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### Cover

This AARD LHD – seen here at Sibanye's Burnstone gold mine – is powered by a Cat C9 engine supplied and supported by Barloworld Power. See page 18 for full details.



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# Informal mining – a curse or a blessing for Africa?

**T**he problems that AngloGold Ashanti has been experiencing at its Obuasi mine in Ghana highlight the scale of informal mining in Africa and the challenges it presents to both governments and the formal mining sector on the continent.

As many readers will already know, the Obuasi site was invaded by hundreds of illegal miners in early February this year, forcing AngloGold Ashanti to declare force majeure and withdraw all non-essential employees from the mine. The incursion followed the withdrawal of military protection from the mine on 2 February, a decision which apparently mystified AngloGold Ashanti at the time. Its repeated attempts to get clarification – and action – from the Ghanaian authorities have failed and it has now invoked the dispute resolution provisions in its Mining Lease in an effort to resolve the situation.

Obuasi has not really been producing gold on any significant scale since the end of 2014 when AngloGold Ashanti halted the loss-making underground operations at the mine – so the actual impact on production is negligible. Nevertheless, and as the company points out, the continued occupation of the lease area threatens the long-term viability of the mine and “significantly undermines investor confidence”.

The problems at Obuasi are hardly unique and I would venture to say that there are scarcely any mines in Africa – outside of Botswana, Namibia, South Africa and Zambia – that are not affected by the problem of informal and/or illegal mining to a lesser or greater degree.

Artisanal miners are known by many names around Africa – for example, they are ‘galamsey’ in Ghana, ‘zama zamas’ in South Africa and ‘makorokoza’ in Zimbabwe – but, wherever they operate, their activities, whether legal or not, tend to be characterised by poor – often non-existent – safety standards, environmental degradation and grossly inefficient exploitation of orebodies, as well as unacceptable practices such as child labour.

Despite the undoubted downside of informal mining, I get the impression that there is a growing body of opinion that views it sympathetically. Here in South Africa, for example, we’ve recently had a conference with the theme ‘Artisanal miners are not criminals’ which was hosted by ActionAid South Africa and Mining Affected Communities United in Action (MACUA). Although I didn’t attend myself, I gather that various speakers – many of

them artisanal miners – pointed out that informal mining is literally the only way in which many people in South Africa can earn a living. The keynote speaker, ActionAid’s Christopher Rutledge, described informal miners as “honest, hardworking unemployed citizens who eke out a living from minerals which at a constitutional level belong to all citizens.”

Of course, one would expect organisations such as ActionAid to adopt the position they do on informal mining. More surprising perhaps is a recent article in *The Economist*, which also looks at informal mining in a positive light.

Entitled ‘In praise of small miners’, the article argues that small-scale mining is not a curse. “Globally, artisanal mines employ about ten times as many people as industrial ones,” it says. “Moreover, small mining towns are less affected by the commodity boom-and-bust cycle than are towns that depend on large-scale capital investment. Big foreign mining firms tend to retrench quickly when markets turn down; small local miners tend to keep digging. Also, small miners’ earnings tend to be spent locally. In central Mozambique, for instance, increased legalisation of formerly illicit gold mining over a decade has led to a farming renaissance in many villages, alongside booms in construction and trade.”

Worldwide, the World Bank estimates that at least 20 million people – a significant number of them in Africa – engage in artisanal and small-scale mining in about 50 countries. Gold is probably the main mineral mined, although diamonds and other gemstones, copper/cobalt, coal and coltan are also important.

I’ve visited artisanal mining operations in several African countries over the years – including Ghana, Tanzania, Zimbabwe (where I was manhandled by a group of illegal miners I tried to photograph) and the DRC – and I can’t say that I was ever impressed by what I saw. But informal mining is a phenomenon that’s not going to go away – indeed, it’s almost inevitable that it will grow in scale.

Certainly mining companies need to recognise this reality and have strategies in place to address it. Some problems – such as those that AngloGold Ashanti has faced at Obuasi – seem particularly intractable but balancing this is the fact that a handful of companies seem to have been remarkably successful in dealing with ‘artisanals’, offering some hope that the formal and informal mining sectors can – for the most part – successfully co-exist in Africa.

*Arthur Tassell*



*Informal mining is a phenomenon that’s not going to go away – indeed, it’s almost inevitable that it will grow in scale.*

## Positive PEA completed on Kipushi redevelopment

Robert Friedland, Executive Chairman of TSX-listed Ivanhoe Mines, and Lars-Eric Johansson, CEO, have announced the receipt of an independent, preliminary economic assessment (PEA) for the planned redevelopment of the company's historic, high-grade, Kipushi zinc-copper mine in Katanga in the DRC.

The PEA plan covers the redevelopment of Kipushi as an underground mine, producing an average of 530 000 tonnes of zinc concentrate annually over a 10-year mine life at a total cash cost, including copper by-product credits, of approximately US\$0,54 per pound of 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 plan focuses on the mining of Kipushi's Big Zinc Zone, 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.

The PEA for Kipushi's redevelopment was prepared by OreWin of Adelaide, Australia and the MSA Group of Johannesburg.

Highlights of the PEA include an after-tax net present value (NPV) at an 8 % real discount rate of US\$533 million and an after-tax real internal rate of return (IRR) of 30,9 %. The after-tax project payback period is 2,2 years.

Leveraging existing surface and underground infrastructure significantly lowers the redevelopment capital compared to a greenfield development project, as well as the time required to reinstate production. A life-of-mine average cash cost of US\$0,54/lb of zinc is expected to rank Kipushi, once in production, in the bottom quartile of the cash cost curve for zinc producers globally.

"This preliminary mine redevelopment plan supports our view that Kipushi is the best brownfield zinc project in the world," said Friedland. "Kipushi's zinc grade of almost 35 % puts the project into a class of its own. Most of Kipushi's underground development and infrastructure is already in place and it is expected to be a straightforward, underground mining and milling

operation. The combination of extremely high zinc grades, low capital requirements and low operating costs make this a compelling development project."

Johansson said that since beginning operations almost a century ago, Kipushi has written a long and storied history of mining achievement in the DRC.

"We are optimistic that the release of this independent, preliminary mine redevelopment plan is a key first step toward redeveloping the mine and beginning the realisation of significant benefits for all of the Kipushi project's stakeholders, including the Congolese people and our joint venture partner, Gécamines. As required by our joint venture agreement, we have shared this study with our partner, Gécamines, for its review and approval, and we look forward to working with Gécamines' experts to further improve the preliminary mine redevelopment plan, where possible."

Historical mining at Kipushi was carried out from surface to approximately 1 220 m below surface (mL) and occurred in three contiguous zones: the North and South zones of the Fault Zone, and the Série Récurrente Zone in the footwall of



Underground at Kipushi showing Y-junction on 1 200-m level. Silos to the right and cage to the left (photo: Ivanhoe Mines).

the fault that is approximately east-west striking and steeply north dipping.

KICO has a significant amount of underground infrastructure at the Kipushi project, including a series of vertical mine shafts, with associated head frames, to various depths, as well as underground mine excavations.

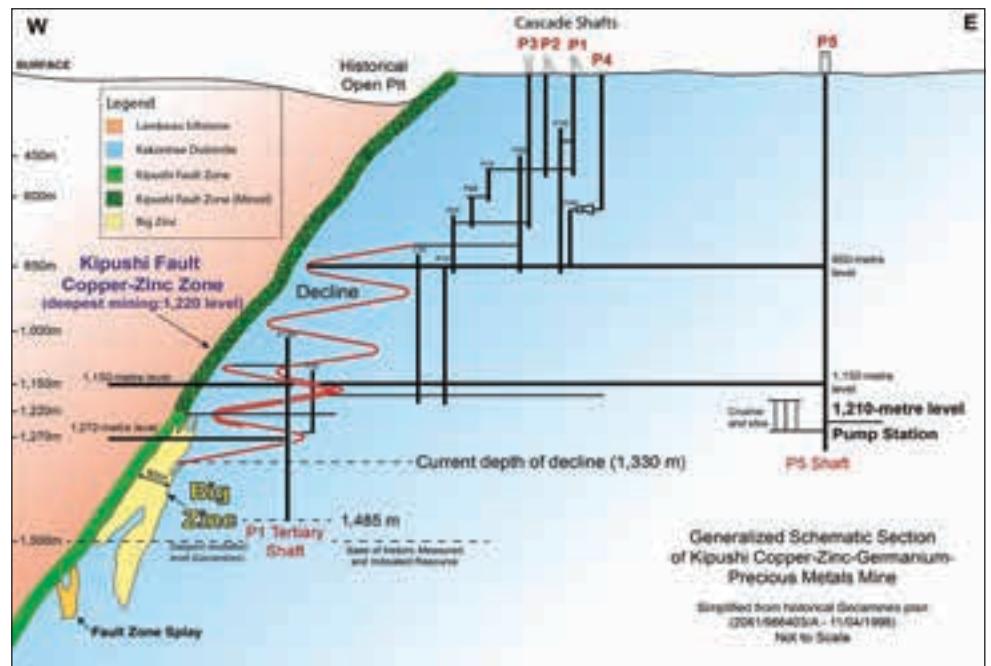
The newest shaft, No 5 (labelled as P5 in the schematic section), is 8 m in diameter and 1 240 m deep. It is expected to be recommissioned as the main production shaft. It has a maximum hoisting capacity of 1,8 Mt/a and provides the primary access to the lower levels of the mine, including the Big Zinc Zone, through the 1 150 m haulage level. Shaft 5 is located approximately 1,5 km from the main mining area. A series of crosscuts and ventilation infrastructure are still in working condition. The underground infrastructure also includes a series of pumps to manage the influx of water into the mine.

The planned mining method is a combination of sublevel open stope (SLOS), pillar retreat and cut and fill methods at a steady-state mining rate of 1,1 Mt/a.

The primary mining method for the Big Zinc Zone in the PEA is expected to be SLOS, with cemented rock backfill. It is anticipated that the crown pillars will be mined once adjacent stopes are backfilled using a pillar retreat mining method. The Big Zinc Zone is expected to be accessed via the existing decline and without significant new development. The main levels are planned to be at 60-m vertical intervals, with sublevels at 30-m intervals.

The cut and fill mining method will be used to extract the copper zone outside the Big Zinc Zone. In this method, mining occurs in horizontal slices, with the blasted copper material removed from the stopes, then crushed underground and sold at the mine gate.

The planned process plant in the PEA is a dense media separation (DMS) plant, which is expected to include crushing, screening, heavy-liquid separation (HLS) and spirals to produce a high-grade zinc concentrate. DMS is a simple density concentration technique that preliminary testwork has shown yields positive results for the Kipushi material, which has a sufficient density differential between the gangue (predominantly dolomite) and mineralisation (sphalerite). DMS washability profiles were evaluated in the



laboratory at three feed-crush sizes using a combination of HLS and shaking tables.

Preliminary test work results on three crush sizes indicated that the –20-mm crush size resulted in the highest recovery and concentrate grade. This crush size achieved an overall recovery of 95,4 % at a concentrate grade of 55,5 % zinc.

Kipushi, which was placed on care and maintenance in 1993, flooded in early 2011 due to a lack of pump maintenance over an extended period. At its peak, water reached 851 m below the surface level. A major milestone was reached in December

2013 when Ivanhoe restored access to the mine's principal haulage level at 1 150 m below the surface. Since then, crews have been upgrading underground infrastructure to permanently stabilise the water levels and support the drilling programme.

Recent improvements to Shaft 5 have included dewatering to expose the main pump station at the 1 200-m level, installation of new hoist ropes on the Shaft 5 Maryanne rescue hoist, stripping of the 1 200-m level pump station and refurbishment and commissioning of the friction-reeler gearbox. ■

## Sedgman selected to design and build Boikarabelo plant

Resource Generation Limited (ResGen), listed on the ASX and JSE, has announced the conclusion of a Heads of Agreement and Letter of Intent (LOI) for the design, procurement and construction of the Coal Handling and Preparation Plant (CHPP) for the Boikarabelo coal mine in South Africa's Waterberg region.

The agreement with Sedgman Limited, a member of the CIMIC Group and a leading Engineering, Procurement and Construction (EPC) contractor in coal and minerals, provides for a fixed lump sum contract for US\$141 million subject to exchange rate fluctuation. The contract price represents a substantial saving over the previously announced estimate and was achieved as a result of the Sedgman design offering a smaller footprint with associated capital savings while offering

equal, if not improved, production outputs.

In addition, under the provisions of the LOI ResGen has indicated an intent to negotiate a three-year CHPP operations contract with Sedgman effective following the expiry of a 15-month operations contract to cover the warranty period post commissioning and to negotiate with Sedgman a contract for the construction of the ancillary infrastructure works.

Rob Lowe, Chief Executive Officer of ResGen, commented: "The conclusion of the EPC contract with a leading contractor based on the significantly reduced capital cost of the project is a major milestone for the Boikarabelo mine and ResGen, and is a step closer to securing full funding for its completion. The board has continued on its stated path of materially reducing risk and capital expenditure." ■



The Bulyanhulu mine, seen here, saw a 27 % increase in production to 78 426 ounces during the first quarter (photo: Acacia).

## Acacia mines performing “ahead of expectations”

Reporting on its results for the first quarter (to 31 March 2016), LSE-listed Acacia Mining – which operates the Bulyanhulu, North Mara and Buzwagi gold mines in Tanzania – says that gold production for the quarter was 5 % higher than in the first quarter of 2015.

Comments Brad Gordon, Acacia’s CEO: “I am delighted by our excellent start to 2016, having produced 190 210 ounces at an all-in sustaining cost of US\$959 per ounce during the quarter, our best cost performance since 2010. All three operations performed ahead of expectations leading to a US\$19 million increase in our net cash position, after making our first prepayment of corporate tax amounting to US\$10 million. This performance is not reflected in our headline net earnings given the tax provision we have taken following a recent adverse court ruling, but our underlying adjusted earnings of US\$18 million were 71 % higher than Q1 2015.”

Bulyanhulu saw a 27 % increase in production to 78 426 ounces. This was due to ounces produced from underground min-

ing increasing by 20 % over Q1 2015, as a result of an 18 % increase in head grade as underground mine grades improved, and a 148 % increase in ounces produced from the new CIL circuit due to a significant increase in throughput. AISC decreased by 32 % to US\$983 per ounce sold due to the higher production base, lower direct mining costs and lower sustaining capital expenditure.

North Mara’s production of 74 721 ounces was in line with the prior year as a 6 % increase in throughput and a 3 % higher recovery rate were partly offset by a 10 % lower head grade due to lower open pit grades partially offset by an increased proportion of high grade underground material in the mill feed. AISC fell by 11 % to US\$737 per ounce sold, predominantly due to lower cash costs.

At Buzwagi, gold production for the quarter of 37 063 ounces was 16 % lower than Q1 2015, due to a 27 % reduction in head grade as a result of the focus on waste stripping in Q1 2016 which led to mining of ore from the lower grade splay zones as previously guided. The lower

production base drove an 11 % increase in AISC to US\$1 246 per ounce sold from US\$1 118 per ounce sold in 2015.

Total tonnes mined in Q1 amounted to 9,4 Mt, 7 % lower than Q1 2015 primarily due to lower open-pit tonnes mined at North Mara as mining in the Gokona pit was completed in 2015. Ore tonnes mined were 2,4 Mt, in line with 2015 ore tonnes mined of 2,5 million.

Ore tonnes processed amounted to 2,5 Mt, an increase of 20 % on Q1 2015. This was primarily driven by increased throughput at Bulyanhulu as reprocessed tailings increased from 0,2 Mt in Q1 2015 to 0,4 Mt in 2016 and increased throughput at Buzwagi as a result of good mill performance in 2016 after an unplanned plant shutdown in Q1 2015.

Head grade for the quarter of 2,8 g/t was 10 % lower than in Q1 2015 (3,1 g/t). This was due to a 27 % drop in head grade at Buzwagi, a 10 % drop in head grade at North Mara and increased processing of lower grade re-claimed tailings at Bulyanhulu, partially offset by increased Bulyanhulu underground grades. ■



## Kogi Iron to advance Agbaja project in Nigeria

Following the recent successful testing of the smelting characteristics of the ore from its Agbaja deposit in Nigeria, ASX-listed Kogi Iron says it will now progress negotiations with a number of parties to accelerate the development of the project. The project will be developed and managed through Kogi Iron's 100-% owned Nigerian-based subsidiary, KCM Mining.

It is intended to initially build a mining operation alongside a 250 000 t/a steel processing plant at Agbaja, located 200 km south of Abuja, Nigeria's capital, targeting domestic (Nigeria is currently a net importer of steel products) and European customers. The long-term plan is to expand production up considerably to 5 Mt/a.

The recent testing, conducted by South Africa's Mintek, determined the project has the ability to produce three steel products – sponge iron, pig iron and a steel product containing 95 % Fe – on site using the deposit's unique oolitic ore and Kogi Iron's planned processing method. A four-step processing method is envisaged. This involves washing the iron ore product followed by a reduction process, melting in an electric arc furnace and, finally, blasting with oxygen to produce the final product.

Kogi Iron's tenements cover 150 km<sup>2</sup> but the initial focus will be on ground covering 20 km<sup>2</sup> which hosts a JORC-certified resource of 586 Mt. The orebody is mostly at surface (maximum cover 8 m) and is mineable by a free-digging open-pit operation. The ore will be trucked to the processing plant, which is located 1 km away from the proposed pit.

With completion of the Mintek metallurgical testing, Kogi Iron is now moving to finalise the Definitive Feasibility Study



Employees of Kogi Iron inspect drill core (photo: Kogi Iron).

(DFS), with completion expected by the end of June 2016.

Kogi Iron has estimated the capital cost of the project at US\$200 million. The

biggest part of this will be spent on infrastructure and the processing plant as the costs of establishing the mining operation are expected to be relatively modest. ■

### Diamond miner appoints Chief Executive Officer

BlueRock has appointed Adam Waugh as its CEO. His appointment follows the announcement of the company's strategic review on 31 March 2016. He will be responsible for overseeing the strategic review and its subsequent implementation.

BlueRock is mining at Kareevlei, located 100 km north-west of Kimberley in the Northern Cape. The property hosts five confirmed kimberlites.

Riaan Visser will become CEO of the company's sole operating subsidiary, Kareevlei Mining, and, as a Director of BlueRock, will retain responsibility for finance matters and will continue to focus

on the operation of the Kareevlei mine.

"I am delighted that Adam has accepted the appointment of CEO," comments Paul Beck, Chairman of BlueRock. "We recognise that as we continue to grow we need to assess continuously our management needs. BlueRock is many times larger than it was when we listed and these management changes allow Riaan to concentrate on ensuring the smooth operation of the mine whilst Adam concentrates on delivering value to shareholders. In addition, we are currently in the process of identifying an experienced mine manager to complement our existing team." ■



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The Morila gold mine in Mali was commissioned in October 2000 and has since produced more than 6 Moz of gold and paid more than US\$2 billion to stakeholders. Morila showed a significant improvement in cost and profitability during the March quarter (photo: Randgold Resources).

## Loulo-Gounkoto complex lifts Randgold's quarterly results

Randgold Resources' flagship operation, the Loulo-Gounkoto complex in Mali, delivered a robust performance in the quarter to March when its Kibali and Tongon mines – in the DRC and Côte d'Ivoire respectively – were impacted by commissioning and other technical issues. This enabled the company to post a profit increase for the first quarter compared to the previous quarter and comparative prior year quarter.

