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Geological Society of South Africa

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news

GEOLOGICAL SOCIETY OF SOUTH AFRICA
Nominated Council Members for 2013 -2014

President and MANCO (positions held 2012-13)
Avinash Bisnath (Kai Batla) – President Elect (2013-14)
Pamela Naidoo (Rio Tinto) - President (2012-13)
Johan Krynauw (Johan Krynauw Geological Services) – Immediate Past President
Thomas Molelengoane – (Harmony) – Vice President Finance
Dumisani Sibiya (Tronox Mineral Sands) – Vice President Membership
Jan Kramers (University of Johannesburg) – Vice President Academic Affairs
George Henry (CSIR Centre for Mining Innovation) – Vice President Communication
Jeannette McGill (CSIR Centre for Mining Innovation) – Vice President Meetings
Marcia Van Aswegen (Sable Data) – Vice President Geoheritage
Ed Swindell (BHP Billiton) – Vice President Professional Affairs

General Members of Council
Alex Mason-Apps (Anglogold Ashanti), Anika Solanki (Kai Batla; new nomination), Bethuel (Ray) Maloka (Mbuyelo), Genevieve Pearson (Phoenix Geoconsulting), Gillian Drennan (University of the Witwatersrand), Graham Gavine (HRP Geopower), Hannes Henckel (African Barrick Gold), Liz de Klerk (DK Consulting), Mapedi Molepo (Kai Batla; new nomination), Mike Knoper (University of Johannesburg), Mxolisi Kota (Council for Geoscience), Neale Baartjes (Ecopartners), Noleen Pauls (The Mineral Corporation), Sello Nzama (Exxaro), Sifiso Siwela (MSA Group), Tarryn Ordford (Venmyn; new nomination), Taryn Scharf (Shango Solutions; new nomination), Tebatso Matlala (IDC), Chris Makgatlha (World Wide Coal), Reinie Meyer (Independent Consultant; Chair REI Fund), Darren Tiddy (University of Johannesburg; student representative)

Branch, Regional & Divisional Members of Council
Mike Lain (retired, KZN Branch and general Branch Representative), Willem van der Westhuizen (Unversity of the Free State; Free State), Steve Prevec (Rhodes University; Eastern Cape Region), Jodie Miller (Stellenbosch University; Western Cape Branch), Sabine Verryn (XRD Consulting; Mineralogical Society of South Africa), Shafick Adams (Dept. Water Affairs; Groundwater Division)

Ex-Officio Members of Council/MANCO
Craig Smith (Executive Manager GSSA)
Gordon Chunnett (G Chunnett Consulting; Chair Fellows Committee)
Jay Barton (Independent Consultant; Editor South African Journal of Geology)

In addition, all past presidents of the GSSA are Ex-Officio members of Council and welcome to attend all Council meetings.

Going into the 2013-2014 year, we have five resignations from the 2012-2013 Council:

Baojin Zhao (TWP)
Byron van der Walt (Umbono)
Gavin Hall (MELCO; Vice President Finance and Administration on MANCO)
Nathi Mntungwa (Xstrata)
Theo Pegram (Theo Pegram & Associates)

We would like to thank our outgoing Council members for their contributions, and welcome the incoming members. We look forward to a great year ahead.

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COVER PHOTOGRAPH:

Council for Geoscience survey vessel 'Geo Manzi' is a dedicated nearshore mapping platform for marine geophysical surveys and continental shelf studies. Marine Geoscience Unit scientists (situated in the Bellville regional office) are qualified commercial divers and conduct geological mapping on the seafloor. This photo was taken on the east coast 'Blood Reef' at a depth of 16 m below Mean Sea Level where aeolianites were being sampled to reconstruct local Quaternary sea level fluctuations. Exciting multidisciplinary ventures in marine geophysics and seafloor geology will feature as part of the programme for the upcoming 2016 IGC conference.
Hayley Cawthra

GSSA
Geological Society of South Africa

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Contributions for the next issue should be submitted by:
15 November, 2013.

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DEADLINES FOR COPY AND ADVERTISING MATERIAL are 15 February (March 2013 issue), 15 May (June 2013 issue), 15 August (September 2013 issue) and 15 November (December 2013 issue).

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* Casual insertions • 4+ insertions

from the editor's desk

Chris Hatton

The recent Geoforum held in Johannesburg provided some fascinating perspectives on the possible future of geology. New technologies, such as smart phones and clean energy initiatives rely on supplies of non-traditional elements. These require new exploration models and Murray Hitzman wondered whether the addition of 4100 newly trained geoscientists to the global skills pool was sufficient to find these elements in the amounts required. The 'cleanest' energy sources, the sun and the wind require photovoltaic elements and magnets to harness their renewable energy. To build solar panels mines have to supply Ga, In, Ge, Se and Te; to engineer sophisticated magnets Rare Earth Elements must be extracted. All energy generation has an environmental impact. It appears that even hydroelectric power has a down-side; the storage dams may be sites where the potent greenhouse gas, methane is generated. The problems with coal, the main source of energy for electricity in South Africa are well known. Every Highveld resident knows how coal-fired power stations pollute the dry air of late winter and early spring, and it is universally acknowledged that coal needs to be cleaned up. However Ian Hall presented the SA Coal Roadmap which showed that coal will remain the main source of electricity generation for another two decades or more. Based on global and local responses to perceptions of climate change, he presented an illuminating framework of four scenarios. Assuming a low global response to climate change South Africa could either be 'At the Forefront' or remain with 'More of the Same'. Assuming a high global response to climate change South Africa could either join the 'Low Carbon World' or 'Lag Behind', continuing to rely on coal as the primary energy source. At present it appears that the government is attempting to position South Africa 'At the Forefront'. It is doing this by imposing one of the highest carbon tax rates in the world. The wisdom of this action has been questioned. There is an unfortunate record of how government's well-intentioned actions can have unforeseen, devastating impacts. When democracy dawned in the New South Africa the promise of high quality primary and secondary education for all shone like a beacon. The very best education system in the world, that of the Scandinavian countries, was now aspired to and outcomes based education became the new model for school education. With hindsight it is now clear that the well-resourced Scandinavian system was unsuitable as a means to spread education from a privileged minority to the greater society. As the resources devoted to education were disseminated throughout society, so the problems posed by limited resources became more pressing. The heavy skills and resource requirements of outcomes based education resulted in its embarrassing abandonment, and left school education in an even more parlous position than it was in at the dawn of democracy. Desmond Tutu's miracle country now requires another miracle to rescue the uneducated majority. One might then wonder whether the good intentions of the carbon tax may have the unintended consequence of stifling the economy. The carbon tax is partly supported by the assumption that carbon dioxide is raising the temperature of the atmosphere. Recent warming trends and the withdrawal of glaciers appeared to convincingly confirm this assumption. This year however the amount of ice in the oceans is 60% larger than last year's record low and the press in now turning its attention to reports that we are in fact in a cooling trend. As the pendulum swings it may appear ever more unlikely that humanity once thought that the carbon dioxide it was releasing had any affect at all on the great climate engine of the earth.

The carbon tax is also intended to drive investment toward alternative energy sources. Ian Hall pointed out that renewable energy is unlikely to provide the next base load station for the electricity grid. The hard fact is that if the next base load station is not coal, then it must be

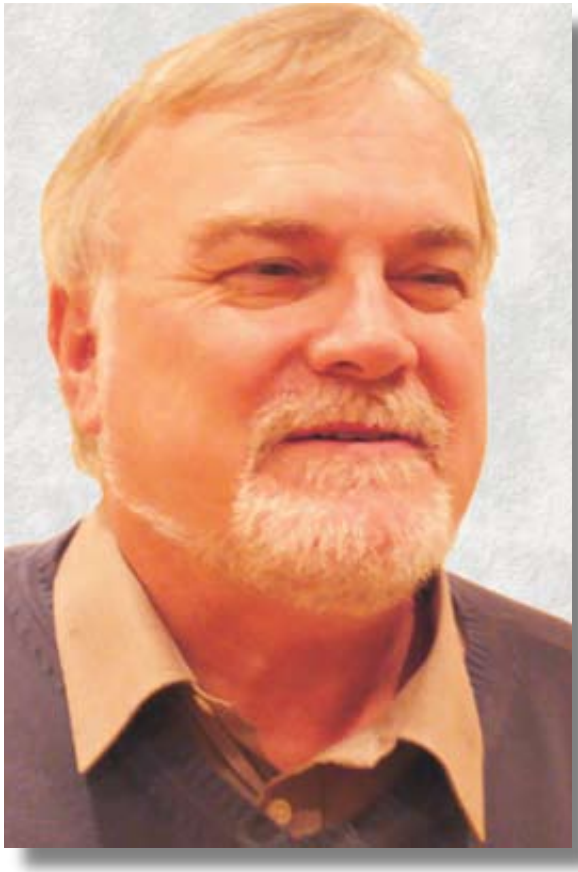
nuclear. If the carbon tax is going to make any sense at all, every cent of this tax should be earmarked for new energy generation.

The key role of the Rare Earth Elements in new-generation magnets highlights the geopolitical aspects of the critical metals of the future; because the market desires a range of suppliers, the dominant role of China as the major source of REE is a concern. A similar concern in the PGE market attaches to South Africa, where the Bushveld Complex is by far the major source. Understanding the origins of PGE mineralisation in the Bushveld is an endlessly fascinating puzzle. Of all the excellent Bushveld presentations at Geoforum, James Winch and Dave Reid presented perspectives looking both backward to the sterling work carried out by pioneers in Bushveld investigations and forward to the secrets that new technology is revealing. The Platreef is a prime source of PGE for Anglo American, but James Winch described how investigations have revealed that some of this resource lies below some unfortunately situated infrastructure. This situation might have been avoided if more attention had been paid to Hans Merensky's pioneering maps, which the geological community had somehow lost sight of. The valuable lesson that 'the age of publication doesn't matter' is a timely reminder for a world where information outside the digital domain is in ever more danger of being entirely forgotten. The marvels of the digital domain were stunningly displayed by Dave Reid who showed how nanoscale Platinum Group Minerals almost entirely disappeared in a thin layer at the very base of the UG2 chromitite layer. Because all the information is obtained digitally, the smart phone can now become a virtual microscope. As a lifelong teacher Dave enthused at the possibility of being able to teach mineralogy anywhere, to anybody.

As outlined in an insert to this issue the Bushveld Complex was a centrepiece for the 15th International Geological Congress which was held in South Africa in 1929. The exciting advances that were revealed at Geoforum suggest that it will again be a centrepiece for the 35th International Geological Congress in Cape Town in 2016.

executive managers corner

Craig Smith



A key activity happening now in the GSSA is the construction of the 2014 GSSA budget, and setting the membership fees for next year. At the time of writing, the final decision on increases has not been made, but by the time you read this, you will probably already have the news via email. We will endeavour to keep the increases as low as possible; the increment is likely to be close to the South African inflation rate. Those of you who are overseas are liable to feel it less, because of the expected weakening of the Rand against the Dollar and the Euro. The administrative staff will start the invoicing process in late September or early October as has been done in previous years. Also, as in previous years, those who pay their 2014 fees early will pay at the 2013 rate. We still have a significant number of members who have not paid their 2013 fees – despite the first round of invoices having been sent early in Quarter 4 of last year. Please ensure that your 2013 fees are paid before you receive next year's invoice. Those who have not yet paid in 2013 will not be getting the early bird special for 2014!

Geoforum 2013 was staged at Turbine Hall in Newtown

in early July. The event was a success, attracting about 250 people to listen to some very well prepared talks on new issues and projects in African economic geology. We attracted a full house of exhibitors, all of whom believed the investment in manning a stand was worthwhile. The conference was aimed at a variety of economic geology issues, highlighting both academic and industry developments. Geosynthesis, the last GSSA annual event staged in Cape Town was largely research focused; in 2014 we will start planning the next annual meeting – and we need feedback from the membership as what 'flavour' it should have. Send your comments to the editor please. The big event in 2014 is the International Mineralogical Association meeting in Johannesburg, which will be a five day meeting focused on global mineralogical research, with a number of very interesting field excursions. Please visit and peruse http://www.ima2014.co.za/. The session program is of very high quality, and we will see large numbers of active mineralogy researchers from around the world. Look for the early bird registration fees (very attractive rates if paid before end 2013); abstract submission will have opened by the time you read this. For South Africans, note that this is an opportunity to attend a scientific meeting of true international stature – without incurring the costs of overseas airline fares. Shortly after the Johannesburg IMA meeting, we will stage an industry-focused diamond meeting in Kimberley following on from the very successful event last held in 2008. This will be a tremendous opportunity for the academic and industry communities to network, and a number of overseas delegates to the IMA meeting are very enthusiastic about attending both – for the price of one international airfare.

The incoming president of the GSSA, Dr. Avinash Bisnath, has penned an article for this issue on the subject of lack of available high level skills combined with a very difficult job market for our younger members, and particularly university leavers. The current industry woes are not helping matters. We know we have a crisis, and we know it's global, and we know that there are many aspects to it. Not everyone agrees on solutions or how to mitigate the career risks for professionals. Continuous professional development is key, as is support for the research community, in order to continually upgrade high level technical skills. The funding of basic and applied research in our universities directly impacts on the number and quality of MSc and PhD students and postdoctoral research appointments, and is acknowledged to be less than optimal. Currently, South Africa spends around one per cent of GDP on R&D, and it's widely believed that this should be at least doubled or ideally tripled for the multiplier effects to really benefit South Africa – and of course high level skills development and employability of young scientists. There is also a question of whether fewer larger programs should be funded as opposed to more numerous but smaller programs. In a recent paper by Fortin and Currie (2013), it was concluded that impact per dollar spent is lower for large grant holders as opposed to small grant holders. There are probably many reasons for this, and it's also true that 'big science' requires 'big spend'. In this regard I would like to highlight the GSSA Research, Education and Investment fund, which has some 3.5 million Rands under management. It disburses some R300,000 annually, and is aimed specifically at funding smaller amounts but with relatively large impact – particularly as regards skills development. For example, it is a very useful source of funding to allow research students to attend and present their work at international conferences. The application procedure is simple and rapid. Our long term objective is to grow this fund considerably, and to grow the impact in this funding space. But we need donations and bequests to do so. Every year a few of our members contribute amounts to the REI fund over and above their membership fees, and we would like to improve this as well as to target bequests and industry for larger amounts. Every project funded assists high level skills development. For information, or to give suggestions as to how to disburse funding, contact R Meyer (Chair REI) or myself through the GSSA offices.

Reference:

Jean-Michael Fortin and David J. Currie (2013), Big Science vs. Little Science: How Scientific Impact Scales with Funding, PLoS ONE, 8 (6), e65263.
(see www.plosone.org).

GSSA
Geological Society of South Africa

president's column

Avinash Bisnath

SKILLS SHORTAGE GAP AFFECTING GEOSCIENCE GRADUATES

I made the following statement as part of my Presidential Acceptance speech…what I am hoping to embark on is to gain an understanding of why industry shouts: "no skills", students say "no jobs", academics "no students for higher degrees". I therefore decided to focus my first Geobulletin article on this state of affairs. The aim of this article is to spark a debate and hopefully set up a task team to address some of the issues and concerns highlighted below.

