

geobulletin

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VOLUME 54 NO. 3

Geosynthesis 2011 Cape Town
In Memoriam: Clive Stowe and John Moore
Quaking in Christchurch

news



This summarises the awards and medals offered by the GSSA in recognition of outstanding achievement, and the 2009 winners (awarded in 2010). See the March issue of the Geobulletin for more extensive details.

AWARDS OF HONOUR

Draper Memorial Medal

The Draper Memorial Medal is the highest scientific award of the Geological Society, and was instituted in 1932 in honour of Dr David Draper, one of the founding fathers of the Geological Society in 1895. It is awarded annually to pay tribute to exceptional contributions to the advancement of South African geology.

The Draper Memorial Award for 2009 was awarded by the Council of the Geological Society of South Africa to Dr. Christopher Alan Lee in recognition of his outstanding contribution to earth sciences in general, and the geology of the Bushveld Complex in particular over an illustrious career. Dr. Lee has worked in industry, but has been a leader and supporter of academic and industry research.

Des Pretorius Memorial Award

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 2009 was awarded to Roy Corrans in recognition of his outstanding contribution to his endeavours in the field of Economic Geology in particular.

HONORARY FELLOWSHIP

From time to time, the Society honours pre-eminent earth scientists for the contribution they have made to the earth science profession over their careers. Honorary Fellowship is the highest category of membership within the Society and is reserved for those individuals who through their careers have demonstrated that they are leaders in the profession.

The Society recognises Bernard Renier Van Rooyen for his lifelong service to the mining industry in South Africa and elsewhere in Africa, and particularly in recognition of his activities during 24 years as board member of Gold Fields.

PRESIDENTIAL AWARDS

At the recommendation of the President or senior members of Council, the Society grants Presidential Awards to members and non-member individuals to recognize eminence in their particular fields, or to honour such individuals for unselfish contribution to the Earth Sciences.

Honours Awards were made to Shane Hunter and Henk du Hoop for conceiving, implementing, and managing, on an ongoing basis, the First Thursday Club, held on the first Thursday evening of every month at the Wanderers Club in Johannesburg.

SCIENTIFIC AWARDS

Jubilee Medal

The Jubilee Medal of the Geological Society was instituted in 1945 to commemorate the 50th anniversary of the Society. It is awarded annually for a paper of particular merit published in the South African Journal of Geology (SAJG) or in Special Publications of the Society.

The award for the best paper published in the Journal in volume 112 is given to PHGM Dirks, EG Charlesworth and MR Munyai for a paper entitled "Cratonic Extension and Archaean Gold Mineralisation in the Sheba-Fairview Mine, Barberton Greenstone Belt, South Africa".

STUDENT AWARDS

Corstorphine Medal

The Corstorphine Medal was instituted in 1927 to commemorate George Corstorphine's exceptional services to South African geology, and recognizes an M.Sc. thesis with exceptional merit, worthy of international recognition.

John Handley Award

The John Handley Award was introduced by the Geological Society during 2002/2003 to recognize the best M.Sc. thesis awarded at a South African university in the year prior to the award.

For 2009 the John Handley Medal and the Corstorphine Award went to Mr Warwick Hastie for his M.Sc. thesis, entitled "Rock Fabric Study of the Northern Lebombo and Rooi Rand Dyke Swarms - Regional and Local Implications", University of KwaZulu Natal (supervised by Mike Watkeys).

Haughton Award

The Haughton award is made annually to recognize a meritorious Honours thesis produced at a South African University in the year prior to the award.

Bjorn von der Heyden (University of Stellenbosch; supervised by AN Roychoudhury) was given the 2009 award for his thesis entitled "Characterization of Mn-slag and Investigation into the Mechanochemical Interactions between Mn-wastes and Anthracene".

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COVER PHOTOGRAPH:

Spectacular scenery of the Beartooth Mountains, the entrance to Yellowstone from the north. Photo Roger Scoon (see article pg 30).



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For detailed prices, mechanical and digital submission requirements, please contact the GB advertising co-ordinator, editor, or layout & design (see Contents Page for contact information) to obtain an up-to-date Rates Card or other information.

DEADLINES FOR COPY AND ADVERTISING MATERIAL are 14 February (March 2011 issue), 16 May (June 2011 issue), 15 August (September 2011 issue) and 1 November (December 2011 issue).

Please note that the design and layout of adverts and inserts is entirely the responsibility of the advertiser. If you wish to contract the services of the GB graphics and layout supplier for this service, please contact Belinda directly, well in advance of the advert submission deadline to make arrangements.

* Casual insertions • 4+ insertions

from the editor's desk

Steve Prevec



Greetings from Grahamstown, once again. Our penultimate edition for 2011 follows on the heels of a very successful Geosynthesis conference in Cape Town, and continuation of a robust exploration and mining sector in the context of healthy metal prices. So while there continue to be many causes for concern on both the local and international scene, we seem to be situated in a position of reasonable strength to face it. Our Executive Manager's column notes several of these issues with regard to the relationship between South African industry and academia. Our new President, Johan Krynauw, discusses the changing face of the Society. Under Letters, Reiner Klemd defends the SAJG, and we report with some trepidation the commercial marketing of bits of our greenstone belts. On a vaguely related note, it is with sadness that we report here the recent death of Dennis Toens, whose letters to

the editor had been featured recently, reporting the onset of his illness, among other things. A formal obituary is planned for the December issue. George Henry, one of the ca. 500 participants in the multidisciplinary Geosynthesis 2011 held in Cape Town in late August, has provided a chatty and informative write up of the conference. We hope to see more of its like. Similarly, Norton Hiller, one of the hundreds of thousands of participants in the multiple earthquakes in Christchurch, New Zealand, earlier in the year, has written an engaging and well-illustrated report of his experiences therewith. University news includes submissions from Rhodes, Stellenbosch, UJ and UKZN. Memorial tributes to Clive Stowe and to John Moore (a Rhodes alumnus and a Rhodes staff member, respectively, amongst their many other attributes) are also included in this issue. Finally, Roger Scoon reports on the geology of Yellowstone National Park, the oldest national park and "pleasuring ground" (I must have missed that bit when I was there) in the world.

'til next time...

The spirit of John Moore bats against Australia



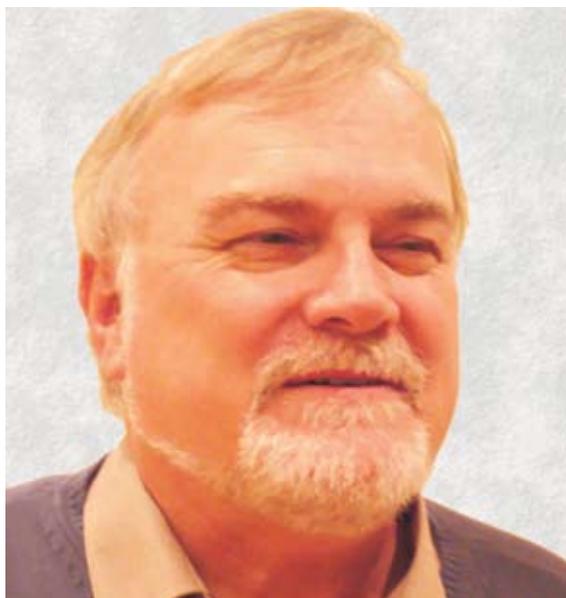
executive managers

Jobs and Careers

As is the case for many other professions these days, the skills shortage in the earth sciences is severe – and is global in extent. The skills shortage is exacerbated by the current resource boom, with demand for commodities by the Far East in particular showing no sign of diminishing. With the credit downgrade of the United States and the debt problems in the Eurozone, the gold price is moving up almost on a daily basis. These factors are driving the hunt for technical skills in the resources sector, and one hears tales of ‘head hunters’ prowling around in airport lounges looking for innocent geologists or mining engineers ripe for poaching.

Yet, simultaneously we are hearing complaints from some of our geology graduates that many cannot find work, much less begin to plan a career path, and this is particularly the case for those people who have not benefited from the industry bursary system. At this point in time, it appears that most graduates who have had bursaries or some form of industry assistance are being employed – but others are not.

For young job seekers, some interesting lessons can be learned from some of the employment websites catering to geologists. Most people (particularly in the academic sector) are aware of Earthworks (www.earthworks.com), in which quite a few professional openings can be found. Another site to have a look at is Careerjet (www.careerjet.co.za/geologist-jobs.html), which is a search engine that tables job openings. Given that Careerjet is a search engine, and because most jobs are being advertised through more than one recruiting agency, there is a great deal of duplication. The 348 job offerings in South Africa (as of end August) probably translate to less than 75 actual jobs, and some of those may be put out more as a fishing exercise than as a serious employment need – but that still leaves a considerable number of job openings that apparently remain unfilled. A bit of analysis of what’s on offer leads to some interesting trends. More than 95 per cent of the posts are in mining geology of one sort or another. These are not exploration jobs, or head office jobs, but mining jobs located on mines. Mines are



corner

Craig Smith

mostly located in remote or rural areas, so if your goals as a professional are to develop a career by starting in a senior position in the middle of Sandton, you are probably on the wrong career path. I do hear industry complaints that expectations of new graduates are not aligned to their needs. Graduates need to understand that they must start their careers where the needs are, and that their role is to meet the needs of the employer and not the reverse.

Secondly, more than 90 per cent of the jobs on offer require five years or more of experience. It may well be that the senior posts are the ones being handed to the recruiting agencies, and that many junior openings exist but never appear. Nevertheless, there seems to be lack of entry level jobs, and this is of course, the frustration of any new graduate lacking years of experience. There are multiple reasons for this mismatch, and I could probably play the blame game for an entire issue of Geobulletin. But this is not too productive – particularly if the skills shortage in the technical areas is a long term structural problem – which it looks to be. From where I sit, it appears to me that over the past decade or so, industry has made a decision to weaken their support for technical expertise and technical leadership development on the grounds that it can be hired on an as-needed basis, thereby saving shareholder money. If an individual group or company takes this route, there is no major effect.



SOCIETY NEWS



Collectively, however, this is devastating, as we are now discovering. We see ads seeking skills with five years and more experience that are the same skills the same employers released five years ago! The lesson for industry is that technical career pathing is a career-long deal and needs to be upgraded at least to the level that managerial and executive talent development enjoy. You can hire and fire managers as you need (there are lots out there, actually), but seriously good, world class, technical skills cannot be treated that way. It's a long-term investment, with a long-term return on investment. And it starts with investing in the universities and programs that produce the people.

I often hear industry complaints that university programmes are not producing 'fit-for-purpose' graduates, and I think this is partially true. However, the purpose of a university education in the liberal arts tradition is to provide the starting blocks for a career of continuous development and learning. Universities are not, and were never designed to be, apprenticeship programs leading to proficiency in whatever specific technical task happens to be the problem of the moment. I worry more that the overload of students in the system is leading to the shortcomings in the 'liberal arts' product.

There are some other problems. Graduates need to work to contact the right people in the right places. I am aware of one situation where a company's mining operations have vacancies that cannot be filled (at junior level) – but applicants are being turned away unless they get their cv's directly to the operations. Lesson – get your applications to the operations as well as to head office.

The resource boom of the last decade, combined with headcount reduction in many companies, as well as the entry of many smaller companies into the resource space, has led to a proliferation of consultants and consulting companies. These groups are also looking for skills – but generally cannot afford to be involved in career development from a junior level. A future trend may be that this will have to happen – but at greater expense to industry clients. (Can ACME Consulting get away with adding a 25 per cent surcharge for talent development and retention?!)

Another problem concerns the quality of some of the students coming out of university. Do I as an employer really want someone who scraped by on a 45 per cent pass rate with a less than ideal work ethic, and then was upgraded because he was close? Employers look at academic track records of applicants from first year on. If a student struggled in university, will he struggle in employment? – frankly the answer is probably yes. Industry does not like to settle for second best. I wouldn't.

As a last word, the GSSA is experimenting with putting a 'jobs available' column into the web site (under Careers). We'll see how this works over the next few months. If you can find that first step on the career ladder, the world is your oyster, particularly in the developing world. As I penned this note, an article in Mining News noted that global companies are shifting their recruiting for high skills jobs from Europe and the US to the emerging economies. As South African professionals, you hold a great advantage.

Craig Smith



Namaqualand in flower season: an excerpt (courtesy of Craig Smith)

president's column

Johan Krynauw

Changes and Challenges

I thought it would be appropriate for my first President's Column, to look at some of the challenges and issues that face our profession and the GSSA, both in the near future and the long term. As geologists, we are probably more aware than most people that change is a constant, whether it is a change in climate, life forms, or the levels of igneous activity. Some of these changes, like the changing composition of the Earth's crust, take place gradually and others, such as the changes caused by major eruptions, earth quakes and tsunamis can happen within a very short time. These changes can include effects on world or local climate, changes in river courses and the appearance and disappearance of islands.

