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MODERN MINING

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- Going underground will double Karowe's life
- Kakula's initial processing capacity increased

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A Volvo A60H articulated hauler, the largest machine of its type in the world, is loaded by a Volvo excavator. The Volvo range of articulated haulers is distributed locally by Babcock and has proven highly popular in the Southern African market. See our cover story on page 18 for further details.

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Kangaluwi back in the spotlight

As a mining journalist, I'm obviously favourably disposed towards mining but, even so, I can't help thinking that some deposits are better left in the ground. A case in point is the Kangaluwi copper deposit in Zambia. It is something of an anomaly as most of the copper resources for which Zambia is famed are found on the Zambian Copperbelt, just to the south of the border with the DRC. By contrast, Kangaluwi sits in splendid isolation far to the south, close to the Zambezi River which forms the border with Zimbabwe and in the middle of what is indisputably one of Africa's most beautiful wildlife areas, the Lower Zambezi National Park.

One might think that Kangaluwi's location in a protected area would rule out any chance of it being developed into a mine. Not a bit of it. The deposit attracted the attention of Australian junior Zambezi Resources in the early 2000s and the company – working through a Zambian subsidiary known as Mwembeshi Resources – subsequently carried out various exploration programmes and studies, culminating in the preparation of an Environmental Impact Statement (EIS) which was approved by the Zambian government in 2014 (despite having been earlier rejected by ZEMA, the Zambian Environmental Management Agency). A mining permit was subsequently issued.

Opposition to the proposed mine – an open-pit operation – by various organisations within Zambia and a court challenge to the mining permit led to the project being put on hold – and it stayed that way till a few weeks ago when the High Court in Lusaka effectively ruled that the mine could go ahead. The subsequent uproar from parties opposed to the mine has led to the Zambian government saying that no mining activities will be allowed in the national park. The mining licence, however, has not been revoked so it would be premature to say that the Kangaluwi project is finally dead.

Zambezi Resources (now known as Trek Metals) no longer owns the project. The company – currently focused on a lead-zinc project in Gabon – announced in April this year it had sold Kangaluwi for just A$1,1 million to Grand Resources, a Dubai-based investment company. Grand Resources is a bit of an unknown quantity, with no one apparently knowing who its owners are – although there has been speculation that there are Chinese interests behind it.

If Kangaluwi does ever go ahead, it would not be the first mine in the Lower Zambezi National Park. Apparently a tiny gold mine – known as Chakwenga – operated there back in the 1930s and 40s, producing (according to one source) around 58 kg of gold (a paltry 1 864 ounces). But of course in those days the area was not protected, the current national park having only been proclaimed in the 1980s.

I remember covering Kangaluwi about ten years back. My recollection is that Zambezi Resources was planning a relatively small 1,5 Mt/a open-pit operation which would produce around 14 000 t/a of copper in concentrate, with a small gold credit. The company was very aware of the opposition to mining in the park and was promising one of the 'greenest' copper mines in existence to anyone who listened. It pointed to the Palabora copper mine and the now-defunct Tshikondeni coal mine, both next to Kruger National Park, as examples of mines which co-existed harmoniously with a national park.

ZEMA, however, was not impressed with the EIS it eventually received nor was a group of experts who contributed to an evaluation report on the project in 2014 for the Lower Zambezi Tourism Association (admittedly not an impartial body). They concluded that there were a "number of critical unanswered questions around the economic value of this project, its full scope, and its potential impacts" and said there was "no convincing nor even coherent economic argument for allowing this mine to proceed."

I never managed to get to Kangaluwi although I have visited the Lower Zambezi National Park and must have been at various times during my stay just a few kilometres from the proposed site of operations. It's worth pointing out, of course, that the park lies directly across the river from Mana Pools in Zimbabwe, a world heritage site.

Somewhat ironically, when I visited the park I stayed in a riverside lodge close to the park entrance which was owned then (and may still be, for all I know) by a well-known copper-mining personality!

What happens now with Kangaluwi is anybody's guess but personally I'm hoping that it will quietly go away although I acknowledge that some readers might disagree with me. For those, who would like to know more about the project, there is a considerable amount of material that can be found on the internet, including some excellent articles by Sharon Gilbert-Rivett which have appeared on the 'Daily Maverick' site and which are well worth reading.

Arthur Tassell

"The company was very aware of the opposition to mining in the park and was promising one of the 'greenest' copper mines in existence to anyone who would listen."

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Sanbrado remains on schedule for mid-2020 start-up

A recent view of the plant area at Sanbrado (photo: West African Resources).

Updating on progress at its Sanbrado gold project in Burkina Faso in its latest quarterly report (to 30 September 2019), ASX-listed West African Resources (WAF) says construction of the mine is proceeding on time and on budget for the first gold pour in mid-2020.

During the quarter, West African appointed African Mining Services Ltd (AMS), as preferred tenderer for the open-pit mining contract for the Sanbrado project. This was the final major operational contract for Sanbrado. Scope of works under the US$170 million, five-year contract will include site preparation, drill and blast, load and haul, and maintenance works. Mobilisation activities are expected to commence in November 2019, ahead of open-pit mining commencement in January 2020.

Two key contracts were awarded late last year, with Australia's Lycopodium being appointed as EPCM contractor for the mineral processing facility and supporting infrastructure and Byrnecut Burkina Faso, part of the Australian-based Byrnecut group of companies, as the underground mining contractor.

At the end of the September quarter, the Sanbrado process plant and infrastructure was approximately 70 % complete, with the CIL tanks completed, structural steel and mill erection commencing, process plant concrete nearing completion, and all major mill components on site.

Construction on the process plant is progressing well, with all seven CIL tanks successfully hydrotested, SAG and ball mill components on site partially erected and civil work complete with the exception of the ROM bin vault and the gold room. WAF has been able to accelerate the construction schedule and now forecasts to pour first gold by June 2020.

The water storage facility was holding over 1,4 gigalitres of water at the end of the reporting period, which satisfies water requirements for commissioning and steady state operations.

Management appointments include Luke Holden as General Manager – Operations, Stuart Cruickshanks as General Manager – Technical Services and Todd Giltay as General Manager – Finance.

Holden has more than 14 years' experience in site-based operational roles in West Africa and Australia. He was most recently Director General of Nordgold's Taparko gold mine in Burkina Faso.

Cruickshanks has assumed responsibility for managing the technical aspects of the mining operations. He is a mining engineer with more than 25 years' experience in the mining industry and has held operational and technical management roles with major and junior mining companies in Australia and Africa.

Giltay will provide key support to the finance team and CFO Padraig O'Donoghue. He has more than 17 years' experience working for Aurion, Placer Dome and Barrick.

A combined open-pit and underground operation, Sanbrado will be a substantial mine, with an average annual production of 217 000 ounces expected over its first five years of mine life and just over 300 000 ounces in its first year. Owned 90 % by WAF with the Government of Burkina Faso holding a 10 % free-carried interest, it is located approximately 90 km east-south-east of Ouagadougou, the capital of Burkina Faso, and covers an aggregate area of 116 km^2, consisting of a granted mining permit and a granted exploration licence. ■

The SAG and ball mill components are on site and partially erected (photo: West African Resources).

The Kibali gold mine in the DRC (photo: Barrick).

Kibali gold mine on track to meet or beat guidance

The underground operation at Kibali gold mine in the DRC set new mining and shaft production records in the third quarter to keep the Barrick Tier 1 gold mine on track to meet or beat its guidance of 750 000 ounces for the year. Throughput and recovery for the quarter were at or above the nameplate level.

Briefing local media in Kinshasa on 23 October, Barrick President and Chief Executive Mark Bristow said Kibali – already a world leader in automation – was taking this to the next level with the commissioning of a Newtrax system which would provide real-time data collection, enhance predictive maintenance, track and manage the fleet, and implement a digital safety system with personnel tracking. The mine is also working towards a proof of concept of a highly advanced system which will allow manned and unmanned operations in the same area.

"In line with our policy of local employment and advancement, we continue to transfer the specialised skills required for automated mining to our Congolese workforce. The success of this policy is evident in Kibali's consistently excellent performance and shows what can be achieved with a world-class asset in a remote and underdeveloped region of Africa," Bristow said.

Positive drill results over the last few years from Ikmava-Kalimva as well as KCD underground are expected to result in reserve growth net of annual depletion. Ongoing exploration has positioned Kibali for continued reserve replacement for years to come, with further potential open-pit extensions in Gorumbwa, Sessenge and the potential KCD super pit, in addition to the definition of the new KCD underground 11 000 lode.

Bristow noted that Kibali was maintaining its solid health, safety and environmental record despite the size and complexity of the operation.

"Following the transition of political power in the DRC, which happened peacefully in the face of many challenges, we plan to engage the new administration in a review of the 2018 mining code. We believe it is still possible to arrive at a dispensation which is more equitable to the industry," he said.

Kibali, which is owned by Barrick Gold (45 %), AngloGold Ashanti (45 %) and SOKIMO (10 %) with operation in the hands of Barrick, is located in a remote part of the north-eastern DRC, approximately 560 km north-east of Kisangani and 150 km west of the Ugandan border town of Arua. It produced its first gold in 2013.

Further good progress on automation at Syama

Automated haul trucks leaving the Syama portal (photo: Resolute).

Resolute Mining, listed on the ASX and LSE, says that a key focus of the September quarter at its Syama Underground Mine in Mali was the commissioning of the Syama automated mining system and the successful completion of site acceptance testing.

During the quarter, automated loaders successfully collected ore from the bottom of ore passes on the 1055 level and loaded automated trucks via a split-level loading facility. Additionally, automated trucks travelled up the underground decline under laser guidance before transitioning to satellite GPS guidance upon exiting the portal and continuing to dump the ore on the ROM pad.

The traffic management system both on surface and in the Syama Underground Mine was also successfully tested. Collectively, these achievements marked a major milestone for Resolute as the company commissions the world's most advanced automation mining system. All stope ore is now being hauled to the surface via the automated trucking loop. In collaboration with its partner Sandvik, the Syama operation team is working on incrementally decreasing truck cycle times and increasing average speeds.

The quarter saw further acceleration in mine production at the Syama Underground Mine. This resulted in total blasted ore tonnage mined increasing to a total of 686 969 tonnes from 622 969 tonnes in the June quarter. Ore hauled to the run-of-mine (ROM) pad during the quarter was 422 517 tonnes, a further significant increase over that achieved in the June quarter (329 356 tonnes). The number of active stoping areas (drawpoints) is now 18, compared to six in the March quarter and 12 in the June quarter.

Current stoping activity is continuing to be undertaken on the first production levels of the cave, which results in a significant quantity of the ore blasted in the stopes being retained in-situ to create an ore blanket against future hanging wall dilution. These ore tonnes will be recovered from the lower levels of the mine. Consequently, the blasted ore tonnage for the September 2019 quarter once again exceeded mined (hauled) tonnage by nearly 300 000 tonnes. In the past two quarters over 1,3 Mt of ore has been blasted, a rate which exceeds the mine's annualised production target of 2,4 Mt/a.

Syama is located in the south of Mali, approximately 30 km from the Côte d'Ivoire border and 300 km south-east of the capital, Bamako. it is a large-scale operation which comprises the Syama Underground Mine and the Tabakoroni Open Pit Mine which provide ore to two separate processing circuits: a 2,4 Mt/a sulphide processing circuit and a 1,5 Mt/a oxide processing circuit.

The mine produced 45 804 ounces during the September 2019 quarter at an AISC of US$1 523/oz. Production over the past three quarters has totalled 196 113 oz at an AISC of US$878/oz. Resolute says the performance in the September quarter was adversely affected by the completion of unplanned maintenance on the sulphide processing plant, and a reduction, as anticipated, in grade processed at the oxide processing plant. This resulted in a reduction in gold poured and an increase in unit costs. ■

Perseus takes option over ground near Edikan

Perseus Mining, listed on the ASX and TSX, has announce that its 90 %-owned Ghanaian subsidiary, Perseus Mining (Ghana) Limited (PMGL), has signed an option agreement with local Ghanaian company, Adio-Mabas Ghana Ltd, to acquire the 23,85 km^2 Agyakusu prospecting licence PL 2/177. Agyakusu adjoins Perseus's Edikan mining leases and is located between 2 and 8 km from the Edikan processing facility.

Subject to completion of customary conditions precedent, Perseus has the right to acquire 100 % of the Agyakusu licence for a consideration of US$600 000, staged over a three-year period and a commitment to spend up to US$1,6 million on exploration during that period.

Artisanal activity on the Agyakusu tenement has exposed an extensive, mineralised granitic system similar to deposits currently being mined on the Edikan mining leases.

"Agyakusu represents an exciting opportunity to potentially extend the current six-year remaining mine life of our Edikan gold mine," commented Perseus's CEO and MD, Jeff Quartermaine. "The agreement is consistent with Perseus's three-pronged organic growth strategy, which involves optimisation of our existing asset base, exploration adjacent to our existing infrastructure and developing an exploration and development pipeline of projects away from existing licence areas, all with the aim of developing a sustainable gold business producing approximately 500 000 oz/a at a margin of not less than US$400/oz." ■

View of the Asanko Gold Mine (AGM) in Ghana (photo: Asanko).

Record quarterly gold production at Asanko

Asanko Gold Inc, listed on the TSX and NYSE American, has reported its third quarter (Q3) 2019 operating and financial results for the Asanko Gold Mine (AGM), located in Ghana. The AGM is a 50:50 JV with Gold Fields with Asanko managing and operating the mine.

AGM achieved record gold production of 62 440 ounces during the quarter and is on track to meet 2019 production guidance of 225 000 to 245 000 ounces. Record proceeds of US$91,0 million were generated from gold sales of 63 009 ounces at an average realised price of U$1 443 per ounce during Q3. The all-in sustaining cost (AISC) was US$1 179 /oz, with 2019 guidance of US$1 040 – $1060 /oz maintained as AISC is expected to drop in Q4-2019 with the completion of the Nkran Cut 2 pushback.

A net loss of US$147,5 million was recorded, primarily as a result of a US$128,3 million impairment recognised by the company on its equity investment in the AGM JV, as a result of the ongoing work associated with the AGM LOM plan.

"We are pleased to deliver another solid operating performance this quarter with record production and sales that resulted in the mine generating adjusted EBITDA of US$25,7 million," said Greg McCunn, Asanko's Chief Executive Officer. "We have now completed the significant capital expenditure programme which was undertaken with the Cut 2 pushback at Nkran. As a result, we expect to see substantially reduced AISC in Q4 and through 2020, which is expected to translate into free cash flow from the AGM generating a return on invested capital to the JV partners. With cash building and no debt, we believe that we are initiating a prudent capital allocation strategy, balancing the requirement for value-enhancing exploration with a potential return of capital to our shareholders.

"We have also taken the necessary steps to align our balance sheet with the most recent developments to the scope of the AGM Life of Mine plan which resulted in a non-cash impairment charge this quarter. The updated Life of Mine plan is still subject to completion, but remains on track to be completed and published along with an updated Mineral Resource and Reserve declaration during the first quarter of 2020."

No lost time injuries (LTIs) were reported during the quarter, and the AGM has now achieved over 30 months and more than 15,7 million employee hours worked without an LTI. There were also no recordable injuries reported during the quarter.

