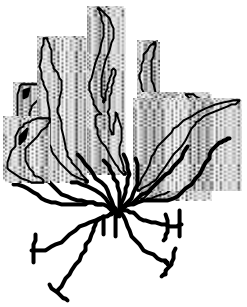
Geological Society of Zimbabwe



Summer Symposium

8am to 5pm, Friday 30th November 2007
Department of Geology
University of Zimbabwe

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Zimbabwe Geological Society Summer Symposium 2007

30th November 2007, Department of Geology, University of Zimbabwe or School of Mines
Registration $ 2 million ($5 for non members),
Lunch $3million (Cash Bar)

Start	Topic	Speaker
08:00	Registration	
08:15	Welcome	Kudzai Musiwa, Chairman Geological Society
08:25	Opening	HE Xavier Marchal, Head of Delegation to the European Community
08:45	Summary of Geological Society Activities	Kudzai Musiwa
09:05	The effects of Government Policies on Mining in developing nations with particular reference to Zimbabwe	Vimbai Chakanetsa
09:25	Senior Staff Vacancies in the Mining Industry, July 2007	Keith Viewing
09:45	**Tea**	
10:05	Government Certificates of Competency	Allan Matanga
10:25	Advances in Mineral Exploration Techniques over the last ten years - 1997 to 2007	Hilary Gumbo
11:05	Niton Handheld XRF	Jaco le Roux
11:25	Niton XRF - Regional Exploration Applications	Mike Kellow
11:45	The Life Of The Mine, Your Reserves Or Mine	Keith Viewing
12:25	How to Construct a Wetland Interceptor to Solve Grey Water Problems	Tony Lampard
12:45	**Lunch**	
14:00	An Irregular Mafic-Ultramafic Contact at Ngezi Mine's South and East box Cuts (Sebakwe sub chamber)	Manford Ngara
14:20	The Murowa Kimberlite Field and Production History	Lovemore Chimuka
14:40	Jurassic Moments – Spielberg To The Rescue	Tim Broderick
15:20	**Tea**	
15:40	On The Need To Preserve Zimbabwe's Geological Heritage	Forbes Muqumbate
16:00	Environment Impact Assessments	Debra Magwada
16:20	Biodiversity hotspots in relation to geological and edaphic features of Zimbabwe	Susan Childes-Worsley
16:40	Summary	Keith Viewing

ACTIVITIES OF THE GEOLOGICAL SOCIETY OF ZIMBABWE

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The Summer Symposium has become an annual event for the Geological Society of Zimbabwe. It is a platform where members share their work with colleagues in the geological and related fields. Regardless of the exodus of its members to neighbouring countries and overseas, the GSZ has managed to organise the 2007 symposium.

During the year, the GSZ organised the following activities which were well attended:

1. 1 June 2007, Professor David Kreamer from University of Las Vegas, Department of Las Vegas, USA, presented a talk entitled **"GROUNDWATER POLLUTION,FLOW MODELLING AND CASE STUDIES"** at the University of Zimbabwe, Jan Kramers Lecture Room, Geology Department.
2. 15 June 2007, Ann Kritzinger presented a talk entitled **"GOLD NOT GRAIN - HARVEST OF THE INYANGA TERRACES"** in the Jan Kramers Lecture Room, Geology Department, University of Zimbabwe.
3. 17 August 2007, Dr Ali Ait-Kaci presented a talk entitled **"EXPLORATION FOR COPPER AROUND DIKILUSHI MINE, DRC"** in the Engineering Conference Room, University of Zimbabwe.
4. 1- 2 September 2007, a trip to see **the Pit Structures and Terraces in the Nyanga area** as referred to in Anne Kritzinger's talk in June 2007 took place.
5. 18 September 2007 Dr Eric Roberts from Wits University, South Africa presented a talk entitled **"LATE MESOZOIC AND EARLY TERTIARY SEDIMENTARY, TECTONIC AND FAUNAL EVOLUTION OF THE RUKWA RIFT BASIN, TANZANIA"** in the Engineering Conference Room, University of Zimbabwe.
6. 30 November 2007, **Summer Symposium 2007,** at the University of Zimbabwe, Jan Kramers Lecture Room, Geology Department.

