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EXPLORATION BEST PRACTICE

Drilling, sampling and surveying

BANRO'S BIG GOLD

Over 200 km of gold belt in DRC

BETA HUNT NICKEL

High productivity underground trucking

TECHNOLOGY CENTRE FOCUS

Equipment and services from Salt Lake City

JUNIOR COMMANDER

John Chadwick travelled to Bukavu for demonstrations of Banro's meticulous exploration and sampling techniques and its innovative use of LiDAR. Four low-cost, open-pit gold mines are the minimum likely outcome

South of Lake Kivu, Banro has a, perhaps, unique situation – complete control of a 210 km long gold belt. The Twangiza-Namoya gold belt in the east of DRC is the last known major undeveloped gold belt in Africa. Normally one would expect a number of companies to have positions on such a potentially rich prize, but Banro is pretty much alone, but not unnoticed.

Scoping studies have been completed on two of the projects – Twangiza and Namoya – showing Internal Rates of Return (IRR) that are probably the envy of the industry – both well over 30% with paybacks well below three years. Many in the industry would be happy with IRRs of around 15%. Lugushwa and Kamituga offer organic project growth, with significant on-site and regional potential. Banro's aim is to delineate worldclass projects on the belt and advance these projects up the value curve. "All [four projects] have the potential for major, stand alone mining projects," explains Peter Cowley, Banro's President. "The gold deposits all lie close to the surface, and tend to be on hills and ridges."

The Twangiza and Namoya prefeasibility studies should be completed in the first half of 2008, when Lugushwa's scoping study is also expected, and exploration drilling there has been accelerated. At Kamituga, the exploration program has been developed and is now being implemented. In regional exploration, airborne radiometrics and geophysics have identified new targets, which are being prioritised.

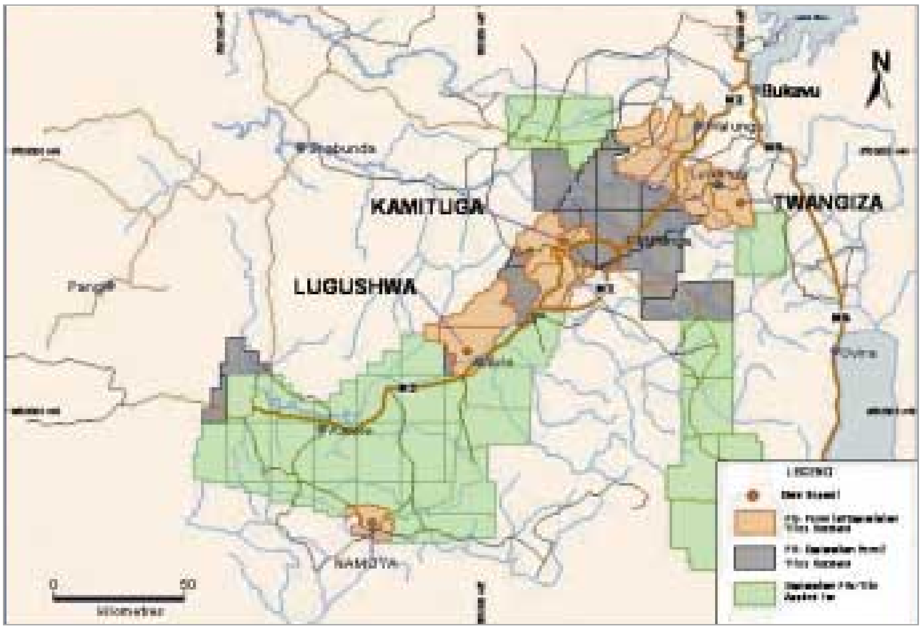
With over 11 Moz (and surely much more to come) on the four projects, Banro describes itself as having "the passion of a junior and the assets of a major." This seems very accurate. With four gold projects to date (including all but proving two mines), and more to come, 100%-equity and no title reviews, first gold production is likely by end 2010/start 2011 from a single 5-8 Mt/y mine. Banro is also very competently managing the great, but not insurmountable, logistics challenges of this tropical rainforest region.

In many ways, Banro is making the region work for its projects and vice versa. It seems likely, for instance, that hydropower will be an option at each site. Knight Piésold is already doing a feasibility study on this. It is likely that the power options chosen for the sites will be co-operative ventures that will also bring power to local towns and villages, many for the first time.

Twangiza is the closest project to the city of Bukavu (just a short helicopter flight some 45 km to the south-southwest) and the most advanced of the projects. Twangiza currently boasts Measured and Indicated resources of 3.87 Moz of gold and Inferred resources of 2.7 Moz. The property consists of six Exploitation Permits covering 1,164 km^2 and its prefeasibility study is due to be completed in the first half of 2008.

The Twangiza Preliminary Assessment was prepared with input from a number of independent consultants including SRK Consulting (mining, social and environmental), SGS Lakefield (metallurgical test work), Knight Piésold (power) and SENET (processing and infrastructure). SENET also undertook the preliminary economic valuation and report compilation. SENET will be heavily involved in future studies and future construction contracts and by cutting out some of the tender process, Banro should save about nine months on bringing Twangiza into production.

