GSSA
Geological Society of South Africa

geobulletin

QUARTERLY NEWS BULLETIN ~ **DECEMBER** 2015

VOLUME 58 NO. 4

Conference Invitation
IGC Field Trip
The disappearance of Moses beach

news

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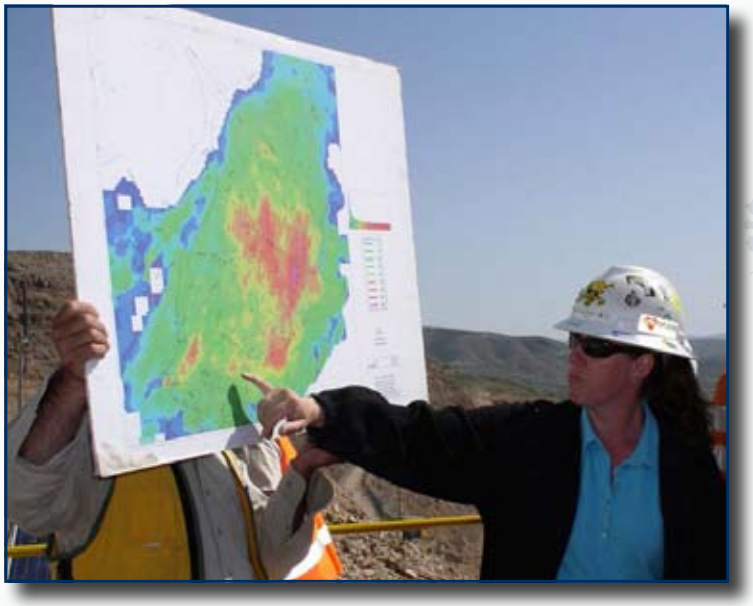

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contents

Cover: *Maggie Newman's dinosaur poster with simple labels, prepared for World Science Day, 10th November, 2015.*

Centrefold: *Maggie Newman's depiction of the Cape West Coast during the Pliocene. A bear-sized wolverine, Plesiogulo, defends its prey, the giant pig, Nyanzachoerus, from an ancestral striped hyena, Ikelohyaena abronia. Approaching from the granite koppie to the left is a giant short-faced bear, Agriotherium, thought to have been largely a scavenger.*
Below the koppie is an ancestral rhino, Ceratotherium, and on the grasslands a herd of extinct buffalo, probably restricted to forested areas. Other herbivores include Mesembriportax, an extinct relative of the India nilgai; three giraffids, including the short-necked giraffe, Sivatherium, browsing in the distance; and relatives of the living steenbuck, hartebeest and waterbuck.
The exceptional assemblage of bird fossils from the Varswater Formation is represented by a francolin and extinct vultures related to the black and lappet-faced vultures.
In the foreground on the left is a relative of the living climbing mice. On the right is a chameleon, yet to be identified.
The forest contains yellowwoods, Cape chestnut, olive and white stinkwood, with the palms, Hyphaene flourishing close to the water. Unidentified fynbos pollens are artistically represented by Protea burchelli to the left, Protea repens on the koppie and Leucospermum tomentosum to the right. Fynbos plants, the restio Thamnochortus spicigerus and the geophyte Gladiolus carinatus, complete the picture.

GSSA
GB (GEOBULLETIN)
5TH FLOOR CHAMBER OF MINES
HOLLARD STREET
MARSHALLTOWN 2107
GAUTENG
SOUTH AFRICA

PO BOX 61809
MARSHALLTOWN 2107
SOUTH AFRICA

Tel: +27(11)492 3370
Fax: +27(11)492 3371
e-mail: info@gssa.org.za
Web: www.gssa.org.za

COMMITTEE

Convener & Editor: Chris Hatton 082 562 1517
Advertising: Jann Otto 082 568 0432

Design & Layout: Belinda Boyes-Varley 079 129 7748

Printing: Seriti Printing (Pty) Ltd 012 333 9757

All submissions to (in order of preference):
email attachments (in Word .doc) to: chatton@geoscience.org.za
disc/hard copy to: Chris Hatton
Postal Address: Council for Geoscience
Private Bag X112
Pretoria
South Africa 0001
Tel : + 27 (0) 12 841 1149
General Fax: 086 679 8591

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* Casual insertions • 4+ insertions

from the editor's desk

Chris Hatton

Bruce Springsteen is a widely misunderstood artist. This is probably deliberate; consider the lyrics, 'End up like a dog that's been beat too much Till you spend half your life just covering up Born in the U.S.A.' How could Roland Reagan, and many others, interpret this as a hymn of red-blooded American patriotism, unless the music was deliberately designed to disguise the words? His other Born song, Born to Run, was not as ambiguous. Although the book 'Born to Run' by Christopher McDougall has little to do with escaping suburban confines by jumping onto a suicide machine and recklessly motorcycling to freedom, the theme of pursuing a dream is common to both the song and the book. In the book the dream of the endurance runner is to finish a challenging race, a seemingly senseless activity which is traced back to the primordial dream of identifying an individual antelope, zebra or other suitable target, then running the prey to exhaustion. This long-term planning is seen as the ultimate root of our modern intelligence which now allows us to dream of books, houses, symphonies, cities then act to convert these dreams to reality. As all South African patriots know, the first modern human endurance runners emerged on the shores of Southern Africa. Dave Roberts, whose tragic death and productive career is recorded on p.38 to 40, discovered 'Eve's footprints' at Langebaan and was involved in dating the even older footprints at Nahoon point. Both sets of footprints are associated with hyena footprints. Although the Old Kingdom Egyptians had a go at domesticating hyenas, we have never got on particularly with them, and the association of human and hyena is unlikely to be based on any kind of co-operation between carnivores. With those other endurance hunters, the wolves, it is a different story. One of the mysteries of human evolution is how we managed to out-compete our much tougher Neanderthal cousins. A recent idea from Pat Shipman, a retired anthropologist, is that we formed a strategic alliance where the wolves provided the bursts of speed and the snapping teeth while we brought in the long-distance killing apparatus, the endurance and the planning skills that were necessary if you wanted to bring down a mammoth. So successful was this alliance that we monopolised the mammoth-killing business and drove out the Neanderthals. Unfortunately for the wolves this meant that we multiplied to the point that there was hardly any place left for them to roam free. The ancestors of the grey wolf survived as free agents, but most of those mammoth-hunting wolves opted to rein in their aggressive instincts, not use their teeth on us and adopt the loving gaze, so that now they live among us, well-disguised.

The truly inhumane thing about beating a dog is not so much that it is cruel, but that it is stupid. Now that we understand pack dynamics, thanks among others to that dog-whisperer on the TV programme that went on a bit too long, everybody should realise that a dog is perfectly willing to cooperate with us. Not only are they willing to co-operate, but the joy that the dog displays in its ability to reach the goal you have set before you do, is at least equal to your delight in seeing the dog get there. All it takes is a bit of understanding.

Having successfully domesticated the dog, we now seem intent on domesticating the entire outer skin of

the planet. Some would argue that this is our destiny. For better or for worse we stand at the beginning of the Anthropocene biosphere. So far our attempts to transform the biosphere don't seem to be going very well. The heat wave at the beginning of November might have felt like the earth was biting back. In truth, the processes that go on in the Earth below our feet are benignly indifferent to most of what happens at surface. If we are indeed at the beginning of the 'sixth extinction' this is because the earth is going through a periodic convulsion; the Permian-Triassic extinction, during which almost all oxygen-breathing creatures in the sea died out, took place entirely without human intervention. This is not to say that we are helpless and are doomed to perish in the next mass extinction. These things take time and although the Permian-Triassic extinction was extraordinarily sudden, 'sudden' on our current perceptions of the geological time scale means less than a million years. On a human scale the Permian-Triassic extinction seems to have played itself out over sixty thousand years or so. Even if the 'sixth extinction' started with the melting of the ice, we still have many thousands of years to work out what to do next. High on the agenda should be efforts to work out how the earth works. Of course this is exactly what we geologists think we are doing, but the general public needs to join the party. The International Geological Congress in Cape Town next year will bring together earth scientists from around the world to build the understanding of the Earth, because you need to understand it well enough to explain it simply. Two IGC field trips will include the Permian-Triassic boundary, and a third will focus exclusively on the rocks recording this event. South Africa contains the most complete record of which land-based creatures died out during this event and which made it through. At the end of the day we will understand what went wrong on land. Having learnt the lessons that the rocks can teach us, some form of the human ecosystem will survive the next mass extinction; the next time your dogs look at you quizzically, don't feel guilty for having taken away their freedom. Tell them they backed the winners.

executive managers corner

Craig Smith

This issue of Geobulletin will be the last for 2015, and I would like to thank all of our contributors for providing news, views and articles during the course of the year. And a special thank you goes to our editor, Chris Hatton, our lay-out specialist, Belinda Boyes-Varley, and our advertising consultant, Jann Otto. Thanks also to our advertisers and sponsors, without which we could not publish the bulletin. We are aware that Geobulletin is seen by considerably more pairs of eyes than the GSSA membership, and it is available in both print and digital versions, the digital copy accessible through the GSSA website. Now is the time to plot your 2016 advertising and brand-building spend! Contact Jann Otto, details on the inside cover.

Geoheritage has been in the news in the last few weeks, with Gavin Whitfield having launched his book "50 Must-See Geological Sites in South Africa". The book is available at a special price to year end from the GSSA and will make a great gift for anyone interested in geology. The book is aimed very much at the non-geologist, and is a great addition to

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South African geoheritage and the development of geotourism. I suspect that not everyone will agree with all of Gavin's choices, and we would love to see some debate about this. Maybe there are another 50 sites that should be highlighted. The general public really is taking an interest in South African geology, and we as the professional community of practice need to be mindful of this. The GSSA office frequently receives queries from the public, and we make it a priority to respond to these as best we can.