GSZ is actively engaging the Mining Industry and its membership outside the country to ensure that the earth sciences departments do not collapse and meet their objectives in the teaching of the science amid the lack of resources. Industry and the membership are responding positively to help the departments. On behalf of the GSZ, I would like to industry and members for the continued support of the society.

THE EFFECTS OF GOVERNMENT POLICIES ON MINING IN DEVELOPING NATIONS WITH PARTICULAR REFERENCE TO ZIMBABWE

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SENIOR STAFF VACANCIES IN THE MINING INDUSTRY, JULY 2007

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The Mining Industry has reported serious shortages of experienced professional and technical staff that affect present operations and the potential for expansion, particularly in the platinum sector. Many factors are involved, but the key is that employment opportunities and remuneration need to be similar to those offered by other countries in the region.

The vacancies for mining industry professionals number 166 with a potential to 233. The vacancies for senior technicians are 265 with a potential to 716. These figures do not include iron and steel fabrication, the cement industry, or Chemplex. The training institutions are under stress also and certain key disciplines cannot be taught or examined adequately.

The numbers of vacancies were established by contact with the mining houses. These were classified and accepted. Data for expansion is included in some cases but in others there is no intention at present of significant investment either in exploitation or in exploration. The Faculties of Engineering and Science at the University of Zimbabwe were taken as case studies of vacancies for academic staff. These may indicate the strengths of other training institutions. Statistics were obtained for the polytechnics.

How can these weaknesses be strengthened and even eliminated where industry has a management input? As always, the factors of safety, health and production are paramount.

There are three main options. The most obvious is to strengthen the affected departments by direct finance from industry, either acting individually or collectively. The number of vacancies is large and continuity could be affected by a slump in metal prices. Alternatively, expatriate staff could be recruited either by foreign aid or from our own resources. Several countries and institutions have assisted in the recent past. For example, Germany in mining and metallurgy, Cambourne School of Mines in mining, Norway in metallurgy, the Free University of Amsterdam and Delft Institute of Technology, in geology. Many factors are involved and a contribution by industry is necessary.

Industry may wish to provide professional staff to support the Universities on a part-time basis, but newcomers to teaching may need to develop a course where no detailed curriculum exists. The concept of mentors drawn from retired persons has merit.

A third option is to select suitable experienced persons in industry for fast track promotion and training at the Zimbabwe School of Mines. Under-graduates unable to complete their studies could be admitted by scholarship. Thus incumbents from both sources could complete their studies at

HND level, and be examined for the National Certificates of Competency administered by the Chief Government Mining Engineer.

At present, these Certificates are for Mine Managers, Mine Engineers and Mine Surveyors, but they could be expanded to include Metallurgical Managers and Mining Geology (for mineral Reserves and Resources), and Geo-mechanics. The mines have entered new geological environments and all work at progressively greater depths.

The Mining Industry has a well established financial input and management capability to ZSOM, and provides examiners to the Government Certificates. The examiners are nominated by the professional societies and these societies need support; some may need to be re-activated. And External Examiners are necessary to link to the University system and ensure that our standards are acceptable to self regulating Professional institutions, probably in South Africa, SAIMM; Britain, IMMM; and Australasia Aus.IMM. Thus the normal aspiration of individuals for recognition of qualifications and experience can be encouraged by industry.

The expense of formal accreditation will be warranted in a stable environment and of special interest to platinum, nickel and gold producers who may wish to transfer staff for experience elsewhere. Thus any review of the curricula for the Certificates of Competency should consider the requirements of neighbouring countries.