1. INTRODUCTION

Unemployment amongst young graduates and some older professionals has become a major and rapidly growing issue. It is well-known that the South African Minerals Industry is short on skilled professionals, while there is great demand for skilled geoscientists in southern Africa. The industry is currently experiencing a notable shortage of skilled personnel, as most highly trained professionals are approaching retirement while experienced professionals are facing retrenchment as they are getting too expensive. Additionally, due to the uncertain economic climate, many graduates face lack of unemployment upon completion of their degrees.

South Africa has approximately 14 institutions which offer geoscience degrees and diplomas. On average, institutions enrol more than 250 BSc undergraduates, a maximum of 40 Honours students and 20 postgraduates (MSc and PhD) annually. From these numbers, an average of 170 BSc undergraduates, 30 Honours and 5 postgraduates are produced per institution annually; this means that a total of approximately 200 to 250 potential employees at Hons level are added to an extremely tough job market by the 14 institutions EACHyear. An honours degree is a general requirement for entry into most geoscience careers and this emerges as a problem for those with only a 3 year degree.

The South African Mining Industry has a very strong foundation that can absorb suitably qualified individuals for its future needs and economic growth. Addressing the causative factors underlying the skills shortage will help ensure South Africa's sustained economic growth.

2. KEY FACTORS LEADING TO SKILLS SHORTAGE GAP AND HIGH UNEMPLOYMENT RATE

Several factors contribute to the skills shortage and the increase in unemployment rates amongst geosciences graduates in South Africa and globally. Graduates are generally not well-equipped (trained) enough for the job market. Thus, the nature of the training within an institution and the curriculum at hand are additional factors detrimental to equipping graduates for the working environment.

These factors deserve major attention as the unemployment rate of geosciences graduates is perpetually increasing. But the question that remains is: who is to blame – the graduates, the academic institutions or the job market?

The key debate lies between the industry saying that "there are no skills", the students or graduates saying "there are no jobs" and the academics saying "there are no students for higher education".

Some of the factors that I consider contribute towards the skills shortage are explained below.

2.1. Academic Institution Training

It is thought that institutions are not doing enough to ensure that their graduates are well prepared for the labour market. Institutions focus more on attaining degrees and generating revenue as opposed to generation of the training and skills required by industry (www.uwc.ac.za).

Students need to be guided and exposed to their future work so that they do not end up with wrong impressions of what lies ahead. A way of dealing with this may be a drive to encourage industry to take in students for vacation work in order to give them a feeling of what is in store for them upon completion of their qualifications. Students should be able to make a more informed decision as to their career paths and not have unrealistic expectations. Institutions need to be proactive in development of curricula as well as in the exposure of university student to the work conditions that they will encounter.

2.2. Skills Availability in Industry

Shortage of skills in the field of geosciences has become a major issue of debate globally. Industry concerns centre on the fact that there are no or scarce skills, or skilled individuals to perform the tasks at hand. The industry states that it requires the right mix of people with the ability, qualifications, experience and drive in the work force. There is still a higher need of skills in this discipline. The industry also believes that it does not require certain skills on a full time basis so in that case does not see the need to support the staff.

The industry has indicated an imbalance between the number of senior geoscience professionals reaching retirement age and the number of early age-career geoscience professionals (Gonzales et. al., 2011). The industry is facing a loss of technical and institutional knowledge that should be transferred to young graduates. This factor will definitely result in a large skills gap.

This gap will be filled by new people being hired or promotions of current staff. Many of these new hires and promoted staff do not have the ability or haven't had preparatory training in order to handle the higher workloads and level of responsibility thrust upon them. Retaining and transitioning high quality geoscience students into core geoscientist positions is critical, as the profession is starting to experience a loss of skill (Gonzales, 2011).

The industry is also faced with the issue of emigration, with a number of skilled people leaving the country to seek greener pastures abroad ("brain drain"). The industry has argued that a greater effort was required to mitigate the effect of pending loss of skilled people and knowledge (Thompson and Kirwin, 2010). But, one must also bear in mind that the current protracted economic crisis does play a major role in this regard. Many international companies also tend to bring their own expertise hence not contributing much to the economic growth or job creation.

2.2.1. Student Impressions

To graduates, the term "skills shortage" is seen as a misnomer. Many graduates believe that they are equipped with the skills that industry demands, but that other additional factors such as work experience, race, academic institution and in some cases, gender, are first taken into consideration when employment decisions are made.

2.2.2. Work Experience

Young graduates are highly at risk; the number of unemployed graduates under the age of 30 is far more than that of older graduates. Most employers are more reluctant to hire young graduates as they are inexperienced. The question in mind is how these people will become experienced if they aren't offered a chance to prove themselves. Most of the opportunities that arise show preference of certain level of qualification and skills competencies which tend to be for middle to top positions.

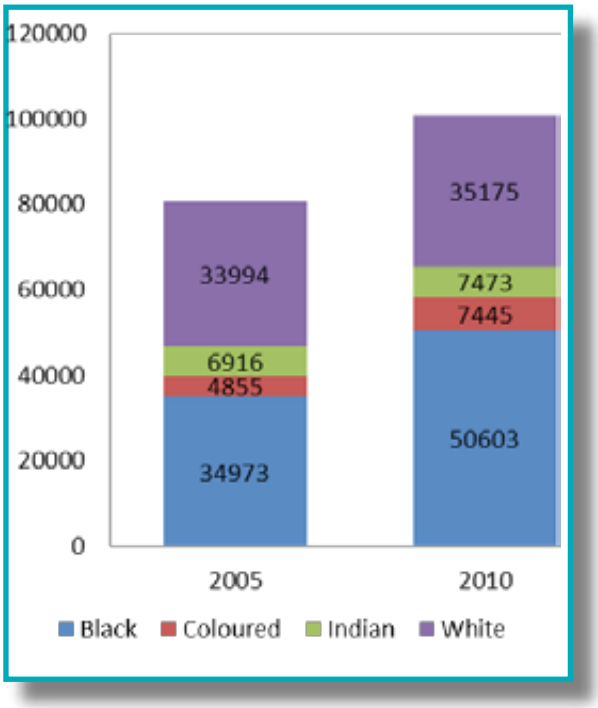
Most graduates are also not given a chance to prove

themselves. Training programmes are necessary for every graduate in order to prepare them for the work environment. Geoscience graduates needs time to be prepared for work: once they graduate internships with geoscience employers and/or research experience should be proposed in order to prepare students.

2.2.3. Race

The number of unemployed black graduates has increased in the past years, as compared to whites. Statistics indicate that in the employment sector, white graduates are more likely to gain employment as compared to black graduates (Anthony et. al., 2013). This is a major problem as the number of black graduates always exceeds that of white graduates (Figure 1). The Figure shows that in 2010, black graduates made up ~50 % of the total graduates, compared to white graduates (~35 %).

Table 1: Number of Graduates in South Africa per Race in all fields of study (Source: Servaas van der Berg and Hendrik van Broekhuizen, calculations based on HEMIS 2005 and 2010)[1].



2.2.4. Academic Institution

Previous studies have shown that there is a general perception that the quality of degrees offered by institutions differs, particularly so for 'historically black universities'. Students from these institutions are said to be overlooked and may struggle to find employment due to the weaker reputation of their institutions (Van der Berg et al, 2012)[1]. Poor quality of teaching of mathematics and science in many 'rural' schools limits the student's options at university. However, available data does not allow us to differentiate between the employment experience and rate of students between different institutions.

2.2.5. Gender

It is believed men are always considered more than women, but this hasn't been proven. In most cases exploration companies tend to prefer to hire males before females due to the extreme conditions of some of the projects. This is because mining is perceived to be a brutal profession meant for men, and given this perception it is obvious that fewer female graduates will have a chance of employment (Women in Mining, 2009). It is generally accepted that there are not enough women engineers, geologists and surveyors in the mining sector.

Issues affecting employment opportunities of female geoscientist include lack of female mentors from professional and academic fields, the hostile atmosphere of some working environments, and possibly family issues.

2.3. Lack of Interest in Postgraduate (MSc and PhD) Studies

In most local institutions the number of local postgraduate students is less than that of international students, which is anomalous. This discrepancy may be due to that fact our academic institutions and departments are not doing enough in encouraging students to pursue postgraduate studies, with the result that students lack interest in pursuing postgraduate studies. The importance and relevance of postgraduate studies in strengthening job prospects is not clearly explained.

Academics need to emphasize the positive effect that postgraduate studies can have on students' career prospects as well as provide clear explanations concerning the availability of funding i.e. scholarships and sponsors. Students should also play a role in taking the initiative to enquire about postgraduate

opportunities.

Postgraduate studies can play a leading role in producing the next generation of academics and skills in Southern Africa. Studies have shown there are specific set of experiences and skills that a student can encounter during postgraduate training which can/will benefit the industry and contribute interest in pursuit of geoscience discipline (Gonzales et. al., 2011).

Additionally, institutions are also facing a loss of academics to retirement, resulting in the loss of mentors and supervisors for postgraduates.

2.4. Graduate Background Factors

The South Africa population is dominated by blacks (79 %), mostly from poor backgrounds. In most cases students decide to go into the work environment instead of pursuing post graduate studies. This is mainly due to students being from disadvantaged backgrounds and thus not being able to afford the extra tuition for postgraduate studies. Some students have family obligations which may also affect their chances to continue with the postgraduate studies. Table 2 below shows the enrolment breakdown of post graduates race (2000-2005). From the data, it is clear that the percentage of black post graduates student is 5-10 % less than that of whites, which is anomalous in terms of the population breakdown figures

3. MITIGATION OF UNEMPLOYMENT, MAXIMIZING RECRUITMENT AND SKILLS DEVELOPMENT

There needs to be an increase in graduate development programmes: companies should take greater initiative and get involved in the development of well-structured training and mentorship programmes that goes beyond creating technicians but rather skilled young professionals, however economic times can pose a major threat as most companies are currently cash strapped and are more focused on conserving cash. In conclusion I wish to highlight a few key points:

1. Liaising skills development initiatives between the government, private companies and mining sectors: an example is that of Mining Qualifications Authority (MQA) and Career wise partnership.

2. Recruitment of local graduates: South African companies should reduce the dependency on import of skills but focus more on in-house skills development programmes.

3. Skills transfer: retiring or retired expertise are required to mentor and coach young professionals.

4. The industry must also partner with Societies such as: SEG (Society of Economic Geologists); GSSA (Geological Society of South Africa); and SAIMM (South African Institute of Mining and Metallurgy). These partnerships can create the optimum environments for informal exchange of information, where highly skilled older generations can interact with the young graduates to pass on knowledge.

5. Postgraduate Funding: more sponsorships and scholarships should be made available to students; this should be either by direct funding or contributing to

Table 2 Race Distribution of Postgraduates per Qualification (2000-2005). Source: Council of Higher Education (March, 2009).

RACE	HONOURS		MASTERS		DOCTORAL	
	2000	2005	2000	2005	2000	2005
Black African	34%	44%	27%	33%	19%	29%
Coloured	5%	5%	5%	6%	5%	6%
Indian	8%	8%	7%	8%	6%	7%
White	53%	43%	61%	52%	70%	59%
Total	100%	100%	100%	100%	100%	100%

Research and Development support through Research Education and Investments(REI).

6. Expanding/Upgrading Curriculum: Institutions must upgrade their curricula in order to be in line with framework utilised in the professional field.

7. Mining companies need to continue with a cultural transformation at workplaces as well make geoscience profession attractive and accommodating to women (Women in Mining, 2009).

4. Acknowledgments

I wish to thank the following Kai Batla staff members, Retang Mokua for collecting the data and Anika Solanki for editorial assistance.

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2. *Gonzales, L. M., Houlton, H. R. and Keane, C. M. (2011). Critical Resource needs in the geoscience profession: Geoscience Student-to-Professional Transitions. SEG San Antonio 2011 Annual Meeting. 912-916.*
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8. *Women in Mining: A Guide to integrating women into the workforce Draft V 1.0 (2009).Sourced from:http://.www.esmap.org*

ADVERTORIAL

SACNASP professional indemnity

SACNASP is in transformation from a small group of registered natural scientists to a directed professional council. The past year has been one of change and transition. The team has had to develop into an organisation that can support the huge increases in registration applications and new initiatives.

As part of our improved service for registered scientists, SACNASP has entered into a partnership that has enabled us to offer professional indemnity insurance cover at competitive prices.

COST OF LEGAL ADVICE

When rendering a professional service, professionals are exposed to claims for damages from many areas. And anyone who has had any experience with obtaining legal advice will know that it does not come cheaply. Should you be sued, even if the allegation made against you is completely unfounded, you could end up incurring significant legal costs to defend yourself.

Claims for damages arising out of:

- Allegations of negligent acts, errors, or omissions (for example damages arising out of negligent design or advice which cause a client or a third party loss or harm);
- Unintentional breach of confidentiality;
- Defamation (if for example a prepared report includes comments that a third party takes offence to);
- Unintentional infringement of intellectual rights;
- Loss, theft of or unauthorised access to third party documents or property;
- Dealings in good faith with tainted third party documents/property (for example where you unwittingly rely on a document that has been forged);
- Dishonesty of employees which has caused a third party loss (for example an employee may be bribed to provide a dishonest report/survey, etc. which someone else may rely upon causing them a loss).

In addition, you may be exposed to:

- Claims arising out of allegations that your negligence in conducting your business has caused someone either injury or loss of/damage to their property (public liability claim);
- Claims arising out of defective or hazardous products where you are involved in the manufacture, design, labelling, packaging, sale or supply of those products. In terms of Section 61 of the Consumer Protection Act suppliers are now strictly liable for any harm, loss or damage caused by a product. All suppliers in the supply chain are jointly and severally liable (products' liability);
- Allegations that in conducting your professional services you have breached the provisions of a statute, for example statutes relating to health and safety or the protection of the environment;
- Allegations against you that you have breached the ethical code of your regulatory body where you could also be sued by a third party/your client for professional negligence.

COST-EFFECTIVE COMPREHENSIVE SOLUTION

SACNASP and CFP Brokers have put an insurance package together which would only be accessible to SACNASP registered scientists, and will cover all of the above exposures.

For example, a SACNASP registered scientist would only pay R814 (VAT and commission inclusive) per year for cover of R2.5 million for each and every claim.

If you are a Candidate or Certificated Natural Scientist

then you would only pay R274 per year for R2.5 million cover on condition that all services you render are supervised by a professional natural scientist.
This policy will also cover you for work done in other countries, excluding North America, so long as you or your company who are contracted to do the work are still domiciled/registered in RSA.

Higher limits of indemnity Currently the on-line registration system caters for limits of up to R10 million for each and every claim.

