

# geobulletin

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CGS Centenary  
Karoo Development Conference  
The Barberton drilling program

news



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Painting by Maggie Lambert-Newman

*Volcanic processes, early life and meteorite bombardment- scene from the primordial sea in the Barberton region 3.4 to 3.5 billion years ago. See the article on the Barberton drilling program on p. 22. For a new Geologic Map of the West-Central Barberton Greenstone Belt see*

*<http://www.geosociety.org/bookstore/default.asp?oID=0&catID=2&pID=MCH103F>*



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\* Casual insertions • 4+ insertions

# from the editor's desk

Chris Hatton

What a tumultuous last quarter this has been. A few months ago Prof Jonathan Jansen and Mamphela Ramphele were on the radio, pontificating on the country's problems and concluding that, despite everything, the country was destined for greatness. Plausible at the time, but after the growl from the grape valley and the howl from Marikana, discussed in our Executive Managers column, the rational man must wonder whether instead of greatness, inspired by great men like Biko and Mandela, the destination that the current crop of "leaders" is sliding toward, is the garbage bin. Life, however, is not entirely rational. How else can one account for the fact that Ramphele's and Jansen's vision still somehow rings true?

Starting with the appalling violence accompanying Marikana, there is at least a public enquiry where the perpetrators are being identified. Not much, but we do have political systems and institutions where lessons can be learnt from these dreadful events. Although the mining companies are often portrayed as ruthless exploiters of the land and the people, direct employment of a single miner spreads out to support many more dependents. Mining companies, large and small, do make genuine attempts to improve society and implement environmental obligations. The support of academic research by mining companies is widely recognized and mining geologists make up a significant part of the geological community. Examples of the contributions made by members of this community can be seen in the obituaries of three recently deceased members whose careers embraced both the academic and mining spheres. A primary aim of this society and this magazine is to support the wider geological community. Here the hard work of the Executive Manager, Craig Smith and his support staff, Sally Nienaber, Lully Govender and Marliese Olivier is often unnoticed. GSSA events such as the Fellows Dinner rely on the contributions of volunteers such as Gordon Chunnett, the MC and program manager. And speaking of enduring institutions, what a pleasure it was to be part of the Centennial Celebrations of the Council for Geoscience. George Henry gives his perspective elsewhere in this issue and the presentations are outlined in the issue of Geoclips mailed together with this issue. Perhaps the enduring message of this conference was from Refilwe Shelembe who managed to express the privilege of having a job that takes you into contact with the wild life and scenery of this great country.

I think it is in the natural beauty of South Africa that



any visions of greatness must be set. Alan Paton begins his novel, 'Cry the Beloved Country' with a lyrical description of the valley around Ixopo. This pristine image serves as a counterpoint to the harsh realities and injustices of a South Africa sinking into the era of apartheid. Although Ixopo is not the same place it was in 1948, South African scenery and geology continues to draw visitors from all over the world. For decades now, Alfred Kroner has been returning to Badplaas, exposing visitors to a cross section of South African geology. This year the field trips, ably and enthusiastically led by Nic Beukes, Roger Gibson, Axel Hoffmann and Allan Wilson ranged from the gold fields of the Witwatersrand, the diamond mine at Cullinan, the Vredefort impact site, the Bushveld, the dolomites on the Great Escarpment to the Barberton komatiites. This spectacular geology together with the animals and plants that make up the South African outdoors, has contributed to the growth of an impressive body of natural scientists in South Africa. Although events such as Limpopo text book saga portray the administration of South African education at primary and secondary level as ludicrously ineffective, the natural class room is still out there. An optimistic vision is that parents will exercise their democratic right to demand excellence, rather than mediocrity, from teachers and that electronic images of our natural class rooms will eventually stimulate first hand contact with our natural heritage. An encouraging example of the value that is now being placed on this heritage was the stiff sentence imposed on a Taiwanese rhino poacher, the judge expressing



his outrage at the attempted destruction of a pride of Africa. Encouraging too are initiatives ranging from Maropeng to the Square Kilometre Array which are fostering a culture of scientific appreciation within the wider community. Within the GSSA the increasing appreciation of geoheritage, discussed in the article by Chris Lee is bringing geology closer to the wider community.

So there are rational grounds for a vision of greatness; we have a great constitution which drives political institutions in the right direction, our magnificent natural beauty has built up a crop of natural scientists housed in great and enduring institutions and the nation's commitment to science may eventually lead to full participation in the knowledge-driven global community. But the vision of greatness is at heart is an act of faith. The Victorian English, like many conquerors, believed that their colonizing efforts were divinely inspired. The British Empire used obedience to the divine to harness an army which colonized much of the world. For Europeans a belief in the divine is convincingly imparted in the great cathedrals, where, sitting on a small chair with stone arches vaulting to infinity above, the smallness of the individual is unambiguously transmitted. How great Thou art, one insignificantly sings. For African ancestor worshippers, the ancestors emerge from the natural world, from the waters, from a cave or a crack in the rock, or from the high mountains.

Consider then the English poet, TS Eliot, who, in a perfect expression of spiritual homecoming, finds the divine on his knees in a draughty English church. "We shall not cease from exploration And the end of all our exploring Will be to arrive where we started And know the place for the first time". At the risk of being crassly literal, we did not start in England. Discoveries such as those of human footprints at Langebaan by Dave Roberts unambiguously demonstrate that we modern humans started somewhere around Cape Town. Eliot's vision could then be transposed to the azure skies over Table Mountain where sailors coming into Table Bay, or overland travellers looking down Sir Lowry's pass can rightly feel divinely blessed. Believe it or not, this is the African century. As Thabo Mbeki reminds us, we are all Africans. Nkosi sikelele Africa.

The ongoing saga of the threat that climate change poses to our earthly paradise is continued in another letter from Deon le Roux and in an article from William McClenney, sourced by Mike McWha. Both contributions question the role of carbon dioxide as a cause of climate change, and are rather technical. However they highlight the dangers of thinking that the causes of climate change are easily understood. Perhaps the new year will bring us closer to a consensus.

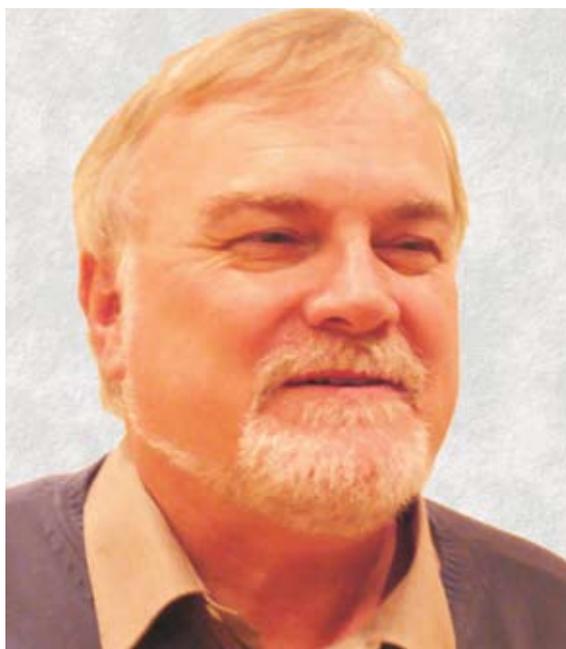
Until then, best wishes for the festive season.

# executive managers

The last quarter seems to have flown by unbelievably quickly, and the first message I would like to convey to our readers is to please have a happy and safe end of year. For those of you receiving Geobulletin in the northern hemisphere, may the weather gods be kind to you. For those of us in the sunny south, well – all the staff and I can say is 'Wish you Were Here'.

Some apologies are due to our readers and advertisers for the lateness of the last issue. You are all aware of the Marikana incident, and the knock-on effects throughout the labour pool in South Africa; the unrest has now spread to farmworkers in the Western Cape. The unrest is attracting lots of press attention, but nowhere did I see a report on the illegal strike embarked on by the postal workers. This happened, and the delivery of the last issue of Geobulletin was delayed for a good few weeks as a result.

Marikana was a watershed event for the South African



corner

Craig Smith



mining industry, and there are lessons in this for everyone, including the professionals that this Society serves. Our collective professions in the earth sciences – whether in the consulting industry, academia, government, or exploration and mining – will be significantly affected in the long term. While the strikes were ostensibly about low wages, there seems to have been a degree of political manipulation as well. No one can deny that many people in South Africa are not paid a decent daily wage. To paraphrase our recent Fellows Dinner speaker, Ralph Havenstein, we have to ask whether our industry (or government for that matter) is unfairly serving the few at the expense of the many. But the fact remains that labour is a commodity, at any level of expertise. The world does not owe any of us a living, and unskilled labour in South Africa is abundantly available. The message that up-skilling with experience and education is imperative seems not to be heard, and South Africa has a serious problem in effectively upgrading skills profiles and workplace efficiency to internationally competitive levels. Our readers are generally higher level professionals either in a career or about to embark on one, and the only message I can convey is that to stay relevant (and marketable) your career is not just about working hard. It's just as much about spending a lifetime learning and experiencing.

The long term effects of Marikana are predictable. First, in the short to medium term South Africa is going to have serious problems attracting future investment, which is needed in the resource industries. Capital is liable to become much more expensive even if available (witness the recent debt downgrades by international ratings agencies), and investors will go elsewhere. From the Johannesburg perspective, this has already started to happen. It will take some time for South Africa to regain its pre-Marikana reputation as a relatively low risk investment destination, and some of our deposits might be temporarily sterilized. Second, as has happened elsewhere, South African mining (and now agriculture in all probability) is probably going to invest less money in unskilled labour, and more money in technologies that replace unskilled labour. This probably means higher demand for highly skilled people in future, but significantly lower demand for those with low skills. The needed skills will be technical in nature and professional in level. Are we producing enough of those skills?

There is a large number of other problems that South Africa faces in attracting investment, including policy uncertainty, eliminating corrupt or unethical practices, the dismally ineffective public school system, power infrastructure and capacity, unfriendly legislation and lack of innovative capacity. But we shall leave those for other editorials! None are unsolvable.

Upgrading professional skills is something we have some control over, but it may not be enough to simply 'produce' high skills. We probably need to ramp up our level of professionalism, which includes ethical behaviour and the effects of our professions and careers outside of our immediate community of practice. The earth science community around the world has been shocked by the conviction and sentencing of six earth scientists and a government official to six years in jail in Italy over the L'Aquila earthquake disaster. Several professional scientific societies have quickly and vociferously condemned the verdict, and we are in touch with some of those groups. The GSSA has not yet come out with a public position on the verdict because we want to see the original judgement, which we will need to translate from Italian. Almost all of the press reports we have seen convey differing nuances of who did what or did not do what to whom, and we are concerned we are not seeing the full facts. So far, though, the conviction seems to be less about science than it does about the consequences surrounding differing viewpoints of professional responsibilities. The GSSA Professional Affairs Committee is watching developments very carefully.

For me, a highlight of this issue of Geobulletin is the cover. Some of our readers will immediately identify Maggie Newman as the artist. Maggie has a long history of producing 'geological art', and is probably one of only a few people doing this today. We would like to get your opinion on what you think a 3.5 Ga landscape might have looked like! It is art such as this that helps us to visualize what science tells us about our ancient planet, and Maggie has done this from the Cretaceous all the way back to earth formation.

We hope you enjoy the final Geobulletin issue of 2012, and wish all of our readers a relaxing year end, and a fantastic 2013.

# president's column

It seems like only a few weeks ago that I was penning my first President's column, but so many things have happened since. The last quarter of the year has seen your President move to Down Under to take up a role on a copper porphyry mine in New South Wales. In getting to know the area, I visited a limestone cave some 120km away, which had an excellent display on stratigraphy and dating of the different infill layers, as well as on the general geology of the area. The facilities and level of information supplied were quite unexpected for a small town. However the caves are a tourist attraction that allows it to distinguish itself from other towns in the region.

I attended the opening ceremony of the 9<sup>th</sup> International Mining History Congress held at Gold Reef City in April this year. I was most heartened to hear our Deputy President Kgalema Motlanthe speak of how mining had shaped the present day RSA society and, with the help of improved legislation and other initiatives, how much of a role it still could play to the future benefit of all South Africans. I think we can all play a part in this.

One of the conference organiser's, Prof Peter Alexander pointed out that although South Africa was a leader in mining and minerals supply, compared to the rest of the world it lagged behind in terms of preserving its mining history. I agree. We are endowed with a number of historical mining and geological sites of interest, that if properly set up and managed, have an opportunity to improve the lives of the communities around them, while preserving the rich history of our country.

The GSSA's Geoheritage Committee and working groups are currently looking at a number of initiatives that are aimed at preserving sites of geological interest and educating society about them. By adding the element of tourism, a number of these could become financially viable in helping to sustain communities long after mining has finished. A number of geological superlatives are also to be seen in rural areas that may never be exposed to mining or other high end industries, but they would benefit enormously from geo-tourism.



Pamela Naidoo

However, there are also a number of legislative conditions to consider and sometimes opposing interests in terms of deriving benefit. Establishing geoheritage sites is not a straightforward process and it requires the interest of the public as well as the help of organisations and volunteers to get them up and running. I would like to appeal to members of the GSSA to become more active in the regions where they live, to assist with some of these initiatives.

When you and your family are enjoying the coast, mountains and hinterland of South Africa during your year-end holidays, I am sure you will have a renewed appreciation for its geoheritage. I would like to wish everyone a safe and restful break – please remember the sunscreen! Do send the Editor any regional news or our webmaster your most interesting geo-pics to share over this festive season. Happy Holidays!

Pamela Naidoo



# fellows' dinner



*Tania Marshall,  
Mike and Colleen Lynn*



*Ken Lomborg,*



*Dumi Sibiyi*



*and Damian Smith  
receiving certification as  
Fellow from  
Gordon Chumnet.*



*Judith Kinnaird delivering  
her acceptance speech*

On the evening of November 16, the Fellows Committee of the GSSA hosted the annual Fellows' Dinner at the Woodmead Campus of the Johannesburg Country Club. It was a stimulating evening, enjoyed by all, and topped off by Gerry Levine presenting two valuable maps to the Society. Judith Kinnaird, Ken Lomborg, Mike Lynn, Tania Marshall, Jeannette McGill, Jodie Miller, Andy Moore, Genevieve Pearson, Dave Reid, Dumi Sibiyi, Damian Smith and Andre van der Merwe were inducted as Fellows of the GSSA. The Jubilee Medal for the best paper published in the South African Journal of Geology was presented to C. Curtis and coworkers for their work on the Koegel Fontein Igneous Complex. The Draper Memorial Award for 2011 was presented to Tom Clifford in recognition of his outstanding contribution to earth sciences in general, and the geology of Witwatersrand, Namibia and Namaqualand in particular over an illustrious career. Tom was made aware of this award at the GSSA AGM before his untimely passing.

The Des Pretorius Memorial Award was introduced by the Geological Society during 1998 in memory and in recognition of the pioneering work of the late Professor Des Pretorius, for work in economic geology to geologists working in Africa. The Des Pretorius Memorial Award for 2011 was awarded to Prof Judith Kinnaird in recognition of her outstanding contribution and endeavours in the field of Economic Geology. Judith was also recently announced as the President-Elect of the SEG for 2013. She will assume the Presidency in 2014, and will be juggling this with her new appointment as Director of the Economic Geology Research Institute at Wits, following the retirement of Allan Wilson in December.

Ralph Havenstein presented an entertaining and illuminating after dinner speech outlining the vast differences in wealth distribution in societies. The challenge facing mining companies is to assist government in narrowing the gap between the rich and poor in South African society. The evening's proceedings were generously supported by Theo Pegram and Associates and Geoexplore Store.

# letters



## Climate Change: the debate continues – Deon le Roux

Since the December issue, when **Rose Prevec** sparked off the debate on 'climate change' in *Geobulletin*, the number of participants has steadily increased. An erratum occurred in the September 2012 issue. The lines preceding the caption of my letter are the introduction to John Truswell's letter, which is resumed after my quotation of Luetkemaier's amendment.

**Chris Hatton** ('from the editor's desk'), reporting on the 34th IGC in Brisbane, made a contentious statement:

"The circumstantial evidence supporting anthropogenic global warming is now so overwhelming ..."

