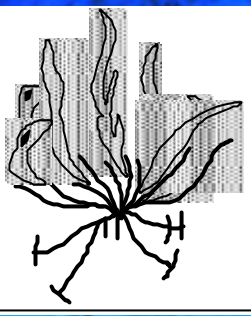
Geological Society of Zimbabwe



# Summer Symposium

**8am to 5pm, Friday 28th November 2008**
**Department of Geology**
**University of Zimbabwe**

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**Zimbabwe Geological Society Summer Symposium 2008**

28th November 2008, Department of Geology, University of Zimbabwe

Registration free for members (non members must join) Lunch $10 or 10litres fuel

| Start | Topic | Speaker |
|---|---|---|
| 08:00 | **Registration** | |
| 08:15 | Welcome | Collins Mwatahwa, Chairman Geological Society |
| 08:25 | Opening | Dr Teddy Zengeni, Dean of Science |
| 08:45 | Summary of Geological Society Activities | Forbes Mugumbate, Vice -Chairman Geological Society |
| 09:05 | Status of Training in Zimbabwe | Kudzai Musiwa, Mining Engineering Department |
| 09:25 | Ultra-Detailed Aeromag - new insights into the Perseverance Nickel Belt | Mike Kellow, ACR |
| 09:45 | **Tea** | |
| 10:05 | Inherited Drainage | Richard Owen, MRC Geology |
| 10:25 | The Indigenisation of the Mining Sector In Zimbabwe, A Reality Check And Practical Perspective | Paul Chimbodza |
| 10:45 | Challenges Facing the Industry Going Forward | David Matyanga, Chamber of Mines |
| 11:05 | Some pointers in planning and executing a drilling programme for Resource Evaluation purposes | Gayle Hanssen, Digital Mining Services |
| 11:25 | Amari Manganese - Kalahari Manganese Field | Andre Botes, AMARI Resources Group |
| 11:45 | Deep drilling on the Great Dyke – the agony and the ecstasy | Tarisai Marazani, Zimplats |
| 12:05 | Structural Setting And Control Of Gold Mineralisation In The Eastern Limb Of The Harare Greenstone Belt | Daniel Chatora, Metallon |
| 12:25 | History of Oil and Gas Exploration in Zimbabwe | Forbes Mugumbate, Geological Survey |
| 12:45 | **Lunch** | |
| 14:00 | Mapping and Inventory Unit – Forestry Commission | Joseph Muchichwa, Forestry Commission |
| 14:20 | Breakthrough in the Analytical Performance of Hand Held XRF | Lynsey Singh, Bruker South Africa Pty Ltd. |
| 14:40 | Use of a Niton XRF machine in determining the position of the BMSZ (Base of Main Sulphide Zone) in PGM Mining | Fred Hlasi, Unki |
| 15:00 | Soil Geochemical Exploration (Burkina Faso – Case Study) | Vimbai Chakanetsa |
| 15:20 | **Tea** | |
| 15:40 | Open Pit Operations and Grade Control at Ngezi Mine | Carlton Muchechetere, Zimplats |
| 16:00 | Todal Mining Overview | Luckstone Saungweme - Todal Mining |
| 16:20 | Fumure - Meteorite Crater? | Tim Broderick |
| 16:40 | Summary | Francis Podmore |

# Activities of the Geological Society of Zimbabwe

**Forbes Mugumbate, Vice -Chairman Geological Society**

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The Geological Society of Zimbabwe was formed in 1981. It used to operate as a sub branch of the Geological Society of South African from 1962 until a resolution was passed which enable it to operate as an independent body.

The primary objectives are to promote geological research, teaching, exploration and mining in Zimbabwe. It acts as a forum for geological talks and field trips.

The society has 4 categories of Membership namely Honorary, Ordinary, Associate and Institutional Membership. The society welcomes new members to enhance and increase the diversity of our science.

The Society sponsors reseach activitities through the GSZ Reaserch and Development Fund and awarding of the Phaup Award. It also awards scholarships to Honours Students from the Geology Department when the honours programme is running.. The best student from the School of Mines is awarded the Mike Vinyu award.

The Geological Society is actively engaging various stakeholders in the Mining Industry through the Geology Lecture Fund Project to ensure that the earth sciences departments meet their objectives in the teaching of the science amid the lack of resources.

