

MODERN MINING

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- Green mining promised at Elandsfontein



TAKRAF 
TENOVA



Jaco du Toit - 12 years



Christina Ramotsabi - 9 years



Ricardo Montoya - 25 years



Rejean Foisy - 25 years



Godwin Dzweiro - 26 years



Noel Mills - 33 years



Fregelina Mabotja - 9 years

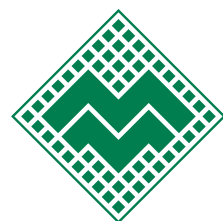


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Cover

TAKRAF rapid rail load-out stations offer high loading precision and low maintenance requirements. The operating system is customised to meet client specified requirements. See page 16 of this issue for an article on Tenova TAKRAF Africa's products and services line-up and its recent contract successes, which have given it a healthy order book as it enters 2017.



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Platreef geologists and Karowe's developers win Canadian awards

Geologists and mine developers associated with two Southern African mining projects – the Platreef PGM project in South Africa and the Karowe diamond mine in Botswana – have been honoured in the 2016 Awards of the Association for Mineral Exploration British Columbia (AME BC).

Focusing first on the Platreef project near Mokopane in Limpopo Province, Sello Kekana and Dr David Broughton, two key members of the Ivanhoe Mines exploration team that delineated the Platreef deposit which forms the basis of the project, have been chosen as the recipients of the Colin Spence Award for excellence in global mineral exploration.

This is the second major geological award that Ivanhoe has received for its African projects over the past couple of years. As readers might recall, in early 2015 the company's exploration team received the Thayer Lindsley International Discovery Award from the Prospectors and Developers Association of Canada (PDAC) for the Kamoa copper discovery near Kolwezi in the DRC.

The citation for this latest award says Kekana and Broughton are being recognised for their “outstanding work” contributing to the discovery of the Tier 1 Flatreef underground deposit. Kekana is currently head of Transformation at Ivanplats, the Ivanhoe subsidiary developing the Platreef mine, while Broughton is Senior Adviser, Exploration and Geology, with Ivanhoe Mines.

Ivanhoe has put out a press release congratulating both Kekana and Broughton. In the release, the company also acknowledges other key members of the Flatreef discovery team who include Tim Dunnett, Danie Grobler, Devine Hadebe, Daniel Mudau, Shane Nielsen, Mike Phipps, Alfred Sarila, Kennedy Singo, Barry de Wet and Nick Williams. The company adds that within the Ivanhoe group's senior ranks the late Ed Flood was a committed advocate for exploration of the Platreef prospect.

Interestingly, Kekana, who holds an MSc in Geology from Wits, was born and raised in the small village of Kgobudi that adjoins today's Platreef project. Comments Ivanhoe's Executive Chairman, Robert Friedland: “He used to graze his family's cattle on one of the farms that overlaid the Flatreef discovery. Today, thanks in part to Sello, we're confident that Flatreef eventually will become one of the world's great platinum mines, contributing to economic growth across the region and providing opportunities and inspiration for a new generation

of South African geologists to follow in his footsteps.”

AME BC notes that exploration in the Platreef area led to the “delineation of a large, near-surface, low-grade resource that was amenable to open pit mining; however, the open pit area was overlain by villages with a combined population of more than 30 000 people. Realising the challenges involved with relocating the villagers, the company's geological team led by David and Sello began work to identify other zones of mineralisation on the property.

“Their unique approach, which included applying advanced geophysical modelling to high-resolution airborne gravity data, resulted in the realisation in 2010 that the regionally steeply west-dipping mineralised reef flattened at a depth of roughly 700 m below surface on Ivanhoe's property.”

Subsequent deep drilling of the deposit has defined a mineral resource containing an incredible 94,8 million ounces of PGMs plus gold in the indicated and inferred categories at a cut-off grade of 2,0 g/t.

Turning to the second AME BC award, William Lamb and Lukas Lundin of Canada's Lucara have received the Hugo Dummett Diamond Award for excellence in diamond exploration and development in recognition of the part they've played in developing the Karowe diamond mine near Orapa.

Although these days he is based in Vancouver, Lamb was brought up and educated in South Africa and spent much of his career prior to joining Lucara with De Beers. Lundin, of course, is a member of the well-known Lundin family, whose interests also include Lundin Mining.

Since starting up in 2012, Karowe has produced a seemingly unending succession of large gemstones, including the second largest diamond ever mined, the 1 109-carat *Lesedi La Rona*. This was recovered in November 2015 in the same week that the mine produced two other ‘superstones’. Commenting at the time, Lamb said that “We are truly blessed by this amazing asset.”

Karowe is indeed a phenomenal operation and its revenues since it was commissioned recently topped the US billion dollar mark, an amazing achievement for a mine that – in terms of carat production – is only a mid-tier producer. As AME BC rightly says, “Lukas and William are deserving recipients of the Hugo Dummett Award for their roles in the realisation of this unique project.”

Arthur Tassell



“Realising the challenges involved with relocating the villagers, the company's geological team led by David and Sello began work to identify other zones of mineralisation on the property.”



The Tschudi open-pit, heap leach, SX-EW operation near Tsumeb in northern Namibia. Its current capacity is 17 kt/a of LME Grade A copper cathode (photo: Weatherly International).

Tschudi gets back to nameplate capacity

Namibian copper miner Weatherly International, listed on AIM, reports that its Tschudi project near Tsumeb in northern Namibia re-attained its nameplate production rate during October, two months earlier than forecast.

In October the company repeated its Tschudi guidance from July that nameplate production rates of 1 417 tonnes per month (tpm) would be re-attained by December 2016, following the reduced production in the June and September 2016 quarters due to excessive groundwater inflow to the pit.

Weatherly has also updated on its potential Tschudi expansion to 20 kt/a, which it first announced in December 2015 when it said the expansion would require expenditure of US\$1,2 million. Subsequent optimisation of the operating parameters used within the solvent extraction and electro-winning plants has now reduced this capital estimate to US\$0,2 million.

The company says the focus for the expansion opportunity evaluation has now shifted to evaluating mining, pad development, stacking, and leach scheduling paths to sustain such a potential expansion and quantifying potential operating cost savings from the expansion.

Regarding its Otjihase and Matchless underground mines in the Windhoek area,

both in care and maintenance, Weatherly says the mineral resources at the mines plus the installed processing plant capacity present a valuable opportunity for the company. Success will be dependent on achieving higher production rates and lower unit costs than were achieved during the period from 2011 to 2015. This will be critically dependent on safer and more productive underground mining execution capability and operator skills development in this area is the critical requirement to unlock the opportunity.

The company notes that the geology and processing characteristics of the Otjihase and Matchless orebodies are well understood and offtake agreements remain in place for the high-quality concentrate which can be produced. While some further geological resource development work may be required over time, for example to upgrade the historical estimate at Old Matchless to a JORC mineral resource estimate and to upgrade and extend the Matchless Western Extension resource estimate down plunge, the critical path to implementing a sustainable restart of operations lies with underground mining skills development.

Weatherly says it has identified a potential opportunity to commence a skills development programme in a man-

ner which could be incrementally cash generative at current spot prices within six months of commencement, partially offsetting current care and maintenance costs being incurred at the sites. Ultimately it is envisaged that a period of up to two years may be required to develop the requisite improvements in underground mining operator skills and to train sufficient Namibians to the best international standard and fully realise the potential of Otjihase and Matchless.

Under the proposal, small scale mining and campaign processing would be conducted by a small team in the first scheduled primary mining area at Otjihase. All of this mining would be conducted in ore and the programme would commence with the establishment of productive and safe primary mining systems.

The current strategic goal envisaged for such a restart would be safe and sustainable production from the Otjihase concentrator of 10-12 kt/a of copper in concentrate at C1 unit costs of below US\$2/lb. Due to the large amount of underground access infrastructure in place plus the fact that the Otjihase concentrator is well maintained and capable of treating up to 800 kt/a of ore, the capital expenditure required to deliver such an outcome is expected to be very low, and would likely rank as one of the lowest capital intensity copper production opportunities in the world. ■

Cardinal announces 4 Moz resource for Namdini

ASX-listed Cardinal Resources has announced a maiden resource estimate of approximately 4 Moz of gold for its Namdini deposit in the far north of Ghana and results of the Phase 1, single hole, metallurgical testwork programme.

Preliminary metallurgical testwork has been completed, with further testwork continuing to determine an optimal process route.

"The Namdini maiden resource and the initial metallurgical results represent a major milestone for Cardinal and highlight the outstanding potential of the Namdini deposit, which remains open at depth and along strike," comments Cardinal's MD, Archie Koimtsidis. "With the first 4 Moz now defined, our aggressive drilling efforts will continue, with exploration around the existing resource already underway. Furthermore, we have four drill rigs on site operating 24/7 to increase the size and confidence within the cur-



Drilling at the Namdini project in northern Ghana (photo: Cardinal).

rent resource. Namdini is well located for future development and the project receives strong government and local landowner support." ■

Blanket gold mine aiming for 60 000 ounces in 2017

Caledonia Mining Corporation, listed on the TSX and AIM, produced 13 428 ounces of gold in the three months to 30 September 2016 at its Blanket gold mine near Gwanda in Zimbabwe, compared to 10 927 ounces in the equivalent period in 2015. The All-in Sustaining cost (AISC) was US\$969/oz compared to US\$1 005/oz in the third quarter of 2015. Production guidance for 2017 is 60 koz, a 20% increase on 2016 production

"The results for the third quarter are another step in our journey of consistent growth in production, profitability and cash generation at Blanket mine," comments Steve Curtis, Caledonia's President and Chief Executive Officer. "We continue to see the benefits of our investment in the mine over the past two years. As we approach the middle of the investment programme at Blanket, we are increasingly confident that the growth in production and declining cost trends will continue as we ramp up production to 80 koz by 2021."

The quarter saw yet another production record, following on from the record set in the second quarter. "The installation of a third mill at Blanket in the quarter

will further improve plant capacity as we continue to mill increased tonnage as part of the production expansion," continues Curtis. "This achievement is a testament to the hard work of the management and employees at Blanket mine, as well as the technical team at Caledonia, over the last 18 months."

He added that the "transformational Central Shaft project continues to progress well with completion on track for mid-2018 with the shaft depth currently standing at 330 m. The completed shaft down to a level of 1 080 m will establish Blanket as a large, low cost operation with excellent prospects to extend the existing mine life." ■

Giyani Gold to acquire Zambian properties

Giyani Gold Corp, listed on the TSX-V, has signed a Letter of Intent (LOI) with Menzi Battery Metals to acquire a 70% interest in two past-producing high-grade manganese mines in Zambia.

The Kampumba and Chiwefwe manganese open-pit mines operated between 1954 and 1968 producing a total combined estimate of 360 000 tonnes at grades exceeding 50% manganese. The mines are close to infrastructure such as gravel roads, a railway line and power. Geophysical survey data and historical non-NI 43-101 compliant resource estimates indicate significant manganese potential, says Giyani.

Under the terms of the LOI, Giyani has agreed to make a US\$200 000 cash payment and work commitment of US\$1 million over five years to Menzi upon completion of due

diligence, title review and completion of a definitive agreement.

Giyani has engaged Boswell Projects as the project manager for its portfolio of assets in Southern Africa. During the effective period of the LOI and subsequent agreements, Boswell Projects will complete a due diligence review of the assets and will assess the potential for near-term production from these mines. Boswell Projects will also be providing Giyani with other corporate services.

This acquisition of past producing high grade manganese mines, in combination with Giyani's manganese projects in Botswana, will expand the company's portfolio of manganese assets and continue the advancement of Giyani's strategy to acquire raw materials for the growing battery industry." ■

Ivanhoe makes excellent progress at Kipushi

TSX-listed Ivanhoe Mines reports that it has made excellent progress in upgrading and modernising the Kipushi mine's shafts, pumping stations and underground infrastructure as part of the plan to prepare the mine for the restart of commercial production. The mine – located in Katanga in the DRC – now has clear and safe access to all of the main underground workings, including the Big Zinc deposit.

The current mine redevelopment plan, as outlined in the May 2016 independent, preliminary economic assessment (PEA), includes a two-year construction period with a relatively quick ramp-up to a projected steady-state production of 530 000 tonnes of zinc concentrate per annum.

A pre-feasibility study (PFS) is underway to refine the findings of the PEA and to optimise the mine's redevelopment schedule, life-of-mine operating costs and initial capital costs required to bring the mine back into production. Ivanhoe expects to complete the PFS in the second quarter of 2017.

"We are working hard to have the mine ready to restart production," said Robert Friedland, Ivanhoe's Executive Chairman. "Given the extremely high zinc grades at Kipushi, the mine has the potential to be one of the world's largest



Control room operator at Kipushi's Shaft 5 (photo: Ivanhoe).

and lowest-cost zinc producers, while also producing significant quantities of copper, silver and germanium. We remain involved in detailed discussions with potential strategic partners and investors relating to the company and our projects, including Kipushi.

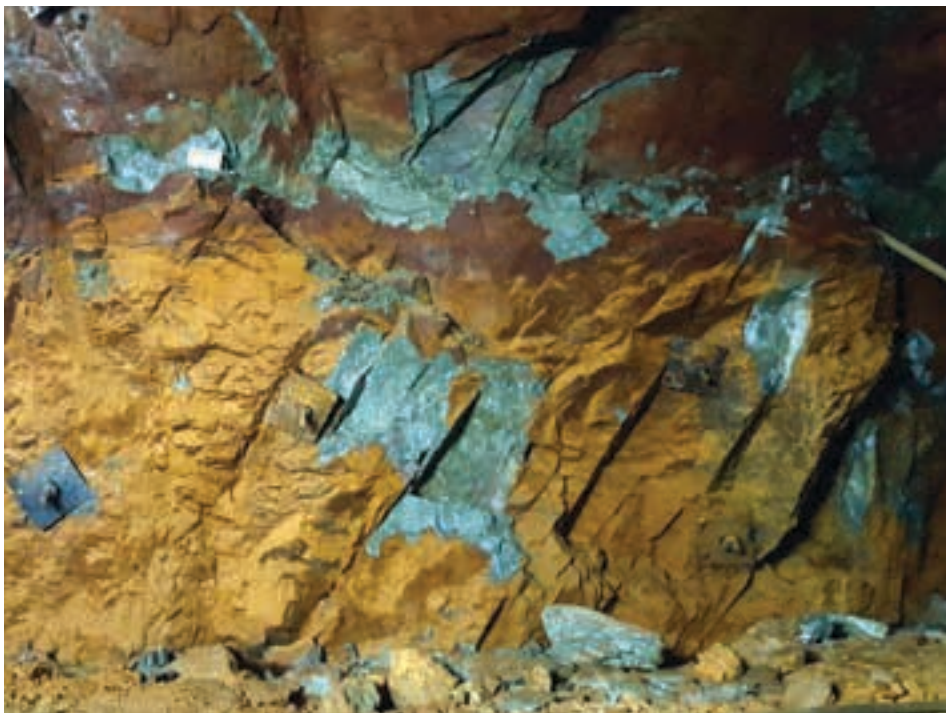
"We look forward to working with our partner, Gécamines, and the people of the Kipushi area to return the mine to production and start writing the next chapter of Kipushi's long and meaningful history.

