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BEKA SCHRÉDER RAISES THE BAR WITH ENERGY-EFFICIENT LED LIGHTING

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Cover
A 'working' Scania G410 mining tipper on display at the recent Electra Mining show in Johannesburg. See page 18 for further details of Scania's mining offering.

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New publication highlights Africa's remarkable geology

Readers might recall that in November last year I devoted this column to a review of Gavin Whitfield's book entitled *50 Must-see Geological Sites in South Africa*. A new publication which would make a superb complement to Gavin's very fine work is *Africa's Top Geological Sites*, which has been issued as a special commemorative volume to coincide with the 35th International Geological Congress (35th IGC), which has recently been held in Cape Town and which is covered elsewhere in this issue.

Published by Struik Nature (an imprint of Penguin Random House), *Africa's Top Geological Sites* has been edited by Richard Viljoen (see also page 32 of this issue), his brother Morris Viljoen and Carl Anhaeusser, all prominent in the geological community. In its 312 pages, it manages to cover over 40 sites around the continent and contributors include many well-known geologists. It is pitched at a somewhat more technical level than Gavin's book (Gavin, incidentally, is one of the contributors to this latest volume) but is still, I think, very accessible to a lay reader.

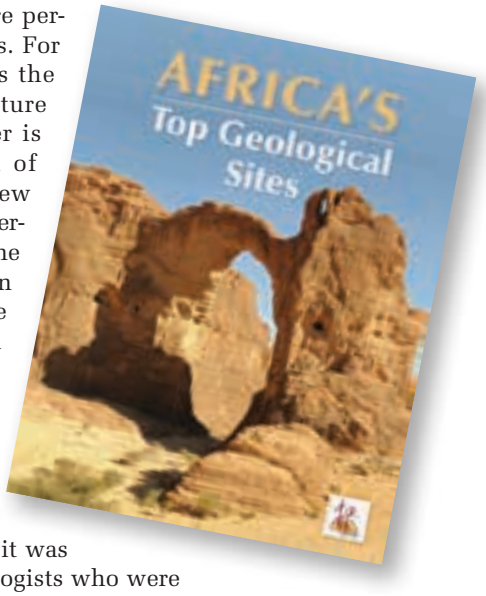
The new work is profusely illustrated, of course, with masses of photos, maps, satellite images and diagrams and includes an excellent glossary of technical terms and a guide to further reading. It has been sponsored by Acacia Mining, which runs the Bulyanhulu, North Mara and Buzwagi gold mines in Tanzania, and logistical support during its preparation was provided by VM Investments, an investment company focused on the minerals field, and one of its associate companies, junior explorer Bushveld Minerals.

There are many other individuals and organisations who deserve acknowledgement but unfortunately space does not allow me to mention them all here.

Explaining the motivation for *Africa's Top Geological Sites*, Richard Viljoen writes in his preface that "The 35th International Geological Congress presented us with an ideal opportunity to showcase Africa's geological heritage, and the concept of a commemorative volume, specially prepared for the event and for the benefit of delegates, was mooted by the publications committee. With a growing worldwide interest in geoheritage, the production of a book devoted to Africa's top geological sites – and as a legacy project of the conference – was an obvious choice."

The content is truly mouth watering. To give just a few examples, Southern African sites and geological formations covered include Mapungubwe, the Pilanesberg Alkaline Complex and the Karoo Supergroup in South Africa, the Matobo Hills and Chinamhora Batholith in Zimbabwe, the Gorongosa area of Mozambique and the Namib Desert and Otavi Mountainland in Namibia.

Moving further north, there are contributions on the Tibesti Massif of Chad and Libya, the Ruwenzori Mountains of Central Africa, the Rift Valley, Meru and Kilimanjaro mountains in northern Tanzania and the Danakil Depression of Ethiopia. Africa's offshore islands are not forgotten and there are two separate chapters covering these.



Some sites and terranes are perhaps less familiar than others. For example, one chapter covers the 'The enigmatic Richat Structure in Mauritania' while another is simply entitled 'The Hand of Fatima'. Both of these were new to me. For those readers wondering what or where these are, the Richat Structure is a 38 km in diameter domal feature in the Taoudeni Basin of Mauritania while 'The Hand of Fatima' refers to the spectacular erosional landforms of the Gourma region of Mali.

The Richat Structure incidentally escaped discovery until the 1940s when it was identified by two French geologists who were mapping in the Sahara. A satellite image of it appears in the book and shows very clearly why it is also sometimes referred to as 'The Eye of the Sahara'.

The contributors are all experts in their fields. Who better, for example, to write about the Tsodilo Hills of Botswana than well-known diamond geologist Mike de Wit, who is President and COO of exploration junior Tsodilo Resources (whose tenements lie in the Tsodilo area), and Mike Main, who knows Botswana backwards and has written a number of guides to the country?

Africa's Top Geological Sites is priced at R390. Although I imagine it can be ordered through most book shops, readers having any difficulty obtaining it can contact the publishers direct. Their website is *www.penguinrandomhouse.co.za.*

Arthur Tassell

Metallon lifts gold production in second quarter

Metallon Corporation, the gold mining, development and exploration company with producing assets in Zimbabwe and exploration assets in Tanzania and the DRC, has announced its production results for Q2 2016 and an update on corporate activities.

Group gold production for Q2 2016 from its four producing mines in Zimbabwe was 22 565 oz, 9 % higher than the previous quarter (Q1 2016: 20 673 oz). Production for the year to date is 43 238 oz. The increase in gold production in Q2 2016 was mostly due to an outstanding performance at Metallon's How mine, located 30 km south-east of Bulawayo.

Power interruptions continued to affect operations in Q2 2016. Metallon lost 112 hours of production during the quarter which equates to approximately 1 700 oz (Q1 2016: 4 275 oz). Metallon says it is working on possible solutions for supplementing grid power supply.

The Q2 2016 Group C1 costs were US$764/oz and all-in-sustaining costs (AISC) US$971/oz. This is an improvement of 14 % and 16 % compared to Q1 2016 (Q1 2016: C1 cost US$884 and an AISC of US$1 156). This improvement was the result of increased production and cost savings from overtime control and central procurement. As production and cost efficiencies improve throughout the year with new equipment and increased capacity, Metallon says it expects these costs to reduce further.

Reporting on its expansion projects, Metallon says How mine has commenced the deepening of the 16N7 Shaft in order to increase ore supply. The shaft deepening from 28L to 34L is to access ore below 28 Level which will increase future production. Commissioning of the deepened shaft is expected in 2018.

The new Tailing Storage Facilities (TSF) at Shamva mine will be commissioned in Q4 2016. Plans are scheduled to refurbish the processing plant at Shamva to 70 000 tonnes per month capacity, which would increase production in 2017.

Construction of the new processing plant and TSF at Mazowe, located 50 km north of Harare, is currently well advanced. The new plant will increase capacity at the mine to 70 000 tonnes per month.

Redwing mine continues to increase production following the resumption of operations in November 2015. Production is expected to increase to 22 000 tonnes per month by Q4 2016. Plans are also underway to increase production to 50 000 tonnes per month in 2017.

Ken Mekani, Chief Executive Officer, Metallon Corporation, commented: "Metallon delivered a positive performance in Q2 2016. Production increased almost 10 % and AISC reduced by 16 % quarter on quarter, with the operations at How mine especially achieving strong results. The new processing plant at Mazowe is 80 % constructed with all key equipment on site and we have confirmation from our contractors that the plant will be commissioned in Q4 2016. The appointment of contract miners at Shamva mine and ramp up at Redwing mine will also provide increased production in the second half of the year. We look forward to the continued expansion across the Group and reaffirm our production target of 120 000 ounces in 2016.

"Metallon is currently investing significantly in Zimbabwe with the deepening of the shaft at How mine, the refurbishment of the processing plant at Shamva mine, the expansion at Redwing mine and a targeted exploration programme across the Group. This large capital expenditure programme over the next few years will considerably increase our production and generate future revenue." ■

The new Mazowe processing plant as it was in early August this year (photo: Metallon).

Study confirms scope for cobalt production at Kipoi

Australia's Tiger Resources has announced that a study by an independent engineering company, Mintrex Pty Ltd, to investigate the viability of Tiger producing cobalt at its Kipoi project in Katanga in the DRC has returned a positive result.

The current Kipoi mineral resource contains cobalt but there is no processing pathway for this material. Mintrex has concluded that based on an expected nameplate copper cathode production level of 32 500 tonnes, measured cobalt in the raffinate pond and a copper to cobalt ratio derived from the Kipoi mineral resource, there is sufficient cobalt potential within the current Kipoi copper leach circuit to justify further studies.

The Mintrex study has identified two potential cobalt process routes for Kipoi: cobalt intermediate recovery (cobalt hydroxide); and cobalt refining (cobalt cathode metal). These processing pathways could be developed progressively or in stages. Mintrex recommends the development of a cobalt hydroxide circuit producing a cobalt hydroxide intermediate product as a first step, and estimates a capital cost of US$22 million (+/- 40 %) for a 1 000 t/a circuit.

Tiger will now scope a metallurgical test work programme to confirm commercial process flow sheets and firm up the capital cost and estimate likely operating costs. This test work is expected to be completed by December 2016.

Tiger produced 26 151 tonnes of copper cathode at Kipoi in 2016, and is undertaking debottlenecking works at the plant to increase nameplate production capacity to 32 500 tonnes per year. These works are scheduled to be completed during the December 2016 quarter. ■

East Africa Metals applies to mine at Terakimti

East Africa Metals Inc, listed on the TSX-V, reports it has filed the mine permitting application for the Terakimti oxide gold project at its 70 %-owned Harvest project in Ethiopia.

The Terakimti project has a mineral resource of 1,12 Mt grading 3,2 g/t and 24,0 g/t silver for 107 000 ounces of gold and 812 000 ounces of silver. Simulated heap leach recoveries of 75,3 % gold and 39,7 % silver have been achieved.

Terakimti is proposed as an open-pit mining operation followed by heap leaching and on site processing to produce gold-silver doré. The combination of near surface oxide gold and silver mineralisation, hosted in soft rock when compared to other deposits, high and rapid extraction of gold at coarse crush sizes in metallurgical testwork, along with satisfactory percolation rates, all support this strategy for the development of the project.

The project is located in the Tigray region of northern Ethiopia, approximately 600 km north of Addis Ababa, the capital. The region has regular air service and very good, modern transportation and power infrastructure.

The proposed mining operation would utilise grid power for the project, for which the nearest high tension power line is approximately 7 km away. Primary road access to the site is by paved highway from the town of Shire, 40 km south of the project.

Local surface and groundwater are expected to be sufficient for a heap leaching operation and the project would maximise recycling of process water.

"Advancing the Terakimti gold oxide project to the permitting stage will mark a significant milestone for the company and highlights the excellent performance the company has achieved with its Ethiopian assets," says Andrew Lee Smith, President and CEO of East Africa Metals. "The resource at the Terakimti project shares a similarity with other copper-gold projects in the region, such as the Bisha and Debarwa deposits, in that the initial mining opportunity was defined by the surface gold-oxide resource followed by mining of copper-gold-zinc sulphide resources.

"Management believes that, over time, the potential exists for mining at Terakimti to begin with the gold silver oxide and then transition to high-grade supergene copper oxide and eventually the copper-gold sulphide resource. The Terakimti oxide gold project will provide East Africa the opportunity to benefit from establishing the first heap leach commercial operation in the country, and generate cash flow to re-invest in exploration and development to grow the company's resources in Ethiopia, which currently stand at 926 000 gold equivalent ounces in the indicated category plus 860 000 gold equivalent ounces in the inferred category." ■

East Africa Metals' geologists working in the field on the company's tenements in Ethiopia. The company's two projects in Ethiopia are Harvest (which includes Terakimti) and Adyabo. They are roughly 15 km apart (photo: East Africa Metals).

Baobab phosphate project enters production

ASX-listed Avenira Limited says it has reached a "transformational milestone" with the first production being achieved at its 80 %-owned Baobab phosphate project in Senegal.

The Baobab process plant is going through its commissioning procedures and the first phosphate product is being stockpiled ahead of trucking to port in the next few weeks. Maiden product shipment is expected to take place in late September or October, somewhat dependent upon the regional wet season.

Avenira says the first production marks a critical step in its move into the agri-nutrient sector, coming just five months after mining activities commenced.

Stage 1 of the Baobab project is designed to produce 500 000 t/a of phosphate concentrate. The successful US$15 million development of Stage 1, which was delivered on time and on budget, paves the way for Avenira to continue to pursue its strategy of multiple stages of expansion across the Baobab project.

"The Baobab phosphate project continues to progress steadily and it is fantastic to see first production at this time," says Avenira's Managing Director, Cliff Lawrenson. "The project has moved from the construction stage to commissioning and is proceeding through production ramp-up with appropriate procedures and protocols being phased in progressively. To have achieved first production in August, after starting mining activities in March, is outstanding by any measure and is a testament to the focused and committed teamwork from the board to the project operators." ■

Stellar plans West Africa's second biggest diamond mine

Stellar Diamonds, the London-listed diamond development company focused on West Africa, has agreed a proposed transaction with Octea Mining Limited, owned by Beny Steinmetz's BSG Resources, to combine Stellar's Tongo kimberlite diamond project with Octea's adjacent kimberlite diamond project, Tonguma. It is envisaged that both assets will be brought into production under the same infrastructure in Sierra Leone.

The transaction will see combined inferred JORC diamond resources of 5 million carats – with diamond grades of up to 290 cpht – being brought into a single mining operation. The average diamond values are US$193 and US$270 per carat for Tonguma and Tongo respectively.

"The proposed transaction, if completed, will be transformational for Stellar and its shareholders," says Stellar's Chief Executive, Karl Smithson. "Once in production, the combined diamond mining operations will be the second largest in West Africa with an estimated maximum output at full production of approximately 250 000 carats per year of high value diamonds. The high grade and high value nature of the kimberlites to be mined are compelling and the combination of operations should provide meaningful cost synergies that will enhance Stellar's projected operational margins. Using the available infrastructure at Tongo and Tonguma, we expect diamond mining operations to commence within the first 12 months post completion of the proposed transaction."

Comments Octea's General Manager, Christo Swanepoel: "We are very excited to be combining Octea's Tonguma project with Stellar's Tongo project and bring the enlarged project into production under Stellar's operational management. Stellar has long-standing expertise in Sierra Leone and the Tongo region in particular, which we believe will be of great benefit to the project. In addition, the enlarged project should significantly increase local skilled employment for many years to come which in turn will support the local economy, as well as generate significant funds for the Sierra Leonean government."

Stellar's Tongo project has a JORC inferred resource of 1,45 million carats at a grade of 165 cpht. The current mine plan for Tongo assumes a conservative lower grade of 120 cpht with an average diamond value of US$270 per carat. A further three high-grade kimberlites are present in the licence area though these have not yet been drilled into resource.

The Tonguma project comprises a 25-year mining licence (granted to Octea in 2012) covering an area of 124 km^2 in the Lower Bambara Chiefdom, Kenema District, in the Eastern Province of Sierra Leone. The Tonguma project is adjacent to and contains the on-strike continuation of the diamondiferous kimberlite dykes which are being explored by Stellar within its Tongo project.

Octea has undertaken extensive exploration activities at Tonguma including over 58 000 m of diamond drilling, as well as bulk sampling which has produced approximately 7 250 carats of which over 3 500 carats has been used for diamond valuation. An independent JORC inferred resource of 3,45 million carats has been estimated at grades of up to 290 cpht and average diamond values of US$193 per carat, to a maximum depth of 200 m.

Independent consultants have also estimated a significant further exploration target on the Tonguma licence, which, based on the mid-range grade and tonnage estimates, results in a potential exploration target of a further 8 million carats.

A full independent competent person's report on the Tonguma project and existing Stellar projects – including Tongo – is being prepared by Toronto-based MPH Consulting.

Given the close proximity of the two projects, the transaction should allow Stellar to undertake both surface and underground mining across both licences. It is envisaged that processing would be undertaken centrally, utilising the existing 50 t/h production plant which will be relocated to the project area from Octea's Koidu mine, approximately 60 km north of Tonguma.

The initial capital outlay for Tongo as a standalone project has previously been reported by Stellar at an estimated US$25 million. Independent consultants Paradigm Project Management (PPM), who together with SRK Consulting are preparing the combined Tongo/Tonguma mine plan, estimate the initial capital requirements at approximately US$40 million (excluding working capital) to establish production for the combined project. ■

Octea's Tonguma project. Bulk sampling of the deposit has produced approximately 7 250 carats.

View of the Bisha site. Starting from the left of the photo and moving towards the centre, the concentrate storage, filtration, thickening and flotation sections of the zinc flotation plant expansion can be seen (photo: Nevsun).