For those more interested in minerals than outcrops, Bruce Cairncross and Terence McCarthy also launched their new book, "Understanding Minerals and Crystals". As we have come to expect from both authors, the book is incredibly will illustrated, and is a compendium of information about minerals and crystals, from the very basics about crystalline solids to mineral classification and identification to descriptions of various minerals. The book is accessible to specialist scientists as well as the general public. This book is also available at a special price from the GSSA until year end.

Many of you will be looking forward to packing the car and heading for your favourite year-end destination. For those leaving Johannesburg, don't forget to turn out the lights because Eskom needs your electricity. Some will be heading for destinations on the West Coast, and if you are anywhere near Cape Town, Langebaan or Paternoster, do not forget to spend part of a day at the West Coast Fossil Park (http://www.fossilpark.org.za/; also featured in Gavin Whitfield's book). A brand new visitor centre is currently under construction, and while it will not be ready for the 2015 year end, it clearly is going to add to South Africa's geoheritage story. A couple of things about the park impressed me on a recent visit. First is the fact that it's well run, thanks to the dedication of Pippa Haarhof, the manager and champion who is principally responsible for preserving, developing and marketing the site. Second, you will see some pretty amazing five million year old fossil beds, and get a pretty good idea of what South Africa's West Coast megafauna looked like back then. Finally, you can see a very successful example of mine rehabilitation. The open pit phosphate mining activity was the reason the fossils were discovered in the first place, and the site rehabilitation is a great example of how to do it right.

The main event of 2016 will of course be the 35th International Geocongress in Cape Town from August 27 to September 4 (see www.35igc.org). By the time you read this, the super early bird special price period will have lapsed, but the early bird pricing will still be in effect. There is a strong technical program, and a strong response from international contributors. The Organizing Committee would like to see as many abstracts submitted from southern Africa as possible, in order to highlight what is happening in this part of the world. Contributions from industry as well as academia are welcome. The three key themes of the conference are geology in science, geology in the economy, and geology in society. The abstract deadline is the end of January, so it's coming up fast.

Sponsorship and branding opportunities that won't break the bank are available, and we are particularly looking to increase funding to the Geohost program, where we can support deserving delegates from South Africa and Africa, as well as from other developing countries, to attend the meeting. If you or your company would like to provide R40,000 we can partially or fully support an additional two or three deserving young scientists to attend the meeting for each contribution, and you will get recognition for your assistance. Contact the Organizing Committee through myself for more detail or options.

May all our members and their families have a good year end, and please travel safely if you are out on the roads. I have two new year's wishes. First, I hope that the resource sector will regain some health in 2016. At least some analysts and investors believe we are at or near the bottom of the cycle, and are busy spending money and making acquisitions. Let's hope they are right. Second, as I pen this column, parts of South Africa are in a major El Nino driven drought, with severe water restrictions in many areas a possibility. Let's hope for some rain soon; we need this well before year end if the agricultural sector is to have a successful planting season.

Craig Smith

GSSA
Geological Society **of South Africa**

president's column

Jeannette McGill

When one takes on a new role management specialists all comment on what was achieved in the incumbents first 90 days. Well, in my case this 90-day period as President of the Society coincided with the culmination of a personal goal – that of tackling a major mountain on a large mountaineering expedition. So a significant portion of these 90 days was spent attempting to become the first South African woman to summit Manaslu – at 8163m the 8th highest mountain the world.

We completed all the acclimatization rotations and then eventually our summit push was upon the teams. As we went higher nothing seemed in the way of summit success – a good weather window, a consistent pace and good health. The evening at camp 3 (7000m) while resting in the confines of nylon and down we heard over the crackling radio commentary between higher up the mountain, camp 3 and base camp that a 4m wide crevasse had claimed an experienced Sherpa, and the route was waist deep in snow. He was extracted with a dislocated shoulder and evacuated to a Kathmandu hospital and now much of the oxygen was on the uphill side of the gaping hole. Our summit attempt was aborted that night and we returned to base camp hoping to go up yet again on a second summit attempt. Unfortunately ropes remained unfixed and the avalanche risks increased due to snow fall. The objective risks were deemed too serious to pursue. However some teams did continue with one death and one helicopter rescue high on the mountain becoming that outcome blurring the summit successes. Geostatistical and econometric training means that I have dealt with fat tails when a seemingly normal distribution brings a catastrophic outcome. Pursuing these objective risks of venturing under snow laden cornices and on snow laden slopes holds the same dilemma. Our team called it off and all my team mates with young families returned home safely.

With all this time on the mountain I was able to cast some thoughts to the Society and all that we are trying

to do to maintain our relevance, ensure responsibility and persevere for the long-haul: all identical activities that I was embracing on the Himalayan mountain.

I was further able to consider our relevance when I returned: hitting the ground running by representing the Society at "The Joburg Indaba" – the sister indaba to the one held annually in CT as well as now where I pen this during the annual Geological Society of America meeting being held this year in Baltimore.

The Joburg Indaba focused all discussion on "Modernization" and what this means to the mining sector role players. I know that this is a topic all our GSSA members are also grabbling with be it in the private or public sectors, in industry or in academia. With a changing landscape how to we ensure our relevance? This issues will again be broached in the meeting of Associated Societies to the GSA – the GSSA is but one. I will also have the opportunity to update the

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At 7000m on Manaslu in the Himalaya's – September 2015

meeting on the progress of the 35th IGC for 2016. Both of these opportunities allow me constantly deliberate on our relevance as the GSSA going forward.

May I finally take this opportunity to thank the GSSA staff for all their hard work over the 2015 calendar year. May you all have a lovely end of year break, and for those who are travelling near or far: travel safe. May 2016 be a good year for you all.

Dr. Jeannette E. McGill

Council for Geoscience Conference 2016

Council for Geoscience

In pursuit of Excellence in the Geosciences
4–5 February 2016

INVITATION

You are cordially invited to the Council for Geoscience Conference 2016.

The two day conference will provide insight into the scientific work of the organisation and will serve as a platform for discussion around various scientific issues that are of national importance.

The conference will bring together local and international experts, researchers, young scientists and decision makers who will exchange their knowledge, experience and research innovations.

Please join us as we build expertise **"In pursuit of Excellence in the Geosciences".**

Date: 4 to 5 February 2016
Venue: CSIR International Convention Centre
Cost: R2 000 per delegate
: R1 000 for students
This fee does not include accommodation

For general and registration enquiries, please email: CGSConference@geoscience.org.za or log onto www.geoscience.org.za

We look forward to seeing you there!

APPLICATIONS

TO THE RESEARCH, EDUCATION AND INVESTMENT FUND OF THE GSSA (PREVIOUSLY KNOWN AS THE GSSA TRUST FUND)

!! DEADLINE FOR APPLICATIONS: 31 JANUARY 2016

The GSSA Research, Education and Investment Fund (REI Fund – formerly known as the GSSA Trust Fund) is inviting applications from GSSA paid up-members (including post-graduate student members) for grants from the Fund, to be received at the GSSA office not later than 31 January 2016. Applications can be made using the prescribed application form available on the GSSA web site (www.gssa.org.za) or by letter outlining relevant details such as a short description of the project, motivation and budget, and should be forwarded to any of the following addresses:

Postal: GSSA Secretariat
P O Box 61809
Marshalltown 2107

E-mail: info@gssa.org.za
Fax: 011 492 3371

to be received no later than 31 January 2016.

Grants can be applied for to support a variety of Earth Science applications, e.g. to offset analytical and/or publication expenses with regard to research projects, to promote Earth Science awareness through geotourism, geoheritage and geo-education, to attend local and international conferences relevant to particular research projects, and to present research results, for travel grants, or for other worthwhile purposes related to the Earth Sciences. Expenses related to (annual) registration, text books, accommodation, etc. required at Higher Education institutions are not covered.

In 2016, grants to assist GSSA members to attend and present findings at international scientific meetings will be restricted to supporting attendance of the 35th International Geological Congress in Cape Town, 27 August to 4 September.

In particular we welcome applications from post graduate student members and would appreciate it if Heads of Departments at Higher Education Institutions and their staff would inform their students of this opportunity. Grants are usually limited to R15 000 to R20 000 per application but well-motivated applications for larger amounts are also welcome. All applications will be judged on merit and/or the importance to the Society in promoting its image. Note that grants are only awarded to members/student members in good standing.

Applications are screened by the REI Fund Committee by mid-February with input and ratification by the GSSA Management Committee and Council, respectively. In evaluating the applications and recommendations, the Committee considers the merit of each application, and depending on the amount of money available for that year, makes a final decision on the allocation of grants for that year. The decision of the Committee is final and no further correspondence on the matter will be entertained. By following this procedure it is anticipated that applicants will be informed by early to mid-March 2016 whether or not their applications are successful. Recommendations made by the Committee require Council approval, which may delay notifications.