The study was proposed by Mr Jack Murehwa, President of the Chamber of Mines of Zimbabwe, was supported by Zimplats, and was greatly assisted by Mr D.Verdon of the Chamber, and Dr W. Mbizvo of the Ministry of Higher and Tertiary Education. The Geological Society had recognised the gravity of the problem for that discipline and remains an inspiration. The author is profoundly grateful to all of those who contributed to the task.

GOVERNMENT CERTIFICATES OF COMPETENCY

ALLAN MATANGA

ADVANCES IN MINERAL EXPLORATION TECHNIQUES OVER THE LAST TEN YEARS -1997 TO 2007

HILARY GUMBO

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The presentation will cover advances in geochemical, geophysical exploration, information management and access as well as remote sensing. Notable in geochemistry is the new approach to exploration applications moving away from the popular selective extraction. In geophysics, advances in airborne surveys inclued gradient gravity, helicopter EM and ground geophysics covers the use of SQUID sensors and DADs. Information management dwells on new initiatives in data management and mineral identification maps in remote sensing. Technology now dominated by 3D surveys and visualisation.

NITON HANDHELD XRF

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In all stages of the mining process, decisions are made based on the elemental composition of representative samples. Whether the task is mining exploration, mine mapping, sorting, grading, extraction, or the prevention of environmental hazards as by-products of a mining operation, chemical data is used to guide mining operations at every step. Obtaining accurate geochemical data quickly in order to guide operations is one of the biggest obstacles to high-productivity operations.

Maintaining permanent on-site labs or dispatching samples to off-site laboratories can be expensive, untimely and impractical. Quickly obtaining geochemical data for rapid delineation of ore boundaries and the in-depth, quantitative analysis of metal concentrations required for mine mapping and grade control is critically important for efficient mining operations. The new generation of Thermo Scientific NITON XL3t and XL3p 500 Series handheld x-ray fluorescence (XRF) analyzers are the ideal tools for these demanding jobs.

Thermo Scientific NITON XL3t 500 Series analyzers, manufactured by Thermo Fisher Scientific, come with 50 kV miniature x-ray tubes and multiple primary filters – the most powerful and flexible XRF sources ever offered in handheld XRF instruments. NITON XL3t and XLt have both been designed to maximize productivity.

The handheld NITON Series of portable XRF mining analyzers offers unprecedented performance at all stages of the mining process, often with little to no sample preparation required.

Weighing less than 3 lbs (~1.3 kg) and made of durable GE Lexan plastics, NITON Series analyzers are the ideal tools for obtaining realtime geochemical data in the field. NITON analyzers provide users with real-time elemental sample analysis directly at the mine face, from bagged samples during survey or drilling operations,or from prepared samples. With the ability to easily set up multiple programs based on sample composition, NITON analyzers measure ores, soils, sediments and cores, concentrates, heads and tailings, coatings, and filter media, allowing for quick and easy delineation of ore boundaries, process adjustments and much more.

Thermo Scientific NITON analyzers represent the state-of-the-art in elemental analysis for geochemical applications, allowing the user to perform rapid, on-the-spot screening for qualitative elemental identification with the simple pull of a trigger. Assaying samples in the field significantly

reduces the cost, time and labor involved in exploration and survey activities. NITON XL3t and XLt 500 Series analyzers provide geochemical data within seconds, allowing for immediate ore flagging, avoidance of lab turnaround delays, and rapid delineation of ore boundaries.

NITON XRF - REGIONAL EXPLORATION APPLICATIONS

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The Niton XRF analyser is a fast and accurate tool for regional geochemical prospecting. It offers very fast sample turnaround, a low operational cost per sample, and effective detection limits for non-precious metals. Exploration examples of basemetal and gold-pathfinder geochemistry are discussed, plus some practical data manipulation and interpretation techniques

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THE LIFE OF THE MINE, YOUR RESERVES OR MINE

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The concern for accurate reports of mineral deposits is age-old, but the image of Mark Twain persists. Mining professionals have attempted to dispel that image for 98 years and still the problem lives on, encouraged by an unshakeable belief in buried treasure at the rainbows end.