The group also posted a significant improvement in safety with three out of five operations reporting zero lost time injuries for the quarter. Likewise the ongoing fight against malaria delivered another step decrease in incidence rate and all operations retained their international safety certifications with only Kibali still working towards certification, planned for this year.

While production was down 11 % from the previous record quarter at 291 912 ounces, the profit of US\$63.9 million was 19 % higher than that of the previous quarter and 25 % up on the corresponding quarter in 2015. This reflected Randgold's tightened focus on the profitability of its mines and a 9 % increase in the

average gold price received for the period. Total cash costs of US\$189.0 million were down 8 % on the previous quarter, thanks mainly to Loulo, where the transition from contract mining to owner mining started paying off in terms of improved efficiencies and lower operating costs.

At Kibali in the DRC, the two mill circuits, usually split between sulphide and oxide ores, were both campaigned on sulphides for an extended period in preparation for the ramp-up in underground ore. Interruptions associated with this process before its successful completion, compounded by a week-long breakdown of one of the ball mills, negatively affected production and costs.

In Côte d'Ivoire, commissioning of Tongon's fourth crushing stage, which completes the mine's flotation upgrade and crushing extension project, took longer than expected, and the operation was also hit again by the recurring instability of the power supply from the national grid. Tongon continues to engage with the government and the power utility on this issue and is also expanding its own generating capacity.

Morila in Mali remained profitable even

while milling material with a head grade of 0.7 g/t, showing a significant improvement in cost and profitability compared to last quarter. Preparations for the transition to the treatment of tailings are well underway while discussions with the government and the local community regarding the Domba project are still continuing. (Domba is a potential satellite pit which could deliver an additional 30 000 to 40 000 ounces before Morila finally closes.)

Chief Executive Mark Bristow said it had been a busy and demanding quarter for Randgold but in addition to dealing effectively with operational challenges at the mines it had also continued to reinforce the foundations of the business to ensure that it is in good shape to cope with the cyclical nature of the gold mining industry.

"Despite last year's record production, we replaced 76 % of our reserves and all our resources depleted, and our exploration teams continue to hunt for additional ounces around our existing operations as well our next big discovery. Confirming the down plunge extensions of our orebodies in the Loulo district is testament to this, as are the encouraging results from ongo-

ing work in Côte d'Ivoire, where drilling at Gbongogo has confirmed a large intrusion hosted stockwork. Around Kibali work is identifying multiple mineralised shoots around KCD.

"We're also steadily expanding our footprint in our target areas, most recently through the Moku joint venture adjacent to Kibali. Over at the Ngayu belt, 200 km to the SW of Kibali, we are preparing to fly a helicopter VTEM survey over recently signed joint ventures and we continue our regional research programmes across West and Central Africa. We keep strengthening our social licence through constructive engagement with and commitment to our host countries and communities," Bristow said.

"With our strategy, plans and projections intact, we are able to continue delivering value at current and even lower gold price levels. We're quite bullish about gold's medium to long term prospects, and when the cycle turns, the work we do now will have equipped us to capitalise fully on the upside." ■

## Reserves grow at Twangiza and Namoya

Canada's Banro Corp reports that the annual review of mineral resources and mineral reserves at its four core gold projects in the DRC, Twangiza, Namoya, Lugushwa and Kamituga, has resulted in a replacement of depleted ore and an increase in mineral reserves at Twangiza and Namoya, its two operating mines.

The Twangiza proven and probable mineral reserves increased by 11 % to 1,82 Moz of gold (27,67 Mt at 2,05 g/t Au) after depletion due to changes in cut-off grade, reversal on bulk density and revision of the pit design. This gives Twangiza a 14-year mine life.

At the Namoya property, the proven and probable mineral reserves have increased by 7 % to 1,36 Moz of gold (20,94 Mt at 2,02 g/t Au) after depletion, revision of the pit designs, addition of gold-in-process and additional drilling results at the Namoya Summit – Filon B portion of the Namoya Summit deposit.

Banro's overall mineral reserves have grown by 9 % to 3,18 Moz of gold (48,61 Mt at 2,03 g/t Au) at a US\$1 200/oz gold price. The total measured and indicated mineral resources for all its properties are 7,04 Moz of gold (141,94 Mt at 1,54 g/t Au) while inferred mineral resources total 5,08 Moz of gold (93,29 Mt at 1,70 g/t Au).

During 2014, the company scaled down its exploration activities at its Twangiza, Namoya, Lugushwa and Kamituga projects and focused its geological expertise in supporting production growth at Twangiza and mine development at Namoya, and further identification of near mine high grade targets.

In order to consolidate Banro's position on the various exploration sites, some limited exploration activities were carried out during 2015 using small teams focused on generating new oxide targets at Lugushwa and Kamituga. ■





The Asanko Gold Mine showing the ROM pad, crusher and conveyor of the Phase 1 processing facility (Photo: Asanko Gold).

## Staged construction the “smarter option” for Phase 2 of Asanko

Asanko Gold Inc, listed on the TSX and NYSE, has provided an update on the Phase 2 Definitive Feasibility Study (DFS) for its flagship project, the Asanko Gold Mine (AGM) in Ghana. The DFS was initiated following a positive Pre-Feasibility Study (PFS) released in May 2015 and is now examining a staged construction scenario.

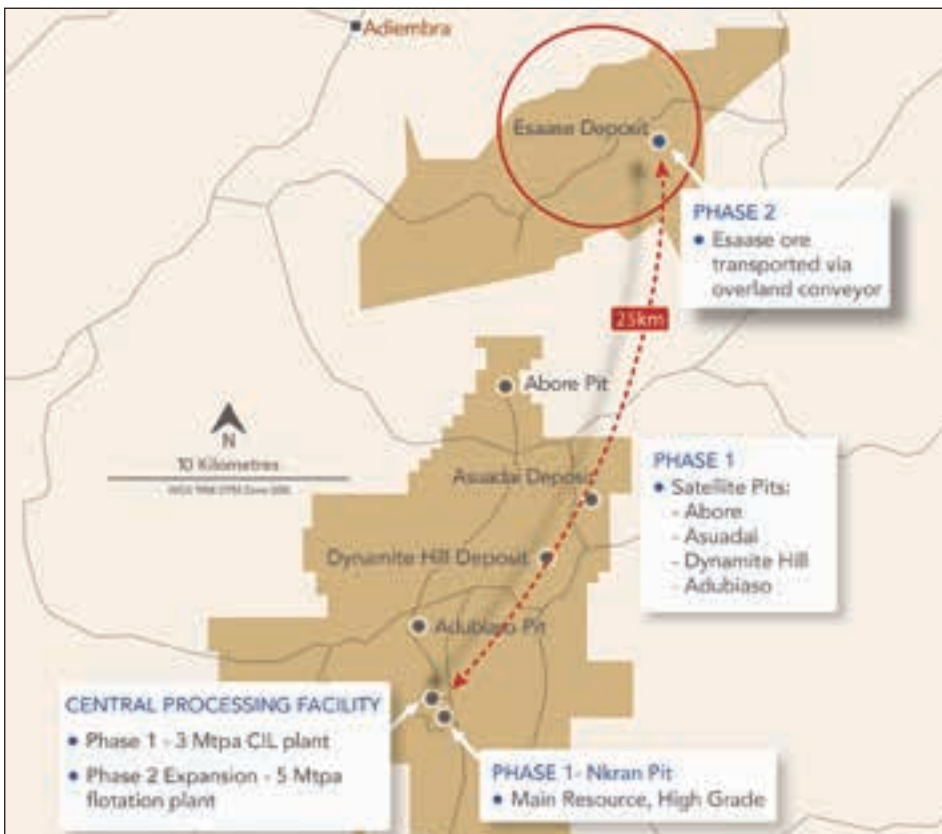
The PFS envisioned integrating the Esaase deposit with Phase 1 – which achieved commercial production on 1 April this year – to create one large, multi-pit mine and expanding the existing processing facilities to produce an average of 411 000 ounces of gold per annum over a 10,5-year Life of Mine (LoM)

from 2018. The ore would be mined and crushed at Esaase and then conveyed to the expanded Phase 1 processing facility, which would include an upgrade to the CIL circuit with two extra tanks to increase capacity from 3 Mt/a to 3,8 Mt/a and the addition of a 5 Mt/a flotation plant.

Following the successful commissioning of Phase 1 in Q1 2016, the process plant has demonstrated the ability to operate at greater than 110 % of the 3 Mt/a design. This has presented an opportunity to take advantage of the Esaase oxide ore (representing approximately 37 % of Esaase reserves) which is well suited to processing through the CIL circuit. Therefore the scope of the Phase 2 DFS has been modified to include a two-stage approach for the integration of the Esaase deposit with Phase 1.

Peter Breese, President and CEO, said: “The successful ramp-up of the Phase 1 processing facility and the additional excess mill capacity has led us to re-think our approach for Phase 2. With a hungry mill and a CIL circuit that can be cost effectively upgraded, we believe staging the development of Esaase is a smarter option that we can fund out of cash flow whilst maintaining our strong balance sheet.

“By focusing on mining just the Esaase oxides initially, which will utilise the mill’s spare capacity, we can increase gold production by nearly 50 %, thereby reducing our unit cost of production and significantly improving cash flow. ➔



Layout of the Asanko project. Asanko Gold is now planning a staged approach to the implementation of Phase 2.

“With Esaase about two years away from production, we will look to advance development of the satellite pits, as well as continue our near-mine exploration programme to find additional resources to keep the mill full until Esaase is brought online.”

Phase 2A will develop the Esaase pit, mining the oxide portion of the mineral reserve to provide an additional 2 Mt/a of material which will be blended with 3 Mt/a of the Nkran fresh ore and processed through the existing processing facility, which will be upgraded.

Development will include construction of mining and crushing infrastructure and a 27 km overland conveyor belt to transport the ore to the existing processing facility. Brownfield modifications will upgrade the existing processing plant capacity from 3 Mt/a up to 5 Mt/a. The upgrades to the processing

facility that were originally envisioned to expand capacity from 3 Mt/a to 3,8 Mt/a in the PFS are now expected to increase production levels up to 5 Mt/a.

Based on the PFS capital cost estimate and mine plan, Phase 2A is expected to take approximately 21 months for detailed design and construction at a capital cost of approximately US\$100-125 million. Production of over 280 000 oz/a is targeted to commence in Q4 2018.

The second stage of the project, Phase 2B, will expand the mining operation to mine both Esaase oxide and fresh

ores and expand the processing facility with the construction of an additional 5 Mt/a milling and flotation plant for the exclusive processing of Esaase fresh ores. Production is expected to exceed 480 000 oz/a from 2022 onwards, with total processing capacity of 10 Mt/a (3 Mt/a from Nkran and 7 Mt/a from Esaase).

The capital cost is expected to be approximately US\$150 to US\$170 million and development of Phase 2B will be staggered so that the capital cost will be funded from cash flow. ■

## Diamcor granted Water Use Licence

Diamcor Mining Inc, listed on the TSX-V, has announced that its application for a Water Use Licence (WUL) to support long-term diamond mining operations at its Krone-Endora at Venetia project has been approved and granted by the South African Department of Water and Sanitation.

“We are very pleased to have successfully secured this WUL for the project,” says Dean H Taylor, CEO of Diamcor. “The granting of the WUL represents the culmination of a multi-year effort in the ongoing advancement of our project, marks the achievement of yet another significant milestone, further de-risks the project, and most importantly, provides us with the desired allocation of water to support the targeted design capacity of the processing facilities installed at the project for the long-term.”

The WUL allows the company to extract 410 148 m<sup>3</sup> of water per year from seven boreholes, with that amount aimed at supporting the project’s envisioned long-term processing target of 300 000 tons per month.

Diamcor anticipates that, upon completion of the additional infrastructure related to the WUL, the resulting additional water resources will enable it to complete the testing and evaluation of the full targeted design capacity of its processing facilities and to compile key data from these higher processing rates which will assist it in arriving at an initial production decision. ■

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## Further positive results from Etango heap leach demo plant



The Etango heap leach demonstration plant showing the leach cribs (photo: Bannerman Resources).

ASX-listed Bannerman Resources – which is developing the Etango uranium project in Namibia – has reported further positive results from Phase 3 of the Etango heap leach demonstration plant programme. The Phase 3 results are similar to or better than the assumptions used in the Etango Definitive Feasibility Study (DFS) and – says Bannerman – have delivered the clear potential to further reduce operating cost estimates. Phase 3 involved trial leaching of Etango ore in three cribs

(2 m x 2 m x 5 m high) and six columns (185 mm x 5 m high) in a configuration designed to mirror the set-up of a full-scale heap operation.

Phase 3 indicates fast leach extraction with high recoveries. Total leach extraction of approximately 93 % was achieved from a 90-tonne sample over 22 days for the three cribs and six columns (compared to the DFS projection for a scaled up heap of 87%). In addition, it confirms low sulphuric acid consumption – on average 13,6 kg/

tonne for the three cribs and 14,2 kg/tonne for the six columns (compared with the DFS projection of 17,6 kg/tonne).

The growing metallurgical database now reflects large scale testing of 273 tonnes of material since commencement of the heap leach demonstration plant programme in April 2015.

“We continue to be greatly encouraged by the results from the heap leach demonstration plant,” says Bannerman’s Chief Executive Officer, Brandon Munro. “This latest success further de-risks the Etango process route and adds to the significant body of high quality technical work that underpins the large in-ground resource at Etango. We continue to optimise the DFS with a focus on reducing operating and capital costs. The Phase 3 results give us plenty of scope for revisiting key assumptions such as acid consumption.”

Phase 3 of the demonstration plant work programme entailed the closed circuit heap leach operation of three cribs (cribs 7, 8 & 9). Leach irrigation was conducted for a total of 22 days in two separate stages in order to simulate the conditions of a commercial heap leach operation. The leach solution collected was designated as the pregnant leach solution and was stored separately to be utilised for the solvent extraction (SX) work, which is part of the pending Phase 4 programme.

Phase 4 will utilise the Phase 3 pregnant leach solution to confirm the DFS assumptions relating to the solvent extraction circuit. This is planned to be followed by a further programme in which a variety of scenarios will be tested to identify opportunities for further cost reductions (Phase 5). ■

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## Aveng companies busy at Lethlakane

Aveng Grinaker-LTA's Mechanical & Electrical Engineering division, working in partnership with Aveng Botswana, was selected as the preferred Electrical and Instrumentation (E&I) contractor for the Letlhakane Mine Tailings Resource Treatment Plant (LMTRTP) project. The scope of work includes the supply and installation of electrical and instrumentation equipment at the Debswana mine. The contract commenced on 25 September 2015 and is expected to complete by December 2016.

"We were up against some fierce competition and being awarded this contract was a great achievement. Aveng Grinaker-LTA, together with Aveng Botswana, has the expertise and the capability to successfully execute this project to the highest standard and in accordance with client specifications," says Shawn Shanahan, Operations Manager for Aveng Grinaker-LTA.

The Letlhakane mine is situated approximately 50 km from the Orapa mine and 220 km east of Francistown and is

the second oldest – it was opened in the mid-1970s – of Debswana's four diamond operations. The mine is approaching the end of its life in terms of its economically

viable open-pit resources but the LMTRTP will ensure that it continues to operate for at least another 20 years, producing up to 800 000 carats a year from the treatment of tailings through the use of new and improved recovery technologies. ■

### Walkabout applies for Namibian licences

Perth-based, African-focused energy minerals developer Walkabout Resources, which is listed on the ASX, has filed applications for three Exclusive Prospecting Licences (EPLs) in a known lithium-spodumene setting 120 km north of Walvis Bay in Namibia.

The Cape Cross-Uis pegmatites are in a north-east trending zone up to 120 km long and 25 km wide. The company's tenure applications of approximately 304 km<sup>2</sup> lie 40 km to the north-east of the coastal town of Henties Bay in the Erongo Region.

Pegmatites up to 120 m in length and 40 m wide outcrop at surface within the Strathmore swarm and have been mined intermittently for Sn-Nb-Ta and Li-Be but the area has not been subjected

to modern exploration for lithium.

Allan Mulligan, Managing Director of Walkabout Resources, commented, "This historic pegmatite and tin mining area has a long history of localised, opportunistic mining. Lithium, while present, has never previously been the focus of exploration and we believe much can be achieved through the introduction of a fresh exploration approach targeting these lithium and pegmatite ranges. Much of the unexplored potential may be located under shallow cover. One site in particular has also been identified as a potential lithium brine site. This consolidates our plan to further diversify into the fast developing supply chain for lithium ion batteries." ■

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## Sentinel boosts First Quantum's first quarter production

First Quantum Minerals (FQM), listed on the TSX and LSE, achieved its highest ever quarterly copper production and sales from continuing operations of 119 287 tonnes and 131 267 tonnes, respectively, in the quarter ended 31 March 2016.

Copper production was 15 % higher than in Q1 2015 largely as a result of the continuing ramp-up of the new Sentinel mine in Zambia. FQM's other assets in Zambia include the Kansanshi mine, the largest copper mine in Africa, and the new Kansanshi smelter.

First filtered concentrate was produced at Sentinel in January 2015. Production at the mine totalled 20 902 tonnes for Q1 2016 compared to 15 190 tonnes for

Q4 2015 and 1 003 tonnes for Q1 2015.

"It was a strong start to the year for every aspect of the company. The momentum generated in 2015 with the excellent performance of the Kansanshi copper smelter and successful cost savings and expenditure programmes, continued into 2016. For four successive quarters, our mines have delivered progressively higher copper output and lower unit cost of production," noted Philip Pascall, Chairman and CEO.

Both Train 1 and Train 2 milling circuits at Sentinel are now in continuous operation with periods of above nameplate throughput being achieved separately, and in combined operation.

Construction of the power lines project

was completed in September 2015, and is partially energised from Lusaka West to Mumbwa substations. ZESCO, Zambia's state-run power company, has advised that full energisation of the power lines has been delayed to the second quarter of 2016.

Although Sentinel has been able to reach design capacity at times with the current 120 MW allocation, the full power requirement is progressively increasing with harder ore from the mine. Sentinel is expected to reach commercial production levels in the second quarter of 2016. A declaration of commercial production will be made when the operation attains a sustained level of operating performance. ■



The Sentinel processing plant. Both Train 1 and Train 2 milling circuits are now in continuous operation (photo: First Quantum).

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The processing plant at the Maseve mine utilises a standard MF2 circuit configuration and is designed to treat ore at a rate of 165 000 tonnes/month. This photo shows the flotation circuit, concentrator and filter press (photo: Platinum Group Metals).

## Maseve mill meets – and exceeds – its targets

Platinum Group Metals, listed on the TSX and NYSE, reports that during April 2016 the new Maseve mine, also known as the WBJV Project 1 Platinum Mine, produced approximately 1 700 '4E ounces' of platinum, palladium, rhodium and gold. The mill continues to perform well with recoveries and tonnage throughput capacity meeting or exceeding targets.

Maseve – near Sun City in the Western Bushveld – is reportedly operating with a good safety record and key management and contractors are in place. Commissioning of the mill was completed in March 2016. During February, March and April, a majority of milled tonnes were sourced from lower grade development muck mined from primary development along the Merensky Reef.

