site

Rather than sourcing expensive sand and aggregates on building sites, a start-up company on the West Rand has begun a ground-breaking new operation that turns spoils and site rubble into valuable building materials for reuse on site.

The aptly named Ground Breakers operation makes use of an ultra-rugged portable scalping and screening machine to separate excavated materials into different sizes or streams such as building sand, building stone, fill, bedding or a range of different sized aggregates as specified by an engineer.

Rather than excavate a site and pay for spoils to be dumped, the duo of JC Janse van Vuuren and Johan Meintjes have turned this traditional method around and are successfully marketing the concept of processing the spoils on site.

"The newly available Powerscreen Warrior 800 scalping screen from ELB Equipment is easily transportable and can begin operation within hours of delivery," says Janse van Vuuren. "The aggressive nature of the screening process allows large quantities of materials to be processed quickly and the addition of a scalping deck ensures that oversized rocks, rebar or mesh from the building site are seamlessly separated without impacting production.

"Effectively that means that materials from raw freshly excavated spoils or even demolitions can be put straight through the machine on site without the need for additional crushers and other cumbersome equipment to be brought into the process. What's more, it is a high-production machine that is capable of running around the clock for weeks or even months on end to get the job done.

"Our role is simple. We set up an operation on site and process materials at a negotiated rate that is marginal when compared to trucked-in aggregates. This is possible due to the elimination of transport costs and other input costs and it reflects well on the structure's sustainability as recycling of existing materials is also more environmentally acceptable. It can even assist developers to earn valuable green credits when building environmentally sustainable structures."

Partners Johan Meintjes (left) and JC Janse van Vuuren with ELB Equipment's Wakefield Harding (centre) are pictured with the Powerscreen Warrior 800.

Meintjies explains that once the concept of the business was finalised, the process of selecting the right machine was a long one. "We have long-term goals and needed a machine that can last as long as these plans and adapt to our changing requirements. The Warrior 800 gives us versatility to operate in a quarry on a 24-hour-per-day basis and build up stockpiles and later get transported to a construction site to process other materials. On site it is easy to set up and operate with hydraulic folding tail and side conveyors, rigid feed hopper sides and two speed tracks that can be used to separate up to three streams and stockpile them."

Ground Breakers officially began producing materials in October last year and went into full production in November.

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

TAKRAF wins major turnkey contract in West Africa

TAKRAF GmbH, a Leipzig-based company with a wealth of experience in development, design, fabrication, erection and commissioning of equipment and systems for the global mining and material handling industries, has secured a major contract for the turnkey supply and installation of a bauxite handling plant in Guinea, West Africa. The contract value is approximately 100 million Euros.

Compagnie des Bauxites de Guinée (CBG), jointly owned by Alcoa, Rio Tinto, DADCO and the State of Guinea, has mined and exported bauxite for more than 50 years and has put in place an ambitious programme to increase export capacity. To meet the needs of the programme, TAKRAF is supplying equipment for the unloading of rail wagons and crushing and conveying of the bauxite.

A major challenge is the brownfield character of the works, which means that the new supplies and modifications to the existing plant have to be carried out whilst the installation is in operation. Very limited plant downtime and difficult conditions for logistics are a further challenge.

TAKRAF is executing this contract in close cooperation with subsidiaries in the USA, China and South Africa. The commissioning of the plant is scheduled for the second half of 2018.

TAKRAF, website: www.takraf.com

Pioneering technology selected for Oman contract

Clean TeQ, via its wholly owned subsidiary, Clean TeQ Water, has been awarded a significant contract by Multotec Process Equipment to design, procure and commission a Clean TeQ proprietary Continuous Ionic Filtration (CIF®) wastewater treatment solution at a minerals processing plant currently being constructed in Oman.

Clean TeQ has also executed an exclusive Technology Distribution Agreement with Multotec covering the African continent. Multotec is a leading provider of high-quality mineral processing equipment and solutions to the mining, mineral processing, petrochemical and power generation industries.

A model of the Clean TeQ plant for Oman.

Comments Clean TeQ Managing Director Sam Riggall: "The Oman contract is a ground-breaking step forward in validating the application of our innovative technology for industrial water recycling and reuse markets. Treating wastewaters from flue gas desulphurisation scrubbers is a major issue for fossil fuel burning industries world-wide. The Clean TeQ plant in Oman will demonstrate the cost effectiveness and versatility of the CIF® technology in this field. We are also delighted to be partnering more broadly with Multotec, a well-established supplier to the global minerals industry, to grow our businesses together on the African continent."