Social change has a similar history, with most change taking place very gradually and other very rapidly due to specific events. However, the rate of social change has been accelerating since the Industrial Revolution. We are now exposed to rapidly changing political environments, world powers, economic realities and a huge increase in access to information. South Africa has undergone major political changes which are shaping us personally and professionally as geologists, resulting in a number of issues and challenges that GSSA face and have to solve. These issues are, of course, in addition to the perennial ones which include retaining the fine balance between being frugal in order to ensure long-term security and at the same time spending on projects to ensure that our members benefit from being part of the Society; the sense of distance that members who do not live and work in Gauteng feel due to the fact that the Society is Johannesburg-centred; and the different perceptions and expectations that academia and industry have of each other. The new challenges faced by GSSA members include direct threats to the industry and the earth sciences profession, as well as the discussion on nationalisation, the numerous issues with DMR and the poor financial support for the CGS.

In the Society, our racial, gender and age profile has changed radically over the past few years. A much higher number of young geologists are now members than in the past, with up to 20% being student members out of the total membership of nearly 3 000. They are the same people who face employment challenges, as discussed by Craig in his column on the previous pages. And this leads to the issue of transformation. As a Society, we need to understand what transformation is really about. Some of us think that transformation is either something forced on us by law or just a numbers game. However, it also means we have to

understand how our cultural backgrounds affect our work, what expectations we have of each other, and how we need to communicate without built-in distrust. How do we ensure that we are a Society for all geologists, where we all look at the professional wellbeing of all geologists and where we eventually will not need a Transformation Portfolio which is currently looking at solving these particular issues?

Other aspects we want to look at are building and improving relationships with organisations, such as GASA, SAGA and the SAIMM, as well as geologists in other African countries. Some initiatives have started and we want to pursue these vigorously over the next few years. If we accept that the Society exists for the benefit of its members, we have to make sure that our "service delivery" to members and also to the public is not only acceptable, but of the highest possible standard. How do we overcome the fact that those of us on Council and Manco are volunteers in a changing society which leaves very little time available outside our work environments? The answer is simple – we need more active volunteers. Our portfolio Vice Presidents will have to manage and delegate better than we have been doing, and genuinely involve people, including members who may not be on Council. I do not know when last it was necessary to hold an election for Council – and that is not acceptable.

The above are only a few of the issues and challenges we face. Of course, trying to solve everything, usually results in a complete lack of progress. I have suggested to the portfolio VPs that they decide what they want to achieve in the coming year and focus on priorities. My personal priority areas are to formalise a sponsorship policy to ensure long-term financial stability for the Society, look at better ways to interact with Government and the public, involve more of our members in Society matters, and to improve relations among the different parts of our Society. If there is progress in any of the items on my wish list, I will feel that there has been some real progress.

Johan Krynauw





Letter to the editor: SAJG readers reassured

Dear Steve,

I wish to comment on the letter published under the title SAJG UNDER SCRUTINY by Professor Carl Anhaeusser, printed in the section Letters to the Editor of the Geobulletin dated March 2011.

As a member of the Editorial Board of the South African Journal of Geology I would like to reassure Professor Anhaeusser that the malaise of an undeniable decline in standards in many walks of life in South Africa in recent times' has not overtaken our Journal at all. I even strongly recommend GSSA members and any other (overseas) geologists involved in geological research in southern Africa to publish in our journal. During the last couple of years it has become a very important regional geological journal even from an international perspective as is shown by the journal's Impact Factor, which is published annually by the international Journal Citation Report (ISI Web of Science). The journal impact factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The impact factor helps you evaluate a journal's relative importance, especially when you compare it to others in the same field.

The impact factor of the SAJG has continuously increased from 0.388 in 2001 to 1.013 in 2009. The 5-year impact factor is 1.687. In comparison, the Journal of African Earth Sciences has an impact factor of 0.875 (2009) and a 5-year impact factor of 1.723 despite the fact that it covers articles from the whole of Africa. Furthermore, our journal certainly is at the same eye-level as other excellent regional journals such as the Australian Journal of Earth Sciences (impact factor 2009 = 1.109; 5-year impact factor = 1.422) or the Canadian Journal of Earth Sciences (impact factor 2009 = 0.824; 5-year impact factor = 1.258).

I am aware that this outstanding performance of the Society's journal is not least a consequence the professional and time-consuming work of the editors, Lew Ashwal and Jay Barton, and their GSSA publishing team. Thank you guys! However, keeping in mind the dwindling numbers of academic geoscientists and the other 'undeniable malaise' in South Africa, it is going to be very difficult to maintain this high level.

Cheers and best wishes,
Reiner Klemm
Friedrich Alexander University, Erlangen-Nürnberg,
Germany

Letter: South African Butterstone (?)

Hello,

I am seeking technical information about so-called South African "butterstone" (containing fossilized stromatolite layers) as it is marketed in the USA (see image below).

Can you tell me if this material is a chert? Also what formation does it belong to and where in South Africa are most of these commercial rock samples collected? I am unable to find much information about "butterstone" on the Internet. I have come across references to Siphonophycus transvaalensis fossils of the Barberton Greenstone Belt. Is this the fossil stromatolite layers found in butterstone?

Thank you for your attention.

Louis Varricchio
Managing Editor
New Market Press, Vermont, U.S.A.

The preceding enquiry was directed to a colleague and ended up with me, from whence it was circulated amongst some of the illuminati of the GSSA. If anyone has any additional insights, the GSSA would be interested in hearing from you. It appears that this is being commercially marketed within the U.S.A., at least, on a modest scale (as can be deduced from a search of the internet). Those who may be interested in legally marketing attractive bits of South African geoscience should contact the Heritage Committee of the GSSA for more information (they would like to hear from you!). Thanks, from the Editor.

The geoilluminati were able to confirm that a) they'd never heard of it before, and b) it appears to be greenstone belt chert with surficial alteration.



pay your dues!

GSSA: Payment of Annual Fees

This is the time of year when the administrative staff comes close to being overwhelmed by various tasks, one of which is chasing down members who have not paid their membership fees, or who have perhaps paid but have not adequately identified the payment. In such cases, the money ends up in unallocated accounts and records show the member as being unpaid.

This year, we have an abnormally large number of members who are behind in their fees, and while in past we have carried this, the Society can no longer afford to do so. We remind you that it is your responsibility as a member to ensure that your annual fees are paid. It is not the responsibility of your employer. Your employer may well have agreed to pay the fees, but that does not mean that the responsibility for any negotiation is passed to the Society.

In the coming few months we will very likely be terminating the membership of a number of geologists because of non-payment. We do not do this lightly, because we know that your professional status is important. But at some point we have to draw the line; on the current debtors list most delinquents have been repeatedly emailed, phoned, and finally have had physical post sent. We do not have the resources to continue the process.

In many cases it is likely that members have changed jobs and addresses, and have simply forgotten to inform the Society of the change. But our administration cannot physically track down all of this information; you as the member need to keep us updated. We have members who are more than two years behind in payments, and if you need to pay your outstanding fees in instalments, contact us to make a plan.

Membership of a professional organization is a crucial component of professional recognition. The GSSA fee structure is one of the least costly of any of the professional bodies in South Africa. Your annual fees cost you less than a family dinner at a mid-scale restaurant.



The invoices for 2012 fees will be coming out shortly, and we will continue the practice of zero increase for 2012 fees paid by December 9, 2011.

Craig Smith
(Executive Manager)

all the news fit to print



RHODES UNIVERSITY
Where leaders learn

Rhodes University, Department of Geology

From Rhodes, the main news was the passing of Professor John Moore in late August after a brave fight with his malignant sarcoma. His life was celebrated in a gathering of many of his friends a week or so after his death, and his obituary can be found elsewhere in this issue of the Geobulletin. I imagine he will be pleased that his ashes will ultimately be influencing the soil and groundwater geochemistry of the Barrydale area of the Western Cape.

In other news, the arrival of our new JEOL probe and of our new sedimentologist are relatively imminent, but we'll report both developments after they've actually occurred. We would, however, like to welcome Neels Gunter (of UFH) to our ranks for the final term of the year, where he will be providing sedimentological teaching expertise for the duration of this year.

Contributed by Steve Prevec



Stellenbosch University, Department of Geology

At Stellenbosch, the University has finally caught up with us and will be evaluating the department late this year or early next. Due to various ructions over the intervening years, we have not been evaluated since 2003, and we are presently in the throes of organising all the paperwork that is involved. Other than that, for US, all's quiet on the Western Cape front.

Contributed by John Clemens



University of Johannesburg, Department of Geology

It seems that postdocs are the order of the day. Another postdoc in the form of Andrea Agangi joined the department. Andrea got his PhD from CODES, University of Tasmania, where his work focused on the Gawler Range Volcanics. His current project focuses on

Au mineralization in the Witwatersrand Supergroup and Barberton Greenstone Belt using pyrite geochemistry and CL of quartz.

Lauren Jolly, who obtained her M.Sc. degree from Wits under the supervision of Roger Gibson, joined the department as a lecturer taking over optical mineralogy modules. She replaces Wendy Thompson. Lauren is also pursuing her Ph.D. on the geochemical and geometallurgical aspects of the Kalahari Manganese deposits.

Fanus Viljoen is currently the Head of the Department during the sabbatical term of Bruce Cairncross. Fanus and Craig McClung attended the 10th International Congress for Applied Mineralogy on 1-5 August, in Trondheim, Norway. Both presented at the conference – Fanus on the in-situ study of PGMs in the Merensky Reef using the Mineral Liberation Analyser, and Craig on a mineralogical assessment of the Broken Hill sulfide deposit.

The annual research colloquium of the Paleoproterozoic Mineralization (PPM) Research Group will take place on the 3rd November (Thursday) at the Auckland Park Kingsway campus. As usual, an afternoon of talks by students and staff of the PPM will be followed in the late evening by a social hour supported by wine and snacks. Attendance is free of charge but booking is essential. More information can be obtained from Michael Chakuparira (email: michaelc@uj.ac.za). A (hard or snail) copy of the PPM annual report can be obtained from Michael on request or directly at the colloquium day.

Compiled by Rajesh



University of KwaZulu-Natal, School of Geological Sciences

2011 has been a very positive year for the School of Geological Sciences at UKZN with growth in post-graduate numbers, the appointment of new staff and



considerable financial investment in the School by the University allowing the purchase of new teaching and research equipment.

Post-graduate news:

Research into vein type gold deposits was boosted by the arrival from India of Dr Sakthi Chinnasamy to take up a post-doctoral position with staff members Ron Uken and Jürgen Reinhardt and Alex Metz from Germany to start a MSc with Ron. Sakthi will focus his research on shearzone-hosted gold deposits in the Pongola Supergroup in northern KZN while Alex will undertake a study of the gold deposits in the Pilgrims Rest area of Mpumalanga. In keeping with our focus on coastal geology Zoey Mkhize started a MSc study with Andrew Green during which she will investigate the sequence stratigraphy of buried river channels in the Durban harbour and surrounds and Errol Wiles will use geophysical data supplied by the Alfred Wegener Institute to study the distribution of deep water bedforms in the Natal Valley. Errol is supervised by Mike Watkeys and co-supervised by Andrew Green.

UKZN has a long and proud tradition of producing graduates in engineering geology and the quality of Brendon Jones an honours graduate in 2010 has been recognised by both the South African Institute of Engineering Geologists (SAIEG) and the Geological Society of South Africa. Brendon received the SAIEG student award and the GSSA Haughton award for his work on slope stability problems in the Coedmore Quarry near Durban. Brendon was supervised by Kumesh Naidoo and Egerton Hingston, the staff members responsible for engineering geology, and his findings will be presented at the Young Geotechnical Engineers conference in early September.

Conference news:

Lopa Saha attended the attend the Goldschmidt Conference in Prague where she presented a paper in the metamorphic processes session linked to her collaborative research in the Assegaai greenstone belt, Kaapvaal Craton, South Africa, and a poster on the Bundelkhand Craton in central India. Kumesh Naidoo attended the 12th International Symposium on Rock Mechanics in Beijing, and presented talks related to her Ph.D. work on pillar designs in South African mines. Conference attendance was supported by grants from the Faculty and as young staff members, provided Lopa and Kumesh with opportunities to network and apprise themselves of the latest developments in their respective fields.

