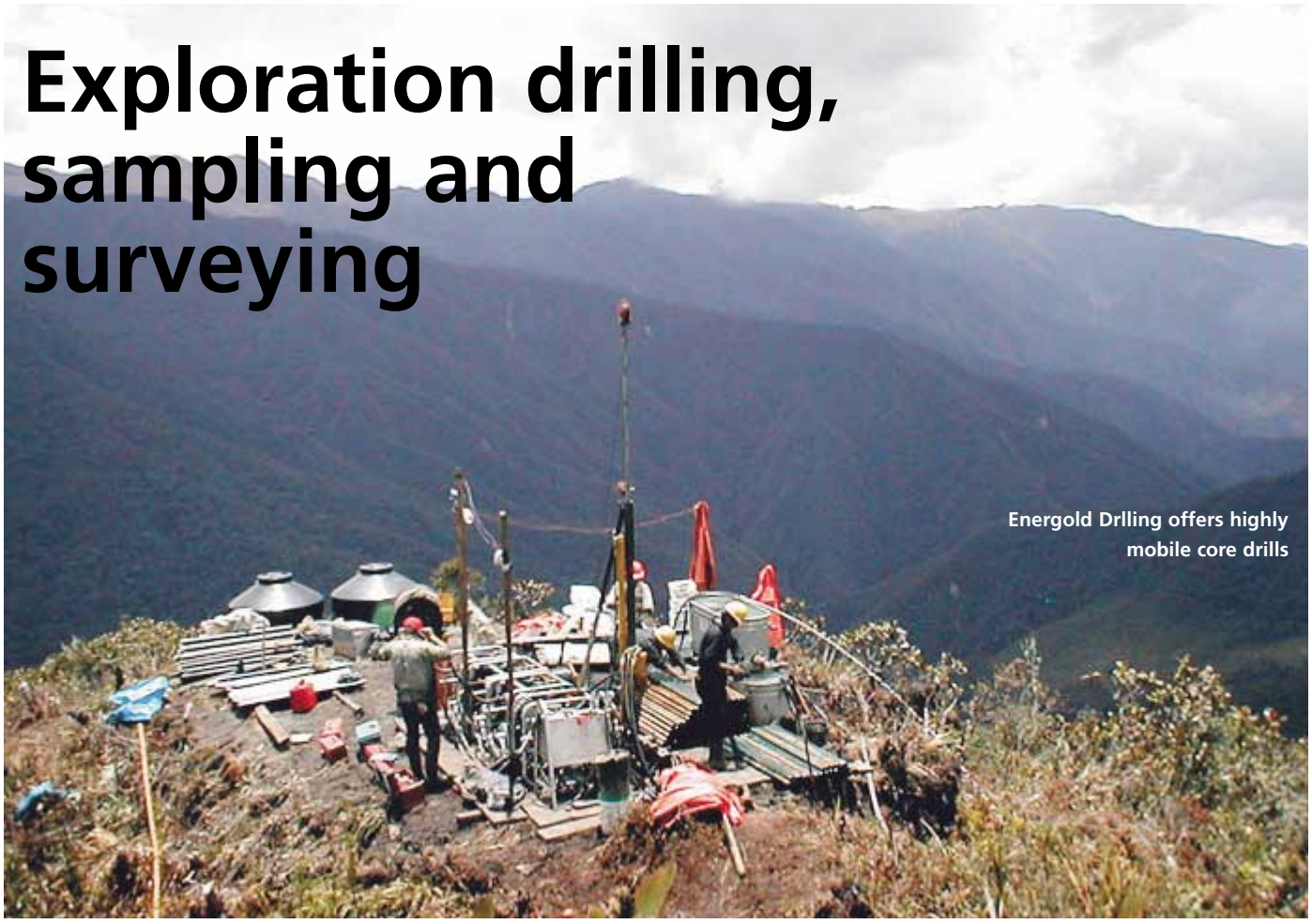
Exploration drilling, sampling and surveying



Energold Drlling offers highly mobile core drills

Exploration is booming – no surprise there! **John Chadwick** looks at results and equipment. Greater depth will be one of the challenges of future drilling

As noted in last month's issue, the trend is towards more underground mines for the future, reducing open pit dominance. This requires, among other things, deeper exploration drilling. Professor Murray Hitzman of the Colorado School of Mines points out[1] "mineral exploration and production is focused on the near Earth surface (<200m)." It is only in known mineral districts that we routinely explore to more than 1,000 m, and in some of those areas (South African gold mines) mines go down to 3.5 km below surface. "In contrast, hydrocarbon exploration and production occurs to depths in excess of 6 km. Geologically we expect significant mineral resources below the depths we are currently exploring.