In the meantime, we welcome international investors and mining analysts to see first-hand the excellent progress our team has made in upgrading the mine's underground infrastructure and to experience an exceptionally rare opportunity to inspect a deposit that is 35 % zinc."

The Kipushi project is operated by Kipushi Corporation (KICO), a joint venture between Ivanhoe Mines (68 %) and Gécamines (32 %), the state-owned mining company. The PEA and PFS focus on the mining of Kipushi's Big Zinc deposit, which has an estimated 10,2 Mt of measured and indicated mineral resources grading 34,9 % zinc. This grade is more than twice as high as the measured and indicated mineral resources of the world's next-highest-grade zinc project, according to Wood Mackenzie, a leading, international industry research and consulting group.

KICO has upgraded the operating shafts, winders and underground infrastructure at the Cascade section of the mine, which are expected to serve as alternate personnel and material shafts – as well as a second egress route from the mine. A new high-volume ventilation fan has also been installed on surface at Shaft 4 to provide fresh air to the underground workings.

The main production shaft for the Kipushi mine, Shaft 5, is in the process of being upgraded and re-commissioned. The main personnel and material winder has been upgraded and modernised to meet western industry standards and safety criteria, and new cages will be



Intersection of extremely high-grade zinc at Kipushi's Big Zinc deposit at the 1 132-m-level decline (photo: Ivanhoe).

installed in 2017. The rock-hoisting winder, which will have a potential annual hoisting capacity of 1,8 Mt, is being upgraded and is expected to be fully operational in late 2017.

The critical path for the redevelopment of the mine runs through the upgrading of the Shaft 5 rock-hoisting winder, as well as the re-commissioning of the main pumping station at Shaft 5, the underground crusher at the bottom of Shaft 5, the Shaft 5 rock load-out facilities and the restoration of the main haulage way on the 1 150-metre level between the Big Zinc access decline and Shaft 5.

Shaft 5 is 8 m in diameter, 1 240 m deep and approximately 1,5 km from the planned main mining area. The rock hoist and load-out system will be upgraded to western industry

standards during 2017 to fully restore the shaft's hoisting capacity. Shaft 5 provides the primary access to the lower levels of the mine, including the Big Zinc deposit, through the 1 150-m haulage level and underground ramp decline.

The planned primary mining method for the Big Zinc deposit in the PEA and PFS is sublevel open stoping, with cemented backfill. The crown pillars are expected to be mined – once adjacent stopes are backfilled – using a pillar-retreat mining method. The Big Zinc deposit is expected to be accessed via the existing decline and without any significant new development. The main levels are planned to be at 60-m vertical intervals, with sublevels at 30-m intervals. ■

Xtract completes review of Manica project

AIM-quoted Xtract Resources reports that it has completed a review of the Manica gold project in Mozambique. The review was conducted as part of a total review of the company's position and prospects relative to its various projects.

The board review covered all past work from previous owners and consultant contributors and has established the most appropriate way forward for the project. As previously reported, Minxcon was appointed to complete open-pit optimisation modelling.

The definitive feasibility study (DFS) which is being reviewed and optimised is not expected to change materially.

The board review concluded that the best way forward would be to develop Manica solely on an open-pit basis and dismissed the concept of a high grade open-pit operation followed by an underground mine. This decision was based on the need in underground development for crown pillars which would sterilise a significant portion of the resource. Weak wall rock conditions underground were expected to require backfill which would have a serious adverse effect on underground operating cost.

As part of the DFS update, a re-optimisation process has recently been completed by Minxcon with the following key inputs and initial conclusions: a gold price of US\$1 270 per oz; approximately seven years life of mine; a target of 480 000 t/a; and an estimated average grade of 2,26 g/t mined. The optimisation over all stripping ratio before detailed design is circa 7,2 while the optimisation break even all-in-cost,

including capital recovery, is US\$908 per oz.

The re-optimisation indicated a positive return for the revised strategy and the net present value will be determined during the DFS update. The review has identified several exploration targets within the Manica concession which have not been tested or, if so, only superficially.

The status of the alluvial resources at Manica remains under discussion and is expected to be finalised shortly.

"I am pleased to report that the Manica project shows all the signs of a robust open-pit gold mining project which can be developed by us or with others, whichever route provides the best shareholder value against risk," comments Xtract's Colin Bird, Executive Chairman. "We are currently reviewing these options. The exploration potential, if successful, could lead to extended mine life with the processing plant paid for. The same could apply for any underground extension which would be justified on its own economics. I look forward to providing the market with a DFS which will be fully optimised making Manica ready for development investment."

Adds Daan van Heerden of Minxcon: "We have been involved with this project over the last two years and have a significant data set which has assisted us to arrive at this point. Further optimisation will be directed towards redesigning the pit and firming up capital and operating cost for the plant. Once commissioned and mandated, we expect to produce an updated DFS in short time, which will allow the company to move the project forward to its next step of development." ■

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Burey “delighted” by recoveries from Giro samples

Australian explorer Burey Gold reports gold recoveries of 91 % for an oxide sample and 90 % recovery for two sulphide samples from the Kebigada Shear Zone on its Giro gold project in the north-east of the DRC using simple CIL methodology.

The oxide and two sulphide reverse circulation (RC) bulk samples were sent to SGS Mineral Services laboratory in Johannesburg, South Africa, for a gold deportment study.

Commenting on the results, Chairman

Klaus Eckhof stated: “We are delighted by the relatively simple metallurgy at Kebigada. We also anticipate that additional metallurgical studies planned on drill core will further improve recovery processes.

“The Kebigada Shear Zone continues to tick all the right boxes as we gather additional information on the mineralisation of the area. We now eagerly await additional drilling results at Kebigada as we build towards our initial inferred resource

estimate. In addition to resource drilling at Kebigada, which is ongoing, drilling at Douze Match continues, with further results expected in the coming weeks.”

The Giro gold project comprises two exploitation permits covering a surface area of 610 km² and lies within the Kilo-Moto Belt, a significant but under-explored greenstone belt which hosts Randgold Resources’ 17-million ounce Kibali group of deposits. The Kibali mine produced over 600 000 ounces in 2016. ■



Core yard at the Giro project in the north-eastern DRC (photo: Burey Gold).

Diamcor updates on its Krone-Endora at Venetia project

Diamcor Mining Inc, listed on the TSX-V, has provide an update on the acquisition of operational equipment associated with the closing of the over-subscribed C\$5,8 million private placement previously announced on August 31, 2016.

The acquisition of additional operating equipment at the company’s Krone-Endora at Venetia project in South Africa’s Limpopo Province is aimed at supporting increased processing volumes, incorporating the processing of large material up to 45,0 mm, establishing a dedicated large diamond recovery circuit, and increasing the capacity of the project’s final diamond recovery facilities.

The project’s in-field dry-screening plant is an important element in the project’s success and has been extensively tested, refined, and developed to achieve the company’s target of reducing the material recovered from the quarry by as much

as 60 % (prior to its transport to the main treatment plant) through removal of fine materials under 1,0 mm in size.

Recent efforts in developing this facility largely focused on the processing of material in the +1,0 mm to -15,0 mm size fractions, with material in the +15,0 mm to -45,0 mm size fractions being stockpiled pending the final decisions on a dedicated large material crushing circuit.

The installation of the finalised crushing circuit at the project is aimed at enhancing processing/recoveries by liberating any diamonds held in the larger calcritised material previously stockpiled, while providing the potential to recover large diamonds above 15,0 mm in a dedicated large diamond recovery circuit being installed at the project’s main treatment plant. Upon completion, all material up to 45,0 mm will be processed concurrently moving forward, and approximately

550 000 tons of large material previously stockpiled will also be processed over the coming quarters.

As part of the expansions/upgrades underway, Diamcor elected to also expand and further automate the final recovery facilities. Four additional X-ray diamond recovery units are being supplied by Flow Electronics (Pty) Ltd, with three units being earmarked for use on small and mid-size fractions of material, with the fourth being allocated to the dedicated large diamond recovery circuit being installed.

In conjunction with the delivery of the modules housing these additional X-ray recovery units, other modules aimed at upgrading, automating, and expanding the sorting facilities at the project will also be installed. The company expects items associated with the dedicated large diamond recovery circuit to be completed shortly, with other associated items on-track for completion prior to the end of the current quarter. ■



The Venetia open pit viewed from the Eastern pit viewpoint. Note the headgears for the VUP.

Venetia Underground contract is a “benchmark”

WorleyParsons RSA has been awarded the engineering, procurement and construction management (EPCM) contract for the De Beers Venetia Underground Project (VUP), a culmination of more than a year’s joint efforts by Anglo American, De Beers and WorleyParsons to resolve a benchmark industry contract and delivery methodology that will ensure the successful delivery of the project.

In 2007, De Beers and Anglo American took the decision to replace the existing Venetia open-pit diamond mine – South Africa’s largest producer of diamonds – with an underground mine beneath the current operating open pit as mining of the kimberlite pipe will not be viable through opencast mining methods in the future. The project scope provides for a techno-economic underground mining and infrastructure solution to continue the mining of the orebodies and extending the life of the mine by some 25 years. The underground mine will comprise a twin shaft and decline mining complex that will reach a depth of 1 000 m when completed.

WorleyParsons has been involved in the VUP since feasibility stage and was commissioned to execute the detailed engineering design for both the surface

and underground infrastructure for the new underground mine.

Robert Hull, WorleyParsons’ Project Director for the Venetia Underground Project, explains that as part of the EPCM contract, WorleyParsons will perform a range of services including the project management, project controls and accounting, project administration, document control, engineering, design, procurement, materials management, construction/

construction management, and commissioning and commissioning support.

The EPCM contract is the largest ever project award received by WorleyParsons RSA and will see the underground mine through to completion in 2022.

“This contract is a result of the combined efforts from all parties who worked tirelessly for over a year to evolve the project into a different format. During our negotiations, De Beer’s holding company,



The portal to the Venetia Underground decline.

Anglo American, was in the process of changing its project execution synopsis, and this is the first contract signed globally in line with Anglo American's new model," commented Henry Jonker, General Manager – Mining at WorleyParsons RSA, at the official signing of the contract on 21 October 2016.

"The new contract model is pioneering for Anglo American in its structure," says WorleyParsons RSA CEO Denver Dreyer. "We acknowledge that a lot of effort and teamwork has gone into getting the project to this point, and we look forward to continue working closely with De Beers to successfully complete this prestigious project."

Adds Christoff Kühn, Head of Projects at De Beers: "WorleyParsons is playing an integral part in the 'tripartite alliance' created between De Beers, WorleyParsons and Murray & Roberts (M&R) Cementation, who is currently undertaking shaft sinking operations on both shafts. We now have the correct building blocks in place and the project is set up for success." ■

Hatch launches Southern African office in Botswana

Hatch has established a new office in the Gaborone CBD on the back of a significant contract win from Debswana. The office is aimed at consolidating its presence in Botswana and the Southern African region.

The consulting engineering company has clinched a five-year contract at Debswana's Jwaneng diamond mine in south-central Botswana, about 120 km west of the city of Gaborone, says Stephen Stacey, MD, Botswana, Project Delivery Group.

Although the Debswana portfolio is the catalyst for the Botswana office, it will also be the springboard for pursuing new work, not just in the mining sector, but also in the energy and infrastructure sectors, where Hatch can contribute significant experience.

"We are very excited about the Botswana government's economic stimulus programme, designed to create employment and expand the private sector. Hatch would like to support this effort by sharing its programme management experience, training capabilities, sustainability development methodologies and project management

tools developed over many years of programme management assignments," Stacey comments.

"Most importantly, Hatch has a long history of localisation in all of the countries where we operate, and Botswana will be no exception. We look forward to a long history in Botswana, working with all of our clients, partners, and stakeholders ensuring sustainable outcomes."

Hatch's current involvement in Botswana includes work on the North-South Carrier (NSC) pipeline, which conveys raw water south for 360 km to Gaborone. The company is currently tendering on Phase 2 of this project. It is also looking to access the thermal power generation market in Botswana, including the Botswana Power Corporation's Morupule coal-fired power station near Palapye.

"It is our intention to grow the Botswana office to about ten people by the end of 2017, and to 50 people with five years," says Stacey. The aim is to establish a significant local presence, with local shareholding and local employees." ■

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Chrome/PGM producer more than doubles profits



A total of 4,7 Mt of reef was milled in FY2016, representing a 5,8 % increase year on year (photo: Tharisa).

Tharisa plc has reported record results for the financial year ended 30 September 2016. The integrated resource group's net profit after tax for the year more than doubled to US\$15,8 million, compared to a profit of US\$6,0 million a year earlier.

Tharisa is listed on the LSE and JSE. It is an integrated group incorporating mining, processing, beneficiation, marketing, sales and logistics of PGMs and chrome through its 74 % interest in Tharisa Minerals (mining and processing) and its wholly-owned subsidiaries including Arxo Metals (processing and beneficiation), Arxo Logistics (logistics) and Arxo Resources.

The group owns and operates the Tharisa mine which is located near Marikana on the south-western limb of South Africa's Bushveld Complex.

Group revenue totalled US\$219,7 million, a decrease of 11 % relative to the previous financial year. This was due to a decrease in the commodity prices for both PGMs and chrome concentrates with the basket price for PGMs reducing by 16,8 % per ounce and the metallurgical grade chrome concentrate price reducing by 24,11 % per tonne over the comparable period. The reduction in revenue was mitigated by the increase in PGM and chrome concentrate volumes sold.

PGM revenues at US\$81,5 million were almost 2 % lower year-on-year while chrome revenues were 15,6 % lower at US\$138,1 million.

Tharisa's mining operations are characterised by the shallow, large scale, open-pit co-production of PGM and

chrome concentrates with a consequential low cost of production. Continuing application of Tharisa's low-cost business model and achievement of record production enabled the company to boost gross profit by 26,5 % to US\$54,5 million for the year. Operating profit climbed by 74,5 % to US\$32,1 million.

Commenting on the results, CEO Phoevos Pouroulis said: "Our full-year results demonstrate that the group has come of age. Improving profitability through economies of scale and operational excellence in a depressed commodity market shows that Tharisa's low-cost model sets the group apart from its peers.

"Clearly benefitting from the innovative co-production of PGM and chrome concentrates, the group was able to leverage its integrated operational platform to capitalise on the production of higher margin specialty chrome products at a time when other commodity prices were depressed."