Staff news:

In July the School of Geological Sciences welcomed Dr Marlina Elburg as the senior lecturer in analytical geochemistry. Marlina was recruited from the University of Ghent in Belgium. As a lecturer, Marlina will be responsible for the undergraduate course in geochemistry and an Honours course in analytical techniques but will additionally manage the analytical facility in the School. As part of the welcome package Steve McCourt was able to secure funds from the University to replace our aging X-ray equipment (these instruments pre-date the closure of the geology department in Pietermaritzburg in 1995) and to purchase a new ICP-MS for laser ablation work. To date the new Axios XRF has arrived and we eagerly await the arrival of a new Empyrean XRD and a Nexios 300 ICP-MS in September and October respectively.

Mike Watkeys continues his research with John Tarduno (University of Rochester) into the magnetic field of the Earth. The two of them, together with two research students, recently travelled to the Mpungubwe area to collect more archaeological samples in conjunction with Tom Huffman (Wits University). This project is examining the change in intensity of the Earth's magnetic field over southern Africa in the past 2000 years. They then crossed the border into Zimbabwe to sample dykes close in age to the Archaean-Proterozoic boundary for a project that is examining the character of the Earth's magnetic field at that time. This research is being undertaken in conjunction with Axel Hofmann (UJ)

Ron Uken continues his research within the African Coelacanth Ecosystem Programme (ACEP) and is currently involved with projects related to bottom sediment sampling and generation of surface sediment distribution and mineralogy maps for the KwaZulu-Natal Bight, situated between Durban and Richards Bay. Palaeontological led by post-doc Maria Ovechkina focussed on the forams and calcareous nannoplankton. A new linked to ACEP II will investigate the palaeoclimate record preserved in corals from Sodwana Bay, KwaZulu-Natal. Using a specially designed hydraulic drill and a team of SCUBA divers, coral cores have been collected from a large porites coral dome on 2 Mile Reef at Sodwana Bay. This material will now undergo detailed analysis using a combination of spectral luminescence, X-ray analysis, stable isotope chemistry, and Sr/Ca chemistry to provide a record of coral growth and environmental history such as sea surface temperature, river runoff and flood events. This



study is being done in collaboration with the Royal Netherlands Institute for Sea Research.

Jürgen Reinhardt is part of a team of authors that have completed an e-book early this year entitled "Guide to Thin Section Microscopy" (M.M. Raith, P. Raase & J. Reinhardt). The book has already found its way into various optical mineralogy courses, including some in New Zealand. As the authors have no interest in exploiting this resource economically (like getting rich from royalties), a decision had been taken to publish the book online, for easier availability to everyone interested and also for the ease of publishing updates. The book is available through the website of the German Mineralogical Society (DMG): www.dmg-home.de/lehmaterialien.html.

Andy Green and Alan Smith have initiated two new research projects focusing on both contemporary and ancient marine sedimentology. These include a study of anomalously large waves and their deposits along the KZN shoreline and the genesis of near-shore sand

bodies within the Vryheid Formation. International research collaboration continues with Prof. Andrew Cooper from the University of Ulster (incised valley fills) and Prof. Dr. Burg Flemming from the Senckenberg Institute (continental shelf dynamics). Saumitra Misra has initiated a research programme on terrestrial asteroid impact craters including the Ramgarh and Lonar craters in India and the Morokweng impact crater in South Africa. The Morokweng study also involves Marco Andreoli and Roger Gibson from the Impact Research Group at Wits.

Last but hopefully not least, Steve McCourt was part of the team responsible for publication of a GSA Memoir (207) entitled Origin and evolution of Precambrian high-grade gneiss terranes with special emphasis on the Limpopo Complex of southern Africa. Dirk van Reenen, Jan Kramers (both UJ) and the late Leonid Perchuk are the other members of the editorial team.

Contributed by Steve McCourt

geosynthesis 2011



GeoSynthesis 2011 – A Resounding Success!

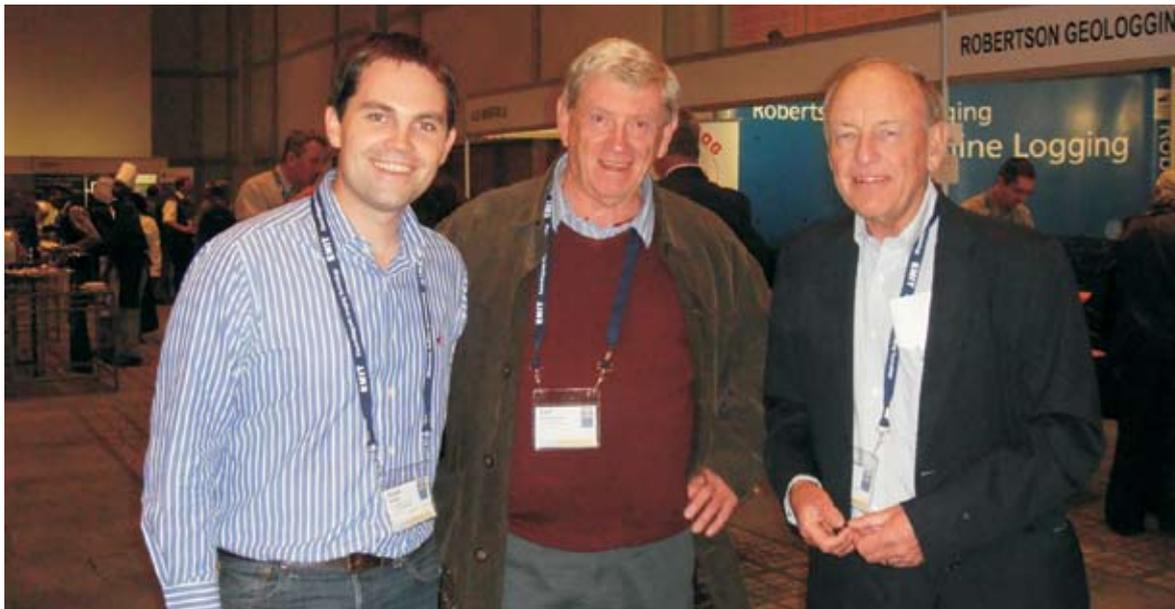
Is it possible for geologists, geophysicists and geostatisticians to live and work in harmony? Asking this is like asking "How long is a piece of string?" and requires a Zen-like answer. Nevertheless, an experiment was tried in the form of "GeoSynthesis 2011", held at the Cape Town International Convention Centre (CTICC) from the 30th August to the 1st September when these three geoscientific disciplines got together to exchange scholarly information. An added bonus was the inclusion of sessions from the International Lithosphere Program, and the attachment of the 8th Annual Inkaba yeAfrica Workshop at the same venue, which provided over four score and ten eager students and seasoned researchers to the party.

The idea germinated in Mbabane, Swaziland two years ago when our Society Executive Manager, Craig Smith, attended the South African Geophysical Association

(SAGA) biannual meeting, and was quite impressed with the proceedings (read partying!). Contacts and negotiations started about a possible joint meeting, and when the venue of choice was selected and the organising committee formed, the event for 2011 began to take shape. Strategic Business Services (SBS) of Cape Town was chosen to organise the conference at the CTICC, and the call for papers was issued.

And the result was a most memorable conference. I personally could not resist the call of Cape Town, and put in for two presentations when I could have gotten away with one! I doff my hat to Doug Cole, Glenn Wilson and Sharad Master who, uncoerced, chose to speak thrice each. About 500 delegates chose to brave the hardships and deprivations of the Cape in the springtime to partake in our humble Conference, including a smattering from abroad.





*Left to right:
Grant Bybee,
Carl Anhaeusser and
Richard Viljoen.*

The formal proceedings on the Tuesday morning should have started with an address by our Deputy Minister of Energy, but she had to unfortunately cancel at the last minute due to pressures of work. Mr. Phillip Barton, the Chief Executive Officer of De Beers Consolidated Mines, gave his address a bit ahead of schedule, and presented an insightful account of his company's operations, and the importance of the role of geoscientists in the search for new diamondiferous kimberlites. De Beers are committed to still be mining well into the future, and the more so in South Africa. Professor Maarten de Wit of the Nelson Mandela Metropolitan University then unveiled his Africa Alive Corridors concept to us, stressing that we could all get involved, and which goes beyond the geosciences into the botanical, zoological and environmental sciences as well. This truly multidisciplinary project needs support and resources from as many stakeholders as possible, and will result in a series of publications that will showcase Africa's importance in geological, biological, zoological and human evolution. Prof. de Wit will welcome discussions from all. Dr Sharad Master of the University of the Witwatersrand was the final plenary speaker, and presented an entertaining narrative on the importance of some South African rock outcrops in the history of the development of geology. Not many of us are aware that the first scientific expedition to South Africa took place soon after the Cape was colonised by the Dutch. Two visiting French monks were tasked to climb Table Mountain to find evidence that it was once under the sea. They did not, but nevertheless reported on their geological observations. Dr. Master also discussed the importance of the Sea Point and Platteklip Gorge outcrops of Cape Granite intrusive into Malmesbury shales in the Neptunism versus Plutonism

debate that raged in Europe in the 19th Century.

As with the food selection at sumptuous lunches that were provided, the choice of talks to attend was overwhelming, and I managed to attend some of those, mostly geological, whose titles I understood! My sincere apologies to the geophysicists, geostatisticians and Inkaba yeAfrika presenters whose talks I could not attend because of my inclinations and lack of multiple personalities! Stoffel Fourie gave an up-to-date account of the geophysical surveys completed over the Waterberg Coalfield, with a mention of the intriguing "Ellisras meteorite crater", detected by the gravity survey, that needs further investigation. The next four papers at the venue dealt with the various aspects of the shale gas potential in the Karoo rocks. The bottom line is that there has been very little science done on the subject, and that this has to be initiated and completed before any important economic and environmental decisions that affect South Africa are made that are not based purely on emotion.

A switch of venues then led to a presentation by Trishya Owen-Smith who spoke about some results of her work on the Doros Complex in central Namibia. Her easy-to-follow talk (for me) brought back memories of my doctoral fieldwork area not too far away to the south-east. Grant Bybee followed with a well-illustrated account on his research on anorthosites in Labrador, and Sue Webb almost convinced us about the hypothesis that plumes from the Large Low Shear-wave Velocity Provinces (LLSVPs) at the core-mantle boundary gave rise to many kimberlites. We have to read her first paper in *Nature* (with co-authors) to scrutinise the details. Chris Prins then spoke about the



size of diamonds, in particular the large ones, and their statistical distribution in the context of recovery. Sinikiwe Ncube took us across the border to the Great Dyke in Zimbabwe when she presented results of her research on the some of the xenoliths found in the Selukwe Sub-chamber. Grant Cawthorn brought us back to the Bushveld Complex (BC) in his inimitable style when he proposed that the Bushveld magmas may have been derived from subducted Archaean oceanic crust. The Tuesday afternoon session closed with Geoff Campbell illustrating some of the geophysical surveys conducted over the BC through the years. The Ice-Breaker Cocktail Party followed, most enjoyed by those who had already given their presentations! Sad to say I was not amongst the chosen few, so it was a relatively early night for moi.

Wednesday morning saw me attending the BC/Great Dyke session again which opened with Lew Ashwal's account of his, Sue and Frederick Roelofse's detailed logging of the Bellevue and Moordkopje cores. This painstaking work revealed geological subtleties that led to their modest suggestion that the "Bushveld stratigraphy was largely constructed by the repeated emplacement of mushes". Chris Harris then presented oxygen and neodymium isotopic evidence that the magmas that produced the Bushveld granites were "derived by partial melting of a source consisting of 90% RLS (Rustenburg Layered Suite) + 10% mantle-derived magma at depth..." Grant Cawthorn's second talk was about the small xenoliths that were found in the Palmietgat kimberlite smack bang in the middle of the BC north of Pretoria. These were proven to be of undoubted BC origin, thus providing physical evidence

of the occurrence of the BC at depth, albeit unknown exactly how deep. Janine Cole then showed us how she constructed her best-fit geophysical model of the BC along a traverse across the western limb.

Venue jumping took me across to listen to Gavin Selfe presenting the results of some geophysical exploration work he's done on the Ombuku nickel sulphide deposit in Kunene Anorthosite Complex in northern Namibia. Then back to relatively soft rocks with John Rogers and his geological evidence of an unconformity between the Graafwater and the Peninsula formations of the Table Mountain Group in the Western Cape, with Erika Barton following up with some detrital zircon dating that supports, and provides time constraints on, the event. Doug Cole took us on a whirlwind tour of the stratigraphy and palaeo-environments of the Karoo-age rocks in South Africa and India. Bob Thomas provided some results of detrital zircons from the Dwyka Group in South Africa and the Falkland Islands, from which he inferred possible source areas. The pre-lunch talk was by Wlady Altermann on Karoo palynofacies patterns in the northern Witbank basin which provide evidence of changing climatic and environmental conditions.