The Oman contract is valued at in excess of US$400 000 and includes a technology fee and payments for engineering, equipment and resin supply and commissioning support. The CIF® wastewater treatment plant will treat wastewater from a flue gas desulphurisation scrubber at a minerals processing plant at Port of Sohar Free Zone, Sultanate of Oman.

The technology uses Clean TeQ's Continuous Ionic Filtration technology to remove toxic pollutants and, in particular, sulphate, antimony and arsenic from the wastewater stream. The Clean TeQ solution is being provided to Multotec as an equipment design and supply package. Multotec is the principal contractor with overall responsibility for delivering the wastewater management systems for the mineral processing facility.

Engineering of the CIF® wastewater treatment plant has been completed and materials, including first fill of resin, have been procured and are in transit to the site. Multotec will construct the water treatment plant under the direction of Clean TeQ personnel. The CIF® plant is expected to be completed and commissioned in the fourth quarter of 2017.

Carien van der Walt, Multotec, tel (+27 11) 928 -4334
Clean TeQ, website: www.cleanteq.com

Kubota RTV-X900 delivers underground

A versatile utility vehicle for the underground mining industry is the Kubota RTV-X900. It has proved popular in the South African market and there are reportedly hundreds of the machines in operation around the country.

Even though Maubra, a South African Kubota dealer, customises the Kubota RTV-X900 for use underground, as it comes it is a capable base vehicle with a powerful diesel engine of just under 900 cc with a unique fluid-drive transmission system that can drive either just the rear wheels or all four. This is controlled by a unique braking system that is linked to the fluid-drive transmission.

Although the Kubota RTV-X900's braking system is primarily controlled by the operator, the vehicle can only move if the transmission is engaged and the throttle is pressed; in any other mode, the wheels will not turn. In the event that the engine has been switched off, the vehicle will not be able to freewheel, which means there is no possibility of it running down an incline uncontrolled.

In the event that the throttle is not pressed, even while the engine is idling, the transmission will supply insufficient fluid to turn the wheels, so in this scenario the vehicle will also not be able to move uncontrolled.

Due to strict requirements for underground operations, the Kubota RTV-X900 must be customised according to the specific task it will have to fulfil. Safety in this regard is paramount, so the base vehicle is fitted with a strengthened roll cage, special-purpose front and back steel bumpers, steel lattice driver and passenger door, and an array of LED auxiliary lights (including nautical style red and green side lights for easy identification of travel direction in the dark). The whole floor surface of the cab as well as the load bed is also coated with a rubberised non-slip material.

The Kubota RTV-X900 utility vehicle.

The speed limit underground is 15 km/h, so Maubra governs all Kubota RTV-X900 vehicles destined for underground to this limit. The vehicle has a diesel engine that is not powered by HT electricity. All other electrical components of the vehicle are insulated in order to prevent any combustible vapour underground from being ignited by any incidental sparks.

Thanks to the modifications undertaken by Maubra, the Kubota RTV-X900 is transformed into a highly effective underground utility vehicle, which is then further customised to suit even more specific applications, such as carrying explosives.

Due to its fit-for-purpose durability and strength, long-term maintenance of the Kubota RTV-X900 is considerably less than a regular bakkie. Without a clutch, brake pads or shoes, as well as a simple, yet rugged three-cylinder engine, there is little to go wrong on this piece of equipment.

Kevin Clarke, Maubra, cell (+27 82) 926- 2519, e-mail: kevin@maubra.co.za

Valve design allows reduction in downtime

Afrivalve, a division of eDART Slurry Valves, now offers a simple patented design of the Red Roc Hi-Lift pinch valve. The design allows for inline changing of the rubber sleeve without the use of lifting equipment and has been granted a patent number.

This "unique and innovative feature", as Afrivalve describes it, offers a drastic reduction in downtime and manpower to replace worn sleeves, eliminates the need for lifting and rigging equipment in remote areas as well as removing the pipework and re-alignment requirement.

The Red Roc pinch valves, which are manufactured at eDART Slurry Valves' facilities in Jet Park, Gauteng, range in sizes from DN150 to DN600, with pressures ranging from PN10 to PN40 depending on the size.