In the event that you:
require a higher limit of cover; or do not meet the qualifying criteria of the on-line registration, eg you are aware of circumstances which could lead to claims against you; or you render services in North America and require a cover extension to include work done in North America, then you can complete the 'non-scheme' proposal form which you can also find on-line under 'New Application' and send this through to CFP Brokers who will then obtain quotes for your consideration. You will still qualify for special rates, so long as you have not previously had any claims against you, which would result in a rate adjustment.

CORPORATE COVER

The corporate option provides cover for a company, partnership or closed corporation so long as all the directors, partners or members of the company, partnership or close corporation take out the cover under the SACNASP facility.

Where the corporate option is selected, all employees whether qualified as a Professional, Certificated or Candidate Natural Scientist should also be encouraged to take out the cover as they will not be covered if they are sued in their individual names together with the company or if they have a complaint against them with SACNASP, unless they have the cover in their own names through the SACNASP facility.

Regardless of whether company employees take out cover- the company that takes up this cover (by ensuring that it pays for the cover for all of its directors, partners or members at the professional scientist rate) will be covered if it is sued based on its vicarious liability for the negligent actions and omissions of its employees.

HOLLARD INSURANCE COMPANY LIMITED.

These unbelievable rates are offered through Hollard, a well-known and reputable insurer. The reinsurance is currently placed with Hannover Re and Swiss Re.

The special rates are only available to SACNASP registered scientists. If you try to obtain this cover in your individual capacity you would pay far more for it.

AUTHORISED FINANCIAL SERVICES PROVIDERS

CFP Brokers is licensed by the Financial Services Board (FSP License no.: 42892.) and specialise in the placement of liability insurances including, professional indemnity.

CFP Brokers has received very positive feedback about the cover and pricing. All information about the cover is available on the website (see address below).

The application process is entirely automated (unless you require special quotes as per some of the examples provided above). You can apply and pay on line and should be issued with a certificate immediately once your payment has been verified.

If you have any difficulty with the application process or should you have any queries about the cover, you are welcome to contact Kristy or Nicky on the number below for assistance. Should you be based in Gauteng, they will willingly meet with you if you would like to know more about the cover before applying on-line.

Contact CFP Brokers on the following:
+27 011 794 8166
info@cover4profs.co.za
www.cover4profs.co.za/sacnasp

all the news fit to print

RHODES UNIVERSITY

Exploration Geology M.Sc. 2013 Field Trip II

Another successful Rhodes M.Sc. Exploration Geology Field trip closed out the Rhodes Exploration Geology Programme's third module that focused on sedimentary and hydrothermal ore deposits. This time around, the trip ran from June 22nd to July 5th, 2013, with 16 students and one delegate, representing 10 different countries from Africa and North America. Again, Professor Yong Yao, director of the Programme, led the students on the >5000 km journey to gain first-hand geological knowledge of South African gold, coal, diamond, base metal, iron ore and manganese deposits and mining operations. Geological and mine stops along the way included visits to the Witwatersrand Basin, the Witbank Coalfields, the Kimberley and Springbok areas, and lastly the iron manganese deposits around Kuruman.

The trip departed from Grahamstown on June 22nd with an overnight stop in Bloemfontein before carrying on to Johannesburg the following day. In Joburg, the class met Prof. Baojin Zhao at George Harrison Park, the first Witwatersrand-gold discovery site. Here on the farm Langlaagte George Harrison and George Walker discovered the Main Reef and Main Reef Leader in March 1886. The students viewed the historic workings and discussed the Wits-gold mining and geology of the Basin. Next, the class was led to the outcropping road cuts on Jan Smuts opposite the University of the Witwatersrand to examine the exposures and deformation structures in the overlying Contorted Beds of the Parktown Shales, Hospital Hill Subgroup. The final stop of the day was at the top of Northcliff, where Baojin informed the students about the regional setting of the Wits Basin using distant landmarks while standing on the well-exposed Orange Grove Quartzite at base of the Hospital Hill Subgroup.

Baojin Zhao pointing out regional features to the students at Northcliff – June 23rd, 2013 ("I can see my house from here").

The following morning, the class left Joburg for the Leeuwpan Coal mine, which is 8 km from Delmas in Mpumalanga and is owned and operated by Exxaro Resources Ltd. After a brief induction to the site, Michelle Steenkamp, a mine geologist at Leeuwpan, gave the group an introduction to the plant operations and geology of the coalfield. Afterwards, the class was led to the Wetlevreden open pit to view the operations on the Seam 2 coals along with a stop at the stockpiles. After lunch, the class set off for the Northern Cape, with the first stop in Kimberley where they spent three nights.

In Kimberley, the class was joined by Jock Robey (Rockwise Consulting, formerly of DeBeers), who provided invaluable geological insight as he led the group around the alluvial diamond depositional settings in the Vaal River area near Barkly West and diamondiferous kimberlites outside of Kimberley. Stops included the former Frank Smith Mine, the reworking operations of the Sover Mine (operated by Grace Diamonds) and the Melko Mine alluvial operations near Delportshoop. The class also took in the San people's ancient rock carvings at Nooitgedacht, preserved in outcropping Ventersdorp lavas. And what visit to Kimberley would be complete without a visit to the Big Hole? There, the class examined the kimberlite indicator minerals and mantle peridotite within the yard and toured around the museum while Jock provided a comprehensive narrative.

Looking into Leeuwpan's Wetlevreden open pit – June 24th, 2013

On June 27th, the class left Kimberley and while en route for Upington paid a visit to Petra Diamonds' Finsch mine, outside of Danielskuil. At the mine, Charity Mampa, Petra's Southern Region Geology Manager, met the class and provided the group with an introduction to the mine operations and geology. After donning the required PPE, the group looked on into the open pit where underground block cave mining methods are now being undertaken to recover diamonds. To wrap up the day the group also visited the core yard to examine some kimberlite core.

Jock Robey explains the geology of the Big Hole in Kimberley – June 26th, 2013

After one night in Upington, the group undertook the drive to Springbok where four nights were spent in that quiet Northern Cape community. While in Springbok, one day was used to conduct geological investigations into the area. The class was led by Yong and visited the historic Klondike workings, Orbicular Koppie, Tweefontein, Jubilee, and O'Okiep copper mines. One free Sunday was also available to the students, the majority of whom drove to Port Nolloth to see the southern Atlantic Ocean and visit a major hub of the marine diamond industry.

Yong providing the background geology of the Springbok Area – June 29th, 2013

The following day, July 1st, the class visited the Black Mountain Mining Ltd. Pb-Zn-Cu-Ag mines located in Aggeneys, Northern Cape. After an introduction to the property, geology and the current operations on the Deeps and Swartberg mines by geologists Susan Oswald, Tarryn-Kim Rudnick, Pieter Steinman and others, the class visited the exploration drilling setups, outcrops of the Swartberg deposit and the core yard to examine core from Swartberg. One final stop was made in the stockpile for the students to select samples of the ore for their personal collections. The visit to the mines was arranged by Mr. Pottie Potgieter (Mineral Resources Manager) and Sean Jenniker (Mining Services Manager).

After the final night in Springbok, the class hit the road for Kuruman, where they spent two nights. During the first day there, the class visited the Khumani BIF-type iron ore mine, owned and operated by Assmang Limited. After an introduction to the geology and mine operations by mine geologist Kgomotso Mekgwe and exploration geologist Brian Nel, the class was taken to the control centre of mining operations before visiting the active mining operations within the King Mine. Then, they inspected drill core back at Khumani which displayed the typical stratigraphy of the mine. That afternoon, the class was also taken to the historic Glosam karst-style Mn deposit that was mined in the 1950s and is also known as Pinnacles for the differential weathering exhibited at the site.

On the following day, the class visited the Black Rock Mine, near Hotazel, also owned and operated by Assmang, where Danny Maluleke (Technical manager), Benjamin Ruzive (Chief Geologist and a past graduate of this M.Sc. Programme) and Lawrence Ngalela (Resource Geologist) met the class and introduced them to Black Rock's operations. Once again, the class suited up in PPE before being ushered down the main shaft by Chris Leipoldt (Mining Observer) and Ms. Mercy Mudau (Mine Geologist) to observe the underground operations of the N'Chwaning 3 workings. After returning to surface via the No. 3 Shaft decline, a tour of the operations facilities led by Marias Boet (Production Manager) followed as well as a drive by the finished manganese products and a stop at the historic workings. The final stop of the day was the Black Rock core yard to examine drill core from N'Chwaning with Lawrence and Benjamin giving the class some geological insight. From Black Rock, the class headed back through Kuruman on the way to Bloemfontein for the last night on the road and the last leg of the cross-country journey. Upon arrival in Grahamstown, the class was welcomed by the tail end of the National Arts Festival and a break before the final module of this year's Exploration Geology Programme.

Underground at Assmang's N'Chwaning 3 Manganese operations – July 4th, 2013

The visits to the iron ore and manganese mines were kindly arranged by Shepherd Kadzviti (Group Mineral Resources Manager, African Rainbow Minerals Ltd.-ARM), Marius Burger (Mineral Resources Manager, Assmang Ltd. Khumani), Sakkie van Niekerk (Chief Geologist, Assmang Ltd. Khumani), Mr Grobbelaar (Executive Operator, ARM).

In closing, we would like to express our heartfelt appreciation and thanks to the companies and individuals mentioned above, all of whom took the time and effort to allow the class to view their operations while catering to a large group of diverse individuals. Without their support, the field trip would not have been as informative and interesting. In addition, special thanks again to John Hepple for the long days of driving the convoy's bus throughout the trip. As well, thank you to Ms. Ashley Goddard for arranging accommodations and dealing with the administrative aspects of the trip. Many thanks are also extended to those who helped with our trips at the numerous sites, but are not mentioned in the text. We look forward to seeing you all next year.

Contributed by Thomas Branson

University of Johannesburg

The UJ Department of Geology has been active on several fronts the past few months. From a personnel standpoint, Elsje Maritz, who has been the departmental Secretary for 29 years, retired at the end of June. She and husband André have moved to the KZN south-coast. Reshika Moodley was appointed as the new departmental secretary from 1st July and she looks forward to many productive years in Geology. One of our valuable support staff, Diana Khoza, is on four months maternity leave until the middle of October. She gave birth to a baby girl during mid-July.

On the academic side, Nic Beukes will be winging his way over to the USA from mid-September to mid-December 2013. He was awarded a prestigious Cox Fellowship by Stanford University and Nic will be appointed as visiting professor for the duration of his stay at Stanford. Clarisa Vorster recently completed her PhD that dealt with laser ablation ICP-MS age determinations of detrital zircon populations in the Phanerozoic Cape and lower Karoo Supergroups (South Africa) and correlatives in Argentina. Clarisa is one of UJ's "New Generation Scholars", that is, top achieving doctoral candidates who were offered special bursaries by UJ and, after completion of their studies, get appointed as Lecturers in the relevant department. In this way, the best post-graduates are kept as academic employees at the university.

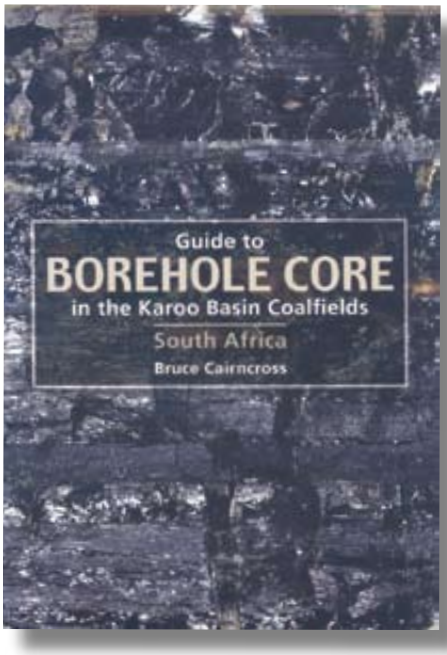
Bruce Cairncross was recently honoured by the IMA (International Mineralogical Association) by having a new mineral species named after him, cairncrossite. The mineral, a strontium-calcium-silicate-hydrate is similar to minerals of the gyrolite and reyerite groups.

Photograph of the recently described new mineral cairncrossite, 7 mm, from the Wessels mine, Kalahari manganese field. Bruce Cairncross specimen and photo.

It originates from the Wessels mine in the Kalahari manganese field and was discovered by the well known collector, Dr Ludi von Bezing.

Bruce has also been busy on the book front. His latest Random House Struik field guide appeared during July this year and is available in both English and Afrikaans.

In addition, he has been working for some time on a handbook describing borehole core from the Karoo basin coalfields. This is a project sponsored by Coaltech and the book has now been published and the various Coaltech member companies will be receiving copies thereof.



Our post-graduate students are also on the move. Two of Hassina Mouri's students, Portia Munyangane (MSc) and Refilwe Shelembe (PhD), are presenting their interim results at the 5th International Conference on Medical Geology to be held in August at Arlington, Virginia, USA. Thomas Dzvinamurungu, Thando Mxinwa, Donovan Pretorius (MSc's), attended and presented posters at Geoforum, while Gargi Mishra (PhD) gave a talk. UJ staff member and lecturer Lauren Blignaut, who is busy with her PhD, also gave a talk on her current research relating to her doctoral studies. All of the above are Geometallurgy post-graduate students of Fanus Viljoen. At the same Geoforum meeting, Nic Beukes was invited to present a keynote address entitled 'Overview of the geology of southern African sediment-hosted Precambrian iron and manganese ore deposits'. In May this year, another of Fanus' students, Thomas Dzvinamurungu, graduated with an MSc thesis entitled 'Geometallurgical characterisation of Merensky Reef and UG2 at the Lonmin Marikana mine, Bushveld Complex, South Africa'. Further good news from Fanus and the department is that his Geometallurgy Chair has been renewed for a further five years as from July 2013. Still with the post-graduates, UJ Geology continues to produce high-calibre graduates as evidenced by the following: The Geological Society of South Africa (GSSA) awarded one of our 2012 Honours students, Christelle van der Merwe, the best fourth year student award for 2012 based on her overall results. This recognizes the best Geology Honours student from any University in South Africa. She achieved an almost unheard of 9 distinctions for all her 9 Honours modules.

Bruce Cairncross and Christelle van der Merwe, at the Geology Department prize-giving ceremony. Christelle won the prize for the best Honours students in the class, and the GSSA prize for best Geology Honours student at a South African University.

During the UJ Spring graduation ceremeony, three MSc students, Craig Blane, Ashley Gumsley and Brian Nel, all received their degrees cum laude.