Post-lunch saw me at the "Africa's Base Metals" venue, with Mike de Wit (?) [speaker listed as Erika Barton in the programme; Ed] about the exploration work being conducted in the Tsodilo Hills area of northwestern Botswana. There are no outcrops of the target rocks, and exploration is being done entirely by drilling of geophysical targets. Promising results have been obtained, and work is continuing. Agnes Jikelo followed with her work on correlating physical properties with



*Left to right:
Richard Viljoen,
Johan de Beer,
Jan Kramers,
Craig Smith and
Morris Viljoen.*



*Sterling EQ, in action.*

geophysical logs from Sishen and Limpopo Province. It only clicked when I visited the AngloAmerican booth afterwards (she was manning it) that I had met Agnes before in June when I volunteered to demonstrate core logging at the Geological Skills course organised by the Society. We visited the Council for Geoscience core-shed at Donkerhoek, and Agnes also assisted with the demonstration. "Africa's Gold" began with Nathan Komarnisky of Randgold Resources discussing the use of airborne electromagnetic (EM) as an orogenic gold targeting tool in the north-eastern Democratic Republic of the Congo. Co-incidence 2: I used to work for Randgold! Then it was my turn to regale the delegates with an account of the work our Centre for Mining Innovation is doing in the field of autonomous narrow reef mining in South Africa. There are challenges aplenty, but such research is vital if we want to be able to mine our gold resources into the future. Oleg Brovko took us to teatime with his re-processing of the available seismic data in the Carletonville Goldfield, and his interpretation of where the economically important Carbon Leader Reef occurs at depth.

Musa Manzi started the graveyard shift with his animated interpretation of the 3D reflection seismic data from the West Rand and Carletonville Goldfields, stressing the importance of the Black Reef Formation marker in his tectonic interpretations. Sue Winkler, a geologist, gave an account of the integration of geophysical and geological data around the Siguir gold deposit in Guinea. Chris Gauert then presented some ongoing work on the geochemistry of Black Reef Formation gold, which is distinct from that of the underlying Witwatersrand Supergroup reefs, and also from Archaean gold samples. He is busy

building up a more representative database. Glenn Wilson followed with a case study of practical 3D Airborne Electromagnetics (AEM) inversion using the Golden Ridge ore deposit in Tanzania. Co-incidence 3: I worked on the Golden Ridge deposit in the mid-1990s when Randgold owned it! How cool (weird?) is that! Then the stoic few listened to my final talk of the afternoon on electric rock breaking – thanks for your support and for saving me the embarrassment of talking to myself.

The evening's Gala Dinner, sponsored by Geotech, at the CTICC is a story unto itself. Imagine a sit-down dinner for just under 600 people. Drinks are ordered and sipped, and then the musical entertainment began – two violins, cello and flute played by the enigmatically named Sterling EQ quartet. What a blast! As well as a feast for the (male) eyes – four gorgeous, mini-skirted lassies playing upbeat classical and popular tunes (see accompanying photograph if you don't believe me!). WOW! Thanks for the treat, Revered Organisers! It will take a lot of topping. As usual there were food and drinks aplenty, and after the formal speeches, there was abundant time for renewing old acquaintances and beginning new ones. I got to meet Stuart Moir, who is the brother of Gordon who used to work for Exxon (aka Esso) and whom I met when I started my geological career after graduation working for Esso.

The final day was a mixed bag for me, beginning with John Anderson's talk on Darwin's Century (fascinating) and ending with Mike O'Brien's overview of geological ore body modelling just before lunch (even I understood this talk in the geostatistics session!). In between, Jeannette McGill gave a comprehensive



assessment of the competitive PGM supply from the Eastern and Western Limbs of the Bushveld Complex, with the former just edging out the latter into the future. Julie Autin presented geophysical data on the structure of the Colorado Basin - offshore Argentina, and Henning Schultz talked about the Cretaceous and Tertiary sediments on the other side of the Atlantic Ocean -offshore Namibia. Sharad then amused us with his third talk about evidence for ancient tsunamites off Clifton Beach in Cape Town. I missed his second talk on the previous day due to a clash – it was on the geoarchaeological confirmation of the shipwreck at Bonza Bay (Eastern Cape) as the Santa Maria Madre de Deus (1643). Jorg Ebbing did some nifty re-processing of gravity data to model the lithospheric structure of northern and western Africa, using seismological data as constraint. The rest of the afternoon was devoted to geophysics, of interest only to those of great dedication and stamina.

In between listening to talks, there was ample opportunity to browse amongst the many high-quality posters, for which the authors must be profusely thanked for putting in such dedication and effort. These informative posters are a highlight of any conference, and present an opportunity for researchers to publicize their work. The Exhibition Hall was filled to the brim, and many a pen and souvenir were collected in the course of tea- and lunch-time rambles. All the exhibitors deserve a round of thanks for their continued support at conferences.

On perusal of the volume of abstracts, the mix of papers was about half geological or geostatistical and half geophysical by subject matter. A large number of the papers could have been classified as completely mixed disciplines, which was the aim of the meeting. There was a generally higher quality of presentations – poster and oral – at this meeting compared to most local or international meetings, and this was specifically noted by a number of delegates during the breaks between sessions. All contributors are thanked for the effort expended. There were a few very memorable sessions, including one on the Bushveld where for the first time we have seen general agreement that the complex is continuous between eastern and western limbs based on geological and geophysical evidence. The International Lithosphere Program offerings produced a number of good papers, and the position of the southern edge of the Congo Craton was documented for example. Those presentations and posters are of high significance to any exploration effort in southern

Africa. “Big Science” was on display, with a new model for kimberlite distribution being proposed. There were a significant number of contributions by the oil and gas community. The geoheritage session produced a great deal of interest. There was a session on shale gas exploration, and great presentations were given by a number of people, including technical representatives from Shell, Falcon, and Umvoto Consulting. I think this was notable, because the audience had direct access to the technical people in the discussion session that followed. Discussion was largely centered around technical information and not emotive issues, and a number of reporters attending hopefully left the meeting with a different sense of the debate.

A significant number of papers had direct or indirect economic importance, and while industry attendance was perhaps less than would have been the case for a Johannesburg venue, a number of senior company people did attend, and no doubt came away with some new insights.

There were 46 exhibitors at the conference, and the general consensus is that they appreciated having access to roughly double the number of delegates compared to the case for separate meetings. One of the exhibitors and participants was Laurent Amiglio, and special mention needs to be made of his magnificent flying machine. After much persuasion, the conference centre allowed him to fly his unmanned drone inside the building. We will never know how much pressure the conference organizer had to exert to allow that to happen!

Finally such an enjoyable and educational event would not have taken place without five critical elements: all the sponsors who so generously gave their support, the dedicated Organising Committee under the chairmanship of George Smith, the conference organisers SBS under Peter Aspinal who put things together seamlessly, all the speakers who took the time and effort to prepare their overall high quality presentations, and the companies and institutions who generously allowed the delegates to attend. Short of one, and the event would not have happened. It was a great conference, and I am sure that all delegates would wish to express their sincere thanks to those who made it happen. Only one request for the next event – PLEASE schedule in a Golf Day!

George Henry

the awards

Best Paper and Poster Awards – Geosynthesis 2011

As part of the Geosynthesis 2011 conference, the Organizing Committee adjudicated awards for best papers and posters, to be announced after the conference. The prize to be awarded is R2500 for each category, to be paid to the senior author. Awards were given by both SAGA and by the GSSA/GASA. The papers and posters by students and professionals alike were of exceptionally high standard at this conference, and judging was consequently difficult. Both the SAGA and the GSSA teams spent some time during the conference on this aspect of the proceedings. In the case of the GSSA/GASA adjudication, it was decided to give dual awards for best paper.

The SAGA winners are:

Best Paper:

'Magnetic Evolution of the Geothermal History of the Western Karoo Basin' by Leonie Maré (Council for Geoscience), Michiel de Kock, Hassina Mouri and Bruce Cairncross (University of Johannesburg). This contribution has implications for shale gas exploration, addressing the problem of dolerite intrusion into the Karoo stratigraphy, and how this may affect hydrocarbons.

Best Poster:

'Study of the Geoelectrical Anisotropy of the Cape Fold Belt' by X. Chen and U. Weckman (Helmholtz Centre, Potsdam). The work has been done under the Inkaba yeAfrica program and documents modelling results for magnetotelluric and electrical anisotropy character of along Cape Fold Belt collisional zones.

The GSSA/GASA winners are:

Best Paper (1) –

'Kimberlites Sourced by Plumes from the Core-Mantle Boundary' by Trond Torsvik (University of Oslo), Kevin Burke (University of Houston), Bernhard Steinberger (Geological Survey of Norway), Susan Webb and Lewis Ashwal (University of the Witwatersrand); delivered by Sue. This paper is a great example of innovative science from a global team, and it focuses on one of the major earth science debates of the day – plate motion or plume emplacement as the responsible agent for a host of geological phenomena.

Best Paper (2) –

'The Geological and Geochemical Characterization of Namakwa Sands Heavy Minerals Mine Ore Types and Their Effect on Beneficiation' by Dennis Alchin, Sifiso Mhlongo, and Elaine Magnus (all from Exxaro; delivered by Sifiso). The presentation took us through the geological and geochemical variation in the Namakwa Sands deposit, relating the geology to beneficiation.

Best Poster –

'Geological and Geophysical Characteristics of an Archean Suture Zone, Barberton Greenstone Belt, South Africa' by Scott MacLennan, Maarten de Wit and Moctar Doucourè (AEON Centre, University of Cape Town). The work is part of the Inkaba yeAfrica proceedings, and reports the geological and geophysical evidence for interpreting the Inyoka Shear Zone, Barberton Greenstone Belt, as a major suture zone separating lower grade greenstones from higher grade gneiss complexes.

Congratulations to all winners, and to the authors of all presentations for the high quality of the conference proceedings.

Craig Smith, Mark Gibson and Sean Duggan

GeoSynthesis 2011
Conference & Exhibition

new zealand earthquakes

Catastrophe in Canterbury: the 2011 earthquakes

This article was originally submitted to the Palaeontological Society of South Africa (PSSA)'s Palnews vol. 18 (2), Sept 2011, by whose permission it is here reproduced. The author, Dr Norton Hiller, is a former lecturer in the Department of Geology at Rhodes University.

Well, what an interesting and unsettling nine months it has been! At 4:30 AM on 4 September last we were wakened by the sound of a freight train rushing through the house. Then everything started to shake. Half out of bed, we could hear things falling off shelves but the fabric of the house seemed to remain intact. After 40 seconds, but seeming much longer, the shaking stopped and we could stand upright again and start an exploration of the property. However, the power was off and I was unable to locate the torch I was sure resided in my bedside cabinet. [At times like this you wish you had paid more attention to the Civil Defence messages about being prepared for a natural disaster.] Carol retrieved a little battery-operated radio and we retired to bed to wait for daylight. There was a fair old frost outside and bed seemed like a good place to be. However, we live by the coast so we contemplated evacuating in case of a tsunami but decided to wait for the warnings. I did wonder if the bed would float.

“...we live by the coast so we contemplated evacuating in case of a tsunami but decided to wait for the warnings. I did wonder if the bed would float.”

News reports started coming over the radio with tales of building collapses in the central city, but no word of casualties. Estimates of the quake magnitude were also reported at about 7.2 M on the Richter Scale. Hmm that's big, I thought, we'd better check the house. Once it was light we went through every room and I checked the outside walls and roof. Fortunately there were no cracks and all the doors opened and closed without problem so the framework was sound. The only damaged we suffered was to a few fallen objects. We

were very lucky. As news kept coming we learned just how lucky we were. We even got our power, water and land lines restored by lunchtime.

Yay, we survived! Where can I buy the t-shirt?

Indeed we all survived and in spite of the magnitude of the quake there were no casualties. It seems that if you are going to have a major earthquake, then 4:30 AM is the perfect time. The night owls will have gone home but the early birds would not be up just yet.



13th fairway at Waimairi Beach golf club

That, of course, was only the beginning. Over the next few months we had lots of aftershocks but by Christmas they had tailed off a lot and barely gave most folks pause. We even grew tired of playing earthquake roulette (guessing the magnitude of an aftershock). This was turning out to be the most studied earthquake in history. Within hours, geologists, seismologists, geophysicists and many others were out there looking for the fault, deploying mobile seismic stations, documenting the affects of liquefaction in suburbs along the river, and studying the responses of different types of buildings. At the Geoscience Society of NZ conference at the end of November, a whole session was devoted to the quake and we heard talks covering every aspect. As a survivor but not a victim I was able to sit back and enjoy it in total fascination.