Tharisa Minerals reported a Lost Time Injury Frequency Rate (LTIFR) of 0,36 per 200 000 man hours worked. In recognition of these achievements, Tharisa Minerals was awarded the Best Safety Performance in Class award at MineSAFE 2016.

Tharisa's mining operations performed well during the financial year, with 4,8 Mt of reef mined, which is 15,6 % higher than the reef mined in FY2015. The focus remains on grade control to improve the plant feed grades, particularly for chrome.

The two processing plants performed particularly well due to the consistent run-of-mine (ROM) production. A total of 4,7 Mt of reef was milled in FY2016, representing a 5,8 % increase year on year. The overall performance across both plants saw a marked improvement in PGM recoveries at 69,9 % for the financial year and improved chrome recoveries of 62,7 % during the year. Tharisa's recovery targets are 70 % for PGMs and 65 % for chrome.

PGM production was 12,4 % higher at 132,6 koz at and chrome production, at 1,2 Mt, was up 10,8 % despite marginally lower feed grades. Specialty chrome concentrate production increased by 138,8 % to 269,4 kt year on year.

The production outlook for FY2017 remains at 147,4 koz of PGMs and 1,3 Mt of chrome concentrates, of which 300 kt will be specialty grade chrome concentrates. ■

Randgold and Newcrest to team up in Côte d'Ivoire

Randgold Resources and Newcrest have signed a heads of agreement to establish a joint venture for the exploration, development and mining of mineral resources in an area of interest in the south-east of Côte d'Ivoire. The area covers the extension of some of the more prolific Ghanaian gold belts and associated structures.

Randgold will manage the exploration programme as well as any mines that it produces. A technical committee of senior geologists from both companies will work closely with the Randgold exploration team and a joint venture board will oversee the

exploration programme and any consequent development projects.

Randgold Chief Executive Mark Bristow said the joint venture would bring together two of the world's leading gold mining explorers in a concerted effort to unlock the potential of an area that has not yet been explored in depth.

"The bigger the footprint, the greater the opportunity, and both Newcrest and Randgold believe in Côte d'Ivoire and the potential for the discovery of truly world class gold deposits," he said. ■

Fekola gold mine on course for late 2017 start-up

In the third quarter of 2016, B2Gold's construction team continued to develop the Fekola project in Mali which remains on schedule and on budget to commence production in the fourth quarter of 2017. The workforce on site is being maintained at approximately 800 employees and contractors.

Headquartered in Vancouver, Canada, B2Gold Corp is reputedly one of the fastest-growing intermediate gold producers in the world. Founded in 2007, B2Gold now has four operating mines, including the new Otjikoto gold mine in Namibia. Otjikoto is expected to produce between 160 000 and 170 000 ounces of gold in 2016.

Earthworks and surface water control structures at Fekola were largely completed during the quarter while much of the concrete work – including for the primary crusher and mills – is at an advanced stage. Conveyor structure installation in progress while leach tank erection is complete.

On June 29, 2016, B2Gold announced an exploration update for the project. Based on the positive drill results to date (at both near surface and underground below the main Fekola pit) and exploration potential, the company is expanding the throughput at the Fekola mine to 5 Mt/a.

The optimised Feasibility Study and Environmental and Social Impact Study were both prepared to accommodate an uplift in throughput from 4 Mt/a to 5 Mt/a. The uplift factors built into the original design included 5 Mt/a assumptions for plant design, general infrastructure and tailings dam design and location.

On August 2, 2016, B2Gold decided to proceed with the mill expansion and approved a US\$18 million expansion budget for additional items including a pebble crusher, one additional leach tank and an additional generator. With this additional capital investment, the Fekola mill expansion is expected to be completed in the fourth quarter of 2017 and commissioned in conjunction with the main plant commissioning.

This mill capacity increase could potentially increase annual production by up to 20 % (subject to mine planning), surpassing initial Feasibility Study projections of approximately 350 000 ounces of gold per year for the first seven years of operation. Further production scheduling and cost guidance under the 5 Mt/a case will be available in early 2017.

The company has also approved a plan to relocate the village of Fadougou, located adjacent to the main Fekola pit. This decision was not made based on a requirement in the Construction Permit but on extensive stakeholder engagement with the local population. Relocation of the village will be completed in accordance with a Resettlement Action Plan (RAP) that was completed by an independent consultant in consultation with all stakeholders.

It is anticipated that the relocation process will commence in the fourth quarter of 2016 and will take two years to complete. Total estimated relocation costs are approximately US\$20 million to be incurred over the balance of 2016 and in 2017.

During 2016, B2Gold approved increases to the Fekola project budget for 2016 totalling US\$27,5 million including US\$6,1 million for 2016 plant expansion costs, US\$10 million related to relocating the village of Fadougou and US\$4,8 million related to the change in timing of ordering certain mine fleet items. ■



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VBKom looks at participating in Mokopane tin project



Mokopane has been mined previously. Seen here are old open-pit workings at Zaaiplets where further mining is planned.

Bushveld Minerals, listed on AIM, has announced the signing of a Memorandum of Understanding (MoU) between its wholly owned subsidiary, Greenhills Resources, and VBKom for the joint development of the Mokopane tin project in Limpopo Province.

Mokopane is a brownfields tin project containing 18 447 tonnes of tin with an average grade of 0,12 % tin (Sn) on two adjacent deposits. It is situated on the Northern Limb of the Bushveld Complex and consists of one prospecting right

(2205 PR), covering six farms with an area of approximately 13 422 ha.

VBKom is a South African specialist consulting company operating primarily in the mining industry. The company was established in 2008 and has extensive experience and specialist knowledge in mining engineering, geology, mineral processing, industrial engineering and project management.

Greenhills Resources, Bushveld's tin platform, was established to develop a pan-African portfolio of tin assets with a

near term production profile.

Under the terms of the MoU, VBKom commits to conduct due diligence on the Mokopane tin project, following which, if a successful outcome, it intends to enter binding agreements to provide capital investment and technical support for the development of the Groenfontein and Zaaiplets deposits to mine commissioning in return for equity participation in the project, not exceeding 50 %. The MoU provides for VBKom to conduct due diligence on the project for a period to 31 January 2017.

The joint development effort is expected to build on the 2014 Mokopane Scoping Study based on Groenfontein and Zaaiplets. The study envisaged an initial 691 000 tons per annum Run-of-Mine operation to produce 700 tons per annum of 99,5 % Sn purity metal. Using a long-term tin price of US\$22 928/ton, the study estimated a pre-tax IRR of 34,6 % and an all-in cash cost of US\$14 276/ton Sn for a US\$16 million capex.

Fortune Mojapelo, Chief Executive Officer of Bushveld Minerals, commented, "We have articulated a strategy for Greenhills Resources to consolidate a critical mass of mineable, low-cost tin resources with a near term production profile in order to build Greenhills' capacity as a stand-alone tin company. The signed MoU, which introduces a credible potential technical and financial partner for the Mokopane tin project, is a welcome step towards achieving that goal. We look forward to developing a long lasting relationship with VBKom, subject to the results of the on-going due diligence." ■

Black Mountain produces its first vermiculite

ASX-listed Black Mountain Limited reports it has produced its first saleable vermiculite product following the acquisition of the Namakera vermiculite mine and processing operations in Uganda.

Black Mountain completed the acquisition of 100 % of the share capital in GLFF Holdings Limited (Gulf) early in November. As a result it has now assumed operating and financial control of Namakera Mining Company Limited (NMCL), the registered holder of the mining licence.

The company says it has commenced its capital investment programme, with a

particular focus on plant upgrade work and optimisation to be funded from the company's recently completed capital raising.

The initial work is targeting feed preparation with an upgrade to the rotary dryer planned to increase efficiency and reduce fuel consumption. The programme will also investigate reducing the volume of over-size rejects. Dust extraction units are to be upgraded across the site incorporating the primary screening, air separation and resizing areas, as well as the final product and bagging area of the plant.

Subsequent work will focus on the

implementation of wet screening on the ROM pad to optimise feed to the dryer, building a dry product stockpile to allow optimisation of plant feed, increasing the screening capacity and increasing the on-site storage capacity.

The Namakera mine is located in eastern Uganda near the towns of Mbala and Tororo, approximately 190 km from the Ugandan capital, Kampala, and close to the border with Kenya.

The Namakera deposit is hosted in the Bukusu Complex, one of a number of carbonatites in the Uganda/Kenya border area and the only one known to host commercially viable vermiculite. ■

Large diamond recovery circuit at Lulo in Angola now operational

ASX-listed Lucapa Diamond Company and its partners, Empresa Nacional de Diamantes EP (Endiama) and Rosas & Petalas, report that the new XRT large diamond recovery circuit at the Lulo diamond project in Angola is now in commercial operation processing oversize alluvial gravels.

The XRT technology and larger screens will, as part of the new coarse recovery stream at the 150 t/h diamond plant, provide capacity to recover individual diamonds up to 1 100 carats. The new XRT technology is also more effective for the recovery of higher quality, low-luminescing Type IIa diamonds.

As previously announced, Lulo mining company Sociedade Mineira Do Lulo (SML) began stockpiling all oversize material in February 2016 following the recovery of the record 404-carat '4th February Stone', which sold for US\$16 million. This oversize stockpile totals approximately 20 000 bulk cubic metres.

Lucapa Chief Executive Stephen Wetherall says the commissioning of the new XRT circuit represents another exciting new phase in the development of the Lulo diamond project.

"We have seen what the implementation of this XRT technology delivered for Lucara – allowing their Karowe mine in Botswana to recover the second largest diamond ever," said Wetherall. "We are

excited to have this XRT recovery technology now fully commissioned as part of our coarse material processing stream at Lulo, where we have already recovered five +100-carat diamonds this year.

"As well as treating the oversize or coarse gravels from daily mining operations, we will selectively process the 20 000 bcm of stockpiled oversize material over time."

Updating on the exploration programme at Lulo, Lucapa says that a second drill rig and crew have arrived on site. This contract rig, which has PQ core capability, will augment the company-owned Sedidrig rig in advancing the Lulo kimberlite exploration and drilling programme, which aims to identify the primary source or sources of the exceptional alluvial diamonds being mined at Lulo.

A third rig – the new track-mounted Hanjin D&B35 rig purchased by Lucapa – has been shipped to Angola and is expected to arrive in port in Luanda in mid-December for customs clearance.

In addition, a helicopter-borne Time-Domain Electromagnetic (TDEM) survey is scheduled to commence shortly over the Caculo River and valley area. This TDEM survey aims to assist the kimberlite exploration programme in identifying other possible non-magnetic kimberlite targets as well as improving target definition on the known targets. ■

Kibo signs collaboration agreement with GE

Kibo Mining, listed on London's AIM and Johannesburg's AltX, has signed a Collaboration Agreement with General Electric International Inc (GE) with respect to the development of the Mbeya Coal to Power Project (MCP) in Tanzania.

The agreement follows the Memorandum of Understanding (MOU) announced on 16 September 2016 and sets out in detail the terms and conditions of the proposed collaboration into a binding agreement. It provides for GE and its affiliate companies (GE Group) to supply equipment, technology and services to the MCP power plant, in addition to assisting and co-operating with Kibo to implement the project.

"We are extremely pleased that we have now finalised this agreement with GE and cemented our relationship in a binding document," said Louis Coetzee, CEO of Kibo Mining. "Since signing the MOU, the company and GE have collaborated closely on progressing development work on the MCP, from which the project has benefitted greatly. As one of the largest and technologically advanced international companies, we are looking forward to growing this relationship. By working closely with GE, we will benefit from their experience and reputation and this will expedite the remaining work required to reach successful financial close on the MCP." ■



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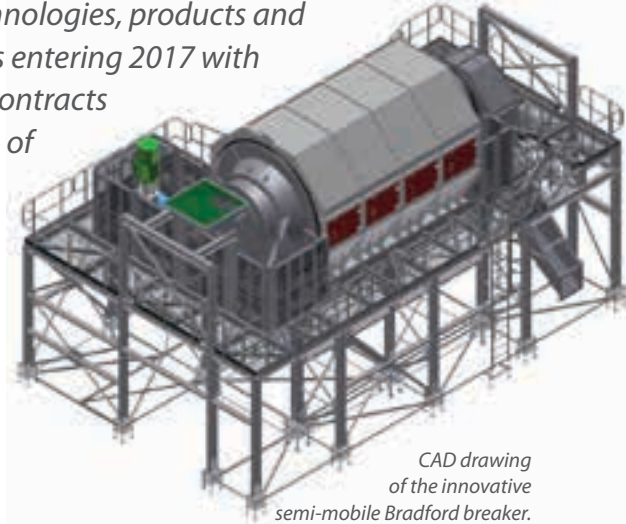
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Tenova TAKRAF Africa on a roll

Tenova TAKRAF Africa, a leading supplier of advanced technologies, products and engineering services to the mining and metals industries, is entering 2017 with a very healthy order book after winning several major contracts in recent months. **Modern Mining** recently spoke to two of the company's senior executives, Richard Späth, General Manager – Engineered Technologies, and Paul Davies, General Manager – Client Support Services, to learn more about the new contracts and TAKRAF Africa's strategy moving forward.



CAD drawing of the innovative semi-mobile Bradford breaker.



Pictured here are (from left) Paul Davies, General Manager – Client Support Services, and Richard Späth, General Manager – Engineered Technologies.

The spate of orders is welcome news for TAKRAF Africa, which last year – like many other companies in the industry – had to ‘right size’ aspects of its operations in order to cope with the effects of the resources downturn. Says Späth: “We emerged from this exercise as a leaner, much more focused business and we’re now reaping the rewards.”

The two most significant orders to be secured are for a dual rotary wagon tippler for the iron ore export market and a truck loading facility, including associated conveyors, for a new power station, both projects being in South Africa. “These contracts were won in the face of very stiff competition based on the quality of our systems, our track record and, of course,

our competitiveness,” says Späth. He adds that the systems being supplied under the new contracts will have a high degree of local content (although the tippler will be manufactured in China).

The tippler will have a capacity of 8 000 t/h, which offers unloading rates in excess of 100 wagons per hour. It will be supplied complete with a positioner and ancillary equipment (hoppers, TAKRAF apron feeders and apron feeder support platform), as well as a 98 m³/h reverse pulse bag filter type dust extraction system.

The tippler is being supplied in conjunction with TAKRAF in Germany, widely regarded as a global leader in mining and bulk material handling systems and equipment, including conveyors, bucket-wheel excavators, stackers, reclaimers and ship loaders and unloaders.

As evidence of TAKRAF’s capabilities, Späth points to the fact that the group was recently awarded the contract for the 10 000 t/h ore transportation system at Codelco’s Chuquicamata underground mine in Chile (see also page 41). TAKRAF’s innovative belt conveyor system will overcome a number of technical challenges including significant elevation change from the underground mine to the surface and will comprise a variety of uphill tunnel conveyors that transport copper ore from underground storage bins.