Ore mined during Q3-2019 totalled 1,11 Mt, including 0,62 Mt of ore from the Esaase pit, at an average mined grade of 1,5 g/t and a total strip ratio of 5,8:1. The processing plant delivered another record quarterly milling performance of 1,44 Mt, at an average plant feed grade of 1,4 g/t. ■

Impressive performance by Mothae and Lulo

The processing plant at the Lulo alluvial diamond mine in Angola (photo: Lucapa).

ASX-listed Lucapa Diamond Company continued its growth as a global producer of high-value diamonds in the September 2019 quarter, delivering record quarterly diamond production from the Mothae and Lulo mines in Lesotho and Angola respectively, while also building on the cutting and polishing strategy to generate additional margins beyond the mine gate. The results leave the Lucapa group on track to achieve the 2020 production target of 60 000 carats of high-value diamonds from the two mines (on a 100 % basis).

The mines underlined their status as large stone resources during the quarter, with combined recoveries of 432 plus 4,8 carat diamonds, including 136 Specials (+10,8 carat diamonds). Against a backdrop of challenging global diamond market conditions, Mothae and Lulo achieved year to date to September 2019 (YTD) sales of US$38,2 million, with a further US$10,4 million in sales already booked post quarter-end. Total sales in 2019 have been achieved at an overall average price of US$1 249 per carat.

"Our continued focus on operational and productivity improvements and reductions in operating costs at Mothae and Lulo have enabled Lucapa to deliver robust results, including record production of premium-quality diamonds, in the face of global headwinds in the diamond sector," commented Lucapa's MD, Stephen Wetherall.

Mining and treatment operations continued to perform ahead of plan in Mothae's third quarter of commercial operations, keeping the mine on track to exceed the treatment plant's 1,1 Mt/a nameplate capacity. Mothae recovered 7 007 carats in the quarter, which was 30 % ahead of plan. Tonnes treated and the recovered diamond grade were also ahead of plan by 11 % and 17 % respectively. In addition, management's focus on productivity initiatives and cost savings saw a 21 % reduction in cash operating costs per carat to plan.

Mothae continued to underline its status as a large stone resource during the quarter, producing 135 +4,8 carat diamonds, including 39 Specials. Mining transitioned completely to the higher grade and higher margin southern pit on schedule during the quarter as further good progress was made raising the new Dam 4 wall in the June 2019 quarter. This enabled the water being stored in the southern pit to be pumped for storage into the new dam, which when completed will have a 500 000 m^3 capacity. This will ensure the Mothae treatment plant has sufficient water to continue operating in excess of its nameplate capacity.

The move to the southern pit met with early success, with recoveries including an exceptional 64 carat D-colour Type IIa gem – which subsequently became the first commercially produced diamond from Mothae to achieve a sale price in excess of US$1 million.

At the Lulo alluvial mine in Angola, operated by Sociedade Mineira Do Lulo (SML), in which Lucapa has a 40 % interest, management continued its focus on productivity and cost efficiencies during the quarter, which resulted in a 46 % reduction in cash operating costs per carat compared to the corresponding 2018 quarter. SML produced 7 603 carats during the quarter, a 67 % increase over the previous corresponding quarter. This was primarily due to an 88 % increase in the recovered diamond grade of 10,5 carats per 100 cubic metres (cphm) as more material was processed from the new higher-grade flood plain Mining Blocks 19 and 31.

This also resulted in a significant increase in the recovery of large diamonds, with the number of +4,8 carat stones produced up 138 % to 297. This included a 111 % increase in the number of Specials recovered to 97. During the quarter, the remainder of the new fleet of Volvo and Caterpillar earthmoving equipment arrived on site at Lulo. This new fleet, comprising six excavators, eight trucks, two tracked dozers and a wheel dozer, is designed to expand diamond production, revenues and alluvial resources at Lulo. ■

Marsfontein mining permit granted to Vutomi

Botswana Diamonds (BOD), the AIM- and BSE-listed diamond explorer, reports that a mining permit covering the diamond-bearing gravels and residual unprocessed stockpiles surrounding the iconic Marsfontein mine has been granted to its associate Vutomi Mining Pty Ltd.

As previously announced, Vutomi (in which BOD has a 40 % interest) has partnered with Eurafrican Diamond Corporation (EDC) to mine and process the identified deposits on both Marsfontein and Thorny River. EDC has commenced with site establishment and commissioning is expected to commence shortly with production ramping-up once commissioning is complete. Cash flows from Marsfontein will be used to fund ongoing exploration work in Botswana and South Africa.

The Marsfontein mine, which comprises a kimberlite blow, was operated for two years in the late 1990s with a pay-back of its entire development cost in less than four days. Marsfontein's run of mine grade was 172 cpht (at a bottom cut off of +1,2 mm), and its assortment was known to contain fancy coloured diamonds.

Evaluation work on the gravels and residual stockpiles adjacent to and surrounding the mine, conducted at the time of mining, indicated them to be diamondiferous with favourable economics. These deposits were overlooked when the mine was closed. ■

Regular upgrades keep Bentley Park at the forefront of training

Further enhancements at the Murray & Roberts Training Academy (MRTA) training facility, Bentley Park, are keeping the organisation at the top of its game in mining skills development.

The extensive training infrastructure near Carletonville in Gauteng is constantly adding to its resources as the demand requires, according to Tony Pretorius, education, training and development executive at Murray & Roberts Cementation.

"Among our new facilities is an indexing wall on which drill rig operators can be trained to drill on a horizontal plane," says Pretorius.

"We are also constructing a new tunnel with a face wall on surface to teach miners how to take line and grade and accurately mark off a development end with laser technology."

He highlights the value of the MRTA's 'blended learning' approach, which makes the learning process more effective by including not just classroom lectures but also e-learning, virtual reality, bench modelling, simulations and integrated learning in a workplace mock-up.

The facility prepares trainees mainly for the hard-rock underground mining environment, in which Murray & Roberts Cementation is a leading contractor.

Other recently developed mock-up facilities at the site include a bord-and-pillar layout constructed on surface to facilitate practical, supervised training for most primary and secondary trackless activities. There is also a figure-of-eight surface roadway for LHD driver training, complete with brake-test slopes. The fleet of trackless vehicles used for training at MRTA includes LHDs, a drill rig, a bolter, a telescopic boom handler, a mechanical scaler and a mechanised shotcreting unit.

With grant-funding from the Mining Qualifications Authority, MRTA will this year train 176 young jobless learners in basic mining-related skills. Those who successfully complete the six-month programme will earn a Level 2 National Certificate in Health, Safety and Environment for Mining and Minerals. Most trainees – half of whom are women – are taken up by Murray & Roberts Cementation's contract mining operations to begin exciting careers in the mining industry. ■

Inspection training on a drill rig underway at the Murray & Roberts Training Academy.

Rainbow to move to mechanised operation

In an operational update, London-listed Rainbow Rare Earths, the Rare Earth Element (REE) mining company which owns and operates the Gakara project in Burundi, says it is continuing with concentrate shipments from its operations with a further 100 tonnes of concentrate grading approximately 56 % Total Rare Earth Oxides (TREO) having been dispatched. This shipment was completed in the first week of October 2019, with additional shipments of concentrate due for processing in the coming weeks.

Significantly, the shipments of TREO contain very low levels of radioactive material, a common issue in rare earth shipments from many other operations. The concentrate from Gakara contains very low levels of both uranium and thorium, meaning it is readily shippable on the open seas. Demand for Gakara's concentrate remains strong as a result of both the quality and limited impurities, says Rainbow.

As previously indicated, production levels are expected to be reduced whilst the company performs the work necessary to achieve higher production target levels as it moves its focus from high-grade vein mining to a more broad, mechanised operation.

In order to achieve the transformation to a mechanised operation, the company is undertaking detailed geological work to establish a drill area that will support this strategy. This exploration programme will be supervised by Malcolm Titley, the former head of mining consultant CSA Global (CSA) in the UK, and by CSA Global itself, with the immediate aim of generating a prioritised ranking of exploration targets in order to complete a JORC-compliant resource in early 2020 that will support the targeted production levels.

The Gakara rare earths project in Burundi (photo: Rainbow).

Rainbow's mining licence has a total of 30 exploration targets, all of which have been shown to have numerous REE occurrences that contain mineralisation. Of these 30 targets, seven targets were historically mined, a very good indicator of high-grade mineralisation in mining deposits in Africa.

Rainbow also advises that it has implemented an operational cost reduction programme within the first month of new management changes which has led to a material reduction in operational costs. The management estimates the break-even level of concentrate production for the operation to be stable and support the above outlined strategy has been reduced from around 270 tonnes per month to 110 tonnes per month of concentrate.

Commenting on the Gakara operation last month (October) in Rainbow's audited results for the year ended 30 June 2019, newly appointed Chief Executive George Bennett said that until September 2019 mining focused exclusively on high-grade veins, which were extracted by hand, with all other materials considered waste.

"Once we have defined a larger orebody to JORC standards, we will develop a mine plan that will extract ore in bulk, by mechanical means. This will allow us to extract a far greater quantity of material at a much quicker rate, and will mean a far larger tonnage of ROM material but with a lower overall grade of mineralisation," he said.

Gakara is one of the highest-grade (47-67 % TREO) rare earths projects globally and the only African producer. Rainbow began production of rare earth concentrates in Q4-2017 and has a ten-year distribution and offtake agreement with multinational thyssenkrupp Materials Trading secured for the sale of at least 5 000 t/a of concentrate produced. ■

Petra Diamonds streamlines its management structure

LSE-listed Petra Diamonds has announced that in order to provide effective support to the company's operations and to facilitate the rapid execution of the company's Project 2022 strategy, a number of organisational changes have been put into effect. Project 2022 is designed to deliver US$150-200 million net free cash flow over the next three years to address net debt.

With all operations having transitioned into steady-state operational performance, Petra has implemented a flatter management structure, with the mines now reporting directly to the Chief Executive. The restructuring has resulted in the removal of the COO role and therefore, through mutual agreement, Luctor Roode is leaving the company to pursue other interests, with immediate effect.

Richard Duffy, Chief Executive, commented: "Luctor has been instrumental in leading the operations' transition to steady-state operational performance following a long period of capital investment across our mines and I would like to thank him for his significant contribution to the company over the last eight years. He leaves Petra at a time when the company is delivering solid and consistent production results across the operations and I am certain that he will be successful in his future endeavours. We wish him well." ■

Mining right received for Generaal coal project

MC Mining reports that the South African Department of Mineral Resources (DMR) has granted a mining right for its 74 %-owned Generaal coking and thermal coal project in Limpopo Province.

The Generaal project, together with the Chapudi and Mopane projects, comprise the company's longer-term Greater Soutpansberg Project (GSP) in the Soutpansberg coalfield.

The company submitted mining right applications for the three GSP project areas to the DMR during 2013 and following the Chapudi project mining right in December 2018, the Generaal project mining right is the second of the applications to be granted.

The Generaal project contains over 407 million gross tonnes in situ of inferred coal resources and supports MC Mining's strategy of being South Africa's pre-eminent producer of hard coking coal, used in the steel manufacturing process and attracting significantly higher sales prices compared to thermal coal.

"The granting of the Generaal project mining right is a further step in unlocking value from MC Mining's significant coking and thermal coal assets, positioning the GSP to be a potential long-term coal supplier to industrial users both local and offshore, including the planned Musina-Makhado SEZ," David Brown, MC Mining's Chief Executive Officer, commented.

"The long-term development of the three GSP project areas is complementary to our flagship Makhado hard coking coal project, also in the Soutpansberg coalfield. The company has made significant progress in advancing Makhado during the last 12 months and anticipates completing the Phase 1 capital raise process in the near-term in order to facilitate the commencement of construction in Q1-CY2020. The conclusion of domestic and export Makhado Phase 1 and Phase 2 off-take agreements reflects the market appetite for hard coking coal and the significant potential of projects located in this coalfield." ■

Graphite mine sets new monthly record

ASX-listed Bass Metals reports that it 'shipped' 809 tonnes of graphite concentrate from its 100 %-owned Graphmada mine complex located in eastern Madagascar in October this year. This represents a new monthly record. Currently, Bass has a further 560 tonnes of forward sales committed to be shipped by the end of the December quarter.

Bass says it continues to receive a strong level of interest for its concentrates and is approaching a status of having all current stock contracted for sale, leaving the company well placed for this quarter and the next.

Having qualified its concentrates for sale into the key markets of Europe, India, the USA and now China, Bass is currently working on placing concentrates into the Korean and Japanese markets, further broadening its customer base with a view to its strategic plans for large scale mining and processing operations. ■

Concor Opencast Mining delivers at Mogalakwena

Anglo American's Mogalakwena open-pit PGM mine near Mokopane, the largest in the world, has excelled in growing its annual production performance year-on-year. This can be attributed to various optimisation efforts on site, as well as the steady performance of its Zwartfontein pit thanks to contractor Concor Opencast Mining.

The majority of Mogalakwena's production originates from the Central, North and South pits, supplemented further by the nearby Zwartfontein pit. Together they should deliver on Anglo American Platinum's record-breaking production target of 1,22 Moz of PGMs for 2019.

Donald Sisiya, Concor Opencast Mining's Zwartfontein Contracts Manager.

While the three main production pits are operated by the mine's personnel, the mine relies on a contractor for the smaller Zwartfontein pit which requires an earthmoving fleet suited to its smaller size and production targets. Despite its size, it is an important contributor to Mogalakwena's annual performance.

A year and nine months ago the pit underwent a significant transition, which saw Concor Opencast Mining secure the load-and-haul contract from its previous operator. "Because the mine required a smooth changeover with minimal disruption to production, we took over most of the previous contractor's fleet, as well as its entire workforce," says Concor Opencast Mining's Zwartfontein Contracts Manager Donald Sisiya.

Having completed work at Mogalakwena's tailings storage facility in the past, Concor Opencast Mining brought to the project not only an existing relationship with the mine but its solid reputation for mining opencast, hard rock PGM operations in South Africa. "Combined with our cost competitive offer, the mine placed its faith in our ability to deliver a seamless transition and then to further optimise production without disrupting day-to-day running during the changeover period," Sisiya continues.

Concor Opencast Mining's contract at Zwartfontein has a three-year duration, as of 1 December 2017. Over this period, it must move 12 million tons of ore and 20 million tons of waste material.

With an effective change management structure in place, Concor Opencast Mining has improved the pit's production performance, having revised the shift structure for all +100 of its employees.

The company has also invested significant capital into upgrading most of the old earthmoving equipment on site which had not been properly maintained. "We have over recent months added three 130-ton excavators to the pit, over and above introducing 10 new 100-ton trucks as well," Sisiya states.

Moving forward, Concor Opencast Mining has production targets to meet by the end of the year and Sisiya is confident of achieving these. "Taking over an existing contract while ensuring minimal impact to the employees and the production targets is a success story for the company which highlights our strong capabilities in the opencast mining space," Sisiya concludes. ■

Electricity supply to Zimbabwean mine stabilises

Caledonia Mining Corporation reports that the electricity supply situation at the Blanket gold mine in Zimbabwe improved substantially in late August and September. It says this was due largely to a timely and coordinated response from the Chamber of Mines, the Ministry of Mines, the Ministry of Energy and Power Development and the Zimbabwean Energy Regulatory Authority (ZERA) which introduced a new electricity pricing schedule for the mining industry to support the funding of imported electricity which is used exclusively to supply participating mining companies.