In complete contrast, 12:50 PM is not a good time to have a big earthquake. At that time on Tuesday 22 February I had just gone up to the museum staff room on



the top floor (Level 5) and poured myself a cup of tea. There was a bang, a rumble and then the most violent shaking I have ever experienced. The water cooler fell over, my tea was all over the floor and I had to grab the door post to keep myself upright. After another 40 seconds of having one's comprehension tested to the limit, it was over. The alarms went off so we evacuated the building and I was surprised to find that I had no problems getting to an exit. All passageways were clear and doors open. We assembled in the Botanic Gardens next to the museum and were joined by lots of people who had been visiting the museum and other tourist attractions close by. After about 10 minutes there was a big aftershock. Earthquakes are different when you are outside. The ground really does move in waves, trees sway like they never do even in a strong wind and buildings and statues come to life in the most bizarre way.

This one was different. As we milled about trying to regain composure and contact loved ones, we became conscious of hoards of people coming up from the city centre a couple of blocks away. Many looked ashen, others were covered in dust.

You just got the feeling that this time there would be no t-shirt.

The Richter Scale magnitude was recorded as 6.3. Not as big as September's quake but the affects were considerably greater. The epicentre was much closer to the city and the movement took place on a different fault. Unprecedented ground accelerations were recorded. A new hidden fault under the hills immediately southeast of the city was responsible for this one. The hills are now about 50 cm higher while the land to the north of them is up to 1 m lower.

Sadly, this time there were casualties – 182 people died and many more were injured, some very seriously, as a result of collapsing buildings and falling masonry. In addition, the effects of the tremors were much more widespread. Liquefaction devastated the eastern suburbs. Houses were moved, roads wrecked, water and sewage pipes destroyed and power lines broken. On the hill suburbs, built on rock, liquefaction was not the problem; because they were virtually on top of the fault, many houses were practically shaken to pieces and falling rocks destroyed others. Those built close to the edge of cliffs were left precariously perched and uninhabitable.



In the days following, those of us who had lost power, water and sewerage were encouraged to dig latrine pits in private corners of our gardens until the authorities were able to set up port-a-loos along affected streets and eventually deliver chemical toilets. Fortunately, we only had to last a week at home before we could flush again. It was just as well as I found squatting in the garden murder on aged knees!

Gashes in river bank as land slumps towards river

The 22 February event started a whole new round of aftershocks and once again the citizens of Christchurch tested their skills at guessing the size of each new shake. Each aftershock was presaged by a loud bang or a rumble, and then the shaking came through the house in a south to north direction and faded away. Every time we would hold our breath waiting to see if the shaking was going to build and got ready to dive under a table if necessary.

After almost four months, things had quietened. The roads had been made passable, if still very rough, and many businesses were operating as normally as they could. At the museum, we were not allowed back for about a month until the buildings had been inspected

Liquefaction crater Bower Ave playing fields





*Liquefaction victim
13 June (above)*

*Liquefaction victim
22 February (below)*

*Liquefaction
(top right)*

and declared safe, and power and water had been restored. Since about mid-April, we have been working short hours on earthquake recovery projects. Collections on display took a bit of a hit so exhibitions staff members have worked their way through all the cases recovering broken items, repairing mounts and cleaning up debris. They had just completed this task when, on Monday 13 June, we had it all again.

In a cruel action replay, we had another 6.3 but this time it was preceded by a 5.6 about 80 minutes earlier. By the time these shakes hit, most folk were out of the building. I had gone to the university and was standing outside the library tower when it started to shake and make odd noises. Workmen up scaffolding on the outside of the building came down like rats

down a drainpipe and gathered with sighs of relief at the bottom. Campus was evacuated so I headed home but got snarled up in traffic. I had not quite made it home when the 6.3 hit. I have to say it is a decidedly weird experience driving in a major earthquake when the road does strange things. In such circumstances control of a car is a foreign concept.

Again, home was fine, but many of those unfortunate folk who had barely finished clearing their properties of silt from February's liquefaction had to start it all over again. Roads are once again like assault courses but the guys working on them are doing a fantastic job. It will be years before our city recovers but every day we take a small step in the right direction. After more than 7000 recorded aftershocks, we are well and truly over it. Now we look forward to the time when our little piece of the crust settles down to some sort of equilibrium.

Carol and I really appreciate all the calls and messages we have received asking after our well being. It is quite humbling that so many people, in many parts of the world, were thinking about us.

Contributed by Norton Hiller
Canterbury Museum, Christchurch, New Zealand



You can't keep a good geologist down. Building came down 4 Sept



What happens to a footbridge when river banks move towards one another

in memoriam:

Clive William Stowe 1931-2011

Dr Clive Stowe, a man who was dedicated to his career as a geologist, would have been influenced by his great grandfather, George William Stowe MD, FGS (1822-1882), who emigrated to South Africa and landed in Port Elizabeth in December 1843. George William was a keen historian and became interested in the geology of the Eastern Cape, publishing his pioneering works in the *Journal of the Geological Society*. The Government of Griqualand West invited him and F.H.S. Orpen, the Surveyor-General, to map a portion of that country in 1872 and the results were published in the *Quarterly Journal of the Geological Society of London* in December 1874.

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

This was the year that Clive entered Rhodes University in Grahamstown to follow his passion for geology. The cursive script of Professor E.D. Mountain records Clive's consistently high marks through to the award of his Honours Degree in 1953. Perhaps at the instigation of his mentor and colleague, Hugh Eales, Clive joined Frobishers back in Rhodesia and worked at the Connemara gold mine between Que Que and Gwelo. This was when he developed his enthusiasm for sailing and he learnt to glide. He then joined Anglo American in Northern Rhodesia where he enjoyed his initiation to geological field work in the vast open bush he so loved. It was in late 1958 that Clive joined the Rhodesia Geological Survey and was immediately assigned the

of Selukwe (Shurugwi) in his native Midlands Province. Working to the east around Mashaba was James Freeman Wilson, and to the west Neil Harrison was mapping the Shangani area. Coincidentally Peter Cotterill, as chief geologist to Union Carbide's Rhodesian Chrome Mines, was leading an aggressive diamond-drilling programme to extend the understanding and reserves of the Archaean podiform chromite ore bodies there. Selukwe had been the first mapping task set by the Geological Survey in 1911 when H.B. Maufe, Ben Lightfoot and A.E.V. Zealley achieved a remarkable initial assessment of this complicated structural setting, further refined by Ronnie Tyndale-Biscoe in his 1949 publication of the geology east of Gwelo. With geologists such as these greats to pit his mind against, Clive set about mapping and structurally analyzing the geology around Selukwe where he recognized three terrains, the highly deformed and linear Ghoko ranges cutting across less deformed gneissic blocks constituting micro-cratons and, east of the Surprise Fault, the allochthonous nappe structures of the Selukwe Schist Belt where he regarded a 'metasedimentary' Mont d'Or Series as being the oldest and lowest unit. Cotterill believed the greater portion of the Mont d'Or to be tonalitic and intrusive into the nappe structure. Needless to say both personalities gained their coveted Ph.D. degrees, Clive in 1968 through the University of London, coincident with publication of Bulletin No. 59 of the Rhodesia Geological Survey and associated papers read at the Symposium on the Rhodesian Basement Complex and published as an annexure to Volume 71 of the *Transactions of the Geological Society of South Africa*.

Geoffrey Bond had become the first Professor of Geology at the University College of Rhodesia and Nyasaland in 1960. He needed lecturing strength in the fields of Archaean and structural geology and in 1963 persuaded Clive Stowe, together with Linley Lister (née King) as a geomorphologist, to join his fledgling department. Clive's lecture load included structural geology, the Archaean and economic geology as well as geological mapping techniques on the 3rd year field



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

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

The time had come for Clive to extend his academic career and he left the University of Rhodesia in 1978 to join the team at the University of Cape Town and

to expand his research within the sphere of their Precambrian Research Unit, which had been established in 1963 under the directorship of Dr Henno Martin but was now headed by Piet Joubert. With Piet and colleague Chris Hartnady, Clive broadened his research into the regional extent of Proterozoic tectonic provinces and the crustal evolution of southwestern Africa. Much of his work was in the Namaqualand Metamorphic Complex along the Upington Geotraverse in the Northern Cape, and many of his ideas on the relationship of the Kheis Belt to the Magondi of Zimbabwe have been expanded in an extraterritorial study on the extent of the Early Proterozoic Magondi Belt and its equivalents by Sharad Master from the University of the Witwatersrand. Hartnady took over directorship of the PRU in 1988, but sadly circumstances called for its dissolution in 1994. By 1995 Clive had expanded his lecture load in the department to that on structural geology, tectonics and engineering geology, the latter subject being inherited on the resignation of John McStay but one in which Clive was to consult extensively, notably on jointing in the Malmesbury Group exposed in the Harbour area in Cape Town. His interest in economic geology allowed Clive to co-author with Bob Foster and others on their treaties on Archaean gold mineralization in Zimbabwe for the Mineral Deposits of Southern Africa volumes in 1986, and in 1987 he edited a book on the Evolution of chromium ore fields published by Von Nostrand Reinhold of New York. He himself wrote the contribution of the chromite deposits of the Shurugwi Greenstone Belt, Zimbabwe.

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

By 2007 Megan and John had both left home and



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

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

Tim Broderick and Megan Poulton-Stowe

582 ZIRCON AGES FOR TWO ARCHEAN BANDED MIGMATITIC GNEISSES, ZIMBABWERUNNING TITTELLE

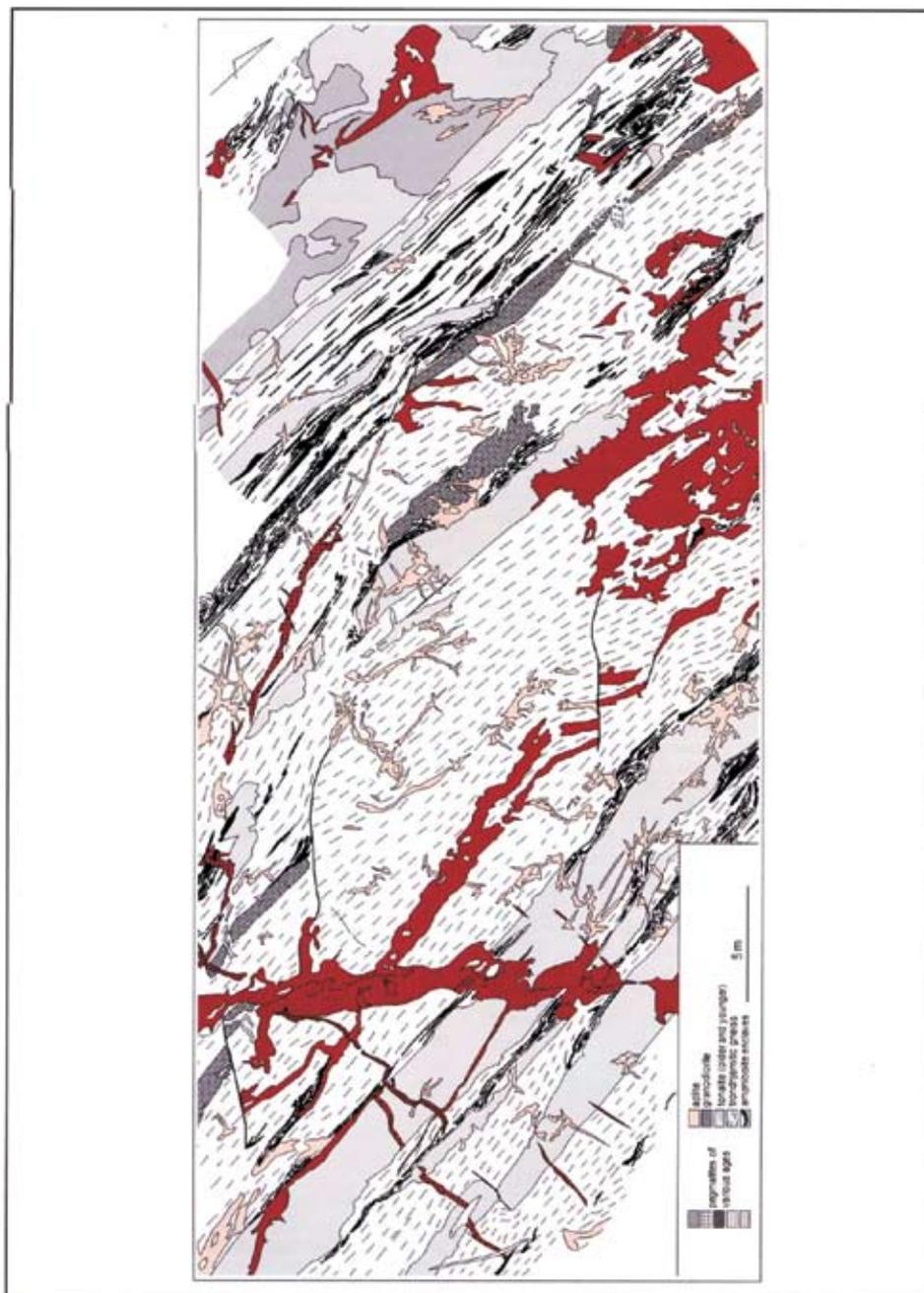
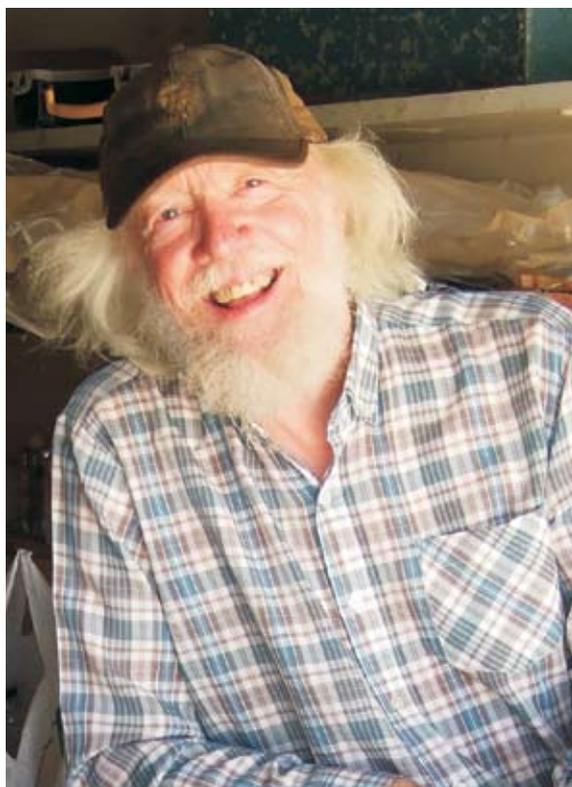


