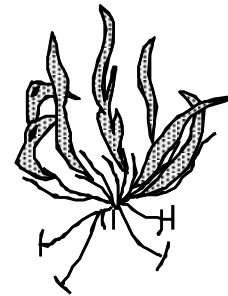

Geological Society of Zimbabwe



Newsletter



October 2011



*Aerial detail of the Bhima Mine (Portal 4) area at Ngezi
PHOTO: Zimplats courtesy of Andrew du Toit*

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The Committee, on behalf of the Geological Society of Zimbabwe, would like to offer a sincere vote of thanks to Marion de Beer of *Cadline* for preparing and printing our Phaup Award certificates for 2009 -- free of charge. This is, as previously, a wonderful gesture of Marion's time and skills and we can only encourage all you geologists and mining houses to steer your Autocad mapping work in her direction and to take advantage of at least 30 years of hard-won cartographic experience. *Cadline* also offers monochrome printing and scanning services in formats up to A0. Their telephone contact is 04-2917261/60 Tel/Fax is 04-301855 and the address is 94B Pendennis Road, Mount Pleasant in Harare. marion.debeer@cadline.co.zw

Editorial

This is the mid-term, pre-symposium issue of the Geological Society of Zimbabwe's Newsletter for 2011. Therefore, I ask you to take note of the line-up of presentations for the 25th November Symposium tabulated elsewhere in this communication. We are happy to announce the acceptance to be with us of two keynote speakers, Andy Moore and Ben Mapani, who are both old friends. Their presence promises to make the Symposium the highlight of the year, and we ask you to make every effort to attend the event. Andy Moore will lead a field trip to Domboshawa and Ngomokurira north of Harare on Saturday 26th November.

Our reports include the abstract to Dr Maideyi Meck's thesis, who with Mrs Lupankwa, are congratulated for being the latest recipients of their respective PhD degrees in the Geology Department. Coincidentally the obituary to Dr Clive Stowe records the life of one of the earliest lecturers in that Department, indeed he was one of its corner stones. We extend our condolences to Clive's family and acknowledge their help given in compiling his life story, one that has been submitted for wider distribution in *Geobulletin*, the Newsletter of the Geological Society of South Africa. Indeed, your Society is looking to re-forging our relationship with the Geological Society of South Africa, an initiative that should emerge in discussion at the Symposium. I say *re-forge* as it must not be forgotten that the origins of our Society in 1963 were as the first regional branch of the Geological Society of South Africa.

We acknowledge Mark Tsomondo's leadership of the field trip to the Midlands Greenstone Belt in late September and Ali Ait-Kaci's presentation on his involvement in coal exploration in Madagascar. Coal is currently a *hot topic* in Zimbabwe due to the renewed exploration initiatives being practiced on our coal localities. Ali's talk serves to impress the need for the application of exacting standards and well thought out exploration programmes, which could lead to the effective establishment of new collieries and careful utilization of our coal resources. Mark's trip was a natural progression from last year's Belingwe trip led by Tony Martin, and we welcome his new ideas in the developing understanding of the geology of the Zimbabwe Craton.

Thanks too are extended to our usual news contributors, who keep us in touch with progress at the Geology Department, the Geological Survey and within the Mining Industry of Zimbabwe. Forbes Mugumbate's careful assessment of events affecting the industry may well help to quell the unease that exists amongst many when it comes to understanding the machinations that are subduing investment and progress in mining in Zimbabwe when in effect we should be taking full advantage of favourable gold and platinum prices and turning our economy around. The plea to revive aggressive efforts in mineral exploration must be headed, for no new mines will emerge without encouraging the application of risk capital and energy that are requisite.

We note with pleasure that the student's Mennell Geological Society has revived with the beginning of the University Year in August, and we encourage them in their endeavours. Note should be taken of possible funding opportunities for projects and research through the Tim Nutt Memorial Fund, supported by the Society of Economic Geologists, and through your Society's own Rand Fund. *Tim Broderick*



Chairperson's Chat

Houda Bouammar

Houda is presently in Algeria on a long awaited reunion with family and friends.

Articles and Reports

DISPERSION OF METALS AND IMPACTS OF MINING ALKALINE ROCKS ON WATER QUALITY IN THE SAVE HEADSTREAMS OF ZIMBABWE

A thesis Presented to the Department of Environmental Science

UNIVERSITY OF BOTSWANA

**In Fulfilment of the Requirements for the Award of the Degree of
DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL SCIENCE**

by

MAIDEYI LYDIA MECK

MARCH 2011

SUPERVISORY COMMITTEE

Dr. J Athlopheng, Prof. W. L. R Masamba

ABSTRACT

The work presented here investigated how metals disperse in alkaline environments and how water quality is impacted by the mining of alkaline rocks. The study area is Dorowa Mine in the Buhera District in eastern Zimbabwe around 19°04'S; 31°46'E. The Dorowa ring complex contains an extensive natural anomaly of metals related to the occurrence of igneous rock phosphate. This study investigated the fate of the metals and the net effect of these metals on water quality of the nearby Save River which is a source of water for domestic use, stock watering, recreation, fishing and irrigation.

Field mapping, observation and analysis of sediment, water and rock and image processing were used to collect primary data. Secondary data was collected from mine documents including annual reports, policies, water analyses, production log sheets and literature on the mine. Rocks, mill feed, slimes, tailings, products, soils, sediments and waters were sampled using standard procedures. They were analyzed by probes, XRF, XRD, AAS, Ion chromatography and ICP MS. Landsat TM images for 1984, 1995 and 2005 were used to assess the land use, land cover changes in the study area.

The results show that the major minerals at Dorowa are feldspars, pyroxenes, apatite, magnetite and calcite. The rocks, sediments and soils around Dorowa contain the metals Cd, Co, Cu, Fe, Mn, Ni, Pb, Sn and Zn. The rocks with the highest metal levels contain magnetite, calcite and apatite. The metals are dispersed downstream and down slope from the tailings into the small stream sediments but not into the Save River. The local conditions are buffering drainage thereby; metals attenuate before they reach Save River. Geochemical modelling with *Visual Minteq* to estimate metal activities show that at the prevailing conditions cadmium, manganese and cobalt are 100% dissolved while the rest of the metals are almost completely precipitated in the range of 92.9 to 100%. Thus cadmium, manganese and cobalt are mobile and available.