Axel Hoffman has been active the past few months and reports on the following. In July, Alina Fiedrich from the University of Kiel in Germany arrived for a two months internship in the geology department as part of the DAAD-sponsored RISE project. During this time she worked together with Axel, Clarisa Vorster (PhD student) and Frantz Ossa (post-doc) on a zircon provenance study of the Francevillian Group in Gabon. Dr Robert Bolhar from the University of Queensland spent 3 months for collaborative research with Axel working on various aspects of Archaean sediment geochemistry. Arnold Gucsik, an expert on Raman spectroscopy and luminescence studies in the Earth and Planetary Sciences, joined us in July 2013 from Hungary to take up a postdoctoral position. Arnold holds a doctoral degree in geochemistry from the University of Vienna and has been working as a postdoctoral fellow and visiting professor in laboratories in Europe, Japan and the US. His presence as a researcher at UJ will open

new pathways in mineralogical and petrological studies using Raman- and luminescence-based techniques. Axel was awarded an NRF National Equipment Programme grant to upgrade the department-owned WITec alpha300M confocal laser Raman microscope to an alpha300R with True Surface imaging capability now allowing high-precision Raman imaging even of irregular surfaces. The equipment is available to any user, both in academia and in industry, who requires high-resolution Raman spectroscopy and mapping.

International Workshop Hosted by UJ Geology

The Department of Geology recently hosted an international field workshop that emphasized the thermal regime, fluid activity, and magmatism of Precambrian granulite facies terranes, with special reference to the Limpopo Complex of South Africa. The field workshop was preceded by a seminar in the department of Geology on June 27th during which researchers from Japan (Toshiaki Tsunogae), Germany (Daniel Harlov), Russia (Oleg Safonov, Leonya Aranovich, and Elena Dubinina), the USA (Robert C Newton, Craig Manning, and Adam Makhluf) and UJ (Dirk van Reenen, Andre Smit, Jan Kramers, and George Belyanin) shared recently acquired data on topics related to the focus of the field workshop. Of special interest were talks presented by Adam Makhluf (PhD student from UCLA) and Leonya Aranovich on granite genesis. Preliminary results of Adam's experimental study showed that the H_2O contents at the granite liquidus in the system Albite-H_2O at deep-crustal conditions are at least twice what other researchers have conjectured based on projections from low-pressure data. This result makes getting any significant amounts of granite out of the deep crust by "dehydration melting" unrealistic.

Leonya Aranovich, in collaboration with Bob Newton and Craig Manning at UCLA, determined first-melting temperatures of haplogranite (40 wt. % $NaAlSi_3O_8$, 30 wt% $KAlSi_3O_8$, 30 wt% SiO_2) in the presence of H_2O-NaCl-KCl solutions of variable composition and concentration at deep-crustal metamorphic conditions of 6-14 kbar and 700-900 °C. Their experimental results showed that there is a large range of P-T space in which subsolidus deep crustal metasomatism may take place at low H_2O activity via migrating fluids. Compositions of K-rich granites are better explained by melting in the presence of brines rather than H_2O-CO_2 fluids. Brines may enrich K_2O and silica in the mid-crust and thus condition it for anatexis. Brine-assisted anatexis differs greatly from rock melting in pure H_2O or in CO_2-H_2O fluids as is for instance shown by the fact that contours of constant-XH_2O liquidi in the presence of brines at P>2 kbar have strongly positive dP/dT slopes, in contrast to vertical or negative dP/dT slopes for those in the presence of H_2O-CO_2 fluids. As a consequence, rising accumulations of granitic magma may be fluid saturated and even increase their melting capacity with decreasing depth because of the great pressure dependence of H_2O activity in salt solutions. The results have been accepted for publication in Earth Planet. Sc. Letters, and are available online.

Based on recent fieldwork and the reinterpretation of the existing geophysical database for the Northern Kaapvaal craton and the adjacent Southern Marginal Zone (SMZ) of the LC we significantly revised our existing Limpopo model suggesting that the SMZ was thrust over the Northern Kaapvaal craton during the Neoarchaean for distances of at least 40km. This new approach suggests that large portions of the pre-existing granite-greenstone terrane of the Kaapvaal craton was overthrust by the hot exhuming granulites resulting in about 4500km^2 of granulites that were rehydrated to amphibolite grade as a result of the influx of hot fluids generated during devolatilization of the underlying greenstone material. This solves a long standing problem regarding the source for such wide spread fluid rock interaction observed in the SMZ. This event also resulted in widespread gold mineralization of both the overthrust greenstones and the overlying granulites.

The field workshop was run from June 28 to July 2nd, and focused on studying field evidence for pervasive and channeled (shear zone-hosted) fluid-rock interaction that included regional hydration of metapelitic granulite, the main pulse of anatexis, shear zone-hosted high-temperature metasomatic alteration of quartzofeldspathic gneisses, and melt-enhanced deformation. The results of this workshop will be published as a special issue of Precambrian Research in the second half of 2014, and will also be presented as a special session of IMA 2014 in Johannesburg.

Bruce Cairncross (HOD)
Compiled from various staff members contributions.

workshop report:

Barberton drilling project

A workshop to inspect core recovered as part of the Barberton drilling project (www.peeringintobarberton.com) was held at the Origins Centre of the University of the Witwatersrand from 18 to 21 February 2013. Sylvia Kenny and Allan Wilson organized the workshop, which attracted about 40 scientists and students from 9 countries. The workshop was followed by a 4-day field trip, attended by about 20 participants, to inspect the drill sites in the Barberton region, organized by Axel Hofmann.

A call for proposals to work on the core was made in 2012 (see Geobulletin December 2012). This call was open to all scientists and students interested in working on the core. By the end of 2012, approximately 20 proposals had been submitted. The workshop allowed participants to view the drill core and to identify sections of core that they wished to carry out research on. The core viewing sessions were organized in the afternoons, preceded by overview talks on the different cores by people in charge of the specific sites.

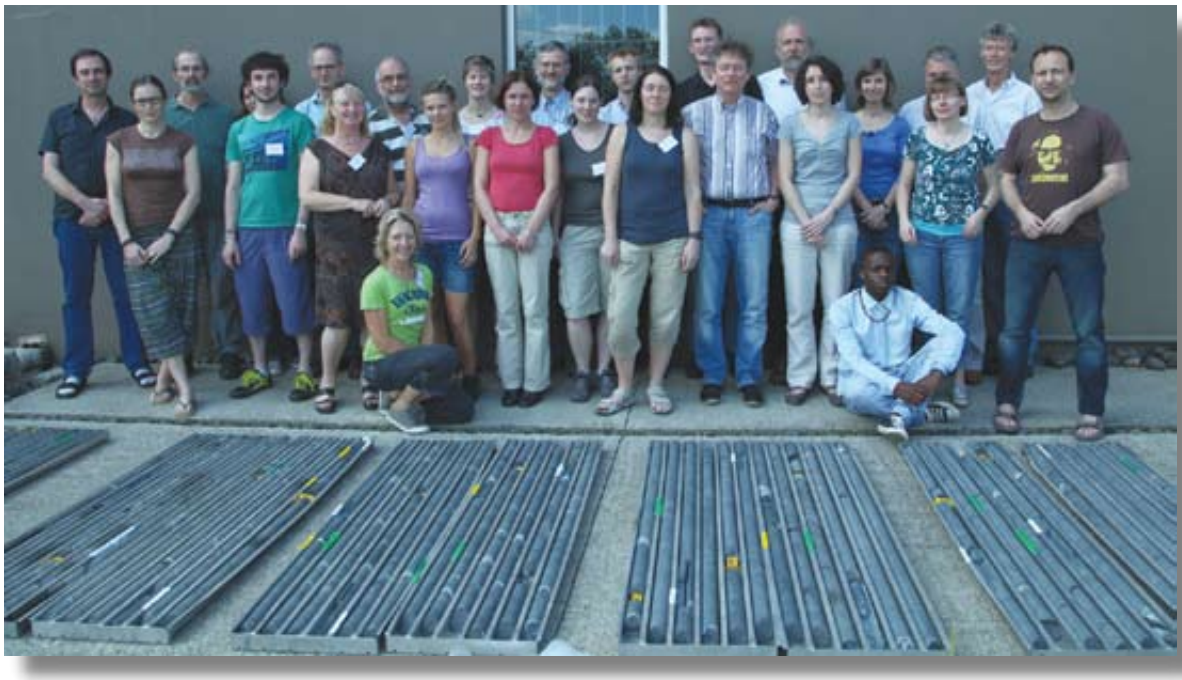
LIST OF CORES DRILLED AS PART OF THE BARBERTON DRILLING PROJECT AND THE PEOPLE RESPONSIBLE FOR ITS HANDLING

- **BARB1 (420 m), BARB2 (431 m) – mafic-ultramafic rocks of the Komati Formation (Allan Wilson and Grace Coetzee, Wits University)**
- **BARB3 (900 m) – sedimentary rocks of the Buck Reef Chert, Hoggenoeg/Kromberg Formation (Axel Hofmann, University of Johannesburg)**
- **BARB4 (539 m) – silicified komatiites of the Mendon Formation and clastic and chemical sedimentary rocks of the Fig Tree Group (Don Lowe, Stanford University; Nic Beukes, University of Johannesburg)**
- **BARB5 (763 m) – clastic sedimentary rocks of the Fig Tree Group, Barite Valley (Paul Mason, Utrecht University; Harald Strauss, University of Münster)**

Technical and scientific papers presented at the core storage facility at the Origins Centre

During the course of the workshop a number of general talks were given, and results from preliminary or related studies were also presented. Roger Gibson welcomed the workshop participants and Nick Arndt (University of Grenoble) presented an overview of the history of the Barberton Drilling Project that was initiated in 2007. Phil Harris gave a talk on near infra-red spectroscopy of drill core that has been undertaken free-of-charge by GeoSpectral Imaging. The usefulness of the infrared scans of the core is that they will give an insight into the mineralogical constituents, particularly aiding identification of zones of alteration. Scientific talks having a direct bearing on the project were given by Luc Andre (Tervuren), Nick Arndt, Christoph Heubeck (Berlin), Jan Kramers (UJ), Noah Planavsky (UC Riverside), Uwe Reimold (Berlin) and Andrea Agangi (UJ). Students that presented preliminary findings of their research included Grace Coetze (Wits) and Katja Farber (Aachen).

A main objective of the meeting was to assure maximum



Attendees and organizers with core laid out at the Origins Centre

cooperation between the various groups as well as understanding what research would be carried out. As a result, discussions were held involving different groups in order to avoid overlap and foster collaboration. Overlapping research proposals included in particular the application of non-traditional stable isotope analysis to sedimentary material. At the workshop no samples were distributed, but participants were able to indicate pieces of core directly on the core trays. Samples were cut and shipped in the weeks following the workshop, assistance for which was provided by Herve Wabo (UJ). As the Barberton drilling project is an on-going project, further proposals for additional research work are welcome at any time. Decisions concerning the distribution of core and the research to be done will be made by the steering committee.

A number of future meetings are planned. A special session on the drilling project was held at European Geological Union (EGU) in Vienna in April 2013 and another meeting to discuss results will take place in Johannesburg in September 2014 at the IMA2014 meeting. It is proposed that a meeting will be held at the Goldschmidt conference in Prague in 2015, where advanced data and results will be discussed.

Nick Arndt, Allan Wilson and Axel Hofmann

On the field trip to the Barberton greenstone belt viewing cherts of the Mendon Formation

Organisation of African Geological Surveys

Organisation des Services Géologiques Africains
Organisação de Serviços Geológicos Africanos

The Organisation of African Geological Surveys (OAGS) was launched on 2 February 2007 in Pretoria, South Africa, during the plenary session of the African Mining Partnership (AMP). The AMP was established to champion the mining and mineral initiatives of the New Partnership for Africa's Development (NEPAD) by harmonising the mining and mineral legislative framework in Africa and optimising the value of mining for the benefit of all.

The objectives of the OAGS are:

- To jointly address African geoscience issues of common interest;
- To promote the contribution of geosciences to African affairs;
- To assist African decision makers to obtain technical advice from the members of the Organisation of African Geological Surveys, and
- To provide a geoscience network between the Geological Surveys.

The OAGS will be holding its General Meeting from 23–26 September 2013 in Ghana. The General Meeting report back on the activities of the Organisation of African Geological Surveys and decides on its future programme of activities.

The program will be as follows:

- **22 September:** Registration
- **23 September:** Welcome session and presentation on the Geology of Ghana
- **24 September:** Guided Site Visits to Kukurantumi & Morontuo Seismic Remote Sites and LakeBosumtwi Impact Crater.
- **25 September:** Workshop and Presentations by EuroGeoSurveys
- **26 September:** Annual General Meeting

At the 2013 Annual General Meeting, the OAGS members, which comprise all the African countries, will be voting for a new President and two new Vice-Presidents, therefore the OAGS greatly encourages the participation of all geological surveys in Africa.

For further information please contact the Secretariat:

Organisation of African Geological Surveys

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GEM workshop

GEM Workshop, 21 / 22 February 2013, Vancouver, Canada

The GEM Diamond Project is part of the Geo-mapping for Energy and Minerals (GEM) program that was established through funding from the Government of Canada, which invested $100 million over a period of five years (2008-2013). The focus of this federal program was to map the Arctic more extensively and identify potential for new energy and mineral resources. The Diamond Project is one of several projects in the program, and the focus of other projects includes hydrocarbons, uranium, base metals, precious metals and rare metals.

The Diamond Project is led by Bruce Kjarsgaard and David Snyder from the Geological Survey of Canada (GSC). Through this project, funding has been provided for both geophysical and geochemical studies of the lithosphere.

The 5th and final annual workshop of the GEM Diamond Project took place at the UBC Robson Square campus in Vancouver, over two days in late February 2013. There were about 40 attendees, representing both industry and academia.

Geophysics talks at the workshop covered several Canadian cratons including conductivity and seismic studies of the Slave craton, the conductivity structure of the crust and lithospheric mantle below the central Rae (Churchill Province) and seismic studies to assess crustal thickness across Canada. Some highlights from the geophysics presentations were:

Bob Busby, the Manager of the Transportable Array of Earthscope's US Array, spoke about his work overseeing 200 seismic stations that need to be removed and redeployed every year. This Transportable Array is a network of 400 broadband seismographs that have temporary sites for 2 years, and are moved from west to east across the United States in a regular grid pattern. Seismic data obtained through this program have contributed to studies of the crustal thickness and composition below the Western Codillera; imaging of Cascadia subducted slabs and the upper mantle structure of various terranes in the United States. The Array installation for Alaska and NW Canada begins in 2014 and should provide important new information on the crust and upper mantle of the North American Arctic. More information at http://www.usarray.org.

Andrew Fredericksen from the University of Manitoba spoke about the Superior Province Rifting Earthscope Experiment (SPREE) - a collaboration between a number of universities in Canada and the US, which uses seismic stations from the Earthscope Flexible Array. These stations are deployed in Minnesota, Wisconsin and Ontario to study the subsurface structure of the Midcontinent Rift that impacted the southern Superior craton around 1.1 Ga. This project will aim to address a number of unresolved questions, such as why the rift may have started, why it failed and what impact it had on the cratonic root of the Superior Province.

Andrew Schaeffer from the Dublin Institute of Advanced Studies presented a new global shear wave velocity model (SL2013sv), using the latest data from the Transportable Array. This new model has a high resolution, previously restricted to continental scale studies, and certain structures within North America can be viewed in greater detail than before. For example, the impact of the Midcontinent Rift in the southern Superior craton is imaged by decreased velocities beneath the Great Lakes region compared to cratonic regions of North America; a subducting slab below the Aleutian Trench is imaged though a dipping high velocity zone; and lower velocities apparent below the Basin and Range province.