At present, stoped mining tonnes are increasing as a percentage of mill feed. Mining has now exposed 29 ends in Merensky Reef and set up and mining in these areas continues. Reconciliation from underground sampling to grade thickness in the current NI 43-101 technical report for the Maseve resource plans is good. Primary headings into the important Block 11, for planned mechanised room and pillar mining, are now (early May) within 250 m and two-and-a-half months of initial access.

As a result of the delay in ramp up announced in Platinum Group's Q2 report, the recently updated mine plan for Maseve calls for approximately 110 000 ounces to be produced to the end of April 2017. This compares to previous guidance of 116 000 ounces in calendar 2016. ■

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## Rockwell's carat sales 22 % up quarter on quarter

In its quarterly production and sales update for the three months ended February 29, 2016 (Q4 FY2016), Rockwell Diamonds, listed on the TSX and JSE, says it continues to pursue its medium term target to process 500 000 m<sup>3</sup> of gravel per month in the Middle Orange River (MOR). MOR carat sales were up 22 % quarter-on-quarter and the value of these goods increased 34 % to US\$7,1 million (excluding beneficiation).

In terms of volumes, MOR gravel pro-

cessed was 1 % down quarter-on-quarter due to lower production volumes at RHC (the Remhoogte-Holsloot Complex) and Saxendrift during the rainy season and over the December closure. These were chiefly offset by higher contractor production volumes.

Gravels processed were 40 % down year-on-year owing to the changed operational profile, with new production from RHC only partly compensating for the drop in volumes following the

sale of Tirisano, the suspension of activities at Niewejaarskraal and the depletion of resources at Saxendrift.

Overall, grades were up both quarter-on-quarter and year-on-year. RHC recorded significantly higher grades of 1,12 cphm<sup>3</sup>, compared to 0,64 cphm<sup>3</sup> in the previous quarter, but on slightly lower volumes.

Average carat price realised from the company's MOR projects improved by 9 % quarter-on-quarter, to US\$1 448 per carat.

During the fourth quarter of fiscal year 2016, the company implemented a number of the decisions that had arisen from the strategic and operational review of the business conducted in late 2015. Among the steps taken are the following:

- ❑ Saxendrift operations – company directed operations continue to wind down; a change in the operational parameters has allowed closure to be postponed beyond the planned end of February to May 2016.
  - ❑ Saxendrift royalty mining contracts – the second of the three-year royalty mining contracts entered into by Rockwell commenced post February 2016. Rockwell is assessing further royalty proposals to continue to extract further value from the Saxendrift property. All diamonds recovered by royalty miners at Saxendrift will be sold by Rockwell through its sales system and 10 % of gross sales will be retained by the company as a royalty.
  - ❑ Start-up of Wouterspan – the recommissioning of Wouterspan and redeployment of existing processing and mining equipment from other operations began early in Q1 FY2017 as planned. Work on the construction of the processing plant is on schedule to deliver a plant and IFS capable of processing 200 000 m<sup>3</sup> per month by September 2016, with ramp-up commencing late May 2016.
  - ❑ Closure of Head Office – Rockwell's Johannesburg corporate office has been closed, staffing reduced and key senior company executives have relocated to the MOR on a full-time basis.
  - ❑ Corporate structure – operational reporting structures have been streamlined; mine management is now directly accountable for all mine operations, reporting to the CEO who is based full-time in the MOR.
- Commenting on fourth quarter production and sales, James Campbell, CEO and President, said: "After a very difficult operat-



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Mining gravel at the Saxendrift property. Rockwell's mining operation at the mine is now winding down.

ing period, the fourth quarter performance showed positive signs of recovery in spite of the continued overall weakness in global diamond pricing. MOR carat sales were down 42 % year-on-year, but encouragingly 22 % higher than in the third quarter at 4 925 carats. The value of MOR sales was up 34 % on the previous quarter at US\$7,1 million but down 45 % on the equivalent quarter last year. The team at Saxendrift have done well to extend the operations there.

"The improvement in operating performance comes on the back of a period of lower than expected grades and overall sales values from Holsloot and Remhoogte. Following the acquisition of the two operations and in spite of the constraints that continue to limit our ability to invest, we were able to construct and commission two in-field screening facilities at Holsloot and Remhoogte, which along with the implementation of our revised EMV strategy should increase throughput capability to a sustainable 180 000 m<sup>3</sup> per month. The recommissioning of a 200 000 m<sup>3</sup> operation at Wouterspan, which is making good progress, is another significant achievement which in time will more than replace Saxendrift and absorb many of the skills and equipment from there as well." ■

### DiamondCorp expands Lace mining fleet

DiamondCorp, which is developing the Lace diamond mine near Kroonstad in Free State Province, reports that it has acquired an additional four Sandvik 20-tonne underground dump trucks, two Sandvik 7-tonne underground loaders and two Sandvik single boom drill rigs.

Three of the trucks have already been delivered to site but require moderate refurbishment before entering service. The fourth truck, two loaders and two drill rigs are nearly new, having completed less than 200 m of underground decline development at another South African non-diamond mining operation which was closed due to low commodity prices.

Whilst representing an unplanned additional expenditure of approximately US\$1 million, the total cost of the eight vehicles, including refurbishment of the three dump trucks, is approximately a quarter of the price of new units at current exchange rates.

DiamondCorp says the vehicles will allow it to achieve tonnage ramp up to deliver 30 000 tonnes per month of kimberlite from the Upper K4 Block to the conveyor belt from July onwards. Taking into account the increase in bottom screen size in the plant from 1,00 mm to 1,25 mm, this production will put the company on schedule to produce in excess of 75 000 carats from kimberlite in 2016 and in excess of 125 000 carats in 2017. ■

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# Cat power and Barloworld support

*Barloworld Power has completed the installation and commissioning of a Cat C9 engine powering AARD Mining Equipment's new AARD 10 ton LHD for Sibanye Gold's Burnstone mine in Mpumalanga. AARD Mining Equipment ordered four Cat C9 engines from Barloworld Power in October 2015 and the first repowered machine has now gone underground.*

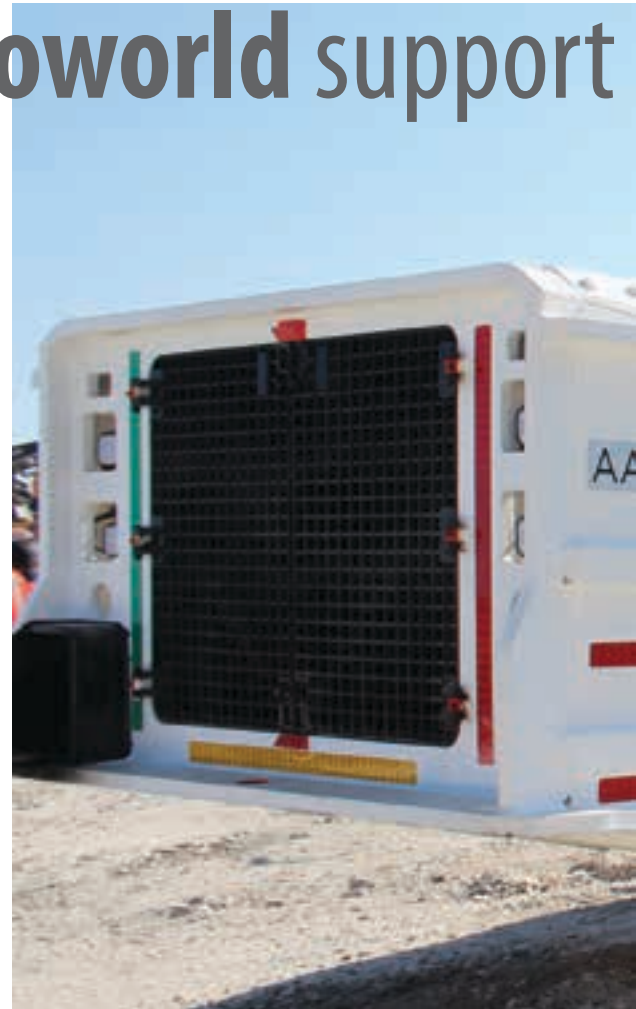
**A**ARD provides underground mechanised mining equipment and ancillary services to hard and soft rock mines in Africa and around the world. The equipment is manufactured in Gauteng, with branches servicing the mining regions of Kuruman, Rustenburg and Steelpoort, as well as facilities in Zambia and Zimbabwe.

*From left: Wiets Roets (Salesperson, Industrial business unit, Barloworld Power); Venash Raghunanan (Industrial Sales Manager, Barloworld Power); Peter Hes (Engineering Director, AARD Mining Equipment); Ian Palmer (Key Accounts Manager, AARD Mining); Eben van Dyk (Trackless Engineer, Burnstone mine); and Bernard Wessels (Vice President, Burnstone mine).*

## Robust performance

Peter Hes, Engineering Director at AARD Mining Equipment, is confident that the new C9 engine will perform well in harsh underground conditions, based on the robust performance of Cat engines in the field on a wide range of mining equipment. Reliability, strong service support and minimum downtime promised by Barloworld Power were compelling supporting factors.

“The 10 tonne LHD requires a 220 kW



engine and the Cat C9 was a suitable fit,” says Hes. “The installation and commissioning of the engine was done professionally and fast, thus saving cost.”

The order was placed with Barloworld Power's Industrial business unit, which supplies Cat engines to various industries, particularly mining. Applications range from powering underground machines to locomotives transporting commodities to their final destinations.

As the Southern African Cat dealer for more than 80 years, Barloworld Power has established a strong reputation in mining, construction, rail, agriculture, dewatering, crushing and screening, defence, and flameproof engines, also supplying most major OEMs. All these industries demand high quality products and support.



# for AARD Mining

*The first AARD LHD to be repowered by a Cat C9 engine supplied and supported by Barloworld Power prepares for underground duty at Burnstone gold mine.*



## Aftermarket support

“The Cat C9 Tier 3 engine is a very versatile engine with a power range of 205 kW (275 bhp) to 330 kW (450 bhp),” says Venash Raghunanan, Industrial Sales Manager at Barloworld Power. “Our ability to supply an engine in the Cat range that has proved itself in these conditions counted in our favour, as did the envelope size and power characteristics together with strong aftermarket support.

“This is a breakthrough order for us as it will be the first underground application for this model to be supplied and supported by Barloworld Power.

“Due to the design of the machine, the C9 224 kW intermittent power rated engine was selected for this application. The C9 engine has proven itself in various strenuous applications within the mining industry.”

He adds that in line with Caterpillar standards each new project goes through a complete installation audit and sign-off which entails much more than just a normal commissioning.

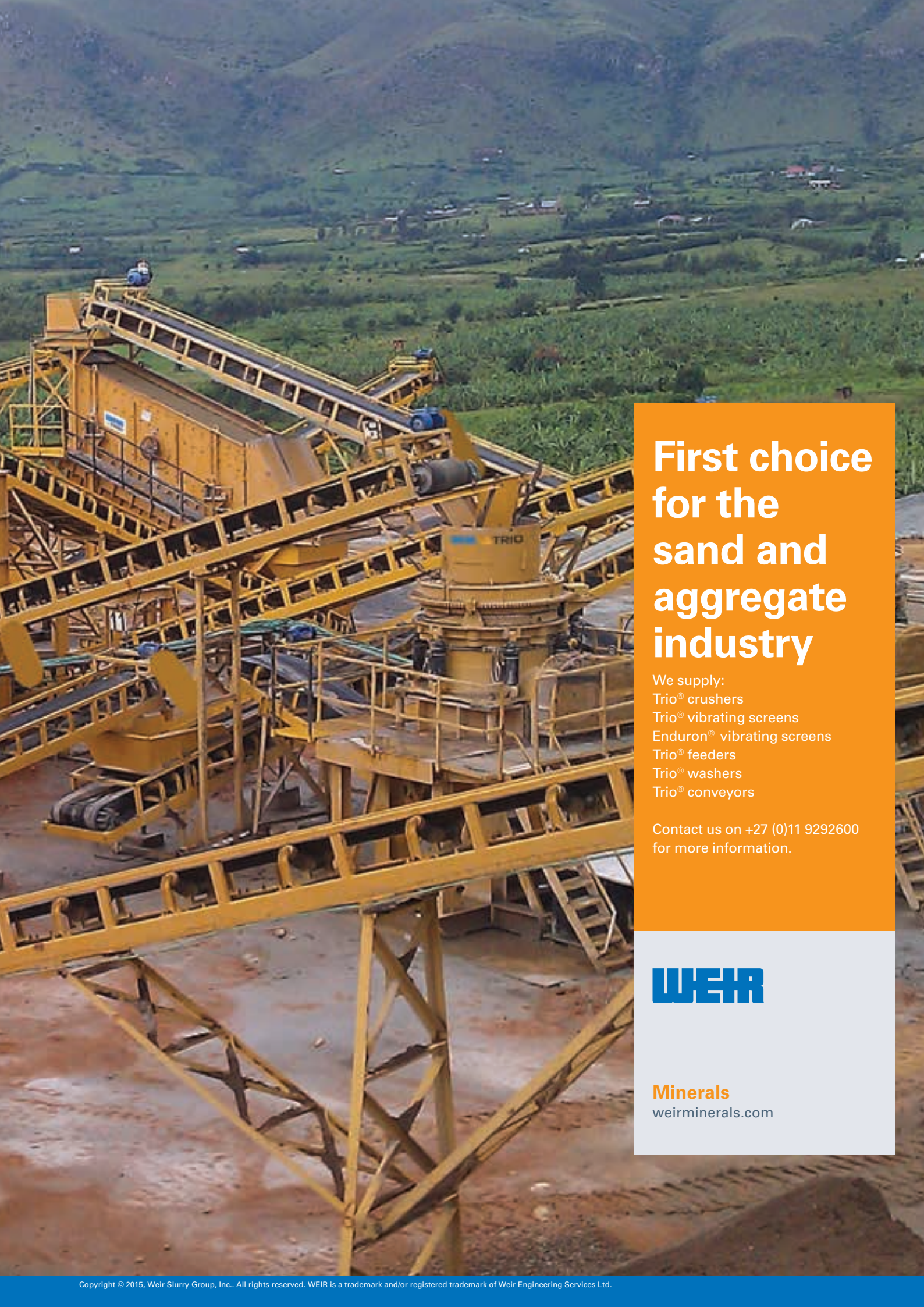
“Our Caterpillar trained applications and installations engineer works closely with the



OEM to provide solutions to resolve issues discovered during audits. This gives both the OEM and Barloworld Power the satisfaction of knowing that the machine should perform within its design capability after sign-off.”

To avoid costly downtime, the Barloworld Power service department attends to breakdowns in the shortest possible period. “Our after sales support gives us the leverage for

*The Cat C9 Tier 3 engine has a power range of 205 kW (275 bhp) to 330 kW (450 bhp).*



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future opportunities, knowing that after sales is a major concern in every industry,” says Raghunanan.

Hes adds that once the performance, reliability and service support of the new Cat engines has been established, the possibility of standardising on the AARD range of equipment will be considered.

“Because of the build options available, such as positioning of turbo and fan mountings, we will specify Cat engines on new designed equipment, specifically flameproof equipment.”

### Flameproof engines

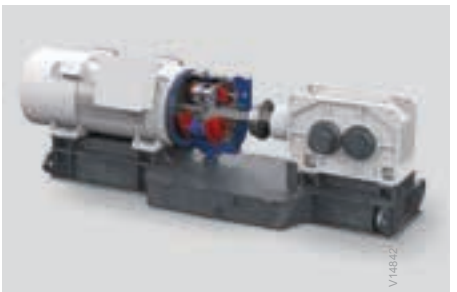
Barloworld Power is the leader in the flameproof engine industry and during the current commodities downturn has put additional focus on working with various customers and partners to further develop its range of flameproof engines. “The demand for flameproof engines has grown beyond our borders and enquiries have been dealt with as far as Russia and India,” Raghunanan points out.

The slowdown has also allowed the Industrial business unit to concentrate on certification of other engine models in its range.



“Although the market is very price sensitive, on certain applications you cannot compromise quality over pricing and for this reason Cat continues to be the engine of choice in specialist mining applications,” says Raghunanan. “Over the years we have assembled a team with a strong technical background. It is easy to sell a product, but the support that you give afterwards is where the difference comes. Working closely with our principal, Caterpillar, we apply proven world class standards.” ■

*The 220 kW Cat C9 engine is a perfect match for AARD Mining's 10 ton LHD and is expected to perform well in underground conditions.*



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# New Luika heads underground

*Currently an entirely open-pit operation, the New Luika Gold Mine (NLGM) of AIM-listed Shanta Gold in Tanzania will have transitioned by the second half of 2017 into primarily an underground mine, a move which will involve a pre-production capital expenditure of approximately US\$38 million (including new power generating capacity).*

*Commissioned in 2012, New Luika is the first – and still the only – modern, commercial scale gold mine in the historic Lupa goldfield of south-west Tanzania and produced 82 000 ounces of gold in its 2015 financial year (to 31 December 2015). **Modern Mining's** Arthur Tassell recently spoke to Shanta CEO Dr Toby Bradbury to learn more about New Luika and its prospects.*

**W**hile New Luika now ranks as a healthy operation (with its production in the last quarter of 2015 being a record 29 139 ounces and its All in Sustaining Cost (AISC) a very competitive US\$595 an ounce), Bradbury says the mine has had a “difficult childhood” and that it has taken a great deal of hard work to get it to the point where it is starting to realise its full potential.

“When the mine was originally planned and developed, Shanta was very much a junior company with limited resources and inevitably compromises were made,” he states. “Literally every function was outsourced and there was very little technical competence in house. Also, there were shortcomings with the building and commissioning of the plant. All these issues have now been addressed. A new elution and electrowinning plant was installed in Q2 2014 and a new crusher/screening plant was commissioned later in the same year. In addition, we now have very strong technical and engineering skills within Shanta.”

Bradbury says that his predecessor Mike Houston, who ran Zimplats in Zimbabwe before joining Shanta and who took over the management of the company just as New Luika was starting its production ramp up, was quick to identify the problem areas in the plant and launched initiatives to get the operation up and running at an increased throughput capacity of 50 000 tonnes per month (tpm) from the original 30 000 tpm design. “Since taking over as CEO in April last year, I’ve been able to build on the foundation created by Mike and I believe New Luika is now operating very efficiently, with



a clear strategy in place to take production through to at least 2022.”

Bradbury, who served as Shanta’s COO for three months before being appointed CEO, is a mining engineer (he graduated from the University of Cardiff in the UK with a BSc in Mining Engineering and also has a PhD in the same discipline) with plenty of African experience under his belt. His previous executive roles have included being Senior VP for AngloGold Ashanti in Ghana – where he was responsible for surface and underground operations producing 600 000 ounces a year – and COO for Anvil Mining, operator of the Dikulushi and Kinsevere copper mines in the DRC.

Explaining what attracted him to taking on the position of Shanta CEO, he says that New Luika is a high-quality, low-cost, high-cash generation asset. “The only thing it has missing is a long life but we’re working on this and are confident that our on-mine and wider regional exploration in the Lupa goldfield will deliver new resources,” he says. “Shanta also, of course, has a second mine – Singida – in the wings. This is a development project with surface and underground mining potential with significant exploration upside.”