Due to metal attenuation, there are no transboundary impacts arising from the metals released during the phosphate mining taking place at Dorowa. However, the metals are adsorbed to the sediment, the transportation of which can act as a source of pollution. WASP modelling and simulation of sediment transport over a 10-year period showed that a total sediment volume of 375 000 m³ will have been transported from the small stream to the Save River.

LULC analysis shows very clear changes on a local scale. There is an indication that these local changes may lead to acidification of soils and waters in the study area providing a risk of dissolving metals currently bound in the sediments being subsequently released to the environment. Simulation with lower pH shows that the species of metals present and the total precipitated will be affected, with the exception of manganese and copper.

OBITUARY

Clive William STOWE, 1931-2011



Dr Clive Stowe, a man who was dedicated to his career as a geologist, would have been influenced by his great grandfather, George William Stowe MD, FGS (1822-1882), who emigrated to South Africa and landed in Port Elizabeth in December

1843. George William was a keen historian and became interested in the geology of the Eastern Cape, publishing his pioneering works in the Journal of the Geological Society. The Government of Griqualand West invited him and F.H.S. Orpen, the Surveyor-General, to map a portion of that country in 1872 and the results were published in the Quarterly Journal of the Geological Society of London in December 1874.

The influence was infectious for Clive's father, de Lacey H. Stowe moved to the Midlands of Rhodesia where he was an accountant and Secretary to the great Globe & Phoenix Mine before he himself became the owner of two small gold properties, the Kaka and BF mines. Clive was born on 17th April 1931 in Que Que (Kwekwe) and grew up on farms near Gwelo (Gweru), the first being a smallholding, Fernleigh. He had two brothers and a sister, Olive. They had a carefree upbringing in the wide-open spaces on the farms and this gave Clive his love of the wilderness. Clive was schooled at Chaplin in Gwelo where he excelled academically and enjoyed cricket. His father then owned a large furniture store in the town and became a town councillor until 1950. de Lacey and his wife Laura then bought and moved to a large mixed farm, New Haven.

This was the year that Clive entered Rhodes University in Grahamstown to follow his passion for geology. The cursive script of Professor E.D. Mountain records Clive's consistently high marks through to the award of his Honours Degree in 1953. Perhaps at the instigation of his mentor and colleague, Hugh Eales, Clive joined Frobishers back in Rhodesia and worked at the Connemara gold mine between Que Que and Gwelo. This was when he developed his enthusiasm for sailing and he learnt to glide. He then joined Anglo American in Northern Rhodesia where he enjoyed his initiation to geological field work in the vast open bush he so loved. It was in late 1958 that Clive joined the Rhodesia Geological Survey and was immediately assigned the area west of Selukwe (Shurugwi) in his native Midlands Province. Working to the east around Mashaba was James Freeman Wilson, and to the west Neil Harrison was mapping the Shangani area. Coincidentally Peter Cotterill, as chief geologist to Union Carbide's Rhodesian Chrome Mines, was leading an aggressive diamond-drilling programme to extend the understanding and reserves of the Archaean podiform chromite ore bodies there. Selukwe had been the first mapping task set by the Geological Survey in 1911 when H.B. Maufe, Ben Lightfoot and A.E.V. Zealley achieved a remarkable initial assessment of this complicated structural setting, further refined by Ronnie Tyndale-Biscoe in his 1949 publication of the geology east of Gwelo. With geologists such as these greats to pit his mind against, Clive set about mapping and structurally analyzing the geology around Selukwe where he recognized three terrains, the highly deformed and linear Ghoko ranges cutting across less deformed gneissic blocks constituting micro-cratons and, east of the Surprise Fault, the allochthonous nappe structures of the Selukwe Schist Belt where he regarded a 'metasedimentary' Mont d'Or Series as being the oldest and lowest unit. Cotterill believed the greater portion of the Mont d'Or to be tonalitic and intrusive into the nappe structure. Needless to say both personalities gained their coveted PhD degrees, Clive in 1968 through the University of London, coincident with publication of Bulletin No. 59 of the Rhodesia Geological Survey and associated papers read at the Symposium on the Rhodesian Basement Complex and published as an annexure to Volume 71 of the Transactions of the Geological Society of South Africa.

Geoffrey Bond had become the first Professor of Geology at the University College of Rhodesia and Nyasaland in 1960. He needed lecturing strength in the fields of Archaean and structural geology and in 1963 persuaded Clive Stowe, together with Linley Lister (née King) as a geomorphologist, to join his fledgling department. Clive's lecture load included structural geology, the Archaean and economic geology as well as geological mapping techniques on the 3rd year field trips. Perhaps the universal comment from his students is that he was a quietly spoken, unassuming person whose significant intellect and knowledge became most apparent to undergraduates in their 3rd and 4th years, and to postgraduate students who worked with him. For instance he showed infinite patience in explaining and reiterating the practical use of the Schmidt net in structural analysis until the beautiful simplicity of this tool dawned, yet he was perplexed that students found the concept difficult. Then it was with them forever as were wonderful distillations on economic geology compressed into a short lecture course. One of his students says he has applied to good avail the notes from Clive's single lecture on petroleum resources to his 20 years in the oil and gas industry of Alberta, a subject the local boffins take 4 years to learn. His practicality in detail for field mapping allowed an assessment of the Red Bed Karoo succession at Sinamwenda on the shores of Lake Kariba and a structural elucidation of the Lomagundi Group near Sinoia (Chinhoyi). He supervised a number of Honours Degree projects in the Proterozoic Magondi Belt, before shifting the 3rd year structural mapping course to the Sanyati River Gorge where a 100% exposure of the mélange zone is displayed with a horizontal mylonite showing conjugate kink folding beneath the Urungwe Thrust plane.

Clive broadened his research into the Archaean of the Rhodesian Craton and in 1971 presented a paper to the First Archaean Symposium in Perth when he outlined its tectonic development and was the first to propose that the geological complexity was greater than the tri-partite subdivision of greenstone belts that had been mooted by A.M. Macgregor in 1951. He also presented on his Selukwe observations at the Granite '71 Symposium staged by the Rhodesian Branch of the Geological Society of South Africa in Salisbury. It was arguably Clive's finest moment when he led his international peers on the field excursion to the exquisite exposures of gneiss in the Gwenoro Dam spillway where he had unravelled thirteen separate geological events. Clive undertook reconnaissance mapping of the little understood Rhodesdale granite terrane and identified a sequence of pluton emplacement as well as assessing the influence of wrench tectonics craton-wide. Both subjects were published in the Transactions of the Geological Society of South Africa, the former earning Clive the enviable Jubilee Medal in 1981.