"Though there is no shortage of metallic mineral resources, finding high quality (low producing cost) deposits is becoming more difficult." As a result, exploration costs are rising, while the discovery success rate is falling. It is also his opinion that "difficulties in replacing reserves by exploration are leading to an increase in mergers (or proposed mergers) in the mining industry."

He suggests that the future will see deep in situ mining that will use existing directional drilling and fracturing technologies from the oil industry. These techniques will allow the prediction of groundwater flow in the deep subsurface and the ability to collect all fluids derived from a target mass.

Looking at the exploration implications, Hitzman says: "We need much better geological models for potential in-situ targets:

- Rock mass model
- Fracturing model
- Geochemical model
- Hydrogeological (fluid flow) model

Currently, most economic geologists are not trained to evaluate these models individually and certainly not in an integrated fashion."

Queenston Mining's activities in Ontario, Canada, are an example of the trend towards deeper exploration drilling. It has commenced a deep diamond drilling program on its 100% owned Amalgamated Kirkland (AK) property. The primary target for this program is the New South Mine Complex (SMC) currently being explored, developed and mined by Kirkland Lake Gold on the adjacent Macassa property. The SMC is interpreted to dip onto the AK property at a depth of some 1,800–2,200 m. The first drill hole was expected to reach target depth by January 2008 and will be the deepest exploration attempt from surface in the history of the Kirkland Lake camp. It will act as a pilot-hole to allow a series of wedge cuts to be established at the projected target elevation.

As we go to greater depths mining exploration will need to look to the oil drilling sector for deep drilling technologies; also geothermal drilling which is quite active these days and attempting depths up to 5,000 m. Drilling to such depths is relatively easy with current equipment. The main problem is controlling deviation. Also, such rigs employed for mineral exploration will be more expensive to deploy so allied technologies and techniques will be needed to define prospective drilling sites with greater certainty.

Furthermore, future scenarios may require drilling rigs that can not only perform the exploration task but can also produce the production holes needed for *in-situ* recovery.

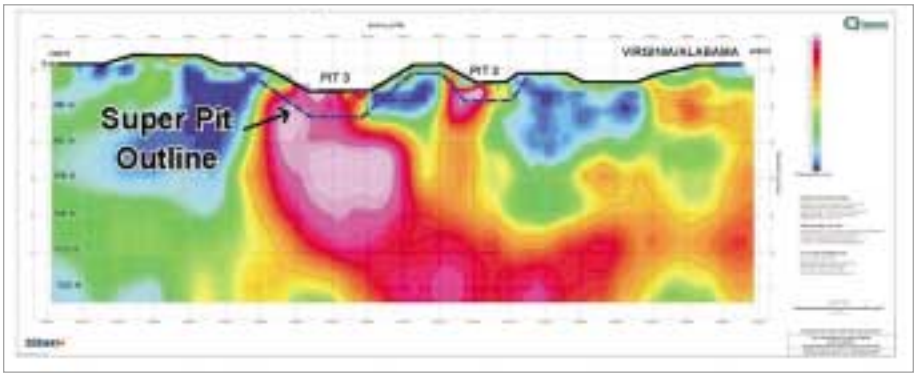
Directional drilling can be very helpful at depth. For example, in 2006 Lundin Mining's Zinkgruvan in Sweden discovered a deep northwestern extension of the existing orebody. Surface drilling intercepted significant zinc and lead sulphide mineralisation at 1,050 and 800 m vertical depth.

A directional drilling program was planned to delineate this discovery with the aims of increasing drilling efficiency by reducing the total drilling length, and increasing hole accuracy. The initial plan was to sidetrack a total of eight new holes from two existing holes, and steer these sidetracks towards specific targets at depth. Devico was hired to do the steering in co-operation with the drilling company Drillcon. It was planned to use two drill rigs, with the Devico crew and equipment moving between the to as directional drilling became necessary.