"The fact that we are a 100 % local manufacturer allows us to tailor our valves to exact customer requirements and we can offer the Red Roc Hi-Lift pinch valve in higher pressures and sizes than the DN600 to meet specific requirements," says Afrivalve's Group Marketing Manager, Gregor Hopton. "Although predominantly used in the mining industry, Red Roc pinch valves are suited for use in various other industrial applications such as in the power generation, sewage and effluent and fertiliser industries".

Gregor Hopton, Afrivalve, tel (+27 11) 791-1411, e-mail: gregh@afrivalve.co.za

Process equipment complies with 'green' standards

The latest equipment for the mining and minerals-processing industry manufactured by MIP Process Technologies of Sandton, Johannesburg has been designed to comply with the pending 2018 South African emissions control regulation of 30 mg/m^3 of particulates.

This is an indication of the OEM's high level of innovation and commitment to ongoing technological development and product improvement, says MD Philip Hoff. Equipment manufactured ranges from attrition scrubbers to clarifiers and thickeners, linear screens, flocculant plants, mixers and agitators.

"Not only do we design all of our equipment to comply with the latest standards and regulations, but we also offer smaller companies a continuous plan to improve their dust-extraction emissions. Our approach is to collaborate closely with our clients to lower their total cost of ownership by optimising their equipment," Hoff explains.

A typical MIP installation. The company is currently manufacturing linear screens and a clarifier for an Australian customer in Panama at its factory in Springs.

MIP is currently manufacturing linear screens and a clarifier for an Australian customer in Panama at its factory in Springs. It is also building three thickeners for a major platinum producer in Marikana. Other local projects include a range of flocculant and reagent plants for various customers.

Such is the quantity of work being derived locally at present that 75 % of MIP's business is located outside South Africa, as opposed to as little as 25 % about a year ago. "We are working on a lot of coal mining projects and platinum projects for junior mining companies," Hoff confirms. He adds that there has also been an upsurge in the chrome mining industry due to rising c ommodity prices.

MIP continues to expand globally, with agents as far afield as South America, Mexico and Australia. "These regions are similar to South Africa in the sense of the size and scope of the mining projects that they are undertaking. Our minerals-processing equipment has a design life in excess of 30 years. Taken together, our pricing and quality mean we are still highly competitive compared to Asian and Chinese manufacturers," Hoff points out.

MIP even has an office in the US, and is looking at using this as a manufacturing platform for certain equipment and components that it finds unfeasible to build locally, and export these to South Africa and the rest of the continent. Looking at Africa specifically, Hoff points out that MIP has a large agent network from Ghana to the DRC. "About half of our work outside of South Africa is derived from the rest of Africa," he adds.

In terms of new market opportunities, Hoff points to the burgeoning wastewater industry in South Africa. "We are looking at developing a more cost-effective product range specifically for this sector, as wastewater is a lighter-duty application than minerals-processing slurries. This means the equipment does not have to be as arduously designed."

Gas cleaning is another potential growth area, with the OEM looking at providing a complete solution from bag filters to scrubbers.

MIP Process Technologies, tel (+27 11) 234-1007

Turnkey power project at Siguiri gold mine

The technology group Wärtsilä has announced it will supply a power plant extension to AngloGold Ashanti's Siguiri gold mine in Guinea, West Africa. This turnkey project consists of three 20-cylinder Wärtsilä 32TS engines running on heavy fuel oil. They will be connected to the existing power plant at site, also supplied by Wärtsilä.

The extension is expected to be operational during the second half of 2018 and the total power output at site will be 30,4 MW. The order is booked for the second quarter of 2017.

Siguiri, a multiple open pit oxide gold mine and the largest gold mine in Guinea, is AngloGold Ashanti's sole operation in the country. AngloGold Ashanti holds an 85 % interest in Siguiri with the balance of 15 % being held by the Government of Guinea.

"This is a significant proof of confidence for Wärtsilä in West Africa," comments Arnaud Gouet, Regional Director, West Africa, Wärtsilä Energy Solutions. "Wärtsilä is a trusted partner to AngloGold Ashanti at Siguiri gold mine where we operate the power generation enabling them to focus on their mining operation."

With this project, Wärtsilä will have over 6 800 MW of installed capacity on the African continent. Globally, Wärtsilä's installed base is over 63 GW in 176 countries. The company is listed on Nasdaq Helsinki.

Wärtsilä, website: www.wartsila.com

Becker Mining secures order for two Kito chain hoists

Becker Mining South Africa has secured an order from Klevan Mining – Becker's distributor in the Limpopo region – for two 10-t Kito electric chain hoists with motorised trolleys.