The time had come for Clive to extend his academic career and he left the University of Rhodesia in 1978 to join the team at the University of Cape Town and to expand his research within the sphere of their Precambrian Research Unit, which had been established in 1963 under the directorship of Dr Henno Martin but was now headed by Piet Joubert. With Piet and colleague Chris Hartnady Clive broadened his research into the regional extent of Proterozoic tectonic provinces and the crustal evolution of south-western Africa. Much of his work was in the Namaqualand Metamorphic Complex along the Upington Geotraverse in the Northern Cape, and many of his ideas on the relationship of the Kheis Belt to the Magondi of Zimbabwe have been expanded in an extraterritorial study on the extent of the Early Proterozoic Magondi Belt and its equivalents by Sharad Master from the University of the Witwatersrand.

Hartnady took over directorship of the PRU in 1988, but sadly circumstances called for its dissolution in 1994. By 1995 Clive had expanded his lecture load in the department to that on structural geology, tectonics and engineering geology, the latter subject being inherited on the resignation of John McStay but one in which Clive was to consult extensively, notably on jointing in the Malmesbury Group exposed in the Harbour area in Cape Town. His interest in economic geology allowed Clive to co-author with Bob Foster and others on their treaties on Archaean gold mineralization in Zimbabwe for the *Mineral Deposits of Southern Africa* volumes in 1986, and in 1987 he edited a book on the *Evolution of chromium ore fields* published by Von Nostrand Reinhold of New York. He himself wrote the contribution of the chromite deposits of the Shurugwi Greenstone Belt, Zimbabwe.

Clive met Marjorie on a blind date, and they were married in 1965 in Natal before moving to Salisbury. They had two children, Megan and John, and the family lived in the suburb of Mount Pleasant until their move to the Cape in 1978. They loved their time in the Cape and spent numerous weekends at Hermanus where Clive could follow his own love for boating, fishing, whale-watching and having picnics. They walked and toured extensively and every day Clive would walk with his German Shepherds and members of his family in the Tokai Forest. Even then he was able to offer an opinion on the eradication of pines in favour of the 'fynbos' in the Tokai and Cecelia plantations by advocating that urban sprawl was more to blame for the threat on species and that a scientific management plan should encompass the whole ecological picture with all inter-relationships between geology, soils, hydrology, plants, animals and people being considered.

By 2007 Megan and John had both left home and had families of their own in the UK and Australia respectively. Clive and Marjorie moved to Howick in KwaZulu-Natal to be close to their respective siblings. They continued to enjoy walking and their visits to the south coast. Clive passed away with all his family, including his four grand children around him on 13th May 2011. We salute the man who put so much of his life and passion into his chosen profession.

Clive Stowe was elected a member of the Geological Society of South Africa on 9th May 1955. He was transferred to Life Member on 27th November 1998 and became a Life Fellow on 11th November 2009. Clive was an Honorary Member of the Mennell Society, the students geological association at the University of Zimbabwe.

Tim Broderick and Megan Poulton-Stowe

**A REPORT ON THE GEOLOGICAL SOCIETY OF ZIMBABWE
FIELD TRIP TO THE MIDLANDS GREENSTONE BELT
Led by Dr Mark Tsomondo, 24th September 2011**

A group of 10 geologists from Harare and Bulawayo made it to the rendezvous point at the Golden Mile Hotel in Kwekwe by 0930 hrs on the appointed day: These were:

Mark Tsomondo	Field Guide (Harare)
H. Bouammar	Society Chairperson (Harare)
H. Gumbo	(Harare)
F. Mugumbate	(Harare)
B. Mupaya	(Harare)
Ali Ait Kaci	(Harare)
R. Chirwa	(Bulawayo)
J. Dube	(Bulawayo)
Bishi	(Bulawayo)
D. Chatora	(Harare)



Mark Tsomondo has been carrying out research in the Midlands Greenstone Belt (MGB) for more than 10 years. Following a briefing on the theme of the field trip the group proceeded to the Hunters Road Project to start the day examining an outcrop showing the base of the Upper Bulawayan in pit 1. Here we were able to see

a sequence of a silicic tuff litho-facies deposited on older Sebakwe-type granitic terrain. There is a gradual upward increase in the number of cherty argillite bands. The sequence is capped by what Mark refers to as the Manjeri-type BIF, with no unconformity observed.

We were also able to examine the Reliance-linked komatiitic sill, which is associated with the Hunters Road nickel deposits.

Subsequent stops on the trip showed evidence for the symmetry of these exposures with formations of the Belingwe Greenstone Belt. The sedimentary facies of the basal Manjeri Formation was deposited under fluvial to shallow marine conditions and include alluvial fans and fan deltas. These were capped, and sometimes inter-layered with bimodal volcanic lithologies.

Where some of the middle limb sections were absent in three anticline-syncline pairs examined in the study area, these anomalies were explained through evidence for thrust excision.

In the end everyone left with no doubt that, as for the Belingwe Greenstone Belt, rifting, arc magmatism and collision have played their respective roles in the evolution of the MGB.



Mark in full swing – Midlands Field Trip, September 2011

Daniel Chatora

Field Trip Theme to the Midlands Greenstone Belt (MGB), Kwe Kwe

Field Guide: Mark Tsomondo (0773-935 780 or 0772-134 881)

Date: 24th-25th September 2011

Rendezvous: Golden Mile at 09.00 hrs

Key Theme: *The Midlands Greenstone Belt (MGB) is the longest on the Zimbabwe craton (ZC). This belt holds the key evidence for **sedimentary and volcanic basin analyse** that permits reconstructing the plate tectonic evolution of a convergent continental margin and back-arc basin, two elements of a **new EXTENSIONAL ACCRETIONARY OROGEN MODEL FOR THE ZIMBABWE CRATON**. The 'supra-subduction' extensional model can produce the necessary crustal thinning to generate primitive mafic rocks and still provide enough continental crust as a source of the isotopically evolved ARC granitoids (see contamination by xenocrystic zircons, Wilson *et al.* 1995).*

There are at least 2 contending models for the tectonic evolution of granite-greenstones of the ZC:

1). The ensialic **model or vertical tectonic model** interprets the Belingwe Greenstone Belt and its correlatives on the ZC as set in intra-continental rifts that were linked to a deep-seated mantle-plume (Bickle *et al* 1975, Hunter *et al*, 1998; Wilson *et al.*1995; Horstwood *et al*, 1999, Prendergast, 2004, etc). *Weakness:* *This popular model understates significant compositional variation across and along strike yet such extreme compositional variability is a feature of Phanerozoic convergent margin settings.*

2). The other model regards the Upper Bulawayan volcanic sequence above the basal Manjeri Formation as **allochthonous oceanic plateau** (Kusky and Winsky 1995, Kusky 1998, Hoffman & Kusky, 2004) or part of **the lateral terrane accretion model** of Dirks *et al* 2002; Jelsma and Dirks 2002. *Flaw:* *These ideas employ complex structural and tectono-stratigraphic evidence that is rejected south of the Sebakwe River (as will be seen in the field) and in Belingwe (see Blenkinsop *et al.* 1993).*

As we shall appreciate better in the field, controversies over the above 2 models reflect contrasting descriptions or explanations of the same facts or geological extrapolations beyond the constraints of the field data. Moreover models of continent formation at Phanerozoic convergent plate boundaries include **BOTH** vertical accretion, via under- or intra-plating of arc magmas from the mantle wedge, as well as the lateral accretion of juvenile oceanic arcs or oceanic plateau, or subduction-accretion complexes.

Irrespective of which model is correct, there is a recognition that accretion of sorts occurred around an ancient 3.5 Ga Sebakwe protocraton (from about 3.0 Ga to 2.6 Ga) with addition of younger granitoids and bimodal mafic to felsic volcanicity both west and north of the protocraton through either vertical accretion (Wilson *et al* 1995) or subduction-related arc magmatism to the north-west (Jelsma and Dirks 2002). The complication here is that granitoid magmatism (3.35 Ga Mont d'Or and 2950 Ma Mashaba tonalites, 2600 Ma Wedza and Chilimanzi suites) and volcanism (2740 Ma Upper Bulawayan eastern succession (Prendergast (MDP) & Wingate) also occurred intra-protocraton, such that the inferred polarity of growth by arc magmatism or

vertical accretion is problematical. Such problems indicate that the cratonization processes of the Zimbabwe craton remain unclear until, perhaps, an orogenic cycle of **rifting, magmatism and collision** is resolved.

The ONE-DAY Field Trip aims to make a case for the following points:

- 1) The felsic Koodovale Formation and its equivalents in the MGB forms the conformable base of the western succession of the Upper Bulawayan Supergroup (Prendergast, 2003, Tsomondo – this study)
- 2) The Manjeri–Reliance–Zeederbergs triad formations of the Belingwe Greenstone Belt are, contra Dirks *et al* 2003, recognizable south of the Sebakwe River (this study)
- 3) The Manjeri Formation BIF is an exhalative unit draping over the silicic Koodovale Formation (eg MDP) and the platformal Manjeri basal beds of rudite-arenite (MJT).
- 4) The field definition of a **back-arc basin** comes from the recognition of rifting, and **asymmetric sedimentation** on opposite limbs of synclinoria-anticlinoria, such that platformal Manjeri-type basal beds (on the cratonic side) are broadly coeval with Koodovale silicic volcanism to the west. Volcanic arc-derived detritus from the west and continental detritus from the east are observed on opposite limbs: the same asymmetry applies in the Belingwe greenstone belt. Note MDP's (2004) N-S line separating platformal from "basinal" facies of the Manjeri Formation defines the proto-craton margin from magmatic arc components further west.
- 5) Bimodal volcanism is a feature of rifting in both Lower Greenstones and the Upper Bulawayan Supergroup. We shall see the Dalling Mine agglomerates that are interlayered with mafic volcanic rocks. Rifting is common to the ensialic and to the extensional accretionary model that we propose here.
- 6) BIFs are not '**tectonic ironstones**' (Dirks *et al.*, 2002, Hoffman *et al.*, 2003) marking thrusts in the MGB or at Shurugwi. The postulated 10 fault-bounded tectono-stratigraphic units south of the Sebakwe River are incorrect. **This field trip is about mapping genuine major thrusts (4).**
- 7) Rather, there are 3 anticline-syncline pairs with missing middle-limbs due to thrust excision. The thrust vergence is east (greenstone-over craton) not east-over-west as postulated by Dirks *et al* 2002. (Shear-hosted gold mineralization in the G & P and Gaika mines show a late east over west reverse sense shear that we can also see in parts of the Shamvaian Group; see also Campbell & Pitfield (1994) in the Kadoma area). *It is not that thrusts do not exist, but the proponents of lateral terrane accretion have not demonstrated good criteria for mapping and recognizing major thrust faults in the MGB, and elsewhere (eg. Belingwe).*
- 8) The 3 anticline-syncline pairs are cored by ca. 3.5 Ga basement granite slices. Two of these granitoid slices were mapped as grits by Dirks *et al.*, 2002.
- 9) The 3 granite slices that core young folds South of the Sebakwe River are taken as evidence for **earlier rifting** that produced narrow (300 m-wide) granite slices several kilometers in length.
- 10) Structural facing based on pillowed basalts is exceptionally well-preserved south of the Sebakwe River; we shall examine outcrops of uniformly west-younging pillow lavas adjacent to major thrusts **that excised the entire Manjeri-type Formation**. A special structural reconstruction is required to produce uniformly west-younging sequences (see also, Campbell and Pitfield, 1994) in thrust-fold duplicated sequences.
- 11) The elements of an orogenic cycle have not yet been demonstrated for the Zimbabwe Craton, yet we now know **that rifting, arc magmatism and collision** played a role. That is the importance of the MGB in establishing a rigorous and modern view of plate tectonics on the Zimbabwe Craton. Subduction-related arc magmatism (*sensu* Jelsma & Dirks, 2002) is important but the postulated allochthoneity or granite-greenstone tectonic imbrication is regionally incorrect or based on controversial criteria (e.g. tectonic ironstones and ambiguous foliation relations).