Bradbury is based in Dar es Salaam but notes that there is now a highly experienced management team on site at New Luika, led by GM Scott Yelland. He is a graduate of the Camborne School of Mines and started his more than 30-year career in mining working in the Cornish tin mines. He subsequently worked in many parts of the world and before joining Shanta was VP Operations of Konkola Copper Mines in Zambia.

Yelland’s deputy is Honest Mrema, a Tanzanian national who is a mining engineer



**Above:** The milling section of the plant.

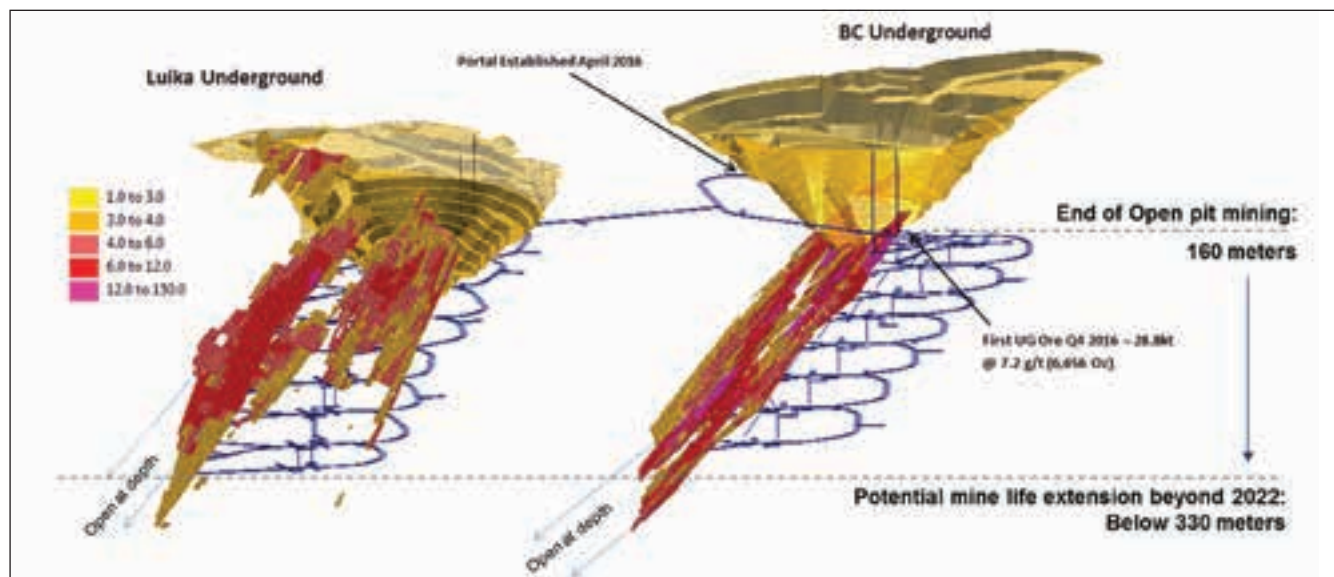
with 19 years’ experience in Tanzania and Mali.

Reviewing New Luika’s performance during 2015, Bradbury says that as the year started, the emphasis was very much on optimising the open-pit mining operation and aligning ore production to the increased capacity of the plant complex. “Ore production had not kept up with the increased plant capacity and there was a reliance on using stockpiled material to supplement feed to the mill. In addition, the strip ratios were as high as 20 to 1 in a falling gold price environment. To rectify these problems, we redesigned both our main pits – Bauhinia Creek and Luika – during the first half of the year.”

Bradbury says the results came through in the second half of 2015. “The strip ratio was reduced to 9 to 1 and ore production caught up with plant capacity. Closer control of mining

**Left:** Night view of the New Luika process plant. Upgrades commissioned in 2014 have increased capacity to 50 000 tonnes per month.

Long section of BC (Bauhinia Creek) and Luika looking towards the north.





**Right:** Underground portal preparation in the BC pit.

**Far right:** The process route at New Luika comprises conventional three-stage crushing, two mills in parallel and a carbon in leach operation (seen here). In the second half of 2015, for the first time, NLGM mined ore at a rate that matched the upgraded mill capacity and at a grade that enabled budgeted gold production to be realised.

– which reduced dilution – and management of plant feed grades on a continuous basis resulted in production exceeding 8 000 ounces of gold a month for every month from July to December.”

While Shanta Gold operates the plant at New Luika in house (after originally having employed a contractor), the open-pit mining is outsourced and is in the hands of BC Mining, a joint venture between Bamboo Rock, from South Africa, and Caspian, a Tanzanian company. Ore is extracted from the Bauhinia Creek and Luika pits with a mining fleet consisting of 40-t articulated dump trucks working in

## The Lupa – Tanzania’s second goldfield

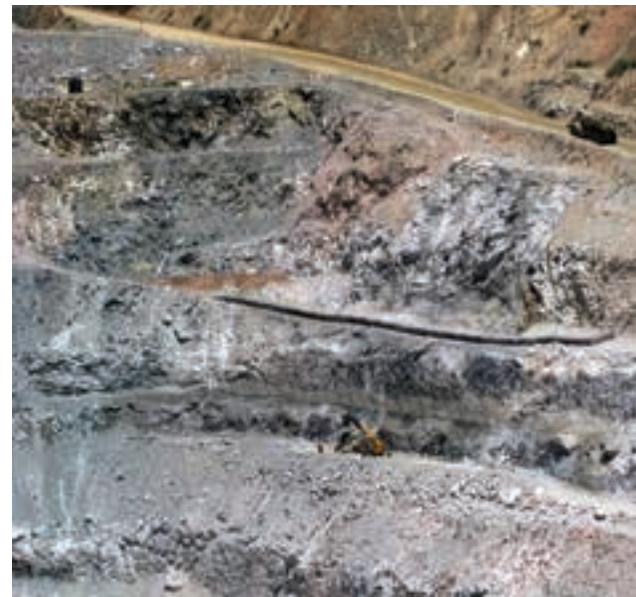
The Lupa is the lesser known of Tanzania’s two main goldfields, with the Lake Victoria goldfield having attracted far more attention from exploration and mining companies over the past couple of decades.

The history of the Lupa goldfield is not particularly well documented but it appears that it began production as an alluvial field in the 1920s. The Saza mine was active in the mid-1930s, later being succeeded by the New Saza mine which was operational from 1939 to 1956.

Although New Saza was the biggest mine in the goldfield, it was very small by modern standards, reportedly only producing around 270 000 ounces of gold over its life. Nevertheless, it was the second biggest colonial-era gold producer in Tanzania, with only Geita in the Lake Victoria goldfield being a more substantial operation.

Apart from Shanta, Vancouver-based Helio Resource Corp is the only company undertaking significant exploration in the Lupa goldfield and it has defined a 590 000 ounce resource at its SMP project, located immediately to the east of New Luika. The SMP property includes the site of the New Saza mine.

New Luika – which was also the site of a colonial-era-mine – is located 120 km north-west of Mbeya. This represents a three-hour drive and most people visiting the mine fly in to the on-site airstrip. ■



conjunction with 70-t and 90-t excavators. Additional satellite pits within the mining licence at the Jamhuri, Elizabeth Hill, Black Tree Hill, Ilunga and Shamba deposits, which are all within a 3 km radius of the plant, can provide supplementary production in the future.

Turning to the planned underground operation at New Luika, Bradbury says that – as detailed in the underground feasibility study completed last year by independent consultants AMC Consultants (UK) Limited – it will extract 1,57 Mt over six years at a grade of 6,5 g/t to produce 310 000 ounces of gold. “The project is very attractive and – at a gold price of US\$1 200 – has an NPV at an 8 % discount rate of US\$72 million and a pretax IRR of 56 %,” he says. “The average cash cost of the underground mine will be US\$499 per ounce and the AISC US\$640/oz. The payback period is estimated at three years.”

The underground mine will be a low tonnage operation, with access provided from a portal in the Bauhinia Creek pit with minimal footwall ramp development. The mining method to be used will be longhole open stoping with rock fill, cemented above the sill pillars. A development drive to Luika – which is located approximately 300 m from Bauhinia Creek – will provide access to a similar footwall ramp for mining by cut and fill methods. The final depth of mining based on current reserves will be 330 m in the case of Bauhinia Creek and 315 m for Luika (although both deposits are open at depth).

Cut-off grades are 3,0 g/t and 3,5 g/t for Bauhinia Creek and Luika respectively. A higher cut-off grade has been applied to Luika because the selected mining method has a



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higher cost per ton. Mining method selection was based on achieving maximum recovery with minimum dilution with particular consideration given to orebody geometry and geotechnical constraints. At Bauhinia Creek the method of long hole open stoping with waste rock back-fill will ensure high productivity at relatively low cost. At Luika the method of cut and fill with flat-backing will ensure higher selectivity and smaller spans in what are expected to be more adverse ground conditions compared to Bauhinia Creek.

The overall underground project necessitates a new 7.5 MW power plant on site. As with the existing facility, the new plant will use heavy fuel oil but will be equipped with medium speed engines which provide a longer life and are more efficient. The power station will be supplied, operated and maintained by the supplier, Inglett & Stubbs International, and is due to arrive on site in Q1 2017.

As regards underground mobile mining equipment, Shanta announced earlier this year that it had completed a US\$5 million finance agreement with Sandvik Mining & Construction which will allow it to purchase the machines. The equipment will arrive at the mine in stages, with the first units scheduled for delivery as this article was being written.

Outlining progress on the underground, Bradbury says the project is in the early stages with work currently focused on the portal development. He

adds that Shanta is undertaking the development of the underground mine in house and has already appointed the key members of the underground team.

The underground mine forms the cornerstone of New Luika's Base Case Mine Plan, announced in September last year, which details the mine's production profile through to 2022. "Essentially, the plan allows New Luika to maintain an average annual production of 84 000 ounces for the next five years," states Bradbury. "Ore production will be from both open pits and underground from 2017 with increasing emphasis on the underground operation. The Base Case Plan also includes a tailings recovery project that will produce 19 000 ounces over six years and this will be commissioned in 2017."

Looking at the upside potential for New Luika, Bradbury says that current resource sitting outside the Base Case Plan amounts to just over half a million ounces, some of it open-pittable and some of it mineable by underground methods. "The Base Case Plan currently has unutilised mill capacity of 362 000 tonnes over the five years so clearly there is potential to bring these ounces to account. We have also committed to a vigorous exploration programme of known prospects within our mining licence area and prospecting licences in close proximity to the New Luika process plant. So there is every prospect that New Luika will continue until well into the 2020s and possibly beyond," he concludes. ■

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## Plant operations at Liberian mine temporarily suspended

**A**ureus Mining Inc, the TSX and AIM-listed West African gold producer, reported earlier this month (May) that processing operations at its New Liberty Gold Mine (NLGM) in Liberia had been temporarily suspended as a consequence of problems with the detoxification circuit in the process plant. NLGM, Liberia's first commercial scale gold mine, was commissioned last year and is designed to produce an average of 120 koz/a over the first six years of its life.

In a statement issued on 10 May, Aureus says the detoxification circuit has not been operating to original design specifications resulting in higher concentrations of cyanide WAD (weak acid dissociated cyanide) in the process effluent. "The company had therefore been operating with process water in a closed circuit (zero discharge from the Tailings Storage Facility (TSF)). Recent heavy rainfall inadvertently resulted in a small overflow of effluent from the TSF onto the wetlands area (within the mining lease area). Aureus is conducting remediation work to rectify the issues in the detoxification circuit and to manage future water discharge from the TSF in order for operations to

recommence in the near future."

Aureus says its investigations to date indicate that there has been no adverse impact on any human settlement as the discharge took place within the mining lease and some 5 km from the nearest settlement. However, further investigations are in progress and, in view of this leakage, a decision was taken to suspend processing operations on 7 May 2016.

SRK Consulting (UK) are on site at New Liberty assisting Aureus with the evaluation of the adjustments to be made to the waste neutralisation section of the detoxification circuit and the management of water discharge from the TSF in order for processing operations at New Liberty to recommence.

Aureus says that during this temporary suspension of processing operations, it is taking the opportunity to effect a mill reline, undertake other preventative engineering maintenance and repairs (all of which were previously scheduled), as well as modifications to the detox circuit proposed by the expert consultants. Furthermore, mining operations are continuing at New Liberty in order to build up ore stockpiles and maintain waste stripping. ■



The New Liberty Gold Mine in Liberia. There are two pits – Kinjor and Larjor – currently operational (photo: Aureus Mining).

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# Commodities downturn takes its toll

With the annual Botswana Resource Sector Conference imminent, **Modern Mining's** Arthur Tassell takes a look at the mining scene in Botswana, which is probably the bleakest it has been in years. Botswana's economy shrank last year by 0,3 % according to Statistics Botswana (a figure which the IMF believes could be an under-estimate), largely as a result of falling mine production due to weak demand for commodities. There are nevertheless some good news stories emanating from the mining sector, particularly in diamond mining, with Lucara's Karowe diamond mine continuing to impress and the Lerala diamond mine of Kimberley Diamonds resuming production.

Interestingly, Botswana is now no longer regarded as the prime mining destination for investment in Africa, with the latest (2015) Fraser Institute Survey of Mining Companies placing it only fourth on the continent (after Morocco, Burkina Faso, Ghana and Namibia). Its lower – although still creditable – showing in the survey was over increased concerns over trade barriers, the geological database and the availability of skills and labour.

The diamond mining sector accounts for the bulk of Botswana's mining production by value, with Debswana being by far the biggest producer. It is targeting a production of 20 million carats this year but this is well down on the 30 million plus carats recorded roughly a decade ago. Reportedly, Debswana cut production by

*Production recently restarted at the Lerala diamond mine. This photo shows the first bucket of stockpiled ore being tipped into the headfeed bin and primary crusher (photo: Kimberley Diamonds).*



3 million carats last year because of subdued demand in global markets and has also placed its smallest mine, Damtshaa (near Orapa), on care and maintenance.

In the Central Kalahari, Botswana's only underground diamond mine, Ghaghoo, has also not been immune from conditions in the global economy with its owner, LSE-listed Gem Diamonds, stating in its latest annual report (for the year ended 31 December 2015), that the operation is being downsized "to minimise the cash to be consumed by this asset. Consequently, a modified target of approximately 300 000 tonnes of ore to be treated has been set for 2016."

More positively, the phenomenal success of Lucara's Karowe diamond mine continues. Located in the Orapa Kimberlite Field and based on the AK6 kimberlite, Karowe was commissioned in 2012. It has since proved to be a prolific producer of large diamonds with more than 700 larger than 10,8 carats being recovered during 2015 (mainly from the south lobe of the mine). This included 20 stones larger than 200 carats (of which seven were larger than 300 carats). The 1 111-carat *Lesedi La Rona*, which was recovered in November last year, ranks as

# on Botswana's mining industry



the second largest gem quality diamond ever recovered anywhere in the world and the largest in more than 100 years. The second biggest diamond produced by the mine, a 813-carat stone (also recovered in November last year and since named *The Constellation*) recently

sold for US\$63 million, the highest price ever achieved for a rough diamond.

The mine's excellent performance has continued into the first quarter of this year with 165 diamonds larger than 10,8 carats (including eight that exceeded 100 carats) being recovered

**Above:** The process plant (seen here) of the now closed Bosoeto copper mine is to be incorporated into Cupric Canyon's Zone 5 (Khoemacau) project (photo: Arthur Tassell).



The processing facility of the Ghaghoo underground mine showing the sort house (photo: Gem Diamonds).



**Above:** The Tau pit at the Mupane gold mine near Francistown showing the portal to the underground mine (photo: Galane Gold).



**Right:** The Karowe diamond mine has proved to be one of the most successful new diamond mines developed anywhere in the world in recent years (photo: Lucara).

in the reporting period. Total carat production for the quarter was just over 90 000. Ore mined amounted to 677 766 tonnes with the plant feed grade being 13,9 carats per hundred tonnes. Lucara is forecasting diamond sales of between 340 000 and 380 000 carats in 2016 from Karowe with operating costs expected to be between US\$33,5 and US\$36,5 per tonne processed.

As mentioned, the Lerala mine – although a tiny operation compared to behemoths like Jwaneng and Orapa – has been recommissioned, with its owner, Australia’s Kimberley Diamonds Limited (KDL), announcing in April this year that production had commenced. Located near Martin’s Drift, Lerala was originally opened in 2008 but a few months later was placed on care and maintenance. It did produce again in 2012 for a short period but this campaign was not successful and the operation was subsequently sold to KDL in 2014. Since acquiring the property, KDL has refurbished and upgraded the plant at a cost of A\$9,4 million. It expects the mine – which is an open-pit operation – to have an average annual production of 336 000 carats over a life of nine years.

Apart from diamonds, the other traditional major pillar of Botswana’s mining industry has been the mining of nickel (with some copper) at the BCL operation in Selebi-Phikwe and also at Tati Nickel (also now controlled by BCL) near Francistown. Both mines are nearing the end of their lives (although an open pit to exploit the Selkirk deposit at Tati Nickel is reportedly being planned). BCL is not running profitably

and is planning to trim costs by retrenching some of its plus 4 000-strong workforce. The exact number of jobs that will be lost is not yet known but the figure is unlikely to be much less than 900 workers (and possibly a good deal more).

BCL’s MD, Daniel Maphulela, was recently quoted in the Botswanan press as saying that it “currently costs us about \$8 to mine a pound of nickel and yet the product is fetching about \$4 on the international market. This leaves us with a \$4 hole for every pound that we mine.” To add to the company’s woes, a smelter refurbishment undertaken last year at Selebi-Phikwe led to a significant loss due to the project over-running on time, resulting in 50 days of lost production.

Regarding copper, Botswana used to have two dedicated copper mining operations. Both have now closed. One, Boseto, was developed by Australia’s Discovery Metals and was only opened in 2012. It was the first mine in Botswana’s Kalahari Copperbelt but soon ran into problems and consistently failed to meet its production targets. The other, African Copper’s Mowana (in the Francistown area), ceased operations in November last year (after apparently failing to pay its mining contractor, Diesel Power Mining Services).

All hope, however, is not lost for Botswana’s copper mining sector. The media in Botswana has reported that Mowana has three potential suitors while the assets of the Boseto mine, including its modern 3 Mt/a concentrator, were acquired last year by Cupric Canyon Capital, a US-based mining company managed by executives with backgrounds with Phelps Dodge (or





its successor company, Freeport McMoRan Copper). Cupric, through its Botswanan subsidiary, Khoemaçau Copper Mining, is planning to develop an underground mine at its Zone 5 site in the Kalahari Copperbelt. The Boseto concentrator – located around 35 km by road from Zone 5 – will be incorporated in the project, which will mean a major saving in capital expenditure.

The proposed Zone 5 mine (covered in detail in our January issue this year) will be an underground 10 000 t/day operation initially producing approximately 50 000 t of copper in concentrate (as well as over a million ounces of silver) annually although Cupric believes that this figure could go up to 16 000 t/day (roughly 89 000 t/a of copper) in a further phase of development and ultimately up to 30 000 t/day (which would translate into 140 000 t/a of copper). Cupric's intention is to have the first phase of the mine commissioned by the middle of 2018 with the capex to achieve this being in the region of US\$350 million.