There is no global warming at present, not since 1998. Add to Phil Jones' admission in 2005 ('Climategate'), of 7 years of global cooling, the media reports in 2011 of cooling during the preceding 5 years, for which scientists blamed the burning of Chinese coal. This, along with HadCRUT data, contradicts the IPCC-climatologists' predictions, and proves that their computer-generated models do not work. Reliable meteorological records, which only started after the coldest part of the Little Ice Age, simply reflects the rebound to more average climatic conditions. There is no correlation between CO<sub>2</sub> emissions, which was insignificant before about 1940, and the past 150 years of intermittent global warming.

**Professor John Geissman**, contributing to the debate from the USA, added his support to **Rose Prevec** (June), urging the GSSA to follow the example of the Geological Society of America, which officially supports the AGW-doctrine. I share the Professor's concern regarding the overpopulation of our planet.

"Students also learn, usually, that there have been profound changes to our planet over the geologic past, including times of very enhanced warming of the planet with considerably high concentrations of CO<sub>2</sub> in the Earth's atmosphere ..., as well as times of profound global glaciations." The Professor is aware that "internal combustion engines and coal fired power plants have

never been important in the geologic past."

The Professor acknowledges natural climate change on a geological time-scale, with naturally fluctuating atmospheric CO<sub>2</sub> concentrations. There is a natural mechanism which causes the latter. The solubility of CO<sub>2</sub> in the oceans increases with lowering of the water temperature and decreases with rising water temperature (solubility of CO<sub>2</sub> at 0° C is about double that at 20° C). During periods of oceanic cooling more CO<sub>2</sub> is dissolved by the oceans, with the reverse applicable during warming. During the geological past increased atmospheric CO<sub>2</sub> resulted from oceanic warming.

**John Truswell** referred to *Mann et al.*'s 'hockey stick' graph, which became discredited after independent researchers like *Steve McIntire* finally gained access to the raw data (largely sub-quantitative tree-ring proxies), and exposed its flaws. In their emails the IPCC-scientists even discussed legal loopholes to avoid handing over their data (with good reason). The perpetrators ought to be discredited along with their findings.

Regarding plate tectonics as a possible cause of natural climate change, the following extract from a paper in *Sedimentary Geology* is informative; for references below see the original paper, J.P. le Roux (2012). A review of Tertiary climate changes in southern South America and the Antarctic Peninsula. Part 1: Oceanic conditions. *Sedimentary Geology* 247, 1-20.

"4.5. Does ocean ridge activity prevent a Snowball Earth?"

There is no doubt that glaciation in Antarctica played an important role in global cooling. Both the CO<sub>2</sub> and <sup>18</sup>O curves in Fig.5 show that temperatures reached a peak at about 49Ma and from there steadily decreased into the Pleistocene. According to (*references*), 49Ma was concurrent with an eightfold increase in the separation rate between SSA and the AP and the initial development of the Drake Passage. From about 34Ma the latter was sufficiently well developed to allow intensification of the Antarctic Circumpolar Current, which isolated Antarctica from warm northerly waters and led to the formation of the East Antarctic Ice Sheet

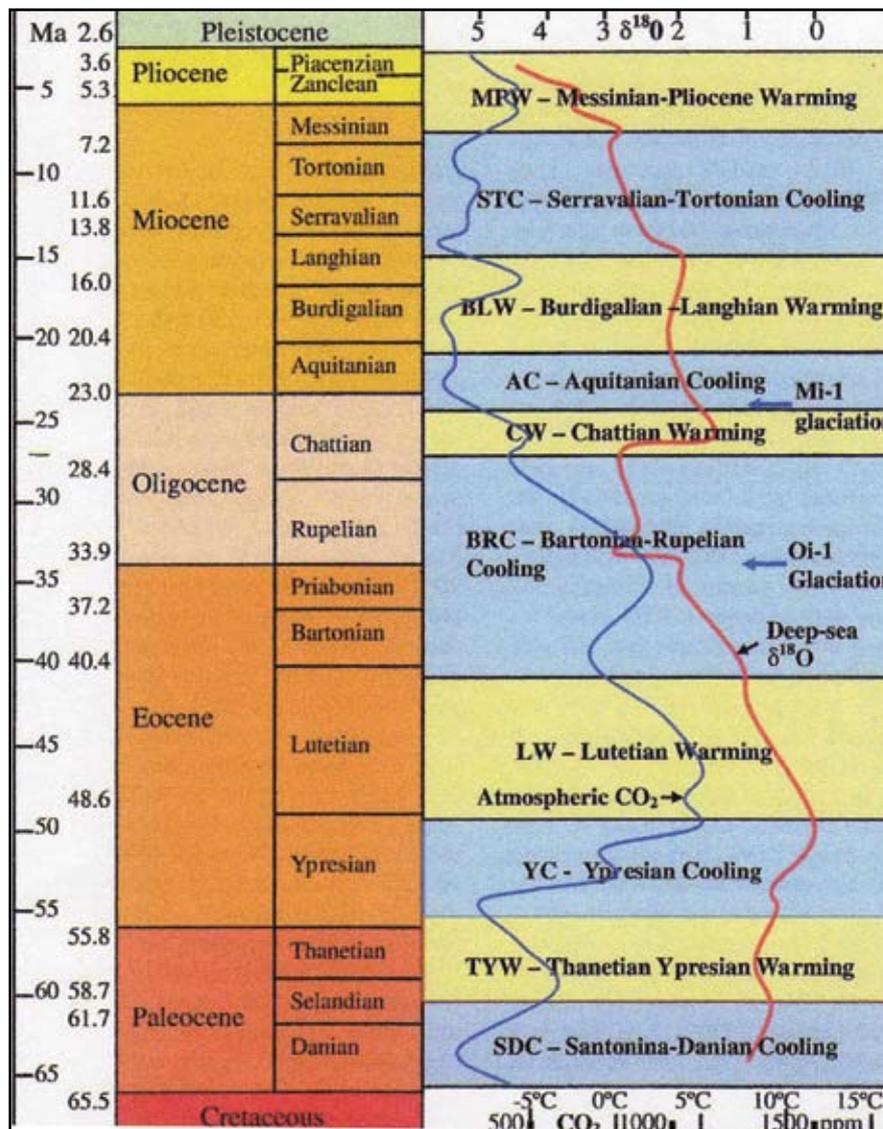


(references). This led to accelerated global cooling, as is particularly well reflected in the CO<sub>2</sub> curve of Beerling and Royer (2011).

Expanding glaciation in Antarctica was accompanied by a gradual drop in sea-level, probably enhancing circulation through the Drake Passage and the further isolation of the continent. Colder surface water would have trapped more CO<sub>2</sub>, thus preventing its release into the atmosphere, while the volume of carbonate precipitation and associated CO<sub>2</sub> liberation on the continental shelves would also have diminished significantly due to cooler water temperatures and less accommodation space. Furthermore, the higher pressure gradient between Antarctica and the equatorial regions would have intensified wind velocities, so that increased dust volumes in the atmosphere reflected more sunlight back to space. The latter would have been aggravated by the expansion of mountain glaciers and ice caps, in particular along the Patagonian Andes where uplift intensified after about 19Ma (references).

All of these interrelated effects and their feedbacks would tend to intensify global cooling, with apparently no intrinsic atmospheric or hydrospheric mechanisms to counteract this trend. However, accepting that ocean ridge activity may have a fundamental influence on global climates, this would indeed be able to prevent a Snowball Earth. Within the context of long-term climate deterioration since about 49Ma, the Earth is presently in an interglacial stage, in which modern CO<sub>2</sub> levels (about 400 ppm) match those during the BLW (21-15Ma) (reference) and slightly exceed those during the MPW (6-2.8Ma). Interesting enough, the modern rate of sea-floor spreading on certain sectors of the East Pacific Rise, which is about 15 cm/yr (reference) also matches that during periods of increased ridge activity during the Tertiary. This suggests that the present climatic conditions might simply reflect another warming event superimposed upon a general cooling trend, and that it may be accompanied by increased subduction with more earthquakes, volcanic eruptions and sudden switches to cold periods."

Long-term global trends in ocean and air temperatures as shown by <sup>18</sup>O and CO<sub>2</sub> records (after Zachos et al., 2002; Beerling and Royer, 2011). An increase in temperature is shown by a decrease in <sup>18</sup>O and an increase in CO<sub>2</sub>.



# all the news fit to print

## RHODES UNIVERSITY

### 2012 Shell Lecture Series Workshop at Rhodes University, South Africa

The Geology Department at Rhodes University recently hosted the 2012 Shell Lecture Series Workshop Applied Biostratigraphy in Exploration and Production (November 12-16). Researchers and students from six South African universities and industry representatives from South Africa, Namibia and Australia attended the one week workshop presented by Katrin Ruckwied (Shell), Iain Prince (Shell), and Annette E. Götz (Rhodes University).

The course focussed on palynology and palynofacies, but a short introduction to all other microfossil groups was also given. Lectures and microscopic exercises focussed on the different terrestrial and marine palynomorphs and their application in biostratigraphy. After an overview of the different fossil groups, a one day exercise was carried out to familiarize the participants with data interpretation and standard biostratigraphic work flows during exploration. Several case studies from the hydrocarbon industry were presented to demonstrate the different applications of biostratigraphy during exploration, appraisal and production in conventional and unconventional plays.

The convenors facilitated an open but professional learning environment, with spontaneous discussions and carte blanche on questions. A welcome reception and a workshop dinner contributed to the relaxed atmosphere of this event.

This was the first time that Shell has hosted a lecture series on this topic in South Africa, and based on the success of the course, plans are underway to make this a more regular occurrence. There is scope to incorporate the course within the framework of the existing Exploration Geology Masters Programme at Rhodes, as well as to establish it as an inter-university course servicing the whole of Africa. There appears to be a deficit of similar courses globally, as evidenced by the willingness of participants to travel from as far afield as Australia.

Micropalaeontology, while used extensively elsewhere in the world and highly regarded as a valuable exploration tool, has never reached its full potential in South Africa. The arrival of Annette Götz at Rhodes University heralds a new era in the development of micropalaeontology in South Africa, in both the spheres of academic research and biostratigraphy with direct application in industry.

**Rose Prevec**

*Informal discussions between sessions at the workshop (photo courtesy of Y. Yao).*



**RHODES UNIVERSITY**  
Where leaders learn



*The presenters are Katrin Ruckwied, Iain Prince (back row, 3rd and 4th from left, respectively), and Annette E. Götz (second from right); photo courtesy G. Costin.*



## Rhodes University Geology Microprobe Launch

The Geology Department at Rhodes experienced an eventful final quarter of 2012, so far. Perhaps the main highlight was the official launch of the JEOL Superprobe on November 9, which was attended by representatives from the NRF (Lindiwe Thabede and Jocelyne Mwabi), the Vice Chancellor of Rhodes University (Dr Saleem Badat), the Dean of Science (Prof. Ric Bernard), and about 40-odd other dignitaries. Short speeches were given, booze was drunk, and gifts were given and received. The departmental poet laureate was enticed down from his spire with a bottle of bourbon on a stick, and prodded into producing this to mark the event:

### ODE TO THE PROBE OH BIG ELECTRON MICROPROBE!

To be sung to the tune of "O little town of Bethlehem"  
Apologies to Rector Phillips Brooks (1835-1903)

*Oh Big Electron Microprobe,  
how will we use thee, wise?  
Above the street, you never sleep,  
and time, it passeth by  
And in the dark night shining, your ever-lasting lights  
In programme mode you zap and go,  
collecting through the night*

*Oh Big Electron Microprobe,  
you'd better get it right  
You'll PETL, ZAF and TAPL 'til our totals are in sight  
And if you get too cocky,  
your limits we will try  
There's manganese and PGE and pesky monazite*

*Oh Big Electron Microprobe,  
our hopes for you are high  
From countless rocks, you'll raise our stocks  
through journals, ISI  
Through thermobarometry by garnet-biotite  
Eight million Rand to measure sand;  
how do we sleep at night?*

*Oh Big Electron Microprobe,  
you're really all the rage  
Your time's not free; for industry,  
ten thousand buys a day  
Oh, NRF, we thank thee,  
to Rhodes our troth we plight  
The hopes and fears of all our peers is met in thee,  
tonight .*



*Dr Saleem Badat (VC Rhodes University) and Ms Lindiwe Thabede (NRF) inaugurate the JEOL. We were advised that smashing a champagne bottle on it might invalidate the warranty.*

Since the completion of its initial installation in about April (it got some new bits added on later), the probe has been running largely day and night, and has already provided data for nine Honours projects (from Geology and Zoology and Rhodes, as well as outside users from NMMU), fifteen M.Sc. projects, and a Ph.D., in addition to working for our academic staff and several industry contracts. It's already earning its keep nicely, with most of its potential yet to be realised.

### Hugh Eales

Finally, we note with great sadness the passing of Hugh Eales in November. He had been a prominent part of this department since 1957, and will be sorely missed and long remembered. A more detailed eulogy is provided elsewhere in this volume.

Contributed by Steve Prevec

## UNIVERSITY OF CAPE TOWN

News from UCT is that Dr Ake Fagereng has received the Claude Leon Merit Award for young lecturers as well as the 2012 UCT Fellows' Young Researcher Award. Both awards recognize outstanding meritorious scholarly work by a young researcher. Ake is also a member of the Hikurangi Working Group that has recently been awarded the New Zealand Marsden Grant, worth about R 6 million, to develop an integrated model for subduction thrust seismic behaviour.

MSc student Catherine Curtis and co-authors won the Jubilee Medal of the GSSA for the best paper published



in the SAJG during 2011. Their paper examines the geochemistry of the Early Cretaceous Koegel Fontein anorogenic igneous complex located along the West Coast. According to the GSSA, this work "represents a noteworthy contribution to the geology of southern Africa."

PhD student Lara Sciscio won the "Lystrosaurus Shield", a special award for the best student presentation, at the biennial conference of the Palaeontological Society of Southern Africa (organized at UCT from 5 – 8 September 2012). Her talk, entitled: "Fluctuating Miocene Climates and Ecosystems at the Southern Tip of Africa: a Multiproxy Approach" was based on the results of her MSc which she obtained at Rhodes University.

Finally, Mr George Smith has been appointed by the Society for Exploration Geophysicists (SEG) as 2013 Honorary Lecturer for Africa and the Middle East.

### UNIVERSITY OF WITWATERSRAND

Cameron Penn-Clarke won the GSSA's Student Prize as the top geosciences Honours student in South Africa in 2011, whilst Russell Johnson was awarded the MINSA Prize for his Honours thesis and scooped a SEG (Society of Economic Geologists) Graduate Student Fellowship for his MSc.



Awards to Judith Kinnaird and Tom Clifford were presented at the Fellows' Dinner (see report on p. 6, Ed.).

Honorary Professor Tony Naldrett took a small detour in his annual globetrotting earlier this year to receive the Haddon Forrester King Medal of the Australian Academy of Science in recognition of his life-long achievements and outstanding contributions relating to the study of orthomagmatic Ni-Cu-PGE sulphide deposits. Tony was also elected an honorary fellow of the GSSA last year.

Lee Berger, who holds a joint appointment in the School and the Institute of Human Evolution, received the US Academy of Achievement's Golden Plate Award and presented a keynote address on his spectacular *Australopithecus sediba* discovery at a gala dinner in Washington D.C. in November.

Sue Webb has also been elected International Secretary of the American Geophysical Union for 2013 and 2014. Sue was previously the second Vice-President in the Society of Exploration Geophysicists for 2010-2011. Sue also led a group of mostly Wits authors on a paper that won Honorable Mention in The Leading Edge about the Geoscientists without Borders project at the Dayspring Children's Village.

The School would also like to take the opportunity to thank Spike McCarthy and Allan Wilson for their services as they head into (semi-)retirement. Allan joined the School in 2007 after a lengthy spell at UKZN, and has been instrumental in building the EarthLab Geochemical Facility. Spike has spent an incredible 41 years at Wits, including 17 years as the Head of the Department of Geology and then Acting Head of the School of Geosciences, in-between which he managed to morph from a meteorite specialist into an igneous geochemist, then a stratigrapher-cum-tectonicist and finally into an environmental geoscientist focussing on wetlands. He even managed to take time out to write the best-selling *Story of Earth and Life* with Bruce Rubidge as well as two other popular geoscience books that reflect his eclectic interests and great ability to explain complex concepts in simple terms. Both Allan and Spike will be staying on in the School.

For further information, download a copy of the bi-annual School Newsletter on our website:

<http://www.wits.ac.za/geosciences/>

*Tony Naldrett Jan 2012*



## UNIVERSITY OF JOHANNESBURG



## UJ Geology Celebrates 413 Years of Expertise!

Four hundred and thirteen years. Compared to the geological time scale, that is a blink of the eye but in everyday terms, four-and-a-bit centuries is a very long time. How does this relate to this short article? Read on.