The conveyor system will be installed with advanced gearless drive technology with the uphill tunnel conveyors boasting the highest drive power ever to be installed on a belt conveyor. In fact, total installed drive power for the entire system will be around 55 MW.

“This is the type of industry-leading



technology we have access to as part of the global TAKRAF group,” says Späth. “TAKRAF’s reputation and track record is such that we don’t really have to convince clients of the quality and capabilities of our products and systems.”

While the tippler and the truck loading facility are the most significant of the recent awards to TAKRAF Africa, the company has also been awarded a contract to supply conveyors to a gold project in Guinea in West Africa. “We work across Africa and are currently involved in several countries on the continent, including Botswana, where we are supplying

two dynamic scrubbing units to a diamond mine, the DRC, where we are supplying our DELKOR Pinned Bed clarifier technology to a copper operation, and Tanzania, where we are responsible for a thickener upgrade at a gold mine,” says Späth. “In South Africa, we have recently received an order for a second apron feeder – with a capacity of 750 t/h – for a copper project.”

As Davies, who is responsible for TAKRAF Africa’s after-market support, points out, some of the current African work exemplifies the breadth of the company’s offering. “We’re not just about large mining and bulk material

TAKRAF’s apron feeders feature robust, heavy-duty frames with standard chains and rugged pans to provide extremely long service life.

Tenova TAKRAF Africa assists black-owned contractor

A small, black-owned erection and projects company, based in the predominantly rural South African province of Limpopo, has seen remarkable growth as a result of TAKRAF Africa’s corporate social responsibility interventions. The company is a sub-contractor on the largest materials handling project TAKRAF Africa has received to date, a lump-sum turnkey materials handling project for South Africa’s national power utility, Eskom.

In line with the South African Government’s Accelerated and Shared Growth Initiative and its own commitment to uplifting local communities and economies, TAKRAF Africa is optimising the use of resources from the surrounding area to assist in the

execution of this project. This major project covers contracts to provide the terrace handling system, the stockyard handling system and the limestone handling facility for the Kusile Power Station.

As a result of the support provided by TAKRAF Africa, which has facilitated its involvement in the Kusile project, the company has tripled its turnover in two years. The support has been wide ranging covering both financial, for example for the purchase of on-site generators, lifting gear and personal protection equipment, and non-financial aspects such as the provision of training, knowledge transfer and mentorship initiatives. ■



A DSI dry fog system reducing fugitive dust.

handling systems,” he says. “We also boast a specialised equipment product line, which includes pipe and chain conveyors, coal granulators, our well-known Bradford breakers and the DELKOR product range, as well as an air & environmental product range. This diverse product line has been one of our strengths through the recession, as there is a steady demand for this type of equipment even when there is an absence of large capital projects.”

As *Modern Mining* explained in an article on the company earlier this year (2016), TAKRAF Africa’s broad offering stems from its history as an amalgam of the Bateman Engineered Technologies (BET) and TAKRAF brands, which were brought together under ‘one roof’ over four years ago when Italian engineering group Tenova, which had already acquired Germany headquartered TAKRAF in 2007, purchased Bateman Engineering, a South African engineering company with roots dating back to the 1920s.

The Bradford breaker that Davies mentions has been a huge success for the company since being introduced to the local market in the 1970s. Although manufactured under licence from Terrasource Global in the US, it has been entirely adapted to the demands of the local

coal market and is a very different product to the American one.

TAKRAF Africa has invested considerably into R&D with a view to developing a semi-mobile version aimed at the junior coal mining market in particular. The new unit was unveiled less than a year ago and TAKRAF Africa is already able to announce their first sales – one machine to Overlooked Colliery and another to Black Wattle Colliery, both open-cast mines located in Mpumalanga.

The semi-mobile version of the Bradford breaker offers the benefits of the traditional breaker in a more compact machine. With affordability being a critical factor for junior and small miners, the design has been rationalised, without compromising on performance, with features such as a centralised lubrication system offered as an optional add-on.

Essentially a rotary breaker, the Bradford breaker consists of a large revolving cylindrical drum driven by an electric motor. As the drum rotates, lifters within the drum lift the lumps of material to a pre-determined height where they then drop, under gravity, onto screen plates and shatter along natural cleavage lines. The machine is easy to maintain and repair, as it is driven from one side only by a simple drive assembly.

Says Davies: “The Bradford breaker has become one of the mainstays of the South African coal mining industry and there is a substantial population of units, many of them dating back many years, operating in the Highveld coalfields.” He adds that the development of the breaker owes much to the feedback received from customers and notes that TAKRAF Africa is known for its willingness to listen to and engage with its customer base.

TAKRAF Africa has also experienced success with another relatively new addition to its product range – the dust suppression systems manufactured by US company, Dust Solutions Inc (DSI). These include dry fog agglomerative dust suppression systems, which use ultrasonic, air atomising nozzles, compressed air and plain water to produce a dry fog that agglomerates to airborne dust particles.

“We’ve received three orders for DSI systems over the past year, with the most recent – although it will be the first to be installed – being for a junior diamond mining operation in Limpopo Province. The product to fulfil this order has just arrived and we will be installing the system shortly,” says Späth.

“We believe the DSI range will do

Conveyor design promotes community involvement

With the need to maximise local employment opportunities in Africa, TAKRAF Africa has developed an innovative modular overland conveyor. It consists of concrete modules precast at the project site and fitted with idler frames and

brackets. These are easily and quickly placed into position, with no civil foundations required. As a result, the modular conveyor offers considerable potential to involve local communities in the erection of the system. ■

very well locally. The technology offers the driest form of dust suppression available and this is obviously advantageous in South Africa, where water consumption is an important issue. Moreover, there is no dependence on any chemicals, so the system is environmentally friendly. We see the main applications being at transfer points on conveyors, in crushing and screening plants, and at truck tips – but in essence, the system can be used wherever dust is being generated.”

While Späth is responsible for capital sales, Davies’ task is to provide the backup that customers rely on, and which is a main contributor to the high number of repeat orders that the company receives. “We are committed to providing first class backup to all our customers, whether they’re just around the corner in Mpumalanga or far to the north in Africa,” he says.

A long-time veteran of TAKRAF Africa, Davies says that the company’s strategy is to bring service support as close to its customers as possible. “We have a branch in Middelburg which looks after the coalfields and which is extremely busy at the moment because of the improved coal price, which has led to a sharp increase in coal mining activity. We also maintain a branch in the Northern Cape, which looks after the iron ore and manganese mines in the area, and at Langebaan in the Western Cape – which is our most recent branch to be established.”

Finally, what is TAKRAF Africa’s prognosis for 2017? “We’re entering the year with considerable momentum and we’re hoping we can maintain this,” Späth responds. “As to whether the mining industry has turned the corner, it’s difficult to say, as there are so many uncertainties both locally and globally which could impact on business conditions. Certainly, though, the prices of many commodities – for example, copper, iron ore and

Setting records in spares supply

Delivery is being completed of one of the largest spares to be ordered and manufactured by TAKRAF Africa, a top and bottom shell for a 60/109 primary gyratory crusher for Kumba Iron Ore’s Sishen mine in the Northern Cape.

TAKRAF Africa (then known as BET) supplied the 60/109 primary gyratory crusher to Sishen more than four decades ago. It has supported the crusher with spares since then, testimony to the long-term stability of the company, giving its clients the assurance that it will be able to support its products over their complete product lifecycles.

Since its installation at Sishen, the superior gyratory crusher has been setting milestones in the supply of spares. An eccentric phosphor-bronze bush, with a diameter of 1 m, a height of 2 m and a weight of 2,3 t, was supplied in 2004 and was, at the time, the largest phosphor-bronze component to be cast in Africa. ■



One of the largest spares to be ordered from and manufactured by TAKRAF Africa – a top and bottom shell for a 60/109 primary gyratory crusher for Sishen.

coal – have improved in recent months and, as a company, we’re very optimistic about prospects. We believe that 2017 should be a good year for us.” ■



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Drape mesh system provides rockfall protection at Rössing

Towards the end of 2015, Fairbrother Geotechnical Engineering approached Geobrugg to help them with a design solution at Rio Tinto's Rössing uranium mine near Swakopmund in Namibia. The request was to address the rockfall hazards on the wall above the Trolley 14 access ramp, an area of 110 m high by 270 m long. The solution adopted was a drape mesh system.

There had been a number of rockfall incidents reported over the years emanating from the western slope of the SJ pit with debris landing on the Trolley 14 access ramp. This ramp is one of the major arteries of the SJ pit and was designated as the main access for the life of mine.

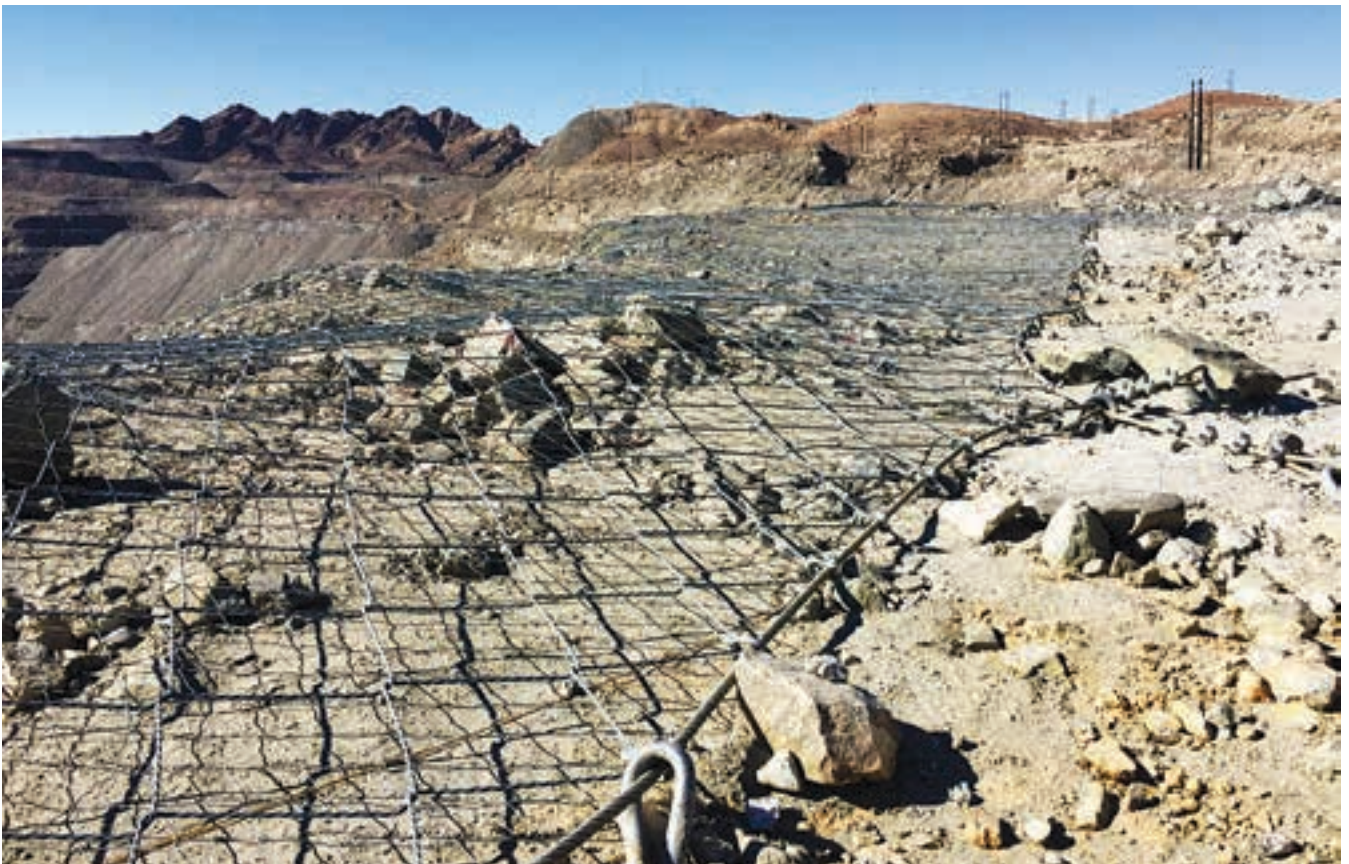
The slope above Trolley 14 was designed to be 15 m high benches with a 10 m catch bench; in most cases, however, the crest was

over-mined due to extensive blast damage caused within the sub-drill area. The resultant rock mass comprised a loose package of jointed blocks hanging along the crest of each bench face, which provided a source for rockfall. Temporary measures to mitigate the rockfall risk had been put in place by the mine but a long-term solution to the problem was required.

Geobrugg visited the site with Fairbrother Geotechnical Engineering and discussed the client's requirements. A drape mesh system was considered the most suitable system as it was the most cost effective and efficient, providing a long term solution to ensure that the trolley line is protected from rockfall and minimising the safety risks during installation.

The installation process was also a significant factor owing to the surface area under consideration, as well as the mine's requirement to keep the trolley line open for as much of the construction time as possible.

Anchor system for the drape mesh at the crest of the slope.



For that reason industrial rope access techniques were proposed to the mine with the additional sub-contract appointment of a specialist company, Alpinist Safety Consultants (ASC), with a track record of successfully and safely executing difficult drape system installations in the civil engineering market.

The Geobruigg Rockfall Drape design software was used to determine the most suitable and economical solution which resulted in a number of draping options being discussed and a solution negotiated with the client to fit the budget allocated for this slope. The final solution was a combination of 16 500 m² of QUAROX® rolled cable nets (3,9 m x 30 m per roll) overlaid by DELTAX® mesh (secondary).

The superior qualities of QUAROX rolled cable nets compared to conventional cable nets allowed for easier and more efficient installation. No extra work was required before unrolling down the slope which provided for a 30 % reduction in installation time. The QUAROX fits unobtrusively on the slopes and can be colored using powder coating to give it an even better visual appeal. The chain link construction of the cable nets offers much better force transmission than traditional connection by cross clip. Standard support ropes, seaming ropes and shackles are used for the installation.

This project was a first as the QUAROX Plus drape system had not previously been used in an application in the mining sector in Africa.

The installation of the draping system was managed by Fairbrother Geotechnical Engineering using their own employees and supplemented by seven rope access technicians (RATs) provided by ASC. The proximity of a haul road at the top of the slope allowed for the provision of track-mounted crawler rigs to install the anchor system for the drape mesh at the crest of the slope. This haul road further enabled Fairbrother to provide a more efficient service to the technicians by using a crane to lower the mesh panels into place before sending the RATs down the slope to fasten the panels into place.

Additionally, to assist the mine with its desired use of the trolley line, a 2 m high berm was constructed in the middle of the road as an exclusion barrier allowing for the trucks to continue hauling payload up the trolley line whilst the RATs installed the drape mesh.