SENET examined access routes to Twangiza for plant and equipment as well as ongoing production materials and consumables. Access to site is available predominantly by rail from Dar es Salaam on the coast in Tanzania or via road from Mombassa in Kenya. The national road (N2) running from Bukavu to Kasongo will pass within some 24 km of the project. This road is currently being upgraded through a World Bank



initiative, and passes relatively close to all four current projects. Banro has said it will use the Chinese contractor employed by the World Bank to build connecting roads from the N2 to the projects. Namoya and Lugushwa also have air strips, which Banro will upgrade as necessary.

Like so much in the DRC, Twangiza has a broken recent history. It is located in the northern half of the Great Lakes sub-province of High Africa, one of the world's principal Precambrian orogenic-metallogenic provinces and was first explored by Minière des Grande Lacs (MGL) for in-situ resources in 1957. Work followed the occurrence of alluvial gold deposits upstream from the Mwana River to the present day Twangiza deposits. Banro acquired control in 1996. Shortly after the completion of the 1997-1998 exploration program, former President Laurent Kabila issued presidential decrees which caused the expropriation of the property from Banro. In April 2002, the Government of the DRC signed a settlement agreement with Banro. The agreement called for, among other things, Banro to hold a 100%-interest in the Twangiza property under a revived mining convention that is renewable in 2027 for another 25 years. No exploration work was carried out on Twangiza between 1998 and October 2005, but artisanal mining occurred on the main deposit depleting over 3 Mt of ore from an area of the southern part of the deposit.

In mid-September 2005, the Congolese authorities regained control of the Twangiza area. Banro mobilised and commenced a simultaneous program of field camp construction (at 2,300 m above sea level) and exploration in October 2005. In February 2006 a helicopter supported diamond drilling program involving two portable Atlas Copco Craelius CS1000 rigs was initiated. In July 2006 two additional rigs were mobilised to expedite the phase I and II drilling programs. The CS1000 rigs features include a reliable, lightweight turbocharged diesel power pack. The powerful variable-speed, P-size drill head has a long stroke feed of 1.8 m. The rod positioner is accessible from the operator's station. The components are modular-style, including quick-disconnect hydraulic hose fittings.

Geosearch is the drilling contractor on Twangiza, while Major Drilling is the contractor on the Namoya and Lugushwa projects. Obviously there are operational differences due to different equipment and differing topography but the general operation of the exploration camps is standard. They are served by two Eurocopters operated by Savanah Helicopters. At the time of IM's visit, one helicopter was serving Twangiza and the other was shared by Namoya and Lugushwa. Kamituga is only just now getting established.

By mid-November 2007 over 180 holes had been put into Twangiza, to a maximum depth of 250 m. Such a hole takes about 48 hours to drill. The orebody remains open at depth, and more gold has been discovered to the north (known as 'Twangiza North'). Further north the extent is still being tested. There are also two promising targets close to the orebodies already delineated – Mufwa and Thsondo, both with extensive artisanal workings. Mufwa Mountain is peppered with adits and clearly holds promise to prove a major orebody.

Crystal ball gazing aside, at this stage in the studies two pits have been optimised – Twangiza Main and Twangiza North. The estimated total resource was 7.7 Moz, with an in-pit resource of some 5 Moz. Grade control will be easy as there is a very distinct difference between ore and waste. The stripping ratio for the deposit down to 250 m will be just 2:1.

Exploration phases

Banro's impressive exploration practices embrace a well defined progress through six phases, with the first covering the whole concession and subsequent stages narrowing the focus:

1. Reconnaissance – map reviewing, regional mapping, geophysics (magnetics, radiometrics)
2. Exploration geochemistry – soil, stream, ridge and spur sampling
3. 'Ground-truthing' geochem anomalies – trenching and pitting

Core drilling at Namoya

4. Resource delineation
5. Resource definition
6. Reserves?/inpit resources.

Diamond drilling

Before commencing a drill program the location, inclination and objective of each drill hole is discussed by the exploration and resource teams. Before drilling, all sites are surveyed by differential GPS (DGPS) by the geologist responsible for site preparation, and clearly marked in the field, with a wooden peg showing the borehole number, inclination and azimuth. Co-ordinates are checked in the field by DGPS and signed off by the Senior Project Geologist. If compensation for crops is required, all the paper work must be completed before any site or access road clearance takes place. The details of the crops cleared, the compensation paid, and the owner's signature will be recorded.

The drill area/access road is prepared to the satisfaction of both the Senior Project Geologist and a representative from the contractor, and signed off by the contractor. This includes the size and location of the sump. In the case of a helicopter supported program, the pilot also signs, to indicate that the site has been checked and accepted as safe. The limits of the drilling area are clearly marked. After completion of the borehole, the site will be cleaned and the sump filled in. Site clearance will conform to Banro's HSE standards for the DRC, and be signed off by the Senior Project Geologist. A photograph is taken of the site immediately after cleaning is complete.

Borehole orientations are discussed and signed off at the start of the drill program. After set-up of the rigs, the Senior Project Geologist (or his delegated geologist) checks borehole inclination and azimuth before drilling commences. The core sizes drilled are PQ, HQ (or HQ3, i.e. triple tube) and NQ (or NQ3).

Each borehole number starts with a project name prefix (K = Kamituga, L=Lugushwa, T = Twangiza, N = Namoya, followed by DD for diamond drill hole and then the number; e.g. NDD020 is Namoya, diamond drill hole number 20). A register of all holes is kept for each project area, with borehole number, co-ordinates, azimuth, inclination, planned depth, final depth, date started, date completed, and comments. An updated copy of the register is lodged at the Bukavu regional exploration office on a monthly basis.