Geochemistry talks at the workshop ranged from kimberlite petrogenesis, age and composition of cratonic lithospheric mantle and diamond formation models. Some highlights from the geochemistry talks were:

Kelly Russell from the University of British Columbia, presented a model for kimberlite petrogenesis whereby all kimberlites start as carbonatites derived from melting of carbonated peridotite. As these melts propogate through the lithosphere, they progressively entrain mantle xenoliths and, after disaggregation orthopyroxene is preferentially dissolved. Increased Si content drives the melt to kimberlitic compositions and leads to exsolution of CO_2 that contributes to

rapid ascent of the melt. This is an attractive model as it explains why kimberlites are restricted to cratons. It may be more applicable for kimberlite genesis in cratons that have higher orthopyroxene content (Kaapvaal), and may explain why cratons such as the North Atlantic craton (that is orthopyroxene-poor) have a higher proportion of carbonatites.

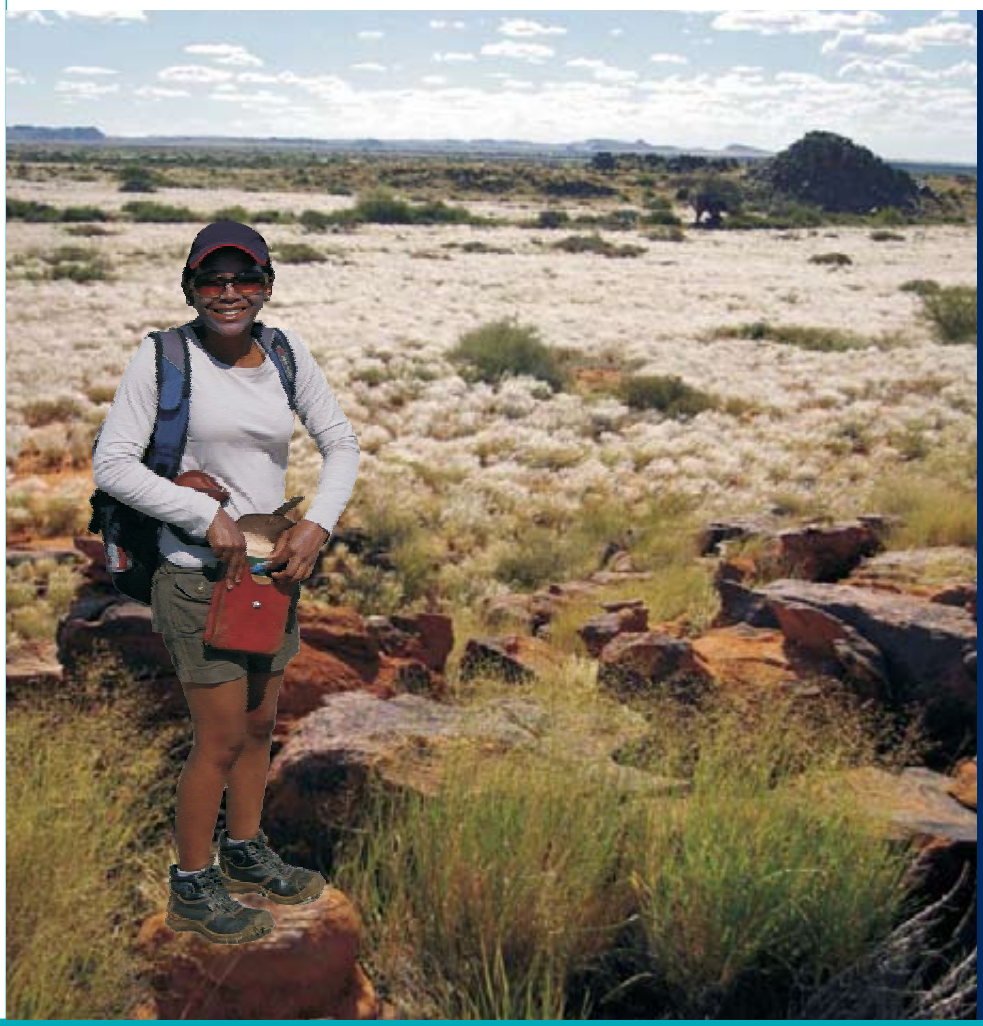
Evan Smith from the University of British Columbia and Thomas Stachel from the University of Alberta both spoke about diamond formation processes. Thomas reviewed the two main redox models for diamond formation - through either carbonate reduction or methane oxidation. Methane oxidation may not be widely applicable, as it requires a relatively oxidised lithosphere, however it has been modelled from covariations in nitrogen content and carbon isotopic composition in the Premier diamonds. Carbonate reduction may be a more common mechanism for diamond formation and Evan provided support for this process from carbonatitic fluid inclusions in Siberian diamonds. These fluid inclusions also have high nitrogen contents, however the origin of high nitrogen contents in mantle melts / fluids is not clear.

Laura Brin from the University of Alberta presented new results on the age and composition of lithospheric mantle below Darnley Bay and Victoria Island in northern Canada. Both these localities have highly depleted residual compositions. Darnley Bay xenoliths have Proterozoic rhenium depletion ages (T_{RD}) suggesting the lithospheric mantle may have been modified by processes related to the MacKenzie large igneous province.

The GEM Diamond Project shows that diamond and kimberlite research is highly relevant and very active in Canada. The wide variety of research topics presented at this workshop highlight that there are still important questions to be answered. Thank you to Maya Kopylova (UBC) and David Snyder (GSC) for organising this workshop. A selection of talks from the workshop are available at: http://www.eos.ubc.ca/meetings/gemworkshop

For more infomation about the Diamonds project of the GEM program see: http://www.nrcan.gc.ca/earth-sciences/about/current-program/geomapping/minerals/9543

About the author: Karen Smit recently completed her PhD in Geology at the University of Alberta.



microCT for geologists

X-ray micro computed tomography (microCT) scanning: an overview of what this technology can do for geologists

A du Plessis, CT Scanner,
Central Analytical Facilities, University of Stellenbosch, South Africa.

Introduction

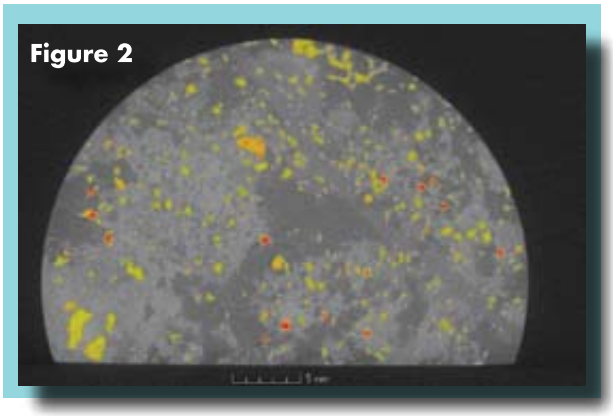
X-ray micro computed tomography (microCT) has been widely used in the geological sciences mainly in academic research until now – this is summarized in a recent review article [1]. This technology has now matured to the extent where routine analysis is possible on a large scale, with microCT service laboratories available all over the world, and also locally in South Africa. The aim of this article is to demonstrate the type of information which can be obtained from a microCT scan.

CT Scan example of a drill core

A drill core containing scheelite minerals (Tungsten being of interest) was used in this demonstration. A microCT slice view of a section of a drill core (35 mm diameter, 70 mm long) is shown in Figure 1, with its corresponding slice plane location shown in the 3D view to the right. These slice images are available from a CT scan at steps corresponding to the scan resolution, all the way through the scanned object – in this case more than 1000 images (JPG format) at a spacing of 60 µm. Such image stacks are very useful for self-analysis of CT scans, as no special software is required and features of interest can be identified for further analysis if necessary. This scan and the making of the stack of slice images, required only 1 hour.

In this example, different phases are clearly discriminated based on their density differences. The same slice image in Figure 1 is shown in Figure 2 in more detail, with different materials discriminated with colours. In this figure, Tungsten mineral particles are red, two different types of sulphides are orange and yellow and the gangue minerals are two shades of grey. From this segmentation full volumetric measurements can be derived for each phase, in this case the relative contents are 0.3%; 0.4%; 4.8%; 50.5% and 44% respectively for the above mentioned phases. The 3D distribution

Figure 2: Threshold segmentation of different materials including scheelite mineral (red), two types of sulphides (orange and yellow) and gangue minerals (two shades of grey).



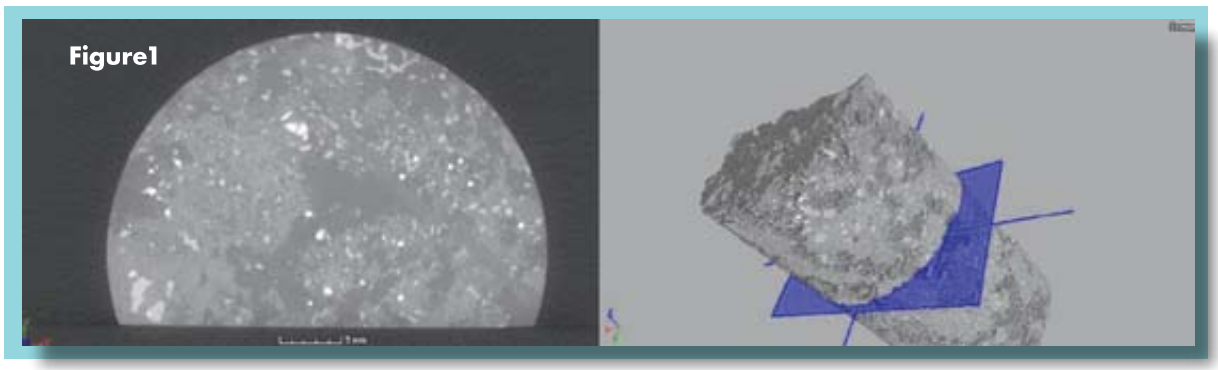
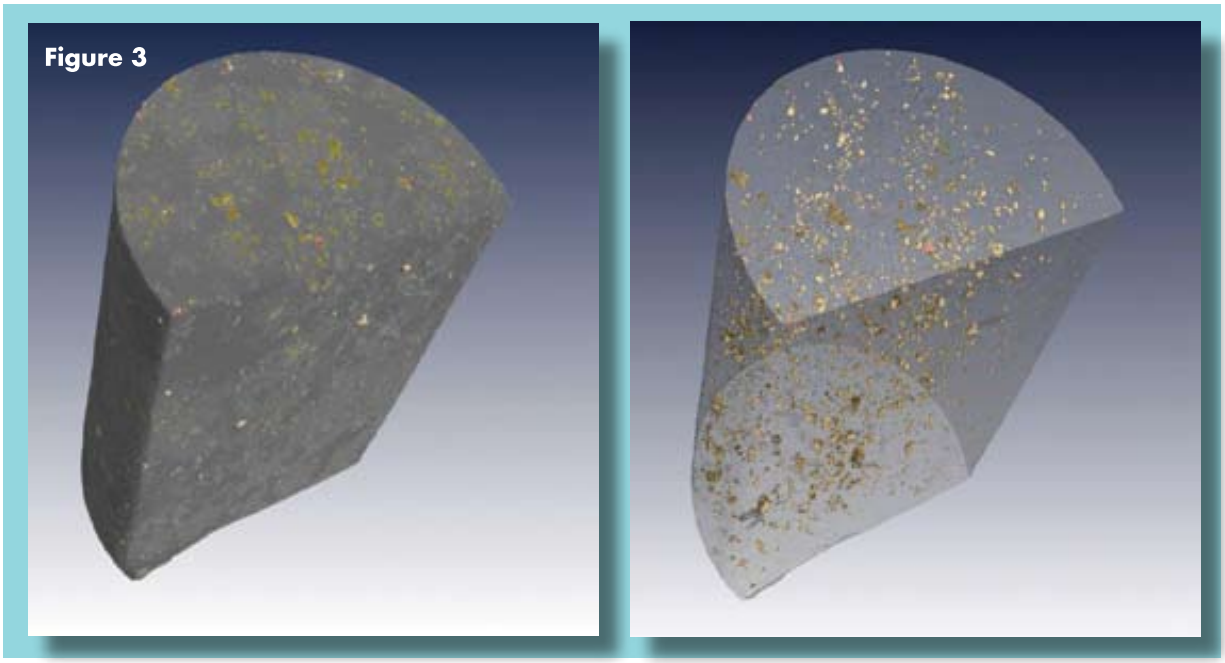


Figure 1: CT scan example of a drill core with scheelite minerals, slice image to the left and 3D surface view to the right (with the position of the slice plane shown in blue).

of the scheelite mineral particles is shown in Figure 3, with the second image having all less dense material made transparent. This 3D image can be useful for determining the particle distribution (e.g. layered or evenly distributed).

Figure 3: CT scan 3D view of scheelite mineral particles, with surface view to the left and the semi-transparent view to show the 3D distribution to the right.



In order to further demonstrate the power of 3D imaging compared to traditional analysis, a virtual "thick section" of the top part of the sample is made to simplify the 3D representation, as shown in Figure 4 (left). In Figure 4 (right) is a close-up view of the top surface of this thick section, which allows one to visualize a surface view as would have been obtained from physical cutting and polishing with the mineral particles sliced open shown in red, as well as the underlying particles. This gives an indication of their actual sizes in comparison to that shown by slicing.

Discussion and conclusion

MicroCT scanning has been demonstrated here for one example of an exploration drill core containing scheelite minerals at relatively high content of 0.3%. Not only can average volumetric content or volumes (mm^3) of different materials be determined, some other very useful information can also be gained which is impossible to find from other techniques. The full 3D data of a drill core sample can, for example, provide useful information on the particle or grain

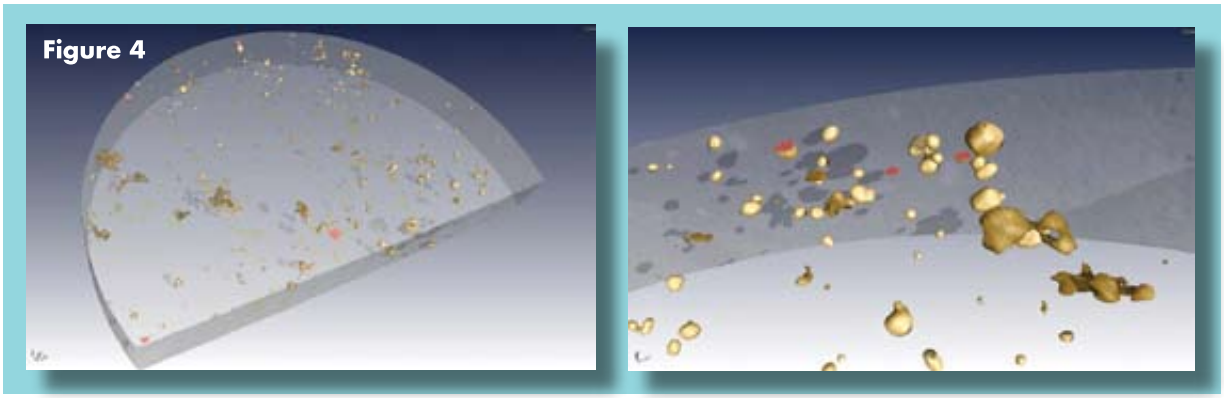


Figure 4: A virtual "thick slice" and close up view of the surface to demonstrate the advantage of 3D viewing of such particles (red shows the virtual surface slice)

distribution (do the particles of interest occur in layers or are they homogeneously distributed), as well as shape information sometimes lost in thin sections. In addition the method is non-destructive, therefore cross referencing with other (more time consuming) methods is easy if the microCT is done first.