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

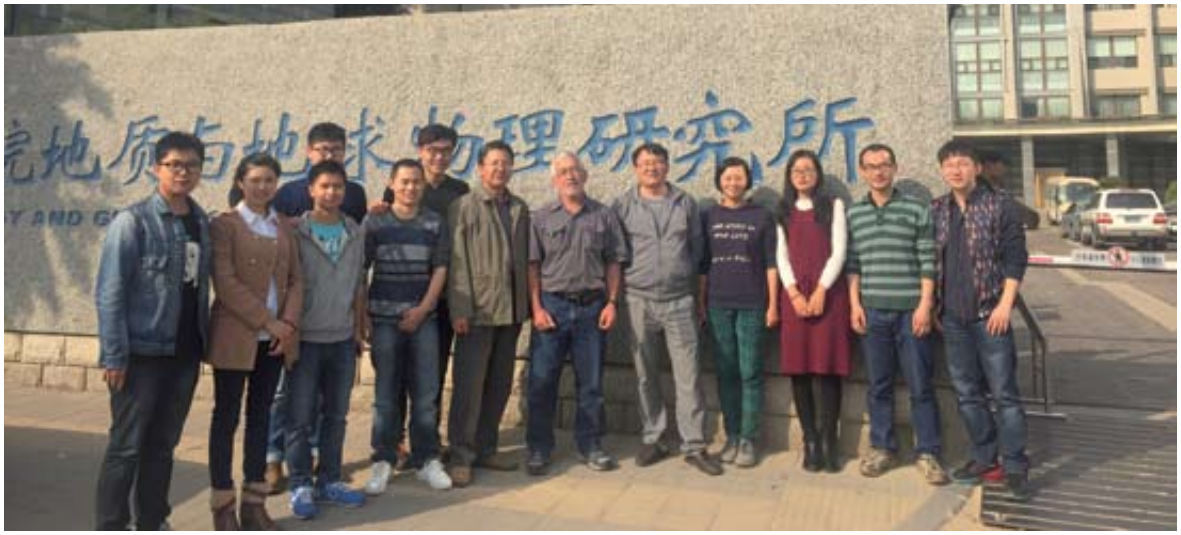
all the news fit to print

UJ

The UJ Department of Geology has had an incredible year in 2015, with continued growth on the academic staff front, new book releases, the successful installation of the Nu Plasma multi-collector ICPMS instrument for isotope analytical work, and much more.

In September, we celebrated Professor Nic Beukes' 70th birthday, and he is active as usual. In October, Nic was invited to Beijing where he delivered several presentations about the formation of Precambrian iron and manganese deposits at the Chinese Academy of Geological Sciences and the Institute of Geology and Geophysics of the Chinese Academy of Sciences. Some of these lectures formed part of a Short Course on "Precambrian Surface Processes" with high-profile presenters from Germany, Canada, and South Africa. In November, Nic received the outstanding "Researcher of the Year" award for 2015 from UJ's Deputy Vice Chancellor Professor Marwala. Nic's humble response to the citation was, via email from a research fundraiser trip in California, "…this can only happen with support from the entire UJ Geology Department; …we work together and collaborate".

In October, the Nu Plasma II multi-collector inductively coupled plasma mass spectrometer (better known as MC-ICPMS) was delivered at the UJ Department of Geology. It was a huge relief to see that the largest instrument parts just fitted into the elevator to bring them up to the Spectrum Analytical Facilities of the UJ Faculty of Science, where the instrument was assembled. After some teething problems during installation, the instrument is performing superbly according to its specifications, and it is now officially signed-on to UJ's growing pool of cutting-edge analytical equipment. We are now waiting for the delivery of the excimer laser ablation component (LA) from another manufacturer, which will make the LA-MC-ICPMS system for various in situ isotope applications on mineral samples complete. The delay of the LA component is caused by a global shortage of laser gases. Our new isotope analytical facility at UJ Geology is in the fortunate position of being able to recruit a full-time instrument scientist, who will be running the LA-MC-ICPMS setup as of 2016. The funding for this position was provided by CIMERA. Sometime in 2016, the new facility will be able to take



Nic Beukes together with participants of the short course on "Precambrian Surface Processes" at the Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing.

Left to right: Jan Kramers (UJ), the Nu Plasma Engineer, and Vincent Tebogo Makhubela (UJ) during a first "tuning" exercise on the Nu Plasma II multi-collector ICPMS instrument at the UJ Department of Geology.

on a wide range of "clever" isotope research projects from partners (including industry) across the country.

Professor Hassina Mouri from UJ Geology continues enthusiastically to establish medical geology as an important new research direction in South Africa. To this end, two new postgraduate students from Kenya (Christa Koki and Patrick Gevera) have joined our department in Johannesburg to work together with Hassina and Dr Lydia Olaka (Nairobi University) on exciting medical geology projects. Their funding is provided by the UJ Global Excellence and Stature Program. In July, Hassina attended the International Conference on Medical Geology in Aveiro (Portugal), and in September she was invited by the Pan African University Institute of Earth and Life Sciences (University of Ibadan, Nigeria) for a lecture series in medical geology that was targeted for MSc students.

In May, Professor Mouri and UJ Geology welcomed Dr Tapo Sarkar from Kiel University in Germany, who started a Faculty of Science sponsored post-doctoral fellowship in the metamorphic petrology group. Tapo will investigate some spectacular granulite facies rocks from India in collaboration with Professor Pulak Sengupta from Kolkata University.

In August, an impressive delegation from UJ Geology (Ashish Dongre, Axel Hofmann, Herve Wabo, Marlina Elburg, Sebastian Tappe) participated in world's most prestigious geochemistry meeting, the Goldschmidt Conference, which was held this year in mesmerizing Prague, Czech Republic. Professor Hofmann delivered a strong Keynote address on the geology of greenstone belts, and Professor Tappe chaired topical sessions on geochemical volatile cycles and diamond/kimberlite geology.

Several UJ Geology academic staff members and post-doctoral fellows will be heavily involved in the planning of the upcoming 35th International Geological Congress in Cape Town, August 2016. Dr Herman van Niekerk will be leading an IGC field trip across the Northern Cape province. Dr Bertus Smith will be organizing a session on sediment-hosted ore deposits, and Dr Jeremie Lehmann will put together a session on the formation of West Gondwanaland. Dr Benjamin Eickmann is calling for abstracts to his session on redox processes in Archean surface environments. Professor Axel Hofmann will coordinate sessions devoted to Early Earth processes, and Professor Hassina Mouri plans a medical geology session. Professor Sebastian Tappe is spearheading a session devoted to the Diamond Mineral System from source to surface in space and time.

Professor Bruce Cairncross was invited as a keynote speaker to the 5th Dallas Mineral Symposium held in

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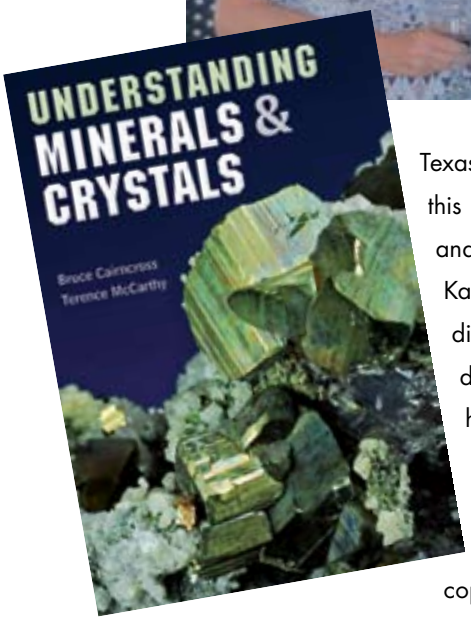
eft to right: Janice Evans and Pippa Parker from Struik Nature, and Bruce and Theresa Cairncross at the recent "Understanding Minerals & Crystals" book launch held at UJ library.



The front cover of the latest book written by Bruce Cairncross (UJ) and Terence McCarthy (Wits).

Texas in August. The theme for this year's event was "Africa" and he gave a talk entitled "The Kalahari Manganese Field: discovery, development and divine minerals". In addition, he presented a second lecture with Dr Robert Bowel of SRK on "Classic and contemporary copper minerals of note from Africa". On the publication front, Bruce and Professor Terence (Spike) McCarthy from Wits had their latest book released in September, entitled "Understanding Minerals & Crystals". There are currently many mineralogy books on the market. In general, these fall into two categories: glossy, almost coffee table books with great illustrations but minimal substantive information; and drab, highly technical books that are difficult to understand for undergraduate students and beginners. The new book aims to bridge the gap through the use of full colour throughout and by providing understandable text describing why minerals and crystals are the way they are and how to identify them. As with previous books by both authors, this latest one is published by Struik Nature.

The members of the UJ Department of Geology would like to thank Professor Bruce Cairncross for his guidance during the many years as the Head of Department. Under "Bruce's watch" UJ Geology has

An enthusiastic 2015 UJ Geology Honours class (and intermingled instructors) during an entertaining historical street car ride around the Kimberley Pipe ("Big Hole"). After a spectacular 15 day geological transect across the Northern Cape province led by Herman van Niekerk and Clarisa Vorster, the field school ends in Kimberley with a one day crash-course in diamond geology provided by Sebastian Tappe.

seen remarkable growth, with an exciting diversification of our research profile. While change is good, the one thing we will certainly hold on to is our world-renowned emphasis on field geology in research and teaching. In the New Year, I will introduce our newly elected Head of Department, who is relatively young but well established in the South African geosciences community.

Sebastian Tappe

University of Limpopo

In October Ivanhoe Mines Limited, the University of Limpopo in South Africa and Laurentian University in Canada launched an educational collaboration between the two universities. The ceremony on the University of Limpopo campus was attended by officials from Laurentian University, the University of Limpopo, Ivanhoe and the South African and Canadian governments.

The principal goal of the five-year partnership is to develop and equip the University of Limpopo's geology department to become a centre of excellence in geosciences. This will be achieved through improved training and curriculum choices in economic geology and mineral exploration at the University of Limpopo; increased teaching and research capacities at the graduate student level; equipping laboratories; purchasing an outdoor vehicle and trailer for field excursions; and collaborating with Laurentian University to improve the University of Limpopo's learning programmes.

Ivanplats also will provide in-service training opportunities for students from both universities and assist them in conducting research on the Northern Limb of the Bushveld Complex.

Ivanhoe Mines, through Ivanplats, has allocated a total of US$2.5 million to the Limpopo and Laurentian universities to fund their partnership during its initial five years. In addition to Ivanhoe's investment, Laurentian University, of Sudbury, Ontario, has been awarded C$500,000 in scholarship funds for the project through the Queen Elizabeth II Graduate Scholarship in Science and Technology (QEII-GSST) Program.