During the year, the society has organised a series of events

| | |
|---|---|
| 13th September 2008 | Mountain View Gold Project - Bindura Greenstone Belt on the Granite Contact. |
| 4th October 2008 | Mutare River Alluvial Gold Project |
| 25th-26th October 2008 | Fumure field trip (possible meteorite impact site) |

The Summer Symposium has developed into a successful annual event.

# Status of Training in Zimbabwe

**Kudzai Musiwa**

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There are only two training institutions in the country namely the University Of Zimbabwe (UZ) and the Zimbabwe School of Mines (ZSM) situated in Bulawayo. The main mining related department s at the two institutions are Geology, Mining, Metallurgy and Surveying. ZSM offers diplomas and Higher National Diplomas while the University of Zimbabwe offers degrees.

Academic staff in-post has declined and continues to decline from the monthly. The situation seems fluid, and almost unstable, with no apparent policy to alleviate the situation. The staffing situation in the departments at the two institutions is summerised below.

| **INSTITUTION** | **DEPARTMENT** | **ACADEMIC STAFF IN POST** |
|---|---|---|
| UZ | GEOLOGY | 1/18 |
| | METALLURGY | 1/17 |
| | MINING | 2/19 |
| | SURVEYING | 2/12 |
| ZSM | GEOLOGY | 0 |
| | METALLURGY | 4 |
| | MINING | 0 |
| | SURVEYING | 1 |

The academics in post are not sufficient to teach Geology, Mining, Metallurgy and Survey, or other courses linked to these disciplines. The important and superb mining and metallurgy laboratory remains closed. Geology, Mining and Metallurgical Engineering, and Survey at UZ did admit new students in 2008, and Geology did not admit new students in 2007.

The need for graduates in the mining disciplines remains. These problems will constrain mining operations in the future and the mining industry and the training institutions have to work together in order to avoid a total collapse of the programmes at the training institutions.

## Ultra-Detailed Aeromagnetic Surveys – New insights into the Perseverance nickel belt.

**Mike Kellow**

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Developments in minaturisation of aeromagnetic systems, and new non-metallic aircraft construction, means that lightweight payloads can now be mounted on a new-generation composite aircraft. These fiberglass aircraft have few magnetic parts and provide a very low-noise platform for aeromagnetic equipment. The new aircraft, with stall speeds below 40 knots, are well suited to flying "low and slow" surveys to obtain highly detailed data. Data density of 50m x 5m is easily achieved.

Data from the Perseverance nickel belt gives detail down to individual layering in the Perseverance ultramafic sill, and is allowing re-interpretation of geology and structure in the belt. In particular, repetitions of the ultramafic may lie concealed below Deweras cover.

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## Inherited Drainage

**Dr Richard Owen**

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## The Indigenisation of the Mining Sector In Zimbabwe, A Reality Check And Practical Perspective

**Paul Chimbodza**

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The talk centres around the hype that has been generated in indigenising the mining sector. It will touch on how ripe (if at all) we are for this eventuality, the opportunities, the hurdles, stakeholder participation and a practical perspective of how I see this subject going into the future.

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# Challenges Facing the Industry Going Forward

**David Matyanga**

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I have been requested to present to you the obvious, as we have experienced the challenges facing our industry first hand over the past 10 years or so. The mining industry has been subjected to an adverse operating environment that has eroded the production base of an industry once considered one of the best in Africa. A mixture of poor policies and inconsistent application of these policies has presented considerable challenges in the operation of mines, resulting in declining production levels for almost all minerals.

The abandonment of ESAP around 1996 created the foundation for the problems that has faced the economy to this day. Although government produced a number of economic blue prints that included the ZIMPREST 1996-2000, the Ten Point Plan, Millennium Economic Recovery Programme (MERP) 2000 (18 months programme), National Economic Revival Programme (NERP) 2003 – 2004, Macro-Economic Policy Framework 2006 – 2006 and National Economic Development Priority Programme (NEDPP) 2006 – 2007, these initiatives failed to provide the need bedrock for the economic development of the country. These economic blue prints all had similar focus of controlling government expenditure, reform of public enterprises, civil service reform, trade and exchange market liberalization, support to productive sectors among others.

It appears that government was unable or unwilling to implement the policies contained in these blue prints. In some cases there was reversal of policies as in the case of civil service reform, exchange market liberalization and trade liberalization. The establishment of incomes and pricing commission dealt a final blow to the concept of free trade.