Two of the 56-mm holes that discovered the mineralisation were reamed out to 76 mm in May and August 2007. From the depth where the reaming ended, respectively at 600 and 300 m, the sidetracking and directional drilling started. No wedges were needed for the sidetracking, only standard conventional and directional core barrels using the difference in hole diameter to deviate out. After 40-50 m with steering the core barrel was switched over to conventional to complete the holes.

When the first targets were reached the conventional core barrel was pulled back to the depth where steering was initiated, and used to cut straight out of the curved borehole to create new sidetracks. The drilling process from the first targets was then repeated, i.e. a short section of steering before completing the holes with conventional drilling.

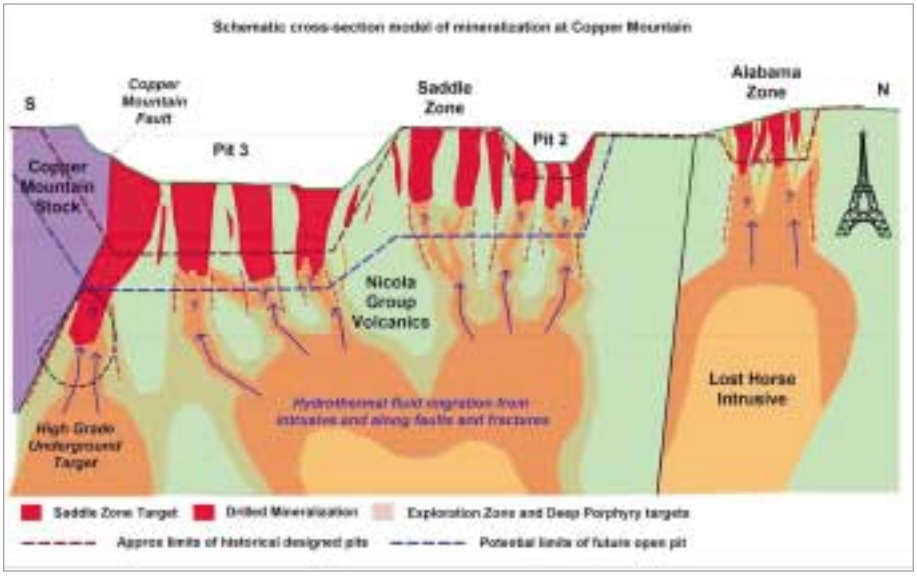
By mid November one of the sidetracks was approaching the mineralised zone at 900 m depth, but the core did not show the expected



Last December Copper Mountain Mining received results from the recently completed Quantec Titan 24 deep penetration geophysical survey on its Copper Mountain project in British Columbia. The Titan survey results were interpreted with the aid of 3D inversion programs and outlined several large areas of high chargeability, both near to surface and at depth. Currently known mineralisation and the interpreted geological model for the area, correlate well with the chargeability anomalies, providing confidence in the survey interpretation. The chargeability anomalies provide several large target areas for follow-up drill testing.

The Copper Mountain property is host to a large alkalic porphyry copper-gold-silver system with historic production. Copper Mountain said "The Titan 24 Deep Earth Imaging system is the most advanced electrical earth imaging technology available. Measuring parameters of DC (resistivity), IP (chargeability) and MT (magnetotelluric resistivity), the Titan 24 measures to depths of 750 m with IP and to depths of more than 1.5 km with MT data. These depths and multi-parameter data make the system one of the best options available for obtaining subsurface information related to geologic structure and for the direct detection of mineral deposits."

President and CEO, Jim O'Rourke stated: "The results of the Titan deep earth imaging suggest that the exploration geologist's enthusiasm for the project is well-founded, and supports the growing evidence for continuation of extensive zones of mineralisation to depth."



With the release of the fourth generation of its computerised control system APC, for the Diamec core drills, Atlas Copco has taken another step to increase productivity. By using the APC with the Diamec rig, the cost of consumables can be lowered significantly in any surface or underground core drilling. The APC makes it easier to control and maintain a more efficient drilling, which prolongs service life of diamond bits and ITH tools

geology. It turned out the borehole was going parallel to the mineralisation and was, according to the project geologist Glenn Patriksson, doomed never to hit it. Instead of abandoning the hole Devico went down with its equipment and achieved a 15° deflection towards the ore. Patriksson explains: "Devico forced it down in inclination, through the ore horizon (which was the best hit so far) and the hole switched from failure to success. I think its just fantastic having the ability to do this."