Combined with a C$570,000 scholarship awarded to Laurentian by the International Development Research Corporation, these funds will create educational opportunities for 35 University of Limpopo students to study in Canada. Scholarship funding from the three sources will support under-graduate, Master of Science (MSc) and Doctor of Philosophy (PhD) positions at Laurentian and be focused on topics and research in mineral exploration and economic geology. The QEII-GSST scholarship will fund up to 15 graduate students and faculty from the University of Limpopo to pursue MSc and PhD studies at Laurentian's Department of Earth Sciences.

The funds also will support a number of Laurentian's graduate students to travel to Limpopo for three-to-four-month internships over the course of the first five years of the funding agreement with Ivanhoe. These advanced graduate students will teach and assist junior faculty at the University of Limpopo.

A portion of the funding will be used to hire a full-time academic tutor/program administrator to provide educational and administrative support for the successful completion of designated educational programs for Limpopo students, along with other support typically offered to all Laurentian international students.

Stellenbosch University

Earth Sciences at Stellenbosch we have been very busy, carrying on our core business of teaching and research with considerable success. Our aim is to be a strong component within our university – which has successfully aligned itself as a premier research-driven institution in South Africa. We are concentrating on adapting and developing our teaching methods to suit the changing character of our undergraduate intake as well as paying attention to getting out the research, to maintain our prominent position in petrology, geochemistry, structural geology and tectonics. In the next issue we will highlight major enhancements to our analytical facilities, but here we will concentrate on recent staffing developments at Stellies.

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Susanne Fietz

Two academic staff have recently joined the department and one not-quite-so-new person has never been properly introduced to you. Dr Susanne Fietz (who has German nationality) joined us after her predecessor in the position of lecturer in environmental geochemistrty (Dr Cathy Clarke) defected to her native Soil Science department at Stellenbosch. Susanne received her PhD in Natural Sciences from Humboldt Universität zu Berlin, for her work on current and past environmental changes in Lake Baikal, Siberia. She then joined the University of Essex in the UK, to study exopolymers as potential survival strategies of Antarctic diatoms. Susanne then moved to Universitat Autónoma de Barcelona in Spain, and worked on molecular markers for palaeoclimate reconstructions. Her current research focuses on modern biogeochemical cycles, including biological responses to alterations, as well as on past climate and environmental changes. She studies modern aquatic ecosystems, sedimentation processes and sedimentary archives. Her work is focused on sites in the Southern Ocean (on South Africa's doorstep, and a key player in marine biogeochemical cycles) as well as the Arctic and large lakes such as Baikal.

Ryan Tucker

After the departure of our previous sedimentologist, Dr Daniel Mikeš, we appointed Dr Ryan Tucker, a US citizen, to this position. Ryan's undergraduate studies (Geology with a minor in palaeontology) were in the South Dakota School of Mines and Technology in Rapid City, South Dakota. In 2010, he completed an MSc in vertebrate palaeontology at the same institution, and his 2014 PhD is from James Cook University in Townsville, Australia. Ryan's research interests include sedimentology, stratigraphy and palaeontology. In particular he works on sedimentary environments using chemical tracers of sediment provenance (e.g., detrital zircon geochronology and Lu-Hf isotopes) as well as palaeontology to address questions about the fossil record and the evolution of sedimentary basins. He has existing research collaborations in Australia, North America, France, and across Sub-Saharan Africa and is developing contacts in Thailand and China. He began teaching last year and we recently caught him sneaking some palaeontology into his lectures, something that has not happened at Stellenbosch for a very long while.

Prof. Abraham Rozendaal served a venerable term at Stellenbosch and retired at the end of 2014. For 2015, in the interim, we were fortunate to be able to appoint Prof. Franz Michael (Head of the Department of Mineralogy and Economic Geology, RWTH Aachen University) Meyer as a guest lecturer. Michael is probably well

Michael Meyer

Bjorn von der Heyden

known in South Africa for the decade he spent at Wits in the 1980s and 90s. He very effectively delivered our 2015 undergraduate and honours courses in economic geology.

Turning to the future, Dr Bjorn von der Heyden, who is South African, is our new economic geology lecturer, and joins us after a stint in the private sector, which followed his undergraduate career and 2013 PhD at Stellenbosch. As a student here, Bjorn won the GSSA's Haughton Award for the top geology Honours thesis in South Africa and he carried out much of his PhD research (on iron nano-particle mineralogy) at Princeton University in the USA. An article derived from his PhD was published in no lesser journal than Science. He then spent two years working in the South African mining industry with Exxaro Resources, contributing to their operations at Arnot and Grootegeluk coal mines, the Mayoko iron ore project and their R & D (Mineralogy) unit. He will begin his lecturing duties in 2016.

Our Earth Sciences academic staff complement is now probably the most cosmopolitan in the University. We have three Australians, two Germans, one American, one Dane, one Indian and three South Africans. Of these 6 have current NRF research ratings and we expect that several more will achieve ratings in the near future. As mentioned earlier, our next report will highlight exciting equipment developments that will allow our staff to carry out cutting-edge research.

Wits

School of Geosciences,
University of the Witwatersrand

A busy and productive few months for the School of Geosciences has seen numerous awards and successes amongst staff and students, as well as continued research developments and international collaborations.

Professor Judith Kinnaird has been awarded a B3 NRF rating, while Professor Roger Gibson has been awarded a B2 NRF rating. Hannah Hughes has been awarded a prestigious Claude Leon Postdoctoral Fellowship. Honorary professor, Trond Torsvik, has been awarded the prestigious Arthur Holmes medal by the European Geosciences Union. The medal will be presented to Trond at the annual EGU conference in Vienna in April 2016.

Former PhD student Luke Longridge's paper titled "Amphibolites of the Central Zone: New SHRIMP U-Pb Ages and Implications for the Evolution of the Damara Orogen, Namibia", alongside Judith Kinnaird and Roger Gibson, received the Jubilee Medal. In addition, honours geophysics student, Julius K Frieherr von Ketelhodt, received the GSSA award for best fourth year student for his final year results.

In July, Susan Webb and Musa Manzi organised the annual AfricaArray international geophysics field school. They welcomed participants from across Africa to engage in various geophysical activities on Koppies Kraal farm in the Vredefort Dome. In addition, several students from the US were able to participate as part of an NSF-funded Research Experiences for Undergraduates program. The group of 35 investigated the integrity of a farm dam, delineated faults and overburden thickness, and mapped artefacts at an early homestead. An article about the field school was recently featured on the cover of the education issue of "The Leading Edge", the professional magazine of the

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Front cover of 'The Leading Edge'. This issue features an article on the AfricaArray international geophysics field school.

Society of Exploration Geophysicists (SEG).

At the South African Geophysical Association conference in September, the school's geophysics group had tremendous success. Professor Ray Durrheim was awarded the Dr Rudolf Krahman Medal. This is the highest award presented by SAGA. PhD student Stephanie Scheiber-Enslin was awarded best student talk for her presentation titled "Flexure modelling of the Whitehill Formation: unlocking basin formation". Professor Gordon Cooper was credited with best poster for his presentation titled "Attribute-based time series cross-correlation measures". PhD student, Matt Terracin, received the award for best student poster for his presentation titled "Structural development of the Potchefstroom Fault, Witwatersrand Basin, South Africa".

Dr Grant Bybee has been busy forging collaborative relationships with the University of Maryland and Penn State University. Grant visited Maryland and Dr. Sarah Penniston-Dorland in July, before hosting a visit to Wits and the eastern Bushveld Complex from a team led by Dr Maureen Feineman from Penn State. The team, made up of students funded by the NSF Research Experiences for Undergraduates Program and several staff scientists visited various parts of the Bushveld Complex to view type sections in the region. The on-going research that students and scientists have been performing was presented in parallel with the results of AfricaArray Geophysics Field School.

In September, Grant also led a successful 3-week expedition to southern Angola. This NRF Thuthuka-funded project, involving local and international collaborators, is aimed at exploring the world's largest Proterozoic massif-type anorthosite (the Kunene Complex), understanding what these temporally restricted rocks reveal about magmatism in the Proterozoic as well as broadening our knowledge of regional geology in southern Angola. As part of this project, Katie Hill and Alan Brower (M.Sc. students in the team) will be conducting research trips and

The Kunene-Angola Expedition team with an Africa-shaped anorthosite sample. From left to right: Grant Bybee, Katie Hill, Alan Brower, Jeremie Lehmann and Trishya Owen-Smith

laboratory work at Brown University and the University of Oslo.

Many staff, postdocs and students were busy attending international conferences during the winter months. Lew Ashwal, Susan Webb, Rais Latypov and postdocs Sofya Chistyakova and Ben Hayes all attended the Layered Intrusion Workshop in Potsdam, in August. The workshop also included a day of ICDP Bushveld drilling discussions as collaborators finalise the details of the drilling proposal. The group that visited Potsdam then moved on to Prague to attend the 2015 Goldschmidt conference. They were joined by Grant Bybee, Allan Wilson, Melissa Plail and Hannah Hughes and all presented on their current research during Goldschmidt. Paul Nex, Musa Manzi, Marta Sosnicka and Tremain Woods all attended the annual SGA (Society for Geology Applied to Mineral Deposits) conference, in Nancy. In October, Judith Kinnaird and Paul Nex both attended the SEG (Society of Economic Geologists) meeting in Hobart.

Susan Webb collecting paleomagnetic data at Oxford.

After the GFZ meeting, Susan Webb went on to Oxford University to work with Conall Mac Niocaill for a week on a paleomagnetic project. They are conducting detailed investigations on the reversals that were previously identified in the Bushveld Complex. While there she presented a talk on the geophysical work on the Bushveld Complex.

The School also hosted research visits by professors' Chris Hawkesworth and Tony Naldrett, as collaborative

SAS-SEG group from Wits and UJ who visited Nkomati mine in October.