While nickel and copper are the main metals mined in Botswana, there is some gold production. This is on a relatively small scale, with the country's sole producer being the Mupane gold mine to the east of Francistown (and just adjacent to Tati Nickel). Developed by Gallery Gold and in production since late 2004, Mupane is now owned by Galane Gold, a company listed on the TSX-V (which has recently also taken over Galaxy Gold, which has assets in the Barberton area of South Africa). Mupane has transitioned into an underground mine with production from the Tau Underground (Tau

is one of the mine's open pits) having started in the third quarter of 2015. Galane produced 24 321 ounces at Mupane in 2015 at an operating cash cost of US\$1 039/oz, excluding royalties, and has a five-year mine plan in place for the property.

Finally, and looking to the future, Botswana's main hope in terms of maintaining a strong mining sector as diamond mining inevitably reduces in scale over the next 20 years is coal. The country has considerable coal resources (around 200 billion tonnes according to the Botswana government) but – as yet – only one coal mine, Morupule, which currently has the capacity to produce 3 Mt/a from underground workings. There is potential for Botswana to export coal once transport links to harbours in South Africa and/or Namibia have been strengthened but possibly a better option in the shorter term will be to use the coal to generate power that can then be exported to the Southern African region.

Apart from Debswana (which controls Morupule), the main players in coal in Botswana are Shumba Energy (listed in Botswana and Mauritius), which has the Mabesekwa and Sechaba projects, Australian company African Energy Resources, which is pursuing the Sese, Mmamabula West and Mmamanstwe projects, and Jindal, which owns the Mmamabula project. All of these could potentially benefit from South Africa's cross border IPP programme, which is looking to secure 3 750 MW of power from cross-border projects. The three companies will be presenting at the upcoming Botswana Resource Sector Conference and *Modern Mining* – which will be at the conference – will provide an update on their plans in its July issue. ■

*Botswana's main hope in terms of maintaining a strong mining sector as diamond mining inevitably reduces in scale over the next 20 years is coal.*

## Botswana Resource Sector Conference

The Botswana Resource Sector Conference is to be held at the normal venue, the Gaborone International Convention Centre, on 14/15 June 2016. The event, which typically attracts up to 400 delegates and is accompanied by a small exhibition, is now in its 13th year.

This year's event will feature four panel discussions. The first will discuss Botswana's infrastructure challenges, the second will look at the future of power in Botswana, the third will look at the diamond industry and the fourth will have the theme 'The potential of a resource driven economy'.

Companies presenting will include Shumba Energy, African Energy, Mount Burgess, Lucara, Gem Diamonds, Jindal, Botswana Power Corp, Vivo Energy, Khoemaçau Copper Mining, and MOD Resources/Metal Tiger. Representatives of the Botswana Diamond Hub, Botswana Power Corp and the Botswana Geoscience Institute will also make presentations.

Details are available from website [www.capconferences.com](http://www.capconferences.com) or by e-mailing [emma@capresources.co.uk](mailto:emma@capresources.co.uk).

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# APT – filling a market niche

*A Johannesburg-based company specialising in economically priced modular mineral processing plants is APT (Appropriate Process Technologies). Founded just over a decade ago, it does not have a particularly high profile in South Africa itself (where it has supplied just one plant over the years) but junior and sub-junior miners throughout the rest of Africa – and indeed in other mining regions around the world – know it as the company to turn to when they want to get their projects up and running at minimal cost and in the shortest possible time. **Modern Mining’s** Arthur Tassell recently spoke to APT’s Business Development Manager, Gary McFarlane, to learn more about the company, its products and its reputation for innovative engineering.*

**A**ccording to McFarlane, APT was founded with the express intention of supplying a niche market – the multitude of small miners around Africa possessed of limited capital but with viable deposits to exploit. “Miners of this type tend to have extremely limited budgets and generally need to get into production as fast as possible – within weeks or months rather than years,” he says. “We have provided a solution for them, offer-

ing well priced, low maintenance, ‘entry level’ plants with capacities as small as 1,5 t/h – but, at the same time, engineered to be highly efficient and easily expanded.

“When we started up, there were hardly any other suppliers addressing this particular market. The result was that we had only limited competition in our early years and were able to grow steadily – to the point where we now have around 50 direct employees in Southern Africa and around 60 different plant configurations



Cononish gold project of Scotgold Resources in Scotland. “This is a small – 1,5 t/h – but complex plant and is designed to be able to grow as the project grows,” says McFarlane. “Cononish will be Scotland’s first gold mine so the project is quite high profile.”

While small plants in the 3 to 20 t/h range are at the heart of APT’s offering, the company is capable of providing plants with much bigger capacities. “Starting roughly four years ago, we started to discern a growing demand for larger plants, probably reflecting the drying up of funding in the junior mining sector,” says McFarlane. “We were being approached by juniors who liked our products – in particular the way they were priced and their modular design philosophy allowing easy expansion – but needed them upscaled to handle higher tonnages and a full range of ore types from oxides through transitional material to sulphides. So we now offer plants – we call them Combo plants – that go well beyond the 20 t/h capacity that used to be the upper limit of our range and, in fact, we’ve quoted on installations as big as 250 t/h.”

As examples of APT’s ability to meet the requirements of bigger projects, McFarlane points to two current contracts. “We’re presently supplying a 120 t/h plant to Piran Resources for a tin project it has in Rwanda and this will be delivered to site shortly,” he notes. “We’ve also just commissioned a 40 t/h CIL plant for CATA Mining Company’s new gold mine in the Mara region of Tanzania.”

While it originally made its name in gold processing, APT products can treat most ores. “We don’t do anything in coal and we’re not involved in some of the bulk hard rock commodities such as iron ore and manganese but

that we can offer customers. We also have representation in 47 countries worldwide and have supplied plants to – among others – Malaysia, the Philippines, Indonesia, Afghanistan, many countries in South America and most of the mining countries within Africa itself. In all, we have plants operating in over 25 countries.”

Interestingly, the company recently supplied its first plant in Western Europe – to the

*Left: A 10 t/h hard rock and wash plant combination from APT for gold recovery.*

*Below: An RG100 10 t/h scrubber wash plant.*



feature



Small scale RG30 and GoldKacha for cassiterite recovery (cassiterite is the main tin ore).

we provide processing solutions for just about everything else – gold and tin, of course, but also all the other precious and base metals, as well as diamonds and minerals such as ilmenite, tantalite and wolframite,” states McFarlane.

A crucial part of the service that APT offers is an ability to do testwork on ores and, based on the results, devise a customised processing solution. “We don’t do the testwork ourselves,” says McFarlane. “Instead, we make use of our associate company, Peacocke & Simpson (P&S), based in Harare, Zimbabwe, which is known globally for its mineral testwork expertise and whose laboratory has ISO900: 2008 accreditation. P&S undertakes extractive metallurgical testing services using all the normal processes you would expect such as gravity concentration, pulp or heap leaching and flotation, as well as some less common technologies – for example, pressure attrition leaching.”

Elaborating on APT’s equipment line-up, McFarlane says that the plants provide ore processing solutions right through from initial crushing and screening to saleable product – usually bagged mineral concentrates or gold doré. “The flowsheet will typically include one of our RG scrubbers to disintegrate loose feeds and separate fines for gravity while the coarser rocks proceed to crushing and grinding,” he says. “Initial gravity recovery can be achieved

either using our own GoldKacha concentrator or – for higher throughputs – Knelson concentrators with jigs being used for the coarser mineral separations. Where gold dissolution is required, the flowsheet will incorporate our own highly efficient and revolutionary TriTank cyanidation system. Finally, we also offer the APT gold smelter, which is essentially an electric furnace at small scale or diesel-fired at larger scale.”

APT’s philosophy is to offer only mercury-free solutions. Indeed, it manufactures plants to specifically remediate mercury-contaminated areas, which can usually recover significant quantities of gold in the process.

The company’s products are all manufactured in South Africa to APT’s designs and specifications by its in-house workshops or third-party fabricators and components are then pre-assembled and – where practical – tested locally before being despatched in containers to site. Says McFarlane: “Assembly on site – which is largely a ‘plug-and-play’ process – can either be undertaken by APT or by the customer with our assistance. Minimal civils are required – generally no more than a concrete screed and not even that with the small plants – and the plant can be in operation within days in some cases. In all, the whole process from initial order to commissioning normally requires no more than 14 to 20 weeks.

“One recent 20 t/h gold plant we did was designed and fabricated in 14 weeks. It was then despatched to site and, once there, was in production in just four days. In another case, we took just six days to erect – and commission – an entire 40 t/h gravity tower.”

He adds that every effort is made to ensure that maintenance demands are kept as low as possible. “In terms of componentry such as pumps and motors, we use recognised brands that are well supported and readily available and we also use standard bearings and shafts which can easily be sourced virtually anywhere in the world. We also have a minimalist design philosophy so that our plants are not encumbered with unnecessary complexity or elaborate ‘bells and whistles’ that can fail and cause problems, particularly out on remote sites.”

While the APT range has been developed in-house, the company is an OEM for the Knelson concentrator range (now part of FLSmidth) in Southern Africa and the excellent Knelson products are incorporated in many of APT’s larger plants.

APT prides itself on being highly innovative. One example of this is the recent addition of ‘GoldFix™’ to its offering. GoldFix



is a non-toxic, natural compound developed in-house by APT and forms part of its GroundBreaker range of gold mining products. According to the company's recent release on GoldFix, the product is designed to take the customer from concentrate to smelted nugget in six simple steps and even the smallest amounts of gold can be captured efficiently.

Another new product, introduced in 2015 and also forming part of the GroundBreaker range, is the GoldMasta sluice, an entry-level device targeted at the artisanal market. It is manufactured from durable, non-corroding material and production can start as soon as it arrives on site. It can be relocated with ease and a power outlet is not required. Two or more GoldMasta units can be placed in series and the units can also work in combination with the GoldKacha concentrator, resulting in a compact package with extremely high recovery.

Also added to the APT line-up recently is an 'all in one' solution for explorers and small miners known as the 'RG30-T Production Kit'. This combines the RG30 scrubber and GoldKacha Mark 4 with the GoldKonka Upgrader and GoldJigga field jig to form a complete mining kit able to process relatively large bulk samples and produce concentrates. The equipment is mounted on a neatly designed, rugged trailer allowing the operator to easily move from one resource to another.

Discussing the marketing of APT's products, McFarlane says that most of the company's business derives from 'word of mouth' recommendations. "We have a lot of satisfied customers out in the field and, over the years, they've passed on their positive experiences with our products to others in the mining community. We also network with customers and



potential customers at events such as conferences and exhibitions and this has also proved to be rewarding for us."

Summing up, McFarlane says that APT has experienced excellent growth since being founded and continues to stay busy despite the recession in mining. "We're fortunate in that we have a huge potential customer base for our smaller plants," he notes. "Remember that for every junior, there's scores, even hundreds, of smaller miners who tend to remain active even through the downturns and we're seeing steady demand for our products from this group. We also deal with the artisanals and this of course is a vast, almost endless, market. Certainly, demand is not as buoyant when it comes to bigger plants but here again we're doing reasonably well since – as I've already explained – the juniors are looking for economically priced plants and are turning to us. So really we can't complain too much – yes, conditions are tight but we're still growing, both in Africa and overseas." ■

**Above:** Gravity tower and TriTank CIL plant installation in progress.

**Top:** An RG800 80 t/h gold recovery plant. APT's standard gold processing plants incorporate its RG scrubber wash plant with either the Knelson concentrator (as seen in this photo) or APT's GoldKacha for optimal gold recovery.

# DRA puts a fresh focus on its

South Africa has a number of companies designing, manufacturing and supplying modular process plants, some of them with world-class reputations. Among them is Johannesburg-based DRA, which has been supplying modular plants to the minerals industry since being founded in the 1980s. Over the past couple of years, the group – which now operates globally – has put a fresh focus on its modular plant business, in the process reinvigorating its modular plant range. **Modern Mining** recently spoke to DRA's Grant Westcott, GM – Modular Division, and Paul Hopwood, Manager Turnkey Projects, to learn more about the benefits and capabilities of DRA's modular offering.

According to Westcott, the benefits of modular plants are well established. “Being pre-engineered, the manufacturing lead time is much shorter than with conventional fixed plants and the time span from a client placing an order to the plant being erected on site and commissioned can be as little as 12 to 16 weeks compared to perhaps a year to 18 months, or even more, for a conventional facility,” he says. “This is without a doubt one of the key benefits of modularisation as most juniors – who constitute the prime market for modular plants – are usually working with limited budgets and need early access to cash flow. Moreover, the capital cost of modular plants is normally much less than with fixed plants and the operating costs are generally lower.”

Westcott adds that modular plants are perfect for the modern mining scene, where small and/or marginal deposits with limited lives are increasingly being exploited. “If you have a deposit with a limited life, you naturally want to limit your capex and build a lean, fit-for-purpose plant that maximises your return – and which can also be relocated, if necessary, to a fresh deposit or a new project,” he observes. “Another point is that one can start small and slowly build up capacity in stages by adding modules to the original installation. Fixed plants simply don't offer this type of flexibility.”

He also notes that modular plants are well suited to remote locations, as the plant modules – which would normally have been tested prior



to dispatch – can be trucked to site in containers and assembled, Meccano-style, by a small team of erectors with only minimal earthworks and civils being necessary. “Compare this to the situation with a fixed conventional plant, where you will need to put in substantial preparatory earthworks and civils and where the workforce needed could well number hundreds of people; specialist skills may need to be sourced from neighboring countries given that engineering and trade skills tend to be limited in remote, undeveloped areas.”

DRA's modular plants are frequently supplied as part of a lump sum turnkey (LSTK) package – which is where Hopwood, who runs DRA's Turnkey Projects Division, comes in. “Frequently, clients want more than just a plant – they want an entire turnkey package that can assist them in making the transition from a ‘greenfield’ site to commercial production,” he explains. “Our LSTK business does precisely this. We are even able to help with project financing and – through sister company, Minopex – with plant operation.”

As an example of this approach in action, Hopwood points to a current contract that DRA has with an emerging junior miner who has secured the rights to an iron ore deposit north of Brits. “We are supplying a package which includes a 160 t/h processing module, as well



# modular plant business



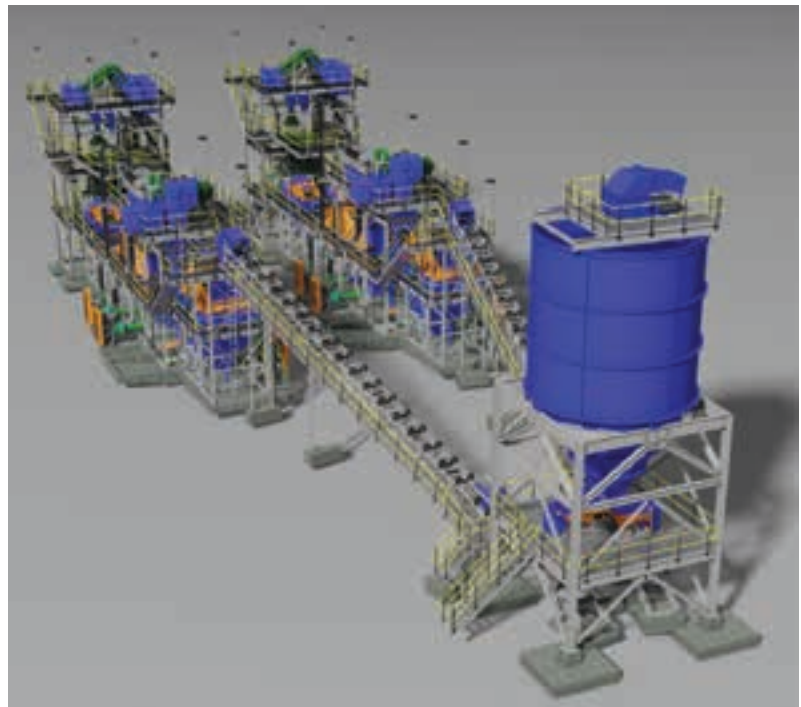
**Above:** DRA has supplied 12 plants over the past 11 years to diamond producer Alrosa for its operations in Russia.

**Above right:** DRA's modular diamond plants – an example is seen here – range in capacity from 3 t/h exploration plants through to 240 t/h production plants using single and twin-streamed DMS modules.

**Right:** A typical DRA modular coal plant incorporating a dual DMS and spirals.

as all the associated infrastructure required,” he says. “We’re also assisting the client with financial requirements and providing the necessary skills for optimal plant operation. In all, the whole process from contract signing to production will be around seven months.”

Hopwood points out that the modular plant business is not huge within the context of the greater DRA group. “DRA – which employs 3 000 people globally – is a multi-disciplinary group providing all the design and engineering services required to advance mineral projects from concept to commissioning and operations and is particularly well-known for its expertise in designing and constructing large-scale processing plants, usually on an EPCM basis,” he states. “Modular plants form only a small part of its overall activity, measured by either turnover or the number of employees. The Modular Division is nevertheless a key part of DRA. In particular, it allows us to address the needs of



the smaller and mid-tier mining companies who form a substantial – and growing – part of DRA’s customer base and ensures that we have a full spectrum capability in respect of mineral processing.”

In terms of capacity, DRA’s modular plants range from 5 t/h to 250 t/h. “Of course, 250 t/h



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does not constitute a ceiling as we can implement modules in parallel – in fact, we’ve quoted on plants as high as 1 000 t/h, consisting of 4 x 250/t modules,” says Westcott. “As a rule of thumb, I would say that modularisation works best for throughputs of up to 800 t/h. If you go much beyond this, the materials handling arrangements – notably the conveyor systems – tend to become too complex and start to negate the benefits of modularisation.”

DRA’s modules are designed to process coal, iron, diamonds, chrome, manganese and mineral sands, as well as metalliferous ores (both precious and base metals) that are disposed to pre-concentration and the removal of gangue using DMS and gravity separation technologies. Unit processes that can be addressed include crushing and screening, dense medium and spirals separation, filtering and thickening, along with materials handling and storage.

The company is particularly strong in coal and its modules can be integrated for various coal wash strategies including production of ‘Eskom’ product, primary/secondary wash, production of sized products, as well as phasing or production build up. DRA has also done well with modular diamond plants, supplying everything from small exploration and bulk sampling plants at one end of the spectrum through to 240 t/h facilities using single and twin-streamed DMS modules. These plants have included modular recovery sections, as well as scrubbers, multi-stage crushing circuits, thickeners and flocculation plants.

In respect of base metals, an effective application is the installation of modular DMS technology to reduce ore cut-off grades and upgrade mill feed, in the process reducing reagent consumption and electrical power requirements. A number of copper, zinc and nickel mines have benefitted from this approach. The suitability of an ore to this method of upgrade is dependent on the results of densimetric testwork.

Although a library of pre-engineered standard module and standard designs is available, DRA can also undertake the engineering and design of tailored modules. “We don’t have a ‘one size fits all’ approach – we accept that clients might have special requirements and we are more than happy to accommodate these,” says Westcott.

He also points out that DRA has partnerships with key equipment vendors when it comes to componentry such as screens, magnetic separators, pumps, crushers, cyclones, thickeners and water tanks. “At the end of the day, the plant we supply will have DRA’s name on it – which



is an assurance of quality and reliability,” he states. “This in turn means that we have to ensure that all componentry meets the highest standards and is fully backed with excellent spares and service support; we only source from reputable companies who are leaders in their field.”