These robust Kito ER2 hoists are to be installed at various pump stations underground and will be used for the installation and maintenance of dewatering pumps and motors. Motorised trolleys ensure smooth, precise traversing and positioning.

"Kito equipment, which meets stringent quality and safety specifications, is known for efficient performance, low maintenance and extended service life. The strength and reliability of these hoists is in the sophisticated design and a meticulous manufacturing process," says Rick Jacobs of Becker Mining South Africa. "The series has been designed with an inverter as standard in a dual speed hoist and trolley for improved efficiency, enhanced safety and easy operation.

"A double safety mechanism, consisting of a friction clutch and an upper-lower limit switch, ensures optimum safety and prevents hoist or load chain damage. The electromagnetic brake ensures strong braking power while holding the load securely and push button controls offer enhanced operator comfort and reduced fatigue. The Kito load bell, which is an optional extra feature, automatically alerts the operator if the hoist is overloaded."

High strength, nickel-plated load chain increases resistance to wear and corrosion. The forged carbon steel hook has been designed to open gradually and will not fracture under excessive load. Top and bottom hooks are equipped with a hook latch and the bottom hook swivels 360 degrees to prevent kinking and twisting of the load chain.

An important feature of this lightweight series is the compact aluminium die-cast body that is structurally strong. The IP 55 rated enclosure offers protection against dust and water, which is critical in many applications. For reliable and safe operation, a standard thermal protector prevents the motor from burning out due to excessive usage. An emergency stop button is standard to allow the motor power to be disconnected in an emergency, without cutting off the main power supply.

A fan-cooled motor, with motor frame fins and a fan cover, ensures quiet operation and enhanced fan cooling capabilities.

Kito trolleys are available as motorised, plain and geared to provide smooth, precise and easy traversing and positioning. Drop stops provide additional security of the motorised trolley for the operator and equipment and rubber bumpers protect the motorised trolley from collisions.

George McMaster, Becker Mining, tel (+27 11) 617-6320

Becker Mining South Africa has secured an order for two Kito electric chain hoists with motorised trolleys.

Containerised substations offer cost savings

More than ever before, businesses are under pressure to reduce their operational costs and maximise their profits. One key area where big industries can make significant cost savings is by using purpose-made, containerised substations, says JB Switchgear. These repurposed marine shipping containers arrive on site pre-installed with fully tested switchgear, ready for immediate cable connection.

A major benefit of containerised substations is that they are fully equipped and assembled at the manufacturer's premises.

Containerised substations are very useful in remote areas. Civil construction costs are high and converting a standard marine specification container into a substation is significantly less expensive than arranging for on-site construction of switchgear housing.

Another major benefit of containerised substations is that they are fully equipped and assembled at the manufacturer's premises, and can comprise bespoke combinations of distribution equipment, control gear and PLC equipment. All this equipment undergoes full function testing before being dispatched, which translates to huge time savings on site. They can even be pre-commissioned.

Once on site, the containers are easily mounted on plinths, columns or skids. If mounted on columns, cable entry is possible through openings in the floor at the base of the container. If this is not possible, then exterior cable entry boxes, mounted to the exterior of the container, provide cable entry through the side. These boxes are removed during transport of the container.

Some switchgear (such as ring main units) also needs arcing ducts out of the sides or bottom of the container. In this instance, special modification to the container is needed to prevent an arc from affecting the interior environment.

Marine containers vary in size, with the average size being about 10 m long, 5 m wide and 4 m high. This means they can easily be transported on a standard low-loader and lowered into position using a crane.

JB Switchgear manufactures high quality switchgear systems that meet the latest national and international safety and performance standards.

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

Process-focused solution from Weir Minerals ups output

Stilfontein-based sand and aggregate supplier CNC Crushers raised throughput at its Roadstone Shaft 5 crushing plant by 45 % while cutting back on maintenance and simultaneously increasing production, after implementing a full process-focused solution from Weir Minerals Africa.

According to JD Singleton, Weir Minerals General Manager for Trio™ and Enduron® equipment, the customer was experiencing high wear on the installed conventional cyclone, as well as on the older technology pump, having to replace liners every 120 hours of operation.

"Our brief was to increase solids to the cyclone underflow and increase the wear life on the cyclone feed pump," says Singleton. "The continuous breakdowns experienced with the older-technology crushing equipment, and the excessive oil usage was also causing high downtime for the plant. CNC Crushers needed a solution that would utilise the existing footprint and infrastructure."