Attendees of the 2015 Layered Intrusion Workshop and ICDP Bushveld Meeting hosted at GFZ in Potsdam, Germany.

2015 SAS-SEG Geoquiz hosted at the Wanderers Club.

research on the Bushveld Complex continues to develop. Trond Torsvik, from CEED in Olso, Norway will visit in November to continue collaborations. Students in SAS-SEG, from both Wits and UJ, had a successful trip to Nkomati nickel mine in October. Finally, the SAS-SEG hosted its annual Geoquiz in October, which was a huge success.

Ben Hayes, Grant Bybee, and Susan Webb.

council for geoscience

Annual Conference 2016.

The Council for Geoscience (CGS) is hosting its first annual conference in February 2016.

Mosidi Makgae, Chief Operations Officer

The Conference, whose theme is "In pursuit of Excellence in the Geosciences", is aimed at providing insight into the work of the organisation and will be hosted at the CSIR International Convention Centre from 4 to 5 February 2016.

The CGS is involved in various projects aligned with the National Development Plan and this conference will serve as a platform for the organisation to showcase its work.

In addition, the conference will provide a forum for discussion on a wide variety of scientific work of national importance.

The conference will feature presentations from local and international experts, researchers, young scientists and decision makers, with keynote speakers addressing aspects of shale gas and advances in mining practices and the rehabilitation of mines. Discussions around these topics are of national significance and the CGS is playing a pivotal role in research that will trigger robust and well-informed decision making.

The Chief Operations Officer, Dr Mosidi Makgae and her team of scientists will highlight work that has been done to achieve the organisation's mandate. In line with its obligation, the CGS proactively provides solutions to economic and social developmental issues. Its research programmes are aligned with the needs and aspirations of the national agenda while at the same time adding to geoscientific knowledge and building expertise in pursuit of excellence in the geosciences.

Improved focus has been placed on projects that are funded by the Medium Term Expenditure Framework. These projects include:

- Shale gas programme
- Management of derelict and ownerless mines
- Mine water management programme
- Promotion of exploration and mining investment and
- Seismic microzonation of Johannesburg.

These projects not only improve scientific knowledge but also aim to deliver key outputs of national importance.

With presentations of papers and posters, the CGS hopes to provide young geoscientists the opportunity to showcase their research and to network with experts in different fields of study. The event is expected to help to share expertise and knowledge as well as to improve the general understanding of research currently being undertaken by young geoscientists in the country.
This conference promises to be informative and insightful.

For more information on the conference, please visit the CGS website at:
www.geoscience.org.za.

Lionel Muchirahondo

Council for Geoscience
Applied Geoscience Solutions

MINSA excursion,

Meet-You-Halfway-There.

PART I

Well…it all started about two years ago when members of MINSA noted there was not enough cohesion between Gauteng and other members of MINSA (specifically those towards the south, more especially members from Cape Town). Personally at this time, I thought that there were not enough excursions. It occurred to me after a particularly inspiring trip to Bloemfontein organised by Annegret Lombard for work colleagues, that Bloemfontein was approximately "half-way between" Pretoria and Cape Town and that the possibility existed of organising a trip to Bloemfontein to explicitly try to build more cohesion between MINSA's

Jennifer explaining to Doug something about the intricacies of moving fossils without breaking them…. Petra (far left) and Keshree look on.

various members. and that this could be done under the guise of a fossil outing (for the most part). I began organising the trip as the "Meet-You-Halfway-There" weekend field trip, and as such it remained. With some further ideas and contacts thrown around, the tour leaders would eventually become the good doctors: Johan Loock (in situ Karoo fossils), Jennifer Botha-Brink (National Museum Fossils of Karoo type) and James Brink (Florisbad Fossils).

Friday the 17th of October saw all participants make our way to Bloemfontein, to check out the palaeontological, geological, zoological and cultural exhibits of the National Museum housed in Bloemfontein.

What we didn't expect was that Jennifer would be so kind as to take us into the very laboratories where fossils were prepared ("backstage" into the belly of the scientific operation as it were) and where we ourselves would be given the chance to clean fossils ourselves under the guidance of expert technicians with the pint-sized rock drills!

Keshree looks on as an experienced technician shows the ropes of extracting fossils from rocks.

Some very impressive fossils were shown in the laboratory including a new species of dinosaur named after Nelson Mandela (for the publication article please visit: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0111154 and the GSSA facebook page), but gaping mouths were garnered by a fossil of a young lystrosaurus curled up in a foetal position suggesting that it had been in an egg.

After some more mulling around at the museum, specifically looking at the massive although somewhat morbid collection of stuffed animals (some of which looked like they had been taken by total surprise at their "stuffing"), we headed off to a local "student joint" at Petra's suggestion, she being quite familiar with Bloemfontein and its surrounds. After accepting that we were not as young as we once thought we were, we headed off to a bit more of a vintage-style restaurant, had a meal, discussed rock (classic, punk, hard), said our goodbyes and headed to bed, to be ready for the most exercise laden part of the trip on the morrow.

PART II

The morrow would entail fish fossils, lystrosaurus fossils, hiking, Anglo-Boer War anecdotes, pomelo picking, first aid inductions, water divining and plenty of sexist jokes.

First off, our leader for the day Dr Johan Loock would enlist the aid of a good friend of his to demonstrate palaeoniscoid fish fossils from the Carboniferous-Jurassic periods. After an amusing anecdote about how the fishes must have been males (they all died with their mouths closed; females would have died with their mouths open – NOT the author's joke), a short discussion about aquifer geography and geology was given by Prof. Loock, noting the typical characteristic of Karoo dolerites being aquicludes (the hanging walls of the dolerites typically being aquifers). Passing by an old cow stockade, Prof. Loock related how it was used during the Anglo-Boer war to house prisoners from the British side. It was then time for a short hike to view lystrosaurus fossils preserved in situ within the Beaufort Group in the surrounds of Dewetsdorp. This was interspersed with discussions on sustainability and palaeogeomorphology.

There comes a time for anyone who is passionate enough about their vocation, to bleed for their craft… and that time came for Prof. Loock on our way back from the lystrosaurus fossils.

We had initially needed to scale a low (-ish?) barbed wire fence to make our way to where we were going and we now had to rescale the same fence to get back to our cars. A missed step caused Prof. Johan to tumble over and graze his arm lightly on the fence. Doug having just become the proud owner of a new triangular bandage was adamant to not let this providence slip

Prof Loock (staff in hand) guiding Nic, Keshree and Petra to view in situ lystrosaurus fossils. It was this barbed wire fence that Prof. Loock would later graze himself on.

Doug applying first aid to Prof. Loock after a collision with a barbed wire fence. Keshree and Nic assist.

That triangular bandage just keeps on going round… and round… and round.

away from him. Ably assisted by Nic, Doug proceeded to wrap Prof. Loock's arm somewhat like one would wrap a corn dog in pastry, but this sufficed until better gauze was found for the "operation".

The day ended with a very pleasant picnic lunch under the ubiquitous bluegum trees and I made sure that I picked up some Pomelo fruit from Prof. Loock's farm to make some marmalade when I returned to Joburg. Some of us when dropping off Prof. Loock were also fortunate enough to see some of his antique books which were on the order of hundreds of years old, written in a Jan van Riebeck style dutch.

PART III

The last day saw a very exciting excursion to the Florisbad Spring site to view Florisian mammal fossils (600 000 to 10 000 years ago) and Middle Stone Age archaeological artefacts. Ably led by Dr James Brink, a cursory introduction to the areas geomorphology and palaeoclimate put things in perspective. We then proceeded to one of the original stratigraphic excavations to witness the depositional history of the area. At approximately 12 m deep, with no safety harnesses, steep sides (between 70 to 80 degrees) and black plastic deceptively covering the excavation,

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Clearly visible stratigraphy demonstrating red/brown dry oxidising conditions intercalated with grey damp reducing conditions. Varves are especially visible in the grey swampy/marshy strata.

SHEQ representatives would have had a hernia allowing us to view the hole. Yet Dr Brink seemed pretty sure in his footing, so no immediate danger was witnessed. It did however bring to mind indemnity forms (or rather our lack thereof). An explanation of the stratigraphy was given, pointing out where in the strata certain fossils and artefacts were found, and an explanation was given about the difference between the grey swampy/marshy, wet, reducing horizons with seasonal varves and the red, dry, oxidising horizons.