One important factor is that the measurement is relatively fast: a good scan is roughly 1 hour, with the basic analysis shown here an additional 30 minutes, resulting in a laboratory turnaround time of 1.5 hours per sample.

As with all techniques, there are inherent limitations and incorrect interpretation of results can lead to errors. The most important limitation is the resolution – for a sample of X mm in its longest axis, the best resolution possible is roughly X µm, in this case the sample was 70 mm long and the scan resolution was 60 µm. Higher resolution is possible in this case by scanning top, middle and bottom parts and stitching these volumes together but this becomes time- and data-intensive. In addition, the x-ray attenuation is not only a factor of density but also of atomic mass, therefore some minerals may not be possible to distinguish properly. This and other limitations such as CT artefacts and effects due to digitization are not discussed here, as they could be overcome to some extent with method development on each type of sample if required.

The aim of this paper was to demonstrate a simple routine analysis using microCT and demonstrate the type of information that can be obtained using this technology. This information is obtained rapidly, and can be very useful for routine analysis of samples for exploration geologists. For more information please visit www.sun.ac.za/ctscanner.

[1] C. Cnudde, M.N. Boone.

High-resolution X-ray computed tomography in geosciences: A review of the current technology and applications.

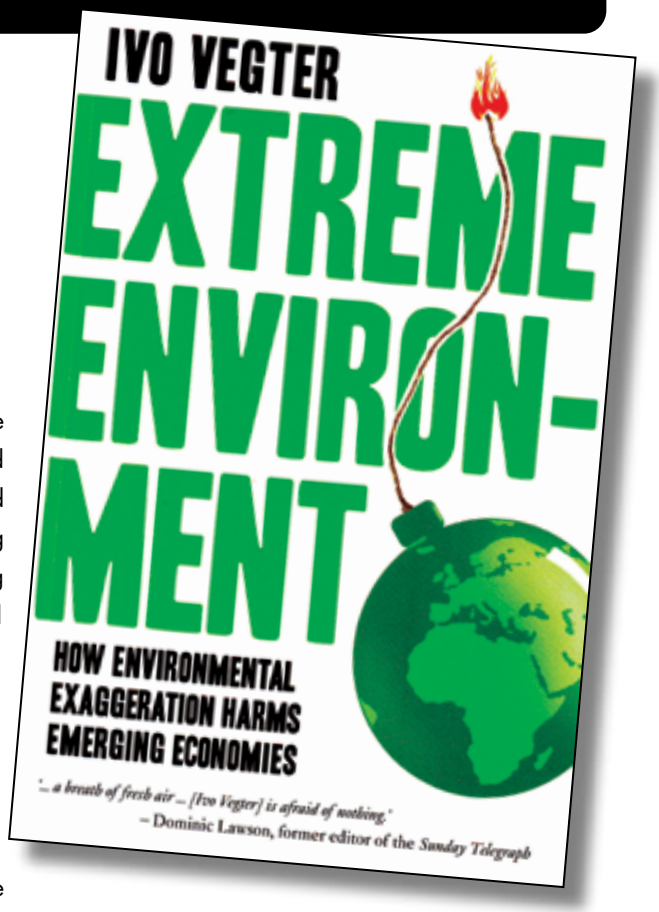
Earth-Science Reviews
123 (2013) 1-17.

book review:

1

EXTREME ENVIRONMENT

by IVO VEGTER
321 pages,
published by Zebra press, in 2012



The scope of this book

Most geologists are interested in and even passionate about our planet and the things that affect it. I found Extreme Environment to be informative, topical and contentious in places; I consider it thought provoking and well worth reading. I learned a lot about fracking and the other issues discussed and the book reminded me, by citing several examples of exaggerated and even untruthful claims that have been made by environmentalists and other scientists (about man's impact on the earth's environment and the negative effects of various chemicals), that we need to question and be critical of what we read, both in the popular press and even in scientific journals. The book clearly shows that some environmentalists and other scientists have been guilty of making some grossly exaggerated claims about man's impact on the planet and of inflating the dangers of some of the chemicals we use. It makes the important point that the exaggeration of man's negative impact on the environment can create unnecessary fear in the layman, but that it has also influenced governments and their policy decisions negatively. In some cases these reactive policy decisions, by way of costly levies and taxes and onerous legislation, have had severe impacts on investment, development and job creation. To paraphrase the author "such regulations have a stultifying effect on countries, curbing their economic vitality and hindering technological progress. While the rich world can arguably afford to be fussier nowadays than it was during its own development, large parts of the world have yet to achieve that state of discerning wealth. In the rich world, onerous industrial regulations merely make rich people a little poorer but in the poor world, the regulatory burden actually causes unemployment, disease and deprivation. When poor people can't find employment because companies cannot afford to exploit new opportunities as a result of environmental taxes, levies or legislation, the result is real human suffering. The same is true when people can't afford food because farmers, production and transport companies face unnecessary constraints, costs, levies and carbon taxes, in getting produce to market."

The first three chapters of the book examine - and in some cases debunk - some of the claims of the "anti-fracking movement" which opposes shale gas extraction in South Africa and elsewhere. Most geologists will find this section of the book the most interesting, particularly as South Africa is currently facing the contentious issues surrounding the licensing of exploration for shale gas in the arid Karoo. As a result my review concentrates more on this issue than others discussed.

The book also discusses and examines similar fears and their veracity around other issues of concern including our food, energy and agricultural industries. In these sections it looks at the claims made about the harmful effects of chemicals on humans, ranging from DDT, which

was so successfully used to reduce malaria during and after the Second World War – thereby saving millions of lives, to the apparent dangers of MSG (monosodium glutamate) and others. It goes on to point out how the green lobby and the press made the tragedy resulting from the devastating natural disasters of a magnitude 9.0 earthquake and resulting 38.9 m Tsunami, which struck off Tohoku on the east coast of Honshu Island, Japan, in 2011, almost exclusively about the damage to the Fukushima atomic energy plant and the risk of a radiation leak and meltdown, rather than about the loss of 20 000 lives, the destruction of 120 000 homes and damage to a further 200 000 as well as extensive infrastructure. Because of this skewed press coverage, most people in the world remember "Fukushima", the atomic plant, where at the time no lives were lost, rather than the real horrors that occurred as the result of the natural disasters.

The book also contains sections on BP's Deepwater Horizon oil spill in the Gulf of Mexico, as well as on climate change and a variety of other concerns. Though pointing out the untruths and exaggerations that the press and certain environmentalists and other scientists, have perpetrated on an unsuspecting public, the author states that "not all environmental warnings are false and some are indeed true and we should be just as careful of the emotive rhetoric of environmentalists as we should be of corporate spin". He goes on to say that he hopes the book will highlight the dangers of exaggerating risks, while ignoring the proven benefits of economic liberty and industrial development, especially for developing nations. The presently developed nations got there without regard to environmental niceties and restrictions on their industries. Looked at in this light, I feel that this book has merit and is definitely worth reading, though I do not agree with everything in it.

The "fracking debate"

In his apparently well researched and informative section on "fracking" the author states that according to initial estimates, South Africa is ranked as having the 5th largest gas resource in the world, after China, the USA, Argentina and Mexico. To make this more meaningful he quotes the U.S. Energy Information Administration as having estimated South Africa's technically recoverable gas resources at 485 tcf (trillion cubic feet). How much of this lies within the Karoo shales is not mentioned. However, he goes on to state that one tcf can generate 100 billion kilowatt hours of electricity which is the equivalent of two and a half years production from the giant, strike plagued and increasingly expensive Medupi Power station. (Latest cost estimates to get Medupi and associated infrastructure up and running are some R 160 bn). Apparently 1 tcf of resources was sufficient to launch the Mossgas project.

Thus, if estimated resources are realized and efficiently exploited, they represent a huge energy source and could, if used in yet to be built local gas fired power stations and other downstream applications rather than being exported, conceivably result in a significant number of jobs for locals over a long time period. The author quotes a study by the late Tony Twine of Econometrix, in which he apparently estimated that the exploitation of the gas along with downstream utilization could result in between 300 000 and 700 000 jobs being created, between R 80bn and R 200 billion income in Gross Domestic Product in addition to significant tax revenues. If realized, such a scenario would be a massive shot-in-the-arm for a developing country with high unemployment such as South Africa, and would be difficult to reject. The potentially positive economic results of the exploitation of the Karoo shale gas, along with the fact that natural gas burns much more cleanly than oil and coal and emits far fewer pollutants, then need to be weighed against the potential negative environmental effects. The major concerns of opponents to the fracking in the Karoo revolve around the contamination and depletion of the valuable ground water and the aesthetic despoiling which the numerous well heads, access roads, and waste treatment facilities will produce. The toxic nature of some of the chemicals used in the process is also a concern.

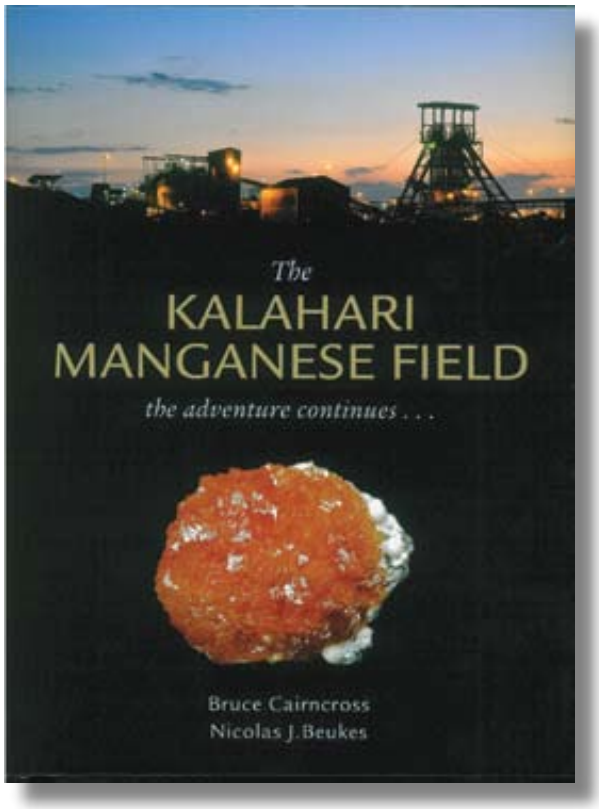
In terms of the aesthetic destruction of the almost pristine Karoo landscape the author makes a fair case that the infrastructure and access roads that are required for the Square Kilometre Array (SKA) of telescopes will be as severe, and in addition to that arrays of these large, highly visible telescopes will be much more of a blot on the landscape, yet most people in the country have been happy to let that process proceed with little opposition. The author deals with aspects

such as the depth of the shale gas resources (2.5 to 4.0 km deep) compared with that of the fresh ground water (less than 500m) and the brackish groundwater (generally 500m to 1.2 km or so). According to a Shell spokesperson much of the 20 million litres of water required for fracking each well will comprise the brackish water which is not currently used for anything. The author makes the point that providing the wells are properly lined with both steel and concrete linings in the way they should be, the chance of contamination of the groundwater is minimal. The trouble with this argument is that subsequent to all the oil pipeline leaks experienced in Nigeria and elsewhere and failure of the deepwater cementing job that is blamed for the devastating oil spill at the Deepwater Horizon oil well in the Gulf of Mexico, it is clear that oil companies are NOT infallible and that either by dint of short cuts, inferior materials or contractors, such leakages DO occur. These incidents can be reduced if oil companies are made accountable, closely policed and held to the highest technological standards. Sadly this is unlikely to happen in South Africa which has some of the best laws in the world but is notorious for not policing and enforcing them properly. Also, over sufficient time and in the presence of the seismic events which are associated with the Cape Fold ranges, such casings are likely to experience some failures. In an unlikely but not impossible worst case scenario, the arid Karoo with contaminated groundwater, could resemble a real wasteland.

More likely however are surface leaks and spills and these, if severe enough, can filter into the groundwater table. Though most additives used in the fracking process are fairly innocuous in low concentrations, there are a few that are toxic in high concentrations. In examining the real cases of contaminated groundwater related to fracking, the author found these were not at all common. But once again the companies and contractors would need to be held to the highest technical standards in implementing their infrastructure and pipelines. I will leave it to you to decide how likely that is and if the country, with over 30% of its workforce jobless, can afford NOT to grasp this opportunity for employment and economic growth.

Reviewed by Mike Wilson.
(Geological consultant and author)

book review: 2



The Kalahari Manganese Field.
The adventure continues....

By Bruce Cairncross and Nicolas J. Beukes.
Published by Struik Nature.
First edition 2013. 384 pages.

In the interests of total transparency, as advocated by our 2013-2014 President of the Geological Society of South Africa, Avinash Bisnath, I am a good acquaintance of both the authors of the book being reviewed. Hence is behoves me to be strictly critical and disinterested, less I be accused of bias, cronyism, favouritism, etc. Choose your damndest moniker! Right at the outset, it must be stated that the book has been independently submitted for critical peer review by Struik Nature prior to publication. The reviewers are Dr Carl A. Francis, Professor J. Barry Maynard and Dr Harry Tsikos, distinguished names in the geosciences, so my task simplifies to an assessment of the tome holistically, the scientific veracity firmly established.
So, where to start? A brief retrospective look at the first Manganese Adventure book, published in 1997

by the Associated Ore & Metal Corporation Limited, is a good place. My copy is still in its original bubble wrap, and has Jens Gutzmer as the third author. The chapter headings are:

Why manganese?

A glimpse into the past: History and development of the Kalahari and Postmasburg regions

Setting the geological scene: The Transvaal Supergroup

Geology of the Kalahari Manganese Field

Geology of the Postmasburg Manganese and Iron Ore Field

Two Manganese Fields: One Story

An Adventure into Minerals

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This landmark publication, written for the informed layman, succinctly encapsulated in 236 pages the historical development of the world's greatest on-shore manganese deposits, with 110 pages devoted to photographs of some of the most beautiful minerals found in that unique ore field. The book is now out of print, and those lucky enough to own copies can be rest assured that they are collectors' items and worthy to be called modern Africana.