Nevsun Resources ships first zinc concentrate from Bisha

Nevsun Resources has sold and shipped the first zinc concentrate product from the Bisha mine in Eritrea. The 10 000-tonne lot was loaded at the Port of Massawa and sailed on September 7, 2016. The concentrate was sold on the spot market, attracting multiple offers and highly competitive treatment charges.

The Bisha mine completed the zinc flotation plant expansion earlier in 2016 on time and under budget. The plant allows Bisha to produce separate copper and zinc concentrates simultaneously from processing primary ore from the Bisha open-pit mine.

Cliff Davis, Nevsun's Chief Executive Officer, commented, "We are pleased to have a high quality zinc product coming to market in an environment of rising zinc prices. Bisha is the only significant new zinc concentrate coming to market in 2016 and we are being aggressively courted for offtake by various customers. We would like to congratulate our partner, the State of Eritrea, for adding another export product to the economy and thank them for their support."

Nevsun is scheduled to load additional shipments in the coming weeks and is ramping up to commercial production which is forecast for Q4 2016.

Nevsun, listed on the TSX and NYSE MKT, is the 60 %-owner of Bisha, which was constructed between 2008 and 2010. The mine is located 150 km west of Asmara. It has nine years of reserve life, generating revenue from both copper and zinc concentrates containing gold and silver by-products. ■

Endeavour makes "excellent progress" at Houndé

TSX-listed gold producer Endeavour Mining says that excellent progress is being made at its Houndé gold project in Burkina Faso. Construction is progressing on time and on budget, with the first gold pour expected during the fourth quarter of 2017.

Jeremy Langford, EVP Construction Services Group of Endeavour, stated: "We are very pleased to have successfully achieved our first set of key project milestones safely, ahead of schedule and on budget, despite the wet season being upon us. Our employment statistics are extremely pleasing with over 96 % of our 1 058 project staff and contractors being Burkinabe nationals. I am proud that this project will deliver significant economic benefits to the local area and the whole of Burkina Faso, in addition to becoming Endeavour's flagship operating mine."

Procurement is approximately 45 % complete, with total capital commitments amounting to US$150 million. The CIL ring beam concrete pour was achieved early-August, two weeks ahead of schedule, and, as of 6 September, all six ring beams had been completed.

The water harvest dam has been constructed, with water already being pumped to the water storage dam, two months ahead of schedule, while the 300-person permanent accommodation village is on schedule for completion during Q1-2017.

A mining fleet equipment financing agreement has been signed with Komatsu with deliveries already on-site, and machinery commissioned and operational.

Following the signing of the power offtake agreement with Sonabel, the national electricity provider, procurement has been completed for the 38 km, 91 kV overhead power line with construction scheduled to start in October 2016.

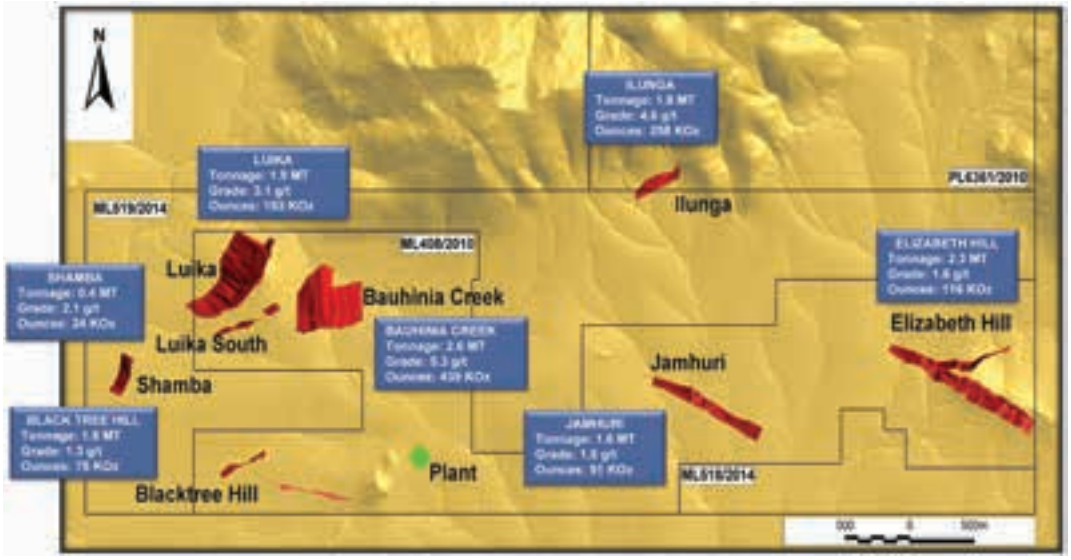
The site has maintained a strong safety record with over 400 000 man-hours worked without a Lost Time Injury (LTI) or Medical Treatment Injury (MTI).

Once in production, Houndé will become Endeavour's flagship low-cost mine, ranking amongst West Africa's top tier cash generating mines, with an average annual production of 190 000 ounces at an All-In Sustaining Cost (AISC) of US$709/oz over an initial 10-year mine life based on reserves. In the mine's first four years, the average annual production is expected to be 235 000 ounces at an AISC of US$610/oz.

The project is an open-pit mine with a 3,0 Mt/a gravity circuit/CIL plant. The initial capital cost is estimated at US$328 million, inclusive of US$46 million for the owner-mining fleet.

Endeavour operates mines in Côte d'Ivoire (Agbaou and Ity), Burkina Faso (Karma), Mali (Tabakoto), and Ghana (Nzema). In 2016, it expects to produce between 575 koz and 610 koz at an AISC of US$870 to US$920/oz. ■

Big increase in satellite deposit resource at New Luika



The New Luika property showing the location of the satellite deposits, including Ilunga.

Shanta Gold, listed on AIM, has announced an upgraded JORC Code compliant (2012) resource estimate at the Ilunga satellite deposit at the New Luika Gold Mine (NLGM) located in the Lupa goldfield of south-west Tanzania. Ilunga is located 2,5 km north-east of the NLGM central processing facility with access already developed as part of the current open-pit mining operation.

Indicated resources have increased by 409 % from 40 352 ounces Au to 205 347 oz Au in the upgraded estimate while the indicated resource tonnage has increased 336 % from 311 355 tonnes to 1,36 Mt. The indicated resource gold grade has risen 17 % from 4,03 g/t to 4,71 g/t.

Total Ilunga resources (indicated and inferred categories) have been upgraded from 73 940 oz at 3,51 g/t to 257 965 oz at 4,55 g/t.

The updated resource will be fast-tracked for engineering studies with a view to defining an underground reserve during the first quarter of 2017. The underground material from Ilunga was not included within the Base Case Mine Plan, reported by Shanta in September 2015, and the company will work to incorporate these resources into the mine plan in due course. The deposit remains open at depth and along strike to the west.

The Ilunga drilling programme was conducted between March and July 2016 and comprised 29 new drill holes of which one was diamond from surface, 20 were reverse circulation with diamond tails and eight were reverse circulation. Diamond drilling totalled 1 844 m and reverse circulation was 3 672 m for a total of 5 516 m.

"We are delighted with the upgraded resource figures from Ilunga," comments Toby Bradbury, Shanta's CEO. "The deposit is a good grade, close to the plant and is likely to contribute to a meaningful increase in the mining reserve which in turn enhances shareholder value. We expect that the majority of the Ilunga ounces will form part of a new high grade underground operation that would start as the Luika deposit is depleted in around 2020.

"At this stage, the company envisages developing Ilunga using cash generated from operations and to utilise existing equipment and personnel to take the new development in its stride. The potential of this high grade extension creates the option to blend with, among others, the upgraded Elizabeth Hill reserve declared earlier this year and thus extend the mine life by a number of years with a lot more prospective exploration still in play." ■

Perseus reports two further growth milestones

West African gold producer Perseus Mining, listed on the ASX and TSX, reports that two further milestones have been achieved on the path to implementing its strategy of transforming itself into a multi-jurisdictional, multi-mine producer of in excess of 500 000 ounces of gold per year by 2021.

Full credit committee approval of a US$60 million project debt facility has been received by Macquarie Bank Limited and BNP Paribas, the prospective lenders to the Sissingué project. Final documentation and satisfaction of conditions precedent for the facilities are due for completion in the December 2016 quarter, at which time funds should be available for draw down.

Sissingué is located in northern Côte d'Ivoire. It is planned to have an average annual production of 75 000 ounces of gold at a LOM All-In Site Cost (AISC) of US$632 per ounce over a mine life of 5,25 years. Payback on the US$100 million capex is estimated within 32 months based on a US$1 200 per ounce gold price.

Development work at the Sissingué site, funded from the proceeds of a recent equity offering by Perseus, has advanced and the project is on schedule for the production of first gold in the December 2017 quarter.

In anticipation of the expansion of its operating activities to include both the Edikan gold mine in Ghana and Sissingué by the end of 2017, and with the prospect of developing a third mine at Yaouré within several years, Perseus has appointed Chris Woodall to the role of Chief Operating Officer.

He is an Australian mining professional who comes to Perseus equipped with a large amount of highly relevant operating experience needed to successfully perform the COO role for Perseus. He most recently held the positions of Senior Vice President Operations (Canada and US) for Goldcorp Inc and immediately prior to that the role of Global Director Mining – Operations Support for Barrick Gold Corporation.

Reporting to the Chief Executive Officer, Woodall will be based in Perseus's corporate office in Perth, Australia but will necessarily spend a significant proportion of his time in West Africa overseeing the growth of Perseus's gold mining operations. ■

Manroc awarded underground mining contract for Prestea

Golden Star Resources (GSR), listed on the NYSE MKT, the TSX, and the GSE, has appointed Manroc Developments Inc as the underground mining contractor for its Prestea underground gold mine in Ghana ('Prestea Underground').

Manroc was selected following a competitive bid process involving a number of large mining contractors. The company specialises in Alimak stoping, a mechanised shrinkage mining method, and has a reputation for safety and efficiency. It has worked on major projects on a variety of continents and its clients have included Barrick Gold, Goldcorp Inc and Nyrstar. Manroc has previously operated in Ghana and Tanzania.

Alimak stoping was selected as the mining method for Prestea due to its safety and efficiency benefits over conventional shrinkage mining. Members of Golden Star's technical team at Prestea Underground have experience of using Alimak mining techniques at the Myra Falls mine in British Columbia, Canada and the Musselwhite mine in Ontario, Canada.

Prestea Underground is a narrow, high grade deposit, with mineral reserves of 1,0 Mt at 14,02 g/t for 469 000 ounces and substantial exploration upside potential.

Golden Star is expected to commence development of the Prestea Underground orebody during Q4 2016 and Manroc is expected to mobilise its fleet to site during the same quarter.

"The development of Prestea Underground is progressing well and the appointment of a mining contractor is the next important step," comments Sam Coetzer, President and CEO of Golden Star. "We remain on track to bring Prestea Underground into production in mid-2017, which will be a significant milestone for Golden Star as it is expected to increase our production rate and further reduce our cash operating costs. The mine is one of the highest grade development projects in West Africa and has a strong history, with approximately 9 million ounces of gold production during the past century. The work to upgrade Prestea's infrastructure is continuing well and we are excited about the potential upside of the deposit's mineral reserves."

GSR personnel at Prestea. The mine ranks as one of the oldest in Ghana and its infrastructure includes vertical and inclined shafts, horizontal development, raises and stopes developed along the 9 km of strike length of the gold mineralisation (photo: GSR).

Pioneering StepWise methodology used on BCL projects

Advisian, the strategic advisory arm of global project delivery company WorleyParsons, is utilising a pioneering and successfully proven methodology called StepWise which was developed in-house to undertake two studies for BCL, a state-owned copper and nickel mining company in Botswana.

Advisian is in the process of finalising a Pre-Feasibility Study (PFS) for BCL's Maibele North copper and nickel project while a Bankable Feasibility Study (BFS) for a new open-pit mine at the existing Selkirk underground nickel mine near Francistown is in progress.

Donovan Munro, Principal Mining Engineer at Advisian, says the StepWise methodology has played an instrumental role in the early determination of financial viability for the two projects. In both instances the StepWise process has been able to identify early on the challenges to economic viability that would only have been detected much later in the project cycle, had purely traditional project delivery methodologies been used.

"We have utilised the StepWise process to quantify potential and value and to this end developed an extensive range of parameters and options that were then ranked utilising the unique StepWise methodology in order to accurately determine the most financially viable options for the projects," says Marthinus Odendaal, the project manager on both projects.

Each phase of the project study (Conceptual, Pre-Feasibility and Feasibility) should incrementally and realistically add

The Selebi-Phikwe and WorleyParsons project team.

BMR Group enters into option agreement for Zambian licence

AIM-listed BMR Group – which is focused on the recovery of lead and zinc from the tailings deposits of Zambia's oldest mine at Kabwe – reports that it has entered into a 60-day exclusive option agreement with Bushbuck Resources Limited of Zambia to acquire Bushbuck's Large Scale Prospecting Licence 19653-HQ-LPL (Star Zinc) in an area to the immediate north of Lusaka, for a total cash consideration of US$1 million plus taxes.

BMR believes the acquisition of Star Zinc would represent an important strategic step for the company as the in-situ ore contains high grade zinc which is planned to be either blended with the tailings from Kabwe's leach plant residues to improve metal recoveries or used to raise the plant head grade to increase Zn production at BMR's proposed processing plant at Kabwe. This is expected to enhance the quality of the product, subject to test work to confirm its compatibility. This, in turn, the company expects, would underpin the long-term future of the Kabwe operation.

BMR's first priority will be to undertake a drilling programme on the karst fill/saprolitic material in the area of the present open pit to determine the extent of the, as yet, untested surface mineralisation and to establish a mineable resource. BMR plans initially to spend up to US$200 000 over the next 18 months.

Wardell Armstrong International was instructed by BMR earlier this year to prepare a technical report for the company into the geological potential of Star Zinc and review the historic and in-house metallurgical test work results.

The Star Zinc licence comprises 83 km^2 and is situated approximately 15 km NNW of Lusaka on the Great North Road and 90 km from Kabwe. The deposit was mined briefly in the 1950s by open-pit methods with the ore treated at the Kabwe mine. The deposit was drilled by Chartered Exploration (the geological exploration arm of Anglo American) in the 1960s. Later, AVMIN Development (Zambia) Ltd acquired the licence and undertook a limited amount of exploration.

Based on Chartered Exploration's 1960s drilling programme, in January 2015 CSA Global reinterpreted the results and

value to the project and so secure potential for return on investment.

The Maibele North prospect is located 50 km north of the Selebi-Phikwe nickel and copper mine and smelter owned by BCL. Exploration in 2010 confirmed nickel, copper and platinum group metals mineralisation and additional drilling in 2014 yielded further finds. Advisian was appointed to undertake a PFS to evaluate results from the previous study that recommended an underground mine based on traditional economic modelling.

Using the StepWise approach, twelve underground mining configurations were evaluated against open-pit mining configurations. These initial StepWise results helped focus drilling activities into areas of higher mining interest and, when the revised geological model was completed, only the more viable options were re-evaluated. Advisian concluded that none of the underground options identified were financially robust enough to justify underground mining at Maibele; however, an open pit was proposed as having potential advantages.

Following the successful utilisation of the StepWise methodology for Maibele North, Advisian was given the opportunity to undertake a BFS for an open-pit mine at Selkirk commencing in February 2016, which is now being undertaken under WorleyParsons branding, allowing a seamless progression to execution.

Underground mining operations began at the Selkirk nickel mine in 1989 but the mine was put on care and maintenance in 2002 due to the depletion of the massive sulphide copper and nickel ores accessible for underground mining.

"The StepWise approach was instrumental in Advisian having been awarded the second project as the client realised the extensive benefits of the early ascertainment of financial viability," says Munro.

The Selkirk BFS is using the StepWise methodology to evaluate previous recommendations that were made in the PFS. The focus of this project is to enhance the ore producing potential of the mine as well as to explore the most financially beneficial transportation options when moving the ore from the mine to the Phoenix concentrator.

WorleyParsons is also currently in the process of developing a high level execution schedule aimed at achieving BCL's objective of first ore by year end 2016. ■

declared a non-JORC hard rock resource of 275 166 tonnes at 20,2 % Zn with a cut-off grade of 14 % Zn.

Recent investigation work by GeoQuest (Zambia) has identified considerable potential tonnages of karst fill/saprolitic material in the vicinity of the open pit, reporting grades up to 20 % Zn, the extent of which has never been fully explored and which remain undrilled and untested.

Bushbuck engaged Skorpion Mineral Processing to undertake a metallurgical programme of test work on grab samples from trenches and stockpiled ore of the Star Zinc hard rock ore and karst fill material. This included gravity and magnetic separation, froth flotation and acid/alkaline leaching. The acid leach Zn recoveries were reported to be in excess of 90 %.