To dispel such mysteries, mining professionals grapple with definitions of mineral reserves and resources that are acceptable to all, and in particular to Stock Exchanges. Mining investment is often taken seriously as 'blue chip', but some stock is as risky as a bet on horses or dogs and is forgiven where cash is applied to exploration.

These problems had encouraged the Australasian IMM in 1971, to issue guidelines that were binding upon members, and helpful to the Exchanges of Perth and Sydney. The ripple effect extended to Dublin, Toronto and Vancouver, and to London. The AIMM rules were reviewed in 1989, and at intervals of 3 to 4 years since then. These serve as an excellent basis for other professional groups.

Zimbabwe had agreed to the principles of the Institution of Mining and Metallurgy (London) definitions of 1991. These were explained and discussed in each of two meetings at the Sheraton, late in 1992, that included guests from the Exchange and the Chartered Accountants. There was concern for use of the word 'ore' and for 'competent persons', as defined in the Act. Six large mining companies of the time used the AIMM rules, two the IMM rules and one the Quebec Securities Commission.

The Council of Mining and Metallurgical Institutions of 1994 considered the distinction between 'Inferred Resources' (AIMM), and 'Mineral Potential' (IMM). The inclusion of an inferred tonnage and grade was seen by the IMM as potentially misleading to investors.

In 2001, a new code was published for the 'Reporting of mineral exploration results, mineral resources and mineral reserves'. This code was prepared by the Institute of Materials, Minerals and Mining (IMMM) in conjunction with the European Federation of Geologists, the Geological Society of London, and the Institute of Geologists of Ireland. The code is binding upon members of these institutions.

The requirements are defined and explained in a document of 34 pages that is particularly helpful in the definition of the 'Competent Person'. The text includes a very useful check list of 8 pages. The Pan European Resources Committee had adopted that code in 2006 and an up-date is expected this year.

The Geological Society (and the MOM&MD) may wish to adopt a code for the benefit of members and students. Six codes exist; AIMM-2004, SAIMM-2000, IMMM-2001, SMME-1999, IME Chile-2004, CIMM&P-2001, 2004.

GREY WATER SOLUTIONS -CONSTRUCTED WETLAND

NATURE'S WAY OF CLEANING UP WATER CONTAINING CERTAIN DISSOLVED POLLUTANTS

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Plan

- Divert run on.
- Use the following formula for the conceptual design and layout:- 700 litres per square meter per week, length = twice breadth.

Concept

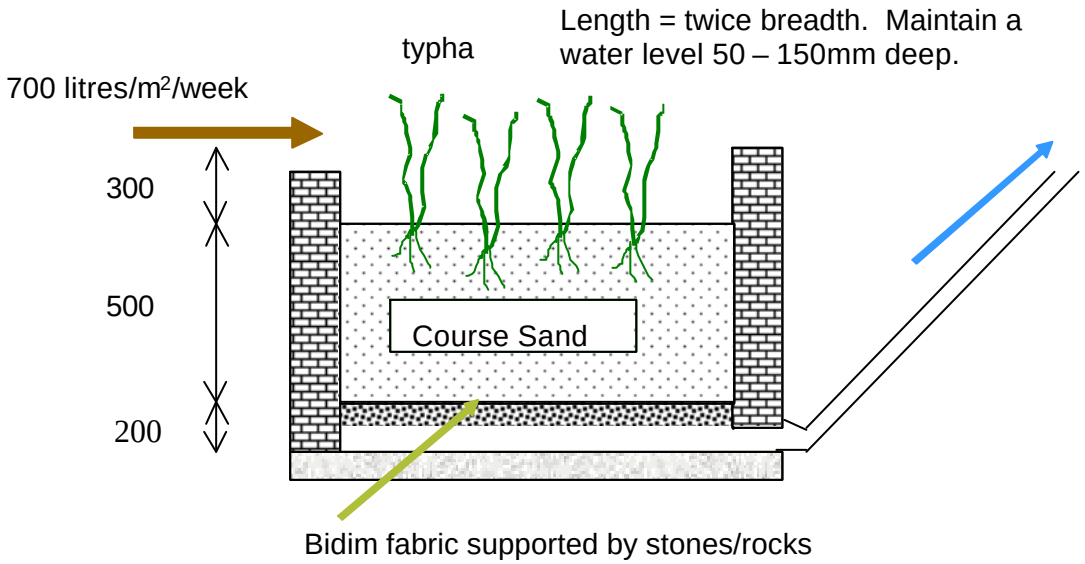
- The hazardous constituents are degraded, transformed or immobilized within the treatment zone.
- The treatment zone is the active part of the constructed wetland.