"From the beginning people were talking about production gain and cost gain with Devico but this aspect of being able to chase the ore horizon when the geology decides to disobey, gives me as a geologist a much easier job and better health," he continued.

The Zinkgruvan directional drilling project has now been extended with several new sidetracks and is expected to continue for most of 2008.

Several exploration projects worldwide have proven that a directional drilling program can be very valuable, both in time and cost. Also if the borehole should miss the mineralisation, a few days extra work to hit the target is cheap compared to the alternative: a completely new hole from surface, without no guarantee of hitting the target.

Rob Gordon, geophysicist and Director of Marketing for Quantec Geoscience says[2] "advances in various technologies continue to contribute to our exploration efforts, specifically towards reducing the time to execute tasks. As we try to sense deeper and find improved means of effectively drilling, we will, more often than not, uncover new information that was unexpected and this may require more thought and time than we had initially intended. This makes the use of technology by itself complicated and using it may require that we re-think the way we do things such as learning new concepts and scientific fundamentals.

"Making a discovery is difficult and is arguably more difficult as undiscovered deposits today are more likely found at greater depths. In addition, the financial risk with deep drilling is hindering deep exploration. Technology advances have been hindered because the mining industry has been traditionally slow to embrace new technologies particularly if they are not easily understood or when the cost paradigm is out of sync with traditional spending habits regarding drilling versus other technologies. However, the dramatic change that has happened within the industry over these last ten years from low to high metal prices has contributed dramatically to the uptake of new technology. Recent advances in digital signal processing, and faster computers, coupled with the ability to collect very high

resolution and deep geophysical data, resulting in physical property contrasts that can now be discriminated from the surface with accuracy and depth penetration that has not been seen before. This provides new opportunity to further geoscientific investigation at greater depths prior to drilling. Drill targeting can be more focused thereby providing better returns per metre drilled. In essence, high potential ground may not be under-explored. Economists have often said a critical failure in exploration is the inefficiencies of exploration while exploring highly prospective regions. Today, images to depths of over 1,500 m for key targeting parameters can assist with required deeper exploration within favourable land packages. Moreover, technology can now provide a means to revitalise exploration in mature mining camps. A 'bottom-up' versus 'top-down' exploration process begins to address economic concerns that face the industry such as drilling risk and discovery rates.

Gordon explains that a sophisticated deep volume exploration process using advances made in the last ten years with technology has been developed around the 'bottom-up' concept to "optimise the return on exploration projects that are either of key strategic importance (brown field) or require the confirmation of deep targets with associated high drilling costs." This process uses Common Earth Modeling (Gocad), calibrated borehole petrophysics and Distributed Acquisition System technology (Quantec's Titan-24) along with other geophysical tools. It "provides geologists with quantitatively integrated data sets in 3D geological models. These models are used to communicate amongst the technical exploration team and to drive prudent project management decisions."

He concludes that "to date, every major exploration technology advance, particularly geophysical, has aided in new discoveries by better focusing drilling efforts. Our scouring of the top 200 m has been relatively efficient. The likelihood of making new mineral discoveries at depths greater than 200 m is increasing due to the ability of the latest geophysical subsurface imaging capabilities and other advances in 3D earth modeling and geophysical inversion."

Rig shortage

The boom has its own problems and the scarcity of available contract drilling time is

leading some companies to buy their own exploration rigs. One such is Golden Phoenix Minerals, which has just formed Exploration Drilling Services as an in-house drilling department focused on the discovery, delineation and expansion of reserves at company-owned mining properties. A five-year lease with option-to-purchase has been executed with Atlas Copco for a new TH60 drill rig. The company expects delivery of the rig in February of 2008, with exploratory drilling to begin soon after.

The company notes that "because industry demand for contracted drilling services is presently high and therefore difficult to secure, the possession of a 'captured' rig assures that the company's basic drilling needs will be met and its projects advanced in a timely way. The aggressive scope of the drill plan for 2008 means that there may be times that this in-house capability will be augmented with contracted equipment, but this acquisition provides an insurance policy that significant progress will be made regardless of third party availability."