These developments impacted on all sectors of the economy and the mining sector was not spared. Factors that affected the mining sector most included the overvalued exchange rate, shortages of foreign currency, electricity supply interruptions, delayed payments of revenue due to gold producers for gold lodged with Fidelity Printers and Refiners and skills flight.

In this environment the institutions that regulate the mining industry became more unresponsive to issues affecting the industry. This was due to loss of professionals within government structures and general apathy that pervaded the institutions.

On the legislative front, the notice to amend the Mines and Minerals Act given in 2004 has to date not been completed. This created an air of uncertainty regarding the security of investment and the intentions of government. Although the mining sector was invited to participate in the formulation of the amendments government was not too keen in revealing their positions and to engage private sector in real debate on these amendments. The product that went to parliament had significant differences to the ideas proposed by the private sector in some instances.

The supply sector has been greatly eroded by the shortages of foreign currency on the official market. This has affected walk in customers more as large scale operators provide foreign currency for importation of their requirements or import on their own. The restocking of the industry requirements, given the global credit crunch, will take time.

Training and academic institutions have been unable to carry out their mandates. The low remuneration levels availed to lecturers and other critical staff has been a major disincentive in the generation of competent graduates. The country is unable to provide the human capita

needed to turn around the economy. Given the global shortage of skills and professionals for the mining sector, the attraction of the needed capital will be a big challenge. The way forward is to train now for our future requirements.

Attracting investment will be a challenge given the cut backs in production currently being experienced world wide. The world economy is expected to start turning around by the third quarter of 2009, if not later. This provides an opportunity for the country to lay down a credible track record on policy application that is needed to provide confidence to investors.

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# Some pointers in planning and executing a drilling programme for Resource Evaluation purposes

**Gayle Hanssen**

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A resource evaluation drilling programme should be executed with thought and precision in the initial stages to allow for all the data to be used in future resource evaluation exercises. A qualified person, a geoscientist with over 5 years experience in the relevant mineral should oversee all stages of the programme and be prepared to commit to signing off the final report. A resource model aims to give the best possible estimation of grade given the information available at the time. The primary information used is drilling.

The following factors are considered essential:

1. **Location of drill holes** – this includes an accurate survey of the collar location in relation to the local grid and down hole surveys. Unknown deflections can distort the 3-D model and hamper the geological interpretation, as can inaccurate placed holes.
2. **Geological Interpretation –** which hangs together from section to section. Generally if there are some uncertainties, more drilling is required and statistical methods tend to give inconclusive results.
3. **Grade** – drill sampling should be done accurately and methodology recorded well. Duplicates and standards inserted will give the accuracy and precision of the assay laboratory, which should have some form of recognised independent accreditation.
4. **Densities –** have a considerable influence on the tonnes of rock and the tonnes of contained metal. These should be measured for different lithologies and oxidation states.

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# Amari Manganese - Kalahari Manganese Field

**Andre Botes and Philip le Roux**

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The entire Kalahari Manganese Field in South Africa was previously held by Samancor and Assmang and their respective predecessors since the 1920's. As a result the field saw relatively little exploration and exploitation as is evidenced by South Africa accounting for only 20% of world manganese production whilst holding 70-80% of the world's high grade resources. The introduction of the South African Mineral and Petroleum Resources Development Act No 280 of 2004 (SAMPRDA) resulted in the opening up of the Kalahari Manganese Field to other players. Notable new entrants were Renova and Arcelor-Mittal.

During October 2007 Amari Resources International Ltd (Amari) acquired a 74% interest in the manganese prospecting rights held by Pico Diamonds (Pty) Ltd (Pico) and Adistra 11 CC (Adistra). held by Amari and 26% by its BEE partners, Pico and Adistra. Amari Manganese now holds the manganese prospecting permits for five farms in and around the Kalahari Manganese Field. However, only two of these overlie manganese deposits at economically exploitable depths, namely Kongoni 311 (Kongoni) and Boerdraai 228 (Boerdraai).

The Kalahari Manganese Field is a compact (approximately 30km by 15km) deposit that houses 70% to 80% of the world's high grade manganese resource located some 300km north-west of Kimberley in the Northern Cape Province of South Africa. The area is very well served with infrastructure since manganese mining operations have been conducted in the area for the past 50 years along with the large scale iron ore mining at Sishen approximately 30km to the south.