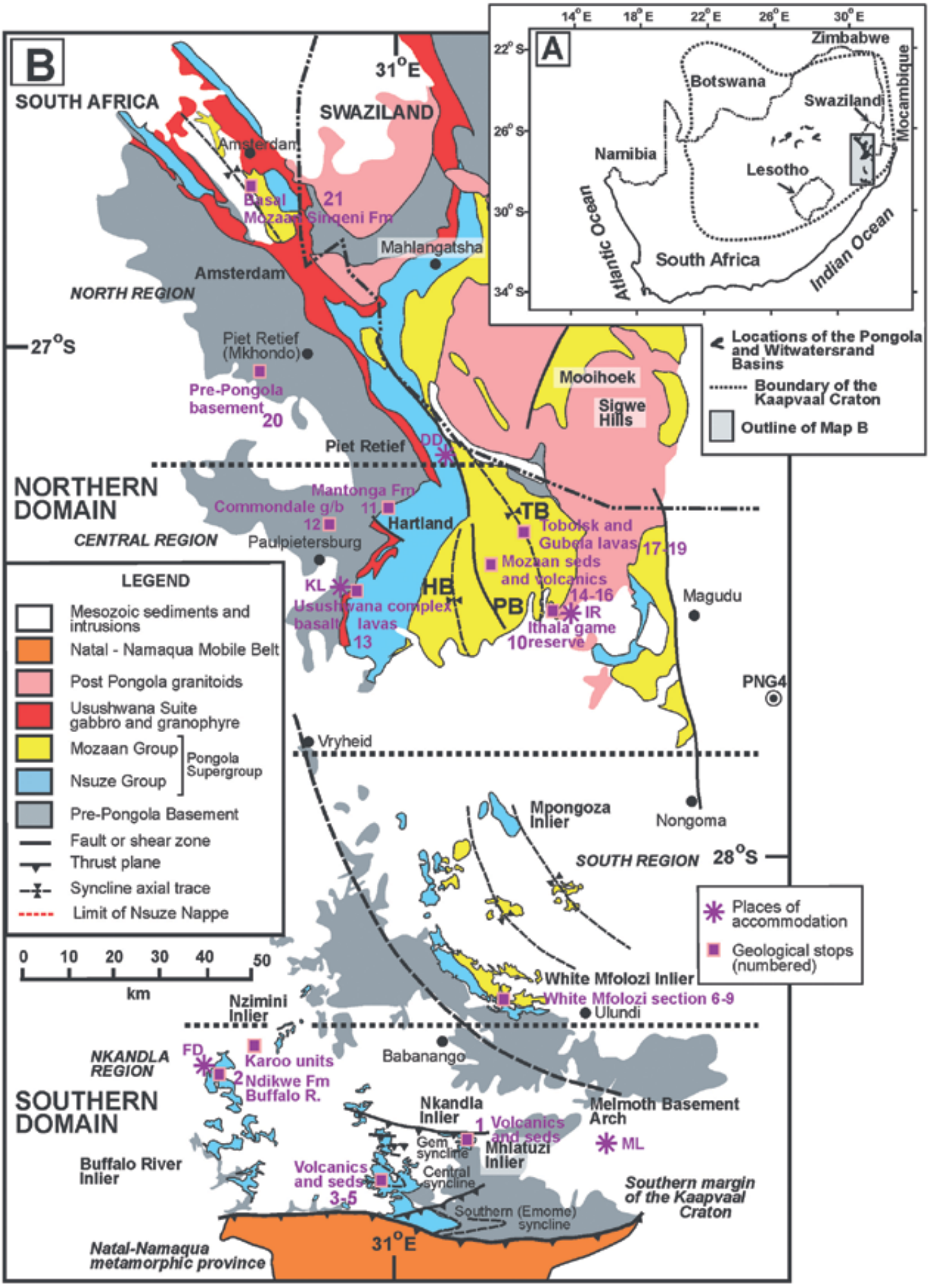
After a short diversion to the springs themselves, with an introduction to their history and mystical healing properties (and an invitation to try these for ourselves after the excursion proper), we then made our way to the fossil archive/storage unit. Fossils upon fossils were shown to us, sorted according to taxa with some pretty sophisticated stone tools also being on display. Probably the most impressive were a skull of a fossilized buffalo with horns spanning the length of a man and archaic wildebeest fossils tracking the divergence between black and blue wildebeests. A very beautiful jaspilite hand axe was also on display – a coveted item I'm sure.

Middle Stone Age artefacts. Note banded jaspilite axe second from bottom.

A short dip in the local springs to cure our ailments, had us feeling refreshed for our way back home. Along the way we stopped at a small village called "Soutpan" for coffee, where indeed salt is mined from a local salt pan. The small town folk hospitality was exceptional for we were treated to an impromptu rendition of the national anthem by a group of local children using recycled plastic bottles as trumpets. The milktert-in-a-cup also hit the spot rather nicely for our way back home.

MINSA is always looking for excursion ideas or leaders. If you have a great idea but are not in a position to lead an excursion let us know anyway and we'll try to make it happen. Contact the editor or author. MINSA also has an archive of previous excursion tour/field

Small towns have a sense of humour…a local bed and breakfast in Soutpan.



Geological map of the Pongola Supergroup in SE South Africa and Swaziland. The various stops on the field trip are numbered and the places of accommodation are shown as follows:

FD – Fugitives Drift ML- Mtonjeneni Lodge KL- Koubad Lodge

IR - Ithala Game Reserve DD - Dawn-Till-Dusk Country lodge.

IGC field trip

THE PONGOLA SUPERGROUP:
EARTH'S OLDEST STABLE CONTINENTAL MARGIN

The c. 2.9 Ga Pongola Supergroup located in the SE Kaapvaal Craton is one of the best preserved Archaean terranes in the world. It is made up of sequences of volcanic and sedimentary rocks that extend as a linear belt in a north-south direction for 270 km in SE South Africa (adjacent map, after Wilson *et al.* (2013)). It is unique amongst supracrustal terrains of this age because its relatively undeformed state affords a rare opportunity to study volcanic and surface processes from rocks in an almost pristine state over a wide geographic extent. The sequence was deposited in a stable continental margin environment with extensive epicratonic volcanism and basin sedimentation. It formed in the period of transition between the general steeply-dipping and highly deformed early Archaean greenstone belts, exemplified by the Barberton Mountain land, to the extensive late Archaean Witwatersrand and Ventersdorp crustal basins.

The purpose of the field trip is to allow participants to view the entire length of the Pongola Supergroup, examining the wide range of rock types from the base to the top of sections, which, at their thickest exceed 9 000 m. An appreciation will be gained of the major variations along the length of the belt including the marked changes in thickness, enabling a reconstruction of the environment of surface processes on the early Earth. The field area is also located in some of the most beautiful and spectacular countryside in South Africa, in an area steeped in history and with superlative accommodation.

The Pongola Supergroup of craton-wide extent developed as two separate basins (Gold, 2006), delineated as the Northern and Southern Domains and into distinct geographic regions: north, central, south, and the Nkandla region in the far south. The north and central regions extend into western Swaziland. In contrast to the northern region, the Nkandla region in the far south has been folded in three main synclines and block-faulted, causing repetition of the stratigraphy. In the south region of the Northern Domain, and in the Nkandla region, the Pongola successions are exposed as distinct inliers each with specific names.

The type sections for all parts of the Pongola Supergroup are located in the Northern Domain but lithostratigraphic correlations, particularly for the Southern Domain, remain debatable and are constantly evolving with continued studies. The lower, dominantly volcanic succession is called the Nsuze Group (4300 m thick in the type area) overlain by the dominantly sedimentary succession of the Mozaan Group (4 800 m thick) (Gold, 2006). The volcanic rocks range from komatiitic basalt to rhyolite and all will be viewed at various stops during the field trip with textures ranging from pillow lavas, classic pahoehoe-textured flow units, pyroclastic rocks and accretionary lapilli. The sedimentary successions include cross-bedded sandstones, pelites, mixed volcanic ash quartz-arenite deposits, stromatolites, banded iron formation and glacial diamictite. On the economic geology side the site of Stanhope mine will be visited as well as the major shear-hosted gold deposit at Klipwal Mine.

Important side aspects of the trip will be to visit the Isandlwana battle site where the British expeditionary force in Natal was comprehensibly defeated by the Zulus on 22nd January, 1879. The short tour to the battle site will be conducted by historian Andrew Rattray. One overnight stop will be at the Ithala Game reserve with spectacular views of the Mozaan sedimentary sequence.

The tour starts from King Shaka International Airport and will head through the c. 1000 Ma Natal-Namaqua Metamorphic Province passing through Devonian sandstones of the Natal Group and the lowest stratigraphy of the Karoo Supergroup. The first stop will be at the Mhlatuzi inlier and Stanhope Mine site. Metavolcanic lava units of the Nsuze Group are

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The Buffalo River near Fugitive's Drift showing the steeply dipping quartzite and pyroclastic units unconformably overlain by lower Karoo sediments with the imposing Isandlwana Mountain in the background, site of the famous battle of the same name.

seen together with the lowest conglomerate member of the Mozaan Group (Sinqeni Formation) exploited for gold at the old Stanhope Mine with workings still visible (Stop 1).

A 60 km drive to the west takes us through the rolling hills of eastern KwaZulu-Natal where traditional Zulu homesteads and villages on steep-sided mountains will be observed. The trip passes by the iconic 'Sphinx-shaped' Karoo sandstone mountain, the site of the great battle of Isandlwana, and then across the Buffalo River to the first evening stop at the world renowned and exclusive Fugitives Drift Lodge. The spectacular view at Fugitives Drift is of the Buffalo River (Stop 2) cutting through steeply dipping units of volcanic and sedimentary units of the Pongola Supergroup in the Buffalo River inlier.