Coal Exploration in the South of Madagascar

Ali Ait-Kaci Ahmed

Ali is visiting Zimbabwe and was kind enough to present, at short notice, a well prepared Power Point discussion to members and students at the Geology Department, UZ on the afternoon of 16th September. Ali has been involved with management and supervision of exploration for coal, diamonds and other commodities in south-west Madagascar on behalf of a Thai-based company SAKOA – Pan African Mining for the past few years. The coal tenements are some 220 km east and inland from the southern port of Tollara. Plans have progressed for the construction of a mine, washing plant, power facility, harbour and communications between the deposit and the port, but are yet to be implemented. The Karoo rocks are preserved in three structurally controlled basins, which hold a north-easterly trend and dip, fairly steeply, at 20 to 30 degrees to the west-north-west. These are the Morandare Basin in the south, the Malijanga Basin and the Antsianawa Basin in the far north. The exploration license covers eight structural blocks, some of which have been drilled to JORC resource or reserve standards. The basal Karoo beds are glacial, being overlain by a multi-seam Coal Measures sequence and these are capped by a Red sandstone series. Higher up there is evidence for a minor marine incursion from the west, which is highlighted by the Votilia Limestone Member.

The coalfields were discovered in 1908, and between 1926 and 1929 they were investigated by means of trench and adit by the French. A small underground mine produced 70,000 tonnes of coal between 1941 and 1945, and between 1948 and 1958 the coal was further probed by diamond drill by French Services Geologique. Madagascar gained its Independence from France in 1960. SAKOA took out its license and have applied two phases of diamond drilling to exacting JORC standards. A corps of Thai and Madagascan professionals have been managed in the field, in the establishment of a detailed database and in an in-house coal laboratory. At least three of the prospective blocks have been drilled in primary and infill phases. The company has calculated its own resource figures whilst consultants Badger Mining have used the information in a detailed feasibility study. Initially open pit mining is planned with a strip ratio that allows a pit or pits to a depth of up to 150 metres before underground mining is contemplated. Progress was interrupted to some extent by the 2008 political crisis in Madagascar, but exciting prospects are in the offing.

Tim Broderick

News



Geology Department, University of Zimbabwe

Maideyi Meck

Though the Department did not take new students in August, the semester has started well. Courses for part 1 to 3 are being run to cater for all repeating students. It is now a requirement at the university that every lecturer should have a minimum qualification of a PhD. For us to run a masters course the Department should have a staff comprising 60% PhD holders. This means that it may be a while before Geology can run their Masters Degree course again.

The good news from the Department is that Mrs M.L. Meck was awarded her Doctorate in March 2011 by the University of Botswana. Mrs K. Lupankwa was awarded her PhD by the University of Zimbabwe in August 2011. Mr Pardon Kanyezi and Mr Victor Owen have finalised their proposals for MPhil studies. Dr Meck in her thesis looked at the “dispersion of metals in alkaline ring complexes”. Dr Lupankwa looked at environmental impacts of metals dissipating from the Trojan and Madziwa mines. Mr Kanyezi will be looking at the petrography, geochemistry and geochronology of the Sebakwian Group rocks in the Tokwe Segment. Mr V Owen will be looking at the geology, geochemistry, spatial distribution and grade of mineralization around the Jay’s Luck Mine in the Kadoma Greenstone Belt, Zimbabwe. Any assistance in the form of supervision, funding or joint field trips for these two projects would be greatly appreciated.

The Department has finalised their move from the BSc General Degree to a BSc Honours Degree and the proposal is currently being considered by the Regulations sub-Committee. Any suggestions on what to include in the course content for the proposed new BSc Honours in Geology Degree are still welcome.

The Part II field trip to Chinhoyi was successfully held from the 11th to 20th June. The Part III field trip is currently being planned. The Department is currently running short courses for the mining industry. The popular courses are Geology for non-geologists and diamond exploration and identification.

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Note: DG – Department of Geology; MRC – Mineral Resources Centre; GSZ – Geological Society of Zimbabwe



ZIMBABWE

Geological Survey Department

1. Introduction

The Department saw some improvement in its funding by mid-year. As a result field trips were undertaken to mines in Kadoma, Maramba and Nyanga, revealing quite significant mining activities.

Senior management attended several mining meetings, which included possible areas of co-operation between the Zimbabwe Geological Survey (ZGS) and Japan on training in Remote Sensing. This will see several ZGS geologists undergoing training at the Botswana Geological Survey in Lobatse. Results from the Chimanimani Regional Geochemical Survey undertaken by China Geological Survey were released to the ZGS in August 2011. Five anomalies for gold and base metals were detected and show possible epigenetic Cu-Au mineralization in the Chimanimani-Chipinge region.

2. Staff Development, major meetings and courses attended

Name	Position	Course/Training/meeting/capacity	Venue/ Comment
T.M Hawadi F. Mugumbate F.B. Mupaya F. Muzanenhamo	Director D. Director Chief Geologist Senior Geologist	Mining Indaba conference	Harare
F. Muzanenhamo	Senior Geologist	Presented a paper on Dimension Stone in Zimbabwe at the AGM for the Mine Surveyors' Association of Zimbabwe	Kadoma
F.B. Mupaya	Chief Geologist	Board meeting for the Pan African Minerals Development Company	South Africa
S. Mpindiwa	Senior Geologist	Training course on radiation protection	Uganda

S. Lunga	Senior Geologist	Short Course on Economic Geology	South Korea
L. Shawarira	Geophysicist	Short course on Ground Water	“ “

3. Progress in Data Acquisition and Management, and on the Provision of Services

Geological mapping (S. Lunga and A. Mudzi)

Finally, digital copies of the 1:1 000 000 topographical map were found at the Surveyor General's Department. Scanned copies of 1:100 000 geological maps have been filed for geo-referencing during compilation of the long awaited 1:1 000 000 geological map of Zimbabwe.

Unfortunately, the tender to facilitate helicopter-borne high-resolution geophysical mapping of the eastern part of the country, omitted in a previous aeromagnetic survey of the country, has been shelved due to administrative issues.

Mines visited (M. Mangezi and T. Kashiri)

Kadoma District

1. The Good Hope Claims
 - Located NE of Chakari on a splay of the NE-trending Lily Shear Zone.
 - Mining has not yet commenced on the property, but exploration pitting is in progress.

Zhombe District

1. The Denald Claims
 - Hosts a 50–150 cm-wide quartz vein that dips at 45° to the SW in basaltic greenstone of the Mafungabusi Greenstone Belt.
 - Average recovery grades are 5.2g/t.
2. The Vizier White Claims
 - Hosted in the Maliyami Formation andesitic lavas. Quartz ore bodies strike from North to South.
 - There are encouraging average gold grades of 7.0 g/t over a 40 cm width.