Electricity is now priced in US dollars at a cost which is slightly lower than the pricing structure prior to the recent monetary devaluation. The electricity supply authorities have also implemented an uninterrupted power supply agreement for the mining industry in an effort to support the sector and electricity supply has stabilised following these changes.

As previously disclosed, Blanket experienced electricity disruptions during the month of July and in early August and relied heavily on its installed diesel generator back-up capacity. Prior to this time, Blanket had installed back-up generator capacity of approximately 12,5 MW, sufficient to run the entire mine at full capacity but insufficient to sustain both the mine and the Central Shaft project.

In response to the increased risk of electricity supply outages, Blanket has purchased an additional 6 MW of diesel generator capacity.

Caledonia is also in the advanced stages of evaluating a project to install solar photovoltaic generating capacity at Blanket to further reduce dependence on the electricity grid, reduce operating costs and ensure a more environmentally sustainable electricity supply.

Advanced engineering work is underway and Caledonia is in the process of applying for the relevant regulatory approvals and will shortly embark on a tender process from interested parties to build and operate the solar project. ■

Maptek Africa donates laser scanner to Wits

Mining engineering students at Wits University will be better exposed to the contribution of modern survey technology in a range of mining disciplines following the donation of equipment by Maptek Africa.

At a handover to the Wits Mining Institute (WMI), Maptek's Nick Venter said the company's I-Site 8800 laser scanner will give students valuable insight into how this technology can assist in functions such as survey, geology, geotechnical and mining. It is applied in both open-pit and underground environments. The value of the laser scanner, including all its auxiliary hardware and software, is in excess of R6 million.

"Using our technology combines long-range laser scanning hardware with processing and modelling software for the mining industry," said Venter.

He said the data collected by the scanner can be applied in various duties, including stope and drive survey; drive mapping; rock bolt identification; geotechnical analysis; stockpile volumes; mine modelling; and identifying tailings dam deformation. The equipment scans a large number of cloud points very quickly, providing detailed data that can be analysed with three-dimensional modelling and analysis software.

WMI Director Professor Fred Cawood emphasised that real-time visualisation of underground environments for risk management is very important for safe mining.

"The ability to scan complex scenes and then add risk management content to the point cloud allows for a 'realness' that other forms of augmented reality are not capable of," said Professor Cawood. "It is in this context that the Maptek scanner will be put to very valuable use by the Wits Mining Institute."

The WMI hosts the Sibanye-Stillwater Digital Mining Laboratory (DigiMine), the Centre for Sustainability in Mining and Industry (CSMI) and the Centre for Mechanised Mining Systems (CMMS).

Said Head of the Wits School of Mining Engineering, Professor Cuthbert Musingwini: "The School of Mining Engineering deeply appreciates the Maptek laser scanner donation to the Wits Mining Institute because it will be beneficial for both teaching and research in geospatial techniques. This aligns well with our re-designed curriculum – which focuses on Mining 4.0."

Venter noted that Maptek has maintained a long and healthy relationship with Wits, recognising the importance of strong partnerships between academia, the mining sector and its technology suppliers.

At the handover, senior lecturer as the Wits School of Mining Engineering, Huw Thomas, highlighted the value of raising technological awareness and competence among students. ■

Huw Thomas (left), Senior Lecturer at the Wits School of Mining Engineering, and Nick Venter, outgoing General Manager – Maptek Africa, at the handover.

Maelgwyn to contribute its expertise to Kobada

African Gold Group, Inc (AGG), listed on the TSX-V, has announced that Maelgwyn Mineral Services Africa (MMSA) will be contributing its expertise to the Kobada gold project in Mali.

SENET, the Johannesburg-based EPCM company managing the Definitive Feasibility study on the project on behalf of AGG, has contracted MMSA to conduct metallurgical testing of material from the project.

"We are pleased to support SENET and AGG on the Kobada gold project," commented Hennie Stallknecht, Metallurgical Manager, MMSA. "Our aim is to re-evaluate different process options and to optimise the best process flow in terms of gold recovery and project economics through the execution of detailed and quality test work. Variability samples from the orebody will also be tested to provide the information required for economic and block-modelling of the project. Samples to commence the test work have already been shipped to MMSA in Johannesburg, South Africa."

"We are delighted to have MMSA on board to undertake the detailed test work on the Kobada orebody", said Danny Callow, Chief Operating Officer for AGG. "We will undertake detailed test work on representative composite samples taken from across the concession and test the most optimal process for the design of the future Kobada metallurgical plant." ■

Feasibility Study confirms the Tier 1 status of Namdini

Cardinal Resources, listed on the ASX and TSX, has announced the results of the Feasibility Study (FS) for the Namdini gold project in Ghana, which has an estimated capex of US$390 million (including a US$42 million contingency).

The 9,5 Mt/a project is based upon a single large open-pit with a conventional process plant design: crush, grind, float, regrind, high shear oxidation (using the Aachen™ technology of Maelgwyn Mineral Services Africa) and carbon in leach (CIL). The first gold pour is targeted for H2-2022 (subject to financing in H1-2020).

The pit has been designed with five phases, the first one (the Starter Pit) having two sub-phases with a single common ramp, allowing early access to the higher-grade ore near the surface. The second phase is largely an expansion of the initial phase targeting the ore to a greater depth. The phase designs were created for optimal ore delivery from the first two phases due to their low strip ratio and waste rock movement. The subsequent phases contain a greater proportion of waste rock.

The waste to ore ratio during the 2,3-year life of the starter pit is 0,9:1; over the 15-year life of mine (LoM) it is 1,9:1. The total ore mined over the LoM is 138,6 Mt with the LoM gold recovery being 83 % (starter pit – 85 %). The AISC over the LoM is estimated at US$895/oz (US$585/oz for the starter pit).

Cardinal's board has approved the FS and plans to further de-risk the project by commencing the Front End Engineering Design (FEED) programme and further enhancement of the Project Execution Plan (PEP). Early site works and advancement of engineering towards construction will be funded through Cardinal's strong cash position of circa A$27 million.

Namdini is located approximately 50 km south-east of Bolgatanga, the capital of the Bolgatanga Municipal District, within the Talensi District in the Upper East Region of northern Ghana. This District is close to the southern border of Burkina Faso. The property is readily accessible from Bolgatanga along a paved highway followed by 15 km of well-travelled gravel roads. The project is approximately 6 km south-east of the operating Shaanxi underground gold mine, which is supplied by grid power.

"Cardinal's Technical Team, led by our Chief Operating Officer, Dave Anthony, along with Lycopodium, Golders and various study managers, have delivered a compelling and robust technical and economic outcome, paving the way for our planned development of the Namdini gold project," commented Archie Koimtsidis, Cardinal's MD and CEO.

"With over 1 million ounces slated for production in the first three years – 421 000 oz in Year 1 alone – and an average annual gold production of 287 000 oz over a 15-year mine life, Namdini ranks amongst the world's largest known, financially robust, undeveloped gold projects.

"Namdini has a 5,1 Moz ore reserve that is projected to generate US$1,46 billion in undiscounted, pre-tax free cash flow over 15 years including US$324 million in undiscounted, pre-tax free cashflow during its first year of full production, based on a gold price of US$1 350, which is significantly below the current spot gold price.

"Since the discovery of Namdini in 2015, we have continued to be focused on de-risking the project and have reached a robust project capex accuracy level of +15/-5 % for this Feasibility Study. Unlike whole of ore gold processing plants, we have the benefit of being able to produce a concentrate for gold extraction on site which means that we have a much smaller back half of the plant providing a huge positive impact on capital costs. Economic and technical optimisation confirms a large, single open pit utilising a conventional process plant with a throughput of 9,5 Mt/a and a very attractive 24-month debt payback." ■

The proposed Namdini process plant.

Key appointment for Bomboré gold project

Orezone Gold Corporation, listed on the TSX-V, has announced the appointment of Mark Humphery as the Project Director at its 90%-owned Bomboré gold project in Burkina Faso. Humphery will be directly responsible for construction of the project.

Humphery is a mechanical engineer with 25 years' experience in the mining industry. Most recently he was the General Manager, Projects and Senior Construction Manager at Alufer Mining Limited's Bel Air bauxite mine in Guinea where he delivered the US$110 million greenfield bauxite project on time and on budget. Prior to that he was in Colombia where he led the successful construction and commissioning of the Santa Rosa gold project. He has also previously worked in Burkina Faso in senior engineering, project implementation and construction roles.

He has extensive experience in mineral processing circuit design, infrastructure, project execution, and management of multidisciplinary EPC and EPCM teams.

Humphery holds a National Higher Diploma in Mechanical Engineering from Technikon Witwatersrand, Johannesburg.

Orezone has a 90 % interest in Bomboré, one of the largest undeveloped gold deposits in Burkina Faso. Bomboré hosts a large oxide resource underlain by a larger, open sulphide resource and will be developed in two stages. Development has commenced on the project with the first gold pour scheduled for H2-2021. ■

Seriti acquires South32's South African coal assets

Seriti Resources and South32 have concluded an acquisition agreement in terms of which Seriti will acquire the latter's 91,83 % shareholding in South Africa Energy Coal (SAEC).

SAEC's operations are located in the coalfields of Mpumalanga. They include four collieries – Khutala, Klipspruit, Middelburg and Wolvekrans – as well as three processing plants, producing energy coal for the domestic and export market.

Included on the Seriti side of the transaction are two trusts which will acquire equity on behalf of employees and communities. The remaining 8,16 % interest in SAEC is held by a black economic empowerment consortium led by the Phembani Group.

The purchase price includes an up-front cash payment of approximately R100 million. In addition, South32 will receive 49 % of the free cash flow generated by SAEC from the date the transaction is concluded until March 2024. That component will be limited to a maximum of R1,5 billion a year.

Subject to a number of conditions being satisfied, the transaction is expected to close in nine to twelve months.

Seriti CEO Mike Teke said: "Finalisation of this transaction will be a significant milestone for Seriti in our ambition to become a black-owned and controlled mining champion.

"The South Africa Energy Coal acquisition will enable us to offer further secured, long-term coal supply solutions to Eskom as a demonstrable commitment to sustainably supporting South Africa's energy needs. The combination of our energy coal businesses will realise further operational and technical efficiencies enabling us to better service our customers by offering competitive energy solutions.

Seriti CEO Mike Teke (left) and South32 COO Mike Fraser at a media briefing on the transaction.

"We remain fully committed to all our stakeholders and we welcome the participation of the SAEC employees and communities in this acquisition."

South32 CEO Graham Kerr said: "We ran an exhaustive and competitive process and we believe Seriti as an established operator is ideally positioned to unlock the potential of SAEC's existing domestic and export operations, including its significant untapped resource base.

"The sale of our interest in SAEC will enable the business to continue to operate safely and sustainably into the future for the benefit of its employees, customers and local communities, consistent with South Africa's transformation agenda."

Seriti is a broad-based, 91 % black-owned and controlled coal mining company. Through its operating subsidiary, Seriti Coal, it currently operates three large-scale, opencast and underground thermal coal mines – the New Vaal, New Denmark and Kriel mines – which it acquired from Anglo American, as well as various life extension coal resources and closed collieries.

Together with its partners, Seriti intends to develop its New Largo project into a large-scale, opencast coal mine capable of providing the base load fuel requirements for Eskom's Kusile Power Station. ■

Commercial production at Nayega approaches

View of the Nayega site showing the bulk sample programme, which was completed earlier this year, in progress (photo: Keras Resources).

Keras Resources reports that the authorities in Togo have granted a licence for large-scale exploitation of the manganese deposit at Nayega in the north of the country to its 85 %-owned subsidiary, Société Générale de Mines (SGM), which holds an exploration permit over the project.

The exploitation permit is expected to be concluded by year end allowing commercial production at Nayega to commence in the first quarter of 2020.

Initial operations will be based upon shipping of ore to smelter end users; however, AIM-listed Keras believe that there is potential to add significant value by the production of manganese sulphate for the fertiliser and battery market as a second stage development. As a result, Keras has appointed Perth-based Simulus Engineers to conduct a Scoping Study on the potential to develop such a refinery for the Nayega project. The decision was taken based on confirmation of the licence and the excellent leaching results from test-work completed on samples obtained from the transitional and deeper saprolitic zones within the Nayega orebody.

"The Council of Ministers Decree authorising the grant of the exploitation permit for our flagship Nayega manganese project is transformational and a major milestone for the company," commented Russel Lamming, CEO of Keras Resources. "Our strategy of proving up the project through the fully funded 10 000-tonne bulk sample programme has been validated, and without investing any further capital, Keras can transition seamlessly from Explorer to Producer. The installed processing capacity allows us to commence production of beneficiated 38 % manganese ore at a rate of 6 500 tonnes per month – this is planned for the first quarter of 2020.

"Concurrently, we will look to implement Phase 1 of the expansion programme through the installation of a new 70 t/h scrubber plant to be constructed in parallel with our existing 25 t/h plant. This gives us the flexibility to use the existing plant as both a production plant in the short-term, but also as a sampling plant when we start assessing the feasibility of producing battery-grade manganese. The company is currently in discussions with various off-takers to provide finance for the expansion programme." ■

Shanta Gold updates its reserves and resources

Shanta Gold, listed on AIM, has provided a reserve and resource update as at 30 September 2019 at the New Luika Gold Mine (NLGM) in south-western Tanzania.

The new resources and reserves have been estimated following a drilling programme for the 6-month period from 1 April 2019 to 30 September 2019, which totalled approximately 8,5 km and consisted of 81 holes all located within 4 km of the plant, at a cost of around US$1 million.

This drilling has added new probable gold reserves totalling 135 438 ounces grading 4,07 g/t Au at Bauhinia Creek Deep West, Elizabeth Hill North, Bauhinia Creek North and Black Tree Hill (the 'Newly Drilled Targets').

Drilling at these targets has resulted in indicated resources of 219 408 ounces grading 3,19 g/t (inclusive of the abovementioned reserves and the 83 543 ounces already announced in July 2019), up 219 % from the 57 916 ounces grading 1,77 g/t at end-December 2017.

In addition, new inferred resources of 94 007 ounces grading 2,75 g/t, up 26 % from 74 427 ounces grading 1,71 g/t, have been estimated at the Newly Drilled Targets, with further drilling planned to prove this up.

At one of the company's existing mining areas, Ilunga, underground reserves have decreased by 44 000 onces since the reserves declared in March 2017 following grade control drilling and a revised resource model design.

Since 30 September 2019, drilling has been ongoing on the mining licences and across other regional targets in the Lupa goldfield. An exploration update is anticipated prior to year-end 2019 with a consolidated reserves and resources statement expected in Q1-2020.

Eric Zurrin, Chief Executive Officer, commented: "The company is pleased to announce a significant increase in reserves and resources at the Newly Drilled Targets, following a short and low-cost campaign that was completed in September. We have high expectations that the targets will continue to grow both in size and number as we look to add to our mine life at New Luika.

"We have restated the reserve at Ilunga, which was insufficiently drilled ahead of declaration in 2017. Grade control undertaken during the period provides for a more accurate representation and increases confidence in Ilunga's contribution to the plant over the coming years."