The manganese deposits of the Kalahari Manganese Field occur within the Hotazel Formation of the Transvaal Supergroup. The Hotazel Formation comprises Banded Ironstone Formation inter-bedded with three manganese horizons. Of these, the lower five to six meters of the lower body normally represents the economic ore horizon. On Kongoni, economically exploitable Mn ore also occurs in the Upper body. The ore horizon varies in depth below surface from 300m in the east to more than 1,000m in the west on Kongoni.

Amari Manganese is currently conducting a Pre-Feasibility Study (PFS) for Kongoni and drilling on Boerdraai.

# Deep drilling on the Great Dyke – the agony and the ecstasy

**Tarisai Marazani**

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Zimplats' Ngezi Mining Lease (ML27) was extended some 27km north of Portal 10 into an area that differs from the southern Ngezi portals that are currently being mined in that a much higher level in the Great Dyke is preserved here. Among the rocks that the dyke intruded in this area are greenstones and not just the granites that dominate its host rocks elsewhere. Numerous xenoliths and roof pendants are also preserved especially in the northern part of ML27 Extension and the effect of these on the PGM bearing main suphide zone (MSZ) is not understood. Very little past drilling was carried out and the majority of it was scattered along the edge of the dyke with a cluster of holes around Rio Tinto's Zinca trial mine in the early 1980s. The bulk of this deep drilling area therefore has no prior drilling information.

The deep drilling programme was therefore initiated with the following as some of the objectives:

- To give an understanding into the influence on the MSZ of the inclusions of the country rocks
- To give insight into the ultimate depth of the MSZ in the deep areas
- To confirm the disrupted profiles in the extreme west and to allow the limits of this area to be refined and possibly to allow the extent of the disruption to be deduced.
- To give some information regarding the nature of younger dolerite intrusions (the drilling resolution is however, too coarse to give any details regarding local intrusions and disruptions)

The deep drilling programme targets 24 holes with a 1km spacing in between holes along 3 lines that are 8km apart. In the 12 holes have been drilled so far and a lot of departures from the norm have been noted and in some cases the results have raised more questions than answers. The 12 holes drilled so far comprise 7 along the southern line, and 5 along the central line. The following are some of the issued encountered so far.

1. Compression of the P1 pyroxenite in the west
2. Unusual lithologies (intrusions)
3. Hybrid rocks
4. Deeper than anticipated MSZ
5. Untypical MSZ geometry (possible departure from the circles model)
6. Sampling complications
7. Other drilling challenges

Even more departures from the norm are expected in the northern line holes as there are numerous roof pendants there.

# Structural Setting And Control Of Gold Mineralisation In The Eastern Limb Of The Harare Greenstone Belt

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The Harare Greenstone Belt (HGB) is a typical gold-quartz vein district. The Eastern Limb of the HGB is separated from the north-western limb by the south-western extension of the Umwindsi Shear Zone (USZ). It is dominantly composed of metamorphosed basaltic and subsidiary ultramafic rocks of the Arcturus Formation.

Three major increments of regional deformation are interpreted in the district. $D_1$ is essentially represented by tight to isoclinal folding on easterly axes. $D_2$, which represents the bulk of the penetrative strain in the district, is characterized by NE- ENE trending fold axes accompanied by shearing, related to northerly to north-westerly directed shortening. $D_3$ has produced minor buckle folding with northwest axes.

Brittle ductile shear zones in the district are grouped into three orders. The USZ, a first order shear zone, is defined by 2 major sub-parallel shears up to 3-4 km apart. Striking in a north-easterly direction, this sub-vertical shear zone exceeds 100km in strike length. Second order shear zones are typically 3-6 km long and less than 300m thick; they are parallel to sub-parallel to the sub-vertical NE-ENE structural trend. Third order shear zones, to which gold-quartz veins are associated are less than 2 km long and typically several metres wide and are generally oblique to the structural trend.

The gold –quartz vein deposits consist of networks of 3$^{rd}$ and 2$^{nd}$ order shear zones made up of shear veins in, moderate to steeply dipping faults and shear zones, and dominantly easterly moderate – to steeply dipping extensional shear veins (mostly 3$^{rd}$ order).

The development of the gold-quartz veins and shear zones is attributed to a late increment of $D_2$ episode of regional deformation. Besides the $D_2$ regional control, local factors which may be related to the local geologic setting of the deposit influence the orientation and geometry of the vein networks.