The TH60 drill rig is state-of-the-art equipment and will be augmented by a specially designed angle package for drilling up to 45° off vertical. The rig features 32,000 kg of pullback and is capable of drilling reverse circulation holes up to 610 m.

A South Australian uranium company is reaping the first benefits of its decision to import a drilling rig from the USA to overcome what it describes as "the severe shortage of rigs which is playing havoc with Australia's mineral exploration schedules." UraniumSA's fully refurbished Mayhew 1000 rotary mud rig commenced its first drilling program in November – on the Mullaquana uranium target, south of Whyalla in South Australia. Not only is this a reflection of the rig shortage, but also the company sees great benefits in being in control of its own rig, rather than using a contractor.

"This milestone will allow us to continuously explore and drill our properties without dealing with the debilitating constraints and frustrations the shortage of suitable drill rigs is causing industry-wide," UraniumSA's Managing Director, Russel Bluck, said. "This is an enviable and almost unprecedented position to be in for a junior uranium explorer. Being in complete control of all our operations will allow UraniumSA to rapidly amend and re-prioritise drilling programs on the basis of daily results, and thereby enhance the opportunities for discovery. Significantly, it allows us to control the quality and cost of our drilling and logging operations, and that is a significant cash conserving opportunity that will enable a more extended and intensive drilling program from our exploration budget.

"We anticipate that the rig will be able to drill and log one or two holes each day, dependent on the depth and ground conditions of each site, and that some 300 holes will be completed each year," Bluck said. The Mayhew rig is the key component of a complete exploration plant which includes a purpose built logging truck equipped with GeoVista down-hole logging tools. The GeoVista tools have been calibrated at PIRSA test pits, and this will enable UraniumSA to report its exploration results in equivalent uranium parts per million.

Mobility

Energold Drilling and its subsidiaries Kluane International Drilling and Pac Rim Drilling have experience drilling in diverse terrains such as at 5,500 m altitude in the Andes, the Amazon jungle and the desert in Yemen. Programs currently being drilled range from early-stage reconnaissance drilling to resource definition and advanced stage programs. Energold uses man portable, highly mobile drills to provide competitively priced, low environmental impact

drilling with greatly improved social and community relations.

Energold can mobilise a drill to any location in the world in the cargo hold of a conventional aircraft. The drill is sufficiently compact so that everything, including rods, can be carried on roads by a 5-t truck or in five pick-up loads. Where access is limited, local labourers and/or mules on footpaths can transport the unit. Everything is hydraulically driven, modular and easily disassembled, so drill moves can be completed in one shift or less. The heaviest single component in each unit weighs between 150 and 200 kg. Quick disconnects allow the rig to be taken apart from the drill position in less than 45 minutes.

On a helicopter-supported job, the drill's light weight and small size significantly reduce the number of flying hours. The drill can be safely landed and assembled while the helicopter hovers, and in case of inclement weather unsuitable for flying, the drill can be supported manually and moved by hand.

As a testament to its approach, one of Energold's drill programs was chosen as a case study by Canada's E3 Environmental Excellence in Exploration initiative.

Energold says it can compete effectively with most conventional drills in depth capability and with larger core sizes. It operates a fleet of standard and high altitude drills capable of drilling BTW to depths of over 450 m, NTW core to depths greater than 300 m and HQ core to depths greater than 100 m in most conditions (NTW and BTW core are drilled with thin wall rods and are slightly larger than NQ and BQ core). The narrow kerf of the thin wall system allows for a higher ratio of power per square unit of cutting face, resulting in improved cutting efficiency as well as recoveries. As a worldwide average, Energold says it drills "25 to 30 m per 12-hour shift (depending on ground conditions). On average, we complete 1,200 m to 1,500 m per month with one drill."

The rigs use smaller multiple turbo charged engines to run hydraulic pumps. The pumps pressurise a reservoir, which provides hydraulic pressure to run the wireline winch, water pump, ram and a top head motor. Energold says "hydraulic drive is a more efficient power transfer system that allows for the modularisation of the rig. Being totally modularised also means repairs can be effected in the field rather than returning the rig to a shop. Only the failed or damaged part is removed and either repaired or replaced."