New Luika, now in its seventh year of production, is comfortably on track to meet guidance for 2019 of 80 000 to 84 000 ounces of gold production at an AISC of US$740 to US$800 per ounce. ■

Strong ramp-up at Bisie tin mine

Tin production at the new Bisie mine of Alphamin Resources in the DRC's North Kivu province was up 269 % in the quarter ended September 30, 2019 over the prior quarter. Plant performance was up 50 % while overall recoveries improved to 65 % during the months of August and September (as against the target of approximately 72 %). The mine delivered an excellent safety performance with zero lost time injuries during the quarter.

Contained tin production increased to 2 345 tons during the quarter from the 636 tons in the prior period, reflecting improved plant recoveries and higher tin grades from underground. Tin grades mined and processed increased in the quarter to an average 5,6 % Sn, which is expected to taper off to between 4 % and 5 % Sn during Q4-2019. Alphamin expects contained tin production of between 2 000 tons and 2 200 tons for the quarter ending December 2019.

Outbound road conditions necessitated the procurement of additional outsourced trucks in order to significantly reduce the current tin concentrate stockpile on-mine. Alphamin says it anticipates much improved tin concentrate sales during Q4-2019. ■

One-ton bags of final product at Bisie ready for despatch (photo: Alphamin).

Containers loaded at Longonjo

Pensana Metals, which is listed on the ASX and is developing the Longonjo NdPr project in Angola, reports that four containers carrying over 60 tonnes of near surface weathered mineralisation have been loaded at the Longonjo rail siding for despatch to Perth, Australia via the Benguela rail line and the Port of Lobito.

Pilot plant testwork on this bulk sample will enable the detailed process route design to be finalised and batches of NdPr rich concentrate produced to be sent to potential customers in China.

In addition, an estimated 190-hole, 7 000-metre, reverse circulation (RC) infill drilling programme has commenced at Longonjo. The drilling is designed to provide detailed data to support an upgrade of mineral resources currently in the inferred category to the measured and indicated mineral resource categories, as well as to test several potential extensions to known mineralisation.

A drone aeromagnetic survey has also begun. The survey is designed to map high grade mineralised, potentially steeply dipping, ring dyke structures around the margins of the carbonatite beneath soil cover to aid in targeting exploration drilling to test for potential extensions to the currently defined mineralisation. ■

South Africa's **miners** sold on **Volvo's** articulated haulers

Volvo's articulated haulers are continuing to prove popular in South Africa's mining industry – so much so that the A40G, the backbone of the range, can now boast the lion's share of the market for machines in its class. According to David Vaughan, Managing Director of Babcock's Equipment business, the excellent sales figures for the articulated haulers are all the more remarkable given that the mining industry remains quiet and that this in turn has impacted the demand for mining equipment.

David Vaughan, MD of Babcock's Equipment business.

Babcock has represented Volvo Construction Equipment (Volvo CE) in Southern Africa since 2000 and over that period has been highly successful in putting the brand on the map. Over 700 of the A40G and its sister machine, the AG45, have been put into the field, with most of the demand coming from the mining and quarrying industries. The haulers have had a particularly enthusiastic reception from mining contractors and plant hirers operating in the coalfields on the highveld, who are now served by a state-of-the-art Babcock branch that opened in Middelburg in 2016 and which offers full rebuild facilities for Volvo owners.

Volvo CE has recently updated the G-Series range, with the new features including cruise control, downhill speed control and the new OptiShift function, which enables fast and smooth directional change. The new features, combined with the unique

Two of Volvo CE's top-of-the-line machines in action – a Volvo EC950E loads a Volvo A60H articulated hauler.

The best-selling Volvo A40G articulated hauler.

Volvo steering, excellent suspension, low noise levels, space and visibility, all contribute to reducing operator fatigue for increased productivity.

While the A40G, which has a 39-tonne payload, is by far the most popular machine in the Volvo articulated hauler line-up, a more recent introduction, the 55-tonne (61-short ton) capacity A60H, has proved to be a winner. It was only launched in South Africa in May 2017 but already 60 units have been sold. Most have been purchased by South African customers but a significant number have also gone to Namibia and the Zambian Copperbelt.

The L350H, Volvo CE's biggest wheel loader, working at Steyn Diamante's Schutsekama alluvial diamond mine.

"We always expected the A60H, which is the biggest true articulated hauler in the world, to do well but we've nevertheless been surprised at just how well it's done," says Vaughan. "In retrospect, it's clear that the mining industry was waiting for an articulated machine with the ability to replace less versatile rigid trucks in applications where relatively high volumes of material have to be moved. The feedback we've had from customers has been extremely positive and they particularly appreciate the fact that the A60H can work in pits in wet or 'sticky' underfoot conditions that would challenge any rigid truck."

He adds that there is significant local and international demand for used Volvo articulated haulers. "We find that many of our local customers are selling their machines themselves rather than trading in and are getting very good prices, often in hard currencies. This in part reflects the durability of the haulers, which have a reputation for absorbing operating hours very well."

The articulated haulers are the biggest sellers

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in the range of Volvo CE equipment available from Babcock but there is also a brisk demand for Volvo's wheel loaders and crawler excavators. The haulers, loaders and excavators are all known for their superb fuel efficiency and this is one of the major selling points of the Volvo CE range. Also worth pointing out is that there is a high degree of commonality between the machines in terms of spares and componentry.

The most popular wheel loaders with mining customers are the L150, the L180, the L220 and the top-of-the-range L350H, a machine with an operating weight of 50 to 55 tonnes (depending on the configuration). In all, Babcock has sold over 700 of its heavier Volvo wheel loaders – from the L150 up – into the local market, with the L150 in particular having built-up a loyal following. A 25-tonne machine, it is widely used in coal-handling, stockyard and furnace applications and one customer recently purchased 20 in a single order.

When it comes to the crawler excavator line-up, the best sellers for mining applications are the EC480D in the 50-tonne class and the EC750D in the 70-tonne class. "These have both been winners for us, particularly the EC750D, which is the perfect match for the Volvo A40G hauler," notes Vaughan. "The newest model in the range is the EC950E, which is a 90-tonne machine ranking as the largest crawler excavator ever produced by Volvo CE. With over 424 kN of breakout force, it delivers amazing productivity in even the most demanding mining environments. The market, of course, for excavators of this size is limited but sales have nevertheless been very pleasing, with 16 units having been purchased since the launch just over two years ago."

Many customers have a wide variety of Volvo machines in their fleets, typical examples being alluvial diamond miner Steyn Diamante and emerging mining contractor Lomeza Mining Services. Steyn operates two L350H loaders, three A60H haulers, three A35 haulers and four EC480 excavators (and has also purchased three 100-ton capacity R100Es, Volvo CE's first Volvo-branded rigid trucks) while Lomeza has 18 Babcock-supplied machines in its fleet, including three A60Hs and one EC950E.

"We find that we have a great deal of repeat business, which is testimony to the quality and performance of the Volvo CE machines," says Vaughan. "It's also testimony to the in-depth aftermarket backup that Babcock provides through its extensive network of branches and agents in the Southern African region. We believe the service we provide is second to none and customer surveys confirm this."

Babcock's aftermarket business also encompasses machines not sourced from the company. "We're working with an Indian company in the far north of Mozambique, for example, maintaining a fleet of 14 EC480s which it brought into the country," says Vaughan. "We're also expecting to look after a fleet of Volvo low-profile loaders in Botswana that an Australian mining contractor is bringing into the country for a large underground project."

The popular EC750D crawler excavator is an ideal match for the A40G hauler.

Contributing to the excellent growth being shown by Babcock's equipment business are the financial solutions that can be provided to customers through Volvo Financial Services (VFS), which launched locally in November 2017. What sets VFS apart from traditional credit lenders is its innovative approach to the financing of Volvo equipment with its solutions including down payments to reduce monthly payments, accelerated payments, fixed and floating interest rates for enhanced finance control, step payments for customers who want to build equity faster, and straight, balloon or seasonal amortisations, all tailored to a client's business cycle.

"Financing equipment purchases can be difficult," says Vaughan. "This is particularly the case for start-ups, including emerging contractors, but even companies that are well established with a long history of profitable trading can be challenged. We fully understand the problems they face. Working hand in hand with VFS, we can invariably come up with affordable solutions that enable customers to invest with confidence in Volvo's machines."

Looking to 2020, Vaughan says Babcock is optimistic about prospects. "We have not yet really seen the long-awaited revival of mining but our sales remain buoyant and we have some good opportunities in the pipeline. The Volvo CE range has really taken off in Southern Africa and we believe we will continue to increase our market share. We're not predicting any sales records but certainly we see steady, sustained growth ahead." ■

"We find that we have a great deal of repeat business, which is testimony to the quality and performance of the Volvo CE machines."

Shaft Boring System put to the test by Master Drilling

The 'holy grail' of fully mechanised shaft sinking has been brought a step closer by JSE-listed Master Drilling, which is currently trialling the 'front end' of its revolutionary Shaft Boring System (SBS) at a site close to its Fochville headquarters on the West Rand. *Modern Mining's* Arthur Tassell recently joined a media/analyst group which viewed the machine in action.

The concept of the SBS was first introduced by Master Drilling, the world's biggest owner and operator of raisebore rigs, at the 2016 Mining Indaba and attracted keen interest from delegates, many of whom attended a presentation on the machine given by Master Drilling's senior executives, including CEO Danie Pretorius and Technical Director Koos Jordaan. Since then the concept has evolved considerably – in particular the size and weight of the machine has been considerably reduced – and Master Drilling has now reached the point where the full engineering of the SBS is 95 % complete and manufacture of the complete system is in sight.

Briefing the media/analyst group on the SBS, Jordaan said that when Master Drilling had asked clients what issues it should address to enhance productivity in the industry and make projects more viable, at the top of the list was the need to access deep orebodies faster – and more safely – than was possible using conventional techniques. As he said, "Conventional shaft sinking is time consuming and

The media/analyst group which visited the site with Koos Jordaan at centre front.

The 'front end' of the SBS with, on the left, the vacuum units.

very costly. Mechanising the process and allowing earlier access to orebodies could have a dramatic effect on new mine development and allow more projects to pass the hurdle rate."

He added that raiseboring – which is at the heart of the Master Drilling offering – was a fully mechanised process but was only applicable where bottom access existed, ruling out its use on 'greenfield' shaft projects, and in certain geologies.

Jordaan said that there was now a need for Master Drilling to show intent. "This is exactly what we're doing with the current trial which is putting to the test the pilot cutter head and gearbox drive, which are the key to the entire system – and the highest risk components. We have about 70 tons of equipment on site, much of it sourced locally. We have a number of KPIs we are measuring, with probably the most important being the rate of advance in the shaft barrel. As a broad generalisation, conventional sinking allows about a metre of advance per day. Our goal is to increase this to at least 3 to 5 m a day – using about a fifth of the personnel one would normally need – and based on the results we're getting so far we believe this is achievable."

According to Jordaan, development of the SBS is being implemented over five phases, with the present trial representing phase one. "If the trial is successful, then – subject to the agreement of our 49 % equity partner in the development of the SBS, the IDC – we'll move to phase two, which will be the manufacture of the entire 350-ton, 45 m-long system. Further phases will see the machine being further tested with phase five being the full roll-out on a major mining project." He added that Master Drilling believed that about 60 % of the SBS's

"Further phases will see the machine being further tested with phase five being the full roll-out on a major mining project."

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Left: The on-site Master Drilling team. They are (from left): Klint Somerset (electrician), Pedro Mucale (assistant), Nicol Goodwin (project engineer), Walter Tshabalala (fitter), Lukas Muller (site manager) and Gordon Brandon (fitter).

components by value could be provided by South African companies.

The SBS will be owned and operated by Master Sinkers, a subsidiary of Master Drilling Group, with the business model being the same as with Master Drilling's raiseborers. "We'll deploy the system on behalf of our clients and the intention is that it should be re-usable – which is why we've designed it to allow the boring of shafts with diameters of 4 m up to 11,5 m and up to 2 km deep," said Jordaan. "It is going to be a very expensive piece of equipment so we'll need to write off its costs over several projects – it cannot be limited to doing shafts of a single diameter."

The current trial near Fochville is being undertaken in rock with a compressive strength of 320 MPa. This is an important point. There is a boring system available from a European company that has proven itself in soft rock but there is no system available anywhere at the moment that can handle hard rock. Another distinguishing feature of the Master Drilling system is that – in contrast to its European competitor – it allows concurrent mucking as well as concurrent shaft support.

When the media/analyst group was on site, the 4 m diameter cutting head of the SBS – which rotates at up to 10 rpm and has a W-shape configuration, allowing the disc cutters to be easily changed – had bored down about 4,5 m, with the advance rate being up to 650 mm/h. The plan is to trial the machine to a depth of around 8 m. The cutter head is accommodated in a frame secured by 12 long anchor bolts. The chippings were being removed by a vacuum system using two rented vacuum units. The cutter head is advanced by the pushing and pulling action of grippers, similar to those used on Tunnel Boring Machines (TBMs).

In full operation, the SBS will involve two phases of boring, with the cutter head being followed by a reamer section to enlarge the pilot hole. The cutter head will excavate around 15 % of the material with the reamer section accounting for the balance. The cutter head will depend on a vacuum kibble system or slurry system for mucking. Rock cuttings created during the enlargement process will be hoisted to surface by means of 16-t kibbles and two single-drum winders.

Following the cutters will be an eight-level stage accounting for the bulk of the machine, from which activities such as bolting, lining and probe drilling of the rock ahead of the sink will be carried out. A headgear will be required on surface to support the sinking operation but it will be relatively small in size compared to those used for conventional shaft sinking projects.

The SBS, of course, is not the only mechanised initiative underway by Master Drilling at the moment. The company is also busy with a contract at Northam's Eland platinum mine near Brits where its Mobile Tunnel Borer (MTB) is being trialled. As *Modern Mining* explained in an article in its September issue of this year, the MTB is an adaptation of the TBMs used in civil engineering to the specialised demands of hard rock underground mining. Weighing about 300 tonnes and with a length of just 31 m in its 5,5 m diameter configuration, it features a modular design, which makes it relatively easy to disassemble and move, can operate on a 12 deg incline or decline, and has a turning radius of only 30 m.

The two initiatives – the SBS and the MTB – represent a considerable investment running into hundreds of millions of rand for Master Drilling but the company, which has a well-deserved reputation for innovation, believes that ultimately its efforts could pay off handsomely. As its executives point out, mining companies are eager to embrace new methods of mechanising operations which will allow them to reduce dependence on the time-consuming, costly and labour intensive methods which are still commonly used. Whether the two initiatives will be successful remains to be seen but the initial results are looking promising and offer real hope that a major leap forward in vertical and horizontal development is on the horizon.

Photos courtesy of Master Drilling

"It is going to be a very expensive piece of equipment so we'll need to write off its costs over several projects – it cannot be limited to doing shafts of a single diameter."

The Karowe mine, which is located in the Orapa Kimberlite Field (photo: Lucara).

Lucara prepares to go **underground at Karowe**

The Karowe diamond mine in Botswana is likely to transition into an underground operation. The mine's owner, Canada's Lucara Diamond Corp, recently announced the results of a positive underground Feasibility Study (FS), which indicate that going underground could double the mine life, extending operations out to 2040. Based on the positive results of the FS, Lucara says it will commence advancement of detailed engineering immediately, in parallel with project permitting, arranging project financing and long lead item procurement.