BMR has also carried out preliminary scoping metallurgical tests using the services of Alfred H Knight and ZCCM, Kitwe, Zambia on a 30 kg grab sample of the karst fill material and achieved a similar Zn recovery. Both the Skorpion and BMR tests required approximately 400 kg acid per tonne of ore treated to achieve these recoveries. Future test work will focus on optimising these results using larger representative samples. ■

Shallow RC drilling at Giro delivers positive results

A drill site at Burey Gold's Giro project in the north-east of the DRC (photo: Burey).

Australian explorer Burey Gold has reported the remaining results from the 97-hole (4 413 m in total) reconnaissance shallow RC drilling at the Douze Match prospect of its Giro gold project in the north-east of the DRC and says it has begun maiden resource drilling.

Significant intercepts from the remaining 56 holes include 18 m at 3,0 g/t Au from 24 m, including 3 m at 9,5 g/t Au from 27 m (Line 4b); 21 m at 2,0 g/t Au from 9 m, including 9 m at 3,7 g/t Au from 15 m (Line4b); and 3 m at 16,9 g/t Au (laterite) from surface and 6 m at 2,83 g/t Au from 15 m. Many holes ended in mineralisation.

Drill holes were generally less than 45 m depth. The drilling was planned to cover 1 100 m of strike of the initial 4 000 m x 2 500 m gold-in-soil anomaly which lies immediately south and east of a dominant granite intrusion in the NW portion of PE 5049 on the Giro project in the Moto greenstone belt. Latest soil sampling results have extended the soil anomaly a further 2 000 m to the south-west and include the historic Belgian 'Siona' workings.

"We are very pleased with the outcome of this initial phase of geotechnical drilling in an area where we had little knowledge of the underlying mineralisation associated with the broad 4 km soil anomaly," comments Burey's Chairman, Klaus Eckhof. "Little was known of the area prior to completion of the soil sampling programme with no information available of Belgian activities in the area where it appears most of their focus was on alluvial mining. The shallow RC drilling has clearly identified a number of in-situ zones of gold mineralisation worthy of follow up with deeper RC and diamond drilling.

"We are also excited at the prospect of seeing how many new areas of mineralisation will be identified from future scout RC drilling as well as understanding the true width, grade and continuity of mineralisation identified to date from the conventional RC and diamond drilling programme.

"In addition to drilling at Douze Match, a second RC rig has been commissioned to commence resource drilling at the Giro prospect. We are extremely excited about understanding the full potential of Giro which to date has only been drilled on lines spaced 200 m to 300 m apart but has delivered significant results over considerable widths of more than 350 m down to depths exceeding 250 m."

The Giro project comprises two exploitation permits covering a surface area of 610 km^2 and lies within the Kilo-Moto belt, a significant under-explored greenstone belt which hosts Randgold Resources' 17-million ounce Kibali group of deposits, lying within 30 km of Giro. ■

Asanko progresses satellite targets towards production

Asanko Gold, listed on the TSX and NYSE MKT, reports it is currently evaluating three near surface exploration targets – Nkran Extension, Adubiaso Extension and Akwasiso – located within short trucking distance of the existing processing plant at its Asanko Gold Mine in Ghana.

"The three current exploration targets offer immediate, low-cost, incremental ounces that will keep our 'hungry' mill full for the next two years while we develop our Phase 2A expansion project," says Peter Breese, Asanko Gold's President and CEO. "These near-surface deposits are now being incorporated into our Life of Mine plan, with mining targeted to commence in early 2017.

"Akwasiso is an exciting new target which is in close proximity to the Nkran Extension and is an important addition to our satellite deposit project pipeline. We are targeting an initial mineral resource estimate during Q4 2016."

The Nkran Extension is located on the Nkran shear structure, approximately 1,5 km from the Nkran pit, and runs for 900 m north-south adjacent to the existing Tailings Storage Facility (TSF). The zone of interest was originally indicated from sterilisation drilling for the TSF in 2013.

The Adubiaso pit is a previously mined satellite pit at the Asanko Gold Mine which is estimated to contain 1,8 Mt of proven and probable mineral reserves at 2,07 g/t gold. In 2015, mineralisation in two zones over a 300 m strike length extending to the north-east of the existing pit was identified based on an analysis of historical drill hole data.

The Akwasiso deposit is located on the Nkran shear corridor and lies approximately 2 km north of the current Nkran pit, immediately north of Nkran Extension and approximately 5 km south of the Dynamite Hill deposit.

The Akwasiso target area is particularly prospective as it was previously drilled by the past owner of the mineral concessions and has a known non-compliant mineral resource estimate. Asanko is completing a 5 000 m diamond drilling programme primarily designed to validate the geology and grade continuity of mineralised zones defined by the previous operator's campaign in 2000 and 2001. ■

Ivanhoe reports "unsolicited interest" in the company

TSX-listed Ivanhoe Mines announced in late August that its board of directors has authorised the company to seek strategic advice at the project and corporate levels to help address unsolicited interest that the company and its projects have received in recent months.

Executive Chairman Robert Friedland said, "The mining industry has taken notice of our company. Our remarkable Kakula Discovery on the Central African Copperbelt certainly is helping to generate attention. We have received a number of unsolicited inquiries from significant mining industry participants in Asia, Europe, Africa and elsewhere. In response, our board has taken the prudent decision to seek strategic advice."

Friedland said it was expected that an investment bank would be retained, its mandate being to examine and advise the board on all strategic options and alternatives available to the company.

The company also has commenced investor and banking analyst tours of its projects, including the Kakula Discovery. Ivanhoe Mines' CEO, Lars-Eric Johansson, said it was important for analysts and investors to gain a first-hand understanding of the progress and potential of Ivanhoe's project offering and to see the scale of the Kakula Discovery. "Following this, we can obtain strategic advice and make informed decisions that benefit our shareholders and the other governmental, community and local stakeholders in our projects." ■

Exploration team member examining high-grade copper mineralisation in Kakula drill core (photo: Ivanhoe).

Kentz awarded SMP contract for Balama project

Syrah Resources, listed on the ASX, reports that its Balama graphite project in Mozambique remains on schedule and budget with an overall completion of 42,6 % having been attained as at 31 August 2016.

Although over 1 100 personnel are working on site, the project's strong safety record continues with over 1 million man-hours worked without a lost time injury.

The key Structural, Mechanical and Piping (SMP) construction contract has been awarded to Kentz Engineers & Contractors Limitada (Kentz), a member of the SNC-Lavalin Group. Kentz has successfully operated in Mozambique for 18 years and – says Syrah – has a proven track record of delivering major mining and metals construction projects in Mozambique.

Flotation circuit plant area at Balama with concrete works underway (photo: Syrah).

"We are delighted to have Kentz, with their strong operational history in Mozambique, join our Balama project construction team," says Syrah's MD, Tolga Kumova. "We look forward to partnering with them to realise our vision of being the largest supplier of high quality graphite globally."

Over 5 700 m^3 of concrete has been poured allowing for the SMP contractor to commence structural steel construction.

Syrah reports that delivery of major equipment and construction materials to site is progressing well with no major delays and that the Tailings Storage Facility (TSF) is under construction with over 700 000 m^2 of area cleared ready for excavation to commence during September 2016.

The Balama project is situated in Cabo Delgado Province in northern Mozambique, some 200 km west of the port town of Pemba. The project has a JORC 2012-compliant ore reserve of 81,4 Mt at 16,2 % total graphitic carbon (TGC) for 13,1 Mt of contained graphite. This is reportedly the largest graphite ore reserve in the world. According to the feasibility study on Balama, the project – which will employ simple open-pit mining – will have a production of over 350 kt/a. Commercial production is scheduled to commence in Q2 2017.

Metallon launches Graduate Training Scheme

Metallon Corporation, which operates four gold mines in Zimbabwe, launched its two-year Graduate Training Scheme in June this year. Fifteen university graduates, aged 18 to 28, were selected from over 1 000 applicants. The selection process comprised academic merits and grades, interview procedures and psychometric testing.

Graduate trainees with Metallon Chief Executive Officer Ken Mekani and Group HR Manager Hopeson Chiswa (photo: Metallon).

As part of the scheme, the graduates will have a six weeks rotation period visiting all the mining operations to gather a full understanding of the business, before being placed in their target discipline. Disciplines include Mining Engineering, Mechanical Engineering, Electrical Engineering, Geology, Human Resources, SHEQ ('Safety, Health, Environment and Quality') and IT.

Comments Ken Mekani, CEO of Metallon Corporation: "My career commenced when I joined the company as a Graduate Trainee and, having risen through the ranks over the years, I can demonstrate that this scheme can have a very significant and rewarding impact. We are training the brightest and most dedicated individuals, not only to be good managers of our business, but also to provide the skills and knowledge required for future managers of our country's rich resources. Rebuilding the country's skills base is key to the future growth of the company, and to driving the Zimbabwean economy."

BlueRock acquires option to purchase diamond plant

BlueRock Diamonds has acquired an option from Diacar to purchase Diacar's processing plant located at BlueRock's Kareevlei mine in the Northern Cape.

Diacar has been operating the Diacar plant at Kareevlei since November 2015 under a sub-contracting agreement for which it was paid 40 % of the diamond revenues generated from the plant. In July this year, BlueRock announced the termination of the agreements with Diacar for loading and hauling services and for diamond processing.

BlueRock has now reached an agreement with Diacar whereby Diacar has granted BlueRock an option to buy its processing plant for R1, 6 million at any time up to 31 December 2016.

The technical capacity of the Diacar plant is similar to BlueRock's existing plant and the option provides extra capacity during the option period and will enable BlueRock, at minimal cost, to further assess its options for providing a permanent increase in capacity.

The Kareevlei property is located approximately 100 km north-west of Kimberley and hosts the Kareevlei kimberlites – five kimberlite pipes ranging in size from less than a 0,5 ha to less than 5,6 ha. They were discovered in 1991 by De Beers. ■

BlueRock's Kareevlei mine in the Northern Cape (photo: BlueRock).

Civils contractor appointed for Yanfolila gold project

AIM-listed Hummingbird Resources has appointed IMAGRI-SARL as civil works contractor for its 2,2 Moz Yanfolila gold project in Mali.

IMAGRI will be responsible for the completion of plant civil works, including those for the ROM tip and primary crusher, the secondary crusher and screen and the milling and Carbon in Leach (CIL) area. Work is targeted to commence at the start of October 2016

"Development at Yanfolila continues on schedule and budget, as we target initial production of 130 000 oz gold from the first full year of production. The appointment of the civil contractor and mobilisation of equipment is a pivotal undertaking in the project's evolution into a producing mine. IMAGRI's local experience, which includes working for Randgold in Mali, will be invaluable as we advance Yanfolila," comments Dan Betts, CEO of Hummingbird Resources. ■

Universal Coal starts mining at New Clydesdale

ASX-listed Universal Coal has started production at its New Clydesdale Colliery (NCC). This represents the company's second coal operation (the first is Kangala) and, says Universal, repositions it as a multi-mine coal producer in the domestic and export thermal coal market.

First production of Run-of-Mine (ROM) coal occurred on 8 September from the Diepsloot underground area at NCC, with the first continuous miner coming on stream.

Underground at New Clydesdale Colliery. NCC – which was put on care and maintenance in late 2013 – was acquired by Universal from Exxaro in 2014 (photo: Universal Coal).

Anticipated production from the NCC phase 1 underground operation is 900 000 t/a ROM of export quality thermal coal destined for export markets. Ramp up to full capacity is expected before the end of December 2016.

Phase 2 development at NCC continues to advance in line with long-term offtake discussions. This phase will be an open-pit development at the adjacent Roodekop project delivering up to a further 2 Mt/a ROM.

Located in the Witbank basin, South Africa's premier coal region, NCC hosts a JORC-2012 mineral resource of 130,4 Mt, sufficient for over 20 years of operations at the envisaged production rates.

Universal has appointed experienced coal mining contractor STA Coal Mining Company to undertake underground mining while Ingwenya Mineral Processing is responsible for the refurbishment of the coal processing facilities at NCC and will operate the plant. ■

Huge gold resource defined by White Rivers Exploration

White Rivers Exploration (WRE) says it has defined a significant JORC 2012-compliant gold resource of 11,5 Moz at 8,89 g/t at its joint venture project in the Free State, making it one of the world's largest unmined, high grade gold resources.

The project is 65 % owned by WRE, the largest tenement holder in the Witwatersrand Basin, and 35 % by Harmony Gold, South Africa's third largest gold miner.

Based on the defined resource, an independent Scoping Study has been completed to determine mining rates from different shafts, annual gold production and the overall mine plan. According to WRE, the results of the study show very impressive economic returns with gold recovery exceeding 6,8 Moz over the 30+ year mine life from the measured, indicated and inferred resources.

The JV project covers a 9,56 km^2 area directly abutting Harmony Gold's operating Target mine. The gold resource is contained within the JV area and a 1 km surrounding buffer zone which attracts a Net Smelter Royalty payable to Harmony Gold.

Neil Warburton, Executive Chairman of WRE, commented: "This defined JORC resource demonstrates that WRE and Harmony Gold are sitting on one of the world's largest unmined high grade gold resources, with huge upside potential.

"By utilising Harmony Gold's neighbouring Target mine infrastructure, including existing shafts, ventilation systems and tailings dams, gold production from the project can be fast-tracked, and operating and capital expenditure required by the JV partners reduced significantly. The initial resources to be mined in Phase 1 are already accessible from previous underground development and lie between 1 100 m to 1 600 m below surface.

"We are proceeding with a full Pre-Feasibility Study and intend to seek in 2017 a dual listing on the London and Johannesburg stock exchanges to facilitate the commercialisation of this very substantial resource."

Neil Warburton, Executive Chairman of WRE.

WRE is a private South Africa-focused mineral exploration and development company. It was founded in 2007 in Johannesburg by Australian explorer and shareholder, Mark Creasy.

Harmony itself has taken a more cautious approach to the potential of the project. Responding to WRE's announcement, Peter Steenkamp, Harmony's CEO, said it was "still very early days for the Harmony/White Rivers joint venture project. We will keep our shareholders informed about reliable numbers once all studies have been completed." ■

Marenica and Deep Yellow conclude technology deal

ASX-listed Marenica Energy has entered into a definitive and binding Technology Licence Agreement (TLA) with Deep Yellow, also listed on the ASX. Under the TLA, Marenica will provide its U-pgrade™ technology and expertise to Deep Yellow for use towards development of the Tumas uranium project in Namibia in return for a licence fee for the entire life of the project.

Both parties sought to formalise the TLA after the successful test work programme recently completed by Marenica on the Tumas ore. Marenica's U-pgrade™ technology can potentially deliver such significant project and operating cost savings as to fundamentally impact the competitiveness of projects with suitable ores.

The TLA represents a landmark agreement for Marenica. Deep Yellow will have the ability to apply Marenica's technology in return for a long term licence fee which equates to around 25 % of the net present value (NPV) of the Tumas project under a range of possible development scenarios. So long as the positive test results achieved to date continue, both parties are confident that the agreement has the potential to lower the uranium price hurdle for the Tumas project.

"We have long identified Deep Yellow's Tumas project as a good fit for our first commercialisation agreement, based on the project's high suitability for our technology, the project's relatively advanced stage of development and the excellent cultural fit between the two companies," says Murray Hill, Marenica's MD. "Importantly, the project is located in Namibia, a jurisdiction that is highly supportive of the uranium mining industry and with operating uranium mines in close proximity that could take the U-pgrade™ concentrate." ■

Massive sulphides intersected in first hole at Kantienpan

Orion Gold, listed on the ASX, reports that massive sulphides have been intersected in the company's first drill hole at the Kantienpan deposit in the Northern Cape.

Significantly, says the company, the abundance and species of sulphides intersected are similar to those seen in historical drilling at Kantienpan, including KN005 which returned 8,84 m at 6,32 % Zn +1,02 % Cu. KN005 is 50 m south of the first drill hole, OKNR014.

Orion's drilling at Kantienpan aims to confirm historical drilling and test potential strike extensions to mineralisation. A fence of holes will be drilled to the north and south of the historical drilling to test these areas. In addition, holes will be drilled in close proximity to selected holes to confirm both historical results and interpreted orientations to the mineralised zone.

Data from drilling will be used to assist in the interpretation of a high powered ground electromagnetic (EM) survey which is anticipated to commence in coming weeks to enable targeting of future drilling.

The Kantienpan deposit was delineated by a previous fixed loop EM survey and has very poor surface exposure. The new high powered survey will provide significantly greater resolution and depth penetration, enabling the morphology of the conductor to be modelled prior to deeper drilling. ■

Scania's thrust into mining

Celebrating its 125th anniversary this year, Scania – the global manufacturer of trucks, buses and engines founded in Sweden in 1891 – took the decision several years ago to target the world's major mining markets. In response to this new strategy, Scania South Africa, which serves the key Southern African mining region, has been working hard to ensure that it has the product line-up, the people and the infrastructure in place to provide an all-encompassing service to the mining industry. ***Modern Mining*** *recently spoke to Becky Smith, Scania South Africa's General Manager: Mining, to learn more about the company's mining strategy and offering.*

Providing an update on Scania's penetration into mining globally, Smith says it has been highly successful. "Scania's move into mining has taken place during a period which has seen the resources sector around the world being impacted by falling commodity prices," she says. "Despite this, it has managed to establish a significant mining 'footprint' in a number of key markets. In India, for example, Scania's trucks have made massive inroads into coal mining while solid gains have also been recorded in Sweden, Russia, Brazil and Australia, which are all countries with large mining sectors."