The consistent geometric and kinematic relationships shown by the gold-quartz veins and associated shear zones provide some plausible predictive capacity that can be used to generate some geometric scenarios useful in efficient exploration for similar deposits.

# History of Oil and Gas Exploration in Zimbabwe

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All known hydrocarbon occurrences in the world occur in sedimentary basins younger than 300 million years. This is the period when life started to flourish on earth. There are three sedimentary basins younger than this age in Zimbabwe. These are the Karoo (150-300 million years), Cretaceous basins (50-140 million years), and the Kalahari basin (4-50 million years). The Karoo and the Cretaceous basins have received much interest in respect of potential for hydrocarbons at different stages in the history of this country.

**Save-Limpopo basins**

Following the late 1940s publication of a Geological Survey Bulletin describing some coalfields in the southern part of the country, several companies acquired EPOs to carry out exploration for the coal. EPOs 25, 30, 50, 112, 228, 393 and 492 gave exploration companies the rights to explore for hydrocarbons in addition to coal in the Save-Limpopo basin. However no reports of oil and gas encounters were reported although there were several drill holes sunk to explore for coal.

**Project X, Gonarezhou National Park**

Following the imposition of economic sanctions on the Rhodesian government by the United Nations, the government embarked on a secret oil exploration programme code named Project X in the Cretaceous sediments of the Gonarezhou National Park from 1967 to 1971. The Geological survey was tasked to carry out the surveys. Five hundred samples were collected for biochemical analysis, which purportedly indicated the presence of hydrocarbon micro-seeps in six areas. Of the six suspected seepages, one was considered to be positive. Following this, gravity, radiometric and seismic surveys were conducted. The seismic surveys indicated that the basin was neither folded nor faulted, which precluded the possibility of oil traps. A 1 100m hole was drilled to below the Cretaceous. Information from the drill hole was destroyed, although data available indicates that the results were considered insufficiently encouraging, and the project was abandoned.

**Bendezi Forest prospect**

The Bendezi Forest area in Nyamandlovu was investigated for hydrocarbons following prophecies by a Mr. A. Hill. A drilling site was selected where presence of oil beneath the ground was forecast. An area of 2 500ha was reserved under S.G. 555 in 1974 for the purpose of prospecting for hydrocarbons. Despite advice on the unlikelihood of oil being found in the area, at least in economic quantities, the company commenced drilling in 1975. No noil was discovered.

**Zambezi Valley Mobil Exploration**

After realization that the thickness of the Zambezi basin could be attractive for hydrocarbon occurrences, Mobil Exploration acquired a licence over an area of 30 120 $km^2$ to explore for hydrocarbons from 1989 to 1993. The exploration generated a wealth of information including: the thickness of the basin; although the reservoirs have abundant good parameters are abundant, traps are scarce; the most widespread source rocks are carbonaceous shales and coal; source rocks with liquid potential were also identified, although limited in extent. Mobil concluded that the area is high-risk gas prone. This was corroborated a Germany Geological Survey (BGR) expert who analysed Mobil data and carried out extensive field. The eastern part of the Zambezi basin was considered to have a capacity 226 x $10^9$ $m^3$ recoverable gas and

95.4 x $10^6$ $m^3$ recoverable condensate. In total, a conservative estimate of 614 x $10^9$ $m^3$ of recoverable gas was given for the whole of the Zambezi Basin.

**Microbial Prospection for Oil and Gas (MPOG)**

Geo Associates, a local company has applied for Special grants to explore for Hydrocarbons in the Karoo sediments of the Lower Zambezi Valley and the Cretaceous sediments of the Gonarezhou area using microbial based oil exploration technique known as Microbial Prospection for Oil and Gas (MPOG) developed in the former East Germany. The basis of MPOG is that oil and gas fields emit a continuous stream of hydrocarbons on the earth's surface. Certain bacteria feed on these. MPOG exploration involves searching for areas of anomalous occurrences of the bacteria. This method has been found to be very successful, with success rates of well over 90%.