Safety was of paramount importance to all the parties and was a non-negotiable on this project. The fast installation methods required that three self-contained teams of RATs work on the slope at the same time clipping the mesh panels together and it was vitally important that there was never a ‘crossover’ between the

The installation of the draping system was managed by Fairbrother Geotechnical Engineering using their own employees and supplemented by seven rope access technicians (RATs) provided by Alpinist Safety Consultants (ASC).



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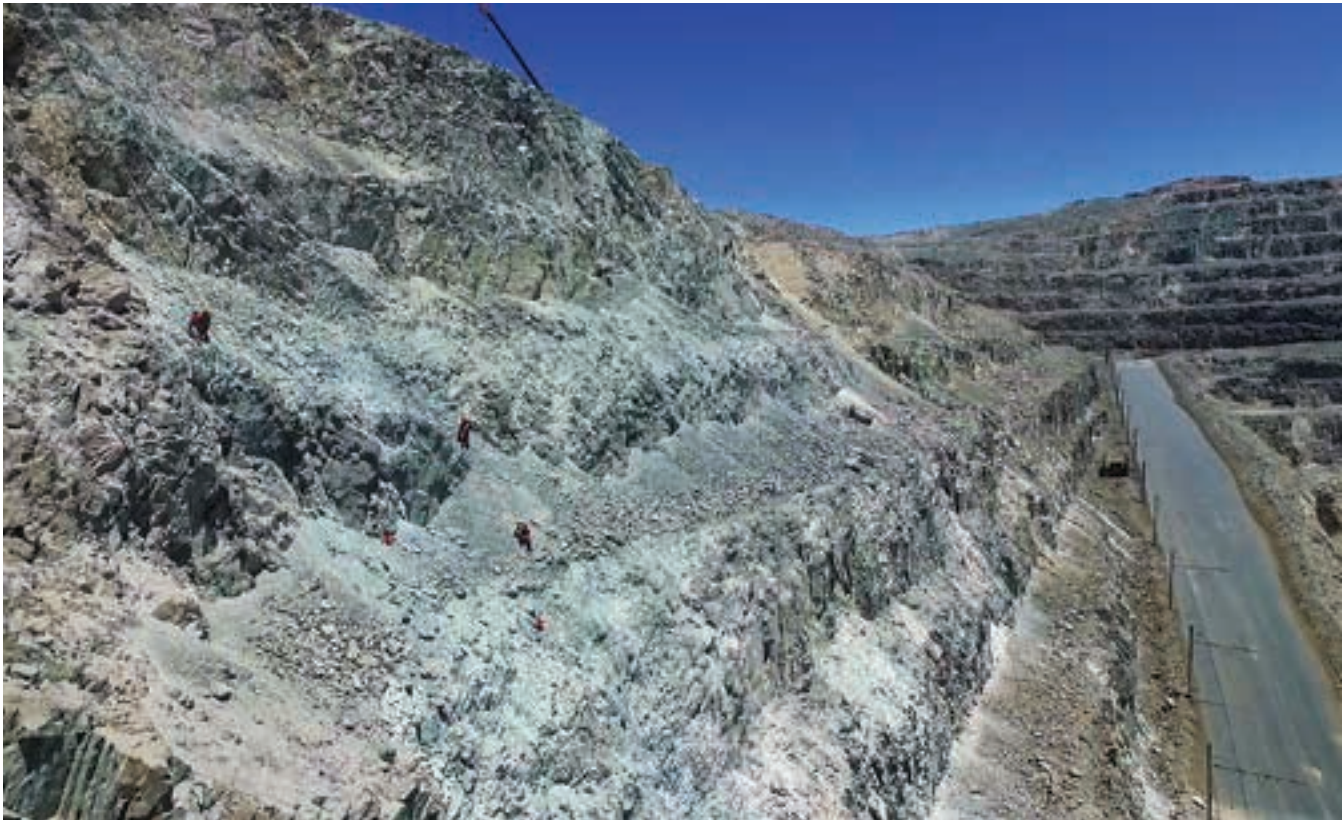
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teams. This aspect was difficult to monitor from the work slope as the visibility was restricted.

Towards the end of the project, a rockfall on the slope resulted in injury to a member of the RAT team. The accident further highlighted the need for such a rockfall protection system to be installed. The work was stopped and the client and Fairbrother had to review the monitoring of movement of the RAT teams on the slope. The client assisted Fairbrother by facilitating a spotter system on the opposite flank of the mine. The spotter was equipped with a high power telescope and was in constant radio contact with the RAT supervisor instructing him on the positions of the RAT teams along the face of the slope.

The project was initially awarded for the installation of 16 500 m² of QUAROX mesh

with an overlay of 4 000 m² of DELTAX but was later reviewed after Fairbrother Geotechnical Engineering deployed their company drone to inspect the bullnose area (a large outcrop of rock at the northern end of the installation). The drone survey revealed that there was unstable rock in this area that needed to be secured. The client subsequently instructed Fairbrother to order a further 3 800 m² of QUAROX and 4 500 m² of DELTAX mesh.

The project, valued at N\$8,5 million, was started in September 2015 and was successfully completed in March 2016. ■

Acknowledgement: The above project was one of the entries in the recent Best Projects Awards organised by 'Modern Mining's' sister magazine, 'Construction World'. The Awards are held annually. Our article is based on the submission made by Fairbrother Geotechnical for the Awards.

Installation of the drape mesh system in progress on the slope above the Trolley 14 access ramp.

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Innovative pre-sink gantry used on

Challenging the status quo in the mining industry is one of the characteristics that has allowed Murray & Roberts Cementation to develop innovative technologies aimed at enhancing safety and increasing efficiencies and productivity in this sector. The latest example of this approach has been the development of a pre-sink gantry used successfully during shaft-sinking operations at the Venetia diamond mine in Limpopo Province.

Development of new technologies by Murray & Roberts Cementation often involves taking best practice components of methodologies used in other industry sectors, such as civil engineering and tunnelling, and adapting these to produce new equipment and systems specifically for the mining sector.

Allan Widlake, Business Development Director at Murray & Roberts Cementation, says that to develop the pre-sink gantry the company leveraged its years of experience in shaft sinking.

This unique shaft-sinking methodology is engineered to deliver optimal safe working conditions and comprises a single rail-mounted gantry which combines the stage and kibble hoists as well as the blast barricade. The stage is

Murray & Roberts Cementation's unique shaft-sinking methodology is engineered to deliver optimal safe working conditions and comprises a single rail-mounted gantry which combines the stage and kibble hoists as well as the blast barricade.



suspended from the gantry on steel wire ropes attached to two 8-t stage winders on purpose-built platforms to the sides of the main girders.

Significantly contributing to the enhanced safety and productivity, man and material loading is handled on one side of the gantry with waste rock being dumped from the other side. "This is achieved with the gantry traversing between these two points," Widlake says.

The main hoist of the gantry, used for kibble hoisting and slinging, was custom engineered to allow a pre-sink of up to 80 m below the collar elevation. On the Venetia project an actual depth of 60 m below collar elevation was sunk.

The hoist is able to raise and lower a kibble with a 10-t payload at a conveyance speed of 0,5 m/s. The gantry system incorporates an automatic tipping frame. The kibble is slewed into its docking position where it is automatically positioned and hooked onto the frame. By lowering the hoist, the kibble's payload is discharged into a truck waiting below.

Widlake says that this system significantly reduces risk thereby enhancing safe working and it reduces tipping cycle times resulting in increased productivity.

The height of the gantry structure is matched to the height of the stage and this allows the stage to clear the collar once raised to its upper limit. Once the stage has been raised in this upper position, the long travel wheel drive motors are energised to move the gantry, complete with suspended stage, away from the shaft. The blast barricade is then drawn over the excavation and this effectively prevents fly rock from leaving the shaft barrel during blasting.

After blasting and clearing the shaft of the blast fumes by means of forced ventilation, the gantry rolls back to its position over the shaft, and the fully equipped stage is automatically aligned and positioned using a fully integrated PLC, and then lowered back into the shaft to the required depth.

An innovation which further facilitates productivity applies to projects where more than one shaft needs to be sunk. The pre-sink gantry offers the ability to pull itself along the rails between the first and second shaft positions.

"Being able to rapidly move from the one shaft to the second during the pre-sink phase

Venetia project

offers major time saving advantages and further reduces risk,” Widlake says. Traditionally, set up for a pre-sink can take between one to three months but with this innovative technology it is now possible to achieve this over as little as two to three days.

Further innovations on the pre-sink stage include integral mechanised drilling systems. These consist of six vertical drill rigs supported on swivel arms suspended under the stage. Each operator guides the drill and manoeuvres it to match the pattern of holes required for the blast. An in-line pneumatic air leg on the rock drill extends to create the necessary thrust between the stage and the floor and for drill retraction after drilling is completed.

“This technology has reduced the physical effort involved in the drilling operation and most importantly there are no longer any manual drill operators in the shaft bottom,” Widlake says.

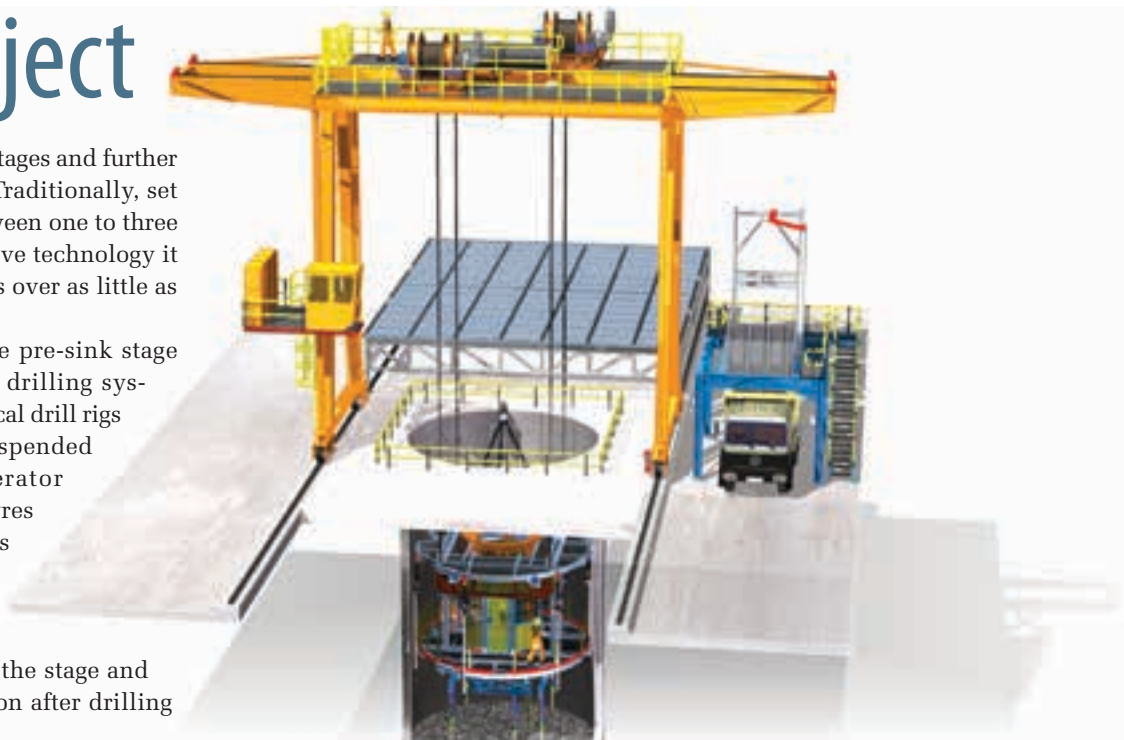
The shaft lining process has also been simplified. A proprietary shuttering system is now suspended from the sinking stage. The shutter depth is 6 m and after each 6 m excavation

the shutter is positioned 12 to 18 m above the shaft bottom. This means that the shutter can be left in position during drilling and blasting operations.

“Importantly, the pre-sink gantry was not engineered for a single project and it is able to handle shaft pre-sinks from 6 m diameter up to a large 10 m diameter shaft,” Widlake concludes. ■

Above: Man and material loading is handled on one side of the gantry with waste rock being dumped from the other side.

Below: This 21st century technology was successfully implemented at the Venetia project.



Developer promises a 'green'



Michelle Lawrence, Kropz's Technical Director.

A recent view of the processing plant at Elandsfontein.

Kropz, the private company behind the development of the R1,35 billion Elandsfontein phosphate mine near Saldanha Bay in the Western Cape, says that the project – which has been opposed by environmental groups – is being built to the highest standards and that fears that it will unduly impact on the sensitive West Coast environment are misplaced. Kropz's Technical Director, Michelle Lawrence, recently briefed members of the media in Johannesburg and said that the company would protect 15 hectares for every hectare disturbed over the life of mine.

Construction of the new mine is already well advanced, with commissioning expected in the first quarter of 2017. Once in production, it will produce between 1,2 and 1,5 Mt/a of rock concentrate with a grade of 32 % P_2O_5 and will provide at least 450 long-term jobs in an area where unemployment is rife. It will rank as one of only three producers of phosphate in South Africa, the others being Foskor in Phalaborwa, a 1,7 Mt/a producer, and the much smaller (40 000 t/a) Gecko phosphate mine on the West Coast.

The project is jointly owned by Kropz, with a 70 % stake, and African Rainbow Capital (ARC), which is a broad-based BEE investment company owned by Ubuntu-Botho Investments.

One of the directors of Kropz is Mike Nunn, a mining entrepreneur who at one stage of his career was closely involved in the mining of tanzanite in Tanzania through TanzaniteOne, a company he founded.

Lawrence, who is responsible for the technical and operational functions at Kropz, holds an honours degree in chemical engineering from the University of Cape Town and has been



approach at Elandsfontein



involved with the Elandsfontein project since mid-2013. She previously held various roles in the mining industry, including with Impala Platinum and DRA.

The Elandsfontein deposit – drilled and defined in the 1980s by Samancor – is a shallow sedimentary (as opposed to igneous) orebody and is reportedly the second largest phosphate resource in South Africa. A mining right application was submitted in December 2013 and it was granted in January 2015, with the Environmental Management Plan (EMP) being approved by the DMR the following month. According to Lawrence, more than 32 specialist studies were undertaken at a cost of R25 million in the development of the EMP. The Integrated Water Use Licence and the Atmospheric Emissions Licence are both still pending.