Figure 3. A portion of the Gwenzoro Dam spillway. After Stowe (1971). Note the different generations of intrusive phases, the orientation of the gneiss layering and the intensity of the deformation that affected the banded migmatitic gneisses.

SOUTH AFRICAN JOURNAL OF GEOLOGY

Banded migmatite from the Gwenzoro Dam Spillway (from Jelsma et al. 2004. Single zircon ages for two Archean banded migmatitic gneisses from central Zimbabwe. S. Afr. J. Geol., Vol. 107, pp. 577-586.)

in memoriam:



John was born in Cape Town on 29 September 1946 to parents who were deeply interested in the natural world and the outdoors. From a very early age he was exposed to the floral, animal, archaeological and geological diversity of the Western Cape, influences which were to shape much of his professional and personal life. After completing his schooling at 'Bishops', John enrolled for a B.Sc. at the University of Cape Town (UCT). He initially considered studying towards a major in archaeology, but ultimately geology and chemistry won the day. A BSc (Honours) degree in Geology in 1969 was followed by a gap-year travelling Europe in an old VW Combi, before taking up his first full-time employment as Assistant Geologist at Cape Portland Cement's operation at Piquetberg and elsewhere in the Swartland. In 1972, John started working as an exploration geologist with Phelps Dodge of Africa, initially as project

John M. Moore 1946-2011

geologist at Broken Hill, Aggeneys, and later at the Zandrivierspoort iron ore deposit in the then northern Transvaal. During his time at Aggeneys, John married Madeleine Rosser whom he had met in 1971. Phelps Dodge also supported John's research work in the Namiesberg south west of Pofadder for which he was awarded an M.Sc. degree by UCT in 1977.

Upon receiving his M.Sc., John moved to Phelps Dodge Corporation (USA) to carry out grass-roots exploration in copper and molybdenum porphyry systems, hydrothermal gold-silver deposits, tungsten skarns and volcanogenic massive sulphide deposits in Arizona and Nevada. It was during this time that John and Madeleine's daughter Caron was born. In 1979, John returned to UCT where he took up an appointment as a Research Associate in the Precambrian Research Unit. Over the next 4 years, John undertook regional geochemical and stratigraphic studies of metamorphosed supracrustal rocks in Namaqualand. The size of the Moore family was also increased by the birth of Jesse in 1981. The Namaqualand research formed the basis of a thesis for which he was awarded a Ph.D. by UCT in 1986. Prior to this award, John had already moved to the position of Research Officer in Economic Geology at UCT, a post that also involved teaching at undergraduate and Honours level as well as the supervision of masters and doctoral students. Ad hominen promotion to Senior Research Officer followed in 1990.

In 1990, John successfully applied for and was appointed to the post of Professor of Exploration Geology and Director of the MSc Programme in Exploration Geology at Rhodes University. John's unusual and strong backgrounds in both academia and the exploration industry made him an ideal appointment to this post, which he filled with distinction



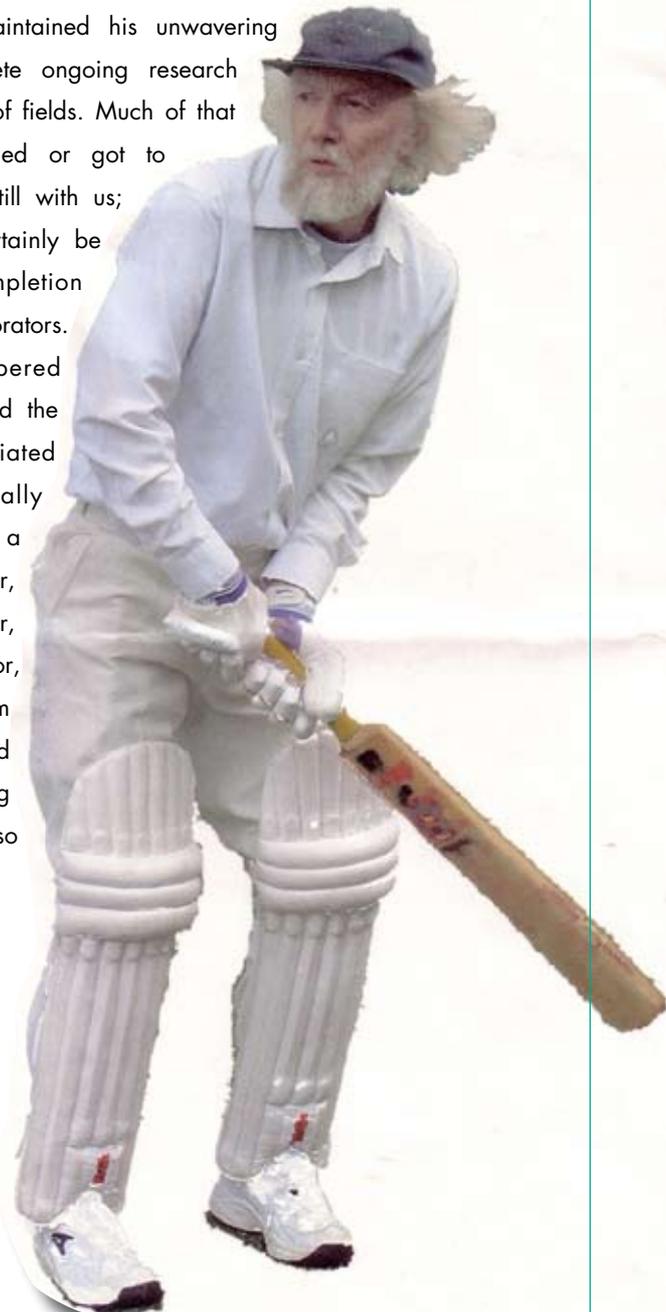
for 20 years from 1991 to 2010. During this time, the programme produced more than 100 graduates, in addition to over 20 research M.Sc. and Ph.D students. In spite of John's very busy schedule of teaching and field-trip instruction during his tenure at Rhodes, he also published over 30 papers in the peer-review geological literature with emphasis on economic geology, accompanied by a similar number of conference presentations. His research has included topics as diverse as the genesis and alteration characteristics of precious and base metal deposits in Proterozoic metamorphic belts; stratigraphy, geochemistry and ore genesis in the Transvaal Supergroup of southern Africa; and geomorphological studies with emphasis on African landscape evolution and diamond placer provenance. Although John has taught and supervised postgraduate students from as far afield as Australia, the Americas, Europe and Asia, in recent years his MSc course has been truly instrumental towards the training of a significant number of African geologists that are currently active in mineral exploration programmes across the entire African continent. Fittingly, John's immense contribution to the African Geoscientific community was recently recognised by the awarding of the Pretorius Medal of the Geological Society of South Africa in 2009.

Like his parents, John loved the outdoors. He was a lifelong member of the Mountain Club of South Africa and beside membership of a number of geology related societies he was also a member of the Botanical and Ornithological Societies of South Africa. In his youth he was a keen rock climber and pioneered a number of rock climbing routes in the western Cape with fellow geologists Andy Killick, Andy Moore, Chris Hartnady and Goonie Marsh, amongst others. He also played soccer and cricket pursuing these sports to an age long after it was perhaps wiser to have reverted to being a spectator. When he moved to the Eastern Cape he played cricket for one of the rural Pineapple League cricket teams where he was affectionately known as 'Moses' on account of his beard and long, flowing hair. John had a well-developed sense of humour and was an astute observer of life, and many will remember him as a great storyteller and raconteur.

Others with whom he corresponded in those letter-writing days of long ago, will also know him as a creative writer. He also had a great love of rock music with a formidable collection of vinyl from the 60's and 70's. He did everything with confidence and an infectious, sunny optimism. One of his great attributes is that, despite his 'posh' and privileged background, he was oblivious to class or race. He easily fitted into whatever company he found himself in. It was this that contributed much to his effectiveness as a great teacher and to the esteem with which he was held by all who crossed his path.

John was diagnosed with a rare form of cancer in late 2008, a disease which he fought bravely and courageously right through to the end. During that uneven battle, he maintained his unwavering enthusiasm to complete ongoing research projects on a variety of fields. Much of that research was published or got to press while he was still with us; the rest will most certainly be carried out to completion by his close collaborators. He will be remembered fondly by all who had the privilege to be associated with him, professionally and otherwise, as a truly inspiring teacher, colleague, supervisor, collaborator and mentor, both in the classroom and in the field, and as the genuine lifelong friend that he was to so many of us.