**Coal bed Methane**

Coalbed methane is a gas that is generated during the process of coalification. Much of the gas remains adsorbed onto coal particles. All coalfields are potential methane gasfield, but there are certain physical conditions required for coal to have utilizable gas. The combined surface area of coal particles make coalfields carry gas quantities many times more than that from conventional sandstone gas and oil fields. Coalbed methane has been utilised successfully in the USA since the 1970s. In Zimbabwe Shangani Energy Exploration pioneered exploration for CBM in the early 1990s in the Lupane area. Fieldwork and laboratory analyses have indicated a world class CBM resource. Conservative estimates for the Lupane area indicates gas resources in excess of 100 000 million $m^3$.

**Post-independence refuted oil discoveries**

Numerous claims of supposed oil discoveries have been brought to the attention of the Geological Survey on several occasions, with oil being reported in most unlikely rocks such as granites and gneisses. Most of these reports are made by people who claim to have some divine or spiritual powers. Such people have proved to be very difficult to work with as they disbelieve or mistrust scientific explanations. However all finds of this manner were proven to be unfounded, and these reports have merely resulted in being a waste of time and effort to both people concerned and the Geological Survey. The most recent such report is a claim by a spirit medium that pure diesel oozes from rocks close to Chinhoyi, a most unsuitable geological environment, as the rocks are very old and metamorphosed. Another report in the late 1990s was from a Murehwa spirit medium which went on to hire a drilling rig despite advice against doing so. Other reports investigated by the Geological Survey in recent years include reports of oil at Tsungai School in Highfield, a report from Buhera, Rusape, and Hwedza.

# Mapping and Inventory Unit – Forestry Commission

**Joseph Muchichwa**

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Until recently,Zimbabwe did not have comprehensive information on the distribution of the vegetation resources at national level. The few existing maps were either too coarse for macro-level planning or were related to intensively managed forest areas. For example the Wild and Barbosa (1968) map produced at 1:2.5million scale is based on the floristic potential and not the actual extent of vegetation cover.

Zimbabwe Forestry Commission in conjunction with the German Development Co-operation (GTZ) launched the Vegetation Resources Information System project in June 1993. The overall goal of the project is to establish a Vegetation Resources Information System (VegRIS) for improved planning, management and sustainable utilization of vegetation resources in Zimbabwe. This information system will allow effective and continuous updating of vegetation data, which are important for decision making in environmental policy, land reforms, and forest management in Zimbabwe.

The main objectives of the VegRIS project are to:

. produce national woody cover maps at 1:250 000 and 1:1 000 000 scales;
.establish a digital database of the woody vegetation cover;
.develop methodologies for monitoring vegetation changes;
.develop methodologies for local level inventories;
.strengthen institutional links for sustainable management of natural resources;
.disseminate the resulting information.

The project uses modern tools such as Satellite Remote Sensing (SRS), Geographic Information System (GIS) and Global Positioning System (GPS) in order to provide most up-to-date information on the country's vegetation resources. The project was scheduled to last four years, divided into two-year phases. During phase I baseline information was generated, whereas Phase II is targeted for user oriented applications such as change detection, local level inventories and land use planning.

# Breakthrough in the Analytical Performance of Hand Held XRF

**Lynsey Singh**

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Bruker announced a technology breakthrough with the introduction of the new TRACERturbo$^{SD}$ , the world's first handheld X-ray Fluorescence (XRF) instrument that uses a Silicon Drift Detector (SDD) for dramatically improved speed, sensitivity and resolution. Bruker's industry-leading proprietary XFlash™ SDD, previously available only in high-performance laboratory XRF instruments, now offers unprecedented speed and analytical specificity when integrated into the novel handheld TRACERturbo$^{SD}$.

With this announcement, Bruker builds on its long tradition of being the technology leader in the handheld XRF industry.

This detector will provide a major improvement in the analytical performance of handheld alloy analysers. The measurement precision will be improved by a factor of two to three times, in addition to making the measurement of light elements such as Mg, Al and Si possible when operating in air mode. This breakthrough technology has previously been available only in large laboratory analysers. The TRACERturbo$^{SD}$ will provide a new capability of measuring aluminum in titanium alloys and magnesium and silicon in aluminum alloys, with no vacuum or helium required.

Now all handheld XRF customer segments can benefit from these compelling performance advantages in their analytical work.