Why the need for another coffee table book covering similar ground? The authors' state in their preface that "much has happened in the Kalahari Manganese Field since The Manganese Adventure was published in 1997", including the opening of several new mines, the discovery of new type minerals and the collection of numerous high quality specimens. In addition, continuing scientific research on the deposits has added valuable new insights into their origin, and these are explained in the book. The chapter headings are:

Manganese

History and mining

Geology

- Origin and global distribution of manganese deposits
- Geology of the Kalahari Manganese Field
- Ores and minerals of different geological events
- Genetic models
- Geometallurgy and manganese alloy production

The Minerals

The book focuses on the Kalahari Manganese Field as there have been few new scientific and mineral specimen findings in the Postmasburg area since 1997. The tone is set by eight stunning photographs of colourful minerals, led by rhodochrosite, before the contents page is reached. The first third of the book covers the ins and outs of the four topics listed above. This section can stand alone as an erudite scientific treatise, and will be reference material in the future. The icing on the top is modestly heralded by "The Minerals", followed by an alphabetical list of all the minerals that have been discovered in the mining area to date, illustrated by truly magnificent photographs. The mineral specimens photographed belong to mainly South African collectors, and are thus destined to remain in the country, forming an important part of our Geoheritage. They are truly priceless, and we can share in their beauty vicariously in the book. Bruce (me name-dropping!) took all the mineral photographs himself, as he did for many of the ones in the first book, and the quality is evident. Much care and attention has been put in producing this book, and it would not be an overstatement to say that is qualifies as a work of art. So are there any "dings" (an informal term used by mineral collectors for the flaws that greatly detract from the aesthetic appeal and value of a particular specimen) in the book? Not that I could find.

My recommendation is go out and purchase a copy NOW! It would not only be a wise investment, but will give you great pleasure in years to come as you page through the book and admire those stunning minerals.

Reviewed by George Henry

obituaries

Pieter Joubert

PIETER JOUBERT
Professor in the Department of Geological Sciences
University of Cape Town
1922 to 2013

Piet Joubert standing on sheared conglomerates of the Koeris Formation in the centre of the centre of the Gamsberg basin. Photo taken in 1980 by Prof David Reid (UCT)

Writing about someone else's life is very difficult, especially that of a very private person such as the late Professor Pieter Joubert, better known as Piet Joubert, who passed away after a relatively short sick bed in February 2013 at the age of 90, leaving behind his wife Denise and three children.

Piet Joubert was born on 22 November 1922 as one of four children. He attended school in Heidelberg (Transvaal, now Gauteng), where his father was a school principal, and graduated from the University of Stellenbosch with a BSc in 1946 and a MSc in 1957. In 1971. he was awarded a PhD degree by the University of Cape Town.

Piet married Hestia van Niekerk in 1948 and together they had three children Estelle, Lucille and Pieter. Piet and Hestia's paths parted in 1977 and in 1982 he married Denise Wadeson; together they shared 31 good years.

His first career appointment was that of a temporary junior lecturer at the University of the Witwatersrand in 1948. From 1949 to 1950 Piet worked for the Trevor Construction Company doing an examination of natural cement in Lake Malmbe in Nyasaland (now Malawi). He then worked as a mine geologist for the O'okiep Copper Company ("OCC") for one year in 1951, until his appointment as a Geologist for the Mines and Geological Department of Her Majesty's Overseas Service in Nairobi, Kenya for twelve years until the country attained its independence from Great Britain in 1963. In October of the same year he was appointed by the Geological Survey of South Africa, first as a Senior Geologist until he was promoted to Chief Geologist in 1964. In 1967, Prof. John De Villiers invited Piet to participate in the Namaqualand Research Programme of the Precambrian Research Unit ("PRU") at the University of Cape Town, which he accepted and in 1967 he was appointed as a Senior Research Associate in the PRU. His subsequent mapping exercise was made possible by generous support received from Anglo American Corporation.

Apart from the broad outline, I know very little of his early career, snippets I remember from his stories are that he was always accompanied in Kenya by a Maasai warrior and that they became very good friends, although they did not share the same dietary preferences. It was also in Kenya that he worked for a while together with Lionel Weiss , co-author with F.J. Turner of the 1963 textbook, 'Structural Analysis of Metamorphic Tectonites', and became familiar with new methods of regional structural analysis. Nine reports written by him during this time were published by the Geological Survey of Kenya and this included work on the basement gneisses in the Turoka area, sedimentation of Jurassic and Cretaceous successions, descriptions of map-sheet areas including the Namanga-Bissael, Mandera-Damassa , Wajir-Wajir Bor, and the Loeperot areas, descriptions of the Mirma Hill, a carbonatitic niobium deposit and a study of the cross folding and re-folding in the basement gneisses. In total, he mapped an area of 16,800 km^2 in Kenya. In addition to the published documents, he also lodged reports on kyanite, lead, graphite, diatomite, gold, copper, mica, beryl and rear earth mineral deposits (Mukugodo) in the files of the Geological Survey of Kenya. He was also responsible for the radiometric survey of Kenya at the time. On returning to South Africa he was responsible for on-land oil exploration by the Geological Survey of South Africa, which he

apparently found very boring.

On joining the PRU Piet commenced with the research for his PhD, which for him was the regional mapping of an area of 12,000 km^2 in an area stretching from the Richtersveld in the north to Kleinzee in the south, then stepping inland to Gamoep in the east and then again down to Bitterfontein in the south. The results of this monumental piece of work were published as Bulletin 10 of the PRU, which became probably one of the most quoted references in the geological literature on the Namaqua Metamorphic Complex ("NMC"). At a time when there was a general scarcity of radiometric dates of the different rock types he devised a method of correlation with reference to the style of deformation and based on sound field observations. His ability to identify different phases of deformation and systematically separate these into different tectono-metamorphic events was ahead of his time and, in some circles, he was ridiculed as Piet Plooi (fold) for his F1 to F20 (he actually identified F1 to F8 as distinct tectonic episodes that took place during two major events). His work sparked a flurry of research conducted by various institution and a proliferations of formation names with uncertain correlation significance. It is not surprising that Piet Joubert's stratigraphic interpretations are confirmed in the most recent detailed geochronological studies.

Following the work for his thesis he continued working towards the east into an area that is known as Bushmanland. In doing so he focussed firstly on the large regional structures. The results of this study were published by the PRU in Bulletin 15. In this study he demonstrated how the large structures are related to strike-slip or wrench faults features that were later identified as the suture zones between different tectonic fragments. When he showed one such a large tectonic feature (the Hartebees River lineament), to participants of the Namaqualand excursion of the 1975 Geocongress, this was very sceptically received.

However, it was his understanding of the regional stratigraphy and structure that led the managing geologists of OCC to ask him for advice as to where to focus their exploration, after the discovery of the Swartberg (Black Mountain) stratabound-stratiform base metal deposit by geologists of Phelps Dodge. Piet directed them to the large synclinal features in which the supra-crustal sequences were preserved and exposed (B. de V. Packham, pers. comm., 2013) and in particular to Gamsberg. According to Mr Stan Hausmann (pers. comm., 2013), who was then with OCC, Piet accompanied himself and Messrs Andries Lombaard and Jan Marais to Gamsberg and explained the structure to them, which they could not comprehend at the time. Following this Mr Hausmann led a team of geologists from the OCC that mapped the Gamsberg Structure in detail, which resulted in the discovery of the stratiform-stratabound base metal deposit there. In the meantime, (according to Dr Rael Lipson then of Phelps Dodge, pers comm., 2013) Piet was also approached by Phelps Dodge to assist them in unravelling the structure at Black Mountain. Dr Pat Ryan, who had recognized the gossan in the F3 fold at Black Mountain and successfully drilled it, brought Piet in to map the deposit. Piet recognized the F2 fold and correctly predicted that the ore body would follow the fold axis down-plunge. Piet's insight also acted as an inspiration and springboard for the young geologists who were living and breathing the new discoveries, and his mapping nomenclatures remained in place for many years. The last bit of information on the discoveries of the Aggeneys deposits was related to me some time ago by the late Prof John Moore, who was also with Phelps Dodge at the time. It was also Piet Joubert who indicated to them that the Broken Hill deposit at Aggeneys would plunge in the direction of his famous F2 lineation, and he indicated to them where to position the first down-plunge drill holes that intersected the massive sulphide ore body. Although none of the discoveries can be directly ascribed to Piet Joubert, there is no doubt in my mind that he was instrumental in the discoveries of some of these deposits, and their extensions, a fact for which he never received any formal recognition.

In May 1972, Piet was offered a position as Consulting Geologist with Phelps Dodge, which according to legend he accepted under the following conditions:

- that he could continue with his mapping of Bushmanland (part of the Namsaqua Complex

between the better known Okiep Copper District and the Copperton Areachap area in the east which was then already mapped by the late Dr Vaclav Vajner); and

- that he be given a field vehicle (six-seater Land Rover) and caravan (air-conditioned) and a cook to prepare his food.

About three years after joining Phelps Dodge Piet was asked by the University of Cape Town to take over the directorship of the Precambrian Research Unit left vacant after the sudden death of John de Villiers and subsequent departure of Prof Alfred Kröener. He was appointed Professor of Mineralogy and Geology in 1975 a position he filled till his retirement in 1986. During his time at the helm of the PRU he published at least 11 additional papers and supervised about 10 post graduate students whose theses were published as Bulletins of the PRU. Piet's map of Bushmanland was published by the PRU in 1984.

Piet Joubert was a Life Fellow of the Geological Society of South Africa ("GSSA") and member of the Geological Society of America, the Institution of Mining and Metallurgy, the American Association of Petroleum Geologists and the S.A. Association for the Advancement of Science. Outside his professional field he was an Associate of the Akademie vir Wetenskap en Kuns, and member of the Van Riebeeck Society and the Simon van der Stel Foundation.

Chris Hartnady, his colleague and successor as PRU Director, recalls that Piet never really enjoyed the administrative and teaching side of university life, and he could, at times, appear remote and brusque to students. To really get to know Piet, you had to have shared some time in the field with him, because Field Geology was his great love, probably arising from his many years' experience as a young geologist with the Geological Survey in Kenya. One of Chris's abiding memories is of a field trip through Namaqualand that Piet, John de Villiers, Alfred Kröener and he undertook together with others around 1968, not long after Piet first joined the PRU. The occasion was a visit to South Africa by the husband-and-wife team of Professors John Sutton and Janet Watson, famous structural geologists from the Royal School of Mines, Imperial College, London. Piet was a superb guide to the area and, at the outcrops, there was much stimulating discussion about the analysis of polyphase deformation. These discussions and arguments continued long into the evenings, when good times were had by all in places like the bar at the Kamieskroon Hotel, helping John Sutton drink his favourite drambuie.

I also came to know Piet Joubert where he was at his happiest, in the field on the farm Rozynenbosch between Kakamas and Kenhardt in 1974, where I came to do a vac jobs with Phelps Dodge and ended up opening farm gates for Piet while he was doing his regional mapping of Bushmanland. Here I most probably learned more about geology than I had at university. Besides the geology during the day, I distinctly remember the evenings when we would sit outside John Lange's wooden cabin (sometimes joined by Chris van Zyl) listening to classical music (the violin concertos of Bach, Beethoven and Bruckner and the opera "Cavalleria Rusticana" by Mascagni spring to mind) playing John's 78-records on a portable gramophone. The discussion ranged from Albert Schweitzer to South Africa's prime wine's with Piet saying that more people died of an infamous sweet wine from Paarl than in the 2nd Word War, this while we were sipping at a very sweet Orange River Dry. In 1977, he in turn invited me to commence post graduate research at the PRU.

I am indebted to various persons that assisted me with information. Including the persons specifically mentioned in the text, I want to mention Denise and Pieter Joubert, Professors Hugh Amoore, the Registrar of the University of Cape Town, Arthur Fuller, Jan van Bever Donker, and Abraham Rozedaal and Messrs Andries Lombaard, Kobus Potgieter, Allan Jack Sakkie Engelbrecht and Koos Beukes. Also a special word of appreciation to Dr Craig Smith and Ms Lully Govender of the GSSA.

Dr Hennie Theart,
June 2013.

media monitor

MINING AND EXPLORATION NEWS

Copper

Ivanplats has begun a revised development study for its Kamoa copper discovery on the Central African Copperbelt in the DRC. The company is proposing two stages of development, with the first phase targeting concentrate production from the high-grade shallow underground resources, and the second entailing a major expansion of the mine and mill, and construction of a large smelter, supported by the full extent of the resources. An updated preliminary economic assessment is expected to be finished in the last quarter of this year, with the full study to be completed in the second half of 2014. Ivanplats executive chairman Robert Friedland said that the revised scenario was aimed at delivering the best balance of a lower initial capital cost and shortest time to first production, while maintaining the company's commitment toward a major mine, mill, and smelting operation. Kamoa is ranked as Africa's largest high-grade copper discovery and the world's largest undeveloped high-grade copper discovery, with Indicated resources totalling 550 Mt at 3.04% copper (36.9 billion pounds of copper).

An independent feasibility study for Sunridge Gold Corporation's Asmara project in Eritrea concludes that mining all four deposits that make up the project, and processing of the ore at a plant near the large Emba Derho deposit, is economically robust, with a net present value of US $837 million. A three-phase staged start-up is planned, which will enable production to begin almost one year earlier than envisaged in the prefeasibility study, and the earlier cash flow, combined with capital cost reductions, will reduce the initial capital requirements by over US$130 million. The first phase of development will exploit the high-grade (15.6% Cu) 'direct shipping' copper ore, with near-surface gold- silver 'caps' treated by heap leaching. During phase 2, supergene copper ore will be processed at a central flotation plant at a nominal 2 Mt/a. At full production, primary copper and zinc ores will be exploited at a rate of 4 Mt/a. Initial capital costs for the DSO and heap leach are projected at US$46 million, with an additional $357 million for the phase 2 and 3 expansions. Asmara would produce about 380 kt of copper, 850 kt of zinc, 436 000 ounces of gold, and 11 million ounces of silver over a 15-year life.

Australian-listed West African Resources reported a maiden resource estimate for its Sartenga Cu-Au-Mo-Ag deposit in Burkina Faso, only 12 months after discovery. The Inferred resource estimate comprises 70 Mt at 0.2% Cu, 0.3 g/t Au, 166 g/t Mo, and 1.1 g/t Ag, with the mineralisation remaining open along strike and at depth. Drilling is continuing towards a resource upgrade by the end of the year. The company has set an initial exploration target of 170–250 Mt at 0.5% to 0.9% copper equivalent, which reflects the potential size of the deposit. The mineralisation at Sartenga is associated with veining and brecciation within broad zones of chlorite-epidote-sericite alteration, located within a shear corridor along the contact between an intermediate schist and a porphyritic diorite.

Iron ore

The International Mining and Infrastructure Corporation (IMIC) signed a definitive agreement to acquire Afferro Mining, which owns the Nkout, Ntem, and Akonolinga projects in Cameroon, for US$200 million. The acquisition is expected to be completed by the end of September. IMIC, an AIM-listed infrastructure development and strategic investment company focusing on African iron ore, currently owns approximately 19% of Afferro.