She notes that progress has been slightly slower in South Africa. "Although we have about 400 mining spec vehicles out in the field, the implementation of our mining strategy only moved into top gear just over a year ago," she says. "Since then, we've made rapid progress and we're now poised to reap the benefits. Not only do we have a product range that is exceptionally strong – our marketing slogan is that we have a Scania for every stage of mining – but we've also ensured that we have the parts and service backup, the technicians and the training facilities to support the thrust into mining."

She adds that while the mining industry is currently in recession, Scania's focus is on the long-term. "As befits a group with a 125-year history, Scania is not interested – either globally or here in South Africa – in a short-term engagement with the mining industry. We want to be partnering with mining customers for decades to come. We're not deterred by the present downturn as we fully understand that

Scania South Africa highlighted its mining range at the recent Electra Mining 2016 show.

gathers pace

mining is a cyclical industry. Having said this, our impression is that a recovery in mining activity is on the way and that we could see real growth in 2017."

Smith, a Canadian who started her career with Lafarge Canada, has been in South Africa for 12 years and with Scania for just on one year. Based at Scania South Africa's headquarters in Aeroton, Johannesburg, she is assisted by two key account managers, Reuben Govender and Charnie-Lee Kruger, who focus on clients in the mining and quarrying industries, as well as a mining service manager, Dean Smith.

Elaborating on the Scania mining range, Smith says the products are designed for every stage of the mining cycle from exploration through to post-processing and from pit to port. They include heavy-duty tipper trucks – based on the heavy-duty EHZ mining chassis – for in-pit and outbound operations, stemming units, fuel trucks, lube trucks, water bowsers and service vehicles, as well as a 'Staff Carrier' available in 36-seat and 54-seat configurations which has a rough-terrain capability allowing it to go to every part of a mine.

Smith is clear that Scania is not competing with ultra-heavy mining trucks when it comes to on-mine applications. "Our popular G410 8x4 mining truck has a payload of up to 34 tons, so obviously we're not going to be competing at the heavier end of the market where mining trucks can have payloads of 100 plus tons," she says. "Where we can compete is in mining operations which typically use either ADTs or rigids of up to 70-ton capacity or influence the early stages of mine design for a more cost-effective leaner haulage solution."

Detailing the advantages of the Scania tipper against ADTs, Smith says the Scania product has a lower purchase price, better fuel economy and lower tyre, parts and maintenance costs. In addition, it has a public roads capability and can travel at faster speeds unloaded. "All this adds up to a lower cost per ton when Scania trucks are used – even in cases where two of our trucks are having to replace one ADT."

Top: *A Scania tipper at work at an open-pit mine.*

Above: *A Scania explosives truck on show at Electra Mining.*

According to Smith, the Scania mining range will be strengthened next year with the launch of a new mining tipper, with an increased payload and even stronger components. She also mentions that Scania in Sweden is engaged in R&D on a driverless (or autonomous, as it is sometimes known) mining truck, with prototypes already out in the field.

Another new technology is Scania Site Optimisation – a comprehensive service for analysing and streamlining all critical points on a mine's haulage system. Although the service is only being introduced globally at this month's MINExpo in Las Vegas, Scania South Africa has already been trialling it via a pilot project with a local customer.

The Site Optimisation service Scania is able to offer encompasses a range of mining advisory services addressing issues such as logistics, transportation planning and monitoring of ongoing operations.

Uptime and productivity, of course, are of

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overriding importance on mines and Smith believes that the Scania service and backup offering is exceptional. "We can provide our customers with a full range of service contracts including full R&M (Repair and Maintenance) contracts providing the convenience of paying a fixed predictable amount that can be calculated per kilometre or per hour. Depending on the nature of the contract, we might have personnel on-site permanently but, even in cases where we do not, we can normally get mechanics and technicians to site within an hour or two as Scania has an extensive network of branches and depots around South Africa."

She adds that Scania's service personnel have in the past had a 'long haul' mindset, reflecting the nature of Scania's core offering – long-haul commercial trucks. "We've been working hard with our service managers around the country to ensure that our service facilities can now also support the needs of mines, where the requirements are slightly different."

Detailing Scania's present penetration into the mining – and quarrying – sector, Smith says Scania's products are working in a range of applications. "To give just a few examples, we have tipper trucks working in many quarries with a major client being PPC. We also have trucks working in the platinum belt in South Africa's Western Bushveld carrying chrome and PGM ores," she says. "In the explosives field, Sasol Nitro uses our explosives units – and has done for many years – while the Kolomela iron ore mine in the Northern Cape has two of our stemming units. Across border, we have our tippers working at the Navachab gold mine in Namibia and four Staff Carriers at diamond mines in Angola."

Looking ahead, Smith says that the Scania South Africa Mining Division is focusing on developing customer relationships at national level and working closely with its regions to support customers at local level. It is also engaging with a number of global players who are already using Scania vehicles in other countries such as Australia or Brazil.

"The response we've been getting is excellent," she states. "Scania's credentials and its 125-year history mean that potential customers already know that with Scania products they can be assured of quality, safety and superb engineering. What we are still building market awareness around is Scania's emergence as a supplier to the mining industry and its ability to provide real solutions to the industry's haulage needs.

"This is where my team and I come in. We engage with these companies, looking at the challenges they have and how we can help meet them. It's very much an open conversation with the emphasis being on providing holistic solutions. Fortunately, we can give hard facts and figures quantifying the results we can achieve, drawing on Scania's worldwide experience in mining and its involvement with many of the world's top mining groups such as Rio Tinto, Vale, BHP Billiton, Glencore and Anglo American. We're making excellent progress and are extremely optimistic that we will soon be notching up some important sales here in Southern Africa." ■

The Scania Staff Carrier is specially designed for use on mines.

Innovation characterises Scania's long history

The Scania Group can trace its origins back to 1891, when a wagon-building company was established under the name Vabis in the Swedish town of Södertälje. Vabis merged 20 years later with the privately-owned, Malmö-based, machine manufacturing company Scania to create Scania-Vabis. The combined company was rebranded in the 1960s as simply Scania.

Still headquartered in Södertälje, Scania is one of Sweden's pre-eminent industrial concerns and also a true multinational, with around 45 000 employees in approximately 100 countries. It is one of the world's leading manufacturers of heavy trucks and buses and is also known for its prowess in the design and manufacture of industrial and marine engines.

The Group has been known for innovation throughout its history. Its R&D operations are mainly located in Södertälje with some 3 700 employees. The aim is to develop high-quality products and solutions for specific customer demand with short lead times from idea to launch.

In 1980 Scania introduced the 2-series, the first modular commercial vehicle range, and followed up in 1988 with the 3-series, which the following year won the International Truck of the Year award. The 4-series, launched in 1995, received the same award in 1996.

In 2000, Scania's millionth vehicle rolled off the assembly line while in 2015 it delivered its 150 000th truck with activated connectivity.

Scania South Africa was established in 1995 as a wholly owned subsidiary of Scania CV AB in Sweden. It initially assembled vehicles in Elandsfontein but – following increased demand – opened a new purpose-built plant in 2003 alongside the head office complex in Aeroton. ■

Challenging coal bunker

Murray & Roberts Cementation has successfully completed the construction of a 1 500-ton capacity underground surge bunker and associated infrastructure at Sasol Mining's new Impumelelo coal mine. Describing the project, Mike Wells, Technical Director: Mine Development of Murray & Roberts Cementation, says it was a very challenging assignment with the box front (essentially the steel and concrete discharge structure below the bunker) being the biggest he has ever worked on in a 25-year career of executing capital projects in the mining field. ***Modern Mining's*** *Arthur Tassell recently visited the site and was able to view the bunker in operation.*

Mike Wells (left) of Murray & Roberts Cementation with Willem van den Heever, Senior Project Manager, Sasol Mining.

Impumelelo forms part of a R15,3 billion mine replacement programme being undertaken by Sasol Mining designed to replace 60 % of its operations in the Secunda area by 2020. Costing R4,7 billion and now in its ramp-up phase, the new mine replaces the Brandspruit operation (the oldest of Sasol Mining's Secunda-based operations) and has the capacity to produce 8,5 Mt/a of ROM coal (although this can be upgraded to 10,5 Mt/a). The mine's entire output – it will mine both the 4 and 2 seams of the Highveld coalfield – is earmarked for the Sasol Synfuels complex in Secunda with the coal being delivered to the complex via a single-flight 27 km long overland conveyor with a planned operating capacity of 2 000 tons per hour (tph). The conveyor is reputedly the longest of its kind in the Southern Hemisphere.

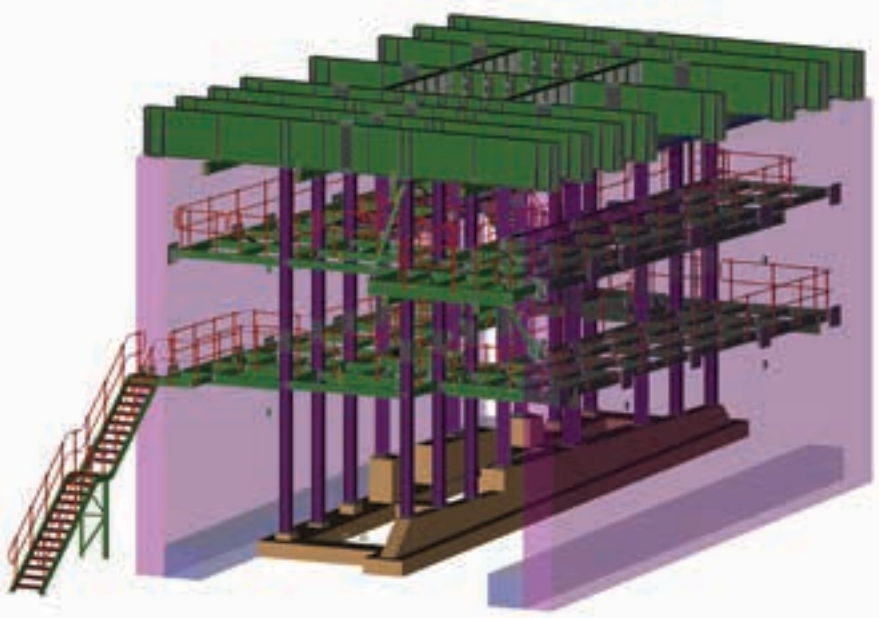
As Wells explains, Murray & Roberts

commissions on schedule

Cementation's involvement at Impumelelo – which is an entirely 'greenfield' project – has extended well beyond the underground bunker. "We were appointed in 2011 as the contractor for the sinking of the two vertical shafts – the main and ventilation shafts – the mine requires and also for decline development," he says. "The first resources arrived on site in May 2011, although the formal sod turning and contract signing only took place several months later in August. Both vertical shafts have been sunk to a depth of 200 m with the main shaft being 11,7 m in diameter and the vent shaft 6,5 m. The decline is 1 000 m long, dips at 17 deg and has a width of 6,5 m and a height of 3,5 m.

"We commissioned the main shaft in December 2014 and in January 2015 the first Continuous Miner (CM) – eventually there will be 10 CMs – started cutting coal. In August 2015 we commissioned the decline conveyor to 4 Seam and in the following month the ventilation shaft fans were commissioned. With the coal bunker having become operational on 9 June 2016, we are now all but complete at Impumelelo with the final value of Murray & Robert's contract – including the bunker – being R1,06 billion."

Turning to the coal bunker, Wells says it was constructed over a period of a year (starting in May 2015), with Murray & Roberts Cementation deploying a team of just under 100 to undertake the work. Excavation extended over roughly the first six months with construction – civils and structural steelwork – occupying the remaining six months. "It was a massive undertaking and we were under huge pressure to meet milestones but fortunately we were able to meet all the critical interface dates," he comments. "I attribute the success we had to the intensive planning we put into every phase of the operation and also the cooperation and support we

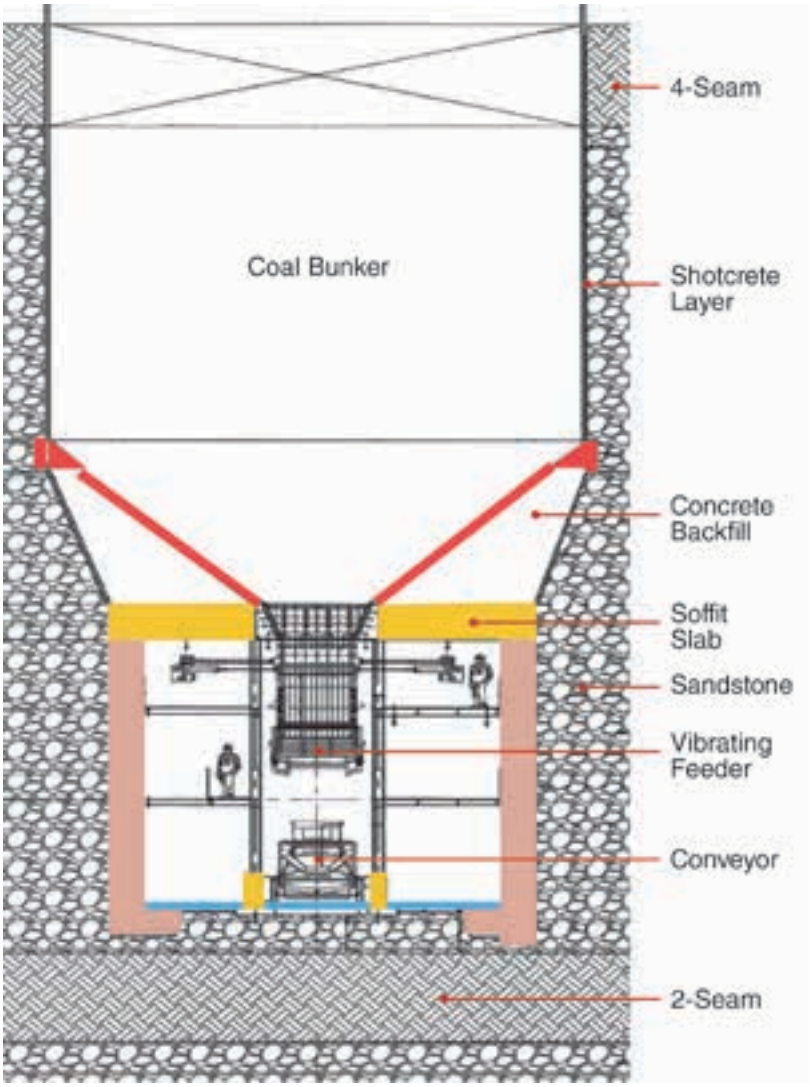


Above: *Isometric view of the box front structure.*

Left: *Coal discharging into the 1 500-ton capacity bunker. Note the steel walkway – this alone weighed 3,5 tons.*

Centre: *The box front showing the feed level (below) and chute level.*

Below: *Chute level of the box front. Each chute weighs about 4 tons fully assembled.*



Above: *Simplified cross section through the bunker and box front.*

had at every step of the way from our client, Sasol Mining."

The bunker feeds ore to the decline conveyor which has a capacity of 2 900 tph and a belt speed of 4,6 m/s. With this capacity, the conveyor system can empty the bunker – assuming no inflows – within 27 minutes.

The decline conveyor seen from the box front. It has a belt width of 4,6 m/s and is rated at 2 900 tph. The extension of the conveyor under the box front was undertaken over four days in May this year.

Describing the bunker, Wells says it has a finished diameter of 14,7 m and extends 24 m down from the 4 Seam horizon (200 m below surface) to the soffit floor of the box front chamber. The bunker has a cylindrical section of 16,5 m and – below that – a conical section of 5,5 m. The box front chamber extends a further 10 m to the footwall of the decline on the 2 Seam horizon.

According to Wells, the first task was to create a collar ring beam at 4 Seam level to facilitate excavation of the bunker. "To do an excavation of this type, you need a decent infrastructure," he says. "So we excavated a top cut to a depth of 1,8 m using an LHD and an excavator. The ring beam itself has dimensions of 1 m x 1 m and – including approach slabs – required 200 m^3 of concrete to be poured. To excavate the barrel of the bunker, we opted to use drop raising to sink a 4 m diameter centre core which was then slyped out to the full diameter of 14,7 m. We supported the sidewalls as we advanced using mesh, shotcrete and rock anchors. In all, the bunker excavation amounted to 5 800 cubes.