Advantages:

- Fastest alloy ID on the market!
- Measure Mg, Al & Si without vacuum or helium attachments
- Provides grade ID and chemistry
- Largest alloy library on the market
- Bruker-NASA patented vacuum attachment gives best precision & accuracy

# Use of a Niton XRF machine in determining the position of the BMSZ (Base of Main Sulphide Zone) in PGM Mining

**Fredrick Hlasi**

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The Great Dyke of Zimbabwe, a layered igneous intrusion of mafic and ultamafic rocks, hosts PGMs in the first cyclic unit of the ultramafics (p1 unit). PGMs are associated with base metal sulphides (pyrrhotite, pyrite, chalcopyrite and pentlandite) with a base metal sulphide profile showing three major peaks from the mafic / ultramafic contact, two in plagioclase websterite and one in plagioclase pyroxenite, which is in the Main Sulphide Zone.

Marking of the BMSZ, which coincides with the platinum peak has been a challenge, this led to the trail of the XRF machine as an aid to BMSZ marking. Visually the BMSZ is marked by a significant tapering off of base metal sulphides from around 10% to about 2% in the main sulphide zone.

The XRF machine emits x rays thus should be treated as a short gun, never point it at anyone, should always be pointing down.

Cu and Ni readings (path finder elements) are taken along a marked profile at 5cm intervals from the h/w to the f/w of the MSZ or along a sampled cut channel, which are then used to determine the position of the BMSZ (where the Cu, Ni values tappers off). Profiles are marked at 3m intervals avoiding the following zones

1. Joint plains sub parallel to declines or face.
2. Altered zones.
3. Closely jointed zones.
4. Faults.
5. Shear zones.
6. Dykes

The XRF and laboratory values show a low correlation but in both data sets there is a marked drop of Cu and Ni values at the BMSZ, thus the XRF machine is quite handy in marking the BMSZ faster and cheaper (less channel samples, reduction of mining cycle, important decisions made right on the face).

# Soil Geochemical Exploration (Burkina Faso – Case Study)

**Vimbai Chakanetsa**

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Soil geochemical exploration is one of the important tools used in modern mineral exploration. The technique needs sufficient background information for a correct analysis and interpretation of results. A good understanding of the geomorphological set-up of the area is key to an effective use of geochemical exploration.

A lot of false geochemical anomalies have been generated and because of ignorance, further exploration has unnecessarily wasted time and money of the most exploration companies.

Goldsearch Technical Services was contracted to do an evaluation of some geochemical targets in Burkina Faso and shall use this exercise to show some of the mistakes that can easily be made in geochemical mineral exploration.

It was observed that the area in question has transported massive ferricrete overburden ranging in depth from 1m to 5m. The massive ferricrete overburden had a sharp contact with the highly sheared metapelitic sediments (mainly slates below). The zone with the geochem anomaly has an average depth of ferricrete of about 3m.

The massive ferricretic overburden overlying the highly sheared metasediments has the following implications:

- The soil geochem sampling was done in the ferricretic overburden that does not have a genetic relationship with the shear zone metapelite. The depth of sampling pits observed is barely beneath 50cm. This implies that the assay values produced are not a reflection of the gold content of the targeted shear zone but of the transported ferricretic horizon. On this basis, the geochem soil sampling done is discredited as any piece of information on the target area generation.
- Gold in shear zones is mostly syn-deformational. This means that gold is emplaced during deformation. The massive ferricrete implies that it was emplaced after deformation (post deformation). This further rule out the ferricretic horizon of any chances of having any traces to genetic mineralization in the shear zone.
- The soil geochem sampling was also done in an area with massive panning sites which was targeting only the ferricretic horizon as shown below.

# Open Pit Operations and Grade Control at Ngezi Mine

**Carlton Muchechetere**

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Zimplats' Ngezi Mine Operates three Underground mines and an Open Pit. The Open Pit is the first PGM Open Pit operation in Zimbabwe and presented its own challenges with respect to mining and grade control.

Large volumes of materials are moved and an average of 90 000t of ore is produced monthly. The Open Pit started operations in June 2001 and production started in Dec 2001 with a designed ore to waste strip ratio of 1:12.

The Grade Control protocol faced a lot of challenges in managing faults, intrusions and dilution from the top and systems were put in place in managing these challenges and these have proved successful. An Audit system was also put in place to verify the effectiveness of these grade control techniques.

# Todal Mining Overview

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Todal Mining Private Limited was incorporated in April 2008, as a joint venture between the Zimbabwean Mining Development Corporation ("ZMDC") and Central African Mining and Exploration Company Plc ("CAMEC"). CAMEC is a diversified mining company with mining operations and exploration ventures in the Democratic Republic of Congo, Mozambique, Zimbabwe and the Sudan.