How

- Degradation of organics results from the action of indigenous microbes and other biological forms.
- Major chemical transformations include adsorption, ion exchange and gas transfer.
- The treatment zone and plants also act as the ultimate sink for immobile, non-degradable wastes and waste by-products.

Constructed Wetland

Natures way of cleaning up water containing certain dissolved pollutants



Drain

- The original design calls for a pvc drain pipe, perforated within the drainage zone, lain along the length at the bottom.
- It is cranked to terminate at a height 50mm above the treatment zone.

Treatment Zone

- Once the screen is secured (if lining with bricks you can build in the paper wire) you need (for typha) 500mm depth of pea gravel for the treatment zone.
- The particles need to be round for easy flow - chippings are not suitable. This should leave you about 150mm from the brim.

Management

Good gardening practice (e.g. control pH) should ensure a healthy wetland to solve your grey water problems

AN IRREGULAR MAFIC-ULTRAMAFIC CONTACT AT NGEZI MINE'S SOUTH AND EAST BOX CUTS (SEBAKWE SUB CHAMBER)

"EVIDENCE OF MAGMATIC SLUMPING, A TRAPPED LIQUID OR A LATER INTRUSION?"

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Ngezi Platinum Mine is located in the South-central portion of the Hartley Geological complex. This complex straddles the Darwendale and Sebakwe subchambers and it is the largest of the four erosional remnants of the Dyke in which the mafic sequence is still preserved. Ngezi Platinum mine is located in the Sebakwe sub chamber

Stratigraphically the Great Dyke is broadly divided into an upper mafic and a lower ultramafic sequence. The major lithologies in the Ngezi Mine area are Gabbronorite (mafic), Websterite and Bronzitite of the P1 Pyroxenite unit (Ultramafic). PGM bearing Main Sulphide zone occurs in the Bronzitite, 5-50m below the mafic-ultramafic contact.

In the Ngezi area the dyke consists of a simple flat synclinal structure that has been modified by cross-cutting faults.

Mining at Ngezi mine has exposed an unusual contact between Gabbronorite and Websterite at the South and East Box cuts. At this contact, websterite of the Ultramafic sequence interdigitates with the overlying gabbronorite of the Mafic Sequence. The structures so formed are analogous to the ball and flame structures of the Sedimentary rocks.

The same websterite also appears in joints and fractures in the gabbronorite, which can suggest late stage upward migration of volatiles. Hydrothermal alteration of fracture planes is also evidenced as material filling in fractures and veins, forming a network in the gabbronorite.

A variation in the gabbronorite also appears in the proximity of this contact. Immediately above the websterite contact at one locality (Ramp at South of South Box Cut), the Gabbronorite although extensively weathered indicates a very high clinopyroxene content (greenish) - evidently a feldspathic pyroxenite (melagabbronorite). Away from the contact it gradually lightens more to feldspathic gabbronorite (more towards Anorthosite)

If this layering observed in the gabbronorite is not due to variations in the pyroxene content, it may be migration of volatiles from the websterite along grain boundaries effecting alterations in the overlying gabbronorite and the effects of the volatiles gradually decreasing further from the contact.