Equatorial Resources completed a positive scoping study for an initial 2 Mt/a hematite-based operation at its Mayoko-Moussondji project in the Republic of Congo. The capital expenditure for first production, at a rate of 500 kt/a, is estimated at US$114 million, with a further US$117 million to ramp up to 2 Mt/a in the second year of production. Based on the initial hematite

resource of 102 Mt at 40.6% Fe, the operating life of mine is estimated at 23 years. The company plans to produce a 'premium fines' product (64.1% Fe) using scrubbing, wet screening, and magnetic and gravity separation. Future work will investigate the potential for an expansion based on the 665 Mt of magnetite resources.

Waratah Resources became the first foreign company to declare an iron ore resource estimate in Gabon, with 43 Mt at 33% Fe (Inferred) at its Mekambo-Est project. The estimate is based on 1525 m of drilling, covering less than 10% of the estimated 37 km strike, and Waratah considers that a target resource of more than 100 Mt is realistic. Test work has shown that the itabirite-hosted mineralisation can be upgraded to a 65% Fe low-phosphorus concentrate using industry-standard techniques.

Industrial minerals

Allana Potash Corporation lifted the mineral resource estimate for its Danakhil potash project in Ethiopia to 2481 Mt at an average grade of 17.9% for 444 Mt of KCl (Measured and Indicated). This is a more than 90% increase over the April 2012 estimate, and close to doubling of the KCl tonnage.

Toronto-listed MagIndustries Corporation has awarded a contract to East China Engineering Science and Technology Company (ECEC) for the planning and construction of its proposed 1.2 Mt/a Mengo potash project in the Republic of Congo. Pre-construction was started in March 2013, and completion and handover is planned for the end of March 2016, subject to financing. The total value of the contract is approximately US$520 million.

Lead and zinc

Metals of Africa has discovered a new high-grade lead-dominated base metal prospect at its Rio Mazoe project in the Tete Province of Mozambique. The company said that the geological and structural setting, in the Proterozoic-age Rushinga metamorphic suite, resembles that of the Gamsberg zinc deposit in South Africa, which is Africa's largest known Broken Hill type deposit. Rock chip samples analysed using a portable XRF instrument have returned lead grades averaging 44.2%.

MDM has been awarded the scoping study for the Kipushi rehabilitation and re-development project in the DRC. Ivanplats acquired a 68% share of the Kipushi mine in 2011, and is currently dewatering the mine in order to access the original workings, known as the Fault Ore. In addition, a further deposit, known as 'Big Zinc', has been identified below the original workings, and the company aims to fast-track production from this orebody. In 70 years of operation, Kipushi extracted 60 Mt of ore at a grade of 11.03% zinc and 6.78% copper.

PLATINUM GROUP ELEMENTS

Atlatsa Resources agreed to dispose of 31.4 million attributable 4E ounces of platinum group metals, comprising the eastern section of the Ga-Phasha property, which adjoins Anglo American Platinum's Twickenham operation, to Anglo Platinum for R1.7 billion (US$171 million). The western section of Ga-Phasha will be consolidated into the broader Bokoni mine lease area, where opencast mining operations on the Merensky Reef have begun. Atlatsa will also issue 125 million new shares to Anglo Platinum for R750 million (US$76 million). The company will use the proceeds from the asset sale and new share subscription to reduce its historical debt by 75%.

Uranium

A-Cap Resources announced a major upgrade of the uranium resources at its Letlhakane project in Botswana. The global resource, based on 143 000 m of drilling, now stands at 248 Mt at 309 ppm U_3O_8 (168.9 million pounds) at a cut-off grade of 200 ppm, 88% up on the June 2012 estimate. In addition, a significant new high-grade resource (82 .5 million pounds at 447 ppm) has been identified using a higher cut-off grade of 300 ppm. The January 2013 scoping study, which showed competitive operating costs of US$42–48 per pound (based on an optimized in-pit resource 57 million pounds of U_3O_8), will be revised over the next quarter.

Other Geoscience News

The rise of atmospheric oxygen at approximately 2.4 Ga fundamentally transformed the Earth, but the processes that led to the evolution of biological photosynthesis have remained largely unknown. Now, a team led by geobiologists at the California Institute of Technology (Caltech) has found evidence of a precursor photosystem involving manganese that predates cyanobacteria, the first group of organisms to release oxygen into the environment via photosynthesis. The researchers investigated the ancient manganese cycle using newly obtained scientific drill cores through the ca. 2415 ±6 Ma Koegas Subgroup in South Africa's Northern Cape Province, retrieved as part of the Agouron-Griqualand Paleoproterozoic Drilling Project (AGPDP). These strata contain extensive authigenic manganese enrichments that formed well before those associated with the rise of oxygen, such as the 2.2 Ga Kalahari Manganese Field. Using microscale X-ray spectroscopic techniques coupled to optical and electron microscopy and carbon isotope ratios, they demonstrate that the manganese is hosted exclusively in carbonate mineral phases derived from the reduction of manganese oxides during diagenesis, and that the original Mn oxide phases were not produced by reactions with oxygen. These findings, outlined in the June 24 early edition of the Proceedings of the National Academy of Sciences (http://dx.doi.org10.1073/pnas.1305530110), show that the oxidative branch of the manganese cycle predates the rise of oxygen, and provide strong support for the idea that the water-oxidising capability of cyanobacteria, and subsequently of algae and plants, evolved from a former transitional photosystem capable of oxidation reactions of manganese. Notably, modern biological water-splitting is catalysed by manganese oxidation, with Mn(II) acting as an electron donor.

The AGPDP (http://general.uj.ac.za/agouron/) is a joint effort between geoscientists from South Africa (University of Johannesburg), the USA (Caltech, Carnegie Insitution, Harvard, MIT, University of California Davis, Yale) and Switzerland (University of Bern) and sponsored by the Agouron Institute, which has made available about R 20 million to drill deep diamond cores in the Northern Cape Province. The main aim of the project is the study of ancient life in marine environments during the Archean- Paleoproterozoic transition.

Caltech graduate student Jena Johnson examines a manganese-bearing outcrop in the 2415 Ma Koegas Subgroup, where evidence of an early manganese-oxidising photosystem was found (photo courtesy of Caltech)

South Dakota

THE GEOTRAVELLER

by Roger Scoon

THE BADLANDS NATIONAL PARK, South Dakota - *Eroded Landscapes and the Golden Age of Mammals.*

View from the south of the uplifted block of Tertiary strata, South Unit, Badlands NP. The short grass prairies, typical of Nebraska, South Dakota, and Montana, are mostly underlain by Cretaceous-age shales.

South Dakota includes several areas of deeply eroded landscapes, or "badlands", within the Great Plains of North America. The Badlands National Park was created to protect one of the greatest stores of mammalian fossils known, as well as areas of remarkable scenery. The description badlands is applied to rugged and desolate areas unsuitable for farming; reports of these remarkable areas added to the allure of the western interior, a vast area of mountains, deserts, and seemingly endless plains.

Many visitors travel to the Badlands NP to observe the deeply dissected landscape, possibly more impressive than parks such as Grand Canyon or Yellowstone. Some are fascinated by the chance of finding mammalian fossils from the deeply-eroded Tertiary strata, whilst others are intrigued by the history of this area and the indigenous peoples of North America.

The Badlands NP is located on a relatively high section of the Great Plains, east of the Black Hills. Major escarpments have developed between tributaries of the White and Cheyenne Rivers. The dissected landscape of uplifted blocks to the north of the escarpments, the most prominent feature of the Badlands NP, has developed from erosion of the poorly consolidated Tertiary rocks. Paleontologists first excavated from this area in the 1850's, although prior to this the indigenous people had identified fossils of marine animals (including turtle shells) and deduced that the area had once been covered by a shallow sea. The first article on fossils from the White River Badlands was published in 1846. By 1929, the US Congress decided the area required protection from hordes of fossil hunters. Fossils from this area are found in many natural history museums, including the Smithsonian, Washington, where the so-called "Golden Age of Mammals" (loosely correlated with the Oligocene) is revealed in spectacular exhibits. The principle fossil beds (locally so rich as to constitute "bone beds"), as well as some of the short-grass prairies were proclaimed a national park in 1978. The park includes several unconnected areas of which the North Unit is by far the

Typical scenery within the North Unit showing the main road and the largest of the look-out sites.

largest and most widely visited.

It is estimated that Native Americans hunted throughout the Badlands area for some 11,000 years. Descendents of these paleo-Indians have lived here for several thousand years and one of the attractions of visiting is to interact with the Oglala Lakota people (part of the Greater Sioux nation) who, not only co-manage the park, but have jurisdiction over many historical sites in the region. These include sites of Ghost Dances, part of a cultural response to the conflict with settlers and the US Government. The discovery of gold in the nearby Black Hills provoked the unauthorized actions of General Custer which led to the well known Battle of Little Bighorn in the adjacent state of Montana. The final part of this conflict ended when the tribes retraced their path eastward and cut down through Badlands at Big Foot Pass. They eventually reached Wounded Knee Creek where a monument to the massacre of 1890 has been established. Other areas worth visiting in South Dakota are the Black Hills, where the granite basement has been eroded into unusual spires and pinnacles, as well as the Custer State Park where the classic scenery of rolling, short grass plains and profusion of bison led to the area been used for the film "Dances With Wolves".

The Badlands NP is traversed by a tarmac highway which makes light of the difficulties of traversing this landscape. The road winds up the southern face of the escarpment, a spectacular feature visible from the Nebraska plains. The deep gullies and pinnacles of the escarpment reveal colours that range from buff and grey through green and maroon. Numerous view sites with detailed information boards have been established, as well as hiking trails to view geological features, including localities where some of the more important fossils have been excavated.

The geological overview presented here is summarized from the detailed articles by Harris et al. (2004) and Stoffer (2003). Badlands is part of the intra-continental area within the North America craton known as the

The Black Hills of South Dakota are dominated by Proterzoic granite which is eroded into unusual spires and pinnacles.

The Cretacaous–age Pierre shales reveal marine fossils including Pliosaurs (Dolichorhynchops osborni), Montana, Smithsonian Musuem, Washington.

Great Plains. The oldest exposed rocks at Badlands are the Cretaceous-age (80-65 my) Pierre Shales. They cover a large part of the western interior and include numerous marine fossils, including the distinctive Pliosaurs. Uplift associated with the Laramide orogeny triggered an extensive phase of erosion during which the uppermost parts of the Pierre Shales were deeply weathered to distinctive yellow and purple colours. By the start of the Tertiary, repeated phases of uplift had resulted in erosion of both the Cretaceous shales and part of the Precambrian basement. Erosion of the Black Hills, a topographic high during this time, resulted in sediment being transported eastward, some 120 km prior to being dumped in an area of low relief. Large amounts of ash derived from volcanic activity in the west of the continent also accumulated during the Tertiary at Badlands. These nonmarine sediments and ashes were consolidated into the White River and Arikaree Groups; they span the Eocene through early Miocene periods approximately between 37 and 20 My. The rocks of the Oligocene dominate the section and are responsible for the bulk of the fossil discoveries.

The lowermost component of the White River Group, the Chadron Formation (Eocene), is dominated by poorly consolidated, grey sandy clays, together with subordinate sequences of conglomerate and sandstone. Many fossils have been unearthed from the three members of the Chadron. These rocks are overlain by the Brule Formation; the boundary is demarcated by a thin, discontinuous, non-marine limestone. The Brule is dominated by mudstones deposited from streams and floodplains during changing climatic conditions of the Oligocene (cooler and more arid than the Eocene, albeit with some wetter and warmer cycles), with minor amounts of volcanic ash. The Brule Formation has revealed intact fossils of animals trapped in mud sheets. The White River Group is overlain by the Arikaree Group which is dominated by ash with minor fluvial sediments. These Tertiary strata are unconformably overlain by a thin sheet of Quaternary sediments. The youngest are deposits of stream terrace gravels derived from erosion

Information board, Badlands NP providing details of climate change for the early- and mid-Tertiary when the White River Group was deposited

The Eocene-age Brule Formation is eroded into a surreal landscape.

of the Miocene beds. Glaciation is not thought to have greatly impacted on the Badlands exposures but the river systems were modified to such an extent the principle systems now flow southward, rather than north into the Great Lakes.

The escarpments are mostly comprised of the White River Group. The rocks of the Brule Formation are of particular interests as they erode to form steep cliffs with knife-edge ridges and pinnacles. The characteristic reddish, horizontal banding on cliff faces is ascribed to the high concentrations of iron oxide in the Brule Formation. Rapid erosion of Badlands is assisted by the current climatic conditions with dry, bitterly cold winters alternating with hot summers in which rainfall is dominated by short thunderstorms. This inhibits plant growth and many

The "interior zone" of the North Unit reveals a deeply dissected landscape that is rapidly eroding. The disticnctive red bands are sandstone layers of the White River Group that are richer in iron oxides.

Multi-coloured beds of the Disturbed Zone occur toward the top of the Cretaceous and may in some ares, be correlated with the K-T boundary.

areas are almost devoid of soil as detritus is rapidly transported away from the steep terrain.

The K-T boundary is poorly defined at Badlands and is subjected to ongoing debate. The boundary is generally ascribed to a unit known as the Disturbed Zone: it reveals evidence of soft sediment deformation. This unit occurs within a poorly defined sequence which was historically known as the Interior Zone, located between the Pierre Shales and the Chadron Group. This is a sequence of brightly coloured beds located between the grey Pierre Shales and overlying sandstones of the Chadron Formation. Many of these rocks are now assigned to the Cretaceous-age Fox Hills Group; others occur at the base of the Eocene, whilst some may mark the K-T boundary. They consist of a sequence of sediments and paleosols and include the well known "Yellow Mounds", localized areas of high relief interpreted as ancient weathering surfaces. In some areas, the Yellow Mounds constitute a well-defined, planar band of paleosols within cliff faces of Cretaceous and Eocene strata.

Climatic conditions at Badlands during the early and mid-Tertiary were generally warm and wet, resulting in a profusion of new animal (notably mammels) and plant species. Episodic floods resulted in remains being quickly buried, such that entire skeletons are commonly preserved. Some fossils are the direct ancestors of modern horses, and it is a mystery as to why horses died out in North America prior to them being reintroduced by Spanish colonists. Ancient turtle shells, one of the most common fossils at Badlands are very similar to current species. Other fossils are of species that have become extinct, such as sabre-toothed cats. Despite fossils of reptiles and birds being discovered, the most important are of huge mammals, including titanotheres, which reached their peak in the Oligocene. One species of these odd-toed ungulates, Brontotherium, attained heights of almost 4 m. Fossils of extinct horses illustrate various evolutionary steps, including changes from three-toed species to ones with one large toe and three smaller toes. An aquatic rhinoceros and ancestors of modern tapirs are examples of animals that are now not found in North America.

Photographs from a visit in 2002

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