Karowe is one of the world's most prolific producers of large, high value, type IIA diamonds and the only diamond mine in recorded history to have produced two +1 000 carat diamonds. Over its relatively short life, it has produced 2,5 million carats and generated US$1,5 billion in revenue. It is widely regarded as one of the world's most successful diamond mines and the extension of its life would be a welcome shot in the arm for Botswana's mining industry, which has seen some significant setbacks over the past several years, including the closure of the BCL operation in Selebi-Phikwe.

The Karowe Underground FS contemplates both a stand-alone underground (UG) scenario and a combined open pit underground LoM scenario with the underground operation mining the South Lobe of the AK6 kimberlite resource from the base of the planned open pit. All underground mined kimberlite will be processed at the existing Karowe processing plant over a 13-15 year period following the cessation of the current open-pit operations.

Highlights of the FS (based on the combined open pit underground scenario) include a LoM production of 7,8 million carats; pre-production capital costs of US$514 million for the underground project; an after-tax $NPV_{5\%}$ of US$718 million; and average LoM operation costs of US$28,43 per tonne of ore processed.

Eira Thomas, Lucara's President and CEO, commented: "Lucara is highly encouraged by the results of the Karowe Underground feasibility study which has outlined a much larger economic opportunity than first envisaged in the 2017 PEA and represents an exciting, world-class growth project for our company. Diamond deposits are rare and getting rarer. In this context, we are extending a mine that is in a class of its own, having produced 15 diamonds in excess of 300 carats, including two greater than 1 000 carats, in just seven years of production.

Further, we have sold ten diamonds for in excess of US$10 million each, including the record-setting 813-carat *Constellation* which sold for US$63,1 million.

"A significant portion of the cost to expand our mine underground can be funded from cash flow, and the investment is expected to be paid back in under three years, as the underground allows us to exploit the highest value part of the orebody first and generate more than US$5,25 billion in gross revenue. What's more, margins remain healthy despite the application of conservative diamond pricing models that reflect the current, difficult market environment. Lucara's short term view is that the market is now stabilising. Longer term, the fundamentals are expected to strengthen in line with supply shortfalls from mature, depleting mines in Australia and Canada. It is important to note that a return to diamond prices observed in 2015 would nearly double the $NPV_{5\%}$ of this project to US$1,4 billion."

An updated resource for Karowe confirms increasing value with depth. The combined open-pit and underground indicated resource now stands at 54,27 Mt at 15,3 carats per hundred tonnes (cpht) for a contained diamond resource of 8,3 million carats excluding stockpiles.

The unusually high strength (and low weathering susceptibility) of the South Lobe kimberlite eliminates natural caving as a mining option but presents a good opportunity for stoping. Kimberlite intact strengths are lower (roughly half) where the kimberlite is in contact with the country rock.

The favourable geotechnical properties of the kimberlite combined with the stable cylindrical shape of the South Lobe are expected to result in a good geomechanical performance.

Water control and the hydrogeological context of the deposit and host rocks are key elements in the mine plan. The AK6 deposit sits within layered, sedimentary, regional aquifers that have been documented since the 1980s. The main water-bearing lithologies are the upper sandstone/basalt contact and the lower sandstone base contact.

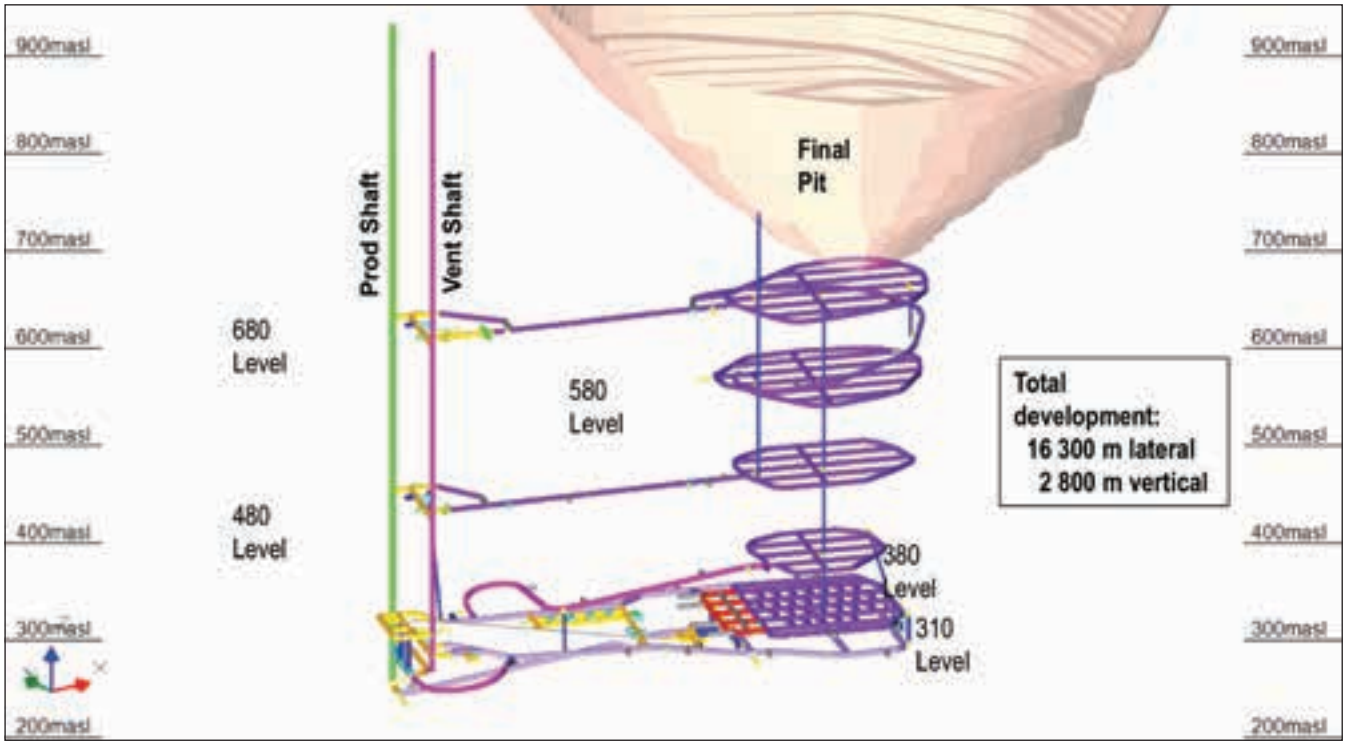
The water-bearing zones are interbedded with impermeable aquitards made up of grey and red mudstones within the lower sandstone lithology. These aquitards have a persistent head and greatly inhibit the ability to dewater and depressurise both the bottom of the open pit and the proposed underground mine.

An underground dewatering gallery and drill array are planned to be installed as a priority in the UG mine development and will be located at the 680 L with access gained via the proposed ventilation shaft during sinking operations.

Currently, Karowe mine is a conventional drill-and-blast open-pit operation, with diesel excavators and trucks providing an average annual 2,6 Mt of kimberlite feed to the mill. The open-pit mine operation is expected to terminate mid-2025, ending at an elevation of approximately 700 masl. The proposed underground operation targets the substantial resources remaining below the economic extent of the open pit.

Several UG mining methods were investigated as part of the study including block caving (BC), block caving with pre-conditioning, sub level caving (SLC), and long hole stoping (LHS). The bottom up approach of the LHS takes advantage of the denser and higher value kimberlite at depth coupled with low operating costs and high capital costs and

"A significant portion of the cost to expand our mine underground can be funded from cash flow, and the investment is expected to be paid back in under three years ... ."



The underground mine design.

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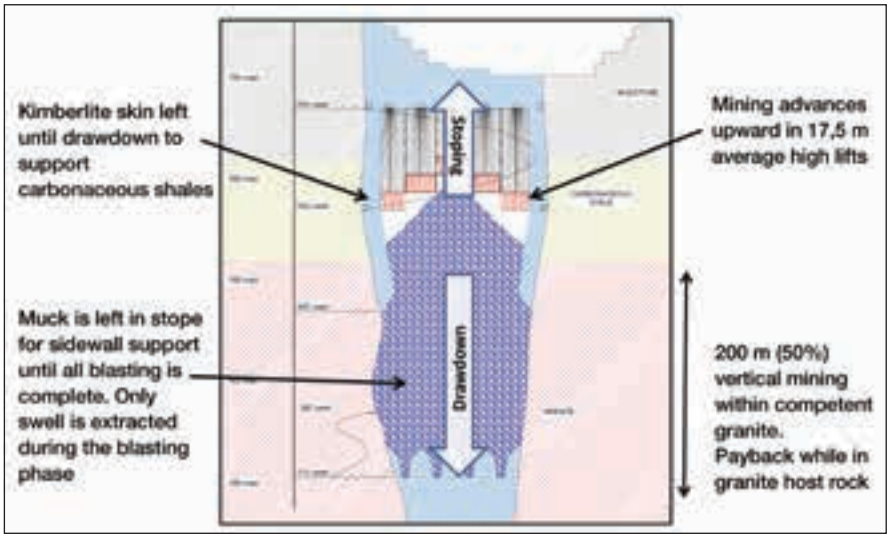
de-risks the project with respect to geotechnical factors and the hydrogeology of the host rocks.

The LHS method is planned to systematically drill and blast the entire lobe on a vertical retreat basis. In LHS, a significant proportion of the blasted muck is left in the stope during blasting and stoping to stabilise the host rock with only the swell extracted during the drill-and-blast phase. Mucking takes place from draw points from the 310 L (310 masl) extraction level. Once the column is fully blasted, the stope is drawn empty by mucking the draw points.

Advantages to the selected mining method include extraction of the highest value rock first; low and delayed dilution; low operating costs; a reduced dewatering risk by using a grouted shaft and delaying surface breakthrough for five production years; and minimal development in poor ground. In addition, development and production of the underground can occur simultaneously with pit operations.



Stope design and sequence.

The mine will be accessed from a 765 m deep production shaft, 7,5 m in diameter, driven from surface to 245 masl. The shaft will be equipped with two 21-t skips for production hoisting and a service cage for man and material movement through the mine. This shaft will also serve as the main fresh air intake to the mine. A second shaft, 6,0 m in diameter and 715 m deep, driven from surface to 295 masl, will be equipped with a heavy lift hoist for moving large equipment throughout the mine life and hoisting development waste during pre-production.

Drill levels are spaced at 100 m vertical intervals and drilling will utilise in the hole hammer (ITH) drills with an effective drill length with 150 mm holes. The average length of hole per ring will be 58 m, with an average 34 t/m drilled.

Stoping will be conducted to maintain a stable arched back.

The extraction level design is set up similar to a block cave design with five extraction drives driven 31,5 m apart and running the entire length of the lobe. A total of 56 drawpoints is planned, giving significant extraction flexibility. Ore will be mucked from the drawpoints with 21-t LHDs that will feed a jaw crusher. Crushed rock will then be conveyed to two 3 500-t bins adjacent to the production shaft.

Moving to the treatment of ore, comminution test work to determine the crushing and grindability characteristics of the deeper kimberlite have been conducted. The deeper kimberlite was found to be compatible with the current processing plant comminution circuit.

The predominant diamond separation and extraction process at Karowe utilises TOMRA X-ray Transmission (XRT) sensor-based bulk sorting machines to separate liberated diamonds from kimberlite and waste host rock gangue. XRT tests were conducted on all deeper kimberlite and host rock zones and all were found to be conducive to efficient diamond separation and recovery with the existing circuit.

The current flowsheet is deemed suitable for processing of underground sourced kimberlite and diamond recovery in line with the resource model.

On the basis of a construction start in mid-2020, ore from underground mining will seamlessly integrate into current operations providing mill feed starting in 2023 with a ramp up to 2,7 Mt/a to the processing plant by 2026, and the opportunity to increase throughput. Current production rates will be maintained through the underground ramp-up period. ■

Initial **Kakula** processing plant capacity boosted to 3,8 Mt/a

Following the completion of basic engineering and procurement, as part of the forthcoming DFS, initial processing plant capacity at the new Kakula copper mine in the DRC has been increased from 3,0 Mt/a to 3,8 Mt/a, boosting projected early-stage copper production. Located 25 km west of the town of Kolwezi in the DRC's Lualaba Province, Kakula – already well into the development phase – forms part of the Kamoa-Kakula project, a joint venture between Ivanhoe Mines and Zijin.

The expansion in initial plant capacity will require increasing the underground mining crews in 2020 from 11 to 14 to ensure sufficient mining operations to feed the expanded plant throughput. This will have the benefit of producing a larger surface stockpile of ore prior to the scheduled commissioning of the processing plant, as well as accelerating the mine development schedule, providing the opportunity to bring forward the commencement of the second phase of development at Kakula.

The second 3,8 Mt/a plant module will be fed from the Kakula mine at a planned full production rate of 6 Mt/a. Further study work will determine the amount of tonnes to be sourced from the Kansoko mine, or elsewhere, to maximise the full milling capacity of 7,6 Mt/a. Any plans to accelerate the second module of Kakula's processing plant would be subject to securing the necessary project-level financing.

Kakula's original 3,0 Mt/a first processing plant module has already been redesigned during the basic engineering phase to a nameplate capacity of 3,8 Mt/a. Purchase orders have been placed for all major long-lead time mechanical equipment, plant earthworks are well advanced, and plant civil works have started. The contract for the SMPP (structural, mechanical, piping and platework) supply and erection portion of the plant construction has recently been awarded.

The updated estimate of the project's initial capital cost is approximately US$1,3 billion (from January 1, 2019), which assumes commissioning of the processing plant in Q3-2021. The capital costs incurred by the Kamoa-Kakula joint venture during the first nine months of 2019 were US$182,5 million.

According to Ivanhoe's latest quarterly report (on the three months to 30 September 2019), the underground development work at Kakula is being

An LHD scoop tram loads development ore into a 50-tonne truck at Kakula for transport to surface.

Screenshot of the 3D engineering model of Kakula's surface infrastructure, including the ore conveyor, run-of-mine ore stockpiles and processing plant (circled in yellow).

performed by mining crews operating large-capacity, semi-autonomous mining equipment, such as jumbo drilling rigs and 50-tonne trucks. More than 5 km of underground development was completed in the nine months ended September 30, 2019.

Development ore is being stockpiled on surface near the site of the concentrator plant. This ore will be used for plant commissioning as well as supplying any gap in the production build-up once the concentrator is operational.

Mine access drives 1 and 2 (interconnected, parallel tunnels that will provide access to ore zones) continue to progress, with access drive 2 having reached the high-grade zone.