Checking core at site (Carriere A, Lugushwa)

The aim is to orientate all core, although this is not always possible in practice due to ground conditions. The frequency of orientation surveys depends on the quality of the core. For example, in unfractured, competent rock, where core can be 'fitted together' across runs, surveys could be carried out every third run. In fractured ground, or where reef horizons are expected, surveys should be carried out after every run.

All core orientation marks are checked by the geologist after each relevant run, and the bottom of hole is clearly marked on the first piece of core. If the orientation mark was unsuccessful, and the bottom of hole cannot be reliably extrapolated from the previous run, the driller is asked to drill a short run and repeat the orientation. Orientation is carried out by the 'spear' method, or another gravity-based method such as 2iC Australia's Ezy Mark system.

Checking and logging core at Namoya

The Banro guidelines state "the Ezy Mark tool should be used during day shift whenever possible. The technique is superior to the spear in that (a) the crayon mark is supported by the arrangement of nails, and (b) the three 'ori-balls' demonstrate that the instrument settled properly in the hole. However, the disadvantage of the system is that the relationship between the crayon mark and the 'Bottom of Hole Line' (BOHL) varies between surveys. Therefore, there is no way to check the survey after the core has been removed from the orientation guide and the instrument has been reset.

"Because Banro does not normally have

geologists on the rigs during the night shift, the quality of the Ezy Mark surveys cannot be checked by Banro. The spear method will therefore be used at night. With the spear there is a direct relationship between the mark and the BOHL, and any spear survey can be checked at a later date. The spear can also be considered as an alternative to the Ezy Mark, when the rock is soft."

To ensure that the contractor carries out an orientation at least at 3 m intervals (unless ground conditions are unsuitable), the driller should record the depth and the survey result. The survey result should be one of the following:

- SR (Survey Reliable)
- SU (Survey Unreliable)
- NR (No result i.e. survey unsuccessful)
- NS-BG (No survey – bad ground)
- NS-OP (No survey – other problem).

Core is packed in the core boxes by the contractor at the drill site, with plastic blocks showing the depth placed at the end of each run. The geologist will check the driller's depths before removing the core from the drill site. Any problems are discussed with the driller and the Senior Project Geologist with the core still at the drill site.

The geologist measures and records core recovered for each run, and the position and amount of any core loss. A wooden block showing the amount of loss is placed in the appropriate position in the box. This is done before the core leaves the drill site. The driller is immediately informed of any core loss, and the recovery records are signed off by the driller before the core leaves site. A copy of the recovery data is given to the Drilling Supervisor by the Senior Project Geologist on a daily basis, and if necessary, any remedial action is discussed and implemented.

Again, before core is removed from site, a generalised lithology log is compiled by the geologist. This log shows the depths of the main lithological units and main zones of alteration/mineralisation.

The drilling contractor carries out single-shot or multishot surveys at intervals of 30 m in all holes. All survey films and/or computer printouts of survey results are supplied by the contractor, checked by the Senior Project Geologist, and the results recorded as required. Before an instrument is used for a drilling program it is checked on surface for accuracy of inclination and azimuth. Results of these tests are documented and placed on file.

Most core is removed from the drill site by helicopter, and the geologist must ensure that the core is safely carried to the pick-up point. Unless the pick-up point is close by on a level surface, each core box must be hand-carried with an empty box strapped on top and with padding on top of the core. At the pick-up point, the contractor ensures that the core boxes are stacked inside aluminium crates, and securely strapped together with an empty tray on top.

Helicopter support is essential to the core drilling

Core logging

Before geological logging commences, back at each project's base camp, the core is marked. Using the orientation survey marks, the geologist marks the BOHL with black marker pen. For sections of the core where the orientation is reliable, a solid line is used. A broken line is used for unreliable orientation. A dotted line is used where no orientation is possible, the reference line being drawn so that it bisects the low point of the foliation. Each piece of core is also marked with arrows pointing downhole, centred on the BOHL.

The BOHL is marked by placing the core on angle iron, rotating the core so that the bottom of hole lies along the edge of the angle iron, and using the edge of the angle iron to mark the line. This should be carried out at the drill site whenever possible.

The cut line (along which the core is cut during sampling) is drawn 3 mm to the left of the BOHL, looking downhole. The cut line should be marked immediately after the BOHL is drawn, using a metal strip placed on the edge of the angle iron, to ensure that the separation between the cut line and BOHL is a consistent distance on all pieces of core.

The depth of the hole is marked on the core at 1 m intervals, with black permanent marker

Checking core with a Kenometer

Cutting core at Namoya with an Almonte core saw

pen. The depth is written on both sides of the BOHL. Where core loss occurs, the geologist places a wooden block in the appropriate position, with the amount of loss indicated.

Core is photographed with a digital camera after marking and before cutting. Each photograph will cover one box of core. Care is taken to ensure that the entire core is wet, and to avoid shadows and reflected light. Each photograph is saved on computer using the borehole number, tray and from/to depths as the file name, e.g. NDD0018.17.85-90m.