UJ is an institution formed by the merger of the Rand Afrikaans University (RAU) and the Technicon Witwatersrand (TWR) in 2004. In November 2012, a reunion of the heads of the geology department of RAU, TWR and UJ was held. The reason for the get-together was twofold. Firstly, all six HOD's are still alive and well and living in Johannesburg, except one who retired to Cape Town. Secondly, all are still actively working in geology, either via teaching, research or consulting. This must be a virtually unique situation where all of the people who have headed up a department since its inception are still alive, well and working. If one looks at UJ (and historically the old RAU), there is probably no other department that can boast this claim.

In order of succession these are:

- **Professor Willem van Biljon**  
(RAU, 1 June 1967 to 31 December 1983)
- **Professor Chris Roering**  
(RAU, 1 January 1984 to 31 December 1994)
- **Professor Dirk van Reenen**  
(RAU, 1 January 1995 to 31 December 1997)
- **Professor Nic Beukes**  
(RAU, 1 January 1998 to 31 December 2002)

- **Bruce Cairncross**  
(RAU-UJ, 1 January 2003 to present)
- **Mr Harry Brown**  
(TWR 1 January 1990 to 2004;  
UJ, Deputy Head 2004 to present)

Willem van Biljon lives in Johannesburg while Chris Roering retired to Cape Town. The remaining four individuals, Nic Beukes, Dirk van Reenen, Bruce Cairncross and Harry Brown are still active in the geology department. Dirk van Reenen had a stint as the Dean of the Faculty of Science before returning to the department to pursue his research interests in the Limpopo while Nic retired at the end of 2010, but, because of his status as an A1-rated NRF researcher, was re-appointed on a 3-year contract and continues to supervise post-graduates, publish his research and still spend time in the field. Bruce Cairncross is the current head of department and Harry Brown is the Deputy Head on the UJ's Doornfontein campus. It is also worth noting that three of the existing staff members, Elsje Maritz, Hennie Jonker and André Smit have served under all five HOD's. By the way, four hundred and thirteen years is the combined ages of the six HOD's!

**Bruce Cairncross**  
December 2012



*Left to right, front and back: Chris Roering, Willem van Biljon, Nic Beukes, Bruce Cairncross, Dirk van Reenen and Harry Brown, photographed in the UJ Geology Department Reading Room, November 2012.*

## UNIVERSITY OF PRETORIA

**Diamond Course at the University of Pretoria, 23-26  
October 2012**



*Some of the participants  
and Petra Diamonds'  
management team at  
their Cullinan Mine*

A very informative Diamond short course was held at the University of Pretoria from the 23rd to 26th October 2012. The objective of the short course was to provide insight into primary and secondary (derived deposits) and to cover the entire pipeline from exploration to evaluation, mining, and marketing.

The course was aimed to provide the honours students in the Department of Geology at the University with an opportunity to listen to experts in the various fields of diamond geology, mineralogy, diamond genesis, mining evaluation of deposits, and the valuation of diamond but it was also open to academia and industry which resulted in some 40 participants.

The first day covered items like the history of diamonds, world diamond markets, origin of diamonds, cratons, exploration, geophysics and kimberlitic minerals and their chemistry (John Bristow, Fanus Viljoen, Hielke Jelsma, Mike de Wit, Laurent Ameglio, Owen Garvie and Dave Apter). The second day was focused on primary (kimberlites and lamproites) and secondary (fluvial, aeolian and marine) sources of diamonds, the classification of primary deposits and their origins, and the characteristics and settings of alluvial diamond deposits in various parts in Africa and India, and marine deposits (Johan Stiefenhofer, Tania

Marshall, John Ward). The third day was dedicated to the exploitation of diamond deposits, evaluation and economic valuation including due diligence and geological requirements, diamond valuation (rough and polished), mining methods, evaluation of alluvial deposits and financial valuation models (John Bristow, Bob Halvorson, Jeffrey Brenner, and Tania Marshall).

A mine visit to the surface area and underground operations at Cullinan Mine was made possible by Petra Diamonds and gave the delegates a first-hand opportunity to see a world class diamond mine in operation.

De Beers, MSA and the Geological Society are thanked for their generous sponsorships and the presenters who volunteered their time. The funds raised from this course were earmarked to cover the registration expenses for the Geology honours students at the University of Pretoria and a post-graduate fund for junior lecturers in the Geology Department at the University.

The success of this course clearly highlights the need for such opportunities of continued education and the dates for next year's course are already been incorporated in the 2013 calendar.

**Mike de Wit and John Bristow**

# climate change

## THE SHORT STORY

In some ways, I applaud the sense of urgency that accompanies the perceived need to do something to affect climate change. The need is there in more ways than you presently know. But the means could be another matter entirely. The Akkadian Empire under Sargon (2,300-2,200 BC), mankind's first empire ever, succumbed to climate change that happened rather suddenly. A 300 year long period of drought struck this nascent civilization and toppled what turned out to be only a 100 year empire. The Old Kingdom of Egypt and the Harappans of the Indus Valley suffered a similar fate 4,200 years ago, succumbing to an abrupt drought that ended those civilizations, with Egyptians "forced to commit unheard of atrocities such as eating their own children and violating the sacred sanctity of their own dead (Fekri Hassan, 2001)". The Mayans had pretty much the same luck with three periods of extreme drought at 810, 860 and 910 AD. Sadly just two years after the last drought, which saw 95% of the Mayan population gone, wet years returned to the Yucatan.

A reconstruction from fossil algae in sediments from Drought Lake in North Dakota of the past 2000 years found that dry conditions were far and away the rule in the High Plains, with the Dust Bowl conditions of the 1930's one of the lesser dry spikes found in the record. Half of the warming that brought us out of the last ice age (the Wisconsin) occurred in less than a decade. There were 24 Dansgaard-Oeschger oscillations between this interglacial, the Holocene, the interglacial in which all of human civilization has occurred, and the last one, the Eemian, in which the first fossils of Homo sapiens are to be found. D-O oscillations average 1,500 years, and have the same characteristic sawtooth temperature shape that the major ice-age/interglacials do, a sudden, dramatic, reliable, and seemingly unavoidable rise of between 8-10°C on average, taking from only a few years to mere decades, then a shaky period of warmth (less than interglacial warmth), followed by a steep descent back into ice

age conditions. Each D-O oscillation is slightly colder than the previous one through about seven oscillations; then there is an especially long, cold interval, followed by an especially large, abrupt warming up to 16°C (a Bond cycle). During the latter parts of the especially cold intervals, armadas of icebergs are rafted across the North Atlantic (Heinrich events), their passage recorded reliably by the deep ocean sediment cores which capture the telltale signature of these events in dropstones and detritus melted out of them.

We know with absolute certainty that these events happen, with evidence of D-O oscillations extending back some 680 million years. We do not know, yet, precisely what causes them. What we do know is that the past 6 interglacials (dating back to the Mid Pleistocene Transition) have lasted roughly half of a precessional cycle, or currently 11,500 years, which just happens to be the present age of the Holocene. What we know is that N65 latitude insolation values are very close now to what they were at the close of the Eemian. What we also know is that GHGs (Green House Gas ed), like us, seem to have played only a spectator role to all of these alarming natural transitions, with temperature changes leading GHG concentrations by a considerable margin of time (800-1,300 years). What we do not know is if the reverse could occur, anthropogenic sourced GHGs triggering a climate change event, for perhaps the first time ever. What we do know is that earth's climate is bimodal, cold 90% and warm 10% of the time for the past million years or so, with the transition times (such as at the end of an interglacial) well known from proxy records to be quite sensitive to forcings we do not yet understand, and the forcings we have identified seemingly incapable of producing the responses we see in the paleoclimate record. Including the recent paleoclimate record.

The climb out from the Last Glacial Maximum of the Wisconsin ice age (called Termination 1 with sea level bottoming out about 121 meters, ~397 feet, below present) into the Holocene is studded with the Younger



Dryas, a 1,300 year near instantaneous return to ice age conditions. "Briefly, the data indicate that cooling into the Younger Dryas occurred in a few prominent decade(s)-long steps, whereas warming at the end of it occurred primarily in one especially large step of about 8°C in about 10 years and was accompanied by a doubling of snow accumulation in 3 years; most of the accumulation-rate change occurred in 1 year (National Research Council, 2002)". Far more suddenly we came out of it: "Taylor et al. (1997) found that most of the change in most indicators occurred in one step over about 5 years at the end of the Younger Dryas, although additional steps of similar length but much smaller magnitude preceded and followed the main step, spanning a total of about 50 years (NRC, 2002)".

Termination 1 went into top-fuel, carbon-free overdrive with what is referred to as melt water pulse 1a (mwp-1a) centered at about 14,680 years ago which resulted in a 24 meter rise (about 78 feet) in sea level believed to have occurred at the rate of 4.5 cm (about 2 inches) a year. It was followed around 12,260 years ago by mwp-1b with a 28 meter (about 92 feet) rise nearer 5 cm per year. Recent model results predict that sea level is currently rising at 32cm/100 years. If we take the low-end of the natural "noise" clocked at 4.5 cm/yr (or 450cm/century) we, (meaning us) will have to kick in some serious turbos (carbos?) to net one and a half orders of magnitude boost if we hope to trump mother nature's bottom bracket.

Another variable worth devoting some cpu time to is just how astonishingly well the fourth cycle of eccentricity matches up with hominid evolution.

"An examination of the fossil record indicates that the key junctures in hominin evolution reported nowadays at 2.6, 1.8 and 1 Ma coincide with 400 kyr eccentricity maxima, which suggests that periods with enhanced speciation and extinction events coincided with periods of maximum climate variability on high moisture levels." state Trauth, et al (2009) in Quaternary Science Reviews. There is just nothing quite like having such a natural fly land in your climate change soup. As it turns out, periods of wet maximum climate variability (in modern lingo, global warming/global cooling correctly re-branded as climate change), cook-up the larger

braincases. We went from 500-550cc braincases 2.8 mya to the average of about 2,500cc today in the most rapid encephalization of any mammal in the fossil record.

Between 6,000 and 7,000 years ago, a period known to geologists and paleoclimatologists as the Holocene Climate Optimum, sea levels peaked between 1.5 to a maximum-found 8 meters higher than today (average in the literature seems to be about 2.5-3.5 meters), and during the Eemian Optimum, some 20 meters (about 60 feet) higher than today. We may have trumped that during marine isotope stage 11 (MIS 11), when it may have reached 21.3 meters (about 70 feet) above msl. During the seven post MPT ice ages, sea levels dropped some 100 or more meters below present, the water tied up in the miles-thick ice sheets that have spread in North America as far south as Kansas. These are just some of the facts of the abrupt climate changes which we, as Homo sapiens, have experienced.

General Circulation Models, of which the IPCC references 20+, have yet to reproduce a single known abrupt paleoclimate change fed with the proxy data. The latest GCM models produce predictions based on a variety of input data and complex equations which few of us would understand. But for all the complexity and investment, they are still only predictions.

Belief in, and acting as a result of, such predictions has opened up what may be the first chapter in faith-based science. The astonishing enormity of natural climate change provides a harrowing appreciation of massive sea level "noise" that can range to over 400 feet (with a beat of lesser, rank-and-file swings [think D-O oscillations]) and temperature shifts that lord over all future fantasies you have yet heard.

What might be quite ironic is that if GHG predicted global warming is in fact real, and, at half of a precessional cycle, we are near to the cliff of the next natural shift to an ice age, we may find ourselves needing to generate as much GHGs as possible to ease our transition into the next ice age. So as I said at the beginning, doing something about climate change is not necessarily a bad thing. Doing the right thing might prove to be quite another. The ice ages and associated interglacials are well known to be paced



by the eccentricity, obliquity and precession cycles in earth's rickety orbit. These we will do nothing about. D-O oscillations show strong evidence of being tied to the 1,500 year cycle of solar output, something we cannot change.

So be ever thoughtful of both facts and predictions before leaping to a conclusion. It was in fact a LEAP that terminated the last interglacial, the cold Late Eemian Aridity Pulse which lasted 468 years and ended with a precipitous drop into the Wisconsin ice age. And yes, we were indeed there. We had been on the stage as our stone-age selves about the same length of time during that interglacial that our civilizations have been during this one.

**William McClenney**

#### **About the Author:**

Mr. McClenney is a California Licensed Professional Geologist #4430 and Registered Environmental Assessor. He was also appointed the first Certified Environmental Auditor in Victoria, Australia in 1991, empowered to sign-off on contaminated site cleanups.

He has been investigating and cleaning up hazardous waste sites for 22 years.

<http://www.theresilientearth.com/?q=content/grand-view-4-billion-years-climate-change>

## gcs centenary

### **Council for Geoscience Centenary celebrations 8-9 November 2012**

It is not often that I regret being a teetotaler, as I would have loved to have downed a glass of champagne in celebration of the Centenary of the Council for Geoscience (CGS), formerly the Geological Survey of South Africa. Perhaps wisely, there was none on offer during lunchtime on the 8th November 2012 when the CGS hosted a distinguished guest-list at its 2-day function to mark this auspicious occasion. The year 2012 is also notable for Queen Elizabeth II's Diamond Jubilee, the 50th anniversary of the first James Bond movie (I am an ardent fan), and perhaps less known, the centenary of Tarzan! So I made the stressful trip (traffic-wise) up to Silverton at the kind invitation of the CGS to partake in their festivities for the day.

Luc Chevallier was the Master of Ceremonies for the opening session in the Auditorium, and introduced acting-CEO Dr Gerhard Graham who gave a brief account of the history of the CGS. Then followed three excellent, well-illustrated talks by Paul Macey, Bob Thomas and Refilwe Shelembe on various aspects of the key function of any Geological Survey – mapping. Despite the amusing exclamation by the character Dr Sheldon Cooper in the sitcom "The Big Bang Theory"

that "Geology isn't really a science!", the series of talks presented by the CGS geoscientists prove otherwise. Geology is, indeed, a science, and may well be the second oldest profession! The importance of the geosciences in our daily lives is epitomised by the range of functions that the CGS is mandated by an Act of Parliament to undertake – from basic mapping to monitoring earthquakes, documenting mineral resources, finding solutions to acid mine drainage and monitoring sink-hole prone areas, just to mention a few. The CGS is publishing a book to celebrate its Centenary, and if readers would like a copy, they should contact Nthombi Mdluli Jacha at [njacha@geoscience.org.za](mailto:njacha@geoscience.org.za) to reserve one.

Tea was a rather hurried affair, with the caterers not expecting such a large attendance, and on resumption of the talks, Manie Brynard and Daniel Sebake explained how the painstakingly obtained field geological mapping data are turned into useful and usable digital and printed products. The day's distinguished guest, the Honourable Minister of Mineral Resources Susan Shabangu, then gave her keynote address that was well-received by all. She re-iterated





*Acting CEO of the CGS, Gerhard Graham, welcomes the Minister of Mineral Resources, Susan Shabangu to the Centennial Celebration of the CGS*

the importance of the CGS to the people of South Africa and the Government's continued support of it. Other distinguished guests included Dr Thibedi Ramontja, the Director General of the DMR (and a former CEO of the CGS), and Professor Phuti Ngoepe, the Chairman of the CGS Board and a few of his fellow Board members. Stewart Foya followed with the importance of South Africa's mineral resources to the economy, and its role in the future. Perhaps a subtle point was inadvertently made when the auditorium suffered two short blackouts during the morning session, luckily before the distinguished guests arrived!

Lunch was served under grey skies in a marquee, and it was an opportunity to catch up with old colleagues as I was with the CGS for five years until Egoli-Tshwane commuting got the better of me. It was a pleasure to chat to Rudie Oosterhuis, Edgar Stettler, Henk Coetzee, Martin Köhler and especially Mxolisi Kota, who has just been appointed the new CEO of the CGS. Mxolisi was my line manager, and I remember him asking me to address him as "Kota" because I had trouble with the click in his first name! An added bonus was that I had my copy of "The Geology of South Africa" signed by Bob Thomas, adding to that of Mike Johnson and Carl



*Mxolisi Kota with Paul Macey of the Belville office and Robbie Kleywegt, retired.*

Anhaeusser – a full house of the editors. Bob is now with the British Geological Survey, and still continues to visit South Africa every so often on projects. So to get his signature was a mini-coup - trust a bibliophile to find such things important!