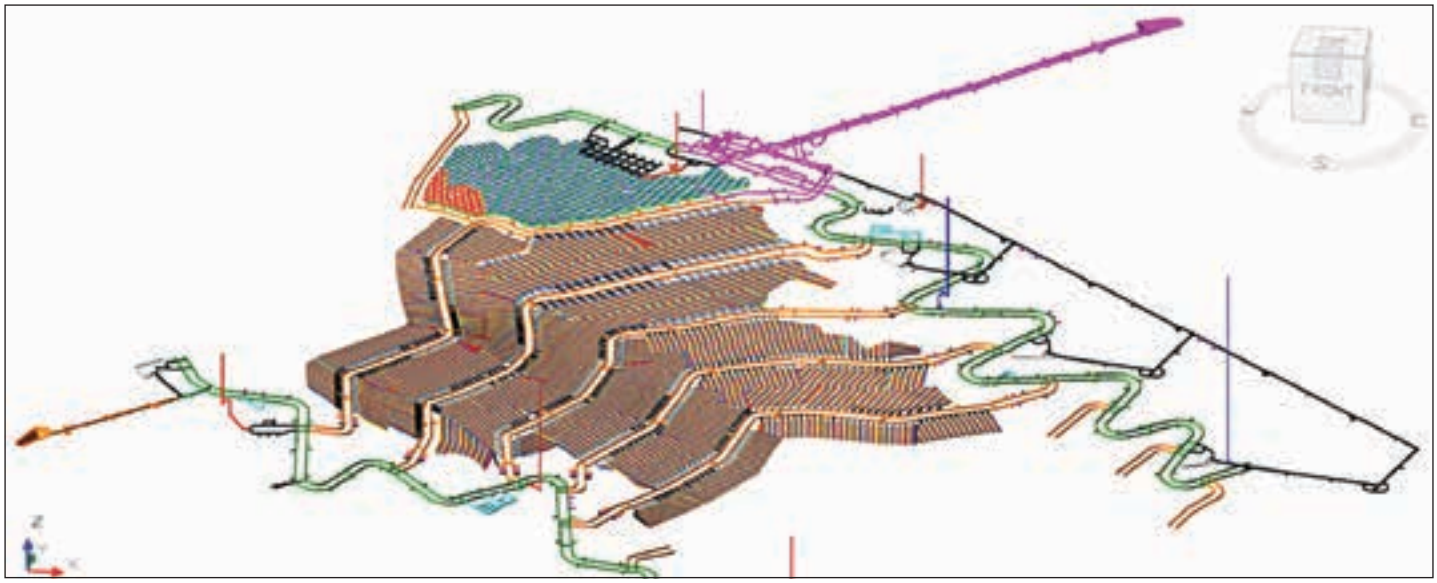
The number of underground mining crews has increased from three at the start of the third quarter, to six now working at Kakula. The project will continue to add additional crews over the next 12 months to further accelerate development. Ventilation shaft 1 has been fully commissioned and work on ventilation shafts 2 and 3 is well advanced, with underground access for both having been achieved and pilot drilling started. Construction of the underground rock-handling system (tips, bins and conveyors) is progressing well and is targeted for completion in Q2-2020. Work on Kakula's main decline dam and pumping station has been completed, and work on the main decline bottom dam is well advanced.

By the end of September 2019, 571 m of development had been completed at the southern ventilation decline, which will facilitate the acceleration of critical early mine development.

Other engineering and construction activities underway at Kamoa-Kakula include the refurbishment of six turbines at the Mwadingusha hydro-electric power plant and associated 220-kV infrastructure to supply the mine with clean hydropower, construction of a permanent road between the mine site and the Kolwezi airport, construction of the first phase of accommodation for 1 000 employees and contractors, and earthworks for the processing plant and other surface infrastructure.

The scale of the Kakula project is considerable. On February 6, 2019, Ivanhoe announced the results from the Kakula 2019 PFS. The life-of-mine production scenario detailed in the study provides for

Kakula's underground development and production five-year plan showing the more than 5 km of development work completed to date (purple with access from the northern declines and yellow with access from the southern decline).



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119,7 Mt to be mined at an average grade of 5,48 % copper, producing 9,8 Mt of high-grade copper concentrate, containing approximately 12,4 billion pounds of copper.

Based on a consensus, long-term copper price of US$3,10/lb, stage-one production at Kakula is projected to have a grade of 7,1 % copper in the second year of production and an average grade of 6,4 % copper over the initial 10 years of operations, resulting in estimated average annual copper production of 291 000 tonnes. The initial capital cost, including contingency, is estimated at US$1,1 billion. The average total cash cost is estimated at US$1,11/lb of copper during the first 10 years, inclusive of royalties. The project delivers an after-tax NPV, at an 8 % discount rate, of US$5,4 billion and an after-tax internal rate of return (IRR) of 46,9 %. The payback period is 2,6 years.

Installing high-capacity fans at Kakula's 5,5-m diameter ventilation shaft 1 that will supply fresh air from surface to the northern side of the underground Kakula orebody.

Kakula is expected to produce a very high-grade copper concentrate in excess of 55 % copper, with extremely low arsenic levels.

Kakula forms part of the overall Kamoa-Kakula project. Earlier this year, Ivanhoe announced an updated independent PEA for an expanded Kamoa-Kakula production rate of 18 Mt/a, supplied initially by Kakula, followed by two 6 Mt/a mines, one at Kansoko and the other at Kakula West, and a world-scale, direct-to-blister smelter.

The very high-grade initial phase is projected to have a grade of 7,1 % copper in the second year of production and an average grade of 5,7 % copper during the first 10 years of operations, resulting in estimated average annual copper production of 386 000 tonnes. Recovered copper production is estimated at 740 000 tonnes in year 12, which would rank the Kamoa-Kakula project as the second largest copper producer in the world.

An independent definitive feasibility study (DFS) for the Kakula mine is underway with an expected completion date of mid-2020. At the same time, Ivanhoe expects to issue an updated preliminary economic assessment for the expanded Kamoa-Kakula combined production scenario that will include an updated Mineral Resource Estimate (MRE) for Kamoa North, including the initial MRE for the Kamoa North Bonanza Zone.

Photos courtesy of Ivanhoe

A 3D model of Kakula's processing plant flotation area.

Aerial photo of Langer Heinrich Mine taken in March 2018 (photo: Paladin).

Improved economics for restart of **Langer Heinrich**

Uranium developer Paladin Energy, listed on the ASX, has announced improved economics to restart its flagship Langer Heinrich Mine (LHM) in Namibia following the completion of the first stream of the Pre-Feasibility Study (PFS1) examining the potential resumption of operations. The study has focused on a rapid, low capital and low risk restart at a production level of approximately 5,2 Mlb/a. The study has also identified an opportunity to increase production to 6,5 Mlb/a.

Langer Heinrich was transitioned to care and maintenance (C&M) in August 2018 due to the sustained low uranium price. Subsequently, Paladin completed a concept study in February 2019 that identified multiple options to reduce operating costs, improve process plant performance and potentially recover a saleable vanadium product.

Paladin commenced a two-stream Pre-Feasibility Study in March 2019 (PFS1 and PFS2) to improve the details of the Langer Heinrich restart plan and to pursue further improvement options to clearly present a compelling investment case. This included Paladin conducting: a study of numerous initiatives to reduce operating cost and to improve operability; approximately 16 200 m of resource verification drilling; an update of the mineral resource model for uranium and vanadium; and further de-risking of the rapid restart plan.

Paladin has now completed PFS1, which focused on confirming effective C&M plans, practices and costs, while also developing a more detailed plan to execute a rapid restart at Langer Heinrich in an improved uranium market.

Importantly, PFS1 has confirmed that Langer Heinrich could be back in production within 12 months of financing being in place. This assumes an appropriate return on investment for shareholders and that studies have been fully completed during the C&M period.

Paladin estimates the initial capital for the rapid restart to be US$80 million, including US$38 million for plant repair and improvement and US$42 million for working capital. This is consistent with the restart capital estimate from the concept study.

Upon restart, Langer Heinrich would have a production capacity on average of 5,2 Mlb/a while processing high and medium grade ores for approximately an eight-year period (after a 12-month ramp-up period) followed by a production capacity of 2,7 Mlb/a while processing low grade ores for approximately 12 years. This would result in an average life of mine AISC of approximately US$33/lb.

In addition, Paladin has identified opportunities to significantly debottleneck existing mining and mineral processing operations for a modest and

discretionary additional capex of approximately US$30 million to achieve an increase in production capacity to 6,5 Mlb/a. This can be done during execution of the rapid restart plan and does not extend Paladin's commissioning time of 12 months from a restart decision. This would initially target processing high and medium grade ore for approximately a six-year period. Processing of low-grade ores for a further ten-year period yields a production capacity of approximately 3,4 Mlb/a, resulting in a reduction in overall average life of mine AISC to US$29/lb, compared to Paladin's aspirational AISC target of US$30/lb.

This improvement results from a review and reconciliation of ten years of operating history and data by an experienced and diversely skilled technical team, specifically mandated to identify opportunities in the operation by overlaying current best practice for optimising mineral processing and mining systems.

Opportunities that were identified in the PF1 plan include:

- ❑ increasing process plant surge capacity to enable the leach facility to operate at full rate as the primary bottleneck;
- ❑ increasing water storage capacity on site to avoid production interruptions from pipeline maintenance and supply disruptions;
- ❑ increasing automation to enable remote, semi-automatic monitoring and operation; and
- ❑ making numerous operational configuration and management changes that will enable the entire facility to increase rate and reliability to operate at its full potential.

The PFS1 mineral resource definition programme has been completed and has achieved its aims, which included drilling high grade mineralised zones to basement to confirm and ensure the mineral resource is included in the restart mine plan; and verifying the grade and characteristics of mineralisation that is beneath an original, above ground dry tailings storage facility to increase confidence of inclusion in the mine plan. It has also provided samples for the geo-metallurgical processing response testing programme, which has increased knowledge of the processing response of ores not yet processed, de-risking future production.

Paladin has declared a maiden vanadium mineral resource estimate as part of the updated Langer Heinrich mineral resource. Based on the updated mineral resource estimate, when mining was suspended in December 2016, there was 31,0 Mlb V_2O_5 remaining in the ground and, at the suspension of processing in August 2018, an additional 7,8 Mlb V_2O_5 contained in 30,8 Mt of medium and low-grade stockpiles giving a combined total of 122,1 Mt at 145 ppm V_2O_5 for 38,8 Mlb V_2O_5.

Outlining its next steps, Paladin says the PFS2 scope has been reduced to focus on completing in-progress test work and updating the pipeline of improvements for further development after Langer Heinrich is restarted.

The scope of the proposed rapid restart Feasibility Study (FS1) in FY2020 has also been reduced to focus on further optimisation and governance of C&M and the rapid restart plans. Completion of the full scope of feasibility study work to Paladin's standards has been deferred to when restart is imminent. The feasibility study work was budgeted to take nine months (June 2020) with the reduced scope now expected to be completed in March 2020.

The estimated cost from commencement to completion of the Pre-Feasibility Study and the proposed Feasibility Study scope to be conducted in FY2020 is US$5,2 million, compared to an original budget of US$6,2 million for the PFS, a saving of approximately US$1 million, all fully funded from existing cash.

Commenting on the results of PFS1, Paladin CEO Scott Sullivan said: "The Langer Heinrich mine is a world class uranium asset and this study confirms Paladin's key position as a first mover back into production in a recovering uranium market.

"Paladin has assembled a first-class team to conduct these studies and they have systematically reviewed in detail the entire Langer Heinrich production history and processes, challenging past practices where necessary and have brought in diverse experience from other companies and commodities to envision an exciting new future for Langer Heinrich.

"Achieving production of over 5 Mlb/a at a cost of under US$30/lb AISC and with a 12-month lead time on execution were key targets of the board and executive team and will see Langer Heinrich in an enviable position when uranium prices recover. This study continues to demonstrate the high quality and potential of the asset and provides a solid foundation for a confident and successful restart.

"We also believe there is the opportunity for further cost improvements progressively after restart and we are excited about the prospect of vanadium production in our future. We will continue to explore these opportunities, once the market shows signs of improvement."

Langer Heinrich is located in the Namib Desert in Namibia, 80 km east of Walvis Bay and about 40 km south-east of the world's longest running open-pit uranium mine, Rössing. It commenced production in 2007 with a capacity of 2,7 Mlb/a but subsequently underwent two stages of expansion to give it a capacity of approximately double this level.

Paladin owns 75 % of Langer Heinrich Mauritius Holdings Limited, with 25 % owned by CNNC Overseas Uranium Holdings Limited (CNNC) since January 2014. Langer Heinrich Mauritius Holdings Limited is the holding company of Langer Heinrich Uranium (Pty) Ltd which holds 100 % of the Langer Heinrich tenements. ■

"The Langer Heinrich mine is a world class uranium asset and this study confirms Paladin's key position as a first mover back into production in a recovering uranium market."

Worley takes mining sector beyond 5D

The digital age is ushering in dramatic change as new technology is adopted at an exponential rate, merging the physical world with the virtual and allowing industry to use technology to improve efficiencies, safety and return on investments. Leading the way in digital transformation in the energy, chemicals and resources sectors, global project and asset services provider Worley is taking digital design capabilities beyond 5D.

By using Building Information Modelling (BIM), Worley is creating digital information models from 3D right through to 7D that contain both graphical and non-graphical information in a Common Data Environment. The information builds in value as the project stages progress until the complete data set is handed over to the client at the conclusion of a project, ready for operation. Each dimension of data offers clients a fuller understanding of their project, from generating accurate programme data to producing accurate estimate costs, and ultimately providing a digital data bank that can be used to drive efficient operation and management and better business outcomes.

Starting with a 3D model, 4D adds the benefit of a project schedule, providing greater insight throughout the design process. 5D allows control of cost and budget components and captures progress dynamically, allowing the entire project team to visualise the project objectives. The benefits of 6D and 7D come to light at handover and provide end-users with a better understanding of the lifecycle and sustainability of their assets.

By using Building Information Modelling (BIM), Worley is able to create digital information models from 3D right through to 7D.

A virtual image of a processing plant prepared using BIM.

BIM Manager for Worley, Russell Du Plessis, says South Africa's mining and mineral processing sectors have traditionally focused on upfront capital costs; however, 6D and 7D BIM allow a planned, pro-active approach to assets that is significantly beneficial, not least in terms of costs.

Du Plessis says that while many companies provide 4D and 5D design focusing on the cost and schedule of construction, Worley's 6D digital capabilities action the commissioning of a project, while 7D allows for optimal operation. He adds that, ideally, the information model should continue to evolve during the 'in use' phase with updates on repairs, replacements, operational data and diagnostics to further assist with informed and effective future decision making.

"Worley's 7D design data mapping allows real-time access to operational related metadata for equipment and systems within a project in a virtual or augmented reality environment. It provides our customers with a highly valuable electronic asset that can easily geographically integrate details that were previously overlooked in paper files," says Du Plessis.

Developed to assist in designing sustainable assets, Worley's 6D data incorporates the Worley SEAL system (Sustainable Engineering for Asset Lifecycle), a unique approach to engineering delivery which integrates technical integrity and safe and sustainable design processes under a common umbrella. The result is designs that are technically compliant with statutory and customer requirements; safer to build, operate and decommission;

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and provide appropriate sustainable solutions that comply with Worley's framework aimed at achieving zero harm.

While there are many third party providers offering 3D modelling services to the mining sector, Worley is one of the few companies with in-house digital capabilities with the know-how and technology to take BIM right through to 7D. Du Plessis says that 7D modelling is where operational functionality lies and also offers customers peace of mind in terms of due diligence in the commissioning process. This furthermore makes 7D BIM a highly valuable tool from an insurance point of view, providing a transparent and accountable digital record. "It's the underlying data that is of value, not the virtual image, as this powerful integrated data makes it possible to provide design accuracy, look pre-emptively forward, and create an intelligent and integrated project scope that runs from the design phase right through to operation and decommissioning," says Du Plessis.