Oxidation Log records the extent of oxidation of the rock, and defines two horizons. The first is the Base of Complete Oxidation (BOCO), i.e. the rock above this depth is totally oxidised. In tropical environments, this is commonly equivalent to the saprolite horizon. The second horizon is the Top of Fresh Rock (TOFR), i.e. all rock below this depth is unoxidised (the sulphide zone). By definition, all rock between BOCO and TOFR is partially oxidised, and is variously referred to as 'saprock' or the 'transition zone'. Oxidised and partially oxidised horizons may occur below TOFR in the vicinity of faults or fractures.

Lithology Log – reference samples of the different rock types encountered are collected in order to ensure standardisation in lithological logging, as drilling progresses. Any new rock-type code accepted by the Senior Project Geologist and Exploration Manager requires an accompanying reference sample, which goes in the 'rock library" in the logging shed.

Thin sections are taken of each reference sample. Each project keeps a file containing (a) photograph of the reference sample, (b) petrographic description, and (c) photomicrograph of the thin section. Polished sections are cut in mineralised zones.

The lithological log provides a rock name, and records colour (based on a standard colour chart), grain size, texture/fabric and type of contact.

Structural Log – planar structures recorded include lithological contacts, bedding, foliation, joints, faults, and shears. Alpha and beta angles are recorded. The reliability of the measurements is indicated in the record, and corresponds to the reliability of the orientation survey result as indicated by the BOHL.

Where the rock is well bedded or foliated, it would be impractical to record all planes.

In this case a single representative bed/foliation plane should be measured every 1-2 m. When recording the depth of a plane, the depth at which the plane intersects the BOHL is used.

Structural zones (e.g. shear zones, fault breccias, mylonites) are recorded by noting the depths and alpha/beta angles of the top and bottom contacts.

Alteration Log records the style and mineralogical composition of any hydrothermal alteration which has affected the rock. More than one style of alteration may affect the same section of core (e.g. pervasive alteration cut by irregular veins) and is entered separately with mineralogical descriptors for each. The type of contact between the alteration zone and the unaltered rock is noted, e.g. sharp, diffuse, gradational.

The alteration minerals are noted and, in the case of sulphides, an estimate of the volume percentage is given for each species. The presence of visible gold and the grain size is also recorded. Alpha and beta angles are recorded for vein contacts, and the sharp contacts of pervasive alteration zones.

Geotechnical Log records core recovery, RQD, rock strength, weathering, and describes the characteristics of fractures. Percentage core recovery is quoted to one decimal place, and the RQD to the nearest whole number.

Final borehole logs are produced using the Century Systems software and are stored both electronically on the central database computer and as hard copies. When final (electronic and hard-copy) logs have been completed, the data is signed off by the Senior Project Geologist and Exploration Manager. A final report is compiled for each borehole summarising the objectives and if these objectives were met.

Core sampling

Sample intervals are determined by geological features. In homogeneous rock, the maximum sample interval will be 1 m. The minimum sample interval will be 0.3 m. For example, 0.3 m of split HQ core will provide about 1.29 kg of material for analysis.

Veins, altered zones, or distinct geological units are sampled so that the contacts are a standard 20 mm within the sample boundaries.

The geologist marks the sample interval position around the full circumference of the core. The sample number and the depth is written in permanent ink on both sides of the BOHL. Sample depths and sample numbers are recorded.

Each site uses Almonte Diamond core saws. The geologist or technician places the core in the Almonte core carrier, and ensures that it is orientated so that it will be cut lengthways, exactly along the sample line marked just above the BOHL. After cutting, the core must be replaced in the core box in the correct position by the geologist/technician.

After cutting lengthways, the half core to the right of the BOHL (looking down hole) is cut across one half of the core at the sample position marks: i.e. when standing in the normal logging position, the half-core nearest the logger is sampled. After cutting, the core is replaced in the core box ready for sampling.

All pieces of core for each sample are placed in a pre-numbered plastic sample bag together with a corresponding numbered label. A second label is placed at the top of the bag, and the bag sealed.

Where core is too broken to be pieced together for cutting, 50% of the broken pieces should be randomly hand-picked and placed in the sample bag. Care is taken to ensure that 50% of any fine material is also incorporated into the sample, using a spatula and paint brush. The geologist cross-checks the number and sequence of bagged samples against the sampling form at the end of the shift and the samples are placed in sample storage.

Relative density measurements are taken in all boreholes. The intervals are every 2 m outside mineralised zones and every 1 m within mineralised zones.

Unlike some companies operating on the continent that are top heavy in non-African expatriates, Banro is a very 'African' company. Cowley is a geologist with over 35 years international experience, mainly in Africa. Prior to joining Banro in 2004, he was Managing Director of Ashanti Exploration (now part of AngloGold Ashanti) where he managed exploration activities throughout Africa. He played a major role in the discovery and development of the Geita mine in Tanzania. He also engendered tremendous loyalty among his staff there and the testament to this is the Tanzanian and Ghanaian geologists now found in Banro's main operations office in Bukavu and out in the field managing the four projects.

Each site has a Chief Geologist from either Tanzania or Ghana, all reporting to Dan Bansah, Vice President, Exploration. These African expats are helping to bring along Congolese into many responsible positions. For instance, there are now 38 Congolese geologists in the company.

Cleanliness and accuracy

In the city of Bukavu, under the management of Peter Kersi the Ghanaian Chief Geologist Mineral Resources, Banro's sample preparation facility is a model of efficiency with meticulous standards and is another great Banro example of integrating the local community – almost completely staffed by Congolese workers, all with science backgrounds. Day-to-day management of the facility is under a Congolese Laboratory Manageress, Marie Mongane Bahati.