The post-lunch session was short, with Dave Roberts speaking about the early modern human footprints



*Bob Thomas, now with the British Geological Survey, Gerhard Graham, Refilwe Sheleme and Paul Macey*

at Langebaan, followed by Danie Barnardo giving the low-down on the functions of the CGS Library, the Geoscience Museum (a section of the Ditsong National Museum) and the National Core Library. Richard Viljoen closed the formal proceedings for the day with a colourful account of the International Geological Congress, the 35th of which is to be hosted by South Africa in Cape Town in 2016. The CGS and the Geological Society of South Africa are the joint organisers of this "Olympics" of the geosciences, which promises to be the largest of its kind held in Africa. A major aspect of the Congress will be the field trips, and we are all aware of the superb geology with which Africa as a whole is blessed. The field trip committee has outlined a provisional list, and can be contacted for further suggestions. A thoroughly enjoyable cheese-and-wine party followed during which further networking and reminiscing occurred.

Day 2 started under blue skies, with Thinus Cloete outlining the functions of the laboratory services, followed by Elish Mulovhedzi's interesting account on geochemical investigations, especially the 1:250 000 scale mapping. Imagine flying in a helicopter along the Drakensberg escarpment in eastern Mpumalanga, all in the name of science! As Refilwe also mentioned, sometimes the freebies just make up for all the hardships



involved in field work. Peter Nyabeze, Eldridge Kgaswane and Martin Brandt then explained the role of geophysics as an important complementary discipline to geological mapping, mineral exploration, and fundamental deep-earth research.

At this junction (to ensure that my article gets published!) I will offer my apologies to the Editor of *Geobulletin* for making a conspicuous exit from the Auditorium just before his talk on the South African Committee for Stratigraphy and the geological time scale. I was committed to attend the Council for Scientific and Industrial Research's Excellence Awards function, so I

am sorry as well to have missed the rest of the talks given by the CGS staff, especially the one by Henk Coetzee, who was uncharacteristically dressed in a suit and tie. A sight to behold! The CGS has put a lot of effort into organising its Centenary celebrations for which we are all most appreciative, and we wish it well for the next century under the able guidance of its new CEO Mxolisi Kota. May the good work continue!

**George Henry**

# karoo development

## conference

### CLAIMING OUR FUTURE

#### *People, Space and Place in the Karoo*

From 14 to 17 October I attended the second Karoo Development Conference in Beaufort West. Other geologists at the meeting were Bruce Rubidge, born and raised in Graaff-Reinet, and well-known palaeo-anthropologist Judy Maguire, for many years resident in the Prince Albert district. Professors, Ph.Ds and other researchers in other disciplines, mainly though by no means exclusively from the University of the Free State, were prominent in the proceedings. Non-scientists in the 200-strong gathering included government officials, farmers and community representatives.

It was the second formal meeting of the Karoo Development Foundation (KDF), the first having been held in Graaff-Reinet in 2009. A wide variety of topics was discussed, centering on tourism in the Karoo, agriculture and community development. Not surprisingly it felt as though the coupled subjects of shale gas and fracking were never very far from the agenda. That and the rising importance of geotourism, as a facet of ecotourism, comprised the main relevance of the conference to a geologist such as myself. Both on the platform and in one-on-one discussions I was able to fly the geological flag. Attending the meeting also gave me the opportunity to analyse at first hand how a

medium-sized conference could be held in a relatively small country centre, attended by delegates from a wide spectrum of academia and civic society.

Regarding fracking the general sentiment of the gathering was moderately to strongly opposed to it for the manifold threats it posed to the environment. Rob Jeffrey, on the other hand, was persuasive in airing Econometrix's viewpoint that, correctly managed and monitored, hydraulic fracturing of substantial reserves of shale gas – if they exist – could be of great financial benefit to the Karoo and the country. Maarten de Wit was another enthusiastic proponent of exploration on the grounds that it would provide an incomparable wealth of geological data on the Karoo Basin. At the closure of the conference Dr Daan Toerien of the Centre of Development Support of the University of the Free State was articulate in cautioning against the KDF taking too extreme a stand against a development which many important – largely voiceless – stakeholders might feel to be a potential contributor to poverty alleviation.

I left the conference feeling that it had been an extremely worthwhile exercise.

**Nick Norman**





*From left: Prof Maarten de Wit (NMMU), Ms Carin Bosman (Sustainable Solutions, Pretoria), Mr Dougie Stern (Karoo farmer and researcher), Mr Johathan Deal (Treasure the Karoo Action Group) Dr David Fig (Researcher Associate, Environmental Evaluation Unit, UCT), Dr Christy Bragg (Endangered Wildlife Trust)  
Front: Chairperson Prof Bruce Rubidge (Wits University and KDF Trustee), Mr Willem Ellis (Centre of Development Support, University of Free State)*

# geotourism conference

## 2012

**Geotourism Conference, October 2012,  
Geological Society of London.**

The History of Geology Group of the Geological Society of London held a conference “*Appreciating Physical Landscapes: Geotourism 1670 – 1970*”. Papers and posters dealt with the role of local geological societies in the United Kingdom, photographic documentation of geotourism, geotourism history and geological monuments in Russia, north Norway, France, Canada, and Serbia. The conference examined the early reports of usually wealthy travellers, the publication of the first traveller’s guidebooks, and the rise of modern landscape appreciation and geo-conservation measures as forerunners of modern Geoparks. The conference introduction noted that geotourism’s rapidly expanding literature has tended to focus on descriptions and case studies, and promotional material in protected areas and Geoparks.

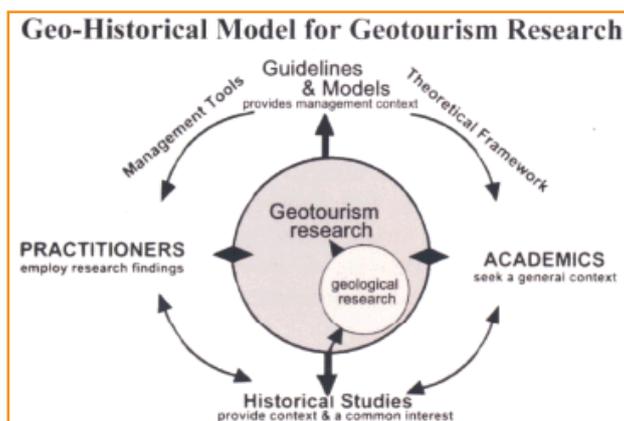
From the 17th century onwards accounts were written of visits to sites such as waterfalls and caves, and these became numerous in the later 19th century.

The first Geotourism conference was held in 1998 in Northern Ireland; since then there have been three ‘global’ Geotourism conferences. Now Geotourism is commonly included in various Geopark conferences, and was one of the themes at the 34th IUGS meeting held in Brisbane in 2012.

Research by Hose (2010) led to the conclusion there was poor communication of the scientific importance, as well as an almost complete lack of the appreciation of the cultural significance of such sites. Modern Geotourism is niche “special interest” tourism. A recent definition by Tom Hose is: “*The provision of interpretive and service facilities for geosites and geomorphosites and the encompassing topography, together with the associated in-situ and ex-situ artefacts, to constituency-build for their conservation by generating appreciation, learning and research by and for current and future generations*”.



A geotourism historical model, shown below, indicates that desktop studies are the essential primary stage of the research effort, and those historical studies provide the context for Geotourism research.



*Model for Geotourism research (Hose TA 2010. The significance of aesthetic landscape appreciation to modern geotourism provisions. In: Newsome D & Dowling RK (eds.) Geotourism: The tourism of geology and landscapes. Goodfellow, Oxford, pp. 13-25).*

The interest in geological and geomorphological sites has a long history, going back to the late 1700's. Initially visitors went to 'marvel and enjoy' scenery as curiosities of nature, a perception which has changed with time to become 'discover and learn', namely geotourism. This trend was reviewed in the presentation: *Rediscovering Geoheritage, Reinventing Geotourism – 200 years of experience from the Sudetes Mountain, central Europe*; this is an area of remarkable geo-diversity and a long history of tourism due in part to local spas. In recent years the Sudetes mountain region has been promoted as a geotourist destination. In 2010 a National Geopark was established in the Sudetes, with trails, information panels and outdoor rock exhibitions.

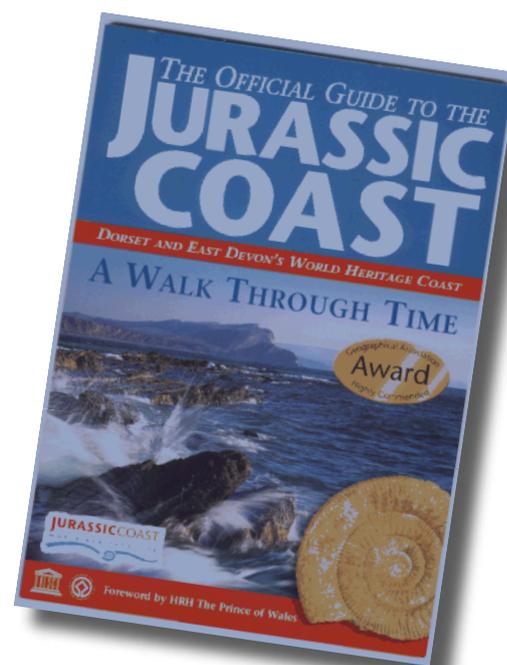
Landscape painters were also discussed at the meeting, in particular how they drew attention to geology and contributed to the need for nature and geological conservation. One paper examined a 19th century Australian landscape painter, von Guerard: *a Geognostic Landscape Painter in Australia*. In this contribution it was variously argued that at the time the landscape painter should portray his subject with the precision of the scientist, and that the future of landscape painting lay in its connection with the sciences, particularly geology. One of the areas von Guerard depicted in detail is the Kanawinka volcanic landscape in Australia, an area which has achieved UNESCO recognition as part of the global Geopark network.

This conference had a short field visit to the east England coast, in rather damp and misty weather, to see Cretaceous sea-mounts and discuss the Victorian tourism that developed from these features.



*Chalk sea-mounts and an interpretation display.*

The abstracts from this conference will be posted on the Geological Society of London History of Geology Group website at: [www.geolsoc.org.uk/hogg](http://www.geolsoc.org.uk/hogg)



*The Jurassic coast guide (Coastal Publishing, 2003)*

The Jurassic Coast in the south of England was designated a World Heritage site in December 2001. It includes 155 km of unspoilt cliffs and beaches from Exmouth in the west to Purbeck near the town of Bournemouth in the east. The over-riding reason for inclusion in the World Heritage List is the insight into the Earth Sciences that the area provides. The rock sequences record 185 million years of the Earth's history in one continuous exposure as a walk



through time along the coast, from the Triassic red desert sandstone, through the Jurassic with marine reptiles, and ammonites in a thick sequence of clays, limestone and sandstones. Tectonics and erosion during the Cretaceous preceded later Cretaceous chalk sequences. The mid-Cretaceous unconformity (the Great Unconformity) is seen all along the coast, with upper Cretaceous chalk overlying Triassic rocks in the west to Jurassic and early Cretaceous sequences towards the east. The tectonic and folding impacts on landscape seen today are illustrated.



*Undeterred by weather, many visitors head for Durdle Door at Lulworth cove, Dorset.*

The area is well served with public transport, and by several tour operators. The guide book contains 64 pages of geological phenomena. There is a detailed fold out map depicting the routes, sites, the location of heritage information and visitor centers on one side and a detailed geological section on the reverse. It describes what to see and where to visit, guidance on fossil collecting (this is allowed from weathered debris on the beaches and wave cut platforms, not from in-situ). It would take about a week to fully visit the entire coast.



*Durdle Door rock arch in Portland stone (vertical limestone beds)*



*One of the Jurassic coast information centres. These displays are notably hands-on.*

The Jurassic Coast was home to several geological notables. William Smith of the first geological map of England (The Map That Changed the World) is one of the early 19th century sons of the area. Also famous is Mary Anning of Lyme Regis, a poor woman of Dorset who became known as the greatest fossilist (sic) that ever lived, and who found the first marine reptile skeletons to come to scientific attention. These fossils are displayed prominently in the Natural History Museum, London. Local information centres have a variety of hands-on fossil experiences, together with displays of Anning,s work.

The area is visited by millions yearly. As an outdoor classroom many of the coastal centres provide organized informative tours and walks for school groups and the public, led by Education Rangers.

Local guide books specific to the sites visited are detailed with clear diagrams and illustrations depicting the geology and the geological process that gave rise to the scenery. The language is clear, concise, and avoids highly technical terms; the books are thus very readable and informative without being patronizing.

**Geoheritage – Geotourism 2013 meeting, Western Cape.**

The extent that scenery is becoming an attraction for visitors is also evident in South Africa, with a number of



Geoheritage sites defined or being developed across the country. The southern Cape Garden Route was described in a previous issue of *Geobulletin*, and local geologists lead tours in the area and also into the Little Karoo. Here the evolution of the landscape of Cape Fold Belt mountains, the deeply incised rivers, massive red Enon conglomerates, ancient plains of the African landsurface, the San art in caves, and the Congo caves are geotourism drawcards. The book *Geological Journeys* by Nick Norman and Gavin Whitfield has greatly contributed to this public interest in landscape and the geological controls on the scenery.

South Africa also has several examples of the influence of landscape and geology on art. Among these artists would be Pierneef, with his paintings of the folded sequences exposed in the Meiringspoort of the Little Karoo Swartberg Mountains, and the dolerite-capped hills of the Great Karoo; another is Volschenk, some of whose landscape works are of the Cape Fold Belt Langeberg mountain range near Riversdale, Western Cape.

Geoheritage Series Number 1 published by the GSSA presented the abstracts of the "Geoheritage and Education in South Africa" for the 6th International Geoscience Educators Conference held in September 2010. Fifteen presentations outlined the endeavors Geoheritage Group of the GSSA; these described

landscapes, geological sites in national parks, and the geotourism potential of sites such as the west coast fossil park.

As much has been achieved since that meeting, the GSSA, the Western Cape branch of the GSSA, and the Geoheritage Group are arranging a Geoheritage – Geotourism meeting in the Little Karoo for the 8th – 12th September 2013, to review progress and report on new Geoheritage developments.

The provisional title is: *"Mountains, Poorts, Passes and Caves - geology, landform evolution, scenery, and land-use in the Klein Karoo Gouritz Cluster Biosphere Reserve: Geoheritage, Geotourism, Geoeducation, and Geoparks, with emphasis on the human – landscape relationship through time"*.

The venue will be in Oudtshoorn, Western Cape. This town is set in the heart of the Klein Karoo and is surrounded by magnificent geology. Pre- and post-conference excursions are proposed out of Uniondale and Oudtshoorn, and perhaps to the Baviaanskloof Mega-reserve.

Meeting details will be posted on the *Geoheritage 2013* web early in 2013. In the meantime expressions of interest can be sent to: [cal@global.co.za](mailto:cal@global.co.za)

# the barberton drilling program

## Searching for the Environment and Origin of Early Life on Earth – The Barberton (ICDP) Drilling Program

The International Continental Drilling Program (ICDP) is an international consortium run from Potsdam in Germany with the aim of carrying out diamond core drilling of critical geological sections in continental areas. The Barberton greenstone belt of South Africa was identified as a key target particularly as it could give insight into the conditions on the planet when the earliest life forms started to appear.

The project was initiated by Professor Nick Arndt (Grenoble University) with a field meeting held in Barberton in October, 2007. This meeting was attended

by about 50 scientists from 7 countries and was aimed at establishing the scope and motivation for diamond drilling in Barberton. After numerous modifications of the proposal to ICDP the Barberton drilling program was approved in 2010 and drilling commenced in 2011. Six drill sites were chosen with the last site being aborted due to shortage of funds. The context and background to the Barberton ICDP is accessible on the webpage [www.peeringintobarberton.com](http://www.peeringintobarberton.com).

The overall motivation for the Barberton ICDP is that in spite of good outcrops important features like



complete sections, contacts between lavas, and critical sedimentary rock sequences containing easily weathered minerals are not exposed. The central aim of the project is to understand the geological and atmospheric setting for the establishment of earliest life (possibly the beginning of life and crustal development on Earth).

In August 2009 the ICDP agreed to support a scientific drilling program aimed at investigating the origin of life on Earth under such international umbrella bodies as "Archean Environment: the Habitat of Early Life", a research networking program of the European Science Foundation <http://archenv.geo.uu.nl/>.