Denver Dreyer, Senior Vice President Mining, Minerals & Metals (MM&M) Europe, Middle East and Africa for Worley, affirms Worley's ongoing commitment to digital transformation, saying that as a global centre for mining and minerals processing excellence, the business is pioneering the move away from cumbersome paper trails to instantly accessible digital data in South Africa. "Worley is leading the way forward in terms of developing BIM capabilities for mining in South Africa, and it's a necessary step for any business wanting to prosper in the new digital age." He adds that this requires a change in mindset of the entire project team, including the customers' side, right down to mine personnel in order to successfully leverage the immense benefits of technology.

Worley is at the forefront of developing digital solutions for the planning, design and execution of mining projects, with the South African office having been responsible for the design and development of much of the group's leading-edge technology in mining and minerals processing. Worley conforms to standards set out by the BIM Institute of Africa, and already has a number of leading customers successfully utilising their BIM capabilities. ■

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"Shared belief" vital to mining's future in SA

The effort to put South Africa's mining industry back on a sustainable growth path is lacking one key ingredient: a shared belief in what the sector could and should deliver. According to Roger Dixon, corporate consultant at SRK Consulting, a fundamental stumbling block to the sector's progress is that stakeholders simply do not agree on what they want to achieve.

Roger Dixon, corporate consultant at SRK Consulting.

"Industry stakeholders such as mining companies, government, unions, communities and civil society NGOs are deeply divided and suspicious of each other," said Dixon. "This really provides no basis on which to forge a sustainable future."

He noted that a useful recent definition of sustainability focused on the "shared belief" that tomorrow will be better than today.

"Such a shared belief appears to be elusive in our industry today, as the recent conflict around the prospect of mining at Xolobeni in the Eastern Cape clearly indicates," he said. "This is despite the fact that the corporate world has long espoused sustainability as a central tenet in mining project development."

Addressing the current impasse will mean confronting the challenge that the mining sector's assets are finite – and are hence in themselves unsustainable. The required sustainability can only be achieved on the strength of concurrent economic development that the mining activity can enable and foster – and which can be carried forward after a mine has closed.

"Real collaboration among stakeholders is therefore vital from day one of a mine's conception, as parties must share both a plan and a belief in what the mine can achieve over its life-time and beyond," said Dixon. "This common commitment is particularly important because the mining company will in fact exit the scene at some point after mining has ended – leaving the other parties to take forward the post-mining vision."

In reaching such a shared belief, he proposed that stakeholders draw inspiration from the United Nation's Social Development Goals (SDGs) – which also include 'Partnerships for the Goals'. He raised the issues of how communities are represented, how their needs are articulated, and whether their relevant forums are effective. He also flagged the unhealthy relationship with organised labour.

"The intensely adversarial approach between trade unions and management – aggravated by poor economic conditions – fosters short-termism and a polarisation of positions," he said.

At a political level, government has the power to foster a culture of collaboration, under the imperative of national unity. Through its departments and agencies, government can promote the spirit of constructive partnerships on the ground.

Dixon also noted that many of the sustainability challenges in mining are beyond the capacity of a single mine. Ways needed to be found to coordinate and consolidate the actions of mining companies to ensure a critical mass and optimise their development impact.

Dixon has spent more than 47 years in the South African mining sector, and today specialises in reserve and resource reporting to stock exchanges. With his principal qualification in mining engineering, his career has included over 30 years in senior management roles at both operations and head offices of large gold mining companies.

As a consulting engineer from 2002, mainly with SRK Consulting South Africa, he has worked extensively in mine valuation, due diligence studies and engineering studies. He also played a leading role in developing reporting standards through the South African Mineral Resource Committee (SAMREC) and the global Committee for Mineral Reserves International Reporting Standards (CRIRSCO), two committees on which he still serves. ■

"Real collaboration among stakeholders is therefore vital from day one of a mine's conception, as parties must share both a plan and a belief in what the mine can achieve over its life-time and beyond."

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Health insurer makes inroads into Africa's resources sector

A health insurance plan specifically targeted at companies operating in the resources sector in Africa is available from The Unisure Group, a UK-headquartered global health and life insurer with a strong African presence. According to Allister Langford, Head of Business Development at The Unisure Group, the plan offers competitive benefits, particularly within the context that mines and similar operations typically work to the very highest health and safety standards.

The Bupa Global Mining and Energy Forum specifically addresses the needs of the resources industry.

Known as the Bupa Global Mining and Energy Forum, the plan provides employee health solutions to companies active in the mining, oil, gas, energy, petrochemical and supporting industries in Africa. It is underwritten by Bupa, a leading UK-based healthcare provisioning and multi-insurance group with a strong international footprint. To service the plan, The Unisure Group maintains a regional operations centre in Johannesburg. This is alongside regional operations centres in London and in Kuala Lumpur.

The company employs around 300 people in Africa. Most of them are based outside of South Africa – with significant numbers in Mozambique and Zambia in particular – and they are backed up by a large operations team in Johannesburg. Langford says: "We own Specialty Emergency Services (SES) in Zambia, which operates two world-class primary care clinics in Lusaka and Kitwe, and Mediplus in Mozambique, which is the country's largest health insurer. SES has licences for both health and life insurance, while Mediplus is a health insurer only."

Langford says that the key factor differentiating The Unisure Group from its competitors is that its flagship product, the Bupa Global Mining and Energy Forum, is sector-specific. "The pricing model we've adopted is based on the fact that companies operating in the resources sector, particularly mines, have very robust occupational health and safety protocols

The Unisure Group's new clinic in Lusaka, which is owned and operated by its subsidiary, Specialty Emergency Services (SES).

The competitive pricing model adopted is based on the high standards of health and safety which characterise resource sector industries such as mining.

in place, more so than virtually all other industries," he explains. "As such, we can price accordingly, offering material cost savings on premiums without in any way compromising on the level of care and benefits for members of the plan."

Companies that qualify for the plan include organisations that supply services to the resources sector, such as those specialising in camp management or security.

The Unisure Group has a full-time complement of general practitioners, clinical officers and nurses on call. In addition, it has an extensive network of contracted consulting specialists and trauma surgeons to support its own staff. Informed telephonic advice and support on a 24/7 basis by a multi-lingual team of dedicated health professionals forms part of the offering and a full emergency evacuation service from even the remotest areas to the nearest centre of medical excellence is available. Typically, about 200 evacuations a year are carried out under the plan.

Langford stresses that The Unisure Group has extensive experience of working in Africa. "We understand the continent and the challenges it can sometimes present in terms of transport and logistics and we're confident that the service we provide is second to none."

As with most medical plans, the Bupa Global Mining and Energy Forum offers numerous pricing tiers, with overall annual maximum benefits starting from US$150 000 and increasing to as much as US$10,2 million. The cover provided by the plan gives members access to top tier hospitals globally.

The Bupa Global Mining and Energy Forum was first introduced to the market 10 years ago and has secured a good share of the market. "We are growing every year, and in some years very rapidly," Langford says. "We now have approximately 7 500 employees and dependants in the resources sector covered by the plan. Mines and mining houses make up the biggest part of our customer base and our clients include companies such as Zimplats in Zimbabwe and Mopani Copper Mines in Zambia."

He adds that The Unisure Group is on a rapid expansion path. "We already have an extensive African footprint, particularly in the southern African region, but we see significant potential for expansion in the continent and we're currently targeting North Africa. We also intend adding more regional offices to our network. We already have offices in Luanda in Angola and Lubumbashi in the DRC and Nairobi is next on the list. We're excited about the huge opportunities that the African market offers and we look forward to many years of future growth to come for The Unisure Group." ■

Hitachi's EX1200-7 excavator arrives in South Africa

The Hitachi EX1200-7 excavator.

The first Hitachi 120-t EX1200-7 excavator, a new addition to the EX-7 Series, recently arrived in South Africa, following its launch earlier this year at Bauma 2019 in Germany.

The smallest machine in the EX-7 Series, the EX1200-7, comes in two configurations – backhoe or shovel – and features a 4,5 % increase in bucket capacity, optimised swing control and an upgraded hydraulic system, including a flow-regeneration valve, which means lower power requirements, lower fuel consumption and increased pump life.

"Fuel efficiency was a major factor in the design of the EX-7 Series because we recognised the importance of caring for the environment while remaining profitable. These machines make this easier than ever before," says Hitachi Construction Machinery (HCM) Africa's Marketing & Business Development Manager, Marius Weber.

The electric-controlled main pump and a hydraulic regeneration circuit added to this latest line of machines have reduced fuel consumption by up to 10 % in some models.

Different engine options are available, in particular the FCO (Fuel Consumption Optimisation) configuration chosen for the African market.

Improvements have been made in terms of fuel economy, with functions such as Shutdown Control which, when activated, prompts the machine to switch to 'soft key off' status to prevent unnecessary fuel burn.

"Customers now have the option to choose between various power supplies, allowing for regional regulatory compliance and/or preferential satisfaction," says Weber.

HCM provides a choice between an MTU internal combustion engine or a Cummins gas engine for all models from the EX2600 upwards, in response to the findings from customer research.

The EX1200-7 offers some structural improvements on its predecessor, the EX1200-6, with the track frame's swing circle having been upgraded from a cast structure to a forged structure, and the top plate thickness increased from 50 mm to 55 mm for greater durability. The EX1200-7 also has an improved grease system that enables automatic lubrication to grease all points in the superstructure, including the bucket pins.

The EX-7 excavators include a number of Hitachi's technologies for digital integration.

Global E-service and ConSite are remote machine management systems that monitor and report on machine health, allowing users to ensure that the EX-7 machines consistently deliver at maximum efficiency. ConSite also allows users to access status information on their machines from a personal computer on a daily basis.

Contamination sensors on all main hydraulic pumps, centre joints and swing motors of the new EX-7 Series can detect contaminants that may cause damage to any of these components and alert the operator of potential contaminants and record the fault in the DLU (Data Logging Unit), even remotely advising maintenance control.

Among several new features added to the EX-7 Series is the Aerial Angle, which is a 360° peripheral vision display system that feeds live footage from cameras mounted on the excavator, improving overall safety for both operator and mine.

In terms of safety, the EX-7 now also has an MDG 15 regulation standard dual isolator switch for both the engine starter and the battery, which aids in safely troubleshooting and downloading machine information.

The EX-7 Series of machines will include the following models: EX1200-7; EX2600-7; EX3600-7; EX5600-7; and EX8000-7.

Hitachi Construction Machinery, tel (+27 11) 841-7700, website: www.hitachicm.co.za

Hook-block a key component of overhead crane

The humble hook-block was recently elevated in status to become the key component of an electric overhead crane completed by Condra for a metal refinery.

Custom designed to specification, the block comprised an electrically insulated square steel frame suspended horizontally from four rope pulleys at its corners, and fitted with five hooks to meet the requirements of three different applications.

After installation and commissioning of the crane, four of the five hooks will carry out the primary function of removing racks of cathodic plates from acid baths used in the refining process.

These identical hooks are bolted two to each side of the steel frame to steady the racks while the crane carries them to stacking areas ready for despatch. Steadying of the racks will allow faster crane movement and increased productivity.

The fifth hook, of conventional swivel design, is mounted centrally in the block to execute the crane's secondary function of loading the plates onto trucks.

Routine plant maintenance, the third of the crane's functions, will also be carried out by this fifth hook.

The rubber matting provides electrical insulation for the crane to protect its motors from the charge applied to the acid baths.

Condra routinely supplies custom-manufactured crane components and complete cranes to customers worldwide.

Overhead crane and hook-block undergoing load test prior to shipping.

Condra, website: www.condra.co.za

Weba chute solution for deep-level gold mine

Bottlenecks were preventing one of the world's deepest gold mines from achieving its targeted throughput on a level 2 850 m below surface. Weba Chute Systems designed and manufactured the solution.

A short slew conveyor was at the centre of the South African mine's challenge, providing the only source of ore from that level. Frequent stoppages from belt cuts on this conveyor – often from large rocks stuck in the bottom of the existing chute – meant costly downtime and disrupted material flow to the plant.

The solution, according to Dewald Tintinger, Technical Manager at Weba Chute Systems, was to design a completely new chute solution that would remove the need for the slew conveyor arrangement.

"The chute we designed has a bypass leg that drops waste material directly into the bypass, while allowing an inline channel of reef onto the conveyor belt," Tintinger says. The custom-designed chute was able to replace the mechanical moving component, which also improved the safety of the working area.

The solution – which also involved 70 m of conveyor belt extension – required the new chute to bifurcate the flow of material from the stopes into a reef stream and a waste stream.

"We achieved that by installing a chute section mounted on a trolley frame, actuated to split the material flow as required," Tintinger says.

Another benefit was that the area no longer needed regular cleaning. Previously, four shifts of cleaners – comprising four workers each – were required to service the area around the slew conveyor and remove spillage.

Weba Chute Systems Technical Advisor Alec Bond says the belt on the slew conveyor was also being regularly damaged by the high direct impact of rocks falling from the previous chute.

"Our flow-controlled chute design ensures that the Weba chute has no free-dropping material," he says. "Instead, the speed of the material is controlled all the way through, right up until the outlet onto the belt."

The free-falling material was also causing regular damage to the chute itself, requiring frequent liner changeouts. By contrast, the Weba chute requires little maintenance. After a year-and-a-half of operation, the mine has not had to replace any of the parts.

Bond notes that the underground location of the project added considerably to its complexity. Space at the point of installation was limited, with irregular angles and levels being imposed by the sidewalls and hanging wall. There were also constraints regarding the size of components that could be transported underground, either inside or hanging from the lift cage.

"Every component had to be designed with logistics in mind," Tintinger says. He highlights the advantage of Weba's custom-design capability and ISO 9001:2008 accredited local manufacturing facility, combined with in-house expertise and years of materials handling and transfer point experience.

Installation of the new system had to be conducted with minimal impact on mine operations. It was therefore installed in stages while the plant was operational, according to Tintinger. The shutdown of the plant took place over the Christmas period, as this was the only time available that would not disrupt production.

"This required us to design the chute and associated structures in such a way that we could build it underground while the plant was running," he says. Construction took place over a six-month period alongside the operation of the slew conveyor.

Weba Chute Systems designed and manufactured a transfer point solution to prevent bottlenecks at one of the world's deepest gold mines.

"At the commencement of the Christmas shutdown, the changeover was done and the previous conveyor arrangement removed," Bond says. "No production was lost during the installation of the new Weba chute and system."

Weba Chute Systems & Solutions, website: www.webachutes.com

ACTOM Turbo Machines wins Sasol award

Petrochemical giant Sasol has recognised ACTOM Turbo Machines with one of its top 2019 awards for exceptional service in repair, refurbishment and ongoing maintenance.

The award in the 'Top Performing Service Supplier': Large Enterprises category was recently made by Grace Nndwammbi, Sasol's senior vice-president supply chain, to ACTOM Turbo Machines' MD, Chris Bezuidenhout, at Sasol's head office in Sandton.

A division of ACTOM (Pty) Ltd, ACTOM Turbo Machines is the only large non-OEM business in its service category to win the award to date. Since its inception six years ago, it has become the largest non-OEM turbomachinery and high-speed rotating equipment service provider in sub-Saharan Africa.

Anton Hamman (second from left), Sasol's principal specialist sourcing mechanical equipment, congratulates Chris Bezuidenhout, MD of ACTOM Turbo Machines, on receiving the prestigious Sasol award. Others in the photo are (from left): Leon Greeff, Sasol's senior manager, oxygen electrical & instrumentation; Mervyn Naidoo, ACTOM's Group CEO; and Nicholas Mokgosi, Sasol's senior manager E,C & I sourcing, category management.