Geographically, DRA has supplied its modular plants throughout Africa and around the globe. Says Westcott: “We’ve sent our plants to Australia (where we have a 50 t/h chrome plant working), Canada, South America and Russia. In fact, Russia has been a great market for us and we’ve supplied 12 plants over the past 11 years, all of them to diamond producer Alrosa. Our latest contract – which we’re just finishing off – is for four modules, two of 65 t/h capacity and two of 110 t/h, in Siberia. The site is extremely remote and to get there from South Africa takes three days of flying – but we pride ourselves

*Coal modules can be integrated for various coal wash strategies including production of ‘Eskom’ product, primary/secondary wash, production of sized products, as well as phasing or production build up.*



Kris Vergote - 21 years



Wilna Hoffmann - 20 years



Ernst Bekker - 23 years



Mike Dexter - 20 years



Javier Kirigin - 36 years



Mohini Singh - 11 years



Niel Lourens - 26 years

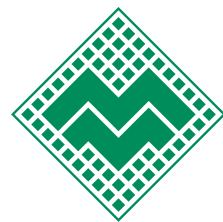


Bheka Majola - 19 years

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on being able to work anywhere in the world. All the modules were manufactured here in South Africa and shipped over but we've used Russian contractors for all site work."

Finally, and looking at the current market, Westcott says that conditions are tight with all tendering opportunities being keenly contested – sometimes by as many as 12 companies. "Having said this, DRA continues to perform in both its modular plant business and its broader offerings. We're operating mainly in the junior space within the modular sector, which has arguably been less affected by the resources downturn than other sectors of the mining industry resulting in a steady demand for our plants," he says.

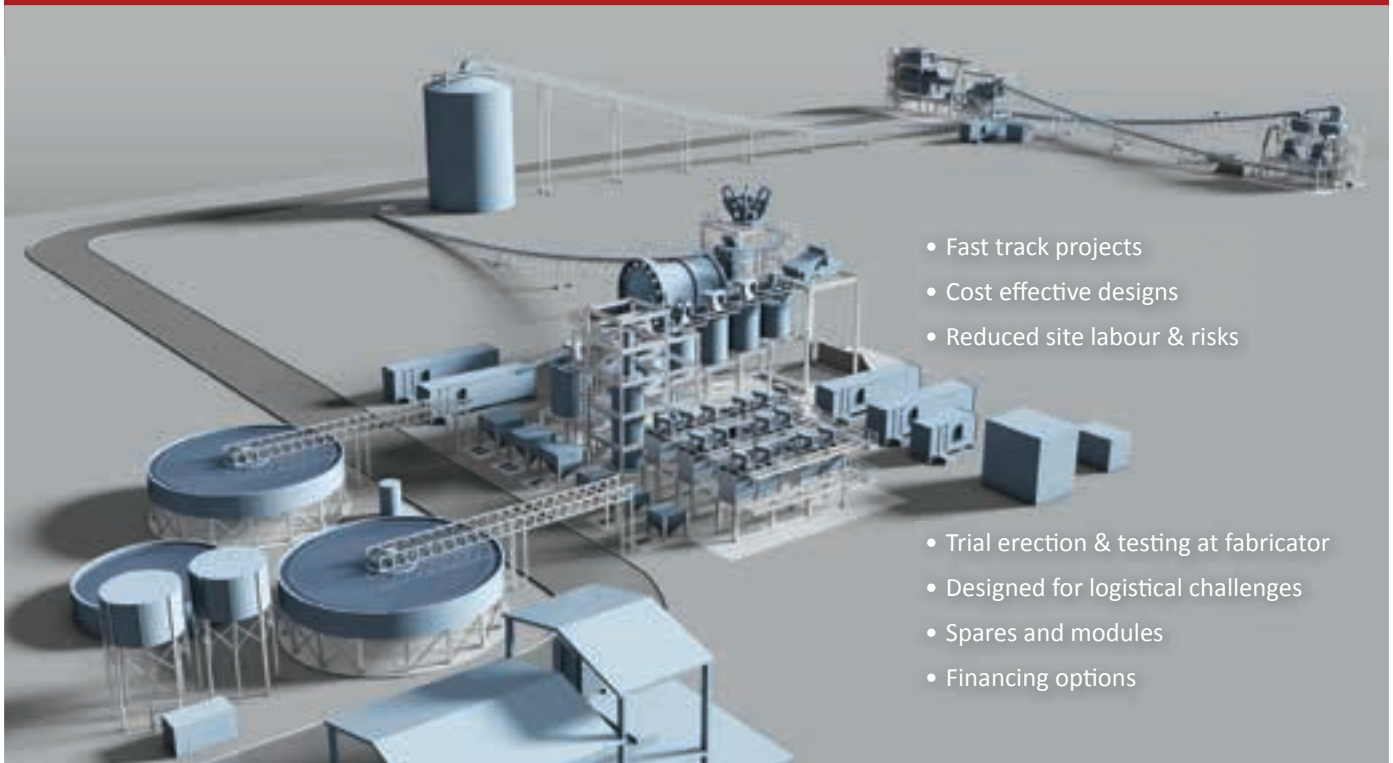
"We're also well pleased that we now have a new, innovative line of modules and plants, which have been redesigned and re-engineered for optimum performance over the past several years based on all the experience we've gained during the 30 or so years we've been operating. We believe we now have the most complete range of modular plants in the country and are confident that we will retain our position as a market leader within the industry." ■



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# Correct screen media selection now

*Asset optimisation has always been a primary objective for all mining houses – the more so in the present tough conditions facing the mining sector. A major asset for all mines, of course, is the minerals processing plant and optimising its operation will vary from commodity to commodity and from mine resource to mine resource, with the selection of the correct screen media being an important part of the process.*

Rhodes Nelson, MD of Multotec Manufacturing, tells *Modern Mining* that some iron ore mines are focusing on increasing the throughput volume because their business model is based on the cent per ton calculation. Other mines are using the differences in their geological resource characteristics and therefore have to look at optimising the product quality to create differentiation.

“The same is true in the diamond sector where mines producing gem quality stones are increasing throughputs to increase yields while those producing industrial type application diamonds are trying to reduce the cent per ton model,” Nelson says.

He notes there has also been a major increase in waste dumps being recycled across a range of commodities. “This,” he explains, “is another opportunity to squeeze volume out without having to deal with the mining constraints and allows miners to meet long term contractual requirements.”

Although greenfield capital project plants have largely dried up, there remain brown-field opportunities within existing operations – including the recycling of dumps – and these present the need to optimise plants to adapt to the changing throughput and grades required by customers.

Market conditions coupled with the ongoing drive to optimise minerals process plants have led to a situation where the control of the changes in the orebody is heightened more so than in more economically relaxed times.

“This has made the selection of screen media more important than ever to make sure that it will fit into the ‘sweet spot’ for the plant because of this variability. Add to this, the sweet spot is a constantly moving target and where, in previous years, a screen media solution supplied would have stayed in place for



*Rhodes Nelson, MD of Multotec Manufacturing, and Roy Roche, Vice President Screen Media at Multotec, inspecting a newly designed screen panel.*

extended periods, today this is no longer the case,” says Roy Roche, Vice President Screen Media at Multotec.

He cautions, however, that changing the throughput on a screen is not the simple exercise that many mines believe it is. “It requires the input of skilled process engineers who can recognise that there are a number of factors that need to be considered.”

In previous years, there would probably have been just one type of screen media on the screen. This has changed dramatically in the drive to optimise screening operations and has led to increased innovation and out-of-the-box thinking in terms of applying fit-for-purpose solutions to screens. Roche says that in some applications today there are up to nine types of panels on a screen deck.

“Another example would be where a combination of compression moulded and injection moulded rubber panels is used along with diverters to ensure optimum throughput with well over 95 % screening efficiency,” he says.

An example would be where specially engineered screen panels which combine Hardox® embedded in rubber have been installed on the feed sections of screens in an iron ore application. These panels are capable of handling the impact of the 600 mm top size. On the same screen bed, high impact slotted skid bar panels, known as Multotec Ratel panels, are used to reduce channelling and ensure accurate cut size while providing maximum screen panel life. In this self-same screening application,

# more important than ever

deck combinations of Multotec O-Slot panels are used to ensure overall cut size efficiency and again maximise life.

“It is the combination of the Ratel and O-Slot panels that ensures material throughput and screening efficiency, and importantly, it is through the clever design of these screen panels that the aperture cut size is maintained for a longer period,” Roche observes. “This translates into improved screen efficiency allowing the sweet spot to be maintained for longer, with the added advantage of greatly reduced maintenance.”

Multotec is well positioned in this market space in that the company is able to offer customers optimum flexibility in design as well as access to its world class production capability. Nelson explains that this value proposition is underpinned by the company’s strong base of internal research and development.

“Being able to effectively engineer and produce the wide range of screen panels required to meet this changed environment in screening, and at a lower volume per panel type, necessitates absolute agility and flexibility in the back end of the production facility,” Nelson says.

At Multotec this is possible because of the company’s extensive design capability. Significantly, the company has integrated its technical and design capability into its process knowledge and it is the leveraging of this together with its skilled human capital that allows the agility that has differentiated it in the market.

Nelson says technical designers are able to react to the customer specific requirement and provide an optimum solution where screen panels are appropriately positioned on the screen deck.

Commenting on the speed of responsiveness and capability for which the company is known, Nelson cites an apt example that demonstrates this. “Our team was able to design and manufacture six completely different moulds and four completely separate sets of inserts in two weeks for eleven different panel designs for a trommel in an iron ore application.”

He explains that typically a trommel screen would have one or two types of panels at the most.

“Significantly, this is one of the major advantages of dealing with Multotec as we do not subscribe to the philosophy that a standard screen panel must be made to fit a screen. We



**Above:** The injection moulding facility at Multotec Manufacturing. **Right:** Multotec produces a comprehensive range of rubber screen panels.

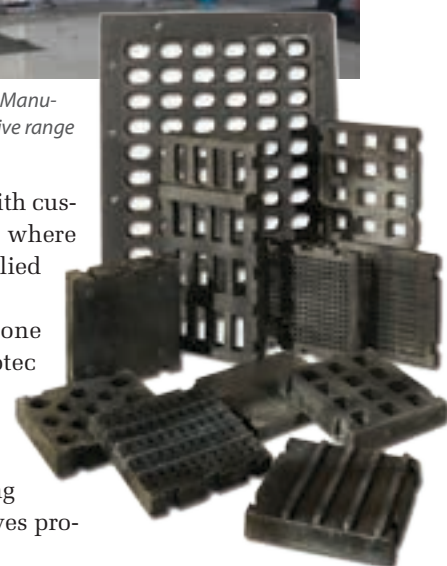
maintain close working relationships with customers and have numerous references where custom designed panels have been supplied as fit-for-purpose solutions,” he states.

“Being proactive has always been one of the major differentiators that Multotec brings to the market and this has not changed. We are focused on the vertical integration of technology in our organisation with the sole objective of being able to identify trends and align ourselves proactively with customer requirements.”

This requires a close collaboration with its customer base and the ability to deliver on the requisite solutions. Nelson says that the company has reconfigured its facilities including the tool room capacity and the rubber injection moulding capacity to ensure its agility can be easily maintained.

“The success is in the DNA of how Multotec works. People can buy the same equipment and companies can copy our products but it is not that simple to reproduce the DNA that has made Multotec a force to be reckoned with when it comes to screen media.

“This is what makes Multotec special and the level of repeat business being received underpins this statement. Our people eat, breathe and live screen panels. This level of focus will ensure our sustainability going forward and our collaborative approach will allow customers to ensure their screening plants operate at optimum efficiency and that the lowest overall cost per ton is achieved,” Nelson concludes. ■



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# Joest Kwatani pioneers new approaches to screen supply

*A company that has applied some innovative thinking to the way in which it does business with the mining industry is Joest Kwatani, a Level 3 Broad-Based Black Economic Empowerment manufacturer of vibrating screens and feeders.*

**K**im Schoepflin, MD of Joest Kwatani, says that the 40-year-old local original equipment manufacturer (OEM) is taking the lead in the screening sector to help mines cut costs in a more responsible and sustainable manner.

The company has achieved this by investing more into its research and development (R&D) capacities to continuously improve the performance of its solutions, while positioning itself as a consultant on all screening related matters. Schoepflin says that this approach is geared at countering some of the worrying trends she sees in the industry.

Firstly, she is very concerned about the “extreme cost-cutting exercises that have seen the industry bleed critical skills” including the artisans and operators needed to optimally operate and maintain a screening plant over its entire life. Technical skills are also being shed in essential R&D departments in both mining houses and mines and some of the vendors that serve them.

As Schoepflin points out, this drastic measure inevitably leads to a marked under-performance of plant and equipment, while total cost of ownership soars. Joest Kwatani is responding to these challenges by taking a completely different approach to doing business with its mining customer base.

“Suppliers to the mines need to break the traditional way of doing business – selling plant and equipment and then moving on to the next sale. We have established open and transparent communication channels with our market, sharing best practices in screening and how to feed optimal tonnages of ore at the lowest cost with our customers,” she says.

An example of this is Joest Kwatani’s contractual risk or gain sharing business relationship



*Kim Schoepflin, MD, and Derrick Alston, CEO, in front of a coal grizzly screen at the Joest Kwatani works.*

with mines. Instead of merely supplying a screen to a mine at a fixed price, this model sees OEMs and vendors share in the gains mines enjoy from efficient screening solutions.

According to Schoepflin, this approach incentivises vendors and mines to make better decisions concerning the project.

“At this point in time, I’m not convinced that suppliers are being adequately incentivised to deliver optimal solutions for projects. However, this type of contractual arrangement aligns the interests of both mine and supplier. This formula of sharing tonnage and risk positions Joest Kwatani as a provider of value rather than a purveyor of products and services,” she says.

Schoepflin believes there are not many screen suppliers who would be willing to enter into such agreements with mines. Joest Kwatani is able to offer such a service because it has an intimate understanding of its customers’ businesses and operational challenges, and – as Schoepflin points out – without this knowledge “there is simply no basis for gain sharing”.

A milestone for the company, in terms of these agreements, is its 11-year contract with a Limpopo-based miner to replace, refurbish, service and maintain 96 coal screening machines at the largest coal processing complex in the world.

Due to the dearth of skills on mines, she also believes that customised service level agreements are key.

“Sub-standard maintenance is being undertaken on plants. At times it is reactive as

***“Suppliers to the mines need to break the traditional way of doing business – selling plant and equipment and then moving on to the next sale.”***

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opposed to being proactive, leading to further costs to the mines. Screening machines are such important elements in the process that regimented maintenance programmes are critical to ensuring ongoing efficient operation and improved yield,” says Schoepflin.

A structured service programme allows mines to select a package that matches their existing needs and the resources of the plant. This offering has been well received by mines, and Joest Kwatani has fixed-year, multi-service level agreements in place with coal, diamond, iron ore and manganese plant operators.

Equally concerning for Schoepflin is the number of mines now opting for lightweight screens to reduce costs. This trend, she says, is very apparent on new projects where the benefits of longevity as a result of superior design are being completely overlooked by some project houses and mines.

She says mines should rather be making informed decisions that are based on striking a healthy balance between cost, performance and reliability of the equipment. However, this trend will see an increase in demand for advanced condition monitoring services and technologies, which Joest Kwatani has developed over many years.

Schoepflin says that the company has taken conventional condition monitoring practices to the next level by bringing advanced testing and measuring technology to the table. This is complemented by the company’s thorough understanding of screen operation in harsh operating conditions, and it applies this intellectual property in its consultations with various mines.

While expertise is important, it needs to be supported by a quality product. As such, Schoepflin places ongoing research and development high on her agenda. She says this is key to Joest Kwatani retaining its cutting-edge in the industry.

“Suppliers to the mines should take a more



A Joest Kwatani 53-ton exciter driven scalping screen being installed at an iron ore mine.

strategic approach to cutting costs. I would argue that today’s difficult operating conditions warrant increasing investment into all facets of R&D programmes. We have found that, by doing this, we have bolstered our abilities to improve productivity and accelerate our time to market. It also ensures that we are well positioned for the future when the commodity prices eventually improve – which they will,” says Schoepflin.

More recently, Joest Kwatani supplied its latest range of screens to a large iron ore mining operation in Kathu. Being exciter driven, these screens provide increased G-forces improving recovery of ferro-silicon media and screening efficiency and reducing maintenance costs.

As she points out, Joest Kwatani’s R&D programmes involve collaborating with the mines. This has given the company an in-depth understanding of downstream and upstream processes, as well as the limitations of flow sheets.

“Staying abreast of wear technology allows us to assess all available options and then select the most appropriate solution. We have used this know-how to improve our vibrating screening and feeding machines, as well as exciter gearboxes and unbalanced motor drive units. This is an ongoing exercise,” says Schoepflin. ■

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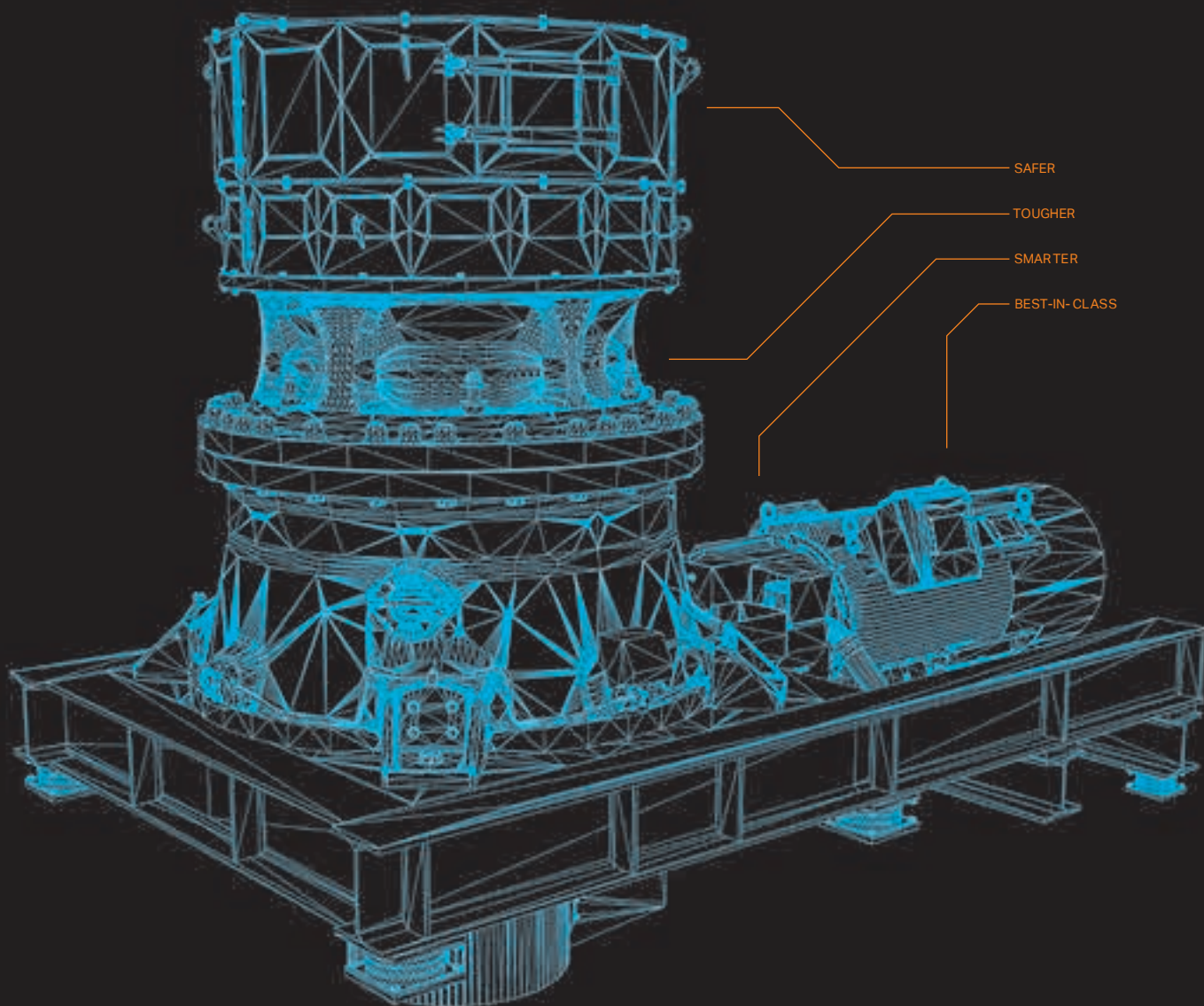
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# Grand plan for legacy brand

*FLSmidth is investing significantly into technologies and expanding on its successful product lines including Meshcape® screen media. According to the company, this range of locally manufactured screen media products is known for its ability to maximise the cost per tonne delivered, thus lowering the total operating cost of a process plant.*

**T**he strategy involves strengthening the company's manufacturing capacities to cater for the increasing demand for its comprehensive range of woven wire, wedgewire and polyurethane screen media, while boosting the exports of Meshcape screen media into other mining destinations on the continent, Alistair Calver, General Manager responsible for screen media at FLSmidth, tells *Modern Mining*.