As a result two main drilling target types were identified. (1) Sedimentary sequences, which would provide information about surface processes on the early Earth, meteorite flux, the composition and temperature of Archaean seawater, and the possible habitats where life may have emerged and evolved.

(2) Successions of ultramafic to felsic volcanic rocks, which would provide new insights into volcanic processes, dynamics of the crust and mantle, interaction between oceanic volcanic crust and the hydrosphere and biosphere.

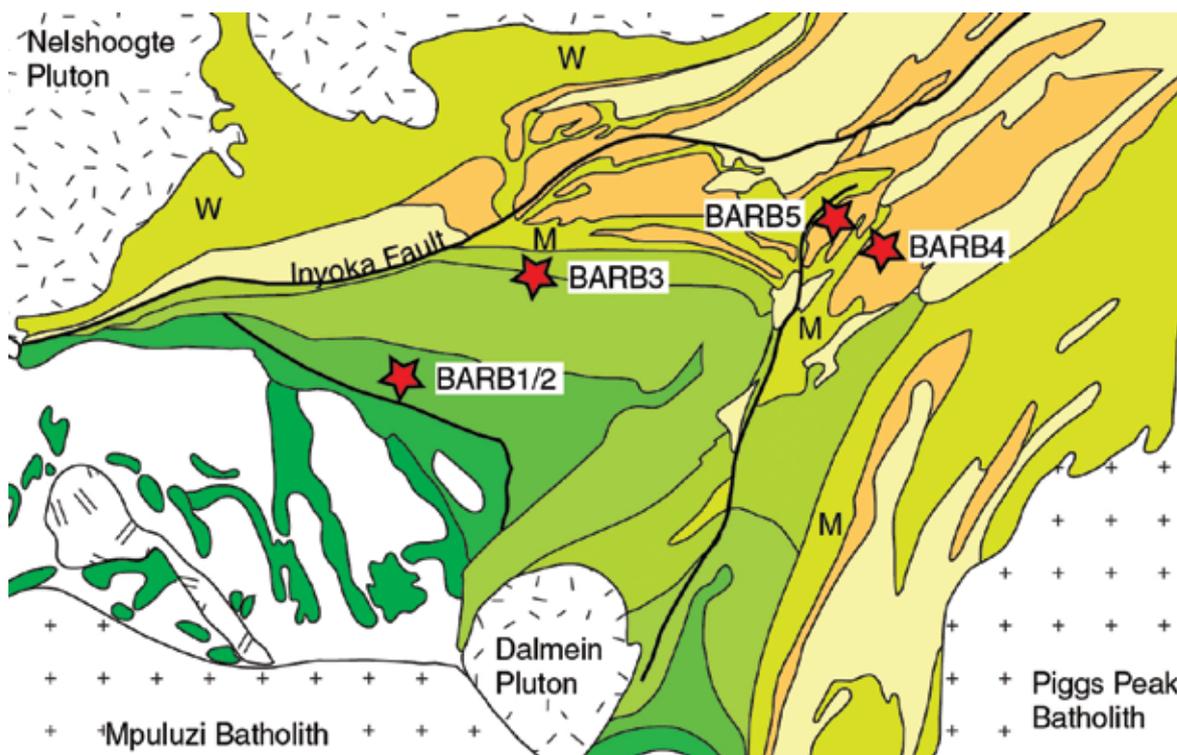
To achieve these aims the specific targets to be drilled with the particular objectives for each site were as follows (see map below)

BARB1 (420 m) and BARB2 (431 m) – two drill cores into the Komati Formation in the Tjakastad area close to the Komati River. The aim was to investigate poorly exposed examples of a volcanic tumulus structure and also the nature and thicknesses of the volcanic units and their compositions and contacts. These cores were expected to yield sections of komatiites, komatiitic basalts and basalts as well as the contacts of these units.



*The drill site at BARB1 – first core recovery. The type section of the Komati Formation is in the background.*

BARB3 (899 m) - a single drill core into the 3.45 Ga old sedimentary Buck Reef Chert which is situated between the Hooggenoeg and Kromberg formations. The Buck



*Map of the southwestern part of the Barberton Greenstone Belt showing locations of the drill sites*



*The drill site of BARB3 in the Buck Reef cherts. The cherts can be seen in the background.*

Reef Chert comprises a thick package of banded carbonaceous and ferruginous cherts. It was expected that this core would provide clues to conditions of the Archaean oceans as well as direct evidence of life forms.

BARB4 (520 m) – this is in the central part of the Barberton greenstone belt and was drilled through turbiditic greywacke, mudstone, sideritic banded ferruginous chert, and banded iron formation of the Fig Tree Group and underlying silicified komatiites of the Mendon Formation.

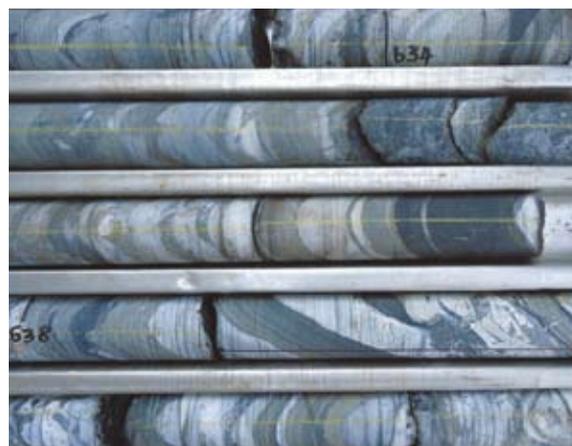
BARB5 (800 m) – this is in the “Barite Valley Syncline” in the centre of the belt and was expected to intersect a series of shale, iron formation, chert and barite-rich formations of the lower Fig Tree Group.

The BARB3, BARB4 and BARB5 cores were expected to reveal information about processes of sedimentation, meteorite impact events as well as the environments of early life, while the BARB1 and BARB2 cores would provide much more detailed information on the nature of the komatiite lava flows and how they interacted with each other and the nature of the contacts between the flows which are seldom exposed on surface. This also comes at a time when the few critical remaining surface outcrops of komatiites have experienced recent unprecedented damage from sample takers.

The current situation is that the drilling has been completed and excellent cores have been recovered. The management of the drilling program was undertaken by Gordon Chunnnett and the initial stages of curatorship, logging and recording of information were conducted

by Gavin Whitfield. The core is currently stored at Wits University under the custodianship of Allan Wilson.

Between 18 and 21 February 2013 a sampling workshop will be held at Wits University where all interested research groups will present research plans for use of the core. This will be an international meeting and South African Universities and research groups are invited to attend. Expression of interest should be sent to the organisers Axel Hofmann (ahofmann@uj.ac.za), Allan Wilson (allan.wilson@wits.ac.za), or Sylvia Kenny (core administrator) (sylvia.kenny17@gmail.com).



*Banded carbonaceous cherts in the drillcore from BARB3*

There will also be a special session at EGU in April 2013 on the Barberton ICDP drilling program. Students working on the core are particularly encouraged to present preliminary results of their research.

**Allan Wilson and Axel Hofmann**

# obituary:

## François Hoffman (“Hoffie”)

François Hoffman was born on 30th June 1931 in Fochville, Gauteng and matriculated at the Hoër Volksskool in Potchefstroom in 1948 and went on to attend Pretoria University where he graduated with a BSc (Hons.) degree in Geology in 1956, met and married Ada Vera Kriel in 1957 and began work in the Department of Mines. He was transferred to Alexander Bay and spent two years exploring and defining the diamondiferous raised beach deposits south of the Orange River mouth; so began a long and illustrious career in diamond exploration.

In 1958 the Federale Mynbou/General Mining Group (later Gencor) formed a joint venture with the Anglo Vaal Group and the Marine Diamond Corporation (MDC) under the leadership of the pioneer of marine diamond mining, Sammy Collins, and in 1959 Hoffie was recruited by Gencor to be the Chief Geologist of MDC where he spent the next five years. In the book “King of Sea Diamonds” written by Roger Williams (Flesch, 1996\*) he was variously described as ...“he played a major role in the creation of the marine diamond mining industry” ... and later on in the book, quoting George Foulis, then MDC’s mining superintendent ...“an astute and logical geologist, having studied ancient and modern maps and sea charts, with his background in diamond prospecting, he worked out where diamonds were likely to be found” ... and...“he also started the planning of geophysical bottom and sub-bottom surveys to help produce a better picture of the ocean floor”. These techniques have developed into the primary tools used in the modern exploration of marine diamond deposits. Hoffie said “In my first year with MDC I slept at home for a total of 40 nights”.

In 1963 Hoffie joined a few entrepreneurial individuals who found the Trans Hex Group (“THG”), which was to become the second largest producer of rough diamonds in South Africa; after a period of diligent prospecting with his friend and geologist, Frans Mostert, they located an alluvial diamond deposit at Komaggas (Buffelsbank) in northwest Namaqualand which was mined continuously from 1965 until the mid-1990’s. Profits from the Buffelsbank operations were used to expand operations to Hondeklip Bay (1971)



and then to Baken on the lower Orange River (1972). After repeated and persistent bulk sampling, Baken eventually became the flagship mining operation of the Group which today is still the case; the Baken deposit ranks close to the top of the world’s premier alluvial diamond deposits in terms of size, ore grade and carat value.

THG acquired marine diamond concessions in 1974 and small, shallow-water vessels were used to feed land-based treatment plants at DePunt, Weskus Mynbou, Hondeklip Bay and Port Nolloth. THG listed on the Johannesburg Stock Exchange in 1981 and under Hoffie’s guidance the Group expanded into open-cast mining kimberlites at Dokolwayo, Swaziland (1983 – 1995), kimberlite dump re-treatment at Bellsbank, Sover and New Elands near Boshoff (1989 - 2000) while expanding operations on the lower Orange at Sendelingsdrift where the Reuning alluvial deposits were mined from 1984.

During the late 1970’s Hoffie started marketing THG’s diamonds through Bert Jolis, a New York diamantaire; they pioneered the selling of diamonds by way of the tender system in Europe during the early 1980’s and



so successful was this system that Jack Jolis, Bert's son, was appointed as THG's marketing manager and opened an office in Antwerp and further refined the tender marketing system; their unique system has now been emulated by all of the major independent diamond producers.

Jack relates that the ebullient Hoffie character really came to the fore during a trip to Russia in 1992 when they had successfully negotiated and signed an agreement with the Aikal Geological Expedition (later torn up by the Governor of the Province) for THG to explore for diamonds – during a break after several tough days of negotiations Hoffie declared in his gravelly, growling voice "You know what Jack, if you took away all the bl...dy ice from here and they discovered decent plumbing it would be just like the bl...dy Karroo and do you know I could learn to be happy here..."

In 1986 Hoffie diversified THG's diamond mining by entering the limestone quarrying and processing business when they acquired Cape Lime's operations at Langvlei (Robertson) and Vredendal. Before retiring from THG in 1994, Hoffie enthusiastically supported the Group's diamond exploration activities in many countries of the world.

To describe Hoffie's business acumen is a simple task – he was brilliant in the role of entrepreneur, building a highly successful and much respected mining company from nothing. Highly innovative, well read and a deep thinker he combined careful, courageous but

decisive decision making to negotiate the best deals for the Group. Hoffie was a "people's person" hugely respected by friend and foe; he detested "deviousness" and this characteristic was legendary – from board level to the coalface. He was adored by his friends and employees for his humour, friendliness, respect and interest in everybody who worked for THG.

In 1994 Hoffie retired to a home he designed and built in Pringle Bay from where he operated a private venture - marketing typical and atypical crystal forms of diamond rough to researchers and teachers of earth science as well as mineral collectors and museums.

Hoffie's life philosophy was based on .."there is only one place to be – the middle of the road – no side tracks, no short cuts, no hidden agendas". Hoffie was elected as a Lifetime Fellow of the GSSA which he joined in 1959; he was a member of the SA Diamond Board and a founding member of the Namaqualand Diamond Trust.

Hoffie died of natural causes in Somerset West on 22nd August 2012 and is survived by his wife, Ada, his daughter Inge, his two sons Fred and Francois and four grandchildren; he will be sorely missed – men like him are certainly not born every day.

**Peter D. Danchin** (FGSSA) and  
**A. van der Westhuizen** (MGSSA).

\*Our thanks to both the author and the publisher for permission to publish the above extracts.

## Mervyn John McCarthy

30/12/1929 - 22/08/2012

John McCarthy (also known as "John Mac", Mr Mack" and "Rocky John") is remembered with deep respect and affection by all who knew him. A quietly-spoken, friendly man of many facets, interests and activities, he is described by many who knew him as one of the great gentlemen of geology in South Africa. His sense of wonder and avid curiosity in the world about him, his integrity, humility, generosity, good humour, quick wit, his appreciation and support of the success of others and wise advice to friends, colleagues and students were the hallmarks of his character. Born in Durban, he attended Glenwood High School. John joined the GSSA as a student member in 1949, converting to

Member in 1950; and was elected to Life Fellow in 2000; his name graces the list of GSSA Stone Sages. His undergraduate years were spent at the University of Natal, Pietermaritzburg (B Sc. 1949). His life-long friend and colleague Peter Matthews recalls that they were briefly introduced to Alex du Toit by Prof Lester King. John's M.Sc. thesis was entitled "The Geology of the Empangeni Fault area". Decades later, when Mike Watkeys visited this area with John, he was amazed that John could still find certain outcrops. John's dry reply was that all the trees had grown since he first mapped in the area.





*John McCarthy with Ken Tinley (left) and Robin Guy (right) near the top of Gorongosa Mountain, Mozambique.  
(Photo dated Nov. 1971, courtesy of C.J. (Roddy) Ward)*

During the early 1950's he worked in Iraq for the renowned exploration geophysicist Oscar Weiss, looking for copper, gold, base metals, in fact, anything but oil. Tragically his young wife died in Iraq and as a young widower with a baby son he recalled completing field work with his little boy strapped to his back. He returned to SA and after a short period with De Beers at Oranjemund he joined the staff at his alma mater in 1958 where he introduced the first geophysics course. John remained a stalwart of the Geology Department in Durban for more than 30 years and frequently, what was meant to be a brief tea break in the staff room would very quickly develop into an intense discussion on some geological issue taking up the entire afternoon.

Exploration field work with De Beers on the west coast inspired him to continue with research on evidence for sea level changes around the African coast. His landmark paper in 1967, "Stratigraphical and sedimentological evidence from the Durban region of major sea level movements since the late Tertiary", *Trans. Geol. Soc. S.Afr.* 70, 135-165 (now SAGJ), was awarded the GSSA Jubilee Medal for 1967 and is still cited in present day coastal studies. He was the first to identify the Aliwal Shoal as a submerged aeolianite. According to Tony Tankard, "This investigation, had a very interesting background which John enjoyed telling. In October 1963, the Aimee Lykes, on her maiden voyage ran aground on the Aliwal Shoal south of Durban, and during subsequent repairs chunks of Aliwal Shoal were discovered lodged in her keel, essentially handing John the rock samples on a platter. Also during these years I remember his discussions on the structure of coastal Natal, and his speculation about

how the faulting may relate to Gondwana breakup, which we now know was in the Late Jurassic to Early Cretaceous. I think he was ahead of the times on this one as so little was then known about the consequences of continental fragmentation."

Rodney Maud adds "in 1978, with Bill Orr, John described a fossil rhinoceros tooth and the lowermost stratigraphy of the Port Durnford Formation from a site first described by William Anderson in 1907, the site having been 'lost' since that time. For Geocongress '88 John submitted four extended abstracts on (A) Tannin stained river waters along the east coast of Southern Africa; (B) Some observations on the occurrence of 'Berea-Type' red sands along the Natal Coast; (C) Late-Karoo micro-tectonic features in the Natal basement; and (D) Late-Gondwana to recent geology of coastal Natal. In 1998, with Mike Cooper, he proposed a revised stratigraphy of the Uloa Subgroup, these rocks having had a very contentious history since first described by Lester King in 1954. (Although the originally described type locality of the Uloa warrants recognition as a paleontological national monument, it also needs to be recognised as a battlefield, numerous acrimonious publications by various workers having attended its history since its first discovery!)."

John was fascinated by the post-Gondwana coastal and marine Cretaceous and Cenozoic history of southern Africa; locally the geology of the Berea Red Sand, the Boulder Beds and Durban Bluff. During the 1970's this interest was enriched further when he joined Eric Simpson and John Rogers to cruise the western Indian Ocean on the research ship Thomas B. Davie. He frequently referred to his experiences on this cruise and the spectacular seamounts that were discovered. It was John's interest in marine geology that inspired the birth of the Marine Geology Research Unit at the University of KwaZuluNatal.