"To establish the profile of the conical section – which we only did earlier this year once the box front was completed – we used sandbags to form a back shutter and then backfilled behind these bags with mass concrete. In all, we used 6 800 sandbags during this phase of construction."

He adds that the volume of shotcreting was huge with 450 cubes of mass fill shotcrete being required for backfilling with an additional 126 cubes of 70 MPa andesite shotcrete, 300 mm thick, being placed on two layers of mesh as the final step in the operation. "This andesite shotcrete was very unforgiving in terms of pumpability and flowability," notes Wells.

While the excavation of the bunker was by no means an easy task, the construction of the box front – which houses the chutes and vibrating feeders controlling the discharge of coal to the decline conveyor system – proved equally demanding. "Put simply, this is primarily a steel structure but with massive amounts of concreting required for the floor slab, the 16,5 m long, 10 m high and 1 m thick east and west side walls and the 1,5 m thick soffit or roof," he notes. "Altogether we poured over 1 800 m^3 of concrete. Given the dimensions of the side walls, we elected to make use of wide scaffolding. These walls, incidentally, each required 30 tons of reinforcing."

The main elements of the steel structure (the

steel was fabricated by Louwill Engineering), are the girder beams, with a total mass of 50 tons, and the supporting columns and floor steel, with a total mass of 40 tons (excluding the floor decking and handrails). Says Wells: "The eight main girder beams have dimensions of 11 m in length and 1,5 m in height. They were taken underground in sections which then had to be spliced together, with each splice requiring 92 bolts. In fact, we had one employee totally dedicated to looking after the bolts and ensuring that none went missing! Similarly, the sixteen 10 m long columns supporting the feeder and chute levels also had to be spliced together.

"We planned everything to the last detail, with the steel being laid out on the bank at surface and hard stamped and marked to allow us to get everything to the workplace in the right sequence with the right bolts and splicing plates. Everything was placed on sleds on surface to facilitate handling and taken down in the cage of the main shaft. Once underground, these sleds were towed by an LHD to the workplace."

Certain elements of the structure – for example, the floor grating and the vibrating feeder frame (which is independent of the rest of the structure) – were trial assembled on surface, again to reduce the chances of any unforeseen problems arising during installation.

Highlighting some of the more interesting parts of the overall bunker project, Wells notes that the logistics of concrete supply were challenging. "Concrete pours which on surface would be routine become difficult when undertaken 200 m or more below surface," he explains "We had to transfer the concrete – a pumpable mix supplied by Lafarge – from surface to 4 Seam level via large diameter drilled and cased aggregate holes and then distribute it using a positive displacement concrete pump. Alongside each aggregate hole, we needed a communication hole so that teams on surface and underground could liaise. The key was to avoid blockages in the aggregate holes – unblocking them could be very time consuming – and we were generally very successful in achieving this objective."

Although not within the scope of the original contract, the electrical and instrumentation (E&I) work for the bunker and box front – including the installation of a MCC panel – was undertaken by Murray & Roberts Cementation. "We both procured and installed the E&I system," says Wells. "This is not normally part of our service offering but we were asked to take it on and the work went very well.'

The main shaft headgear at Impumelelo.

Finally, Wells notes that the Impumelelo project was recently named as the best performing project within the Sasol Mining group, receiving the 'Best Overall Performance of the Year' Award for 2015 from Kobus Louw, Sasol Mining's Vice President, Projects & Sigma.

"The award recognises the achievements of the entire team responsible for designing and implementing Impumelelo including Sasol Mining itself, as well as the EPCM contractor – the RSV ENCO Hatch Goba Joint Venture – and the major contractors, notably Murray & Roberts Cementation and – in the case of materials handling – ELB Engineering Services," says Wells. "The bunker, of course, represents only part of the overall project but is nevertheless a critical part of the mine's infrastructure and we're proud of the fact that we've been able to deliver it on time and within schedule – and, perhaps most importantly of all, with an excellent safety record."

Photos by Arthur Tassell

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Despite downturn ELBCON

The decision by leading engineering solutions provider ELB Engineering Services to establish its own in-house construction arm – ELB Construction (ELBCON) – just over five years ago is an initiative that has paid off handsomely. ELBCON has brought new levels of responsiveness, control and competence to the on-site execution of ELB Engineering Services' many projects throughout Africa and – with its reputation now firmly established – is in the process of taking its service offering beyond the boundaries of the ELB Group. ***Modern Mining*** *recently spoke to Trevor Budd (right), ELBCON's Managing Director, who says the company – notwithstanding current conditions in mining – is expecting its order book to grow significantly over the coming year.*

Outlining the rationale behind the creation of ELBCON, Budd says it was established to de-risk the execution model of ELB Engineering Services. "Prior to the formation of ELBCON, ELB Engineering – which primarily works on an EPC basis – relied on contractors to undertake the construction work on its projects," he states. "While this model once worked reasonably well, it started to break down perhaps a decade or so ago, reflecting declining skills levels – particularly a shortage of competent supervisory staff – in the construction industry. ELB was increasingly having to intervene directly on site to ensure that work was completed to the quality standards required and within the budgets and time scales specified.

"ELB Engineering Services' Chief Executive, Dr Stephen Meijers, was concerned by the problems being encountered and was determined to do something about it. I had known

ELBCON has upgraded materials handling facilities at the Matola coal terminal in Mozambique.

sees strong growth ahead

The Impumelelo overland conveyer is one of the longest single-flight conveyors in the world.

Stephen for many years – we had first worked together in the early 1990s – and we discussed the possibility of setting up a construction arm of ELB. This led to the establishment of ELBCON in 2011."

Budd has acted as MD of ELBCON since start-up and is well-qualified for the role. At the beginning of his career he specialised in aviation engineering but – after joining ELB Equipment, part of the then Edward L Bateman group, in the early 1980s – became increasingly involved in the construction and mining sectors. In the 1990s he went into the projects division of Edward L Bateman – Bateman Projects – and this new direction in his career eventually resulted in him having senior managerial roles on two of the key African mining projects of the past decade – the Lumwana copper mine in Zambia and the Ambatovy nickel project in Madagascar (where he managed the construction of what was then the biggest acid plant in the world).

His close knowledge of the mining industry has been of huge benefit to ELBCON, as most of the construction contracts it undertakes on behalf of ELB Engineering Services are in either the mining, FMCG (Fast Moving Consumer Goods) or power generation sectors. The company does not, however, confine itself to these areas and has undertaken work for general industry – with its recent accomplishments having included, for example, the refurbishment of a plastic piping facility and the expansion of a coffee factory.

One of ELBCON's very first contracts was for Eskom's Medupi Power Station near Lephalale in Limpopo Province, where ELB Engineering Services was awarded a major contract in 2011 to provide coal and ash handling facilities. "This gave us a flying start and we're still on site today," says Budd. "We have progressed well with the construction of ELB's materials handling contract and are also involved with the project by assisting Mitsubishi Hitachi Power Systems, the contractor responsible for the steam generators. Overall, our contribution to Medupi has been – we believe – exemplary and, most importantly, we've enjoyed an excellent safety record. We've won several safety awards and have recently completed one million LTI-free hours."

Another flagship ELB Engineering contract that ELBCON has been deeply involved with is the materials handling system for Sasol Mining's new Impumelelo coal mine near Secunda, which – among other things – has involved the construction of one of the longest – at 26,9 km – single-flight conveyors in the world. "We're very proud of the contribution we've made at Impumelelo," notes Budd. "This has been a huge undertaking for us and our workforce on site peaked at around 250 people. As at Medupi, we've enjoyed an outstanding safety record and the project ranks as a huge

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feather in our cap. The materials handling system has been commissioned and we're now all but complete with our contract, with just a handful of our people still on site."

Still in the mining field, ELBCON has just started an assignment at Assmang's Black Rock Mine Operations (BRMO) in the Northern Cape which will see it constructing a Rapid Train Loading Station (RTLS), an associated feed conveyor, as well as two product stackers. Black Rock Mine Operations is operated by Assmang Limited, which is jointly owned by Assore Limited and African Rainbow Minerals Limited.

ELBCON has not confined its activities to South Africa and has operated as far north as Sierra Leone where it refurbished facilities at the port of Pepel (for the Tonkolili iron ore project). Closer to 'home', it has completed projects in Zambia (notably at Ndola Lime on the Copperbelt), the DRC (for a mining client) and Mozambique (where it refurbished and upgraded materials handling facilities at the Matola coal terminal). Its only cross-border contract currently is at a diamond mine in Botswana but Budd says that within a matter of weeks the company will be returning to the DRC to work on a tailings project.

While ELBCON identifies as a construction company, Budd points out that it is not in the business of directly executing civils and building work. "Our core expertise lies in project supervision and site management and we 'buy in' the civils and building work we need," he explains. "Having said this, we are a fully-fledged structural, mechanical and piping contractor and within the group we have sister companies with related skills. B&W Instrumentation and Electrical – very prominent in the E&I field – was purchased by the ELB Group in 2014 while, in the same year, we also launched a new business unit, ELB Conveyor Maintenance, which handles all aspects of conveyor installation, commissioning and maintenance. We work closely with both these companies and their skills complement our own."

Regarding the scope of work that ELBCON can handle, Budd says that contracts can range in value from less than a hundred thousand rand to several hundred million rand on some of the bigger mining and power generation projects. "Typically, the smaller contracts will be assignments such as scheduled plant shutdowns, preventative maintenance projects or repairs following equipment breakdowns," he states. "This type of work – which can last as little as a day or as long as several weeks – is one of our specialties and we provide a full service which includes assistance with the planning and scheduling of outages.

"Within our workforce, we have a core of 40 people," says Budd. "They constitute a young, competitive, hands-on team – there's a huge amount of energy. We believe in allowing our managers to exercise their initiative and this is promoted by the fact that we have a relatively flat reporting structure. There are no barriers to fast decision-making.

"ELBCON now has a substantial fleet of vehicles and heavy equipment which includes trucks, rough-terrain hydraulic cranes, forklifts, generators, welding equipment and LDVs," he says. "We also, incidentally, have a substantial investment in IT systems and make use of state-of-the-art software for estimating and costing projects and for site management."

Finally, and discussing current conditions in the marketplace, Budd acknowledges that the recession in mining has not left ELBCON unscathed. "We're facing the same challenges as everyone else operating in the mining sector and our order book, as a result, is not where we would like it to be. But we've avoided retrenching people and have maintained our team intact. We're also, as a company, very optimistic about the future," he concludes. ■

Above: *Construction at Black Rock Mine Operations in the Northern Cape.*

Left: *Celebrating one million LTI-free hours at Medupi.*

"Our core expertise lies in project supervision and site management and we 'buy in' the civils and building work we need."

Cape Town hosts successful 'World

The recent 35th International Geological Congress (35th IGC) held at the Cape Town International Convention Centre was a huge success, attracting approximately 4 000 delegates from 117 countries. Years of preparation went into the event – considered the 'World Cup of Geosciences' – with one of the key figures involved in the planning being well-known South African geologist Richard Viljoen, who acted as Co-President of the Local Organising Committee (LOC). ***Modern Mining's*** *Arthur Tassell spoke to him on the opening day of the Congress.*

The Cape Town event is only the second to have been hosted by South Africa. "The first International Geological Congress took place in 1878 but it wasn't until 1929 that South Africa was given the opportunity to play host," said Viljoen. "The venue for this was Pretoria and the congress attracted a very good turnout of around 500 delegates, probably reflecting the intense interest at the time in the Bushveld Complex and South Africa's platinum resources, with the Merensky Reef having been discovered just several years before. The only other IGC to have been held on the African continent prior to the current one was hosted by Algeria in 1952."

Pictured here at the 35th IGC are (from left) Professor Phuti Ngoepe (Chairman of the Board – Council for Geoscience), Dr Richard Viljoen (Co-President of the 35th IGC), Minister Mosebenzi Zwane, Dr Jeannette McGill (Co-President of the 35th IGC) and Simon Sikhosana (Acting CEO – Council for Geoscience).

As is the case with the Olympic Games and Soccer Word Cups, countries have to bid for the privilege of hosting the IGC, which is held on a four-yearly cycle. "Our bid was adjudged to be the best at the Oslo IGC in Norway in 2008 and four years later when the Congress was held in Brisbane, Australia, we were handed the 'World Cup of Geosciences'. This is an actual physical cup and is an innovation by the Australians – in future, each host country will pass the cup on to the next country to play host."

Viljoen added that the next IGC would be held in Delhi, India, in March 2020. During the Cape Town event, four countries (Russia, Germany, Korea and Turkey) presented bids to host the 2024 congress (37th IGC). The bid was won by Korea with the Congress to take place in the city of Busan.

Viljoen became involved in the planning of the 35th IGC around seven years ago. "Since then, it's been really hard work – not just for me, of course, but also my Co-President, Jeannette McGill, who is, incidentally, the current President of the Geological Society of South Africa, our Secretary-General, Greg Botha, who is from the Council for Geoscience, and all the very committed members of the Local Organising Committee. The scale of the task we were presented with can be gauged from the fact that we have over 2 900 oral presentations being given at the Congress, as well as 1 700 poster presentations. We also have no less than 44 keynote addresses. To accommodate all the

feature

Cup of Geosciences'

Above: *A delegate in the poster presentation area at the Congress.*

Left: *South Africa's Mineral Resources Minister Mosebenzi Zwane delivers the keynote address at the opening of the 35th IGC in Cape Town.*

presentations, we are having up to 30 sessions running in parallel."

The 35th IGC was also accompanied by an astonishing number of field trips – 16 pre-congress and 10 post-congress trips within South Africa with a further 15 field trips covering the entire African continent up as far north as Mali, Ghana and Tanzania. When *Modern Mining* talked to Viljoen in Cape Town (at which point only the pre-congress tours had been completed), he described the field trip programme as a formidable exercise. "We have over 700 delegates participating in the various trips, all of which have to have expert guides," he said. "Probably the most ambitious was our 'Geological Summits of Africa', which saw participants – including my Co-President – going down South Africa's deepest mine, Mponeng, and then flying on to Tanzania to summit Mt Kilimanjaro."

An extremely popular post-congress flagship field trip was the train journey from Cape Town to Victoria Falls. Expert guides were on hand to introduce participants to the outstanding geological, mining and cultural features at the various stops along the way including the Cape Fold mountains, Kimberley and diamonds, Johannesburg and gold, the Cradle of Humankind, Mapungubwe, Great Zimbabwe, the Matobo Hills, the Chobe game reserve and, finally, the Falls.

Discussing foreign representation at the Congress, Viljoen said the biggest contingent was from China (around 660 delegates) with a strong contingent from India also being present. "We're happy with the number of attendees. The total is lower than at the most recent IGCs held in Brisbane and Oslo, which both had in the vicinity of 6 000 delegates, but is nevertheless very respectable given the current economic climate and particularly the poor state of the resources industry globally."

He pointed out that the organisers had made a conscious effort to draw in delegates from all over Africa. "Bridging the distances between African geoscientists has been a key goal of this IGC," he stated. "Among other things, we've had a GeoHost programme which has been designed and developed by the International Union of Geological Sciences (IUGS) to help young, financially disadvantaged geoscientists to attend the IGC."

Accompanying the conference was an exhibition, which – according to Viljoen – exceeded expectations. "We have more than 200 exhibitors and we've been delighted with the response," he said. "They range from mining groups such as Exxaro – our main sponsor – and Vale through to companies providing geoscience services and equipment, as well as academic and research organisations and geological survey organisations from around the world."

The huge number of presentations at the Congress ranged from the practical through to the highly academic and they were grouped under three main core topics – Geoscience for Society, Fundamental Geoscience and Geoscience in the Economy.