Some hypotheses have been considered in this presentation in trying to deduce the paragenesis of these structures, these are the release of a trapped liquid, magmatic slumping and a later (post genetic) Intrusion.

THE MUROWA KIMBERLITE FIELD AND PRODUCTION HISTORY

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The Murowa Diamond Mine is located near Zvishavane mining town in South Central Zimbabwe. Murowa Diamonds Private Limited (MDPL) is company owned by Rio Tinto plc (78%) and RioZim (22%) a Zimbabwe listed company. The Murowa mine is managed by Rio Tinto.

Murowa kimberlite field has been dated at 0.5ga. The field comprises of 6 kimberlite bodies covering a footprint of 10km2 (World averages 20km2). The kimberlites post-date the igneous activity of the Great Dyke at 2.2Ga. The kimberlite bodies ranges from blow-out pipes(k1 to k5) to dykes and fissures ranging from 1 to 7m wide.. It is theorised that the igneous activity of the Great Dyke led to the craton structural weaknesses creating deep-seated conduits which allowed kimberlites to intrude and extrude from the mantle.

The on-craton kimberlites intruded the 2.6 Ga Chibi granite batholiths emplaced into 2.6-2.9 Ga gneisses and greenstone 10-20 km north of the boundary of the Northern Marginal Zone of the late Archean Limpopo Mobile Belt.

The Murowa kimberlites, which have been numbered K1 to K5, lie between two main structural features. Immediately to the west is a dyke of doleritic composition which forms part of the Sebanga Poort Dyke system. To the east is a shear zone that can be traced across the granites up to the Tokwe block and south towards the Buchwa greenstone belt. The shear contains abundant quartz along its length and forms strong positive topographic relief where present. This feature is of particular importance to the emplacement control of the K2 body.

Five kimberlite pipes were discovered in 1997. Feasibility studies and mine planning were conducted from 1998 to 2000. The two larger pipes comprise mining reserves of 19 million tonnes with a grade of approximately 0.9 carats per tonne. Out of the 5 pipes only 3 pipes contain economically exploitable resource.

A number of requirements had to be addressed to enable production from the Murowa Diamond mine to commence. These included relocating 926 people to 6 farms purchased by MDPL at Shashe near Mashava. Families were provided with new homes and newly prepared plots for seeding.

At the mine site the treatment plant and security facilities were constructed and commissioning commenced in August 2004. Other infrastructure for the mine including access roads, office buildings, village, and power supply were also simultaneously established at the same time. MDPL initially employed 90 people with 71 contractors providing mining and village services in a bibo (bus-in-bus-out) commute roster.

The start of 2005 saw the onset of full scale production at approximately 200,000 tonnes per annum.

JURASSIC MOMENTS – SPIELBERG TO THE RESCUE

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In October 2006 a visit to assess the geological controls of the spring in the Chitake River, Mana Pools National Park, led to a visit to Mike Raath's 1970's *Syntarsus rhodesiensis* bone bed where new material was found exposed by seasonal erosion in the Forest Sandstone cliff section. A second visit in January 2007 confirmed that these bones were liable to be lost to gravity processes as the river flooded and undercut the cliff. An application was made to the Parks and Wildlife Management Authority to rescue these fossils in collaboration with National Museums and the University of the Witwatersrand. The value of this fossil location is that it represents the scene of a mass death equivalent to that of Ghost Ranch, New Mexico where *Coelophysis*, to which genus *Syntarsus* has been added, occurs in a similar mode in an arid palaeoclimatic environment close to the Triassic/Jurassic boundary. A visit in July 2007 showed that some collapse has in fact taken place and that an articulated distal section of a caudal column and part of a maxilla, with teeth were now exposed. This put pressure on the need for the permit, which was granted at the end of August and an expedition was launched with Dr Eric Roberts from Wits and representation by way of technicians from both the Natural History Museum in Bulawayo and the Geology Department at UZ. The vulnerable parts of the bone bed were excavated and plaster-cast, and are now awaiting shipment to the Bernard Price Institute for Palaeontological Research for preparation. The presence of a basal conglomerate to the post-Karoo Dande red bed Formation was confirmed in the vicinity, both directly overlying the Forest Sandstone and in fault relationship with it. Isolated larger bone remains of *Massospondylus* were also confirmed as being present elsewhere in the Forest Sandstone in this area.