Nyanga District

1. The Matiz Gold Claims
 - The gold claims host quartz veins averaging 3g/t over 50cm in the Umkondo Quartzites, an unusual gold occurrence.
2. Newco milling Centre
 - A newly established 3-stamp gold milling centre near the Gairezi River. Most of the ore comes from the Ethel Mine area.

Geological data Management and Archiving

150 Library books, 4 Technical Report files, and 10 EPO reports were added to the ABCD data base. The new database was agreed in Botswana at a SADC Libraries workshop to be the standard for the region.

3. External Relations

The following organizations visited to discuss mutually beneficial relationships:

Korea Institute of Geoscience and Mineral Resources (KIGAM)

Although an MOU jointly drafted by the Zimbabwe Geological Survey (ZGS) and KIGAM has not yet been signed, the ZGS is already benefiting tremendously from the training sponsored and conducted by KIGAM. Between August and September 2011, two geoscientists: Mr S. Lunga (Senior Geologist) and L. Shawarira (Senior Geophysicist) trained at the Institute on Mineral Exploration and Groundwater, respectively.

5. Comments

Although, activities at the Geological Survey of Zimbabwe have remained low due to resource constraints, there is good will in the industry and with international organizations to help resuscitate our operations. Hopefully the 1:1 000 000 geological map of the country will be finalized this year.

Bornwell Mupaya

MINING INDUSTRY NEWS

Forbes Mugumbate

Recent changes at the Ministry of Mines

The term Permanent Secretary appears to apply to ministries other than the Ministry of Mines. This is because the Ministry of Mines has had more Permanent Secretaries than any other government Ministry in Zimbabwe. Only two years after being appointed Thankful Musukutwa has been replaced by Prince Mupazvirihwo, a career civil servant, who was previously the Permanent Secretary for the Ministry of Youth Development, Indigenization and Empowerment.

Pedius Shumba, who has been the Mining Commissioner for Harare Mining District for several years resigned to pursue private practice, and has been replaced by Irvine Chihota. Irvine has been a mining commissioner based at the ministry head office for decades. There will be a new Assistant Mining Commissioner in Mutare following the dismissal of the incumbent.

Chamber of Mines

Changes have also occurred at the Chamber of Mines. Dr Chris Hokonya, the former CEO, has left to pursue private practice. He has been replaced by John Chikombera. Following its Annual General Meeting in Victoria Falls, a new leadership has taken over at the Chamber. These comprise Winston Chitando as President, Alex

Mhembere the 1st Vice President and Allan Mashingaidze, as 2nd Vice President. Allan is a geologist, and a member of the Geological Society.

Indigenization Policy

The issue of indigenization within the mining industry has dominated the news. The policy requires that 51% of all foreign owned business be acquired by local black people. The Minister of Youth Development, Indigenization and Empowerment gave relevant companies within the mining industry until 30th September to comply or face cancellation of their licences. On due date 137 mining companies, including Zimplats the country's largest platinum group metals producer, were threatened with closure. This threat, however, revealed policy discord and the Ministry of Mines gave an indication that no mine would be closed. Instead all avenues to ensure compliance with the laws and regulations would be explored. By the first week of October 2011 twenty-one companies, including all the significant mineral producers in Zimbabwe, were reported to have complied with indigenization requirements.

Mining Legislation

The Mines and Minerals Act is still on the table for amendments. It is now over a decade since the exercise was started. The President of the Republic of Zimbabwe indicated in his opening speech of the current Parliament that the Mines and Minerals Act will be one of the Acts earmarked to go before the current Parliament for debate. Whether the Ministry of Mines will be able to complete the amendments before adjournment of the Parliament remains to be seen. The Ministry is also supposed to come up with legislation that enables establishment of a government-owned mineral exploration company.

A Growing Mining Industry

Presentations at various conferences have shown that the Zimbabwe mining industry grew by 33% in 2009 and by another 47% in 2010. Further growth is expected to be by 43% this year, driving the national economic growth to 9.3% in 2011, as major mines increase production. The Chamber of Mines estimates that the mining industry needs an investment of about US\$6 billion in the next 5 years to realise its full potential. Zimbabwe could easily reach a production of over 50 tonnes of gold per annum if properly capitalised. Highlights of the recovering industry are illustrated by the following:

- Freda Rebecca Mine is now producing more than 100 kg of gold per month. However, the plant is still operating at about 70% capacity.
- Chrome ore output increased from 194,000 tonnes in 2009 to 517,000 tonnes in 2010, reflecting an increase of 167% largely driven by the resuscitation of Zimasco.
- Ferrochrome production increased from 72,233 tonnes in 2009 to 154,000 tonnes in 2010, an increase of 114%.
- Coal production rose from 1.6 million tonnes in 2009 to 2.7 million tonnes in 2010. The outlook appears bright as new companies such as Makomo Resources come on stream. Zambezi Gas is courting strategic partners to start production on the Entuba coalfield.
- Two new mines at Chiadzwa, Anjin and Purediam are boosting diamond production. However, clearance by the Kimberley Process Certification Scheme to allow marketing of the diamonds is still to be finalized. Mbada and

Marange Resources are certificated. DTZ-Ozgeo's diamond discovery in Chimanimani is at advanced stages of exploration and development.

Shortage of Geologists

The economic challenges that have faced Zimbabwe in recent times have seen an exodus of professionals, including geologists. Zimbabwean geologists are now found literally in all corners of the world. This and the inability of the UZ to produce geologists, has resulted in an acute shortage for our profession. Many of those who remained in the country have taken advantage to provide short-term consultancy services to the mining industry. Although they are greatly helping the situation, the practice has led to the emergence of dubious characters masquerading as geologists who cheat mostly foreign investors. This is tarnishing our professional image. Engineers have done something drastic to protect the integrity of their profession. It is time geologists enforce their own ethics in practice.

Mine Entra

This year's Mine Entra was held in Bulawayo from the 20th to 22nd July 2011. Many companies and individuals participated in the conference, anticipating major policy pronouncements by the Ministry of Mines. Participants benefited from the networking opportunities provided by the conference. Mine Entra has proved to be an important venue in the mining calendar.

Mining Indaba

The 3rd Zimbabwe Mining Indaba organised by UTHO Capital was held from the 15th to 16th September in Harare. It attracted about 500 delegates. Several policy issues of concern to the industry such as indigenization were clarified. The three ministers that addressed the conference were the Minister of Mines and Mining Development Obert Mpfu, the Minister of Economic Planning and Investment Promotion, Tapiwa Mashakada, and the Minister of Youth Development, Indigenization and Empowerment who promised investors that no mine will be closed down. This follows unsettling reports in newspapers that the Ministry of Youth Development, Indigenization and Empowerment had given ultimatums to some mines to comply with the Indigenization laws or face closure.