Addressing some of the issues facing minerals explorers in South Africa, Viljoen told *Modern Mining* that a prime concern was the obstacles placed in the way of finding new deposits and developing projects. "Mining

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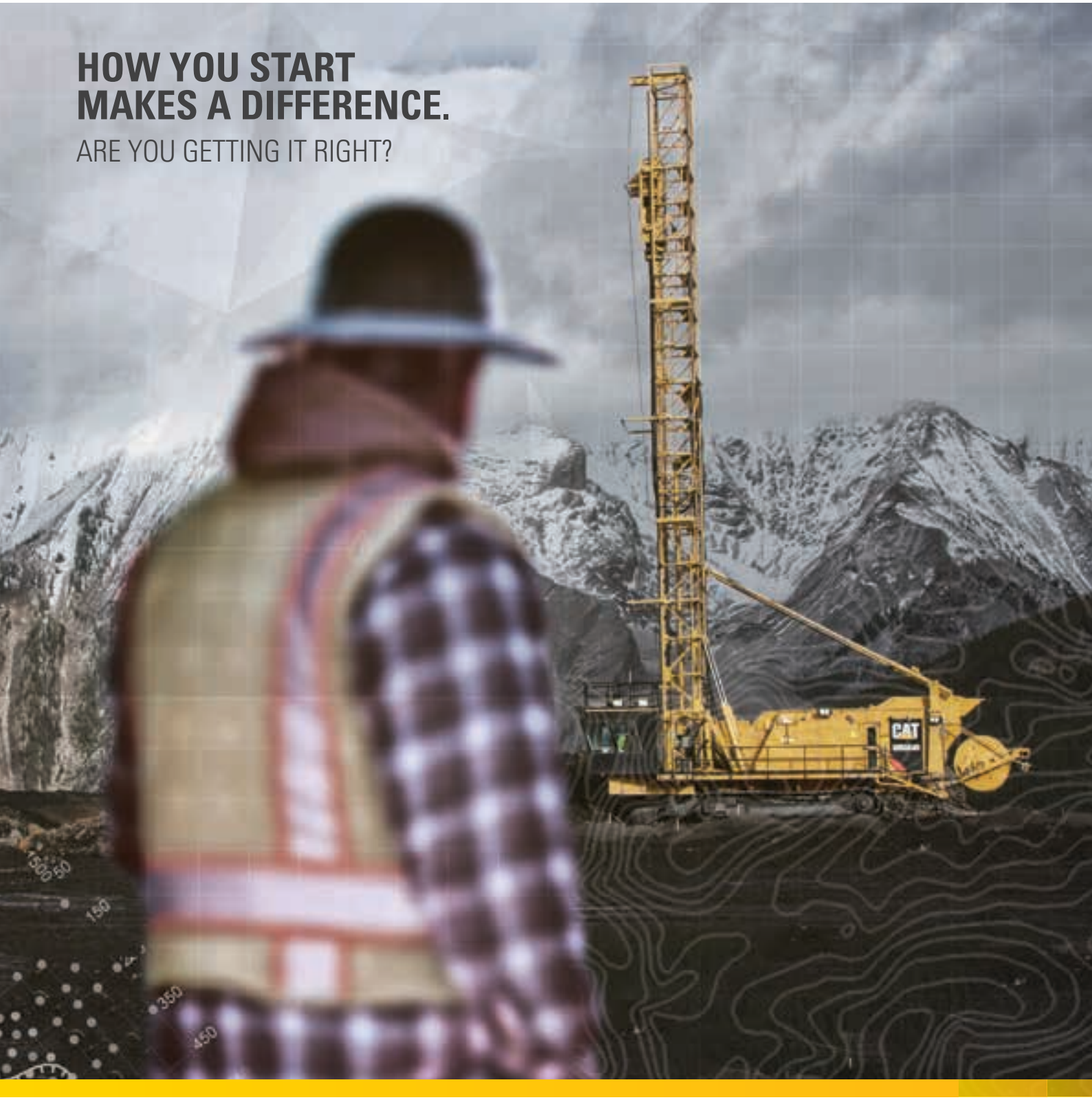

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is slowly dying in South Africa," he said. "In order to get a prospecting right or a mining right, companies have to go through all sorts of hoops and deal with a multitude of government departments. The process is time consuming and expensive and is deterring investment in mining. So one of the functions of the IGC, spearheaded by Exxaro, has been to focus on this issue and to bring together some of the opposing parties such as the environmentalists on the one hand and explorers and miners on the other with a view to finding solutions that encompass the legitimate concerns of both sides."

Viljoen noted that many other African countries were more 'mining friendly' than South Africa. "In Namibia we have uranium mining in the Namib Naukluft Park and in Botswana diamond mining in the Central Kalahari Game Reserve. So what have they got right – if they have got it right – and why are we stifling our mining industry? These are questions we need to address." He added that the IUGS has introduced a new initiative entitled 'Resourcing Future Generations', a topic of direct relevance to the African mining debate.

According to Viljoen, a major initiative to improve the state of geosciences in Africa is the PanAfGeo initiative, which was launched during the Congress. A collaboration between the Organisation of African Geological Surveys (OAGS) and EuroGeoSurveys, PanAfGeo – which comes in the wake of a two-year feasibility study which covered 25 African countries – will focus on policy governance and communication and will put in place mechanisms allowing African countries to collaborate in the field of geosciences.

Another theme of the 35th IGC was the growing importance of geoparks, geoheritage and geotourism and many of the presentations and panel discussions focused on these 'hot topics', reflecting the fact that the IUGS has launched a worldwide geoparks initiative. "Despite the rich geological heritage we have in Africa, we've not made the same progress seen in some parts of the word," said Viljoen. "China, for example, has 40 or so geoparks whereas South Africa does not have a single one – although, of course, some of our geological sites are protected inasmuch as they form part of World Heritage sites. We're very much hoping that this Congress will kick start the geopark concept here in South Africa. At the moment, we're simply not realising the incredible geotourism potential we have."

He added that to coincide with the 35th IGC – and to further promote the geopark concept – over 40 of Africa's top geological sites have been reviewed and have been presented in a specially prepared book entitled *Africa's Top Geological Sites: The Geoheritage of a Continent* published by Struik/Penguin (see also page 3 of this issue).

A second publication timed to coincide with the 35th IGC is *The Great Mineral Fields of Africa*. Sponsored by Pangea Exploration, this is a special issue of the IUGS journal *Episodes* and includes updated reviews of the geology, resource base and origin of various deposits across the continent, together with mineralisation models and comments on possible extensions. "I've been closely involved as project director with the preparation of this volume, which has been guest edited by Michael Wilson, who is an economic geology consultant and extremely well-known in geological circles," said Viljoen. "With more than 400 pages and a host of expert contributors, more than 30 in all, it's been a massive undertaking – and one of which we're very proud. It will undoubtedly become a standard reference."

A special issue of ten stamps and two first-day covers celebrating South Africa's geological highlights was released by the South African Philatelic Bureau for the 35th IGC.

On the subject of the state of exploration in Africa, Viljoen believes the continent is only getting a fraction of global exploration spend. "This is a great pity as Africa probably ranks as one of the most under-explored regions of the world, particularly in terms of the application of modern geoscience techniques. I'm in no doubt that it's an area where there is still huge scope for new finds as we've seen with the amazing Kamoa/Kakula copper discoveries of Ivanhoe near Kolwezi in the DRC. There is also the potential to extend known mineral provinces, an example being the Waterberg project of Platinum Group Metals which has opened up an entire new section of the Northern Limb of the Bushveld Complex. Our hope, of course, is that this 35th IGC will – among other things – lead to an increased interest in African exploration and an increased allocation of exploration dollars to the continent," he concluded.

Photos by PhotoKru

"At the moment, we're simply not realising the incredible geotourism potential we have."

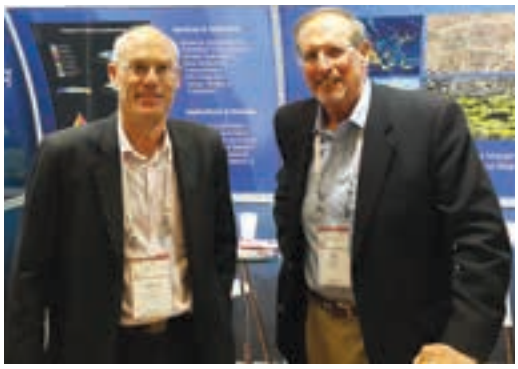
feature

Geoscience technology on display

More than 200 exhibitors had their products and services on display at the 35th IGC in Cape Town. The exhibitors included geological societies and organisations from around the world, as well as a host of companies displaying their latest offerings for the geoscience market. ***Modern Mining's*** *Arthur Tassell took time out from the formal proceedings to take these photos in the exhibition area.*

Geological societies from around the world, including – of course – the Geological Society of South Africa (GSSA), exhibited at the Congress.

James Cleverley of REFLEX demonstrates the company's REFLEX IQ-Logger, a new handheld core logging solution.



Norman Banks (left) of Southern Mapping with Mark Landers of SpecTIR™.

The EuroGeoSurveys stand.

feature

Paul Linton (left) and Mark Landers of TerraCore. Landers also represented SpecTIR™ at the exhibition.

Stuart Bateman (left) of Innov-X Africa with Aaron Baensch of Olympus.

Wynand Smit (right) of PANalytical with colleague Chris Sherry from the US (who is holding an ASD TerraSpec Halo mineral identifier for the exploration geology market).

Denis Blewett (left) of the Geo-Explore Store with Henry Lynch of Coremetic.

feature

Exploration drives the Randgold success story

Based on its track record over the past couple of decades, Randgold Resources is arguably the most successful gold explorer in Africa, with world-class deposits such as Morila (7,5 Moz), Yalea (7,2 Moz) and Gounkoto (5,9 Moz), all in Mali, and Tongon (4,9 Moz) in Cote d'Ivôire to its credit. As Group General Manager Exploration Joel Holliday (left) recently explained to ***Modern Mining's*** *Arthur Tassell, the company's high 'strike rate' is no accident but is based on a generative research programme which is unique in Africa, as well as hard, unrelenting work in the field which continues year in and year out through all the ups and downs of the commodities cycle.*

Holliday says consistent funding is one of the key principles guiding Randgold's exploration effort. "Generally speaking, discoveries don't just come out of the blue," he states. "They depend on sustained work over years. Most companies will cut budgets during downturns and this can be very disruptive to exploration programmes. By contrast, we maintain – and even increase – the money allocated to exploration when times get tough. Fortunately, there is a keen appreciation within Randgold, many of whose senior executives – including CEO Mark Bristow – have backgrounds in geology, that continuous well-resourced exploration is essential if the company is to make new discoveries and also replace depleted ounces."

Holliday, a geology graduate of the University of Portsmouth in the UK, has spent

A Randgold exploration team in the field in the north-eastern DRC in August this year.

feature

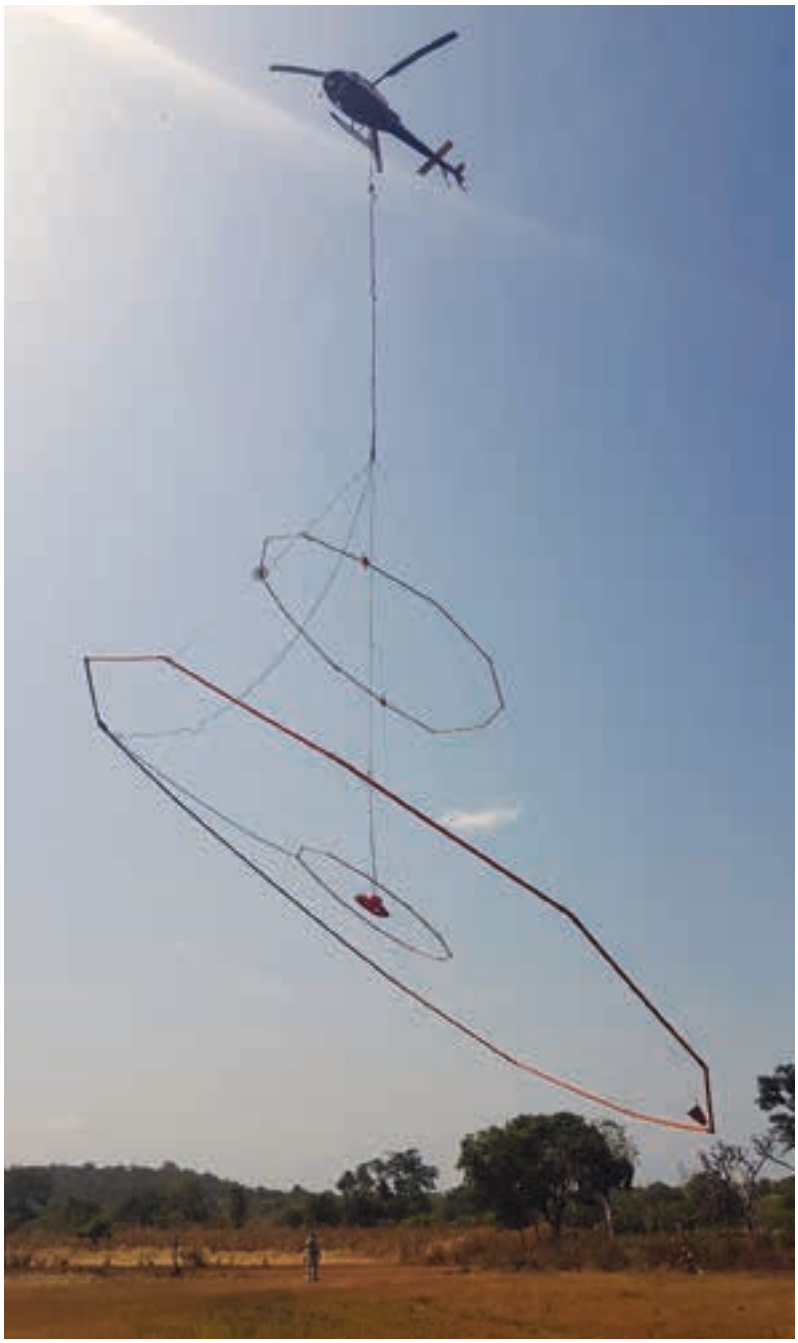
most of his working career (apart from a stint in Venezuela) in Africa. He joined Randgold in 2004 after having worked for a number of juniors in West Africa. He spends about half of the year visiting Randgold's sites in Africa.

Holliday makes the point that in recent years the annual rate of significant new gold discoveries has plummeted down into probably single figures. "The harsh reality is that the industry is not replacing what it's mining. As we speak, and assuming no further discoveries, the world only has about 11 years' worth of gold reserves at present rates of gold production. The average grade of new deposits has also halved in recent years – from around 2 g/t to 1 g/t. Despite all this, gold exploration budgets have been slashed around the globe. The gold mining industry will not have a future unless these trends are reversed."

The truism that there are no short cuts when it comes to exploration is demonstrated by the fact that Randgold has worked on around 1 500 targets over the past 20 or so years – with these delivering just a handful of deposits deemed worthy enough to be developed into mines. It should be stressed though that Randgold sets the bar high when it comes to evaluating orebodies. "What we regard as an economic deposit is one with at least 3 Moz of mineable gold with a minimum IRR of 20 % at a long-term gold price of US$1 000/oz," says Holliday. "Obviously, viable mines can be developed from much smaller orebodies but this is not the space we're in – we're focused only on world-class deposits."

Currently Randgold's exploration effort – which targets the greenstone belts of West and Central Africa – consumes around US$50 million a year and is carried out by approximately 80 graduate geologists, most of them drawn from the countries in which Randgold operates. "We don't have many expatriate geologists," says Holliday. "Given the wealth of local talent available in Africa, we don't see any need for them. Many of our geologists have been with us for many years and some have migrated into positions of senior management at our mines."

Detailing Randgold's current exploration activities, Holliday says expenditure is divided evenly between greenfields and brownfields programmes. "In terms of greenfields exploration, our priority areas in West Africa are the MTZ (Main Transcurrent Shear Zone) in Senegal, the Senegal-Mali Shear in Mali, and the Boundiali and Senefou belts in Cote d'Ivôire, while in the north-eastern DRC – where our Kibali mine is located – we are concentrating on the 35 km-long KZ structure, which is a terrain boundary hosting multiple plunging orebodies. The total portfolio contains 137 targets, all of them at varying levels in the resource triangle model which we use to guide our exploration and development plans."



A helicopter-borne Versatile Time Domain Electromagnetic (VTEM) airborne survey underway in August this year over the Ngayu greenstone belt in the north-eastern DRC.

Elaborating on the resource triangle, Holliday says that Randgold's generative work ensures a constant supply of targets to the base of the triangle. "We apply a set of filters at progressive levels within the triangle which allows us to promote quality targets and reject inferior ones," he explains. "At any one time, most of the projects will be in the lower part of the triangle with only a small number making it through to the top. If we look at the current triangle, of the 137 projects, 64 are classified as

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identified targets, 23 as follow-up targets and 14 as advanced targets. The remainder sit in the top portion of the triangle and are at various stages of resource and reserve definition, with some having entered the feasibility stage."

One of the projects in the current triangle showing considerable promise is Massawa in Senegal, presently in the feasibility stage. Reserves at Massawa stand at 2,2 Moz at 2,1 g/t but, in its 2015 annual report, Randgold said the project had not yet passed its strategic filters due to the high cost associated with processing the refractory ore of the Northern Zone of the deposit. However, ongoing work on the less problematic Central Zone, as well as the potential offered by the non-refractory Sofia deposit, 10 km to the west of Massawa, are providing considerable encouragement to Randgold.

Elaborating on the generative work being carried out by Randgold, Holliday says it is aimed at putting the company in the right place to find the type of deposits that interest it. "Ground selection is critical," he observes. "It is not unknown for explorers to spend years, even decades, working in the wrong place. What we're looking for is large mineralised systems with the potential to host plus 3 Moz orebodies and these tend to occur where there have been major breaks in the earth's crust.

"As I said in our recent quarterly report, our generative research is the only work of its kind being carried out in Africa at the moment and is providing new insights into the controls of large orebodies on a range of scales from continental targeting to detailed orebody definition."