Calver reports that a new wedgewire manufacturing machine is being commissioned at FLSmidth's manufacturing plant in Johannesburg. The facility will also benefit from an investment into a wide range of tooling that will improve its ability to manufacture very specific wedgewire screen media products for key mining markets.

In addition, the 17 000 m<sup>2</sup> facility will receive an aesthetic overhaul, bringing it in line with FLSmidth's other international plants.

"This shows just how committed FLSmidth is to the Meshcape screen media brand," says Calver. "Meshcape has a long history in the country that dates back to 1905. Since then, the company has been at the forefront of wire innovation with its research and development programmes giving rise to the Vibro Optimax™ wire and a host of other innovative screen media solutions, such as self-cleaning woven wire screen media, hybrid poly ripple screens and poly wire."

Calver says FLSmidth's massive African footprint will be used to grow its screen media presence in other mining markets on the continent. This includes the company's large installed base of equipment in Namibia, Zambia, Mozambique and the DRC, as well as Tanzania, Botswana, Zimbabwe and Ghana.

The range of Meshcape screen media products manufactured by FLSmidth is already very well known for its sound performance in a host of screening applications, with one of South Africa's biggest iron ore producers being just one of many users in the mining sector.

Ross Dott, Sales Manager – Screen Media

at FLSmidth, says it is the optimal performance of application specific screen media which translates into cost savings for plants. "Being able to facilitate enhanced throughput of material, increasing the life of screen media and reducing maintenance costs on a screening plant have become more of a competitive edge than ever for FLSmidth, especially given the economic challenges facing mines due to the global slump in commodity price," he says.

Dott is, however, concerned that there are still screening operations that opt for inferior screen media in a cost-saving exercise. He notes that by the time the issues associated with this decision are apparent, these plants have generally experienced excessive unplanned downtime.

"The overall lifespan of the screen media product is absolutely key as this enhances the operation of the screening plant and will reduce maintenance costs. It is a fallacy that bigger is better in this industry. For example, it is the way in which we draw our wire that improves the tensile strength of Meshcape's woven wire screens, making these lighter and more cost effective as well as allowing for improved wear characteristics," Dott says. "Meanwhile, we engineer our polyurethane screen panels to suit specific applications. Here, we aim to maximise the open area as much as possible, while reducing the mass of the panel itself as well as the overall installed mass of a screen."

As an example Dott points to two platinum mines that achieved significant savings through applying the correct screen media to their screening plants. Other examples include maximised magnetite recovery in coal operations where Meshcape wedgewire is being used. ■



*Modular polywire screen panel in a silica application.*



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# Osborn rotary breakers find favour in coal

Two recent orders for Osborn rotary breakers reflect the continued demand for these robust, reliable machines in the coal industry, says Osborn Engineered Products. The Elandsfontein-based equipment manufacturer has supplied a rotary breaker to a new customer in the Kriel area and has secured an order from a coal mine in Secunda, says product sales specialist Etienne Swanepoel.

“At the Kriel coal mine, our customer has installed a 3 600 mm x 6 700 mm Osborn rotary breaker to optimise the performance of his plant, remove rock and contamination, and increase the operation’s yield. This machine has a design capacity of 1 350 tons per hour, but our customer is running it at 500 tons per hour.” Osborn supplied, installed and commissioned the new machine, including the chute work and the support structure, Swanepoel adds.

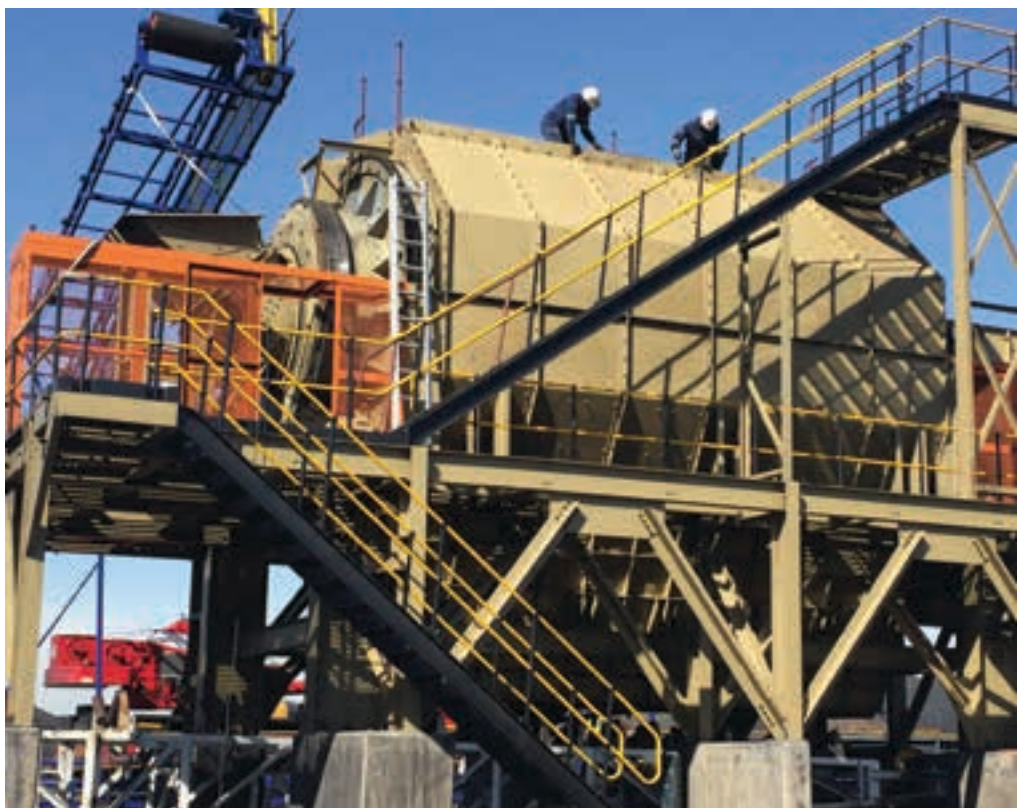
He contends that this mine, like many others, recognises the value of an ‘old classic’ like the rotary coal breaker.

“For rock removal, rock and coal separation, the rotary breaker is the best machine for the job. This tough, hardworking unit has come back into favour in the coal mining industry in recent years, and it is once again making its mark as the most efficient machine for use in ‘dirty’ coal mining environments, where there is a lot of rock in the run-of-mine material.”

Explaining the rotary breaker’s operation, Swanepoel says it works on a gravity method to break coal in a very efficient manner through attrition. “Material is continuously introduced at the feed end, repeatedly raised by the lifters and dropped until it is broken to size and falls through the perforations in the screen plates to a collection hopper below.

“Any hard rock present in the feed material assists with breaking the coal during the raising and dropping action. The Osborn rotary breaker is designed to reduce soft to medium coal and is not entirely suitable for hard coal or coal with a high moisture content.

“Mine rock, refuse and other uncrushable debris is automatically carried to the end of the drum and is discharged through a chute,” Swanepoel continues. “The Osborn rotary breaker’s design incorporates a chain and sprocket drive arrangement which drives a heavy duty reinforced drum. Renewable



*An Osborn rotary breaker in a typical application.*

perforated plates are fitted around the interior of the drum. Interchangeable lifters and ploughs are bolted on the inside of the drum. Due to variations in the types of coal being processed, capacities and power requirements will vary from mine to mine.” ■

## Iron ore mine opts for Metso equipment

Metso reports that it will deliver to Sedibeng Iron Ore, a subsidiary of Tata Steel, a stationary crushing and screening solution for its Sedibeng iron ore mine in the Northern Cape. The delivery includes a five-year Life Cycle Services contract, which will reportedly bring Sedibeng increased production capacity and reliability while reducing production costs.

The cold commissioning is scheduled for late 2016, and the plant should be operating at the beginning of 2017.

“This complete solution covers services and equipment and thus ensures planned maintenance and better production reliability for the customer. For Metso, the order represents a new way of operating in Southern Africa. It increases our installed base in the area and will surely open up new opportunities in the growing market,” says Charles Ntsele, Metso’s General Manager for Mining Sales in Southern Africa.

Sedibeng Iron Ore mine has previously been using a Metso mobile crushing and screening solution operated by a sub-contractor. Due to a planned increase in capacity, Tata Steel, the principal shareholder, wanted to investigate the possibility for a stationary plant.

The complete order consists of a vibrating feeder, a C130 jaw, a CVB 603 screen, an HP 500 cone crusher, conveyors, electrics and automation, together with the auxiliary equipment. ■



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# Fit-for-purpose bespoke chute systems in demand globally

*Given the current turmoil in the mining industry and extreme pressure on operating and maintenance budgets, mines need to look at ways of enhancing operational efficiency and trimming expenditure wherever possible. One of the highest cost areas is the crushing, milling and screening circuit. And this, says Mark Baller, MD of Weba Chute Systems & Solutions, is where one of the company's strengths lies.*

**A**s an internationally leading transfer system OEM, Weba Chute Systems & Solutions can leverage its extensive experience to produce fit-for-purpose chute systems that will assist mines and plants to optimise plant throughput and reduce unnecessary downtime.

“Through bespoke chute design we have been able to assist numerous operations by significantly reducing maintenance costs while increasing operational productivity,” Baller says.

“More companies are seeing the real benefit in having a chute system custom manufactured to cater for the specific parameters of each area where material is transferred within a plant. Those that may have had reservations about the cost have come to realise that the significant savings in reduced maintenance costs, as well as a dramatic reduction in unscheduled downtime, mean that the chute system can pay for itself in as little as six months,” he says.

Baller says the company has noticed a move by mines to look at replacing chutes that have been identified as exceptionally high maintenance areas. “And this is a good example of where – if the capital is allocated to a more appropriate material transfer solution – the saving from the maintenance budget will pay for the replacement chutes,” he adds.

Weba Chute Systems & Solutions is currently working with customers to replace chutes using operational and maintenance budgets with structured payments facilitating this process which then makes it more affordable. Baller anticipates that there will be an increase in this need during the year as the spotlight remains on increasing productivity and reducing costs in all commodity sectors.

This OEM, with a legacy going back more than 25 years, has more than 4 000 transfer

chute installations in place in South Africa, in many African countries and in several other parts of the world.

By adopting a streamlined and scientific approach to the dynamics of bulk materials handling at transfer points, a multitude of benefits are provided to mines and plants where Weba Chute Systems have been installed. In addition to reduced maintenance requirements, other advantages include improved transfer conditions, longer conveyor belt life, less spillage, reduced product degradation and higher throughput.

“The first step is always a site visit by our experienced team, and from the information collected we are then able to identify transfer issues. It is a collaborative effort with the customer that ensures we develop a tailor-made solution that will increase the return on investment in a short space of time,” Baller says.

The Weba Chute System uses a ‘supertube’ effect with a cascade lining system which is achieved by using sound engineering principles and a sophisticated 3D Computer Aided Design (CAD) program. This design results in 95 % of the material running on material at all times. The bottom layer of particles in the product stream moves in a tumbling motion as opposed to sliding down the chute. Wear is significantly reduced and in, many cases, the lips remain completely covered by material providing a longer life span.

“The intellectual property of our engineers remains the crux of our design ideas and concepts but we do believe in complementing our practical knowledge with Discrete Element Method (DEM) simulation as a verification tool. Our primary objective remains engineering a tailor-made best practice chute solution for each and every customer,” Baller concludes. ■



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

***“Our primary objective remains engineering a tailor-made best practice chute solution for each and every customer.”***

feature



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# Trio crushers show their mettle

*A producer of aggregate from mine waste rock dumps is not only optimising its production in Stilfontein using its range of Trio® comminution equipment, but has also lowered its total cost of operation by entering into an extended service level agreement (SLA) with Weir Minerals Africa.*

Since replacing equipment at its two operations with Trio® crushers and screens from Weir Minerals Africa, CNC Crushers Roadstone has enjoyed uninterrupted production, ranging from 1 000 to 1 200 tonnes of aggregate a day for road construction in various areas of North West Province.

Weir Minerals Africa first entered into its long-standing business relationship with CNC Crushers Roadstone's owner, Carl Crous, at the beginning of 2014. This is when the original equipment manufacturer (OEM) installed a Cavex®400CVX10 cyclone and a Warman® WBH® 100 centrifugal slurry pump at one of his operations, known as Shaft 5. Crous says that he was so impressed with the overall performance of the equipment that he decided to invest in a screen and two crushers from Weir Minerals Africa. Crous' other operation, Shaft 4, is now also using a Trio® TC series cone crusher.

JD Singleton, Weir Minerals' General Manager for Trio® products in Africa and Middle East, says like all Trio® equipment, the rugged design makes these crushers ideal for African mining environments.

CNC Roadstone is using a Trio® TC36SH (short head) and Trio® TC51S (standard head) in its operations.

The Trio® TC36SH weighs 12 000 kg and has a feed opening of between 100 mm and 180 mm, as well as a head diameter of 914 mm. It has a maximum power capacity of 90 kW and a maximum capacity of between 27 t/h and 186 t/h.

The Trio® TC51S has a head diameter of 1 295 mm and weighs 22 500 kg. It has a feed opening of between 65 mm and 135 mm, and a maximum power of 200 kW. The unit has a maximum capacity of between 36 t/h and 255 t/h.

Crous says he has been very impressed with the tonnages being achieved using the Trio® cone crushers. These have exceeded the initial production requirements, leaving the operation with ample spare capacity, if it

should be required.

The aggregate producer's first piece of Trio® screening equipment was a TIO5162 inclined double deck screen.

Singleton says Trio® TIO Series screens generate their motion via three timed shafts with eccentric counter-weights. The combination of three shafts provides an oval strike with adjustable amplitude, speed and operating angle that are determined by application, feed size and gradation. The vibrating unit uses an oil bath lubrication arrangement.

The 1 560 mm by 4 880 mm Trio® TIO5162 screen operating at CNC Roadstone weighs 6 452 kg, and is driven by a 22 kW motor at between 675 rpm and 850 rpm, screening 10 mm to 19 mm material.

Weir Minerals Africa also built the mounting frame for the screen to accommodate its installation in an existing footprint, while the cone crushers were installed on existing concrete plinths, with the steel adapter bases manufactured by the OEM, thus further reducing the capital outlay of the equipment.

While the predictability and reliability of the crushers and screen are very strong selling points for Weir Minerals Africa, this operation, specifically, has maximised the operation of its Trio® comminution equipment by entering into an extended service level agreement with the OEM.

This agreement sees Weir Minerals Africa's technical field service personnel spending two full days a month at the operations undertaking preventative maintenance on the equipment. ■



*Trio TC36 short head cone crusher in a tertiary crushing application.*

## Belt cleaning systems solve carryback problems

US-based Martin Engineering, which is represented in South Africa, has resolved excessive carryback problems on the conveyor systems of the largest gold mine in the Dominican Republic by installing several heavy duty belt cleaning systems.

The Pueblo Viejo Dominicana Corporation (PVDC) – newly updated and reopened by Barrick Gold Corporation – realised the conveyor system’s existing belt cleaners were unable to adequately address the area’s overburden. Operators observed large amounts of carryback at discharge points, causing expensive equipment failures, unscheduled downtime and costly man-hours. Martin Engineering replaced the existing equipment with

primary and secondary belt cleaners at sixteen discharge points, which increased production, reduced downtime and lowered the cost of operation.

“We lost nearly US\$250 000 in revenue due to clogged pulleys and headers from abrasive dust and belt fouling in the first year,” explains Ed Power, General Process Maintenance Superintendent at PVDC. “We decided to invite a team of experts from Martin Engineering to assess the problem.”

Production is 365 days a year; however, between April and October the area can receive as much as 6 feet (1,83 m) of precipitation. Moisture can cause cohesion in fine clay particulates, which reacts to load pressure, causing it to stick to the contact surface. “The substance had the consistency of thick toothpaste, which was also able to adhere small chunks of aggregate to the belt, causing a destructive carryback that wreaked havoc on our pulleys and headers,” says Mike Lenart, Mechanical General Supervisor for PVDC. “It was a mess.”

In just two weeks, Martin Engineering replaced the existing belt scrapers with Martin QC1™ Cleaner XHD primary cleaners and DT2H™ secondary cleaners. These extra heavy-duty units are able to handle speeds of up to 6,09 m/s on belts as wide as 2,44 m and pulley diameters of more

than 762 mm. Installers fitted them with low-adhesion urethane blades specifically designed for sticky and tacky material. Able to withstand temperatures from -30° to 70°C with up to 305 mm of wear life, the blades endure high summer temperatures and constant production schedules with more time between replacements.

“The curved scraper is designed in sections, adjusted individually to conform to the belt, assuring continuous contact across the belt profile,” says Alfonso Granata, GM of PeGran, the local dealer and service agent for Martin Engineering products. “Martin Engineering manufactures a wide range of different cleaning blades, which specifically address the chemical make-up of almost all types of conveyed bulk materials.”

Sixteen Martin DT2H secondary belt cleaners accompanied the primary units to mitigate belt fouling. Attached two to three feet behind the header, the units were equipped with tungsten-tipped urethane blades suited for heavy-duty applications. To avoid product loss due to fugitive material, the Martin Engineering team also installed ApronSeal™ skirting constructed from 70 durometer EPDM rubber composite for its low abrasion index characteristics.

Martin Engineering, tel (+27 13) 656-5135



The carryback had the consistency of toothpaste, adhering chunks of aggregate to the belt and causing damage to pulleys and headers.

## Liviero adds new 70-tonne Liebherr crawler tractor to its fleet



Pictured with Liviero's new PR 776 are Louis Du Plessis (Liviero), Tendayi Kudumba (Liebherr-Africa), Richard Edwards (Liebherr-Africa) and Nehan Deysel (Liviero).