Construction of the mine access road started

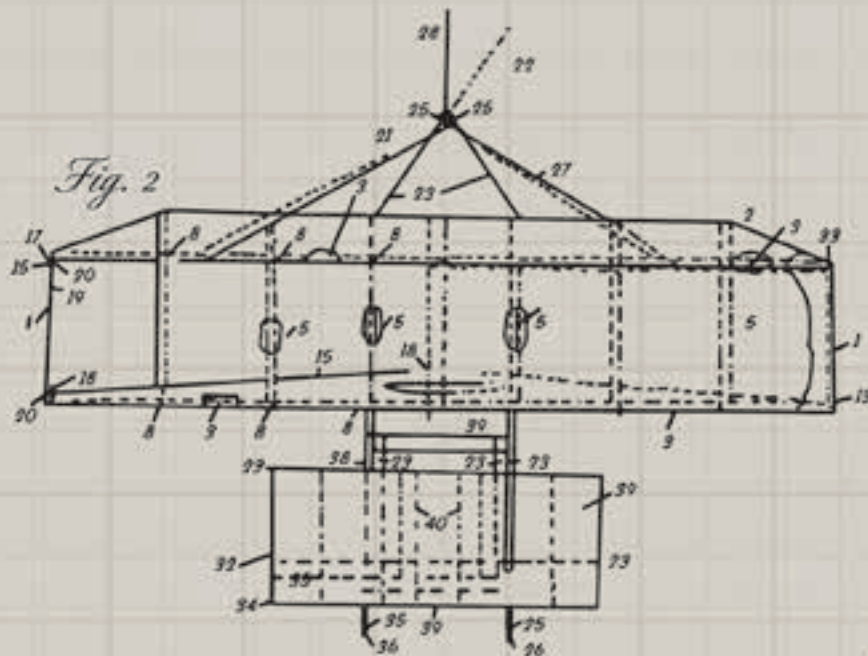
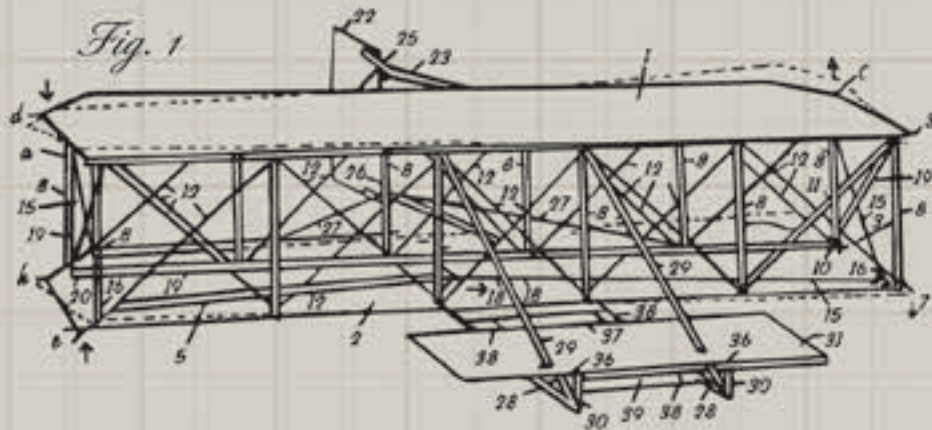
in February 2015 with civil construction getting underway in September 2015. Mining development began in August this year (2016). The EPCM contractor for the processing facility is DRA while the mining contractor is Trollope Mining Services. The running of the plant will be outsourced to Minopex, part of the DRA group. The construction of the mine has provided jobs for up to 1 025 people, almost half of them resident within the Saldanha Bay Municipality.

Detailing the measures being taken to ensure an environmentally friendly mining and processing operation at Elandsfontein, Lawrence said a key factor would be the employment of the roll-over mining method, whereby the mine would be excavated in 50 m wide strips with overburden from the new strip being placed back into the previously mined strip. At any

The mine office could be converted into a future tourism hub.

Environmentally friendly aquifer dewatering and recharge is planned. As shown below, water is pumped up from underground (A) before it reaches the deposit and is then transported above ground via a closed pipeline (B) to boreholes beyond the deposit, ensuring the water chemistry remains unchanged. It is then pumped back into the ground (C) to restore the water table to its natural level.





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one time, the open area of the mine excavation would be limited to 60 ha. She said a search for protected species would precede each stage of mining, with plants being removed to a nearby nursery for further propagation.

The process allows the land to recover during operations over the course of the project, with seedlings being established five months after placement. Lawrence also pointed out that the sandy nature of the deposit meant that it was free digging with no drilling or blasting being required.

Lawrence told the journalists at the media briefing that the processing route would upgrade the ore using size classification and flotation. The plant function, she said, was to separate silica and apatite with the silica being recovered via a reverse flotation process using a biodegradable collector – a departure from conventional phosphate flotation. She added that the plant tailings would be filtered for maximum water recovery, avoiding the need for a conventional tailings storage facility.

In order to access the ore, a portion of the Elandsfontein aquifer needs to be dewatered. Fears have been expressed by environmental groups that this process could ultimately affect the Langebaan Lagoon, which lies 15 km to the west of the deposit. Lawrence, however, was adamant that the mine would take care to ensure that fresh groundwater flowing towards the lagoon remained unaffected and said a groundwater monitoring programme was being put in place for continuous surveillance.

Water is pumped up from underground before it reaches the deposit, ensuring that the mining area remains dry and that the water does not come into contact with any

mining activities. The water is transported above ground via a closed, dedicated pipeline to boreholes beyond the deposit and is pumped back into the ground to restore the water table to its natural level.

According to Kropz, the land on which the project is located was previously zoned as agricultural land, and no communities or economic activities were displaced as part of the mine development. The project lies adjacent to a remote wilderness area of the West Coast National Park but – contrary to some reports – is not located in a buffer zone.

Elaborating on Elandsfontein's offset programme, Lawrence said that an initial 1 500 ha of offset land had been identified and secured and that further incremental acquisitions would take place over the life of mine (which is 15 years in phase 1). The final details would be agreed between Elandsfontein's management and SANParks.

The mine is also collaborating with Heritage Western Cape to protect the Elandsfontein Fossil Beds, which lie on a portion of the property and a full-time archaeology/palaeontology team has been appointed as part of the Heritage Management Plan.

Finally, Lawrence said that once operations finally ceased at Elandsfontein, there was potential for its facilities to form the basis of a tourism hub and she showed the journalists at the briefing a series of slides illustrating how the mine entrance had been designed with future tourism in mind and how the mine office could be converted into a visitor centre and the ROM stockpile tunnel into a future fossil museum.

Photos courtesy of Kropz

It is intended that the ROM stockpile tunnel could ultimately become a fossil museum.

Plant tailings will be filtered for maximum water recovery, avoiding the need for a conventional tailings storage facility.

A string of new contracts boosts

*ELB Engineering Services (ELB), part of the JSE-listed ELB Group Limited, has reinforced its reputation as a leading provider of bulk materials handling and mineral processing solutions, with a number of recent contract awards which are collectively worth several billion rand and which guarantee it a healthy workload for at least the next two years. **Modern Mining** recently spoke to Dr Stephen Meijers, CEO of ELB Engineering Services, about the company's extraordinary run of success.*



Dr Stephen Meijers (right), CEO of ELB Engineering Services, with Alistair McKay, Business Development Executive: Africa.

The biggest of the new contracts is for the provision of Engineering, Procurement and Construction (EPC) services to Black Mountain Mining (BMM), the Vedanta Zinc subsidiary which is developing the US\$400 million Gamsberg zinc project near Aggeneyns in the Northern Cape. The project involves the establishment of an open-pit mine at Gamsberg, as well as a 4 Mt/a zinc concentrator plant and associated infrastructure, including bulk water and power supplies. ELB will essentially be responsible for building the concentrator and the water and power infrastructure and anticipates being on site for around 20 months.

Meijers describes the contract as a 'company



changer' and says it is the culmination of many months of hard work by ELB in close collaboration with the BMM/Vedanta team. "Gamsberg is one of the biggest 'greenfield' mining projects currently underway in Southern Africa and we're very excited to be part of it and playing such a pivotal role," he says. "We won the contract – which consists of three separate work packages – in the face of intense competition and it will certainly rank as one of the biggest beneficiation engineering projects we've ever undertaken."

He adds that the process plant will incorporate cutting-edge staged flotation reactor technology from Canada's Woodgrove Technologies, a company with whom ELB has a long-standing co-operation agreement, and that it will also be assisted in the execution of the contract by another international partner, ENFI, one of China's leading engineering companies operating in the non-ferrous metals field.

ELB's participation in Gamsberg will be through its Engineered Technologies division, which specialises in the design and construction of process plants and supporting infrastructure. "We set up this division several years ago in order to diversify our service offering and it's been a real success," says Meijers. "So far we've operated mainly in coal, chrome, manganese

ELB's order book



companies in South Africa supplying plants of this type.”

The two other divisions within ELB are Bulk Materials Handling, traditionally the backbone of the company, and Industrial Projects, which offers turnkey solutions to the industrial sector and whose expertise includes fine powder handling, air pollution control and small-scale power plants.

A second contract in the mining field secured by ELB encompasses the life extension of the Cullinan portal reclaimer scraper at the Cullinan diamond mine of Petra Diamonds near Pretoria. The focus of the life extension improvements will be on safety and production and will allow the machine to operate at a higher availability and capability level.

ELB's scope of supply for this project includes a combination of repair work and replacement of equipment which will include the design and engineering services for the supply of all mechanical, structural, electrical, instrumentation and control

and iron ore, although our expertise covers all metals and minerals, and we've recently built 11 DMS plants, making us one of the leading

Left: ELB Engineering has recently been awarded a contract for the life extension of the portal reclaimer scraper at the Cullinan diamond mine of Petra Diamonds near Pretoria.

Below: A 10 000 tonne/day concentrator designed and built by ENFI, one of ELB Engineering's international partners.



feature



A Rapid Train Loading Station (RTLS) is being provided at Assmang's Black Rock Mining Operations (BRMO).

equipment/materials, as well as the associated installation on site.

Further north in Zimbabwe, ELB has been awarded a contract by PPC Zimbabwe for the upgrade of the clinker loading facilities at Colleen Bawn in Matabeleland South. ELB's responsibilities include the design, procurement, delivery, installation and management of all the elements of the upgrade, which is designed to reduce the excessively high dust volumes generated during the process of loading rail wagons and to achieve a quicker turnaround time of the complete rake.

The dust volumes will be reduced by innovative design around the integration of the de-dusting unit with the bulk loading head while the increased loading rate will be achieved by the interface between the feed conveyor, weigh flask and loading head configuration.

Whilst ELB has had a long involvement in executing projects in Africa, a recent contract will be taking it to Ghana, where it has

never worked before. Says Meijers: "We've been appointed to undertake the Front End Engineering and Design (FEED) for the 27,1 km single-flight overland conveyor forming part of the Phase 2A project at Asanko's flagship operation, the Asanko gold mine. The capacity is 1 200 t/h and the installed power will be 2,8 MW. We'll be working with our American technology partner, Conveyor Dynamics Inc (CDI), one of the world's leaders in the dynamic analysis and design of bulk materials handling systems."

In executing all its new contracts, ELB will be relying to a large extent on its in-house resources. "In 2012 we established ELB Construction (ELBCON) as our construction arm and this has been a game-changer for us, allowing much better control over costs and project execution," says Meijers. "ELBCON has a full structural, mechanical and piping capability although we still have to contract in the necessary building and civils skills. In addition, we are now self-sufficient in electrical and instrumentation work following our acquisition of B&W Instrumentation & Electrical in 2014, without question one of the leading companies operating in this field in Africa."

Giving a round-up of some of ELB's other current contracts, Meijers says the company is still on site at Eskom's new Medupi Power Station near Lephalale, where it has been active since 2011. "Medupi has been a flagship project for us, with the heart of our work being the provision of coal and ash handling facilities," he says.

ELB is also busy at Black Rock Mine Operations near Hotazel in the Northern Cape, which is operated by Assmang Limited, which is jointly owned by African Rainbow Minerals Limited and Assore Limited.

"At Black Rock Mine Operations, we're providing a Rapid Train Loading Station (RTLS) for the Nchwaning mine, an associated 518 m feed conveyor, as well as two product stackers. Our RTLS technology is amongst the best in the world and the facility at Black Rock will be able to meet Transnet quick loading requirements."

Across border, ELB is working at a diamond mine in Botswana and is also undertaking a shiploader upgrade in Mozambique.

Finally, and reflecting on ELB's successes, Meijers says it is amazing what a difference just a few months can make. "When 2016 opened, we were feeling the effects of the recession in mining and were forced to cut our overheads drastically," he observes. "We achieved this in part by cutting the salaries of everyone in the company, including management, a move



which was overwhelmingly endorsed by our staff when it was put to a vote – the alternative being retrenchments. This enabled us to keep our experienced and highly committed team together, a decision which has now been

justified by our recent run of successes. So we're ending the year feeling confident and are very much looking forward to our involvement in Gamsberg, Asanko and our other recently awarded contracts." ■

ELB Engineering has been working at the Medupi Power Station site near Lephalale since 2011.

feature

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Reducing maintenance on chute systems is simple

Transfer points do not need to be high maintenance areas on a mine anymore. This is the view of Mark Baller, Managing Director of Weba Chute Systems, who says the solution to reducing maintenance costs on transfer points is simple.

More often than not, says Baller, this issue is addressed by looking at new materials handling solutions including the use of sophisticated lining composite materials which can be extremely expensive. “The solution does not have to be as complicated as this and, as soon as engineers realise this, the closer they will be to saving money on their maintenance budget,” he states.

Baller explains that the Weba Chute System is not an alternative to conventional chute systems. “It is, in fact, a completely different engineered approach with a ‘supertube’ or ‘cascade’ scenario with 95 % of the material running on material at the same time.

“Some engineers may be familiar with the term ‘boundary layer’ which is used in aero and fluid dynamics. Study of this phenomenon shows that when a boundary layer is in place friction can be reduced by up to 30 %,” he says.

When viewed in slow motion, it becomes apparent that the particles close to the surface actually move in a tumbling motion and are, in fact, moving slower than the main flow of material. Baller explains that sliding particles moving at higher velocities cause extensive wear, while those that tumble at a lower velocity cause far less wear.

“Controlling the material’s movement down the transfer point is only the first step,” Baller says. “By changing the angle of the transfer point, the material can be controlled from its entry into the chute right up until the point of discharge.”

This optimal control of the material during its journey through the transfer point not only reduces wear but can eliminate spillage. Spillage can be a major cost issue both in terms of waste and when it comes to cleaning



up the area around the transfer point.

Baller says that on a new transfer point it is actually possible to completely eliminate spillage, and on projects where Weba Chute Systems are retrofitted into existing installations it is possible to significantly reduce the spillage. This also results in substantial savings for the mine.

Weba Chute Systems currently services six different continents, mainly from its South Africa manufacturing facility, and has distributors and agents in most regions. The company holds ISO 9001:2008 accreditation and quality manufacture forms an important part of the process. ■

The Weba Chute System is not an alternative to conventional chute systems; it is a completely different engineered approach.



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No spillage conveyor system from Tega

Mine processing solutions provider Tega Industries has released an efficient new skirt sealing system to prevent spillage at transfer points or in areas where spills may occur due to the angle of the conveyor or any other factors.