John also had a special interest in Geological Conservation and based on his incredibly detailed knowledge of the many trails of the Drakensberg, Natal Midlands and coastal regions, he identified and described many significant Geosites around Durban and elsewhere, taking great delight in leading groups to see these special places. His input regarding critical groundwater supply issues contributed to the final decision against the proposed mining, culminating in the 1999 declaration of the iSimangaliso /Greater St Lucia Wetlands Park as a World Heritage Site.



### A gifted teacher

John's greatest legacy is to the hundreds of students who attended his lectures or spent time in the field with him. His boundless energy, stamina and enthusiasm for his subject were inspirational. He had an encyclopaedic knowledge of SA geology, encouraging questions and debate. He demanded excellence and enjoyed posing geological conundrums, such as, "Why are the waters in rivers of the Southern Cape brown?" and "How did Bevet's Conglomerate form?" Ever sceptical that oil would ever be discovered off the KZN coast, he declared that he would drink the first glassful!

George Milne recalls John presenting an enthralling honours course on the post-Gondwana geology of the entire east coast of Africa from Somalia to the southern Cape. These lectures (without notes) were based on his own extensive photographic record of his travels through Africa, a geophysical profile of the Mozambique Channel and a large map of Africa. That year John also defeated everyone in the honours class who challenged him at squash. Many will know John was a very good tennis and squash player and continued to play well into his retirement years when he was a well-known competitor on the National Masters Squash Tournament Circuit.

Alan Smith remembers spending seven days on an honours trip in Maputaland looking for Schooneberg Hill. "Apparently there were ammonites there. We

never found it but somewhere along the line I became a geologist. I guess that hill is still out there. He was a lecturer second to none but you had to crack the code. He started in the middle of the chalk board and drew his way across the board in all directions. Most students begin pages at the top left to start their notes, which meant they soon ran out of space. The trick was to turn the page to landscape and draw! After all geology is pictures not words! He was an interesting guy."

Ron Uken recalls, "There was always an element of surprise when attending John's lectures and fieldtrips. They could go anywhere and would usually leave one with more questions than answers, very different to the often over-structured lectures demanded today! It was this that promoted a passion for geology and sense of adventure for all those who had the pleasure of attending his courses and field trips. With his collection of large format slides and a monstrous cannon-like slide projector John would entertain us with Southern African geology or we would find ourselves crowded around one or other geological map - his favourites being the Worcester or Chuniespoort sheets. The geology was discussed in great detail highlighting the problems and the big story! After a long day around Lake St Lucia a last minute decision was made to also see the geology around Kosi Bay and we headed off without any camping gear. We were soon benighted and found ourselves bivvying out in a dunefield!"



*UND Honours class 1985 on their Maputaland field trip. View from North bank of the Umfolozi River standing on seaward dipping Jurassic basalts.*

*Left to right: John Searra, JOHN MAC, Ian Graham, Trevor Clarke, James Whitecross, Kevin Hodges, Ron Uken, John Deane, Tony Mills. (Photo by Tony Harwood).*



Gerald Davie writes: "Perhaps at the time we were all too young for him, but he essentially taught us our geology in the first couple of years of university life. Saturday field trips were highlights in the year, and with the MacRock Productions video camera rolling in the background, mostly unbeknownst to us, he created a hilarious record of those outings which were subsequently screened at the start of the Friday afternoon practicals. We would vie to carry his massive VCR linked to the camera with a curly wire while he would be out ahead filming geology and students alike, all the while drawing our attention to the significance of the geological feature we were looking at. Then there were those wonderful hand-drawn cross sections which he would construct across the blackboard, while his students frantically tried to reproduce in their notes, only to be dismayed when he would grab the blackboard duster, rub it all out and announce that those theories were now debunked, to be painstakingly replaced by another cross section showing the latest understanding of the stratigraphy. He introduced us to wonderful terms such as kurtosis, allochthonous, potable and obduction, and he would tell that wonderful story of the Survey of India, the Kalianpur and Kaliana discrepancies, and their ultimate geological explanations. It was all amazing stuff for our young ears and we lapped it up,

and that was perhaps his genius – he had an ability to keep us enthralled and entertained. Underlying it all – perhaps one could call it the bedrock - was his immense humanity – he was gracious, approachable, fair and always willing to help, and there was always a sense of humour bubbling away not far beneath the surface. A little bit of light has gone out of this world."

John McCarthy's passing is indeed a great sadness, but he will long be remembered with fondness by all those students, and others, with whom he came into contact and influenced favourably for their later careers during the very many years he served the Geology Department of the University in Durban. Our heartfelt condolences are extended to his son, Alan now living with his family in Australia and to John's sister in Johannesburg.

*Thank you to all who provided information for this tribute in particular Rodney Maud, Nick Norman, Tony Tankard, Mike Watkeys, John Rogers, Neil Gardyne, Mike Cooper, Alan Smith, Ron Uken, Gerald Davie, George Milne, Mike Duane, Roddy War, Tony Harwood.*

**Peter Matthews and Lesley Turner**

## Hugh V. Eales

1929 - 2012

Hugh Victor Eales was born in 1929 in Zastron, in the Orange Free State, on the 20th of October, where his father had been posted as the Standard Bank manager. He was the youngest of four children, all of whom have now predeceased him. A thoroughbred South African, his mother had been born during the siege of Mafeking, and his father's family, descended from 1820 stock, farmed in the Tarkastad district. With his father moving around the country as he did, Hugh's early schooling was in the Eastern Cape, attending Muir College in Uitenhage and then Dale College in King William's Town, from whence he matriculated in First Class in 1946. His father retired in King and bought a small citrus small-holding, so Hugh was expected to cycle to school daily and do plenty of farm maintenance during his holidays, which stood him in good stead some years later.



*Hugh Eales, looking spry (photo courtesy Anne Eales)*



*Excerpt from the Rhodes Geology "Domesday Book", where Edgar Mountain notes Hugh's original appointment.*

1957 — Dr. H.V. Sales joined staff middle of 1957

WEEK ENDING	NAME	M.	TU.	W.	TH.	F.	S.	M.	TU.	W.	TH.	F.	S.	M.	TU.	W.	TH.	F.	S.	M.	T	
	<b>GEOLOGY I</b>	Pr.	Jl	Pr	I		Jz	Rz	J		Mp	Pr		CR	P	Pr	T	%				
	<del>A. ...</del>																					
	M.M. ...		75	79	76		66	91	57		47	42		61	174	110	284	57		P2		
	G.C. ...		92	61	85	8a	50	46	28		26	42		33	125	102	227	48		P3		
	J. ...		60	60	60		54	64	50		35	54		49	134	105	239	48		P3		
	<del>A. ...</del>		24	56	37		17	20	15													
	L.S. ...	M	55	73	61	a	58	44	57		37	25		48	133	106	239	48		P3		
	W.C.R. ...		72	64	64		61	46	62		56	79		64	151	140	281	58		P2		
	A.D. ...	M	51	54	53		38	31	25		27	32		35	42	-	42	8		F		
	C.P. ...		36	60	44		23	35	25		25	38		34	58	72	130	26		F		
	A.P. ...		45	40	44		14	49	15		16	20		24	39	65	84	17		F		
	R.A. ...	a	65	84	69		32	65	36		30	43		42	172	118	290	58		P2		
	G.P. ...	M	59	80	56		69	66	43		49	42		52	138	127	265	63		P2		
	H.R. ...	M	31	50	37	a	24	64	17		30	33		38	62	60	132	24		F		
	R.P. ...	M	25	57	38	a	25	54	19		18	25		26	58	56	94	19		F		

After a year in Pretoria learning to be independent and working as a technical assistant at the University of Pretoria (Dept of Agriculture), he soon realised that tertiary education was essential if he was to realise his potential. So he borrowed his fees from his father and sister and came to Rhodes ostensibly to study Botany, but landed up falling in love with geology, which became his abiding passion throughout his life. He proceeded to undertake his B.Sc. degree at Rhodes University (1948-1950), from which he graduated with Distinctions in both Chemistry and Geology, and was awarded the Schwarz Prize for Geology in 1950, as well as the Junior Captain Scott Medal for the best thesis in Geology nationwide. In that year he was also the president of the Rhodes University Students' Scientific Society (all Science Departments). He proceeded along these lines by being the Founding Chairman of the Rhodes University Geology Society in 1951, receiving a First Class for his Honours in 1952, and a Distinction for his M.Sc. in 1953 for his thesis "The Khale dolerite sheet, Bechuanaland Protectorate" (supervised by Edgar Mountain).

Now was the time for pay-back to the family so he set off for Tanganyika to work for Williamson Diamonds Ltd. (from 1953 to '55). Thrust into the wilds of the bush he quickly had to learn Swahili as his workers were to be the only company he was to have for the initial 6 weeks. He experienced teeming herds of game and took masses of photographs; he felt he had been forever spoiled for game viewing in game parks. He found the climate there very humid and sleep-inducing, so decided that having two years of experience in

diamonds, he now sought gold as his next goal. He then worked as a field geologist in Southern Rhodesia, traipsing all over the country looking at prospects for the Canadian firm Frobisher Ltd, with its head office in Bulawayo, from 1955 to '57.

Social life there took place at the MacDonald Club, where swimming, tennis, squash, pool, etc. were on offer, plus meals and fairly regular dances. There he met Anne Jeannette Scholes, who had come with another Old Rhodian, and not having had much female company for several years, he became smitten. Lucky Anne had recently relocated to Bulawayo from Harare after her father's death to be closer to her mother who farmed near Plumtree. Her engagement present to him a year later was a set of golf clubs – was she to regret it later on when he really took to golf at weekends? Not really, as he always said later that he paid his dues to the golf course rather than to the medical profession.

1957 was an auspicious year for Hugh; he began it by marrying Anne in Bulawayo, Zimbabwe, in January. He was subsequently appointed as a Lecturer on the academic staff of Rhodes Geology, which was then headed by Prof. E.D. Mountain, whilst commencing his Ph.D. research. He was dropped in at the deep end, teaching palaeontology, stratigraphy, economic geology, sedimentology, and crystallography, whilst polishing off his doctoral research. The lecturing load, with only three teaching staff members and no secretary or telephone in the department, was extremely heavy; lectures and practicals every day and three-hour pracs with the Honours students on Saturday



mornings! Although his post was nominally created for him to lecture palaeontology – not his first love – he now had access to lab facilities, and developed the technique of polishing rocks with jewellers' rouge on a baize block for inspection under the microscope. This ore microscopy was the basis for his Ph.D. thesis, entitled "Gold fineness in hydrothermal ores – an investigation into the distribution of gold and silver in some Southern Rhodesian gold ores" (again under the guidance of Mountain). Upon acquiring his Ph.D. in 1960, he was promoted to Senior Lecturer. Upon Mountain's retirement in 1970, Hugh assumed the Head of Departmentship, as well as the Professorship, until his formal retirement in early 1993.

During his Headship, he oversaw the building of an analytical and ideologically modern geology department, just in time for the 1970's booms in metal prices and in geology undergraduate enrolments. In 1974 he oversaw the introduction of Electron Microprobe (a refurbished Cambridge Instruments Geoscan Microprobe) and X-ray Fluorescence (a new Philips XRF) techniques for major and trace-element analysis of minerals and rocks. 1978 saw the founding of the Rhodes University Post-Graduate (M.Sc.) School of Exploration Geology with the appointment of Dr R. ("Bob") Mason as first Course Director. To date on the order of 200 M.Sc. (Exploration Geology), M.Sc. (Econ. Geol.) and Ph.D. degrees have been awarded through this programme to candidates from more than 20 different countries. He also assembled a new departmental teaching staff, building the core of the department that would last the next four decades, featuring Roger Jacob and Goonie Marsh, among others. Over the same time, he fathered his three daughters. In addition to building a family and a department staff, he also planned, with the architect, the redesign and equipping of a new Geology Department building (our current residence), which was occupied in 1984. In 1985 the original microprobe was replaced by a new JEOL CXA 733 Superprobe (funded by the FRD and Rhodes).

He was eventually obliged to retire due to serious heart problems; this probably slowed him down merely to a normal person's speed subsequently. During his career, he authored or co-authored 55 journal publications (15 of them after his retirement), 15 books or chapters

therein (on topics ranging from the Bushveld Complex to histories of the Rhodes Geology Department and the Grahamstown Golf Club). He also produced 30 conference abstracts and 25 technical reports, all of this with a heavy teaching and administrative load. He supervised (and more significantly, oversaw the graduation of) 30 postgraduate students (including 9 Ph.D.s) during his career, which accounts for 20% of the total postgraduate output of the department since its inception in 1904 (admittedly he has been an active or retired member of staff for just over 50% of this time!), and nearly 30% of its total Ph.D. output. He is perhaps best known for his geochemical and petrological work on the Bushveld Complex, facilitated by a dozen or so M.Sc. and Ph.D. students through the 1980s, and disseminated through numerous journal articles and his book contributions. However, his earlier body of work included studies on gold, silver, molybdenum, and nickel-copper ores and mineralisation, and extensive work on intrusive mafic rocks of the Karoo, with particular emphasis on the spinels. His work was dominated by petrographic, petrological and mineral geochemical emphasis; fundamental igneous petrology, and he was contributing new ideas and polishing off old ones right up until the final months, always interested, enthusiastic, and happy to oblige in interactions with colleagues and students alike.

Eventually his heart ailments caught up with him again, and he was obliged to give up field work, then golf, then tobacco (on and off), and eventually (from about 2011) he started to trim back his 40-hour work week.

He celebrated his 83rd birthday in October this year, and attended the official opening of the new JEOL Superprobe on November 9 which replaced the one he bought in 1985. He never lost his enthusiasm for geology, and for solving interesting problems, and supporting and nurturing the younger colleagues. He was an inspiration to generations of geologists, and will be sorely missed. He is survived by his wife, Anne Eales, and their three daughters (in order of appearance), Sue van Coppenhagen, Kathy Eales, and Beth Hockey, and four grandchildren.

**Steve Prevec and Anne Eales**

# media monitor

## MINING AND EXPLORATION NEWS

### COPPER

Blackthorn Resources' Kitumba project in Zambia could support a 7.5 Mt/a open pit operation producing 55–75 kt/a of copper in concentrate over a life of 14 years, according to a scoping study completed in September. The start-up capital expenditure is estimated at US\$377 million, with average cash costs of US\$1.49 per pound of copper. The study is based on the recently completed geological model by MSA, with an estimated mineable resource of 84.5 Mt at 1.19% Cu. The company plans to advance the project to a pre-feasibility study, which will include an assessment of the opportunities to improve the economics and extend the life of the operation by means of underground mining.

Hana Mining, which owns the Ghanzi copper-silver project in Botswana's Kalahari copper belt, agreed to a C\$67 million all-cash takeover offer from Cupric Canyon Capital. Cupric Canyon, which currently owns 18.6% of Hana, is a private equity firm backed by the natural resource investments division of Barclays Bank. Discovery Metals, owner of the adjoining Bosteo project, rejected an A\$820 million takeover proposal from Chinese private equity firm Cathay Fortune Corporation (CFC).

### GOLD

Wits Gold has moved its De Bron-Merriespruit project in the southern Free State gold field to the final feasibility study stage. The pre-feasibility study, completed earlier this year, outlined a shallow underground mining operation with an average gold production of 200 000 oz/a over an 18-year life, based on a Probable reserve of 23.5 Mt at a grade of 4.1 g/t (3.1 million ounces).

PMI Gold Corporation is raising C\$100 million towards the development of its Obotan project on the Asankrangwa Gold Belt in Ghana, after completing a positive feasibility study. Obotan is expected to produce an average of 196 000 gold ounces per annum over an 11.5-year life, with the first output in early 2014. In Liberia, Aureus Mining completed a feasibility study for its New Liberty project, which will become the country's first commercial gold mine, with

total planned gold production of 846 000 ounces over an 8-year mine life.

### HEAVY MINERALS

Australian company World Titanium Resources completed a definitive engineering study for its Ranobe mine, which is planned as the first stage of the Toliara mineral sands project in Madagascar. The study outlines an operation with an annual production of 407 kt of ilmenite concentrate and 44 kt of zircon concentrate over a 21-year life, with a capital cost of US\$192 million. The Ranobe 'starter pit' contains proven and probable reserves of 161 Mt at 8.2% total heavy minerals out of a global mineral resource of 959 Mt at 6.1%.