As a solution, Weir Minerals Africa installed a new technology Warman® WBH® 100 slurry pump and a Cavex® 400CVX10 hydrocyclone; it also replaced the existing cone crushers with Trio™ TC51S and TC36SH cone crushers to increase up-time and reduce maintenance costs.

"After 1 900 operating hours, the slurry pump was still running without needing any replacement parts, a vast improvement on the previous mean time between liner replacements of 120 hours," says Singleton.

According to CNC owner Carl Crous, this has meant that the company could take pumps off the critical maintenance list. "Pump problems are something of the past," he says.

With regard to the hydrocyclones, these proved to be more efficient than the conventional cyclones, highlighting the benefits of the Cavex® hydrocyclone's laminar spiral inlet geometry.

For their part, the cone crushers have increased plant availability as well as production, while meeting the criteria of matching the customer's existing footprint. These crushers also incorporate multiple hydraulic cylinder clamping and adjustment, which enabled them to reduce the closed-side setting adjustment time from an hour-and-a-half to just five minutes.

Following the crusher upgrade, a competitor's installed primary and tertiary classification screens were replaced with a Trio™ TIO5162 (5´ x 16´ double deck) inclined screen, and the final product screen was replaced by a Trio™ 4102 (4´ x 10´ double deck) inclined screen.

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

CNC Crushers' owner, Carl Crous, next to a Cavex 400CVX10 hydrocyclone.

Johnson provides heavy lift services at Secunda

Engaged by Stefanutti Stocks Oil & Gas Division in the construction of the largest air separation train ever built, Johnson Crane Hire has been providing heavy lift services as well as a range of smaller lifts at Sasol's Secunda complex.

This milestone plant under construction for Air Liquide is the 17th train to be built at this site, and will have a total capacity of 5 000 tonnes of oxygen per day.

The contract for the project's heavy lift scope was won by Johnson Crane Hire's Heavy Lifts Project Division on a fixed value basis, according to Peter Yaman, Executive – Sales, while the smaller crane work was serviced through the company's Trichardt branch near the Sasol Secunda site.

Most of the large components were lifted in an almost fully assembled state.

At the heart of the plant is the argon column, which presented Johnson Crane Hire with its heaviest lifts. According to Grant Parker, Project Manager – Heavy Lifts Projects Division, the lower section of this column weighed 287 tons, and was lifted by the company's main lift crane, a Liebherr LR1750. This 750-ton lattice boom crawler crane was configured initially with an 84 m boom length, which was later in the project extended and re-configured at 112 m.

"An interesting aspect of the contract was that most of the large components – such as the columns – were lifted in an almost fully assembled state," says Parker. "The upper sections would then have to be accurately positioned on the lower sections, with tolerances less than 1 millimetre per metre. For the large argon column, this meant a tolerance of less than 10 millimetres."

The tall structures meant that verticality had to be carefully addressed in the lift planning, with the use of tailing cranes – mainly the Liebherr LTM1500-8.1, a 550-ton telescopic mobile unit.

Close attention to planning and safety procedures is always key to the smooth implementation of lifting projects undertaken by the company, says Yaman, so Johnson Crane Hire placed a CAD technician permanently on site to create two-dimensional and three-dimensional plans for all lifts over five tons – which the customer would also sign off before execution.

"This planning allows us to position the cranes in exactly the right locations to facilitate the coordination between the main crane and the tailing crane, and to ensure the cranes don't work against each other," says Parker. "As the column nears the vertical, for instance, the weight transfer between the one crane and the other can occur very quickly. With the HP/LP column, another of our heavier loads, this transfer took place over an angle of just two degrees."

A 400-ton lattice boom crawler crane was also brought to site for additional tailing capacity in the big package lifts, as well as a support crane in the form of a 100-ton Liebherr LTR1100 telescopic boom crawler crane.

A particular challenge was the wind resistance created by the installed panelling on the columns, which could delay work if the wind strength exceeded a certain level. Once lifted, the upper section would have to be held in place for extended lengths of time while being secured to the lower section – sometimes overnight.

Johnson Crane Hire also engaged its mix of specialised equipment such as slings and spreader beams, and made use of various techniques to move and position large components. The 100-ton intercooler for the main compressor, for example, needed rails combined with a jack-and-slide system to position into an awkward space.

Johnson Crane Hire, tel (+27 11) 455-9222

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