The unique modular block arrangement of Tega's Spill-Ex system allows for individual blocks to be adjusted to fit the contour of the belt and create a snug fit against the belt. Due to the special soft compound material used in the design of Spill-Ex, the system will conform to the shape of the belt without causing any damage. This allows the system to create a completely spill-free seal.

Spill-Ex also provides continuous adjustment by means of serrated clamps and a screw fastening system which allows individual blocks to be moved up and down over the backing plate in accordance with the contour of the belt. As wear occurs, the blocks can simply be lowered by adjusting the bolts so that the gap that was created due to wear and tear between the assembly of blocks and the conveyor can be sealed.

According to Tega MD Fernando Monteiro, when material falls onto a belt it remains agitated and needs to be guided along a certain distance until it is stabilised. Traditional skirts only provide a partial seal and this can lead to tons of wastage of valuable commodities at transfer points.

"The most exciting news is that Spill-Ex can be easily retrofitted to most conveyors. It is simple to install and maintain and can deliver a rapid return on investment in situations where spillages can occur regularly. There is no limit to its application and it can be used on all bulk materials handling projects almost regardless of

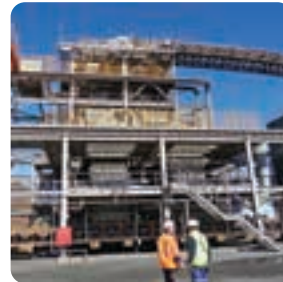
materials being transported," he says.

Based in Brakpan, Tega supplies a range of products to the minerals processing industry, including mill linings, screen panels, trommels and hydrocyclones.

Its range of conveyor components includes ceramic pulley lagging, which is especially suited for pulleys where slippage and excessive wear and tear problems make normal rubber lagging ineffective, and the Tega Friflo impact pad. ■



Fernando Monteiro, Tega's Managing Director.



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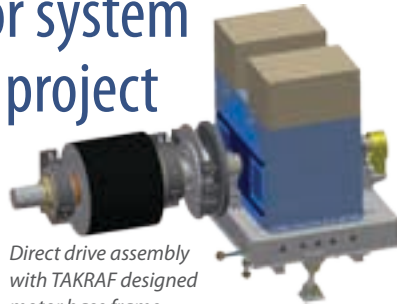
Powerful conveyor system ordered for copper project

TAKRAF, an integrated solutions provider to the global mining, materials handling and minerals processing industries, has recently been awarded the supply of the principal ore transportation system for the Chuquicamata underground mine project by Chile's state-owned copper mining company, CODELCO – the world's leading copper producer.

Chuquicamata is one of the largest open-pit copper mines and the second deepest open-pit mine in the world and is located 1 650 km north of Santiago, Chile. The mine, popularly referred to as 'Chuqui', has been operating since 1910. The underground mine project is being developed to access the orebody situated beneath the present open-pit mine and aims to extend mining operations for a further 40 years. The new mine is scheduled to be in operation in 2019.

TAKRAF's belt conveyor system will overcome a number of technical challenges including the significant elevation change from the underground mine to the surface and will comprise a variety of uphill tunnel conveyors that transport copper ore from underground storage bins. The system will also include a number of feeder conveyors as well as an overland conveyor feeding into the existing conveying system.

The conveyor system will be installed with advanced gearless drive technology with the uphill tunnel conveyors having the highest drive power ever to be installed on a belt conveyor. Total installed drive power for the entire system will be around 55 MW. Gearless drives eliminate the need for a gearbox, thereby significantly reducing the number of main wear parts. This results in increased efficiency and reliability, as well as less maintenance being required. Further advantages include a considerable reduction in the drive system's



Direct drive assembly with TAKRAF designed motor base frame.

footprint and the amount of instrumentation required.

Safety, as well as the ease and speed of maintenance, are critical success factors for a project of this nature. TAKRAF's innovative chute maintenance solution will allow for all regular chute maintenance to be conducted from outside the chute.

Another significant achievement will be the installation of a newly developed steel cord belt, ST10000, on the uphill tunnel conveyors. This will mark the world's very first conveyor system to employ this premier steel cord belt technology.

The conveyor system will boast a design capacity of more than 10 000 t/h and, in order to manage and dissipate the intense heat generated by the system, a complex cooling system has been included in the project scope, which requires that no heat be dissipated to the underground environment. TAKRAF's total scope includes a variety of engineering disciplines, as well as the supply of various components and extensive site assistance.

"This order is another significant milestone for TAKRAF in the Chilean copper industry and we look forward to supporting CODELCO in their aim of being the world's leading supplier of copper," says Dr Frank Hubrich, TAKRAF's CEO. "Our industry-leading conveying technology and proprietary material handling equipment are widely used by customers around the world. Our customers are increasingly demanding innovative and cost-effective solutions to global issues as ore reserves are depleted and mines are required to dig deeper." ■

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Zest Energy plant will power Balama project

The remote operation to mine one of the world's largest finds of high grade graphite – the Balama deposit in Mozambique – will be powered by a generator plant being constructed through South Africa-based Zest Energy, part of the Zest WEG Group.

According to Alastair Gerrard, MD of Zest Energy, the plant will begin producing electricity during the first quarter of 2017, with an initial capacity of 12,5 MW from an installation of seven 2 200 kW diesel generators.

"The isolated location of the Balama mine – over 250 km west of Pemba in northern Mozambique – means that while the operation does have access to power from the national grid this will need to be supplemented to ensure an adequate supply for full plant demand," Gerrard says. "We

are therefore required by the customer to ensure 100 % availability, and have consequently designed the plant with substantial standby capacity to allow for maintenance and repairs without affecting the continuous supply."

He says the plant, which is the largest footprint project yet tackled by Zest Energy, will initially run with seven 2 200 kW generators – six running and one on standby – and will later be expanded to include eleven generators, of which two will be standby units.

Equipment for the extensive scope of supply has been sourced from various companies within the Zest WEG Group, locally and worldwide. The containerised power generators include WEG alternators with automatic voltage regulation systems, as well as motorised louvres, generator auxiliary systems, and fuel and lube tanks.

To cool the engines, a horizontal-type radiator system, rated for 50°C ambient temperature, was manufactured in South Africa and each radiator includes 10 WEG 3 kW fan motors positioned in two cooling banks of five fans each.

"One of the challenges of the mine environment is the presence of graphite dust, which is highly conductive and must not be allowed to enter the power generation units," Gerrard says. "For this reason, a filter system was designed that could accommodate the high volumes of moving air

required to cool the engines, while also requiring as little maintenance as possible."

Once again, a local solution was designed, in the form of a custom-engineered, self-cleaning cartridge type ventilation and pressurisation fan unit, comprising four WEG 7,5 kW fan motors.

To feed diesel to the generators, Zest Energy will install a 30 000 litre intermediate fuel tank to draw from the customer's bulk fuel storage system with a duplex fuel filtration and circulation system, as well as all interconnecting piping, valves, pumps and fittings within the power plant area.

A local fuel connection point within the plant area will also be installed as a contingency, should bulk fuel supply not be available. To comply with environmental regulations, a bunded fuel and oil area will be constructed, with an oil-water separation system.

"There are also various systems we will provide for plant auxiliary power requirements and for plant earthing and lightning protection, as well as cabling, terminations, racking and supports to all plant electrical equipment," Gerrard says. "Through our member companies in the Zest WEG Group, we are able to give our customer a single point of contact for the range of services we are providing, while project managing and quality controlling every aspect of the power plant."

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



The custom engineered diesel generator set solution for Syrah Resources' Balama graphite project.

MICROMINE releases latest version of Pitram

MICROMINE has announced the release of Pitram 2015 Version 4.6, its underground fleet management and mine control solution.

Pitram 4.6 includes many new and enhanced features which have been designed to further assist both surface and underground operations to reduce costs, increase productivity and improve safety.

Pitram is now able to generate measure events from drillhole data which is obtained directly from the mobile device fitted to the drill rig. As these files are loaded, Pitram Mobile generates a series of events that reflect the initial design data. The drill data file is subsequently updated when drilling is undertaken.

In the case of a Carlson drill rig, a .drl file is created which contains design infor-

mation plus the 'actuals' recorded during drilling.

"Pitram Mobile is able to detect these file updates and generate further measure events, length drilled and penetration for the holes drilled for real time accuracy," says Michael Layng, COO of MICROMINE.

In Data Acquisition, when a fired cut is entered against a location, the cut length is now derived directly from the jumbo that drilled the cut. The Location Measures dialog within Pitram has been enhanced to support the recording of 'metres advanced' derived from the drilled metres at a location.

A location status column has been added, including the ability to define a colour for each status for ease and simplicity of use. In addition, a last recorded measure column has been added which is

populated directly from the Business Model Server (BMS) without the need to access the Reporting database for added efficiency.

A reversing camera and wiring harness is now available as an option. The camera image is displayed on the screen of the TREK-773 in place of the Pitram Mobile screen graphics. The camera image can be displayed automatically when reverse gear is selected, or manually selected at any time by the vehicle operator pressing a function key to increase safety throughout the mine site. The camera has mirror and normal image modes.

Pitram can be configured to the exact needs of any operation at any stage of the mining process. A variety of data capture and integration methods allows the solution to operate with or without a central control room.

MICROMINE, website: www.micromine.com

Workshop cranes installed at coal mine

Three high capacity double-girder overhead travelling workshop cranes, completed on schedule for Exxaro and installed recently at Grootegeluk coal mine in North West Province, are undergoing commissioning trials.

The three cranes, ordered to assist with large vehicle maintenance, were manufactured by Condra on behalf of East Rand Cranes, the company's authorised distributor for North West Province. East Rand Cranes secured the R7-million-plus contract in April.

Two of the cranes are identical 18,4-m span 50/20-ton machines fitted with variable frequency drives on the main hoists to facilitate precise positioning of very heavy loads. Exxaro's third crane, also with a span of 18,4 m, has one 20-ton hoist.

Design of all three cranes was described by a Condra spokesman as "standard", although they feature live-axle drives across their design in place of the more common ring-gear configuration, part of

Condra's mandate to keep maintenance costs to a minimum.

Other non-standard elements of the Exxaro contract include special LED lighting, limit switches on the long-travels and cross-travels, and armoured cable on all wiring.

East Rand Cranes is thought to have won the Exxaro order because of a combination of competitive pricing, machine durability, after sales service and Condra's ability to meet short lead times.

Although competitors for this contract included companies from Europe and China, they were not able to overcome East Rand Cranes' record of very high levels of on-site after sales service, and Condra's ability to manufacture on short notice.

"We have developed manufacturing techniques over the past 50 years that enable us to fast-track production and accommodate the tight deadlines that today's global markets often demand," commented Condra's MD, Marc Kleiner.



One of the three cranes for Grootegeluk undergoing load testing at Condra's Germiston factory.

"We also pursue a market-imposed mandate to continuously drive down machine maintenance costs, which is why we offer live-axle drives.

"Our gearboxes were up-rated some years back to deliver additional power, and the company today uses a 36B case-hardened material on most pinions. This material, though expensive, is beneficial in extending crane lifespan.

"Additionally, we fit our hoists wherever possible with high tensile-strength ropes to reduce rope diameter and enable a reduction in drum diameter and a smaller gearbox and motor."

Condra, tel (+27 11) 776-6000

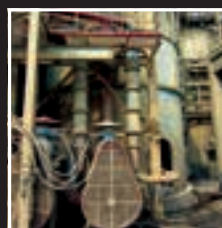
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M&C refurbishes rotor poles for platinum mine

The ability to implement enhancements during the repair or refurbishment of critical electrical rotating machinery is a major advantage to end users. Marthinusen & Coutts (M&C), a division of ACTOM (Pty) Ltd, has established a strong reference base and reputation for this, with a recent project showcasing this capability being the rewind and refurbishment of three gearless mill drive rotor poles for a platinum mine in North West Province.

The enormous 17,5 MW, 4 220 V, 12 rpm, 5,8 Hz grinding mill motors, which are 15 m in diameter, are driven by cyclo-

converters which supply the motors with a variable frequency to control their torque and also allow the speed to be controlled for optimum metallurgical processing.

Rob Melaia, Engineering and Technical Executive at Marthinusen & Coutts, says that these are among the most critical large special high profile motors in the world. Interestingly, there are only two OEMs worldwide that manufacture these enormous machines which have an assembled mass of 1 000 tons each.

"The rotor poles were subjected to overheating due to an operational error, and we were approached by the mine to assist," Melaia says. "While this contract could be seen as a simple procedure, we believe it is the immediate access to a large local service provider with OEM capabilities and backup that led the customer to award the contract to Marthinusen & Coutts instead of to the international OEM.

"It is always critical for operations to have this level of support available, providing skilled technical assistance with very quick response times," he adds.

The removal of the poles required a two-day shutdown during which time Marthinusen & Coutts assisted the mine

maintenance personnel with this task. The poles were delivered to Marthinusen & Coutts' Cleveland facility where thorough investigative work was undertaken on the defective poles to determine the extent of the damage caused by the overheating.

"The second part of this activity was to investigate the best method to improve and partially rectify the surface insulation of the remaining poles of which there are 60 in total," says David Motloung, Design Engineer at Marthinusen & Coutts.

Marthinusen & Coutts made use of a two-part epoxy spray treatment and repeated insulation resistance tests under extremely wet coil conditions.

This was to simulate the worst case conditions on site with the ultimate purpose of evaluating a method devised by Marthinusen & Coutts to improve the insulation of the remaining poles still fitted to the machine. "This solution can be implemented in-situ, negating the need to remove the poles to improve the insulation," Motloung explains.

Motloung says that after studying the design of the pole coil it was decided to use a different conductor for the rewind as this would increase the insulation integrity. Marthinusen & Coutts conducted detailed investigations and extensive tests, especially in terms of heat dissipation with the thicker insulation on the coils.

Test results confirmed that the thicker coil insulation did not cause it to run at a higher temperature due to the reduced heat transfer, and there was a negligible impact from the reduced copper cross sectional area.

Upon the successful completion of the first coil, Marthinusen & Coutts was awarded the order for another two severely overheated coils. This was secured despite the pressure applied by the international OEM on the end user, who did not believe that a local service provider would be able to implement a quality refurbishment.

"The end user's decision to award the additional rewind and refurbishment work to Marthinusen & Coutts is testimony to the trust in Marthinusen & Coutts which is due to providing innovative, high quality, technologically sound solutions for all the mine's rotating machinery over many years," Melaia says.

Marthinusen & Coutts, tel (+27 11) 607-1700



Marthinusen & Coutts' David Motloung records photographic evidence of tests on one of the enormous gearless mill drive rotor poles recently refurbished by the company.