### INDUSTRIAL MINERALS

Minemakers Ltd sold its 42.5% interest in the Sandpiper marine phosphate project in Namibia to Oman company Mawarid Mining for A\$25 million. The company continues to hold a stake in the project through its 14.3% shareholding in joint venture partner UCL Resources, with whom it has been involved in a long-running takeover battle. A definitive feasibility study completed in April 2012 showed that Sandpiper could produce 3.0 Mt/a of 27.5–28.0% P<sub>2</sub>O<sub>5</sub> phosphate concentrate over a life of 20 years, for a capital cost of US\$326 million.

Elemental Minerals' Kola potash project in the Republic of Congo could produce 2 Mt/a of muriate of potash (KCl) from a conventional underground operation with a 23-year life, according to an independent pre-feasibility study. The initial capital cost is estimated at US\$1.85 billion, including US\$0.58 billion for infrastructure. The study was based on proven and probable sylvinite reserves of 151.7 Mt at average grade of 20% K<sub>2</sub>O (31.6% KCl). Carnallite mineralisation was not taken into consideration, owing to the more complex metallurgical treatment required, although the large carnallite resources present a future opportunity for the extraction of additional potash. Elemental plans to complete a full feasibility study with a view to starting



construction by the end of 2013, with first production in the third quarter of 2016.

A scoping study confirmed the viability of a 1 Mt/a phosphate rock export operation at Minbos Resources' Kanzi project in the Bas Congo province of DRC, with operating costs of US\$56 per ton of concentrate and a capital cost estimate of US\$106 million. The study is based on a 'pittable' resource of 26.07 Mt within the high-grade Inferred resource of 44 Mt at 21.4% P<sub>2</sub>O<sub>5</sub>. An upgraded resource statement, which will form the basis for a feasibility study, is expected early in 2013. In the neighbouring Cabinda province of Angola, Minbos is starting a feasibility study on the Cacata phosphate project, where it completed a positive scoping study in June.

### IRON ORE

Sylvania Platinum has sold its iron ore assets on the northern limb of the Bushveld Complex to AIM-listed Ironveld plc (previously Mercury Recycling Group) for £13.7 million in shares, in order to focus on expanding its PGM projects. The transaction constitutes a reverse takeover, with Sylvania holding approximately 85% of the enlarged company. The project area contains an Inferred resource of 21.69 Mt at 42.5% Fe in the Main Magnetite Zone over a strike length of 6.8 km, with the mineralisation open to the north and south. Ironveld expects to complete a feasibility study during 2013.

Zanaga Iron Ore Company released a maiden ore reserve estimate of 2.5 billion tons at 34% Fe (Probable) for its Zanaga joint venture with Xatrata in the Republic of Congo. The reserves, derived from a Measured and Indicated resource of 4.7 billion tons, are sufficient to support the planned production of 30 Mt/a of high-quality 68% Fe pellet feed product over a 30-year mine life. A feasibility study is scheduled for completion in 2014.

In Nigeria, Australian company Energo Resources declared an initial resource of 488 Mt at 42.7% Fe (Inferred) for its Agbaja project. This is the first ever JORC iron ore resource reported for Nigeria. Agbaja is a shallow, flat-lying channel iron deposit consisting of iron-bearing nodules (ooids and pisoids) in an iron-rich matrix, with the mineralisation occurring predominantly as goethite, maghematite, and limonite.

### NICKEL

Bindura Nickel Corporation is re-starting its Trojan nickel mine in Zimbabwe, which was placed on care

and maintenance at the end of 2008 due to operating difficulties in Zimbabwe and a sharp decline in the price of nickel. Sale of the first nickel concentrate is expected in April 2013. The company reported a number of significant high-grade nickel intercepts, including 94.0 m at 3.14% Ni and 27.7 m at 10.63% Ni, from its ongoing resource drilling programme on the down-dip extension of the massive sulphide zone within the main orebody.

### PLATINUM GROUP ELEMENTS

Nkwe Platinum and Realm Resources have agreed to transfer their PGM and base metal prospecting rights at Rooderand, on the western limb of the Bushveld Complex, to Chrometco Ltd. Nkwe and Realm will each have a 16% stake in Chrometco, which holds the chromite mining right on the property, as well as on the adjoining portion of the farm (Platinum Australia's Rooderand project). Realm said that the proximity of the economic horizons constituted a strong case for a combined chromite and PGM mining and processing operation.

Platinum Group Metals Ltd announced an initial Inferred resource estimate of 6.6 million ounces 3E (platinum, palladium, and gold) for its Waterberg joint venture, on the far northern limb of the Bushveld Complex. The mineralisation occurs in two horizons, the 'T' layer and the 'F' layer, with average 3E grades of 3.33 g/t and 2.80 g/t respectively, and covers less than half of the estimated 6 km strike length on the current prospecting permits.

Ivanplats (previously Ivanhoe Nickel and Platinum) raised US\$307 million in conjunction with its listing on the Toronto Stock Exchange. The company is advancing the Platreef project, on the northern limb of the Bushveld Complex, which contains an Inferred high-grade resource of 175 Mt at 4.6 g/t 3E, 0.41% nickel and 0.20% copper. The orebody has an average vertical thickness of 16.8 m and is relatively shallow-dipping (<15°), and could be exploited by selective underground mining at depths of 700–1100 m. A preliminary economic assessment is expected to be completed in 2014. Ivanplats is also conducting a pre-feasibility study of the newly discovered Kamoa deposit in the Democratic Republic of Congo, which ranks among the world's largest and highest-grade undeveloped copper projects, and is re-developing the past-producing Kipushi zinc-copper mine.

### RARE EARTHS

Galileo Resources announced that UK-based GBM



Minerals Engineering Consultants has begun a preliminary economic assessment of the Glenover rare earth joint venture in South Africa's Limpopo Province, where it recently reported an Indicated and Inferred resource estimate of 28.93 Mt at 1.24% total REO plus yttrium. The study is scheduled for completion in early 2013.

## URANIUM

French energy group Areva has postponed the start-up of its US\$1 billion Trekkopje uranium mine in Namibia until market conditions improve. The company said that the project, which is about 80% complete, was viable only at a uranium price of US\$75 per pound or higher. In the past 12 months, uranium spot prices have declined from US\$53 to US\$43 per pound, with contract price currently at around US\$60. Trekkopje began pilot-scale production in 2010, and was expected to ramp up to full-scale operation for a production of 3000 t of uranium oxide per year in the fourth quarter of 2013.

## OTHER GEOSCIENCE NEWS

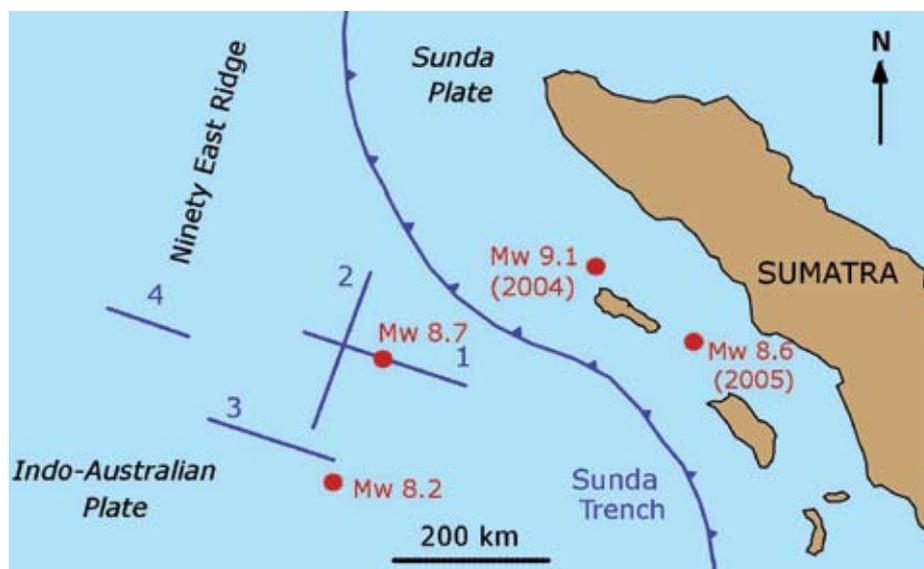
The two massive earthquakes that struck in the north-eastern Indian Ocean on 11 April 2012 may signal the early stages in the formation of a new plate boundary, according to detailed analyses published in the journal *Nature*. A study from the University of Utah and University of California showed that the main shock, one of the largest strike-slip earthquakes ever recorded (seismic moment magnitude Mw 8.7), was due to an 'extraordinarily complex' sequential rupture along four separate faults, which are thought to extend through the crust and a further 30–40 km into the upper mantle, with individual displacements of up to 30 m. This lasted

about 160 seconds, and was followed some two hours later by a Mw 8.2 aftershock on a fifth fault. Strike-slip earthquakes usually occur at transform plate margins, and a within-plate event (the epicentre was about 150 km seaward of the subduction zone) on this scale is unprecedented.

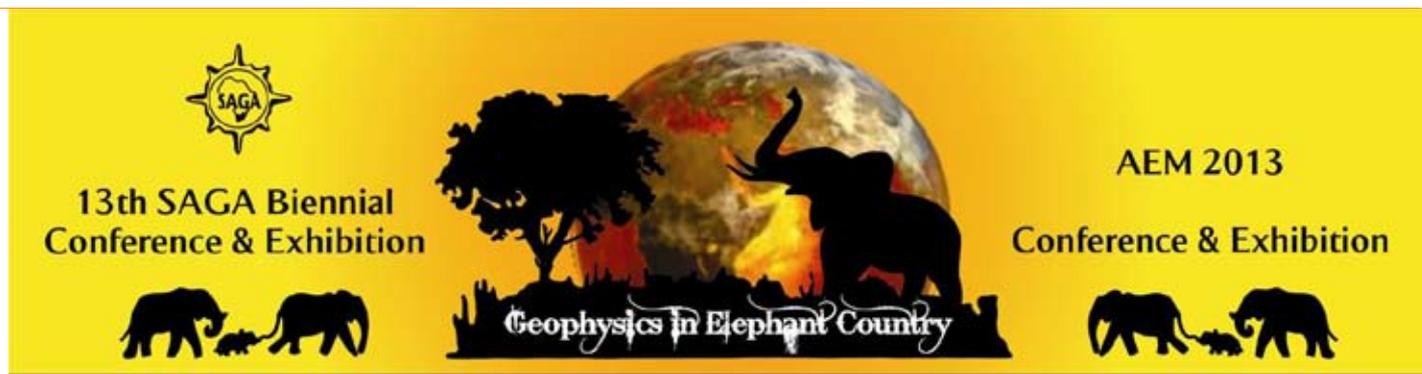
A second study, led by France's Ecole Normale Supérieure, showed that quakes were triggered by the increased intraplate deformation that followed the Mw 9.1 Banda-Aceh 2004 and Mw 8.6 Nias 2005 megathrust earthquakes. On a longer geological timescale, the Indo-Australian plate is undergoing internal deformation caused by the transition along its northern boundary from an environment of continental collision at the Himalayan front in the north-west to an island-arc subduction zone at the Sunda trench. The lattice of strike-slip faults represents part of the separation of the Indian and Australian sub-plates along a yet-unclear boundary west of Sumatra and southeast of India.

The third study, led by the US Geological Survey, revealed that, in the six days following 11 April, the global rate of distant earthquakes (more than 1500 km from the epicentre) with Mw in the range 5.5–7.0 increased nearly fivefold. The authors suggest that the mainly horizontal shear waves, together with the high magnitude and long duration, gave the earthquake an exceptionally strong triggering potential. Also, the global earthquake rate preceding the event had been unusually low, so it was likely that there were more regions under stress than normal. Until now, distant aftershocks have not been included in hazard assessments, yet the changes in seismicity were predictable enough to be included in future evaluations of earthquake hazards.

Antony Cowey



Map showing the network of four faults involved in the Indian Ocean earthquake of 11 April 2012. Numbers represent the sequence of rupture. Red dots indicate the epicentres of the Mw 8.7 main shock and Mw 8.2 aftershock, as well as the 2004 Banda-Aceh and 2005 Nias earthquakes associated with the Sumatra-Andaman subduction zone. Sources: US Geological Survey,



## SAGA's 13<sup>th</sup> Biennial Conference and the 6<sup>th</sup> International Conference on Airborne Electromagnetics (AEM 2013)

The South African Geophysical Association is pleased to announce the forthcoming 13th **SAGA** Biennial Conference and the **AEM2013** Conference, which will be held back to back, once again at an 'exotic location' in South Africa. The venue will be the world-renowned **Kruger National Park** in Mpumalanga, South Africa, where an excellent Conference Centre exists which conforms to international standards. The Conference will be hosted by SAGA and will take place under the aegis of the Society of Exploration Geophysicists (**SEG**). This event is scheduled to take place the **6th to 11th October 2013** and is expected to attract in excess of 350 delegates from all over the world. The 13th **SAGA** Biennial Conference will take place from the **6th to 9th October 2013** and the **AEM2013** Conference will take place from the **10th to 11th October 2013**.

### Who will attend?

Delegates from the private and public sector will attend and will include:

- Delegates from Senior and Junior Mining Companies
- Delegates from petroleum companies
- Geophysicists
- Geologists
- Hydrologists
- Consultants
- Geophysical contractors
- Geoscience service providers
- Software developers
- Geoscience researchers
- Mathematicians
- Academics from universities and industry
- Students

Delegates from the SEG, ASEG, EAGE and other Professional Societies are also expected to attend.

Conference Secretariat : Going Africa CC, P.O. Box 1195, White River, Mpumalanga 1240, South Africa  
Tel : +27 (0) 13 751 2148, Fax : +27 (0) 86 520 9872,  
Email: [registrar@saga-aem2013.co.za](mailto:registrar@saga-aem2013.co.za)  
Website: [www.saga-aem2013.co.za](http://www.saga-aem2013.co.za)

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[www.saga-aem2013.co.za](http://www.saga-aem2013.co.za)



by Roger Scoon

## **The Penwith and Lizard Peninsulas, Cornwall: Spectacular Coastal Scenery, Mineralized Granites and an Ophiolite Complex.**

*Mosaic of Landsat 7 images of the south-western extremity of Cornwall (approximately 60 km in width). The northernmost of the two peninsulas is Penwith, the southernmost the Lizard. Image processing by Philip Eales of Planetary Visions Ltd. The beaches of Sennen and St Ives on the north coast of the Penwith Peninsular are clearly visible*



*The two peninsulas that make up the extremities of the south-westerly county of Cornwall, England, reveal some remarkable geological features. The dramatic coastline of the Penwith Peninsula, which includes the well known tourist locality of Land's End, is the result of the marked contrast between resistant granite and relatively soft metasediments. The southernmost of the two peninsulas, the Lizard, is dominated by greenstones, interpreted as part of an ophiolite complex.*

*Coastal scenery at Land's End. Cliffs are comprised of Variscan-age Land's End granite showing prominent vertical jointing.*



*The north coast of Cornwall is exposed to the prevailing south-westerly winds and swells from the Atlantic Ocean. The rugged coastal scenery for which Land's End and the offshore islands and rocks are so well known is the most prominent feature of the Penwith Peninsula. The high cliffs are interspersed with deeply incised coves such as Sennen, with many spectacular beaches. In comparison, the southern, or English Channel, coastline is more sheltered, and despite the prominent cliffs at the western extremity, the Lizard Peninsula includes long, deep inlets (known as "rias"), many of which provide deep water harbours. The best known of these, the Helford River, includes stately homes and gardens, the latter being nurtured by the mild climate associated with the Gulf Stream. Frenchman's Creek, made famous by Daphne du Maurier, is a branch of the Helford River. The principle town in the area, Penzance, is the birth place of Sir Humphry Davy (1778-1829) inventor of the miner's safety lamp and one of the foremost chemists of his time.*





*View of Sennen cove, looking north, a popular surfing beach located a few km north of Land's End.*

The interior of the peninsulas forms a gently sloping plateau dominated by either metasediments (locally known as "killas") or greenstones. Conspicuous uplands (or moors) are associated with granitic massifs. Weathering of the granite moorland during periglacial conditions, but also dependent on localized jointing forms "tors", which resemble small koppies in the Karoo. Deeply dissected river valleys in the interior were incised during the Pleistocene glacial low. The offshore islands and rias formed when sea levels rose at the end of the last glacial epoch.