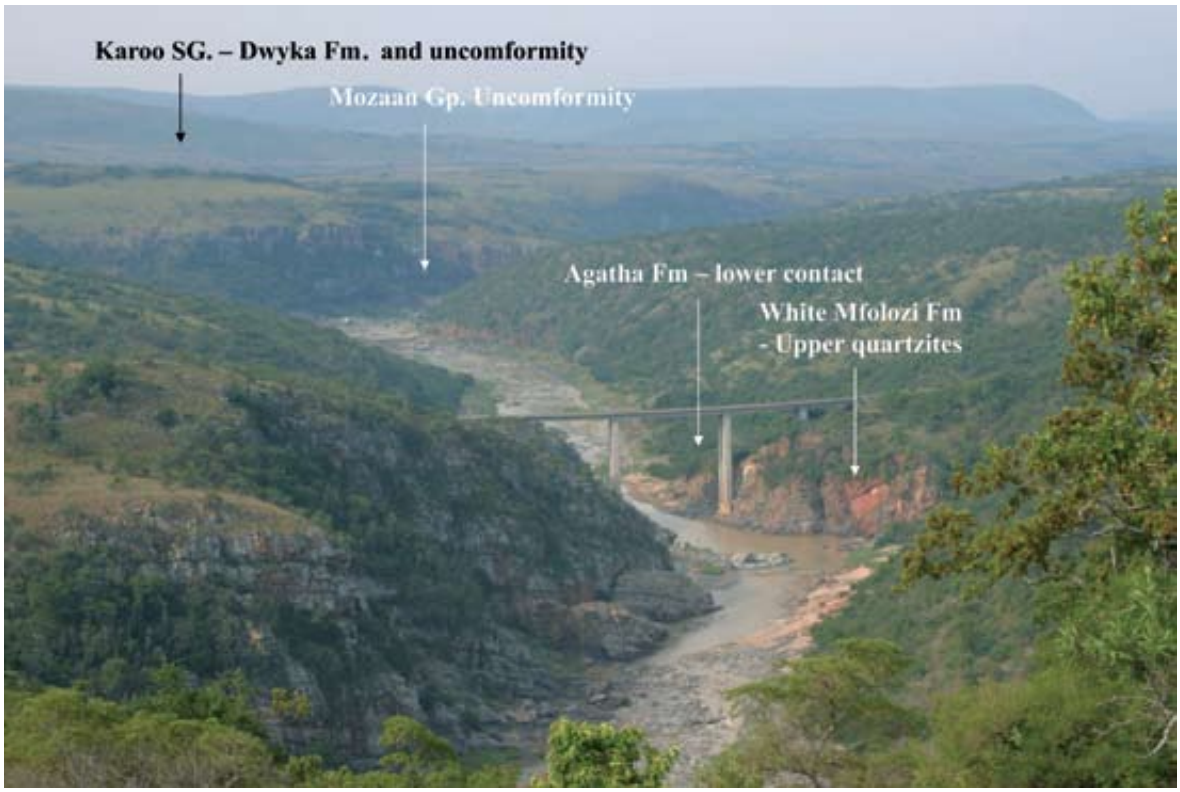
The next morning (**DAY 2**) commences with a two hour visit to the Isandlwana Battle Site of 22nd January, 1879. The mega-cross beds of the Karoo Vryheid Formation make up the mountain, where the history will be recounted in great detail by expert historians. We will then visit the sediments and volcanic rocks of the Central Syncline (Stops 3 – 5 on map, p 22) with spectacular views of the folded sequence in the Nsuze River. Accommodation that night will be at the luxury Mtonjeneni Lodge close to the town of Melmoth.

The next day (**DAY 3**) will be a walking traverse through the spectacular gorge of the White Mfolozi River (Stops 6 and 7).

We will view the cross-bedded arenites, stromatolites, mafic tuff and diamictite in this section, then the superbly preserved lavas of the Agatha Formation.

Columnar stromatolites in the White Mfolozi Formation.

Ropey lava at the top of perfectly preserved pahoehoe lava flow units in the White Mfolozi valley.



View of the White Mfolozi valley with the upper quartzites of the White Mfolozi Formation in the foreground, the lavas of the Agatha Formation in the middle overlain by gently dipping (to the east) sediments of the Mozaan Group.

The superbly preserved stromatolites provide unique insights into the evolution of the ancient atmosphere (Beukes & Lowe, 1989). The base of the volcanic Agatha Formation will be examined in the road cut of the R34 where a mafic tuff together with accretionary lapilli are seen overlying the quartzites of the White Mfolozi Formation.

The high Mg, Cr and Ni contents of the fragments attest to an ultramafic magma which was never preserved as flow units.

Cyclical banded tuffs and accretionary lapilli at the base of the volcanic Agatha Formation.

Contact of the lowermost sandstones of the Mozaan Group in contact with sheared pahoehoe lavas of the Nsuze Group.

The second day (**DAY 4**) at the White Mfolozi section will examine the lowermost succession of the Mozaan Formation (Sinqeni Formation). The basal portion of the Sinqeni Formation is most commonly defined by a fluvial conglomeratic succession (Denny Dalton Member), which has its type area at the Denny Dalton Gold Mine, in the White Mfolozi Inlier which will be visited at Stops 8 and 9. The Denny Dalton Member comprises a succession of laterally impersistent gold-bearing conglomerates, granulestones and quartz arenites and is overlain by a succession of mature, coarse-grained quartz arenites. Higher in the succession of the Sinqeni Formation is a spectacular exposure of the sandstones overlying sheared lavas of the Agatha Formation.

The lowest of the jaspilitic banded iron formation units of the Mozaan Group will then be examined.

The day will be concluded by a drive through the picturesque northern Zululand to the Ithala Game Reserve. The cliffs of the Mozaan Group quartzites (Stop 10) will be viewed and an evening game drive will be arranged either that evening or the next morning.

Departing the game reserve the first stop of **DAY 5** will examine closely the basal contact of the lowest unit of the Pongola Supergroup (the Mantonga Formation) in the vicinity of Paulpietersburg (Stop 11). This feature shows the world's oldest clearly established palaeosaprolite in which coarse-grained sandstone to gritstone overlie weathered early Archaean granodiorite (Matthews & Scharrer, 1968).

Ultramafic fragments contained within the basement granitoid and close to the contact of the Pongola

The lowermost contact of sandstones of the Mantonga Formation overlying the palaeosaprolite formed by subaerial weathering of the Archaean basement granodiorite.

Banded iron formation and ferruginous shale units of the Sinqeni Formation in the White Mfolozi valley.

Lava flows of the Pypklipberg Formation in the background incised by the Bivane River at Koubad Lodge

rocks will be examined. Close to this same area the c.3.3 Ga ultradepleted komatiites of the Commondale greenstone belt will be visited as well as a banded iron formation underlying the komatiites (Stop 12).

On proceeding to the night stop at the beautiful Koubad Lodge, the lowermost unit of Nsuze Group lavas (Pypklipberg Formation) in the Northern Domain will be viewed as well as intrusive gabbros of the extensive Usushwana Complex (see map, p 22) (Stop 13).

DAY 6 will be spent viewing the Mozaan Group in the type Hartland area (Stops 14 – 16). The structural complexity will be demonstrated on the basis of the three major depositional basins in the area. Strike-slip shear zones separate the basins and have given rise to significant gold showings some of which have been exploited in the Altona and Klipwal gold mines. A major banded iron formation is demonstrated by the Scott's Hill Member. Within the Klipwal Member is an 80-m thick diamictite, arguably the world's oldest clearly recognizable glacial deposit (Young *et al.*, 1998). Higher in the succession the two lava units within the Mozaan Group will be visited (Stops 17 – 19). The Tobolsk Formation has pyroclastic and reworked ash deposits together with pillow lavas and the pyroclastic rocks of the Gabela Formation lavas represent the highest preserved unit of the Mozaan Group. Accommodation will be at the picturesque luxury Dusk-to-Dawn Lodge overlooking the hills of the lower Nsuze Group.

DAY 7 is the return to Johannesburg and Stop 20 will be at the Piet Retief quarry where the complexly deformed basement tonalite/granodiorite to the Pongola Supergroup can be viewed. The final stop (Stop 21) will be where the road cuts through the spectacularly exposed quartzite units and interbedded shales of the Sinqeni Formation in the most northerly occurrence of the Pongola Supergroup.

Note: Program may be changed without notice due to unforeseen circumstances

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Allan Wilson, Nigel Hicks and Digby Gold

the disappearance of Moses Beach

The disappearance of Moses Beach, Clifton (Cape Town), over Christmas 2014- caught in the act!

Dr Sharad Master is a researcher and lecturer in geology in the School of Geosciences at the University of the Witwatersrand, Johannesburg. He came to Cape Town to have a holiday. Instead, he was forced to watch his favourite beach disappear, from the balcony of his holiday apartment!

The summer of 2014 had produced very unseasonably windy and rainy weather in Cape Town, and for a couple of days, around Christmas, from about 25 to 26 December, winds blew incessantly, churning up the oceans, and turning Clifton Bay into a roiling, seething, tumbling maelstrom of furious waves, surf, and seafoam whipped up from the mucilage secreted by shredded kelp fronds from the relentlessly buffeted kelp forests growing among the rocks. The atmosphere reeked of kelp and iodine as an organic haze hung over Clifton Bay like a thick white mist. Cape Town finally had a White Christmas, and it was not due to snow!

Wed 24th December 9:45 AM Moses Beach revealed at neap tide, with "Moses rock" exposed in the surf. In the background are the four famous Clifton Beaches, 1,2,3 and 4, with the peaks of The Twelve Apostles under cloud.

When calm finally returned to Cape Town, and hot dry days marked the return of typical holiday weather, the crowds returned to the Clifton beaches. But something was odd: a regular beachgoer recognized that his favourite rock outcrop in the sea off Second Beach, Clifton, which used to be 5m from the edge of the water, was now 10m away- the beach had shrunk! More worryingly, the least known of the Clifton beaches, the northernmost one (closest to Bantry Bay), called Moses Beach, which had been spectacularly revealed as a lovely sandy beach during the neap tide of a few days before, had completely disappeared. It was as if the tide came in one day, and never left! Now the waves are permanently breaking against rocks which used to be 10m from the sea! And where there was a sandy beach, the waters, when clear or retreating, reveal low outcrops of granite which were formerly covered by the beach sand.

The following photographs reveal the very sudden disappearance of Moses Beach. It was very pleasantly exposed during the low tide on 24th December, as a lovely, smooth beach with pristine sands, ringed by rounded granite outcrops. Christmas Day was rainy and windy. The 26th of December was when the storm surge really hit Clifton Bay, inundating the beaches. The raging waters turned cream from all the sand that was being carried away in them. When calm returned, and the sun came out, the Moses Beach was gone!

In May 1984, there was a huge sea swell, due to a storm surge, that caused the sea to overrun the main road in Camp's Bay, and the tidal pool in Camps Bay was completely filled up with sand. At the same time, however, the storm surge washed away all the sand from the Clifton beaches, leaving the bare granite substrate exposed [2]. The storm surge of Christmas 2014 has carried away the sand from Moses Beach, and if the previous instance of this happening at Clifton 30 years ago is to be relied on, it may take a few months before the sand is re-deposited on Moses Beach, and on the

other four Clifton Beaches (Clifton 1, 2, 3 and 4), which have also lost a lot of sand. What happened to all the beach sand? It was taken out to sea by the ebb flow from the storm surge, and has been deposited in a submarine sand dune system in the shallow shelf off Clifton Bay. Gradually, over the next few months, and perhaps with a few good storms, the waves will stir up this sediment, and it will be returned in increments to nourish and replenish the beaches with sand. This is a natural process, and reminds us why the Cape of Good Hope is also known as the Cape of Storms!