Ministry of Mines and Mining Development (MMMD) Stakeholder's Workshop

The MMMD hosted a stakeholder's workshop held in Mutare on 3rd October 2011 ahead of an internal ministry strategic review workshop held at Leopard Rock Hotel on 4th and 5th October 2011. The stakeholder's workshop was interesting in that it was held in Mutare, close to the Marange diamond fields. Many stakeholders attended including those who were pro- and anti- to the process of marketing diamonds. It was a no-holds-barred meeting where everyone was allowed to speak his mind for the sake of progress. It became clear that there are suspicions between government and NGOs funded by western countries. Whereas the NGOs suspect that government is not being transparent in its dealings in the Chiadzwa area, the government accuses the NGOs of being agencies of western governments that do not wish to see Zimbabwe selling its diamonds. It became clear that there is a need for constant dialogue between the two parties to reduce tensions. This meeting was to this effect in that it created a platform for future dialogue.

Exportation of Raw Chrome Ore

Despite concerted efforts by mostly small-scale miners to have the ban on exportation of raw chrome ore lifted, the Ministry has vehemently refused to give in as this will compromise the principle of local value addition to mineral products. Miners are arguing that local smelters are unable to consume all local production, and are paying far below the market value of the ore. As a result, chrome ore stocks are piling up along the Great Dyke. On the other hand, government argues that the ban has always been in place, but was only lifted temporarily to allow miners to generate capital to establish smelters. However, it appears the miners decided not to establish smelters, but to continue exporting to their own advantage.

Equipment for Small-Scale Miners

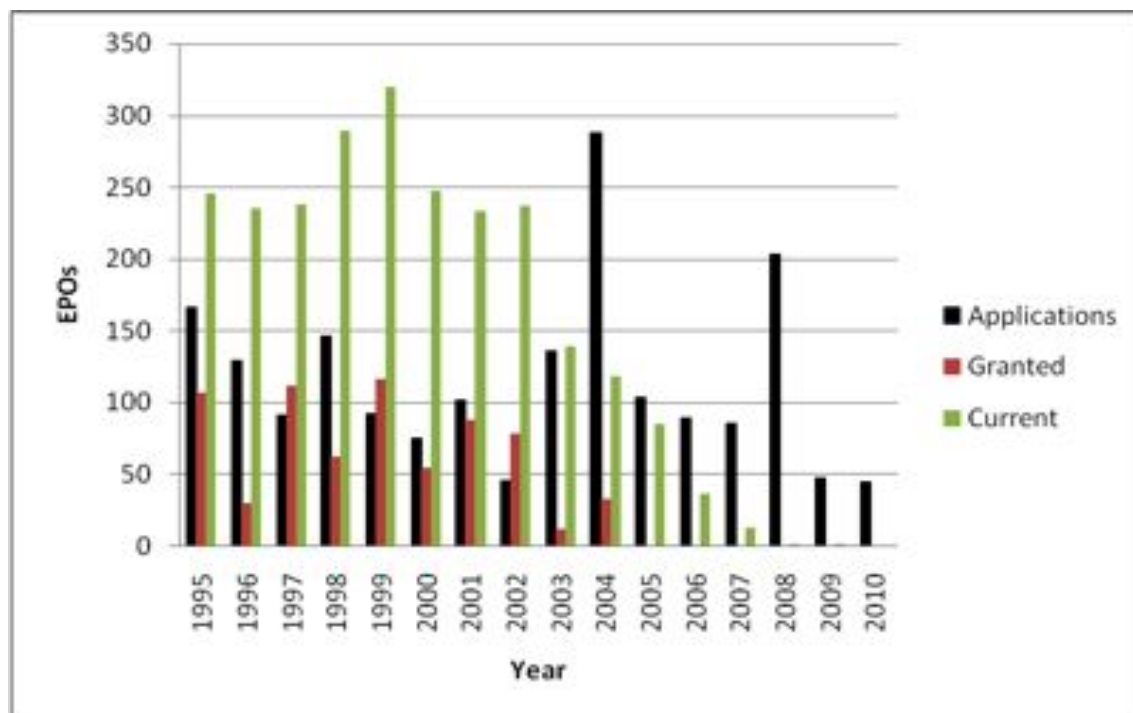
The Mining Industry Loan Fund under the Chief Government Mining Engineer has acquired mining equipment from China to be distributed to small-scale miners. The equipment, comprising compressors and water pumps will be sold or hired out to miners through the Ministry's regional workshops. Details of how this will be done are being worked out, and miners will be informed. The Ministry has put in place measures to ensure the availability of spare parts for the maintenance of this equipment. Engineers and technicians from the Ministry twice visited the company manufacturing the equipment in China to ensure manufacturing of the equipment as per specified requirements.

Mineral Exploration

It is perhaps not enough to talk only about the growth of a mining industry based on the resuscitation of mines without considering mineral exploration. The graph below depicts a grave state of affairs in terms of mineral exploration. Although EPOs were last granted in 2004, companies have continued to submit their applications for areas, fourteen of which have so far been submitted in 2011. There is now virtually no systematic exploration taking place in Zimbabwe, as there are no current EPO licences. Companies interested in investing in the mining industry have no choice, but to use mining claims as an exploration title. This obviously leaves very little room for manoeuvre. Although there may be an apparent growth of our mining industry as mines resume operations following stabilization of the economy, the future for developing new properties is bleak without the exploration component.

However, a lot is happening in coal exploration. A total of 23 Special Grants are current for this commodity, and exploration is in progress in some of them. It appears most of the recipients of the Special Grants are local companies with no requisite capital for exploration. The Minister has threatened cancellation of these grants, as the applicants would have lied to the Mining Affairs Board that they have the financial and technical capacities to carry out exploration, which by its nature requires to be intense and exacting.

Figure 1: EPO trends over the years



News about Zim Geoscientists

Geophysicist, **Dr Oswald Gwavava** was appointed to the Petroleum Agency Chair in the Geology Department at Fort Hare to develop their curriculum in Petroleum Geology.