Contributed by:
Goonie Marsh,
Hari Tsikos
& Steve Prevec



the nabro volcano

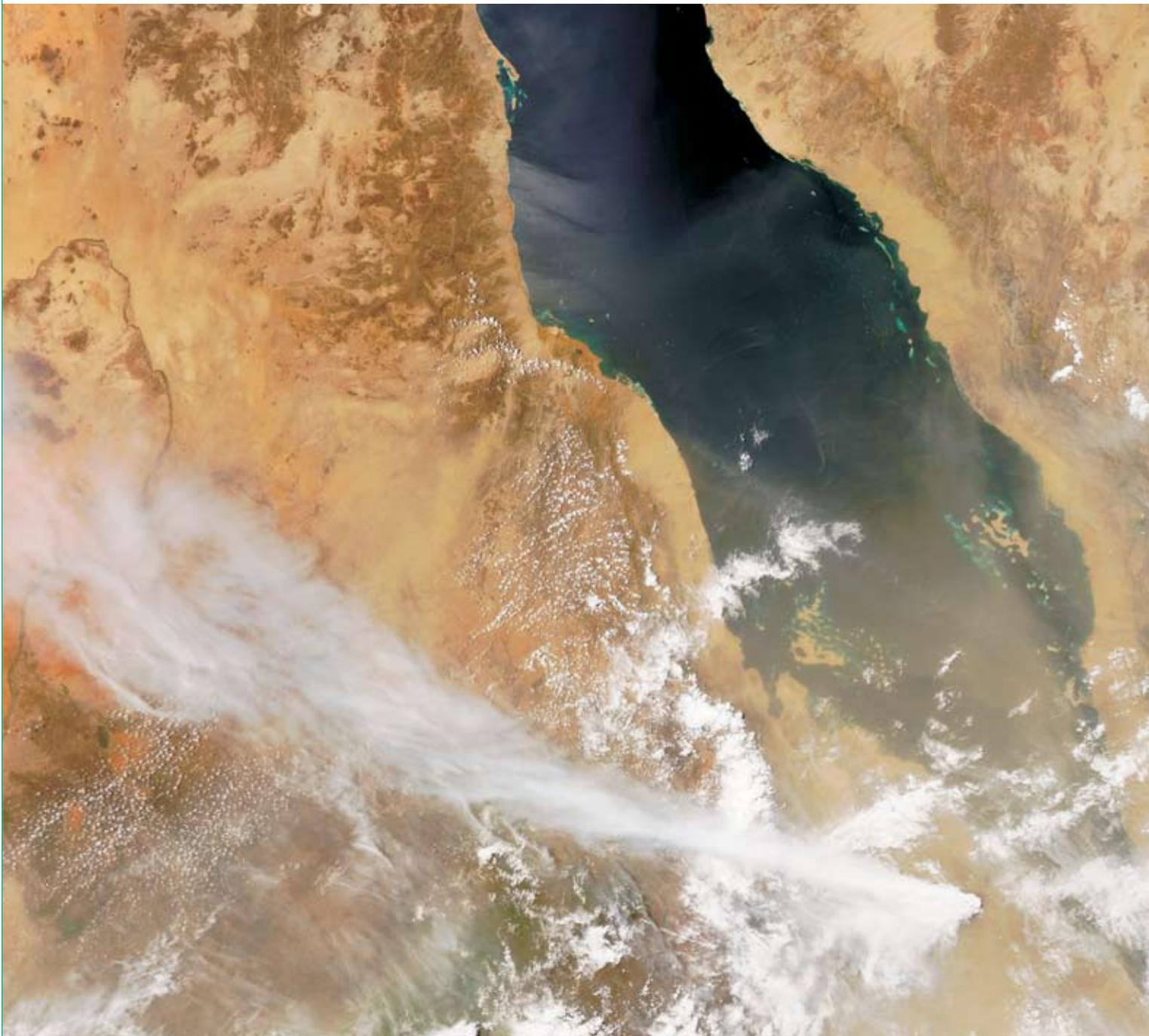
Eritreia

Nabro, a stratovolcano in south-eastern Eritrea, rumbled to life late in the evening on June 12, 2011, following a series of earth tremors that culminated in two strong quakes of magnitude 5.7, all around 10 km depth. The eruption produced an ash plume that reached an altitude of between 10 000 and 14 000 m, and exceeded 1000 km in length. The Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua satellite captured this natural-color image of the

plume on 13 June. Nabro is part of a larger complex with several nested calderas, and is part of the East African Rift. There is no record of historical eruptive activity at Nabro, although Dubbi, a nearby volcano, was responsible for the largest known eruption in Africa in historical time, in 1861.

Contributed by Antony Cowey.

NASA Earth Observatory



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MINING AND EXPLORATION NEWS

Copper and cobalt

Discovery Metals boosted the Measured and Indicated mineral resources at the Zeta deposit in north-western Botswana by 56%, to 17 Mt at 1.5% copper and 25.4 g/t silver. Zeta is one of three deposits that form the Boseto copper project, where the total resources are now 111.5 Mt at 1.4% copper and 17.6 g/t silver. Production from open-pit mining is scheduled to start in the first half of 2012, and a definitive feasibility study for an underground mine at Zeta is planned for completion in December.

China's Jinchuan Group trumped Vale SA's R7.5 billion offer for copper and cobalt producer Metorex Ltd with a R9.1 billion cash offer. Jinchuan, China's largest producer of nickel, cobalt and the platinum-group metals, and one of the top three producers of refined copper, plans to establish Metorex as an integrated platform for acquiring, exploring, developing and operating copper and cobalt projects in Africa.

Gold

Pan African Resources has lifted the mineral reserve at its Barberton Mines by 51% to 1 million ounces (3.83 Mt at 8.12 g/t). Total resources have increased by 7% to 2.55 million ounces, with a 33% rise in resource grade to 8.35 g/t. Drilling is now focusing on geophysical anomalies on the prospecting area and southern extent of the Fairview Mine property. The Barberton operations consist of three mines: Fairview, Consort and Sheba, with a combined annual production of approximately 100 000 gold ounces.

Canadian company Giyani Gold Corporation has agreed to acquire a 74% interest in the past-producing Madonsi gold mine, together with a 66.5% interest in six other historical gold producing properties in South

Africa's Giyani greenstone belt. According to the Council for Geoscience, the geology and mineralisation of the belt are not yet properly understood, principally due to its relative remoteness, lack of exposure, and deep weathering hampering exploration.

AngloGold Ashanti is taking an 11.5% stake in London-listed Stratex International plc. The funds from the £3 million private placement will be used in part to fast-track exploration in the Afar epithermal gold province in Ethiopia and Djibouti. AngloGold is already a strategic partner in the first 11 licence areas that comprise the Afar project. And Centamin Egypt, owner of the Sukari gold mine in Egypt, closed its £7.48 million offer for Sheba Exploration after gaining a 95.6% stake in the company. Sheba holds three gold and base-metal exploration licences in northern Ethiopia.

Iron Ore

Newly-listed Australian company Nemex Resources reported the discovery of potential direct-shipping iron ore (60-63% Fe) on its Télimélé licence, part of the Coastal project in western Guinea. Outcropping iron formation extends over more than 30 km², and the company has secured an additional 1946 km² of ground covering the same formation. Nemex also has an option to acquire the previously unexplored Beyla project in eastern Guinea, which borders Rio Tinto and Chinalco's Simandou Mountain project.

Sesa Goa, the iron ore mining arm of Vedanta Resources, is buying a 51% stake in the Western Cluster iron ore project in Liberia from Delaware-based Elenitlo Minerals & Mining for US\$90 million. The three concession areas, consisting of the Mano River, Bomi Hills, and Bea Mountains deposits, together contain a potential resource estimated at more than 1 billion tons. Also in Liberia, Sable Mining Africa has acquired a 60% interest in the Kpo Range iron ore exploration concession, which covers a 60 km strike length of the



Kenema-Man iron ore province and is contiguous with the company's Bopulu reconnaissance licence.

Afferro Mining reported an increase in the mineral resource at its 38.5% owned Putu iron ore joint venture with Severstal in Liberia to 3.24 billion tons at 34.3% Fe, with 1.89 billion tons promoted to the Indicated category. The pre-feasibility study has been accelerated for completion in the first quarter of 2010, with the definitive feasibility study expected in the first quarter of 2013. At Afferro's Nkout project in southern Cameroon, the resource has risen to 1.42 billion tons at 33.6% Fe, with 700 Mt in the Indicated category, and a further resource estimate to include the oxidised material is expected in September.

Ferrum Crescent concluded a five-year offtake agreement with Swiss-based Duferco for up to 6 Mt of iron ore pellet production per annum from the Moonlight project in South Africa's Limpopo Province. Moonlight currently contains a JORC-compliant Indicated resource of 74 Mt, with a further 225 Mt of Inferred resources, at a grade of 30% Fe. A detailed feasibility study is being carried out on the development of a pellet plant, with magnetite concentrate delivered to the plant via a slurry pipeline from Moonlight. Also in South Africa, newly-listed Ferrex plc reported near-surface intercepts of up to 60% iron, with wide intervals of lower grade mineralisation (including 177 m at 45% Fe) from first drilling at its Malelane project in Mpumalanga Province. A maiden JORC compliant resource is expected by the first quarter of 2012.

Industrial Minerals

An independent evaluation of Elemental Minerals' Sintoukola potash project in the Republic of Congo envisages a production rate of 1.8 Mt/a, based on the current Indicated and Inferred resource of 804 Mt at 19.53% K₂O at the Kola deposit, with an estimated capital costs of US\$1.7 billion and an IRR of 27% over a 20-year mine life. A second phase of exploration is under way targeting an additional 0.32-2.08 billion tons of mineralisation, and a full feasibility study is due for completion early in 2013.

Allana Potash released a new NI 43-101 compliant

Measured and Indicated mineral resource estimate of 673 Mt at 18.65% KCl for its Dallol potash project in Ethiopia's Danakil Basin, with a further Inferred resource of 596 Mt. In the Eritrean portion of the Basin, South Boulder Mines expects to complete the scoping study at its Colluli project (Measured and Indicated resources 207 Mt at 18.57% KCl) at the end of August, with a feasibility study due by mid-2013.

Manganese

Australian company Shaw River Resources has begun a 10 000 m drilling programme at its Otjozundu (Otjo) manganese project in Namibia. A feasibility study is under way for a proposed initial 250 000 t/a operation producing gravity-beneficiated lump ore at a grade of 38-40% manganese, starting in 2012 and subsequently ramping up to 500 000 t/a. The JORC Inferred resources currently stand at 6.8 Mt at 23% manganese, and the company is targeting a resource of 35-50 Mt.

Platinum Group Elements

Aquarius Platinum estimates that it will cost approximately R850 million (US\$120 million) to include the Booyendal South property, which it is acquiring from Northam Platinum, in its Everest Mine plan. The expansion will extend the Everest mine life from the current 6 years to more than 30 years, while increasing production levels to about 250 000 PGE ounces per annum from 2017. The company will also re-examine the feasibility study for Everest North in conjunction with Sylvania Platinum, with a view to forming a joint venture to exploit the deposit and process the ore through the Everest concentrator. Aquarius suspended funding for the jointly-owned Blue Ridge platinum mine, which has been closed for redevelopment since August 2010, pending a decision to place the project on care and maintenance because of low platinum-group metals rand prices.

Australian-listed Realm Resources has agreed to earn a 51% interest in Nkwe Platinum's Rooderand project in the western Bushveld Complex by spending A\$2 million over two years. The project, which is adjacent to Platinum Australia's Rooderand project and Platmin's



Pilanesberg mine, contains an Inferred resource of 36.7 Mt at 3.8 ppm for 4.5 million 4E ounces. The Merensky and UG2 reefs in this area occur from surface, and are separated by only 20-35 m, which enhances the economics for open-pit mining. Realm is also in the process of acquiring Nkwe's Kliprivier, Ghost Mountain, and Tinderbox projects on the eastern limb of the Complex.

Rare Earths

Great Western Minerals Group has contracted DRA Mineral Projects for the detailed design of the plant for its Steenkampskraal project in the Western Cape Province. The processing plant will "crack" the monazite ore through a caustic leaching process, with recovery of copper and gold by flotation. Thorium will be removed and stockpiled in a licensed facility, leaving a clean mixed rare-earth chloride ready for separation by solvent extraction. Great Western has signed a heads of agreement with Ganzhou Qiandong Rare Earth Group of China to build the separation plant, and is expecting construction to start early in 2012.

Japanese geoscientists have discovered high concentrations of rare earth elements (REE) in seafloor sediments over large areas of the Pacific Ocean. The team, who reported their findings in *Nature Geoscience*, looked at 2 000 samples taken from 78 sites, and found REE concentrations as high as 0.2% of the mud in the eastern South Pacific, and 0.1% near Hawaii. The REE and yttrium appear to have been concentrated by uptake in mineral phases such as hydrothermal iron-oxyhydroxides and phillipsite. Some of the deposits are several tens of metres thick, and the team estimates that an area of 1 km² around a single hotspot near Hawaii could hold 25 000 t of REE. However, owing to the great depths, averaging between about 3000 and 6000 m, and low concentration compared with land-based deposits currently being developed, which are typically from about 3-10% REE, the deposits are unlikely to constitute an economically viable resource.

Uranium

Extract Resources announced a 37% increase in the

reserves at its Husab uranium project in Namibia to 319 million pounds of U₃O₈ (280 Mt at 518 ppm), extending the projected mine life to more than 20 years based on an ore throughput of 15 Mt/a. Husab is now established as the fourth largest uranium deposit in the world.

In Zambia, Denison Mines has begun a second phase of drilling on its 100% owned Mutanga uranium project. The Phase 1 drilling returned a number of strongly mineralized holes, including 8.6 m averaging 2 496 ppm eU₃O₈ and 3.8 m at 1 278 ppm .

INDUSTRY TRENDS

The mining industry has entered a new era, according to PricewaterhouseCoopers (PwC), with supply becoming the most significant challenge. The consultancy said in its eighth annual review of global trends, *Mine 2011*, that although demand for mineral commodities continues to be driven by strong growth in emerging markets, supply is becoming increasingly constrained as development projects become more complex and are typically in more remote locations. Furthermore, the cost base of the industry has permanently changed as lower grades and skill shortages take effect, while the cost of key inputs such as energy and construction costs remain high. Revenues for the world's 40 largest miners by market capitalisation reached a record \$435 billion in 2010, with copper, iron ore and coal accounting for more than 60% of the total. Net profits hit \$110 billion, 156% up on 2010, with operating cash flows rising 59%, leaving more than \$100 billion cash on hand. The top 40 companies have announced more than US\$300 billion in capital expenditure, over US\$120 billion of which is planned for 2011, more than double the total for 2010. Investment in new supply is increasingly focused on emerging markets and new entrants, as customers, particularly the steel and power industries, buy into bulk mineral assets in order to secure stable supplies of raw materials.