He adds that Randgold is one of the contributors to the West African Exploration Initiative (WAXI) whose overall aim is to enhance the exploration potential of the West African Craton through an integrated programme of research and data gathering. Another objective is to build the capacity of institutions – such as geological survey departments and universities – in the region. Already the initiative has developed a 500 Gb Exploration GIS with over 250 layers, 80 of them unique to the WAXI project.

According to Holliday, one of Randgold's goals this year is to progress its interpretation of WAXI data to update interpretations and prospectivity analysis for the Loulo district in Mali, the Kedougou Kenieba Inlier in eastern Senegal and the West African Craton.

Interestingly, Randgold is not presently active in Burkina Faso, a country which is currently enjoying a gold boom with eight new mines having been brought into production over the past six years – the most recent being Karma, Yaramoko and Bouly, all commissioned this year – and more on the way. Comments Holliday: "We've had ground in Burkina in the past and we certainly acknowledge that it is highly prospective for gold. But we're not convinced that its geology is favourable for the big deposits we're looking for so – for the time being, at least – it is not a country where we are deploying our exploration resources."

Randgold geologists on site at the Massawa project. Massawa, currently in the feasibility stage, is located within the Kounemba permit in eastern Senegal which geologically lies within the 150 km long Mako greenstone belt.

On the state of exploration in Africa generally, Holliday argues that it is increasingly difficult to acquire ground and in particular to assemble the large portfolios required to justify major investment in exploration programmes. "This is why we are doing more and more joint ventures," he states. "This strategy is very evident in the north-eastern DRC, where we've recently concluded three joint ventures. These have given us control over the Ngayu Archean greenstone belt and boosted our groundholding in the country to over 6 500 km^2 – which, incidentally, is a substantial part of our entire African permit portfolio of around 14 000 km^2."

Finally, Holliday believes that there is less 'quality geology' being done in Africa these days than a generation ago. "There's too much reliance on computers and exploration programmes are increasingly being managed remotely. This is not the right approach in our view. You have to get your hands dirty. Using modern technology is important but you also need to have senior people out in the field directing the activities of exploration teams. This is what we do and the results speak for themselves. Our exploration programme is – we believe – one of the best anywhere in the world and we're confident that it will deliver our stated target of three new mines over the next five years."

Photos courtesy of Randgold Resources

"It is not unknown for explorers to spend years, even decades, working in the wrong place."

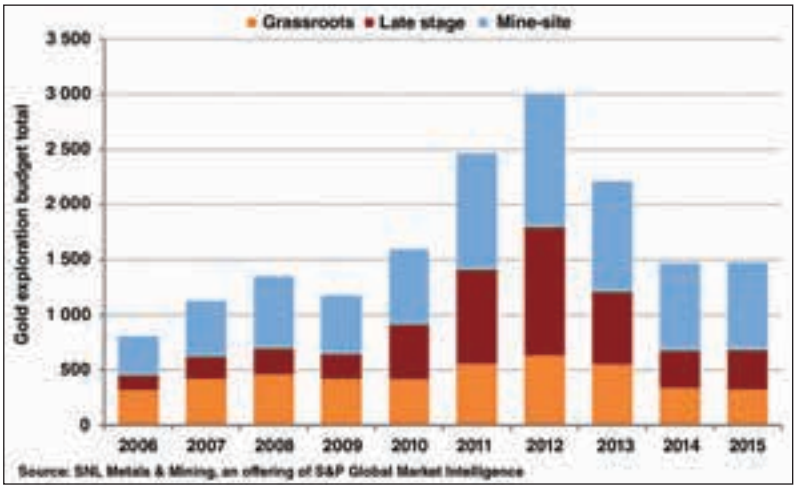
feature

Top gold miners foregoing early-stage exploration

An analysis of the data compiled in SNL Metals & Mining's recently released profiles of the world's top 20 gold producers reveals that the major gold miners have significantly shifted their exploration focus over the past decade. The profiles form part of the Strategies for Gold Reserves Replacement study series of reports.

As illustrated in the chart below, the top gold producers have shown a trend toward increased mine-site exploration at the expense of grassroots exploration over the past 10 years. From 2006 to 2015, the share of total gold exploration budgets devoted to near-mine work rose from 44 % to 54 %, while the share allocated to greenfields programmes decreased from 40 % to 22 %. In dollar terms, mine-site exploration's lead over grassroots exploration jumped from a mere US$36 million in 2006 to US$470 million in 2015.

Exploration budgets by stage for top 20 gold producers (US$M).



Since the total gold exploration budget of top gold producers reached a high of US$3,01 billion in 2012, both grassroots and late-stage budgets have fallen sharply, while the decline in mine-site allocations has been much less steep.

The increased focus on mine-site work in recent years has been due to the major producers spending more at and near their mines to replace or increase reserves depleted by mining and to develop new reserves more quickly at lower costs by using existing infrastructure.

Gold Fields Ltd is a vivid example of this trend, and has even admitted its lack of success in greenfields exploration and in taking projects from initial discovery through construction and into production. Despite having spent roughly US$600 million on early-stage exploration since the founding of the modern Gold Fields in 1998, and despite the discovery of two multimillion-ounce deposits, Gold Fields has not taken a single project from discovery to production, demonstrating how elusive greenfields exploration success can be. As a result, the company has made a strategic shift from capital- and time-intensive exploration-led growth to a programme of brownfields exploration and opportunistic, value-accretive acquisitions.

In late 2013, Gold Fields eliminated its Growth and International Projects division and announced a drastic cutback of its greenfields exploration projects portfolio. Responsibility for exploration was devolved to the group's

operating regions, with a focus on near-mine activities. The company's grassroots exploration budgets went from a high of more than US$92 million in 2012 to zero in 2015. By contrast, Gold Fields has been very successful with near-mine exploration, particularly at its orogenic-style orebodies in Australia and at Damang in Ghana.

As the shrinking grassroots spending suggests, over the past six years the number of new discoveries has fallen drastically compared with the first decade of the 2000s. While some of the decline can be ascribed to recent discoveries still being too small to be considered 'significant', the two-thirds drop in exploration budgets since 2012's peak makes it extremely challenging for explorers to define new resources at their targets.

For example, Barrick Gold Corp is credited with the only discovery identified for 2015 to date: the 5,5 million ounce Alturas deposit in Chile. Besides the discovery's large size, a crucial factor in Alturas going from discovery hole to a defined, significant resource within the same year was the simple fact that Barrick has an ample early-stage exploration budget.

While the company has cut back its overall exploration spending as much as the rest of the industry, its grassroots budget has held comparatively steady, falling from US$73,5 million in 2012 to US$37 million in 2014, before rebounding slightly to US$41,5 million in 2015.

Over the past decade, AngloGold Ashanti Ltd was the biggest spender on gold exploration among the companies in the study, with budgets totaling US$2,53 billion from 2006 to 2015. During the 2001-2015 period, the company is credited with shares in eight major gold discoveries hosting 73,3 million ounces of attributable gold in reserves, resources and past production – the largest amount of gold discovered by any of the profiled producers, and more than twice the amount discovered by its nearest competitor, Barrick Gold.

With gold prices continuing to rise through late August, SNL anticipates that, while companies will maintain their focus on existing operations, most will begin to reactivate modest early-stage efforts as part of their strategy to address the lack of new discoveries.

Acknowledgement: The above article is authored by Robert Anders and appears on the SNL website: www.snl.com

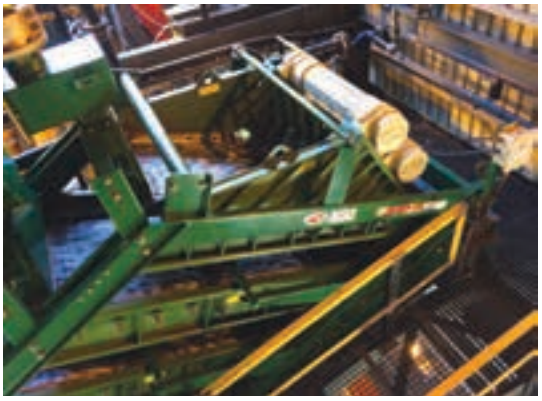
feature

Screening specialists team up to drive best practice

Kwatani, previously known as Joest Kwatani, and US-based Derrick Corporation have partnered to drive best screening practice in the African mining sector.

This important development sees Kwatani represent Derrick Corporation's range of engineered fine screening solutions in selected mining regions in Africa. The original equipment manufacturer (OEM) will share this responsibility with Derrick Solutions International (DSI) Africa, which has represented Derrick Equipment Company since 2014.

The collaboration, which was announced at this year's Electra Mining Africa (EMA), positions Kwatani as a single source for state-of-the-art screening solutions for all commodities.



Kwatani and Derrick Corporation have partnered to drive best screening practice in the African mining sector.

"Kwatani now has access to machines for coarse and fine screening and for arduous applications through to technologies with patented polyurethane panels for screening at 45 microns and finer particle sizes," says Nic Barkhuysen, Vice President: Africa of DSI.

Barkhuysen says this is a significant competitive edge for Kwatani considering the slump in commodity prices and the need for OEMs to have a wide variety of solutions for all minerals and base metals. He believes there is no other screening company that is capable of such a comprehensive offering for the African mining industry.

Importantly, this collaboration brings together two research and development (R&D) driven OEMs who will be able to share and transfer knowledge and experience to their customers to assist them achieve the lowest total cost per ton.

Kim Schoepflin, MD of Kwatani, says this is one of the many synergies between the two companies that led to the start of informal discussions between Kwatani, Derrick Corporation and DSI Africa at EMA 2014.

"Kwatani is well known for its high level of ongoing product development that ensures customers access to new generation technology aimed at achieving the lowest cost per ton. Derrick Corporation has a similar R&D philosophy which has seen the introduction of latest technologies to the African mining industry," Schoepflin comments.

Barkhuysen says that DSI Africa has trained Kwatani's process engineering and service maintenance teams in Derrick Corporation's technologies and applications. "The company is ready to market, service and maintain these machines in its territories. On-site support and screen refurbishment services are also available from Kwatani," he says.

Derrick Corporation was founded by H. William Derrick Jr in 1951 to solve some of the most challenging mechanical separation needs of the mining industry. At the heart of the company's current offering is the integrated vibratory motor which was invented by its founder and gave life to an entire line of innovative separation technology.

Kwatani, tel (+27 11) 923-9000

Zambian copper mine renews its blasthole drill fleet

Amidst lacklustre global commodity prices, Zambia's largest copper mine, Kansanshi, has opted to renew its fleet of blasthole drill rigs.

Rob McMaster, Key Account Manager for First Quantum Minerals at Sandvik Zambia, says First Quantum Mining & Operations (FQMO) has taken a progressive step to ensure improved efficiency and reliable production by renewing its DR500 fleet with Sandvik D25KS and DP1500i drills that are easier to maintain and operate on site.

He adds that Sandvik has entered into a buy-back agreement with FQMO to trade in the company's 11 Sandvik DR500 series rigs that are used for blasthole and pre-split drilling and replace them with nine new Sandvik D25KS rigs and four new Sandvik DP1500i rigs. The bundled deal makes the transaction more affordable and is in-line with FQMO's overall objectives.

"We work closely with our customers to ensure operations are run optimally at all times," he continues. "When circumstances change and a mine's requirements are altered along with them, then we do our utmost to restructure equipment and fleets in such a way that the customer's new needs are met. This is precisely what we have done at Kansanshi where we are proud to deliver a solution that is tailored to Kansanshi's current and changing future requirements. The new Sandvik D25KS and DP1500i drill rigs are machines that will require less maintenance and specialised care than the predecessors.

"They will be joining a number of other Sandvik D25KS drill rigs, as well as the larger Sandvik D45KS and Sandvik DP1500i top hammer drills. The standardisation will in many ways simplify maintenance, stock holdings of spares, rock tools and parts to make the operation easier to manage."

The Sandvik D25KS blasthole drill is a very stable and highly manoeuvrable surface drill for surface mining and large-scale quarrying. It is a down-the-hole (DTH) hammer drill with a high pressure air compressor, air-line lubricator and fine feed control. It is commonly used in large mining operations globally with a choice of hole sizes from 127 mm to 172 mm.

One of the biggest selling points is its speed and fast set-up with effective pipe handling of 9,14 m length pipes with pipe sizes in diameters ranging from 89 to 140 mm. Pipe loading is controlled from the operator's cab with the effective handling of drill pipe contributing to shorter cycle times and getting more holes drilled.

The Sandvik DP1500i is an intelligent, self-propelled, self-contained, crawler-based surface drilling rig equipped with a cabin, movable boom and a rod changer. It is designed for production drilling in large quarries or open-pit mines and construction work sites but is also well suited to wall control (pre-split drilling) and development works.

Mutale Chilufya ,Sandvik Mining Zambia,
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Fibertex paving fabric used to upgrade roads to Zambian mine

The Fibertex range of geotextiles, which is designed especially for civil engineering, mining and road construction and maintenance projects, includes a paving fabric – Fibertex AM-2. This paving fabric has been used in a recent road surfacing project in Zambia.

"In order to gain access to one of the world's largest copper mines at Kalumbila on Zambia's Copperbelt, a network of dirt roads off the main road between Solwezi and Lumwana needed to be constructed. The new mine is situated in a remote location, which meant all road building materials had to be transported over long distances and at great cost," says Chris Powell of Fibertex South Africa. "High seasonal rainfall in this region has a detrimental effect on roads, substantially increasing maintenance requirements.

"To lower the costly routine maintenance intervals on these roads, they were later upgraded to a surfaced standard, using Fibertex AM-2 paving fabric. Fibertex AM-2, is a flexible needle-punched nonwoven fabric, with added thermal bonding on one side only. The purpose of this pre-compressed 140 g/m^2 polypropylene (PP) bitumen-saturated paving fabric is to prevent the ingress of surface water into the selected layers of the road prism, thereby reducing the bearing capacity of these layers.

"This membrane also acts as a Stress Absorbing Membrane Interlayer (SAMI) to prevent surface stress cracking by absorbing stresses imposed by differential loads. This paving fabric also prevents the propagation of stress cracks from lower surface layers (older asphalt or chip seal layers) in the case of a road reseal."

By including Fibertex AM-2 in the reseal design, the formation of stress cracks and eventual pothole formation is prevented, thus extending the service life of the road surface.

Additionally, when using Fibertex F-grade geotextiles in a separation application below the layer works of the road prism, the road design can be altered to include less of the costly imported engineered fill. This reduces the thickness of the selected layers, resulting in a more cost-effective design.

Without the use of a separation fabric in weak subgrade conditions, intermixing of engineered aggregate into the weak subgrade could occur. As a result, the bearing capacity of the base course is reduced, which could lead to base course failure of the road.

The Fibertex AM-2 system can be applied mechanically for large volume installations, as well as manually in cases where narrow width installations are required.

Chris Powell, Fibertex South Africa, tel (+27 31) 736-7100

Fibertex AM-2 paving fabric has been used in a recent road surfacing project in Zambia.

DCD builds base for dragline excavator

Vereeniging-based DCD Heavy Engineering is nearing completion of a 380-ton base for a Caterpillar dragline excavator destined for a coal project in Mpumalanga.

The contract to manufacture the base locally was awarded to the company in April 2015. The base is 18 m in diameter, and comprises 16 individual sections.

"This substantial project has been carried out with real team commitment, extensive planning and regular engagement with the customer and employees," said Kenneth Kok, Project Manager at DCD Heavy Engineering. "High efficiencies of over 100 % in boiler-making and welding, and a low weld-repair rate, confirm the capacity of local manufacturing to tackle large, demanding projects."

Kok said the pre-planning, the pre-testing of welders, and the overall project management resulted in the contract being delivered on time, with a very high safety standard maintained throughout the manufacturing process.

"The project's success began with an expert think-tank on manufacturing method options, leading to an innovative approach being applied to the construction of the base," he said. "Mock-up test structures were built to simulate the confined spaces that welders and grinders would encounter in the work environment and steel templates were supplied to ensure that we conform to drawing requirements."

He highlighted the importance of good communication and effective training. In this project, regular meetings were held to check planning instructions before issuing to the works, and workshops with welders, boilermakers and grinders reinforced the exact tolerances and specifications required. The health of employees working in welding and grinding areas was also monitored at regular intervals.

DCD Heavy Engineering is part of the DCD Group's mining and energy cluster.

Kenneth Kok, DCD Group, e-mail: kkok@dcd.co.za

The 380-ton base for the dragline excavator.

Successful motor rebuild for Zambian copper mine

Marthinusen & Coutts, a division of Actom, recently completed the rebuild of a 6 550 kW, two-pole, 11 000 V, squirrel cage induction blower motor for a copper mine in Zambia.

According to Rob Melaia, Engineering and Technical Executive at Marthinusen & Coutts, the motor had suffered a rotor failure which caused collateral and associated damage to the stator and also considerable damage to the rotor laminations at the core extremities.