Todal's primary purpose is to develop the 18km$^2$ of platinum mining claims, located near Shurugwi, collectively registered as the Bougai and Kironde claims. The mining cla ims were acquired by the Government of Zimbabwe from Anglo American Plc ("Anglo"), as part of the Government's Indigenisation and Economic Empowerment policy.

Based on historical work conducted by Anglo the mining claims contain mineral resources in the order of 135mt of PGMs @ 3.5g/t (4E) with economic traces of nickel and copper. The mineral resource is relatively shallow, at a maximum depth of approximately 200m.

From an initial evaluation the resource lends itself to relatively quick and easy development due to the proximity of tarred roads, power supply, water resources and a ready labour source in the towns of Shurugwi and Gweru. As such Todal intends to expediently establish an operating mine. The mine could conceivably be setup to produce at 140,000 tpm of ore, given the nature and extent of the deposit. The prospect has been named the Bokai Project, after a prominent hill of spiritual significance in the area.

Todal intends to complete a bankable feasibility study by early 2009, from which a mine construction timetable will be determined.

To this end, to date some 4,000m of diamond drilling has been done to evaluate the deposit, though the resultant assays are yet to be evaluated. Preparation of an environmental impact assessment is well advanced. Mine design and metallurgical plant designs have been commenced. And discussions have been brokered for the concentrate off-take arrangements.

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# Fumure – A new meteorite Impact Structure for Zimbabwe?

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The anomalous 2 km-diameter circular topographic feature dominated by Fumure Hill in Ndanga Communal Land north-east of Bangala Dam and east of Renco Mine is imposed across the distinct north-north-easterly structural trends that characterize the North Marginal Zone of the Limpopo Mobile Belt. The feature was discovered during an aerial photograph interpretation for ground water potential in the Mshawasha Small-Scale Farming area north of the Mutirikwe River in 1999. Announced in the Geological Society Newsletter, a field trip to verify the possibility of a new impact structure was mooted. This eventually took place at the

close of October 2008 when a small group of Society Members were able to coincide with a visit by Dr Sharad Master, now a specialist in meteorite impact structures, who kindly drove up from Wits University to be with us. The enthusiasm and hospitality shown by the Renco geologists is much appreciated.

Only the 15-20 km-diameter Highbury structure in the Umboe Valley and the small Sinamwenda crater have been associated with meteorite impacts in Zimbabwe. Such features are now realized to have had a distinct influence on geological expression and process at the surface of all celestial bodies. However, the recognition of impact features on Earth is frustrated by the dynamics of surface processes that modify and obscure their original expression. Criteria needed for the confirmation of an impact origin include crater morphology, geophysical expression, evidence (usually petrographic) for shock metamorphism and the presence of meteorite fragments. Simple craters are usually less than 4 km in diameter and are bowl-shaped whereas wider-diameter craters usually display a central structural uplift. The bedrock on impact is fractured and brecciated and the rim may be overturned and enhanced by the accumulation of allogenic breccia derived from ejecta from the crater. The degree of erosion around the crater may result in the loss of this ejected material and the down grading of *in situ* fractured and brecciated rock towards more competent bedrock. This seems to be the case at Fumure where only discontinuous suggestions of *in situ* brecciation were found, especially in the more brittle quartzitic rocks that often have a mylonitic texture relating to shearing within the Limpopo domain. The northern rim of the Fumure structure corresponds to a well-foliated, blocky magnetite quartzite that has remained resistant to weathering and erosion. It appears to have been warped and to have been displaced by radial, post-impact fractures. Gneiss and mafic granulite that occupy the floor of the basin trend without disruption across the enclosing topographic rim and are also brecciated in places. No evidence for the presence of allogenic breccia was found, suggesting that if Fumure is of impact origin, it has been deeply eroded and is therefore of considerable age. A number of rock specimens were collected for petrographic study, notably relating to the nature of the breccias, the possibility of there being planar deformation features (PDF's) present and the assessment of the character of quartz and other minerals. A combination of criteria may result in Fumure being added to the growing list of African impact structures. A nickel anomaly associated with soils and mafic granulite has been geochemically defined and drilled by both percussion and diamond methods.