Prior to the 20th century, Cornwall was one of the most important mining areas in Europe. Cornish miners provided much of the geological and mining expertise used throughout the English-speaking world, and beyond (some geological and mining nomenclature is derived from the Celtic-based Cornish language). Many of the most impressive mining sites occur along the north coast of the Penwith Peninsula; Botallack, for example, is one of the iconic images of Cornwall. These sites include old ventilation chimneys and ruined engine houses amidst disturbed bare ground that includes open shafts and spoil heaps. Geological sites in Cornwall have been described in many textbooks, and the relationship between granitic intrusions and tin and copper mineralization was in part established from this area.

This overview has relied heavily on the guidebook by Selwood and colleagues. The geology of this part of England has been intensively studied, and this guidebook is an excellent source of references. Detailed mapping by the BGS is an important framework for geological articles in this area. Cornwall is dominated by Paleozoic

sediments and intrusive granites (290-270 My), the latter being associated with the Variscan orogeny (350-290 My). The oldest rocks are of Lower Devonian age. Classification of the Paleozoic of south-western England triggered one of the great conflicts of geological science (due to the complex field relationships and anomalous fossil evidence). The conflict was resolved by recognition of a new system (the Devonian) between Silurian and Carboniferous, as discussed in a fascinating book by Martin Rudwick. The Devonian, despite its name, is poorly exposed in both Devon and Cornwall, and exposures of the well known Old Red Sandstone and its terrigenous equivalents are restricted to discrete basins and folded enclaves; interpretation of these rocks is ongoing. Thermal aureoles associated with the granites have affected metasediments, which have, in



*Pillow lava in the Devonian-age Mylar Slate Formation at Cloddy Point, near St Ives.*



*Megacrysts of alkali feldspar (up to 20 cm in length) in the Land's End granite.*



in addition, also been deformed. Metavolcanics are a minor component of the Devonian rocks. A national geological site at Clodgy Point, near St Ives (north coast of Penwith) is an exposure of the Mylar Slate Formation that includes pillow lavas.

The dominant feature of the Penwith Peninsula is the Land's End Granite. Dated at 293 Ma, this is the youngest of the exposed plutons of the Cornubian batholith. The latter, which crops out from Devon in the east to the Isles of Scilly in the west, varies in thickness from 10 to 20 km and is some 40-60 km wide at the base. In addition to cliff sections and upland moors, the granite is exposed in metal mines, china clay pits, and stone quarries. Deep boreholes have been drilled into the granite to tap geothermal heat. The Land's End granite is dominated by coarsely crystalline biotite granite with megacrysts of alkali feldspar.

The biotite granite is cut by veins and mappable bodies of leucogranite, typically with abundant tourmaline. Tourmaline veins are a common feature, and development of the iron-rich variety (schorl) may be so prevalent, together with quartz, as to result in a rock locally known as schorlite. Exposures of tourmaline-rich veins and pockets in the jointed granitic cliffs at the Morvah beach are widely known. This area includes old mines on the beach where cassiterite was exploited from quartz-tourmaline veins. The granite juxtaposed to veins and bodies of tourmaline reveals a distinctive red colouration. The granite in some areas is altered by a process of greisenization to an assemblage of quartz and white mica, locally with topaz. The granitic stock at St. Michaels Mount, Marazion, is a popular tourist attraction reached by a causeway at low tide. Pockets of greisen are readily observed in the granite here. At Praa

*View of St Michaels Mount, part of a small granitic batholith, looking northward toward Land's End. The island is reached by a granitic causeway that includes exposures of tourmaline-rich greisen.*





*Severely deformed Devonian-age schist with quartz-cassiterite veins (entrance to an old tin mine on right) at Praa Sands, near Marazion.*

Sands, near Marazion, old mine workings (flooded by the high tide) occur where tin was worked from quartz veins in brecciated Devonian schist.

Mineralization associated with the granitic intrusions in Cornwall and Devon defines a well established trend ascribed to temperature. The highest temperature deposits (skarns, greisens, and veins) occur within or next to batholiths. Vein deposits of cassiterite, topaz, tourmaline and wolfram are associated with temperatures >400°C. The most important, Sn deposits, however, occur in lower temperature hydrothermal veins. The earliest of the hydrothermal vein assemblages are dominated by Sn (and to a lesser extent W), succeeded, in turn, by veins of Cu-Fe-As, and finally veins of Pb-Zn. The temperature relationships are reflected in the spatial association with batholiths, so that Pb-Zn veins, for example, occur farthest from granitic bodies. The Cornish

metallogenic province is further characterized by changes in the gangue mineralogy with temperature. The rich Sn mineralization occurs in relatively narrow veins, a feature which has adversely affected the economics of the local mining industry. Tin was initially mined by the Celtic-speaking communities for trade with the Carthaginians. Romans, despite initially being more interested in copper and lead in the UK, resulted in a boom in tin mining in south-west England, triggered by the usage of bronze. By the 18-19th centuries both tin and copper were mined extensively in the area, resulting in development of larger harbours. The export of minerals out of the area (one of the most deprived communities in the UK) remains a grievance of the local people.

The complexity caused by mineral rights being awarded on specific metals, the oldest being for tin, resulted in disputes such that miners illegally exploiting copper resulted in "bounders" being incorporated into our language. The Saint Just mining district in the Penwith Peninsula includes one of the largest tin mines, Geevor, that is now a popular tourist attraction. One of the last processes affecting the granites is kaolinization (the debate based around the relative importance of hypothermal activity and weathering is on-going), resulting in development of the most extensive, high-grade kaolin (or china clay) deposits in Europe. One of the reasons the deposits are high grade is that iron-released during the breakdown of biotite is incorporated into tourmaline in the boron-rich granite.

Interpretation of the Lizard Complex has been radically



*Old mine workings (chimneys for the furnaces) at Botallack, in the St Just tin mining district.*



*Kynance Cove, a protected site of national beauty, reveals classic exposures of multi-coloured serpentinitized peridotite, basal part of the Lizard Complex.*



reappraised in recent years. An older, intrusive origin for the peridotite and gabbro has now been discarded, and it is now seen as part of a slice of obducted oceanic crust, i.e. an ophiolite. The gabbro has been dated at approximately 375 Ma, although the gneisses at the Lizard Point are far older (500 Ma). Several discrete tectonic units are recognized and thickening and deformation, including zones of mylonite, have been interpreted by Gibbons and Thompson as due to ductile extension. Serpentinized peridotite, the basal part of the complex can be observed at Kynance Cove, a privately owned National Trust property. Two varieties occur here, basinite (dark) and tremolite (green). These rocks and one of the principal mineral components (a platy type of chrysotile) gave rise to the name "lizardite". The dark and green varieties of serpentinite are quarried extensively for decorative carvings. The peridotite close to the old lifeboat station at Lizard Point is severely deformed and is intercalated with hornblende and mica schists. At

Coverack, a small coastal village on the southern side of the Lizard Peninsula, the transition from oceanic crust (troctolite and gabbro) to mantle (peridotite) is exposed for >1 km on the beach. The contact is also exposed in cliff sections, albeit being rather sheared.

Photographs by the author (2010).

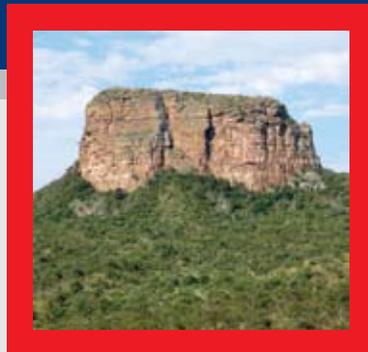


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*View looking north at Coverack, a rare opportunity to examine the boundary between upper mantle and oceanic crust. Transitional assemblage of light troctolite (foreground), gradational into gabbro (background), contrasts with dark peridotite (left and foreground). Contact probably also corresponds to the Moho discontinuity.*





## GSSA Conferences and Professional Development Courses 2013

GSSA Conferences and Professional Development Courses – 2013 (Provisional)	
15 February	Target Generation
15 -16 March	Basic Geological Skills
17 – 19 April	Drilling Skills in Johannesburg
16 – 17 May	Structural Geology
3 days in June	Iron Oxide Copper Gold Deposits (IOCG) Short Course by Murray Hitzman
3 – 5 July	GeoForum 2013 in Johannesburg
14 – 16 August	Drilling Skills in Rustenburg
8 –12 September	Geoheritage in Oudtshoorn
13 – 14 September	Exploration Seismics/Exploration Geophysics
17 – 18 October	Competent Persons/Valuators
1 November	Geohydrology for Geologists

**\*\* Additional professional development courses for Structural Geology and Drilling Skills will possibly be scheduled in Botswana, Namibia, Zambia and Tanzania during 2013. Watch your emails for future notifications.**

As Vice-President for the GSSA Meetings portfolio I am glad to provide the following provisional program of professional development courses and the dates for GEOFORUM 2013 - which will cover a strong commodity and techniques application focused theme. While there is a multitude of geoscience related courses and conferences on offer these days we as the GSSA continue to hold your professional development and ability to interact with your professional network as key drivers to pursue such a program. For 2013 CPD points will be allocated for attendance of these offerings. We are very excited about this new development.

For any questions, comments or suggestions please email the VP Meetings:  
Dr. Jeannette E. McGill (jmcgill@csir.co.za)



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## IMA2014 – The 21st meeting of the International Mineralogical Association

South Africa, through the Mineralogical Association of South Africa (MINSa) and the GSSA, is proud to be hosting the International Mineralogical Association's 21st meeting, to take place in Johannesburg from 1-5 September 2014. This is the first time such a conference will be hosted in Africa, and we are looking forward to a successful meeting – the last meeting in

Budapest attracted some 1700 participants from all over the world, and a similar number is targeted for 2014.

Under the overall Conference Theme: Minerals as Mines of Information, some of the key themes for the conference include Process Mineralogy and Geometallurgy, Environmental Mineralogy, Economic/ore deposit geology and mineralogy, Critical metals and Advances in instrument and analytical techniques, amongst many others. The Scientific Committee has accepted more than 30 proposals for sessions to date with the second call for detailed session/workshop/short course proposals currently open ([www.ima2014.co.za/call\\_for\\_papers.php](http://www.ima2014.co.za/call_for_papers.php)). Prospective convenors of sessions are encouraged to propose sessions covering a wide range of topics. Sessions accepted to date are listed on the website for the conference.

To complement the scientific programme of oral and poster sessions, workshops and short courses, field trips have been arranged to a number of South and Southern African localities of mineralogical interest, including mines and ore deposits. Shorter one day outings include visits to mineralogical facilities in the Johannesburg area. A list of field trips on offer may be found on the conference website.

As with any event, sponsorship is sought to bring in speakers and accommodate students in making the conference a success. We appeal to prospective sponsors to consider supporting the conference through a range of sponsorship opportunities that are listed on the conference website.

Organisation of such a conference requires a concerted effort from a number of people. Portfolios on the committee are as follows:

Conference Chair: Dr Sabine Verryin

Scientific Programme Chair: Dr Desh Chetty

Finance Chair: Dr Craig Smith

Sponsorship and marketing Chair: David Long

Fieldtrips Chair: Prof Judith Kinnaird

Logistics Chair: Wiebke Grote

Conference organiser: Scatterlings Conferencing – Carolyn Ackerman

Anyone interested in becoming a member of the organising committee is welcome to contact us via e-mail: [info@ima2014.co.za](mailto:info@ima2014.co.za). More information about the conference can be found at [www.ima2014.co.za](http://www.ima2014.co.za).

**We look forward to a successful conference, and welcome you to IMA2014!**

**APPLICATIONS TO THE  
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INVESTMENT FUND OF THE GSSA**  
(PREVIOUSLY KNOWN AS THE GSSA TRUST FUND)

**!! DEADLINE FOR APPLICATIONS: 31 JANUARY 2013 !!**

The GSSA Research, Education and Investment Fund (REI Fund – formerly known as the GSSA Trust Fund) is inviting applications from GSSA paid up-members (including post-graduate student members) for grants from the Fund, to be received at the GSSA office not later than 31 January 2012. Applications can be made using the prescribed application form available on the GSSA web site ([www.gssa.org.za](http://www.gssa.org.za)) or by letter outlining relevant details such as a short description of the project, motivation and budget, and should be forwarded to any of the following addresses:

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**E-mail: [info@gssa.org.za](mailto:info@gssa.org.za)**

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Grants can be applied for to support a variety of Earth Science applications, e.g. to offset analytical and/or publication expenses with regard to research projects, to promote Earth Science awareness through geotourism, geoheritage and geo-education, to attend local and international conferences relevant to particular research projects, and to present research results, for travel grants, or for other worthwhile purposes related to the Earth Sciences. These grants are normally only considered for students enrolled for MSc or higher degrees or for any members involved in specific research or other projects related to the Earth Sciences or to the Society. In particular we welcome applications from post graduate student members and would appreciate it if Heads of Departments at Higher Education Institutions and their staff would inform their students of this opportunity. Grants are usually limited to R15 000 per application but applications for larger amounts are also welcome. All applications will be judged on merit and/or the importance to the Society in promoting its image. Note that grants are only awarded to members/student members in good standing.

Applications are screened by the REI Fund Committee during mid-February with input and ratification by the GSSA Management Committee and Council respectively. In evaluating the applications and recommendations, the Committee considers the merit of each application, and depending on the amount of money available for that year, makes a final decision on the allocation of grants for that year. The decision of the Committee is final and no further correspondence on the matter will be entertained. By following this procedure it is anticipated that applicants will be informed by early to mid-March 2013 whether or not their applications are successful.

**The current members of the REI Fund Committee are: Reinie Meyer (Chairman), Rob Ingram (Treasurer), Frank Gregory, Richard Viljoen, Mike Wilson, Derek Kyle and two office bearers of the Society who have ex officio status, namely the President (Pamela Naidoo) and the Executive Manager (Craig Smith).**



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# GeoForum 2013

Mineralization and Geosciences in Africa



**Dates** 3-4-5 July 2013

**Venue** Turbine Hall Newtown, Johannesburg, South Africa

Welcome to GeoForum 2013: Africa's Premier Geological Exchange. The Geological Society of South Africa takes great pleasure in inviting you to attend this event in Johannesburg on 3-4-5 July 2013. GeoForum 2013 will be where the geological community meets to interact and share information about developments in mineral deposit projects, commodity exploration and application of various geoscience techniques from an academic and industry perspective. Five commodity focussed themes will be the opportunity for you to showcase developments and learn about recent advances by others. In addition, the geological exhibition and career fair will be the perfect networking platform to meet colleagues both established and new. Africa will also be hosting IMA2014 and IGC2016 and these too will be represented at GeoForum 2013. We look forward to welcoming you in Johannesburg for GeoForum 2013.

#### SOCIAL GATHERINGS AND DAY DRIVE

- Welcome Function and Exhibition Opening (2 July 2013)
- Launch of the IGC 2016 (3 July 2013)
- IMA 2014 Lunch (3 July 2013)
- GSSA AGM (4 July 2013)
- IMA 2014 Guided tour to the MuseumAfrica (Afternoon – 3 & 4 July 2013)
- Magaliesburg Cable Car and Geological Overview Day Drive (5 July 2013)

The day drive will depart from Turbine Hall at 11:00. Pre-booking is essential. The maximum number of participant is 50. A bus will transport participants to the site and return to Turbine Hall. No participant will be allowed to take their own car. A packed lunch, juice and water will be provided.

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R4760.00. Printed material to be supplied. Please ensure that the inserts do not exceed the trim size of 280 x 210 mm. All inserts must be delivered to the Editor GB (see below).

## 5. DEADLINES FOR COPY AND ADVERTISING MATERIAL

March issue:	15 February 2013
June issue:	15 May 2013
September issue:	15 August 2013
December issue:	15 November 2013

## 6. CANCELLATIONS

Four weeks prior to deadline

## 7. ADVERTISING AGENCY COMMISSION

Excluded

## 8. CIRCULATION

GeoBulletin is issued and dispatched at no additional charge to all of the various members of the Society and its local and overseas exchange partners. The circulation list exceeds 1800 and reaches all of the decision-makers in the geoscience and mining community; the geological consultants and leaders in the Mining Groups, the Mining Industry and Government Institutions, universities, private, public and state libraries. Electronic versions of the GB are freely distributed through the society's web page.

## 9. ADVERTISING BOOKINGS AND SUBMISSION

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