Falcon Drilling is another Canadian drilling contractor making its own rigs. The F1000 and the F2000 are both diesel powered hydraulic drills, powered by either a four-cylinder Isuzu (74.5 kW) or a six-cylinder Isuzu turbo diesel (112 kW). A hydraulic system, driven by the engine, is used to ensure maximum efficiency and productivity, minimum downtime and simple operation.

The F2000 – more powerful and flexible version than the F1000 – can penetrate deeper and handles HQ and NQ bit sizes as well as BTW. It is designed around the same concept of reliability and ease of use, and also breaks down into the same four modules for easy moves. Both drills can be moved and re-assembled with only two ground crew. If helicopter support is not required or available the drills can be equipped with skid frames to enable relocation using a bulldozer or skidder.

Late last year, Soho Resources entered into a diamond drilling services contract with Falcon Perforaciones Mexico, a subsidiary of Falcon Drilling, for a minimum of 5,000 m of core drilling. Ralph Shearing, President and CEO of Soho stated: "Falcon Drilling is a highly competent drilling contractor with an excellent reputation within the exploration community and we are very pleased to have retained this group for drilling operations at Tahuehueto. We plan to add a second Falcon drill to the project as soon as possible in 2008 and trust that Falcon can meet all of our projects' future

drilling requirements on an ongoing basis."

After years of working with large drills, Coeur Products recognised the need for small, lightweight hydraulically powered drills for short-hole exploration, definition, and grout hole drilling. The Termite core drill has a simple construction with very few parts, is easy to operate and is a good choice for depths to 100m. The power to the drill is supplied with modern hydraulic components; the rotation unit is driven by a high tech belt drive. This quiet drill is particularly suitable for narrow vein applications.

The total weight of the Termite and control panel is only 160 kg (350 lbs.), making it easy to move to and from any site.

Reverse circulation

Over the last 40 years, reverse circulation (RC) drilling has proven to be a highly effective method in a variety of applications, including exploration drilling and inpit grade control. "Given the benefits of this technique – not least its cost-effectiveness – it isn't surprising that the market for top quality equipment is growing," Atlas Copco Secoroc reports.

The company says the "tough realities facing reverse circulation drillers are not new to us." Its latest product, designed for 140–152 mm holes, the Atlas Copco Secoroc RC 50, "is built to deliver superior efficiency – even in the toughest conditions." It uses an open standard bit shank for easy compatibility. Drillers are not locked into using equipment from one supplier. Secoroc has also through-hardened the centre recovery tube to achieve what it claims is "the market's longest service life."

That recovery tube features an entirely new – patent-pending – design. Thanks to this innovation, there's no need to open the hammer, which means maintenance and field replacement are much easier. RC 50 also features the Quantum Leap air cycle, ensuring great performance in both grade control and deep-hole drilling. Furthermore, generous piston bearing and sealing areas minimise the kind of wear that is so common in RC applications.

The RC 50 has been subjected to rigorous trials in the field over the last few years. Conditions and applications have differed from site to site. However, field reports conclude, "customer demands regarding performance and service life have not only been met, but also exceeded."

Drill Africa of Zambia is a contractor at the forefront of developments in Africa, supported by geotechnical know-how and equipment from Atlas Copco. The company operates in both Zambia and the DRC, the latter accounting for some 60% of its exploration work in 2007, a figure that is expected to increase in 2008.

The company sees increasing demand for RC drilling in the region and had three RC rigs in its fleet, until recently when it decided to add a third – the Explorac 220RC, the fourth of these rigs to be delivered in Africa so far. "It was our long term relationship with Atlas Copco Zambia, plus the excellent reputation established by the Explorac 220RC in Australia," says Drill Africa's Franco Russo, "that underpinned the decision to buy this machine."

The Explorac 220RC, mounted on a Mercedes truck chassis, is now being used in the DRC's Katanga Province. The main target here is the copper-cobalt mineralisation in the CMN (calcaire mineralisé noir) horizon found in

late Proterozoic sediments of the Lufilian Arc that has provided much of the country's copper and cobalt output. The Explorac is contracted for a total of 20,000 m, drilling primarily 150 m deep holes at 100 m spacing intended to reach the footwall of the CMN horizon. More than 4,600 m have been completed. The rig is drilling with SDS hammers and 6 m long pipe. The 127-mm holes penetrate highly altered overburden to a depth of about 60- m at a rate of 1.2 m/min, and then enter the hard dolomitic limestone that includes the CMN horizon.