The facility was designed by ALS Chemex and has adopted the best practices of ALS Chemex, SGS and Genalysis. The samples prepared here are sent to the SGS laboratory in Mwanza, Tanzania, for analysis, and the SGS work is periodically tested by Genalysis in Australia.

The operating procedures prior to sample shipments to the analytical laboratory include:

- Sample layout in ascending order by project and by sample type
- Insertion of blanks
- Sample drying
- Sample disintegration and sieving (for soil samples)
- Sample crushing
- Sample splitting and re-splits
- Sample pulverising
- Pulp packaging and dispatch to office
- Storage of splits
- Inserting of standards.

Quality control measures are put in at key stages to ensure that essential sample preparation requirements are met before dispatch to Tanzania.

Samples of about 3 kg in weight each are received from project sites, each with three tickets and a field dispatch sheet. The samples are in plastic bags and are packed into sacks of up to eight sample bags per sack. Samples sacks are labelled with their content and sample type is indicated on sacks as well as the accompanying field dispatch sheet. Upon receipt, samples are checked against the field dispatch sheet.

Layout: Samples are sorted and laid out in series. Each sample is emptied into a clean stainless steel drying tray together with the sample tickets. Sample tickets in the sample are checked to ensure that their numbers match those written on the sacks and also that the required number of tickets (three) have been included with each sample. Blanks are inserted using the pre-generated random number sheet – one blank inserted in every 50 samples.

Drying: Samples are dried in an electric oven; trays are stacked in an ordered manner onto drying racks. The content of every rack is recorded, and the racks are sent into the drying oven. Details of samples in the oven are recorded in the logging sheet, a copy of which is kept at the entrance to the oven. The oven has a pre-set temperature of 100oC. Samples are dried for at least six hours, depending on sample type and state.

Financed by the World Bank, this new road through the Twangiza-Namoya gold belt is an example of the region's improving infrastructure

Sieving: Soil samples received from the field are checked, dried, disintegrated using wooden mortars and sieved in 2 mm stainless steel sieves, the plus 2 mm faction is discarded and the undersize fraction is sent for pulverising. Sieves are cleaned between any two samples.

Stream sediment samples received from the field are water washed and wet screened in 75 micron stainless steel sieves. The -75 micron portion is dried in the oven. The sample is weighed and pulverised, then placed in a labelled pulp packet (up to 150 g) for dispatch to SGS for assay.

Depending on requirements, entire stream sediment can be sieved into various sized fractions, such as +5.6 mm, +2 mm, +1 mm, -1 mm and each of the different fractions separately processed. In this case the +5.6 mm and +2 mm are crushed prior to pulverising whereas the other fractions go straight to the pulveriser.

Crushing: Samples are logged in the crushing station logging sheet. Two sample bags are labelled for each sample prior to crushing. Entire trench, rock chip and core samples of about 3 kg are crushed to 80% passing 2 mm by a TM Engineering Terminator. The crusher is thoroughly cleaned with compressed air between samples. It is cleaned further (flushed) with blank (barren granite) after every tenth sample.

A quality control (QC) officer performs a granulometry test on every 20th sample to ensure that the crushing is done to the required particle size and percentage passing. Results are entered into the crusher quality control monitoring sheet. If any samples fail the test, the operator at the crushing station is alerted. The failing sample is recrushed after adjusting the crusher jaws. Up to three samples before and after the failed sample are checked to see if the effect was limited to the test sample or spread to other samples. One out of every 50 samples tested by the QC officer, is re-tested by a senior officer other than the initial testing officer as a check on the performance of the QC officer. Monthly time series plots are generated to review crusher performance by crusher QC monitoring.

Splitting/re-splits: The entire crushed/sieved sample is split into two parts on a clean stainless steel riffle splitter and both portions weighed to check equity of the two portions. One half of between 0.80 - 1.59 kg is taken and passed for pulverising and the other half is poured into an appropriately numbered sample sack and forwarded to the rejects station. Where the initial split does not give the required amount of sample, a re-split is done to obtain the required amount of sample. The splitter is thoroughly cleaned in between samples with compressed air and a brush.

Pulverising: Samples are logged in the logging sheet at the pulverising station (where TM Engineering and ESSA Australia pulverisers are used) and poured into clean B2000 low-chrome bowls with disc. The bowls are covered and samples pulverised for a pre-set time (depending on the quality of the samples) to obtain 90% passing a 75-micron screen. The chrome bowls and disc are washed with barren granite in between samples or washed with soap and water (using a cloth) when samples stick in the bowl.

The pulverised sample is poured into a stainless steel bowl and then into its plastic bag and shaken to homogenise the sample. Two pulps packets are pre-numbered with the same sample number as the enclosed ticket. Two pulp filled and weighed packets are fetched from the homogenised plastic bags and put into well labelled pulp packets, each of the two pulp packets is sealed and packed into two different (90 x 130 x 490 mm) boxes. One packet is for SGS and the other for the internal pulps store.

The remaining sample (pulp rejects) is sent to the reject station for storage. Pulveriser granulometry QC tests follow the same practice as crusher QC tests. One laboratory duplicate (pulp) is inserted in any batch of 20 samples sent to SGS.