Also in July 2007 the Ntumbe dinosaur trackways were revisited, this time in the company of Society Member Xavier Marchel and others. Upstream of the known Allosaurus tracks at the drift, discovered and reported in 1984 and measured by Operation Raleigh in 1990, and in the tributaries, described and measured by Lingham-Soliar, Broderick and Ait Kaci Ahmed in 2001, a new trackway comprising 16 clear prints and displaying cross tracks was found to be re-exposed. This trackway had been noted by Lingham-Soliar in 1990, but in 2001 it was obscured beneath river sand. In 2001 Ait Kaci had recognised and described five apparent mega-prints of the herbivore Brachiosaurus in the bed of a tributary stream, but on a subsequent visit the one classically formed print was found to have been destroyed by elephant that had drunk from an adjacent water source. In a right-bank re-entrant opposite the 'new' Allosaurus prints are exposed a new find of Brachiosaurus prints forming a trackway of six impressions, each more than 90 centimetres in diameter and about 1-metre apart. Apart from their addition to what now must be a 'World-Class' dinosaur trackway location, the significance is that these giant traces are seen to cross an Allosaurus track, confirming the co-existence of herbivores and carnosaurs in this 'Jurassic Park'. Indeed, the *Syntarsus*-bone rescue expedition was, in part, funded by Steven Spielberg's Jurassic Foundation.

ON THE NEED TO PRESERVE ZIMBZBWE'S GEOLOGICAL HERITAGE

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Zimbabwe's heterogeneous geological environment hosts some of the best exposed and information-packed rocks in the world, which have helped to elevate parts of the country into virtual natural geological laboratories in which early earth processes can be observed. For instance Archaean greenstone belts contain rock assemblages and structures that explain the tectonic systems by which the foundation of the earth was constructed as well as details of the origin of life and evolution of the atmosphere. Komatiites, pillow lavas, banded iron formation, and stromatolites are some of the most curious rocks in this environment. Other monumental geological structures include the Limpopo Mobile Belt, one of the oldest such belts in the world, and the Great Dyke, a geological wonder hosting huge resources of mineral deposits. Several other features including fossils are exhibited throughout Zimbabwe's geological record, and these give a testimony of the past life forms, past geography, climate, and local environment, the knowledge of which is important for understanding the dynamic earth. In addition to these geological environments of both scientific, educational and economic significances, Zimbabwe has a profusion of varied topographical features including river gorges, waterfalls, rifts and escarpments, mountains, castle kopjes, balancing rocks, and caves, some of which are renowned tourist destinations.

This paper, which is a slight variation of one prepared for the Research Council of Zimbabwe symposium (Mugumbate, 2007) highlights some attributes of selected geological environments to reiterate and raise an awareness of the rich and varied geological marvels in Zimbabwe and to instill a sense of appreciation on the scientific and aesthetic value of such features in order to promote preservation of typical sites for the present and future generations to enjoy and to study for better understanding of the Earth.

THE EIA PROCESS AND MINING IN ZIMBABWE

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The EIA policy was launched by the Minister of Environmental and Tourism in 1994 but had no legal backing to it. This meant that developers could implement EIA of their own free will. The Environmental Management Act (Chapter 20:27) provided the legal framework.

It is a requirement in terms of section 97 of Environmental Management Act (Chapter 20:27) for all projects listed in the 1st schedule of the Act to have an EIA done prior to commencement. The fixed date for the Act is 17 March 2003. Statutory Instrument 7 of 2007 (EIA and Ecosystems Protection Regulations) consolidates the Act as it details the specific requirements of this Act.