Drill Africa is using the remote control driller's panel for drilling and sampling and also the helper's remote control panel to operate the Explorac 220RC's rod handling system. It is also possible to use the driller's panel at distances up to 10 m from the rig. The rig's on-board storage rack can hold 12 lengths of drillpipe and the rod handling system can draw further lengths from the bed of the support truck if required. The on-board hydraulically operated cyclone takes samples at each metre, with the rig audibly alerting the operator at the appropriate time. These samples are analysed by the client's Congolese geologists, who also monitor the contractor's performance.

Drill Africa's Atlas Copco Explorac 220RC operating in the DRC

High confidence in handheld XRF

Over the last few years, handheld x-ray fluorescence (XRF) manufacturers have aggressively touted these portable elemental analysers as a vital tool for modern exploration. The claims of simple point-and-shoot design, reliable accuracy, precision and repeatability, elemental concentration data of up to 30 elements in 20 seconds, *in-situ* analysis of soils, sediments, RAB and RC cuttings and diamond core make these units sound too good to be true. However, several factors have converged over the last five years to bring us to the point today where handheld XRF is, in actuality, a routine exploration tool. Users are saving money and are so confident in the data quality that handheld XRF data is regularly reported in announcements to the ASX, TSX and London Plus markets.

Laboratories are overwhelmed, sample turnaround times are at an all time high, exploration companies are looking to more and more remote locations and want to get rapid feedback concerning the potential of a piece of ground. These companies are looking to maximise exploration budgets, identify drill targets quickly, reduce re-mobilisation costs and get an accurate report to the capital markets as fast as possible.

"It's these factors that have contributed to the enthusiasm we now see for handheld XRF analysis in exploration," says Todd Houlahan, Sales and Marketing Manager for Thermo Scientific NITON® Analysers in Europe. "And, of course, the advancements made in the technology have helped make this possible. The new handheld XL3t 500 analyser has a powerful miniaturised x-ray tube at 50kV, fast internal electronics systems, enhanced detectors and is capable of analysing more elements than ever before. This improves value to the mineral explorer, especially through lower detection limits (LODs) of around 10 ppm for elements like Hg, Ag, As and Mo, 20 to 30 ppm for Cu, Zn, Sb, U."

Several case studies illustrate how some exploration companies are benefiting from the use of handheld XRF as part of their exploration programs.

A Niton user since 2003, Perilya found that it saved time and money, achieving analytical accuracy and precision, after testing for just 30 seconds on the ground. Using Niton analysers, the company can test up to 500 soil samples a day – three to five times faster than conventional techniques – and 700 samples a day in its percussion drilling and rock-chip sampling operation. It also appreciates the ability to download and convert data to a conventional database for easy trend analysis.

Iain Groves, now a consultant, was Perilya's project manager when the company conducted its initial trials with the analyser. He states, "The Niton handheld XRF analyser is a revolutionary exploration and mining geochemical tool that facilitates rapid exploration through instantaneous geochemical feedback. It can be used for geochemical sampling, RAB, and RC

drilling, diamond drilling for homogenous ore types, and during mapping and evaluation work.

"The cost benefit of utilising a Niton analyser for exploration, particularly base metal exploration, can be enormous, not only in saved assaying costs, but most importantly, in months of saved time. The ability to follow-up on anomalous geochemical results the same day, or to decide to extend or infill drill on the spot, makes a Niton instrument invaluable. An analyser will typically pay for itself in two to six months." In one trial of in situ soil analysis using the analyser, Perilya estimated it saved $5,000 a day.

Silvermet is using a handheld XRF analyser in the field to provide preliminary analyses, which are carried out on the flat face of freshly cut drill core. Selected areas along the eastern margin of the intrusion are currently designated for in situ XRF analyses to establish representative grades and extents of mineralised zones. This work is in conjunction with sampling for mineralogical and metallurgical testing that will help ascertain the viability of a lower grade, high tonnage resource with localized high-grade enrichments.

Because of the reliability of the data collected using Thermo Scientific NITON 500 Series instruments, Albidon's compositing and assay choices during this time have been made with confidence, resulting in mistake-free decision making. By assaying samples in the field, Albidon has achieved 20 to 30% savings in mineralised zones, more than 50% savings (based on assay and composite strategies) in non-mineralised zones, and dramatically reduced its Tunisian sample freight costs, sending only assay check samples to its West Australian laboratory.