Once samples have been prepared, the pulps are sent to the sample packaging and dispatch station. Each pulp packet is weighed and packed in an orderly manner into sample dispatch boxes. Each box is labelled with its contents (from-to numbers plus box and batch numbers). Point/sample numbers for insertion of reference materials are indicated on removable stickers placed on the boxes and spaces allocated for them in the boxes. The sample dispatch form (Laboratory – Office) is completed and the samples are dispatched to the office. The sample dispatch form includes information on points for insertion of Rocklabs reference materials. Reference materials are pulverised rock of known gold content, suitable for analysis. These are low cost, quality control aids used to monitor the analytical process.

Standard reference materials are selected by using the pre-generated random assay number sheets to determine which samples are standards (four standards are inserted in every 50 samples). The reference materials selected are printed out and the list is sent together with the samples to the standards insertion room (outside the laboratory). Up to 150 g of the selected reference material is placed, in previously labelled pulp packets, in the same manner as normal samples so as to conceal their identity. A standard sample packet is filled plus ticket then the sample is inserted in the reference material. The reference material is inserted into the appropriate box. For the already inserted blanks, their tickets are completed and inserted when the reference materials are inserted.

The interiors of the containerised laboratory areas are properly cleaned at the close of every shift. The open working area (300 m2) and laboratory offices are washed every day. The entire laboratory is cleaned once every week.

The laboratory's central dust extractor ensures that the interior of the laboratory is as free from dust as possible. Samples in pans on drying racks are covered with custom made covers to prevent dust from contaminating samples prior to crushing. The working area for soil sample disintegration and sieving is confined to control dust.

At its peak this facility can process 500 samples per day. Turnaround time in Bukavu is just one day, and the SGS turnaround is four days on receipt of the samples. So sampled core could see an assay result back in the Banro office within 10 days.

Banro saves considerable costs by producing its own samples, not shipping a lotl of waste weight to Tanzania, compared with having core shipped to Mwanza for sample preparation and assay. It also saves considerable time. Many projects around the world are waiting six to eight weeks to receive assay results.

Crushing and pulverising samples in the Bukavu facility

Where to look?

Banro re-commenced exploration activities in the region in November 2004, after an absence of some six years. "At that time," explains Mike Trenor, Chief Surveyor, "there was little in the way of useful, up-to-date topographic mapping available. Years of neglect and destruction of the national geodetic reference networks, and a paucity of infill mapping meant that Banro had to look seriously at an in-house mapping campaign."

A proprietary GPS-based survey network was introduced at the start of 2005. Reference beacons were established on the various projects, and a homogenous co-ordinate system was introduced. Geological mapping and sampling was done in the early days using differential GPS (DGPS) techniques. The survey department was established in September 2005. Some small-scale topographic work was carried out, and the diamond drill collars were surveyed in by dual frequency GPS and optical total station. However, Trenor notes "the overall requirement for current, accurate large scale mapping remained."

Aerial photography, satellite imagery, InSAR, SRTM and LiDAR (Light Detection and Ranging) were the possible mapping techniques investigated. It was necessary to define the mapping product that would

Difficult survey conditions

best suit Banro's present exploration and future development needs for Twangiza–Namoya before comparing the various techniques. The primary need was topographical mapping. Trenor wanted a DTM, from which contour maps, cross sections, and terrain visualisations could be extracted. "The DTM is also required for resource modelling, and modern mine design and civil engineering software packages."

"The preferred format is digital orthophotos (vertical digital photography from which lens and topographic distortions have been removed). From this imagery, conventional line mapping can be extracted by digitising features such as roads, buildings, etc. This imagery would also provide a useful baseline snapshot of the project areas, for geology, planning, compensation and environmental purposes.

"Initially, the requirement was for base mapping at a nominal scale of 1:5,000 with a DTM capable of delivering accurate contours at the 2 m interval. The orthophotos should have a ground pixel size of not more than 0.5 m. For consistency with existing survey and mapping, it was stipulated that all data be referenced to the Banro UTM co-ordinate system, with heights based on the EGM96 geoid model (or mean sea level)." A general specification of 0.50 m relative accuracy in position, with 0.30 m relative accuracy in height, was established.

The rainforest canopy and the problem of visibility through it ruled out aerial photography. For satellite imagery, it was estimated that acquisition would take 210 days, due to the problems associated with cloud cover in the region. The drawbacks with InSAR, or synthetic aperture radar mapping, were the cost, time to completion (estimated 15 months for the project), and below specification accuracy.

Trenor explains: "Airborne LiDAR, coupled with digital orthophotography, became the obvious choice." A contract with Southern Mapping was signed in April 2007, and the field crew arrived in Bukavu in May. "Despite some inclement weather, the entire 299,000 ha was flown in 15 days. Three months later, on August 21, the final data was delivered. LiDAR has delivered on its promise to provide Banro with accurate, detailed topographic information for the current and planned exploration campaigns, and for the newly instituted mine development phase."

He cites a number of "distinct advantages" for LiDAR:

- A dense survey co-ordinate model is produced, allowing accurate DTM and DEM products to be derived
- Accurate volumes can be extracted from broken ground (for example, informal open pits and badly eroded areas)
- The laser also reflects off and measures above-ground features, such as tree canopy, buildings and power lines
- Due to the relaxed requirement for ground control, survey of inaccessible or dangerous areas is facilitated
- Data acquisition is rapid and delivery of the final product appeared quicker than other techniques investigated
- Of particular interest to Banro – the laser is able to penetrate small gaps in vegetation and reflect off the ground below, affording a means of determining an accurate DTM in forested areas.