EIA is a process that is aimed at predicting impacts of developmental projects and reducing the negative impacts while enhancing the positive. This is in line with the principles of sustainable development that all development must embrace the environment, social and economic spheres of any society. Development cannot and should not be stopped but should proceed in a manner that does not compromise future generations from benefiting from the environment. It is a project management tool that can determine the direction that a project will take including project design, alternative sites and alternative inputs where necessary.

In Zimbabwe, the EIA process can still be described as being in its infancy with little tangible changes in the way of operations of many mines except as a tool for compliance. Thus, there is need for both the regulatory agencies and industry to seriously look at changing the way of operating if this process is to achieve desired results.

Mining is an environmentally degrading activity, which despite the effects, cannot be abandoned as it has far-reaching positive benefits in our modern lives. To stop mining would be to take modern civilisation back to time immemorial, which is counterproductive. Zimbabwe is a country whose economy is based on primary activities of mining and agriculture. As such there is need to ensure that these activities are carried out in a sustainable way to keep the wheel of the economy running into the future generations. Part of keeping that sustainability in the mining industry includes ensuring that the environment is taken care of and mining is carried out in line with the country's regulatory framework.

Not many proponents were undertaking the EIA process before Operation Chikorokoza Chapera/Isitsheketsha Sesiphelile and as such there were few projects that were assessed. Since the first EIA report was submitted in 1995 until the launch of the Operation, on 21 November 2006, there was an average of 3 EIAs submitted per month. This has since dramatically risen by over 5000 % to on average 150 reports being received monthly with most of these projects being for small-scale mining.

640 EIA reports had been recorded in the database at the launch of the operation. Currently the database is at 3 000, exceeding in just 1 year what took 11 years to achieve although there still is need to really monitor the projects with EIA acceptance.

SOME BIODIVERSITY HOTSPOTS IN ZIMBABWE, IN RELATION TO GEOLOGICAL AND EDAPHIC FEATURES.

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The aim of this paper is to highlight some of Zimbabwe's important biodiversity areas, that are also of geological and edaphic interest. Biodiversity is a complex concept and is defined at genetic, species and landscape levels.

At the landscape level, the Eastern Highlands form a vital link from the Eastern Arc mountains in East Africa to the Drakensberg and Cape mountains in the south. These mountains form "stepping stones" for plant and animal species to move and are therefore important for gene flow and genetic diversity.

The Nyanga and Vumba mountains are largely granite with dolerite intrusions. The high rainfall means that the soils are highly leached, acidic. Impeded drainage on the mountain tops, coupled with low ground temperatures in winter has resulted in the formation of grasslands that contain a variety of endemics and restricted range species. The grasslands are seriously threatened by the invasion of alien pine, wattle and blackwood. The moist evergreen forest covering the windward slopes and river valleys are home to a wide diversity of orchids, ferns and other taxa. The forests are contracting rapidly under the combined onslaught of clearing for agriculture and fire.

The quartzites of the Chimanimani mountains have given rise to pale, acidic, low nutrient sandy soils. Over time, some of plants growing on these soils have evolved into new species and the Chimanimanis has the greatest number of endemic plants (72) in Zimbabwe.

Just off the edge of the central granite shield are the isolated peaks of Wedza, Bikita, Buchwa and Nyoni Hills. These mountains form another important series of stepping stones linking the eastern highlands to the Matobo Hills. These sites are seriously threatened by deforestation. Little is known of their biodiversity.

Perhaps the best known and most studied geological feature in Zimbabwe is the Great Dyke. The ultra mafic rocks are high in chrome, nickel and other minerals. The vegetation is an open grassland with scattered small trees and shrubs. There is also a high level of endemism in the plants, with 30 species being recorded. Despite the geological importance of the Dyke, very little is known of the biodiversity of this unique feature. Threats include habitat loss through mining and plant collectors.