Metallica Minerals has a clear objective and strategy to achieve lower capital cost, high margin long-life nickel production. Discussing Metallica's use of handheld XRF analysers, Managing Director Andrew Gillies notes, "Knowledge is the key, and Niton XRF gives us on-the-spot knowledge. This facilitates decision making, resulting in time and cost savings."

Niton XLt3 drill core analysis

Sample comminution

selFrag comments that: "Conventional crushing and grinding limits the accuracy of results from exploration sample analysis. Contamination, lack of selectivity, high wear and tear, or the influences of comminution to the components are just a few of the problems." It says its technology will "boost accuracy and speed of the analysis of exploration samples."

The principle of selective fragmentation using high voltage (HV) pulsed power was developed by the German Research Centre Karlsruhe (FZK). selFrag commercialised this patented technology under a worldwide licence from the FZK. The technique is based on HV discharges forced into solids. This energy causes high-pressure impulses to propagate through the solid. Reflection along major internal material boundaries induces tensile stress. This causes rocks to disintegrate, predominantly along grain boundaries.

selFrag says "the highly selective process has a vast potential in various research areas like mineralogy, geochronology or geochemistry. It increases the accuracy of sample analysis. The advantages are applicable to the exploration of various economic deposits, ranging from base and precious metals, diamonds, industrial minerals to gemstones." It has been successfully tested in various fields, for example diamond exploration by GTK, Finland. "Tests with low-grade base metals of a property in Finland owned by Magnus Minerals indicate a tremendous improvement compared to current processing methods."

The compact device is suitable for in-house or onsite processing. There is virtually no wear and tear of the single step process because there are no moving parts and rock hardness does not influence the process. Cross contamination of samples is negligible because the process produces no dust and the process area is easy to clean. The production of mono-mineral fragments enables an accurate and quick sample analysis of the mineralogical characteristics. It also simplifies further treatment like the efficient separation of economic important minerals from the host rock to evaluate the deposit.

selFrag provides what it claims is the first commercially available continuously operating HV-pulsed power device to process exploration mini bulk and batch samples for further analysis

Surveying

Gedex has established multi year strategic alliances with De Beers and Anglo American aimed at developing and exploiting its next generation resource exploration system. The new proprietary Gedex High Definition Airborne Gravity Gradiometer (HD-AGG™) is expected to be a breakthrough airborne survey technology and is already gaining international recognition from major resource companies seeking enhanced refinement and effectiveness in exploring for precious metals and minerals, the company says.

"Gedex's next generation airborne gravity gradiometer system is expected to provide images of subsurface density that, independently and in conjunction with other data, provide valuable information in exploring for and delineating subsurface resources. Historically, density has been the single physical property most diagnostic of economic ore deposits however extremely difficult to measure.

Anglo American will seek to develop and apply a second-generation version of the HD-AGG technology in the broader mineral exploration sector, supporting further research aimed at validating the Gedex technology.

On the ground, De Beers is using the latest laser mapping technology from 3D Laser Mapping to improve safety at the world famous Kimberley diamond mine in South Africa. Its SiteMonitor scanning system captures highly accurate slope measurements and will help identify potential failures within the pit wall of this closed mine.

De Beers uses 3D Laser Mapping's SiteMonitor, including a high performance Riegl LMS-Z420i laser scanner, to capture highly accurate measurements of the dolerites and shales that make up the upper portions of the pit walls.

3D Laser Mapping has developed a mining version of its StreetMapper system. MineMapper uses the latest mobile laser scanning technology combined with high precision positioning systems to capture highly accurate and detailed measurements on the move. It is ideally suited for mining as the system can be deployed on a range of vehicles to suit all terrains. When combined with 3D Laser Mapping's SiteMonitor software it can automatically create detailed 3D models.

MineMapper comprises a series of vehicle-mounted laser scanning units together with an on-board positioning system that uses satellite technology and an INS navigation system. Each scanner transmits an optical pulse from a known position and at a known direction and angle and records the time taken for the beam to be 'bounced' back to the receiving unit. The speed of light is then used to calculate the exact position of the feature from the laser unit. ***IM***

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