News of **Oliver Mapeto** - "I was the Resource Geologist at Rossing Uranium Ltd, Namibia for 3 years, then Specialist Resource Estimation Geologist for Rio Tinto Iron Ore in Perth for 3 years. I then became involved in modelling and resource estimation for a number of major projects including the execution of pre-feasibility and feasibility studies. I am currently with Coffey Mining (Global -Mining Industry Consulting Company) and have recently worked on diverse commodities in Australia, South Africa, Namibia and in Mauritania.

My responsibilities include;

- § Geological modelling, resource estimation and reporting
- § Audits, due diligence and feasibility studies
- § The provision of independent technical reports
- § Geostatistical analysis
- § Conduct reviews, and
- § Training and technical development for the resource group."

Roland Kuchocha and **Ellah Muchemwa** are presently seconded to the Rossing Uranium Mine in Namibia.

Ann Kritzinger visited Wits University in September and went on a field trip to Mpumalanga Province archaeological sites at the invitation of Prof. Robert Thornton of the Anthropology Department in the School of Social Sciences. Thornton's recent work focuses on the stone circles and 'terraces' in Mpumalanga as "metal extraction and processing sites not cattle kraals, probably both iron ore and gold".

She will attend African Archaeology Research Day at the University College, London on 25-26 November 2011 when the conference theme is 'Interfaces of Archaeology and Tradition in the African Past'.

Please provide us with news about yourself or other geologists. We need to keep in touch with all of you out there. E-mail hbouamar@hotmail.com or makari@zol.co.zw



GSZ Research and Development Fund

Enquiries relating to the distribution of funds through this facility should be made through the standing Chairperson.



SEG Timothy Nutt Scholarship Memorial Fund

This fund will be available to provide financial support for geology students and young economic geologists located in Zimbabwe or in Southern Africa with ties to Zimbabwe. The fund may be used to support SEG student chapter activities, travel to meetings, field trips, for research or study grants, technical lectures or any other activities approved by the SEG Regional Vice President for Africa.

Applicants must describe what the project is, why the research is important and how it is to be done.

An estimate of expenses for the project must be included with the application.

Grants are expected to be fully utilized by year-end.

Grant recipients are required to provide a year-end accounting of how the money was spent together with a suitable progress report or final abstract.

The next call for applications will be in January 2012. See the Society of Economic Geologists website for further details.

Conferences

Magmatic Rifting and Active Volcanism, 11 – 13 January, 2012, Addis Ababa, Ethiopia.

<http://www.see.leeds.ac.uk-afar/conference/registration.html>
anne-sophie.boutelier@ensg.inpl-nancy.fr

For sponsorship contact **ARISE:**

10th International Kimberlite Conference, 6 – 11 February, 2012, Bangalore, India.

10ikcbangalore.com

The 23rd International Geological Congress, Cape Town, South Africa – 2016.

Geological Society of Zimbabwe

Summer Symposium 2011

25th November 2011, Department of Geology, University of Zimbabwe

Registration (incl teas and lunch) \$20 for members (non-members should join)

Keynote Speakers: Ben Mapani and Andy Moore

Here is a selection of the talks you can look forward to:-

Strategic considerations for Growth of the Minerals Sector – Vision 2020	David Matyanga
The evolution of continental crust of the Nuna-Rodinia component: Examples from the Hohewarte Complex, Namibia	Ben Mapani
Dynamic Evolution of the Central Zimbabwe Watershed	Andy Moore
PGE Resources on the Great Dyke	Collins Mwatahwa
On naturally sculptured granites in Zimbabwe	Forbes Mugumbate
Perspectives on geology practice in Zimbabwe	Arimon Ngilazi
Geophysical applications	Collins Mwatahwa & Tenyears Gumede
The Business of Geoscientific Data	Marcia van Aswegen
Geoscience in Zimbabwe vs The World	Maideyi Meck
Integrated Exploration on Coal Project in Southern Zimbabwe	Hillary Gumbo & Peter Bourhill
Copper Deposit Types of Zimbabwe: An Exploration Guide	Bornwell Mupaya

For further enquiries about the symposium, contact andrew.dutoit@zimplats.com

Please put this date in you diary now

3D EARTH EXPLORATION (Pty) LIMITED

Geophysical Contractors & Mineral Exploration Consultants

3D Earth Exploration is a Botswana-registered company operating in the SADC area and provides the following services:

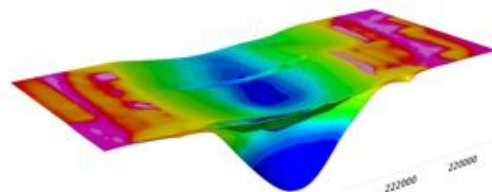
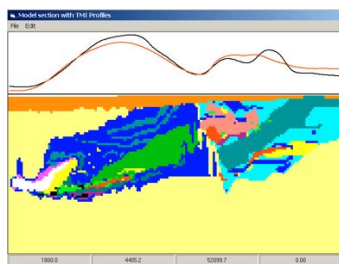
- Ground geophysics surveys
- Physical rock properties measurements&..... 3D Data processing and interpretation



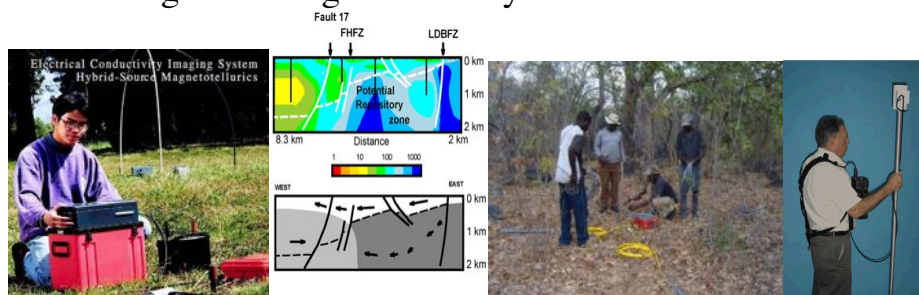
GDD MPP-EM2S+ Magnetic susceptibility and conductivity probe

and aximOnsite data processing

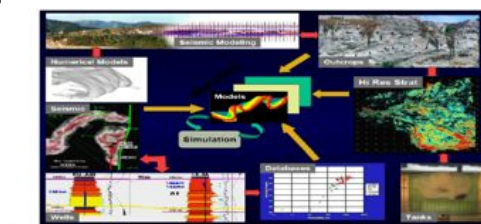
- 3D magnetic and gravity data modelling



- CSAMT and ground magnetic surveys



- 3D Data integration and visualisation



CONTACT:

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