Contributed by Antony Cowey



Geological Leaders

The MSA Group is inspired by our core values of passion, professionalism, integrity and responsibility. Our mission is to be recognised as the leading provider of exploration, evaluation and environmental consulting solutions to the mining industry.

The MSA Group provides career opportunities for both experienced staff and new graduates alike. We are unique in our ability to offer our employees project work in a number of different commodities, in various phases of a mining project, both in and outside of South Africa.

This organisation is constantly focused on the development of capacity in our team. Included in our strategic plan for 2014 is the goal of one promotion for all. MSA, as an organisation provides an ideal environment in which to develop your talent. You will be given opportunities to work on interesting and challenging projects while being exposed to the wealth of knowledge that exists in our company. Promotional opportunities are both technical and managerial.

The MSA Agenda, our strategic plan, is cascaded on an individual level through our bespoke performance management system. The achievement of individually set goals is supported by the implementation of tailored learning plans. Each learning plan details the formal training, ad hoc learning, project work, coaching and mentoring required to develop one's professional ability.

We offer competitive salary packages that include benefits and can be adjusted to suit you, the individual. In addition to compensation we view recognition as key. The size of our organisation allows everyone to play a significant role in our success and be recognised appropriately for that contribution. We are constantly surveying our employee value proposition and feedback continues to show that emphasis is placed on the opportunity to be part of a team of bright, knowledgeable professionals who care about the work they do and continue to achieve. This supportive environment is embedded in our organisational culture.



Available Positions

Our Geological Department currently has **three unique opportunities** for suitably qualified Geologists. Firstly we are looking for an **Exploration Project Manager** to join our Geology MANCO and assist in the management of multiple exploration projects. This role is based in Johannesburg with travel and limited field time. Applicants must have at least seven years' experience in an exploration environment along with some time spent managing effective teams. Secondly we are seeking to appoint a **Technical Professional Assistant**. This person will report into the Head of Group Operations and will have involvement in various aspects of all projects managed by The MSA Group. Finally, our resource team is expanding and as such requires a **Resource Consultant**.

Individuals wishing to apply should have at least seven years' working experience of which five should have been spent developing geological models.

If you are up to the challenge and would like to join an organisation that is focused on your career development and growth, please contact **Claire McMaster** (clairem@msagroupservices.com) or visit our website www.msagroupservices.com for further information.

Yellowstone National Park



THE GEOTRAVELLER

The multi-coloured walls of the Yellowstone canyon illustrate the derivation of the Park's name. The brightest patches of colour are due to hot springs and fumaroles.



World-famous volcanic and geothermal geology

The greatest density of volcanic thermal features on Earth occurs in Yellowstone National Park (NP), mostly located in the state of Wyoming, USA. Most of the geological features in this, the oldest of the world's national parks, are ascribed to potentially one of the most hazardous (active) volcanic systems known. Much of the area is elevated at over 2000 m, and the park is closed in winter due to the excessive snow fall.

The remarkable features of Yellowstone were first documented by an expedition in 1859. In 1871 a large government-sponsored expedition led to an extensive report, complete with paintings and photographs. This led to the signing of a bill in 1872 in which the area was proclaimed as a "public park or pleasuring ground for the benefit and enjoyment of the people". Settlement and mining activities were not permitted. The occurrence of yellow and orange rocks in the canyon walls, a result of alteration of the volcanic ash by hydrothermal fluids and active steam vents gave rise to the park's name.

Many visitors travel to Yellowstone to observe the classical fauna and flora for which the Rocky Mountains are known. Large herbivores such as bison, elk, moose, and bighorn sheep can be readily observed in their natural habitat with predators such as grizzly and black bear, wolves, and coyote. However, it is interesting to report that guidebooks and information boards located at viewpoints within the park emphasize that the primary reason for establishing the park is the unique geology.

Many of the hiking trails have been established to view the geological features, and despite the probability of relatively close encounters with bears and bison they are widely used. (Unlike many of the African parks, there are few fences, and visitors are encouraged to walk unaccompanied trails.)

The geological overview presented here is summarized from the publications by Harris et al. (2004) and Smith and Christiansen (1980). The region is surrounded by various mountain ranges, most of which are composed of Proterozoic or Paleozoic rocks. They include the spectacular Beartooth Mountains, which are dissected by the road providing the entrance to the park from the



Spectacular scenery of the Beartooth Mountains, the entrance to Yellowstone from the north.





Cliff face dominated by rhyolite with intercalated basaltic flows displaying columnar jointing.

north. The park is straddled by the continental divide. Glacial activity has carved out U-shaped valleys more than 1200 m deep in the enclosing mountains.

Yellowstone National Park rests on one of the largest active volcanoes in the world. The volcanic eruptions have built up the Yellowstone Plateau from three huge, caldera-forming eruptions during Pliocene and Quaternary times. The eruptions produced rhyolitic ignimbrite sheets that cover thousands of km². The volume of erupted magma is thought to exceed 6000 km³. Recent terminology (possibly influenced by popular scientific documentaries) describes such large systems as supervolcanoes.

Yellowstone is in part typical of a bimodal volcanic system, although basaltic lavas represent <5% by volume. The rhyolites form steep cliff-faces that are readily eroded and subjected to landslides due to seismic activity. Basaltic lavas intercalated with the rhyolite reveal distinctive columnar jointing in places. The rims of the various calderas are visible from viewpoints, as are lava domes, some of which are actively expanding. The presence of a shallow magma chamber has been established by measuring electrical conductivity, curie depths, and seismic surveys.

Three major eruptions have shaped the face of the park. The most recent occurred at about 640,000 BP, creating part of the huge multiple-eruption caldera which contains the large, freshwater Lake Yellowstone. Heat from the relatively shallow magma chamber drives the hot springs, geysers, fumaroles and mud pools. Thermal features cluster in areas known as geyser fields, the largest and most frequently visited being the Lower, Upper, and Norris Basins. Not surprisingly the plumbing systems of individual fields are interconnected at depth and changes in groundwater movement, in part triggered by seismic

activity causes changes in the activity and frequency of individual geysers.

Development of the different thermal features is ascribed to water flow and temperature. Geysers can only develop in watertight plumbing systems that can withstand tremendous pressure. Silica leached from the rhyolite, deposited as a sinter along passageways, provides the necessary sealant. Water boiling in the plumbing system at depth produces steam bubbles, which expand and rise to the surface. The abrupt reduction of pressure

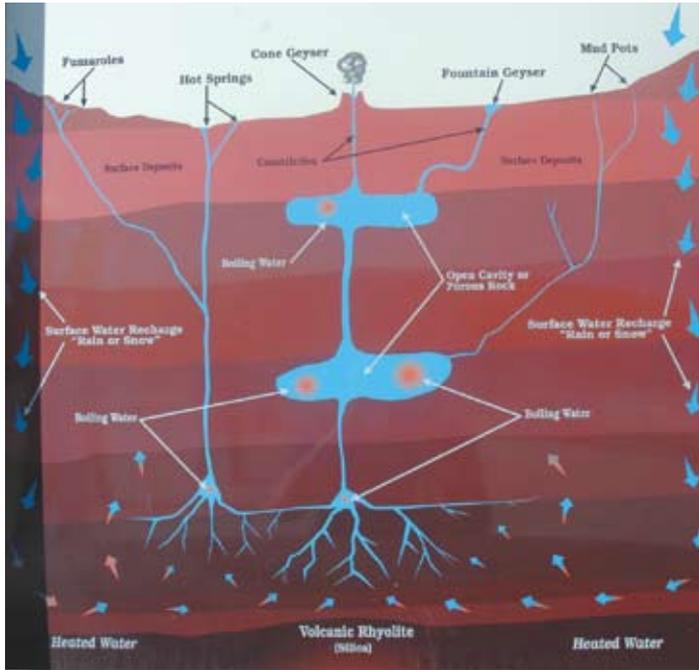


View of the Norris Geyser Basin revealing the desolate scenery associated with clusters of geysers, fumaroles and hot springs. The distinctive white rock is a siliceous sinter, locally known as geysersite.

causes water trapped in side chambers to flash into steam, forcing water and steam higher in the system to be ejected under intense pressure. Some of the geysers shoot water more than 60 m high, but it is the regularity of the cycles (e.g., the Old Faithful geyser) which is so remarkable. Hot springs develop where the openings are less constrained, and are fascinating due to the range of colours of the associated hydrothermal deposits.

Thick deposits of multi-colored travertine at the Mammoth Hot Springs have developed in a thermally active area underlain by marine limestones. Deposits of volcanic glass at Obsidian Cliff are spectacular – erosion





Missouri system. The river has cut an impressive canyon (originally known as the Grand Canyon prior to the discovery of the Colorado River system), and includes two spectacular waterfalls. Canyon formation is ascribed to rapid erosion of the flat-lying, partially consolidated volcanic ash deposits. Recent reports suggest the canyon may have been carved out over a period as short as a day or so, due to catastrophic floods released from ice dams breaking up at the end of the last Ice Age, at approximately 8000 BP (several thousands of years younger than the main retreat in Europe and Asia). The occurrence of large glacial erratics in the park, as well as petrified trees, some of which were preserved by lahars, is also of interest. At one locality, it is estimated that some twenty forests of different ages were preserved within Eocene times due to episodic burials associated with volcanism.

Mud pools are evidence of lower temperature activity, and often include well-developed mud cracks on the rims.

The plumbing system of the thermal activity is illustrated on this information board.

is constantly exposing new samples – and is reported to have been exploited by indigenous peoples for stone-age tools many thousands of years before the European explorers visited Yellowstone.

The unique landscape at Yellowstone has been created by a variety of geological forces, including volcanism, earthquakes and erosion and continues to change as a result of these ongoing processes. There are many areas where recent earthquakes have triggered landslides, e.g. at Hebgen Lake where a magnitude 7 event occurred in 1959.

The Yellowstone River flows north from Lake Yellowstone prior to turning eastward to eventually feed into the



The colour of the multi-coloured pools is related to temperature.
 Blue/clear: hot, locally >boiling point due to elevation with cyanobacteria.
 Yellow: 70-60°C with algae.
 Green: 60-50°C.
 Brown: 50-27°C with mosses, crustaceans and insects.





Terraces of travertine at the Mammoth Hot Springs reveal constantly changing forms as they are shaped by subtle changes in the springs' plumbing system. The colours are in part due to their relative age and/or the presence of thermophiles.

The volcanism and thermal activity at Yellowstone is almost certainly driven by a continental hot spot. Pierce and Morgan have suggested this may be driven by a deep mantle plume. The southwesterly movement of the North American plate explains the slight offset of new calderas associated with each major eruption.

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Submitted by R N Scoon.



Photographs from visits in 2002 and 2006.



Black volcanic glass occurs in both layers and discordant features at Obsidian Cliff.

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PJ's (purple jobs) in a kokerboom forest; second picture shows a very regular kokerboom distribution in a 'forest' containing some 8000 trees. Which we were told were counted from the air. A lot less other vegetation in this area – about 50 Km north of the previous pics. Very different flowers.



Close up of some undisturbed land where flowers are not all of a single species or color, but very mixed. In a couple of square meters we counted 25 species, which means there was probably 50 or 100 in reality. There are square kilometres of this stuff. And apparently these are appearing throughout Namaqualand and not just in patches as is the norm. We were told this was the best display since 1961.



PJ's amid kokerboom forest about 25-30 km north of Nieuwoudtville. I did not take a GPS reading or look at the map while I was there, but from the 1:1000000 map (back in Cape Town) I assume the rocks to be the Knersvlagte unit of the Vanrhynsdorp group (Nama equivalent). I know this looks suspiciously like Karoo, but the tops of the hills would have some Dwyka (way out of sight I think), and there is Table Mtn Group rocks not more than a few kms to the north. If you use this photo in any way, I probably need to check a more detailed map, as well as Google earth to find out exactly where we were!

Photos are looking west; kokerbooms occur on the north facing slopes it appears. This is the northern Bokkeveld.

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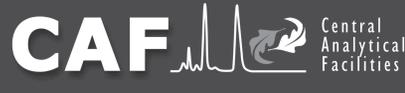
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Rates card 2012