During the LiDAR survey, flying at 2,000 m above ground, the laser scanner made some 10,000 measurements every second, scanning a swath 1,600 m wide. "At the same time," Trenor explains, "the on board GPS and IMU logged data for the post-processing, and the 39 mega pixel digital sensor photographed the landscape below.

"Banro surveyors provided ground support in the form of GPS base data for the processing phase, from the permanent GPS base stations in Namoya and Lugushwa, and from roving GPS receivers for Twangiza, Kamituga and some of the hydro power sites."

In all some 60 GB of data were generated, including 3,550 digital orthophotos in ER Mapper's ECW format. The images were processed to remove cloud shadow, and mosaiced where necessary. Each image covers 1 km^2 and is geo-referenced to Banro's co-ordinate system. The processed laser points are classified variously into "ground" and "above ground" points and are filed in corresponding 1 km^2 blocks. Ground point density is dependant on vegetation cover. The 20 km^2 surrounding the main Twangiza pit, for example, comprise some 785,000 ground points.

LiDAR ground points are now the default ground/topographic DTM for general mapping, GIS, resource modelling and mine planning purposes. "The digital orthophotos," Trenor adds, "form a useful backdrop for various applications, and can be used for digitising."

A set of orthophoto maps at a scale of 1:5,000, with 10 m contours, is being produced for all project and hydro areas. Individual maps in the series cover 20 km^2, and plot on an A0 sheet. A live DTM is created for each sheet in ModelMaker, using the laser ground points.

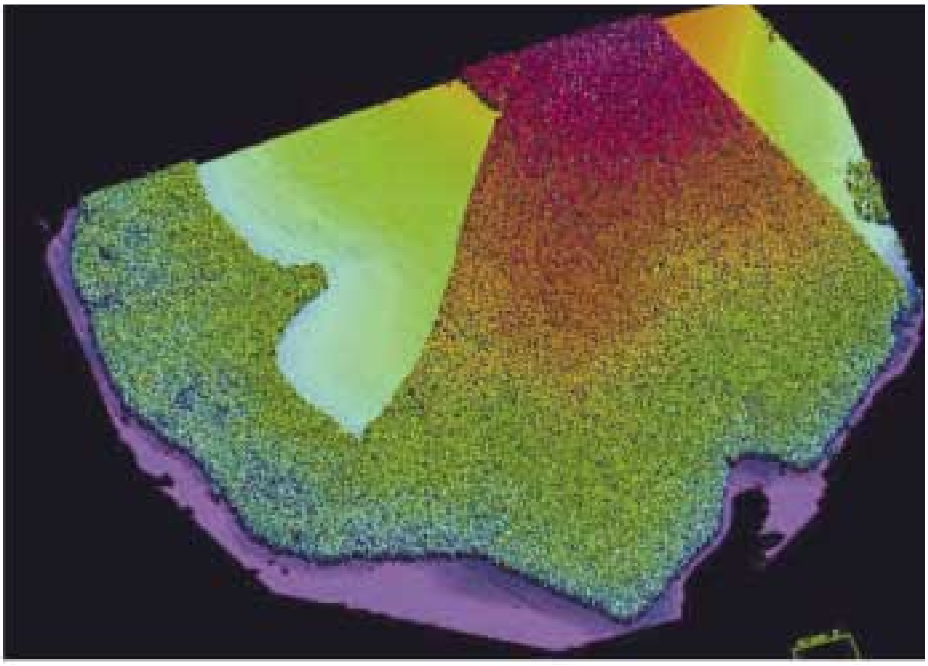
The recently initiated Regional Exploration Program uses the orthophotos for visual target identification. Regions of artisanal working are visible on the images. These are digitised, and where necessary, co-ordinates extracted for navigation and follow-up. The orthophoto images are also proving useful for geo-referencing historical geological information and maps.

Trenor is very enthusiastic about LiDAR: "Airborne LiDAR has come of age, and is set to become the de facto survey and mapping technique in the 21st century." He concludes that "in an area where there is little or no relevant topographic mapping, limited access, and dense forest cover, LiDAR is the proven technology. Data acquisition is fast, there is no onerous ground control requirement, and the delivered product has clearly met Banro's current exploration needs.