Multi-disciplinary contractor Liviero recently took delivery from Liebherr of the first new Liebherr R 776 prototype crawler tractor to land in South Africa. The machine is the world’s first hydrostatically powered crawler tractor in the 70-tonne category and it joined Liviero’s fleet ahead of its global market launch at Bauma 2016.

Liviero says its mining clients will reap the benefits of the PR 776’s lower fuel consumption, outstanding performance, operating comfort and safety. An intuitive joystick control has maximised operating comfort, while safety has been enhanced by a design that offers an excellent view of equipment and the surrounding area.

Liebherr handed over Liviero’s new acquisition at a celebration at Vanggatfontein colliery, where Liviero Mining is working in partnership with client Keaton Energy, and has delivered outstanding production results over the years.

“We are delighted to add this modern, high-performance new machine to our fleet at Vanggatfontein. It reflects Liviero’s commitment to investing in state-of-the-art equipment that can enhance our performance and give our clients a competitive edge,” comments Liviero CEO Neil Cloete.

## Mogalakwena acquires CYBERMINE Full Mission Simulator

Employees of Anglo American's Mogalakwena platinum mine in Limpopo Province, as well as members of the surrounding community, are reaping the benefits of the mine's high-fidelity, simulator-training programme.

The mine has recently purchased another CYBERMINE Full Mission Simulator (FMS) from Durban-based ThoroughTec Simulation, this time for the training of Caterpillar D10T dozer operators. This simulator complements the mine's existing system for the training of Taiyuan Heavy Industries WK55 rope shovel operators, which was the first of its kind in the world.

"The CYBERMINE simulators provide us with an environment which is as close to the real thing as possible. It allows for a lot of practice, and mistakes to be made in a safe environment at zero risk," says Richard White, HRD Coordinator QA & Learning Delivery, at Mogalakwena.

The mining of platinum is heavily mechanised and the costly equipment

used can be dangerous. By the time the learner operators graduate from the simulator, they are already comfortable with the equipment's controls and what they can expect in the mining area.

"After evaluating the dozer simulator for a period of time and having proven its utility and benefit to training, the mine decided to purchase it outright," says Adam Smallman, Regional Vice President for EMEA at ThoroughTec.

The simulator is not just providing safety benefits. "There are also productivity upsides," says White. "We've found that now, after simulator training, a lot more ripping gets done by the dozer operators." The simulator's 360-degree field of view and ripping capabilities provide a life-like situation for operators to practise not only dozing, but ripping as well.

This particular simulator is also being used in a community development project

known as Dozing to Success. "The dozer is our entry level equipment for up and coming operators; therefore the D10T sim will be our primary tool in teaching community members who have no mining experience whatsoever about the mining environment in a safe, realistic manner," says Stephan Voges, HRD Trainer. "It's broadening the skills base in the area."

ThoroughTec Simulation, tel (+27 31) 569-4033



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## Innovative standby power solutions from Zest WEG

Power outages have become increasingly frequent with a widespread knock on impact being experienced across industry. The ability to provide fit-for-purpose standby power solutions is one of the skills that differentiates Zest WEG Group's Generator Set Division.

Standby power solutions can range from a single diesel driven generator set to a total standby power solution depending on the size of the building or project in question. Larger contracts often require a blend of smaller and larger generators to meet the needs of the various ele-

ments within the project. In all instances, fast reaction times from suppliers and the deployment of a reliable and durable generator set should be the standard.

Zest WEG Group's Generator Set Division says it has built a solid reputation with a large number of clients over a diversity of industries, clearly demonstrating its capability to cater for large-scale standby power projects. A number of recent contract awards highlight the company's ability to provide solutions that range from standalone generator sets to turnkey power stations, such as the one supplied to AVI Group's Indigo Brands.

The scope of supply on the Indigo Brands project comprises three 1 000 kVA generator sets and three 1 000 kVA transformers. Zest WEG Group's Generator Set Division is also designing a custom-built electrical panel for distribution, interfacing and synchronisation purposes. The company will additionally be supplying a 23 000 litre bulk fuel tank system, as

part of the optimum solution.

In a recent refurbishment contract, a containerised standby power system was supplied to a client at the V&A Waterfront. Craig Bouwer, Projects and Product Manager at Zest WEG Group's Generator Set Division, explains that after discussions with the customer it was determined that this would provide the most cost effective solution.

The project involved a 'rig-out' of the existing equipment from the original building and designing and fitting a sound proof canopy, louvres and base frame adaptor to allow the generator set to be housed outdoors, as well as final testing of the newly containerised unit.

Zest WEG Group's Generator Set Division believes that the key to its success is its ability to devise innovative solutions. A prime example of this is the contract to supply a standby power supply for worker accommodation at Firestone Diamonds' Lihobong diamond mine in Lesotho. ➤



Three 450 kVA Zest WEG open type diesel generator sets equipped with WEG alternators.



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◀ A major challenge encountered by the Zest WEG Group's Generator Set Division team was the location of the mine, which is positioned high in the Maluti Mountains. Not only did special consideration have to be given to the logistics of transporting all components to the site, but the presence of significant amounts of snow during May to September called for an innovative solution to the housing of the generator sets. The access road to the mine had to be widened and its load-bearing capacity increased to accommodate the low-bed trucks transporting the Zest WEG equipment.

Zest WEG Group's Generator Set Division designed, supplied and installed three 12 m high, purpose-built containers that incorporate a special 'snow roof' structure to prevent snow build-up on top of the generator sets, and subsequent blocking of the louvres. Particular attention was paid to the design and engineering of these 'snow roofs' to enable them to be collapsed when the containerised units are transported.

The three 630 kVA generator sets needed to be synchronised via Woodward Easygen controllers and were subject to a soundproofing requirement of 65 db(A) at 7 metres. This stringent standard is normally applied to residential areas but was deemed necessary, since the application was for worker accommodation. Further requirements were for a 1 000 litre fuel tank with gauge and level indicators and a fusible fire link on the generator sets and inlet dust filters.

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

## Eazi Group extends its range

The Eazi Group reports it has now extended its equipment range to the versatile Power Towers machinery. "Low-level powered access provides an easier, simpler, more efficient and safer way to work than manual ladders, steps, podiums and small scaffolding," says Brett Fleming, CEO of the Eazi Group.

Over the years, Eazi has positioned itself as a leading supplier and distributor of access equipment to the Southern African market. Eazi services the largest fleet of telehandlers and work-at-height equipment in the region. Its head office is located in Midrand, north of Johannesburg, with an additional 13 premises across South Africa.

Eazi's product range includes machines from big industry players such as JLG, Magni and Maeda. Recently, JLG bought 100 % of Power Towers, a formerly UK-based company. Says Fleming: "This acquisition opened the doors for the Eazi Group to take on Power Towers through our partner JLG for the African market. We are now in the position to fill a gap in the niche market of low access equipment in Africa."

The low level access segment refers to a lifting and working environment of up to 4,5 to 5 m. In the access industry such relatively low working levels are considered a specialist sector, particularly for tasks which include the installation and maintenance of heating, ventilation, air-conditioning and electrical systems and ceiling work.

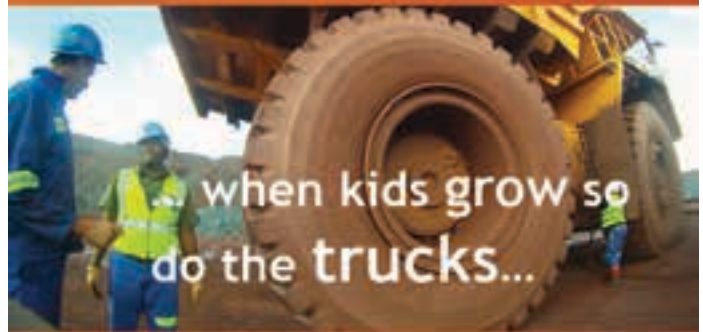
Power Towers are said to be highly versatile and efficient whilst still being cost-effective. Unlike scaffolding, a ladder or steps, Power Towers can easily be put into position, adjusted and moved while observing high safety standards.

Currently, the range comprises seven machines. The Power Tower, Nano, Pecolift and Ecolift make up the push around range. The Nano SP range covers the self-propelled machines. The latter are well suited to work on cables and pipes as well as for plastering and painting, particularly where space is limited.

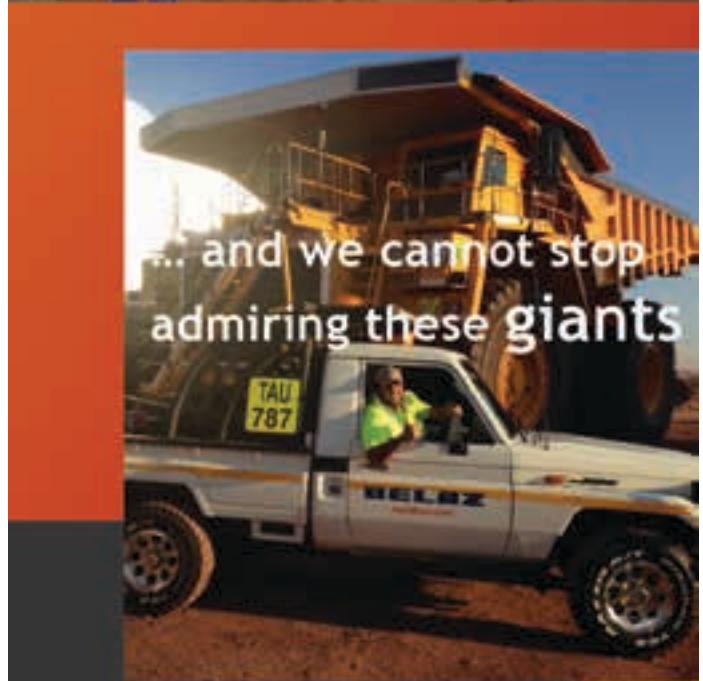
Eazi Group, tel (+27 11) 312-2118



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## World's largest articulated hauler introduced locally

Babcock has introduced the new Volvo A60H articulated hauler to the Southern African market following its much-anticipated unveiling at the 2016 Bauma exhibition. This heavyweight 60-tonne articulated hauler is the largest machine ever to be built by Volvo and is the largest of its kind in the world. Babcock is the exclusive regional distributor for Volvo Construction Equipment in South Africa.

The A60H's higher payload represents a 40 % increase on Volvo's current A40 models, significantly lowering the cost-

per-tonne ratio for hauler customers, while its stability, comfort and high hauling speeds are ensured by the matched drivetrain, automatic drive combinations, all-terrain bogie, hydro-mechanical steering and active suspension. An added advantage of the A60H is that it has many features that will be familiar to A40 operators, eliminating the need for any major operator training.

"It will be an easy transition for operators with only a short orientation course needed," says David Vaughan, Sales Director – Equipment at Babcock. "Furthermore, technicians who regularly service other Volvo haulers will have knowledge of many of its elements such as a front grill that swings down, opening up a service platform with anti-slip steps, and an electric hood that opens to 90 deg, allowing full and safe access to the engine compartment."

The A60H has been launched locally in conjunction with the new Volvo EC950E, a 90-tonne crawler excavator that com-

bines power and stability to handle a higher capacity in the toughest applications. Vaughan says that this excavator is eminently suited to the Southern African market and fits right into Babcock's product line, as well as complementing the A60H hauler.

"The A60H is ideal for hard rock mining, coal mining, general mining and big quarry applications, and the EC950E has been designed to load the massive A60H, so they work hand-in-hand," explains Vaughan.

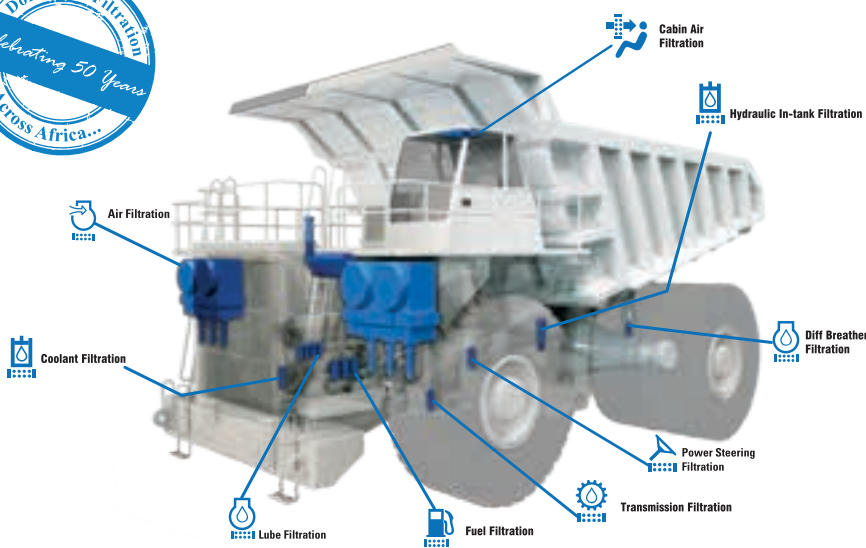
Bauma is the biggest construction machinery and mining industry trade fair in the world. This year Babcock attended the exhibition along with a number of its mining customers, including Burgh Plant Hire from South Africa, which has become the very first customer to place an order for not just one but three Volvo A60H articulated haulers, as well as one Volvo EC950E excavator.

Babcock, tel (+27 11) 230-7300



The newly launched Volvo A60H articulated hauler.

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## Local pump supplier to distribute Sykes range

Integrated Pump Rental has secured the distributorship for the Sykes range of pumps, complementing the company's existing rental offering by adding this line up of reliable, proven diesel driven units. Sykes pumps are purpose designed and built for the mining, construction, municipal and rental markets. Integrated Pump Rental will also be marketing and selling the range to its customers.

"By becoming the official distributor of the Sykes range of pumps in April, we have significantly boosted our abilities as a pump project rental specialist. By having quality diesel mobile units in our range, we can now offer our customers mobile units that can be used in areas where there is no available electrical power," says Lee Vine, Integrated Pump Rental's MD.

The company says it decided to partner with Sykes because of the original equipment manufacturer's more than 40 years of experience manufacturing quality, high performance pumps.

"Sykes is a well-known and respected player in the international pumping industry, while Integrated Pump Rental has built up a solid reputation for being able to supply quality pumping solutions for a range of projects. These synergies mean that both companies will benefit significantly from this partnership," says Vine.

The Sykes pumps feature cleverly designed automatic priming capabilities based on a Venturi system that can deliver

suction lifts of up to 9 m. The pumps offer market leading efficiency, are extremely robust and built with a 316SS impeller and wear plates as standard construction.

Vine also notes that the dry running, oil lubricated mechanical seals fitted to the Sykes range allows, the pumps to operate under snore conditions and reprime automatically without incurring damage.

Integrated Pump Rental will be offering the OEM's full range of pumps, including the Low Head (LH), Medium Head (MH), High Head (HH) & Extra High Head (XH) series for handling solids.

Vine reports that the response to the Sykes launch by South African pump users has been phenomenal with many Integrated Pump Rental customers expressing a keen interest in the technology.

Significantly, in order to increase the local content value Integrated Pump



The Sykes Xtra High Head pump range caters to the arduous demands of the mining industry and all models have the ability to operate unattended at high discharge heads.

Rental will be packaging some of the Sykes range in Johannesburg, Gauteng. This will include local fuel pods, skids and trailers, and Vine says the final package will be very competitive and also ensure excellent flexibility in meeting customer specific requests and lead times.

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

### ELB to refurbish tipplers

ELB Engineering Services (ELB) has been contracted by Transnet Capital Projects for the refurbishment of Tipplers A and B at the Transnet Port Elizabeth Manganese Terminal.

The company's scope of work will include design, supply of new components, stripping, refurbishment of the tipplers including mechanicals, structural and elec-

tricals, and the installation of the two 1964 Strachan and Henshaw tipplers.

The refurbishment of the two tipplers will be done in a phased approach. Tippler A will be refurbished first with a number of new components and, once completed, tippler B will be refurbished. This project will extend these two tipplers' life cycle by another five years, while the new terminal building is being built.

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## TAKRAF awarded contract for ore transport system

TAKRAF 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.

Chuquicamata is one of the largest open-pit copper mines and the second deepest open-pit mine in the world and is located 650 km north of Santiago.

Popularly referred to as 'Chuqui', the mine has been operating since 1910. The underground 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. It is scheduled to be in operation in 2019.

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 system will also include a number of feeder conveyors as well as an overland conveyor feeding into the existing conveying system.

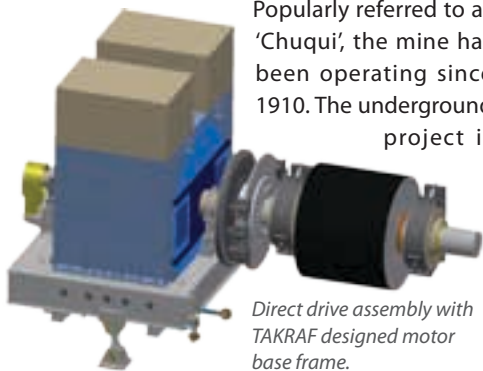
The conveyor system will be installed with advanced gearless drive technology with the uphill tunnel conveyors boasting the highest drive power ever to be installed on a belt conveyor. In fact, total installed drive power for the entire system

will be around 55 MW. Gearless drives eliminate the need for a gearbox, significantly reducing the number of main wear parts.

TAKRAF's innovative chute maintenance solution will allow for all regular chute maintenance to be conducted from outside the chute, with no person having to enter 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 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.

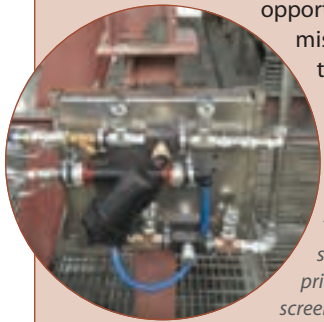
TAKRAF, website: [www.takraf.com](http://www.takraf.com)



Direct drive assembly with TAKRAF designed motor base frame.

## Misting system installed at Zimbabwean mine

Zimbabwe's first-ever misting system has been installed at Caledonian Mining's Blanket gold mine in Gwanda by I-CAT. The installation was on the mine's primary crusher and screening plant and will open opportunities for more misting projects in the region.



The misting system serves the mine's primary crusher and screening plant.

The crushing process at mines produces dust particles that are capable of entering the lungs and becoming a health hazard. It is therefore important to have control over the silica dust generated from the crushing units. I-CAT's water mist technology is used to capture the dust and ensure a visible environment.

I-CAT Technical Manager Morne van Wyk explains the project was secured by the Phumla Group, which is I-CAT Zimbabwe's agent. "Although not a large project, the installation consisted of a dosing unit and surfactant tank, an in-house manufactured control panel with filter and hydraulic flow control valves, some stainless steel piping and GTK nozzles."

As part of the process, a bracket was installed on site to facilitate the installation of nozzles on one of the conveyor transfer points. After the installation, testing was conducted on the system before it was commissioned. It has since been running at optimal efficiency.

Van Wyk says the mine was so impressed with the installation that it has decided to expand on its current system and intends to use I-CAT's technology at its primary crusher plant and stockpile transfer points. "The solutions that I-CAT offers will be used by the mine above ground and there is a possibility of assisting the operation with road dust solutions underground in future," he concludes.

I-CAT, website: [www.i-cat.co.za](http://www.i-cat.co.za)

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