Sandvik to support NFC Africa at Chambishi

Sandvik Mining and Rock Technology has entered into a long-term agreement with NFC Africa Mining Plc (NFC) to supply the necessary equipment and skills to effectively mine the lucrative South East Ore Body (SEOB) of the Chambishi copper mine in Zambia.

The four-year agreement will see the mine receiving a comprehensive solution that will include automation of the mine, equipment, services, training and Sandvik's unique Trans4Mine optimisation programme.

Sandvik will begin to supply NFC with a complete suite of mining equipment to successfully mine the SEOB in March 2017 with the contract running through to 2020.

"We believe this is just the start of a bright partnership with NFC and its mother-company, China Nonferrous Metal Mining Co Ltd," says Daniel Banister, Sales Area Manager for Central Africa at Sandvik Mining and Rock Technology. "Our investment in increasing the competence of our personnel is clearly paying dividends as

we have the right people and products to support even the largest operations in the Central African region. It certainly paves the way for future similar successful partnerships with other mines in the region."

During the signing ceremony held at the mine recently, NFC's Senior Deputy Chief Executive Officer, Donghong Zhang, affirmed the good working relationship that exists between the companies, adding that since the project started in 2012 Sandvik had shown tremendous support and commitment.

He also commended the company on its ability to leverage its local and international expertise to find solutions for the Chambishi mine.

"A project of this nature underscores Sandvik Zambia's ability as a full-fledged solution provider, rather than just being a product-driven company," Zhang says. "This is just the kind of company that NFC needs to be doing business with in the future."

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

Mahle filter range available from BMG

BMG says that its fluid technology filtration solutions focus on the prevention and control of contamination of water and particulate to ensure optimum performance, improved reliability and extended service life of machinery, equipment and vehicles.

"The company's extensive range of quality branded filtration systems is supported by engineering solutions and technical services to ensure fluids – including oil, fuel and lubricant oil – are within the required cleanliness standards," says BMG's Steven Louw. "BMG recognises the importance of following international filtration trends, including compliance with ISO4406 cleanliness specifications for fuels and oils."

Mahle industrial filtration products – available in Southern Africa exclusively from BMG – are designed especially for machine manufacturers and operators of mobile and stationary hydraulic equipment.

This range includes Mahle Duplex filters, with a patented single-hand operation design and leakage-free switching of media flow.

The multi-layered design of these filter elements offers high differential stability and a large dirt-holding capacity to provide constant filtration performance and maximum protection in diverse applications, even under pulsating loads.

These modular systems, which can be used as in-line filters and tank-fitted return filters, have an optimal flow design for improved pressure differential stability. Maintenance work, including the replacement of elements, can be carried out without suspending production.

Duplex filters comprise two filter housings which can be switched on and off interactively during operation via a change-over unit in the filter head, with no disruption to filtration.

An ergonomically designed switch-over lever enables three functions to be performed with one hand. When the lever is activated, a pressure equalisation valve opens, ensuring an equal pressure level in both filter chambers. The filter can be switched from one filter chamber to the other, without having to shut down the system. A safety lock secures the lever and prevents inadvertent switching.

Visual electrical and electronic maintenance indicators ensure optimum utilisation of the dirt-holding capacity of filter elements and also clearly indicate features such as clogging to simplify maintenance procedures.

Mahle has further improved its range of Premium Select elements – now known as Premium Select Plus. Features of this new generation include an increased dirt-holding capacity and an element design that is resistant to pressure impulses.

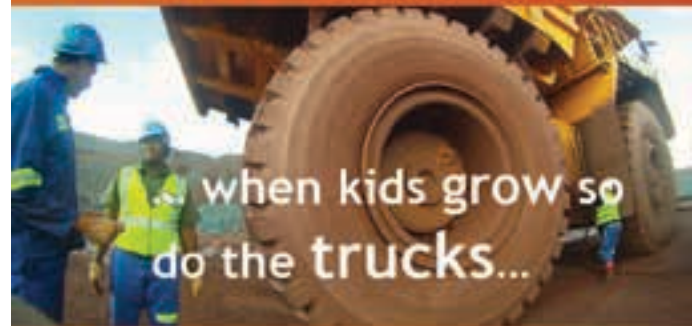
Steve Louw, BMG, tel (+27 11) 620-1607



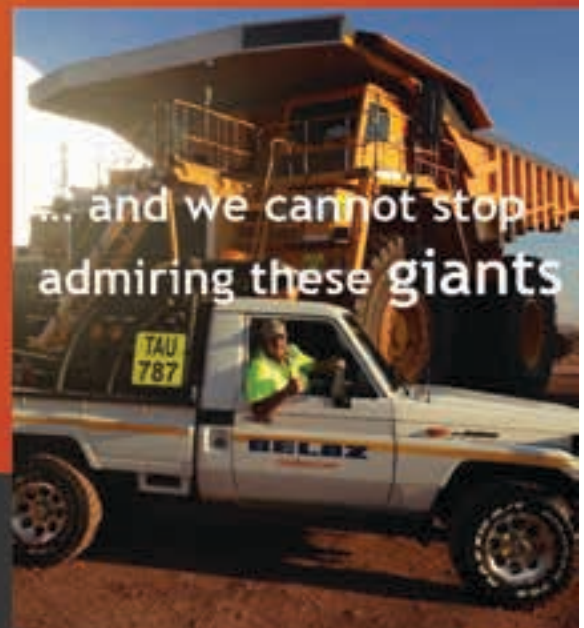
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Kwatani puts exciter quality to the test

Assuring customers of the quality and reliability of Kwatani's locally manufactured exciter gearboxes means testing them at full load before they leave the company's workshop. This is according to Kenny Mayhew-Ridgers, General Manager Engineering at Kwatani.

"As the designer and manufacturer of these products, we want to be sure there are no issues with the running temperatures, oil cooling and noise emissions," he says. "The only way to do that confidently is by applying the load that the machine will be subject to during its lifespan on site."

Kwatani, previously known as Joest Kwatani, has operated in South Africa for more than four decades and is known for its vibrating screens and feeders, drives, controllers, conveyor feeders and dry-

ers. The company also leads the field in terms of the sheer size of its exciters. For this reason, the facilities for testing these large units – located at Kwatani's Spartan premises near Johannesburg – are similarly above-average in scale.

"Our largest exciter can displace 20 tonnes with 10 mm movement – so this needs a strong, heavy frame," says Mayhew-Ridgers. "We designed a full-scale test rig so the gearbox can endure a full load on its bearings, and it must withstand this without generating undue noise or heat."

To ensure that the vibrations do not carry into Kwatani's test building, the rig is placed on a secure sub-frame to dampen the movement and dynamics to the floor.

"We also put the rig at an angle, because it is important to test the oil flow in the position in which the unit is going to be



To ensure that the vibrations do not carry into Kwatani's test building, the rig is placed on a secure sub-frame to dampen the movement and dynamics to the floor.

used – to make sure there are no oil leaks," he says. "We have spent many research and development hours on fluid dynamics to simulate the flow of oil inside the exciter gearboxes, leading to some very rewarding solutions."

He believes that after almost two years of full-load testing, Kwatani leads the industry in terms of the way it tests exciters. "We build the exciters ourselves – everything except the bearings – and use a highly qualified consultant and specialised foundry to ensure the best quality castings for our exciter housings."

The other advantage of Kwatani's facility is that a variable speed drive (VSD) has been connected to specialised monitoring software, allowing experiments to be conducted on the gearbox at various speeds. This checks whether there are any critical or 'natural' frequencies created by rotating equipment and records important aspects

Mining hose launched by ContiTech

ContiTech recently launched its new CONTI®ULTIMATE mining hose system. It is a heavy-duty, abrasion-resistant suction and discharge hose that is designed to provide flexibility in mining and mineral processing applications, including the transportation of sand, gravel and slurries.

The durable mining hose system includes the high-tensile hose, reusable couplings, gaskets and flanges, as well as ContiTech's new hose condition monitoring wear indicator, Conti Orange.

The Conti Orange wear indicator, placed directly beneath the hose's textile reinforcement layer, continuously monitors the wear of the hose's abrasion-resistant NR compound lining to prevent unexpected production breakdowns.

Along with the specially designed liner,

the hose features high-tensile textile reinforcement with an embedded steel helix to provide durability as well as flexibility with its small bend radius while the UV, ozone and abrasion-resistant IB/BR cover enables it to withstand harsh operating conditions associated with mining and mineral processing.

In addition, the hose system features a specialised high-strength, aluminium alloy flange that is designed to have no contact with transferred medium, ultimately reducing wear and providing a smoother medium flow.

Lynne Dunn, ContiTech, tel (+27 11) 248-9444, e-mail: Lynne.Dunn@contitech.co.za



of operation such as the torque generated.

"This also makes it possible to become much more accurate when specifying components like drive motors – where we can specify size and capacity in a more scientific way," states Mayhew-Ridgers. "We might find, for instance, that a smaller motor will start the motion just as well as a larger unit allowing a saving on capital costs and energy consumed."

The test frame can also be used to test different condition monitoring solutions, by installing the necessary tools and conducting computer monitoring; even the performance of newly developed isolators under the machine can be tested with results escalated to suppliers about how their items could be further enhanced for better results.

He says the company's compact design of a dual motor base – where the motor base can stand on a pedestal between two machines and drive them both – also makes it easier for a mine's process plant to accommodate this technology.

Kim Schoepflin, Kwatani, tel (+27 11) 923-9000

New rigid dump truck tyres from Goodyear

Goodyear is introducing the RM-4B+ Off The Road (OTR) tyre range for rigid dump trucks in the Europe, Middle East and Africa (EMEA) region. After successful performance in the United States, the brand-new OTR range, which includes several new sizes – among them a 63-inch version which was recently presented at the MINExpo in Las Vegas – is now available to customers in EMEA.

The range comprises five sizes for vehicles operating in severe conditions such as those typically encountered in mining and quarrying.

The Goodyear RM-4B+ range features 170-level tread depth and optimal tread zone stiffness for excellent wear performance. The innovative CycleMax tread rubber compound ensures cool running and is enhanced by tread lug blading for additional heat resistance. Heat resistance is also a benefit of the centreline channel, which gives added lateral traction.

Other tread features include interlocking blading for high stability and angled main grooves for forward and lateral traction. Particularly important for severe operating conditions are the extra thick sidewalls, which provide excellent protection against friction and impact.

"Our new RM-4B+ OTR tyres feature our latest technologies in materials, design, construction and manufacturing. Thanks to this they provide high performance in all areas resulting in a high number of operating hours and therefore reduced costs per hour to our customers," said Tracy Maclear, Marketing & Brand Manager, Goodyear South Africa.

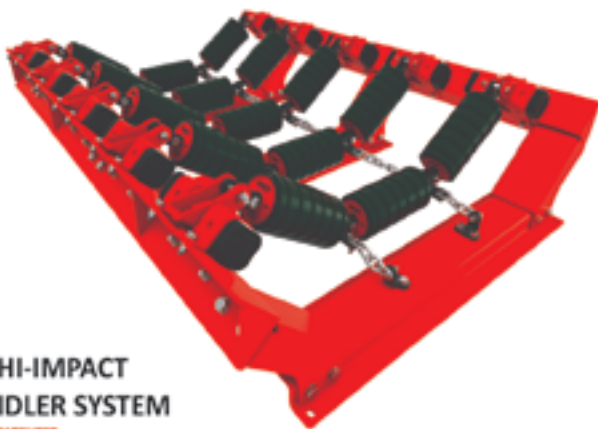
The tyres are all tubeless radials with load capacities from 12 150 kg up to 63 000 kg.

Goodyear South Africa, tel (+27 41) 994-6911



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SEW-EURODRIVE launches Field Service Department

SEW-EURODRIVE reports it has established a Field Service Department, headed up by newly-appointed Eben Pretorius, who has six years of experience in the industry. The new department will focus on customer support, as well as growing the OEM's footprint.



The multi-skilled field service team supports SEW-EURODRIVE's large installed base of geared motors.

Pretorius explains that the department – which will be responsible for the field service function throughout sub-Saharan Africa – can carry out a number of services on both mechanical and electronic equipment. These include site surveys, fault finding, oil changes, inspections, commissioning, on-site repairs, technical advice and application support.

The Johannesburg department has mechanical and electronic field service technicians. In addition, SEW-EURODRIVE has field service technicians at its Durban, Nelspruit, Cape Town and Port Elizabeth branches.

An important function of the department is to improve and grow SEW-EURODRIVE's service offering. "It is important that we are able to back up our high-quality products with an equally high-quality field service offering," Pretorius comments.

The Field Service Department is cur-

rently embarking on a marketing drive to inform SEW's customer base and sales staff of the full scope of services offered. Pretorius and his team will also educate customers on the value of preventative maintenance, in addition to common issues to look out for.

"An example is where geared units have been mounted incorrectly, resulting in incorrect oil levels and possible premature failures. Using field service to assist with commissioning of units can prevent these types of problems," Pretorius elaborates.

In addition to establishing the Field Service Department, SEW-EURODRIVE recently appointed Paul Clark as its new Head of Repairs. Clark is highly experienced in gearbox repairs, and has already made significant improvements to the Johannesburg Repair Centre to provide better customer service.

SEW-EURODRIVE, tel (+27 11) 248-7000

Retrofit option on Multotec cyclones

The demand from customers to provide a cyclone solution where the well-established and recognised Multotec cyclone can be retrofitted into existing 26-inch cyclone clusters has seen this leading OEM engineer design such a solution.

Richard Haydon, Process Manager at Multotec Process Equipment, says this flange-to-flange-fit solution will allow customers to reap the benefits of the Multotec cyclone technology in a retrofit installation. Multotec high capacity classification cyclones are said to achieve optimal separation while offering plants low overall operating costs.

"Multotec also has a solid reputation for the on-site support of its products across the African continent and customers opting for this retrofit option will now have immediate

access to the same high levels of backup that have underpinned our equipment supply across mining regions," Haydon says.

Multotec operates a branch network located strategically in the main mining centres in Africa and Haydon confirms that this means customers will readily have access to replacement liners and in certain centres the refurbishment of ceramic lined cyclones is available.

The Multotec Tornado 660 cyclone features an innovative inlet design which facilitates an increase in capacity. By retrofitting this ingenious Multotec cyclone to an existing cyclone cluster, it may be possible to increase the capacity and at the same time reduce wear. This ensures optimum life of the liner.

This steel shelled cyclone can be equipped with the most appropriate liner for a given application, thereby facilitating optimum performance and reliability. Liner operations include engineered ceramic tiles or cast replaceable rubber liners. Haydon explains that the selection of liner is dependent on the commodity, the application and customer preference.

The Multotec Tornado 660 cyclone is available in varying configurations providing a high level of flexibility. For example, it can be supplied with a different cone angle to facilitate varying cut points, and differing spigot and vortex finder sizes are available.

While the current cyclone offers a 660 mm diameter, Multotec will be expanding the range to accommodate other common sizes.

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

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