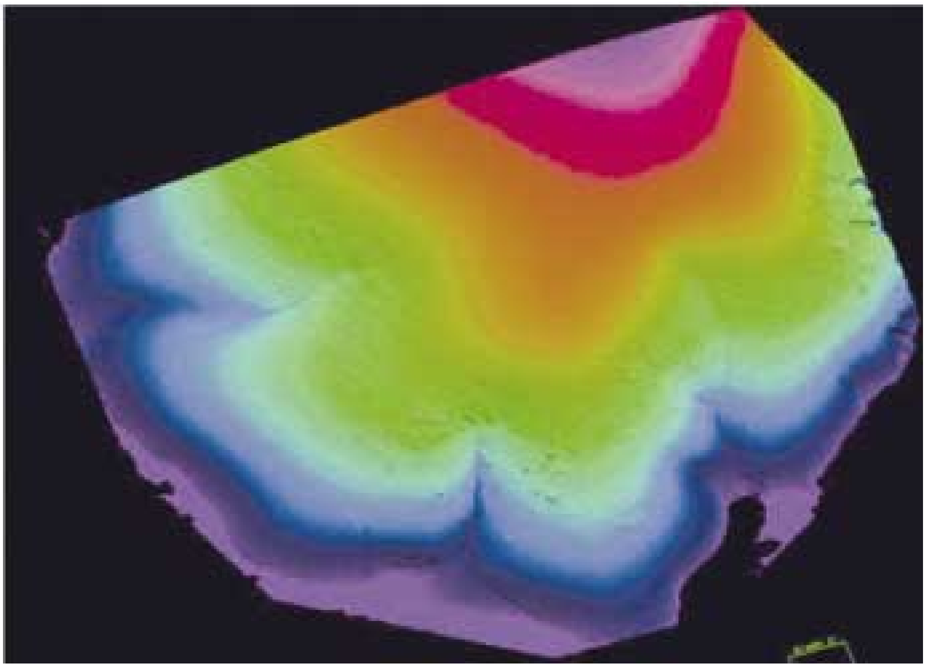
"On cost, LiDAR compares favourably with conventional aerial photogrammetry, and delivers a faster, better product than may be expected from satellite techniques."

By way of final comparison: an area covering the main Namoya deposits, (from Namoya Summit to Mwendamboko) was previously surveyed by conventional GPS and total station methods. "This was a fairly laborious task," he explains, "which included cutting lines through the forest, and traversing some fairly steep slopes.

"Apart from the obvious difference in productivity, it could be argued that LiDAR gives a better overall product, since the resultant DTM is based on a more random, higher density survey point model. The added benefit of the orthophoto imagery is not quantified here."



Above: LiDAR data with tree cover, below: LiDAR data without tree cover (note drainage detail)



Prefeasibility studies

Reflecting the fact that prefeasibility studies are underway, which will quickly move to bankable feasibility studies and construction, Mike Prinsloo, a mine developer with a strong track record, was appointed Banro's CEO in September 2007. He is starting to build a mine development team, continuing Banro's African traditions and looking to bring on Congolese as much as possible.

Twangiza is relatively close to a development go-ahead and discussing it with Prinsloo he clearly already has some very practical ideas for its future development – like consideration of two 2.5 Mt/y circuits with smaller mills rather than a single one for 5 Mt/y (and it could be three circuits for about 8 Mt/y). As he rightly points out, problems with a big milling circuit in a region like this might be manageable (but very uncomfortable) for a major, but could kill smaller companies.

Namoya will follow shortly after Twangiza becomes operational. At this scoping study stage, Banro is looking at combined first year output of 600,000-800,000 oz. Both start as open pits, with great potential at depth. Metallurgy is relatively simple, but extra gold may well be recoverable from Twangiza by employing some of the latest technologies.

Namoya and more

The Namoya Measured and Indicated resource is almost 1 Moz, with another 600,000 oz Inferred. Studies have optimised three open pits – Namoya Summit and , running northeast, Kakula and Muviringu/Mwendamboko. More ounces will be generated at a number of promising prospects like Kangurube (the current priority), which is within 2 km of Namoya Summit. Then there is Seketi, very close to the proposed plant site, west of Kakula, and Kakula West.

The three Lugushwa PEs cover an area of 641 km^2 and are located approximately 150 km southwest of Bukavu. Within Banro, Lugushwa is considered to be the "sleeping giant." Back in 1999, SRK estimated four deposits there to amount to 18.3 Mt at 3.12 g/t Au (for 2.7 Moz). After months of no drilling, two drills started turning there in January 2008. And unlike Twangiza and Namoya, it may be possible to effectively use RC and/or RAB drilling here. Furthermore, while all three projects have extensive artisanal operations, Lugushwa's is probably the largest – if that can be considered an indication of future potential.

Comparison of ground survey and LiDAR methods

Density	(Points/ha)	Speed (ha/d)	Cost	Cost per Point
Ground Survey	24	3	$100.76/ha	$4.21
LiDAR	799	529	$1.78/ha	$0.002

Example of LiDAR laser point penetration of forest (see Figure below).

It should be noted that Banro has good relationships with all artisanal miners on its areas. Eventually, when they have to be moved from the sites (those that do not finish up as employees), this will be done in a compassionate manner and should result in a better quality of life for all, and much better local environmental management.

The first three projects have villages nearby (and there is the town of Namoya about 7 km distant from that project), but Kamituga borders a large town, of that name. It lies some 100 km southwest of Bukavu and the project consists of three PEs covering an area of 649 km^2. It is the most mature of the four properties, having previously been the site of major alluvial and underground mining operations.

Gold was first reported in the Kamituga region during the early 1920s with the discovery of alluvial gold. At the closure of the Kamituga operations in 1996, about 1.5 Moz of gold had been produced from alluvial and hard rock mining.

Banro's independent geological consultant, SRK, noted in its February 2005 report: "...there is much evidence to support the wide scale occurrence of gold mineralisation. Most of the work to date has been confined to the area surrounding the Mobale mine and very little appears to have been conducted throughout the remaining area of the concession." That report, outlined a mineral resource estimate, using a 1 g/t cutoff, of 7.26 Mt at 3.9 g/t Au (915,000 oz of gold). Serious Banro exploration is only just starting here, but is certain to be thorough and will no doubt generate many more ounces. ***IM***