Sasol is very OEM-reliant in terms of service backup and parts supply, according to Anton Hamman, Sasol's principal specialist sourcing mechanical equipment. Nonetheless, ACTOM Turbo Machines has proved itself in service provision for turbo machines, where critical and complex skills are required.

"We view turbo machines as the heart of our operations, so it is absolutely essential that the service provider has all the critical skills needed to ensure that the equipment is maintained to OEM specification," Hamman says. "If you use a non-OEM company for this work, you must be certain they have the required skills and competencies to perform this work to the correct standard every time and understand the associated risks."

He emphasises that safety awareness is a critical aspect of this service. The 36 MW machines in Sasol's oxygen plant, for instance, are extremely large and heavy. This makes them difficult and potentially dangerous to work on.

"ACTOM Turbo Machines has demonstrated its awareness of the hazards involved and rigorously applies all the procedures necessary to ensure that no one gets injured and that the work gets done as per agreed schedules," he says "On turbo machines, we look for the best skills in the country and globally, and this is what ACTOM Turbo Machines offers."

Bezuidenhout says ACTOM Turbo Machines was honoured to have received the award. "It signifies recognition of the highest order, which we greatly value and cherish," he says. "It marks an important milestone for us in our ongoing drive to provide the best possible service to industry."

Marthinusen & Coutts, website: www.mandc.co.za

Large volume SAG mill trommel screens from Multotec

The global mining industry has become more discerning about equipment selection for process plant applications, driven by the need to increase throughput and reduce downtime. The SAG mill trommel is one example that delivers on both fronts. With large volume capabilities and a robust and simple structure, it is considered a viable alternative to vibrating screens in SAG mill scalping applications.

Many designers and mill operators believe that the benefits of simplicity and the ability to handle throughputs in excess of 3 500 tons per hour of solids make trommels the preferred equipment for this application.

"A key component ensuring optimal performance of SAG mill trommels is the screen panel, which enables this equipment to classify large volumes of mill product," says Francois Fouche, senior screening specialist at Multotec.

The company has developed a special range of rubber compounds that are used to manufacture the compression moulded rubber screen panels which are considered the highest wearing items in the trommel.

"We have achieved excellent results from our compression moulded screen panels with wear life extending over six months in 4 500 tons per hour SAG mill applications," Fouche states.

Multotec has nearly four decades of experience supplying locally manufactured trommel screens and today has the process capability to size SAG mill trommel screens with diameters up to 5,5 m. The company also designs its trommel screens to suit each customer's unique requirements and confidently offers process and mechanical guarantees.

"Considering the size and complexity of large SAG mill trommel frames, Multotec is able to apply the latest Finite Element Analysis techniques during the design phase to ensure we reduce fatigue stresses and ensure structural integrity," Fouche points out.

Given the arduous duty, Multotec covers all frame surfaces that are exposed to the milled product with a wear resistant material, typically rubber.

Fouche says that the operational performance of a SAG mill trommel is another key consideration for Multotec. "As adequate retention time is required for the efficient removal of the fine fraction, we need to reduce the high velocity of the slurry that exits SAG mills. We are able to achieve this with various configurations of weir bars. The design of a set of scrolls is an integral part of the design process as these regulate the flow of solids through the trommel screen," he says.

Multotec has supplied a number of trommel screens for 38 to 40-foot SAG mills that required 500 to 600 mm high weir bars to create sufficient retention time.

Multotec, website: www.multotec.com

Tracked stackers offer high productivity and mobility

HPE Africa's McCloskey conveyor systems, which complement the range of crushing and screening plants, have been designed for high productivity and easy mobility in many industries.

"Benefits of McCloskey stackers include efficient operational costs, reduced material costs per tonne, improved material quality and enhanced safety on site," states Rasheel Sukdhoe, McCloskey Product Manager at HPE Africa, which is part of the Capital Equipment Group (CEG) of Invicta Holdings Limited.

"The TS4080 tracked stackers have been designed with the flexibility and mobility needed to ensure that the stockpiling process is as fast and efficient as possible. These units allow operators to stockpile or transfer material directly from mobile crushing and screening plants without incurring the double handling costs of using conventional loaders."

The McCloskey TS4080 tracked stacker.

With a 36,5 kW engine as standard, the TS4080 has a belt length of 23,77 m and a width of 1 000 mm. It offers a stockpile capacity of 1 685 m^3 and a production capacity up to 450 tons per hour. It can also be containerised for transport, with minimal setup time, substantially reducing transport costs.

With 4 m tracks for enhanced manoeuvrability and stability, the unit comes with many important standard features, including a fuel-efficient hydraulics system, user-friendly hydraulic controls, a hydraulically adjustable discharge height up to 11 m and a hydraulically adjustable feed-in height to complement crushing and screening plants. For added efficiency, it has a fully skirted tail section.

The stackers are designed to efficiently handle a variety of materials, including sand and gravel, aggregates, waste materials and coal.

HPE Africa's range of McCloskey equipment – comprising jaw, cone and impact (horizontal and vertical) crushers, trommel and vibrating screeners, stacking conveyors and washing systems – has been designed for easy operation, high efficiency, low maintenance requirements and extended service life.

HPE Africa, website: www.hpeafrica.co.za

Compact ERC takes crushing efficiency to the next level

With customers increasingly demanding optimal crushing performance from their equipment, thyssenkrupp's Minerals Processing division, a specialist in comminution, designed, developed and manufactured the compact and robust Eccentric Roll Crusher (ERC) which is taking crushing efficiency to the next level.

The inspiration behind the creation of this ground-breaking ERC, which is unique to thyssenkrupp, stems from the growing need to look at an improved, faster and more cost-effective way to crush bulk materials and precious metals such as platinum, copper, kimberlite and iron ore.

The new Eccentric Roll Crusher from thyssenkrupp.

After two years of intensive development, the completely new hard rock ERC was born. Said to be ideally suited to processing a wide selection of commodities above and below ground, this versatile machine delivers highly efficient crushing capabilities to underground mines, mobile and semi-mobile crushing plants in open-pit mining as well as mineral processing plants.

"With Minerals Processing boasting one of the largest global crushing and grinding technology portfolios which can be customised to customers' plant process needs, we are extremely proud to now bring to the market this truly one-of-a-kind Eccentric Roll Crusher," states Wilfred Barkhuizen, GM Minerals Processing, Energy and Power at thyssenkrupp Industrial Solutions Sub-Saharan Africa. "With a distinctive design that sets it poles apart from conventional crushers, the ERC without any doubt sets the efficiency benchmark and presents the next step in the crusher revolution."

The machine's integrated screen elevates efficiency as fine material does not pass through the crushing chamber but instead is discharged directly. This new approach ensures a host of benefits such as diminished power consumption, reduced risk of material compaction and machine overload, as well as lessened wear on the crushing elements.

Another wear reduction feature is the smartly integrated automatic gap adjustment. The adjustable swing jaw, which forms part of the crushing chamber, allows the gap to be precisely adapted to suit a specific product. The adjustment range of up to 200 mm for the largest model is more than adequate for gap adjustment to offset wear on the crushing elements. The gap adjustment also features an overload protection function in order to protect the crusher against overload damage.

"In the event that the acceptable load has been exceeded by non-crushable foreign bodies, for example, the valve opens and the gap is enlarged, protecting the crusher against overload damage," Barkhuizen explains. This function includes a unique hydraulic cylinder that controls the load in the crushing chamber as well as the pressure.

thyssenkrupp has built the ERC to be impact resistant. When large chunks of material are fed into the crushing chamber, instead of falling onto the mounted working element, the material hits the machine's exceptionally resistant and rugged hood.

According to thyssenkrupp, the ERC has completely surpassed its designers' efficiency expectations in over six months of rigorous testing. Tested in the crushing of andesite, a material akin to copper and iron ores with strengths of up to 200 MPa, the ERC reportedly blew operators away with its impressive delivery of almost two times the expected throughput.

thyssenkrupp, website: www.thyssenkrupp-industrial-solutions.com

Wear lining for fine slurry abrasion applications

Engineered to provide superior wear performance to counter fine slurry abrasion, Linacure® 40 is locally manufactured by Weir Minerals Africa. This uncured natural rubber compound is suitable for applications where hot bonding is the preferred method of installation.

Using the same formulation principles employed in Weir Minerals' standard Linatex® premium rubber, Linacure® 40 was created to provide a differentiated wear performance when compared to competitor uncured natural rubber products.

Worldwide tests have confirmed the performance of this wear lining which is rated at 40 IRHD against the ISO 48-2010 standard. It offers a tensile strength of 21,5 MPa and is suitable for use in operating temperatures from -40 ºC to +70 ºC.

Linacure® 40 is manufactured in sheet form of varying thicknesses, allowing it to be cut or configured into any shape that the application may require. It is lighter and more flexible than other wear liner materials such as steel and ceramics, making it easier to handle and install.

Typical applications for the product would be to line pipelines, chutes, tanks and hoses.

Weir Minerals Africa, website: www.minerals.weir


Linacure® 40 is locally manufactured by Weir Minerals Africa.

SmartCyclone™ system helps optimise process plants

SmartCyclone wear and roping sensors can be installed on KREBS® cones, apex and other cyclone components.

Process plant optimisation techniques have become a necessity for mines looking to maximise their operating performance by keeping costs low, throughput high and downtime to a minimum. FLSmidth's automated SmartCyclone™ system is a solution that delivers in all three areas for cyclone circuits, a vital processing element in any plant.

FLSmidth's SmartCyclone is a monitoring and control solution for reducing cyclone-related process deviations. It also improves cyclone overflow particle size distribution, predicts and controls cyclone maintenance schedules, and optimises closed-circuit grinding processes.

This equates to monitoring the performance of individual cyclones within a circuit in real time, preventing unplanned breakdowns from occurring and monitoring wear rates while ensuring the cyclones are operating optimally at all times. This translates into higher efficiencies in the plant and, ultimately, higher profitability.

The SmartCyclone closed circuit grinding optimisation system combines a variety of FLSmidth patented technologies which include the FLSmidth Krebs SmartCyclone wear detection sensor technology as well as the Krebs patented roping sensor technology with patent-pending wireless controller system.

The closed circuit grinding optimisation system also incorporates FLSmidth's ECS/ProcessExpert® process control software with a new patent-pending SmartWear™ cyclone maintenance algorithm. One of the largest benefits associated with this software is the ability to develop a uniform operation strategy that outlines the best way to run the plant. Once this strategy has been established, the necessity to train new operators is reduced.

Reducing or eliminating manual operation, which decreases the potential for human error, is in fact one of the overarching benefits of SmartCyclone.

FLSmidth has more recently enhanced its Krebs SmartCyclone system with wireless technology that enhances installation simplicity by eliminating the need for individual nodes and the interconnecting cables between the sensors and nodes and associated controllers.

It utilises a central wireless controller that can handle up to 16 sensors per unit, providing real-time wireless detection and communication of roping and/or wear data. The new wireless controller unit is a handheld device that can be removed from its docking/charging station to sync the individual sensors. Once it's removed, it goes into battery power mode and the user can walk to a desired sensor, activate it with a magnet, trigger and set the necessary operating parameters.

FLSmidth, website: www.flsmidth.com

Motor system efficiency high on global agenda

With electric motors consuming almost 70 % of industry's energy, companies are always looking for better motor efficiencies. For many years, motor efficiency has been well defined; however, when driven by a variable speed drive (VSD), the VSD efficiency and the total efficiency of the VSD and the motor have not been well understood. Choosing the right product combination can also be more difficult as manufacturers' data is not always easily comparable. This is where the international IEC61800-9 standard comes to the rescue, according to global motor and VSD manufacturer WEG.

The IEC61800-9 standard – based heavily on the previous EN 50598 standard – gives manufacturers a clear framework for grading a complete motor system. End-users can compare the overall efficiency of a manufacturer's products, irrespective of design and component selection.

The IEC61800-9 standard uses the Extended Product (EP) approach. This considers the efficiency of the Motor System, which is comprised of the Motor, the Basic Drive Module (BDM) and the Complete Drive Module (CDM). Together, these make up the Power Drives System (PDS), which also includes any switchgear and controls.

A WEG motor and drive combination.

This terminology sounds confusing but is just a technical way to say: Switchgear + VSD + Motor. The efficiency levels are defined by considering eight different operating points, covering low to high speed and torque. The user can easily compare his application load and speed requirements to the motor system defined speed and torque points.

The EP approach employs a semi-analytical model to calculate the efficiency of each of the components at the operating points of the driven equipment. The calculations are also based on tested and verified values. This results in the most efficient component selection for the application.

Using this standard, the user may be assured that:

- ❑ a motor complies with the defined motor efficiency levels of IE1, IE2, IE3, IE4 or IE5;
- ❑ a VSD complies with VSD efficiency IE0, IE1 or IE2; and
- ❑ the manufacturer's motor and VSD used in combination will meet or exceed a system energy standard of IES0, IES1 or IES2.

Using this EP approach, the European Commission expects the increasing use of more efficient systems to help achieve its targets for carbon dioxide (CO_2) reduction.

In line with these efforts, WEG VSDs and IE2 motors in combination achieve IES2. And significantly, WEG's VSDs and IE3 efficient motors exceed the highest system levels of efficiency. Additionally, WEG has product lines that exceed even IE4 and IE5 classifications.

The EC's regulation 640/2009 already requires that all electric motors operated from a variable speed drive or inverter must adhere to a minimum of IE2 to be eligible for sale. Fixed-speed applications must meet a minimum of IE3 to comply.

Where a motor does not operate at its nominal torque and speed, the variable speed drive represents a significant opportunity for energy optimisation. In addition, the greater the range of speed variation results in a greater PDS efficiency. Using WEG's IE2 motors with any WEG variable speed drive can achieve an efficiency classification of IES2. However, using other WEG lines of motors with the right drive, much better levels of efficiency can be reached.

WEG has a complete line of variable speed drives which exceed the IE2 requirements outlined in the IEC61800-9 standard. When combined with WEG's robust and reliable motor line, the products create an integrated solution for all applications.

Zest WEG Group, website: www.zestweg.com

Skyriders assists with snagging at new coal silo

When a major coal-mining company in Limpopo built a new silo as part of its ongoing expansion, Skyriders became involved upfront in specifying the type of rope-access anchors needed for future inspection and maintenance. This also allowed Skyriders to assist with the final snagging process of the new silo before official handover to the client.

Snagging involves identifying any final improvements or modifications needed. The process is particularly important with such a massive structure, with the coal silo topping out at a height of 30 m. At the time of snagging, all the traditional means of access required for the construction phase had already been dismantled, Skyriders Marketing Manager Mike Zinn points out.

"To rebuild that scaffolding solely for the snagging process would have been prohibitively expensive and time-consuming," Zinn says. However, due to the foresight of the client in incorporating rope-access anchor points in the original design, Skyriders was able to dispatch a four-person specialist team for the fast-track, week-long project.

In terms of the snagging itself, Skyriders' scope of work involved removing some concrete shuttering, and the installation of additional access anchors and minor concrete remedial finishing tasks. "The project team did an exemplary job of demonstrating our skill set, and how we can always come up with a solution for any specific client requirements," Zinn comments.

Skyriders, website: www.ropeaccess.co.za

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