Marthinusen & Coutts has extensive experience with the rebuilding of such large rotating machines and it is this ability to leverage knowledge gained from years in the industry that facilitates the identification and repair of electrical machinery in limited time.

The repair work undertaken comprised a stator rewind, a rotor rebar including a partial recore with new laminations and the replacement of the P900 high strength rotor retaining rings.

Interestingly, the retaining rings are made from the same steel used for the largest turbo generator in the world and this was sourced by Marthinusen & Coutts from a leading German supplier in record time. "Working closely with our network of local and international partners facilitates access to specialists in all fields and allowed the fast-track procurement of these specialised rings. This was especially impressive as these were procured over the Christmas period," Melaia says.

The rotor rebar involved new rotor bars using high resistivity brass alloy and the redesign of the rotor cage axial locking system.

Once the rebuild had been completed, the motor was tested at Marthinusen & Coutts' facility which houses the third largest high speed dynamic balancing machine in sub-Saharan Africa.

"We were able to perform high speed balancing as well as a full no-load run test to verify vibration and bearing integrity condition performance," Melaia says.

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

Marthinusen & Coutts recently completed the rebuild of a 6 550 kW, two-pole 11 000 volt squirrel cage induction blower motor for a copper mine in Zambia.

Six Siemens substations for trolley assist system

Billions of litres of diesel are consumed annually by the global mining industry, which is under severe pressure from weak commodity prices. Up to 80 % of this costly fuel consumption comes from haulage trucks moving uphill on ramps.

A Namibian uranium mine is overcoming this challenge with six 11 MW Siemens substations that provide electric power to the overhead DC (Direct Current) power lines, which in turn provide the DC power to the adapted diesel-electric haulage trucks.

Siemens SA launched one of three completed units at its North Riding facilities recently. They will be used to power a fleet of Komatsu 960E trucks, which are among the industry's biggest and highest capacity mine haulage vehicles, with a load capacity of 214 m^3 or 327 tonnes.

Another breakthrough for this new order is that 90 % of components in the containerised substations are entirely manufactured by Siemens, compared to past units that contained approximately 30 % Siemens components.

"Consistent innovation has kept us at the forefront of mining technology, and sourcing nearly all of our components internally means greater quality control, improved functionality, and greater capacity," says Siemens SA Project Manager Phiwa Thindwa.

Each 11 MW containerised substation boasts 1,8 kV of DC voltage and up to 10 000 A to ensure that it can run two trucks continuously, three trucks for ten minutes or four trucks for one minute along the overhead power lines. This combination of substation and overhead line is known as trolley assist technology.

A trolley assist solution is installed on any uphill stretch between the mineral ore loading (pit) and offloading (dump or process plant) points, as the speed on the gradient is limited by the diesel engine's horsepower, Thindwa explains.

With the inclusion of the electric drives, the electric power supplied to the wheel motors of the haulage trucks enables the vehicles to move faster uphill, which results in quicker turnaround times and higher productivity for the mining operation.

Engine operating and maintenance costs are directly linked to hours of operation of the haulage trucks and using trolley assist on gradients reduces the cycle time of the haulage trucks, thus increasing the intervals for maintenance.

Siemens' DC containerised substations are manufactured in Pretoria with components currently imported from Germany. "The company aims to manufacture components such as switchgears and control panels locally in future," says Siemens SA Country Business Unit Lead: Rail Electrification, Joey Govindasamy.

Siemens' trolley assist solutions for the mining sector were first developed in South Africa in 1981, and the local operation has since remained a global leader in installed capacity. Currently Siemens SA is the only provider of the trolley solution in the Siemens group.

Siemens, tel (+27 11) 652-2000

New generation conveyor belt for coal mines

ContiTech South Africa has designed, manufactured and installed a new generation solid woven conveyor belt, Coal Flo, for use in underground coal mining applications.

"This four-layer PVC belt illustrates our ability to produce a new generation conveyor belt at a reduced cost through innovation and extensive research and development," says Avril Botha, Managing Director Conveyor Belt Group at ContiTech Africa. "This is essential in current mining market conditions where it is paramount for suppliers to have the capability to reduce cost to clients without compromising quality of product."

Four rolls of 250 m of Coal Flo have been installed on South 911 Irenedale Bosjesspruit in Secunda, Mpumalanga. The belt is being used by Sasol in a trunk conveyor belt application. Bosjesspruit is one of five underground coal mines belonging to Sasol and has 47 km of underground conveyor belting installed.

Due the presence of methane gas in underground coal mines, equipment used needs to be flame retardant. With this is mind, Coal Flo has been manufactured to comply with specifications contained in the SANS 968:2013 regulations.

"We expect the installed product to have a lifespan of four years during which it is expected to convey up to 25 million tons of coal," explains Botha. "During the test period, Sasol will analyse the performance of the belt and make a decision regarding the replacement of existing conveyor belts in its underground coal mining operations with ContiTech's Coal Flo. Preliminary feedback on the performance of the Coal Flo belt is favourable, but a long-term evaluation is required for in-depth analysis."

Paul van Zyl, ContiTech South Africa, tel (+27 11) 248 -9337

Fit-for-purpose wear solutions from FLSmidth

Pressure on maintenance budgets coupled with the need to increase productivity while reducing unplanned downtime in the mining, quarrying and power sectors of the market presents a unique set of challenges.

One of the most obvious ways to cut costs is to look at areas in the plant where excessive wear is occurring and to then apply best practice wear solutions technology to address these issues.

This is according to Roland da Silva, Global Product Line Manager, Wear Solutions at FLSmidth, who recently visited the company's South African operation.

Da Silva says there are many reasons for excessive wear and that it is essential to identify the cause before applying a solution. "Different wear technologies cater for different causes within a plant and it is essential to apply a fit-for-purpose solution to ensure the customer will benefit from the intended increase in wear life," da Silva says.

He points to the obvious differences between wear caused by sliding abrasion and that caused by high impact. "Rubber is capable of handling high energy and impact, while ceramic is best for sliding abrasion; however, there are instances where both impact and sliding abrasion occur," he explains.

The Ludoliner from FLSmidth is – he says – ideal for this scenario where there is high material flow with moderate impact forces.

Waynne Martin, Product Manager Wear Solutions at FLSmidth, notes that the Ludoliner is an easy-to-fit system of bolt-on wear panels that combines the properties of alumina ceramics and rubber resulting in exceptional wear and impact resistance.

The locally manufactured Ludoliner is available from FLSmidth's Meshcape® Screen Media business. Typical applications of Ludoliner panels include screening chutes, conveyor chutes, material deflectors, ball mill discharge chutes and transfer chutes.

Wear-Resist™ Epoxy Ceramic is simple to apply.

Another solution available from FLSmidth is its well proven Wear-Resist™ Epoxy Ceramic. This cost-effective epoxy coating is claimed to be ideal where a quick hard-wearing solution is required.

The product is fabricated from a proprietary mixture of epoxy and wear resistant beads and combines the hard-wearing properties of a ceramic with the flexible installation properties of epoxy.

Martin says it is a proven solution in areas where sliding wear problems are common. Wear Resist™ Quick Set has a working time or pot life of approximately 15 minutes from being thoroughly mixed and will be hard cured in four hours, based on an ambient temperature of 23°C, while Wear-Resist™ Standard Set has a working time of approximately 30 minutes and is hard cured in eight hours.

"This makes it ideal for quick equipment maintenance turnaround with a minimum of downtime," Martin concludes.

FLSmidth, tel (+27 10) 210-4820

Unique design features in gas sensor

Developed to meet specific requirements for gas monitoring at fixed locations, the locally manufactured ESI Smart Sensor is said to incorporate unique design features that effectively address the shortcomings of conventional sensor instrumentation.

This unit features a localised display of sensor information. A single controller can measure 15 different gases, typically including oxygen (0_2), carbon dioxide (CO_2), flammable gases such as methane (CH_4) and combustible gases such as carbon monoxide (CO). The Smart Sensor can also accommodate other sensors with analogue outputs, such as air velocity sensors or smoke detectors.

Ingress protection on the Smart Sensor exceeds IP56 and the instrument carries SANS IEC 60079 Part 0:2005, SANS IEC 60079 Part 11: 2007 and IEC 60529 (IP code) approvals. Also certified as EXia T4 Intrinsically Safe, the unit's dimensions are 265 x 150 x 60 mm and it weighs 1,8 kg.

Booyco Electronics, tel 0861 BOOYCO (266926)

Spirals retrofit delivers improved recoveries

Northam Chrome Producers is realising improved recoveries, better grades and higher yields following the retrofit of Multotec spirals at its recovery plant.

The decision to replace the existing spirals with those designed and manufactured by Multotec was taken following extensive testwork performed by both Northam Chrome Producers and Multotec.

Results from the testwork performed at Northam Chrome Producers revealed that Multotec's spirals outperformed the competitor units originally installed in the plant. Testwork was later revalidated at Multotec's in-house technology division in Spartan, Gauteng by Faan Bornman, Technology Manager.

Based on the outcome of these trials, Northam Chrome Producers decided to replace the existing spirals, which had reached their end of life, with Multotec spiral technology. "Tests showed that by using the Multotec spirals, the plant would be able to increase recoveries by an additional yield of 6 %," says Multotec's Graeme Smith.

In progress retrofit installation of Multotec HX3 spiral bank in a custom designed frame to suit the existing spiral building structure.

Smith says Multotec was tasked with removing 172 spiral assemblies from Northam Chrome Producers' existing recovery plant and replacing these with 72 Multotec spiral assemblies. These comprised Multotec HX5 and Multotec HX3 spirals with feed tonnage capacities ranging from 4 to 9 t/h per start.

Smith says one of the biggest challenges of the eight-week long project was retrofitting the new spirals into the existing structure.

The project was overseen by Smith and Field Service Technician Raymond Masinga. "The commissioning of the plant was an easy exercise. It started up the same day and immediately started outperforming the earlier test results," Smith says. He reports that the entire plant's yield is now closer to 30 %, compared to the average of 21 % in 2014.

Multotec engineers have ascertained that the cost of the spiral assembly is about 0,004 c/feed ton, with Northam Chrome Producers expected to see a return on its investment within a four-year period.

Smith says it is encouraging to hear from Northam Chrome Producers' personnel based at the operation that the assembly has sustained its performance over the past 12 months. "We have increased the plant recoveries by 6 % of additional yield. The customer has been very happy with the project overall, and we are engaging with Northam Chrome Producers on another large project," Smith says.

Multotec is currently testing the performance of its own cyclones at the plant with the intention of replacing the existing units, which have also reached the end of their life.

Smith says that Multotec – based on the feedback the company has received from many of its customers – has the best performing spirals in the market in fine and heavy minerals applications. He attributes the success of the performance of these large 1 m diameter spirals to their optimised feed-in angle.

They were originally designed as a rougher and scavenger spiral to handle material ranging from 800 micron to 38 micron. "Such is their reputation in the international mining sector that a prominent iron ore miner wants to test them at one its flagship operations. Here, they will be used to recover fines ranging from 80 micron to 75 micron," Smith says.

The success of the performance of the plant at Northam Chrome Producers has also seen it turn to Multotec to help boost recoveries even further. He reports that work has already started on designing an extra stage in the existing plant to bolster recovery yields by up to 9 %.

Another important aspect of this project is that this is the first time that Multotec's pipe launder systems have been used in a chrome application.

Unlike their steel competitors, the pipes are made from uPVC and PU lined, materials well-known for their resistance properties, boosting the lifespan of the pipes by up to nine times, according to Smith. They are also lighter than their steel counterparts.

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

Locally built continuous miner launched at Electra Mining

Broadening its footprint as an Original Equipment Manufacturer (OEM), JA Engineering (JAE) introduced its first ever in-house designed continuous miner at Electra Mining 2016 – the Wildcat JAE42 CM.

According to JAE, the Wildcat is designed to meet the unique hard cutting conditions in South African coal mines. The company says it listened intently to its customer's needs and requirements and incorporated these specifications into the design.

The Wildcat, which is 90 % locally manufactured and procured, has a mass of 110 tons and a total installed power of 828 kW. The minimum/maximum cutting height is 2,20 m to 3,95 m (short barrel cylinder) and 2,20 m to 4,70m (long barrel cylinder).

JA Engineering has more than 29 years of experience as a leading manufacturing engineering company in the mining industry. The company was established in 1987 by the Alexander family to provide the South African mining industry with alternative aftermarket support through reverse engineering solutions.

It was also during this time that the company established itself as an OEM in the design of battery scoops for the South African coal mining industry.

JAE Engineering, tel (+27 11) 397-3237

The Wildcat JAE42 continuous miner.

Floor grating range expanded

Andrew Mentis has announced that its Rectagrid RS floor grating range has been expanded to include different pitches. This move, according to Elaine van Rooyen, Marketing Manager at Andrew Mentis, is in line with current market demands where certain projects require a more lightweight steel product.

Rectagrid RS40 will now be available with a pitch of 40 mm by 40 mm, 45 mm by 40 mm, 45 mm by 50 mm and an 80 mm by 40 mm pitch which is known as RS80. Panels are available in 2,4 m by 1,2 m for ease of installation.

"The new pitches will be manufactured using the same pressure locking system that has been in place for years and customers can be assured of the high standard and quality that they have come to expect from all Mentis products," van Rooyen says.

Andrew Mentis floor grating is engineered to take specific loading, which ensures optimum safety of people walking or working in those areas. A complete understanding of the load bearing capacity of grating is necessary to ensure that the correct floor grating is selected for a specific application.

Andrew Mentis, tel (+27 11) 255-3200

Zero leaks with knife gate valve

For many years, plant operators have battled with leakage problems, searching for valves which will isolate the flow and prevent leaks to the atmosphere, but are often left feeling frustrated and out of pocket.

External leaks from valves during valve cycling are common problems for plant operators around the world. These leaks can have disastrous consequences, contaminating the environment and endangering workers with hazardous materials, resulting in major downtime for the company.

Customers can install Delta Industrial™ valves into problem areas secure in the knowledge that they will achieve long term performance with exceptional isolation results.

Delta Industrial™ knife gate valves can guarantee plant operators in difficult process applications zero leakage, says John Abbott, Weir Minerals Global Product Manager for Valves. "This isolation is very important because it ensures safe and consistent plant operation, minimises downtime and provides lowest total ownership cost.

"Our customers can install Delta Industrial™ valves into problem areas secure in the knowledge that they will achieve long term performance with exceptional isolation results, protecting their people, their plant and their environment," Abbott continues.

Weir Minerals Delta Industrial™ guided shear gate valves are designed to repeatedly close and provide bi-directional zero leakage isolation no matter what the process fluid may contain.

"Our knife gate valves guarantee no process will come past the closed valve, even abrasive slurry or when operating under high temperatures," Abbott states.

This is a significant feature of the Delta Industrial™ valves and one which provides numerous important benefits to the customer, providing some insight into why Weir Minerals acquired and continues to invest in Delta Industrial™

Delta Industrial Valves, Inc was founded in 1987 and the company began designing and manufacturing high quality knife gate valves in 1989. At the time, the company recognised the urgent requirements within the market for a superior knife gate valve. It is an established industry leader in the valve industry and, with the backing of Weir Minerals, says it will continue to pave the way in high quality knife gate valves for its customers.

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

Latest version of X-series Agitator introduced at Electra

The X-series Agitator from SEW-EURODRIVE represents the latest iteration of the well-known X-series, designed specifically for mixing applications such as minerals processing. The new agitator was launched at this year's Electra Mining Africa show.

Responding specifically to customer requirements, the new X-series Agitator features an integrated Extended Bearing Distance (EBD). This means it consists of a standard gearbox with a modified output side in order to increase the radial and axial forces. The distance between the low-speed shaft bearings has been increased, while bearings with larger dynamic capacities have been used.

"An integration of the EBD with axial and/or radial bearings into the gearbox is far more cost-efficient for the customer than a purely external bearing configuration mounted on the application," comments Andreas Meid, Head of Department – Engineering. The main applications for the X-series Agitator are mixers, agitators and aerators, where high radial forces, combined with axial forces, act on the low-speed shaft.

"We already have a strong footprint in these sectors with our existing X-series and MC-series gearbox, and it is anticipated that the new X-series Agitator will only enhance that. What we have done is look at all competitive products available on the market, and incorporated the strongest features in our unit. This means we have a lot of extra selling points, in addition to unique accessories on offer, such as a Condition Monitoring System," Meid explains.

The main advantage of the X-series Agitator is that it is essentially an off-the-shelf unit that uses existing components. The entire design is fully integrated, which makes for a highly efficient and compact unit that is easily maintainable.

"Different lubrication options are available, such as bath lubricated with expansion tank, or pressure lubrication with drywell. All the lubrication piping is integrated fully into the unit, which is thermally optimised as well. Different filter options are also available," Meid points out.

SEW, tel (+27 11) 248-7000

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