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27 December 3:15 PM- Moses Beach is gone!

29 December 2014, 6:01 PM. A sunny afternoon, with sunseekers out on First Beach, in the background on the right. However, on the left, in the middleground- Moses Beach has disappeared, and where there was sand just a few days before, there are now rounded granite outcrops poking out of the shallow water in the surf zone! Compare this photo with the one taken on the 24th December.

26 December 2014, 7:26 AM. A storm surge has resulted in a roiling, surf-covered sea completely inundating Moses Beach. A white organic mist hangs over Clifton Bay.

26 December 4:01 PM- Moses Beach, on the left still has recognizable sand, which is now being washed away, rendering the turbulent waters a creamy colour.

THE SOUTH AFRICAN MINERAL CODES

THE SAMREC/SAMVAL COMPANION VOLUME CONFERENCE

An Industry Standard for Mining Professionals in South Africa

17–18 May 2016, Johannesburg

BACKGROUND

The SAMREC and SAMVAL Codes have been updated and will be released in 2016. In the process of updating these Codes numerous aspects were discussed that required more explanation and guidelines than could be included in the codes. In addition it was noted that the SAMCODES have no recognised guidelines or recognised standards, besides the coal commodity specific SANS 10320 National Standard

OBJECTIVES

The conference provides Competent Persons and Competent Valuators the opportunity to prepare and present details of recognised standards and industry benchmarks in all aspects of the SAMREC and SAMVAL Codes. These contributions will be collated into a Companion Volume to provide a guideline and industry standard for the public reporting of Exploration Results, Mineral Resources and Mineral Reserves and the Valuation of Mineral Projects.

The conference will provide a wide range of information pertaining to industry best practice including aspects of a various geological deposit types, commodities, permitting and legal obligations, resource estimation, mining engineering methodologies, metallurgical and process arrangements, engineering/infrastructure design, social and environmental factors etc for SAMREC Code reporting. Other papers will cover the application of the various methods of valuation and where and when they should be applied in accordance with the SAMVAL Code.

This is a valuable opportunity to be involved in the compilation of industry standards and benchmarks to support in all fields related to the SAMREC and SAMVAL Codes.

WHO SHOULD ATTEND

The conference provides a platform for:

- Resource geologists
- Resource investors
- Project Finance Practitioners
- Exploration geologists
- Geoscientists
- Mining engineers
- Mineral Resource and Reserve managers
- Mineral Resource and Reserve practitioners
- Competent Valuators.

SAMREC CODE

Exploration Targets

Reporting of Exploration Results
Exploration Targets
Target generation

Mineral Resources

Geological data collection
Drilling techniques and drilling density
Bulk density
Sampling theory
QA/QC
Sampling and analysis protocols
Geological interpretation and geological modelling
Mineral Resource estimation
Conditional simulation
Mineral Resource estimation
Classification and reporting
Audits and reviews
Deleterious elements/minerals

Mineral Reserves

The modifying factors
Selecting a mining method
Metallurgy
Markets
Optimal mine scheduling
Cut-off grades
Feasibility studies
Risk assessment in Resource and Reserve
Classification and reporting
Grade reconciliation

Other Aspects

Legal aspects
Environmental
Sustainability issues
Social and labour planning

Diamond Resource and Reserve Reporting

Coal Resource and Reserve Reporting

SAMVAL CODE

Cost Approach

Valuation of exploration properties using the cost approach

Market Approach

A review of market-based approaches
Valuation of mineral properties without Mineral Resources
Valuation methods for exploration properties and undeveloped Mineral Resources

Cashflow Approach

A Review of cashflow approaches
Discounted cash flow analysis input parameters and sensitivity
Discounted cash flow analysis methodology and discount rates
The valuation of advanced mining projects and operating mines
Valuing mineral opportunities as options

SAIMM
THE SOUTHERN AFRICAN INSTITUTE OF MINING AND METALLURGY

GSSA

SPONSORSHIP

Sponsorship opportunities are available. Companies wishing to sponsor should contact the Conference Co-ordinator.

THE SOUTH AFRICAN MINERAL CODES

THE SAMREC/SAMVAL COMPANION VOLUME CONFERENCE

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Call for papers

CALL FOR PAPERS

Prospective authors are invited to submit titles and abstracts of their papers, in English. The abstracts should be no longer than 500 words.
Authors will be required to register for the conference and present their papers.

For further information contact:
Head of Conferencing, Raymond van der Berg
SAIMM, P O Box 61127, Marshalltown 2107
Tel: (011) 834-1273/7, Fax: (011) 833-8156 or (011) 838-5923
E-mail: raymond@saimm.co.za · Website: http://www.saimm.co.za

KEY DATES

31 July 2015	Submission of abstracts
15 August 2015	Acceptance of abstracts
30 October 2015	Submission of papers
17–18 May 2016	Conference

The Southern African Institute of Mining and Metallurgy
Head of Conferencing, Raymond van der Berg
THE SAMREC/SAMVAL COMPANION VOLUME CONFERENCE
P.O. Box 61127, Marshalltown, 2107, Tel: +27 11 834-1273/7
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☐ I am interested in attending the conference
☐ I intend to submit an abstract of the proposed paper entitled:

Title of paper: . . . . . .

Personal Details: Name . . . . . .

Address . . . . . .

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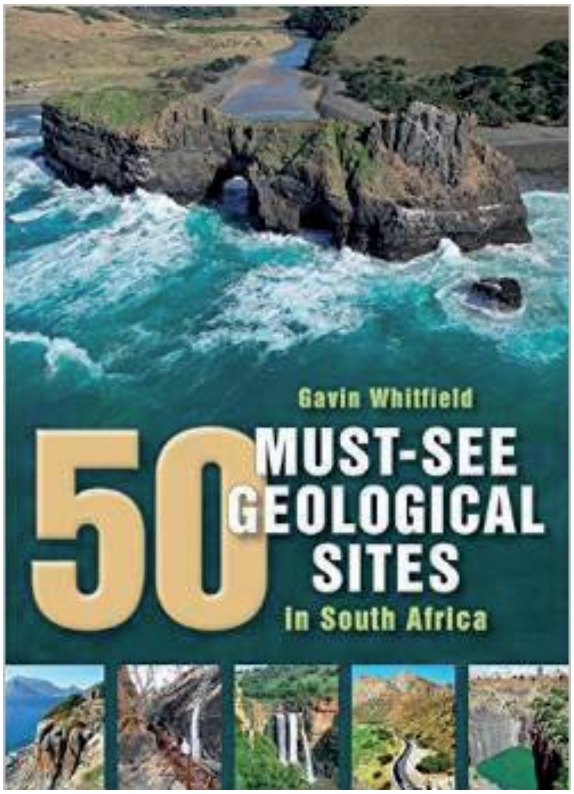
E-mail: . . . . . .

book review: 1

50 Must-See Geological Sites in South Africa
by Gavin Whitfield



During a visit to Dr. Christopher Hatton's office a brown package, couriered to him was delivered. Chris, aware of my curiosity, proceeded to open the package and revealed a brand new book," 50 Must-See Geological Sites in South Africa by Gavin Whitfield. Aware of similar popular geological books in my collection including "An Introduction to South Africa's Geological and Mining Heritage" by M.J. Viljoen and W.U. Reimold published in 1999, "The Story of Earth and Life, A southern African perspective on a 4.6-billion-year journey" by T. McCarthy and Bruce Rubidge published in 2005, "Geological Journeys" authored by Nick Norman and Gavin Whitfield in 2006 and "How on Earth? Answers to riddles on our planet" by T. McCarthy in 2009, my immediate thoughts were "Why another book on Geological Sites as the subject might already be exhausted? Descriptions of geological sites have already been published and this might just be another repetition of the subject". But boy oh boy was I surprised! In the age of electronic media many readers might prefer E-books, Blue Ray- and DVD discs and TV but this book reminded me that books are still the "real thing". Books provide humans with a unique experience. It evokes pleasure through the senses of touch, sight and even aroma, especially that of a new book. Yes, I confess, I am a bibliophile! Information contained in the words in books may evoke all the different emotions of human beings and some provides us with information, sometimes lots of it and in much more detail and this brings me back to the initial question, why?

The book has 320 pages, is approximately 16.5 cm wide, 23.5 cm high and about 2cm thick which makes it slightly smaller than most of its predecessors, but it is ideally suitable to take along as a companion in the field or for normal bedside reading. When you quickly page through the book the first thing you notice are the large amount of vivid, colourful photos, graphs and maps. Where needed, the photos are well annotated and this is discreetly done, without distracting from the image. Sets of photos are provided where attention to detail or the larger environment is needed. All individual photos or sets of photos are printed on the same page, avoiding the appearance of a "fault" when they are printed across pages. There is also a vast amount of colourful and beautifully drawn illustrations and maps that help to illustrate and explain the how's, where's and when's! Among the illustrations there are also some beautiful prints of Maggie Newman paintings and the fossil diorama at Albany Museum, Grahamstown, depicting the scenery during the formation of diamonds and late Beaufort deposition respectively.

The introduction briefly describes some of South Africa's standout geological heritage sites including

the economically important Witwatersrand and Transvaal Basins and the Bushveld igneous Complex, the scenic Vredefort meteorite dome, Waterberg and Soutpansberg, the Cape Fold belt, Karoo Basin and Igneous Province, Great Escarpment and Cradle of Humankind. This is followed by a comprehensive introduction to geology describing the minerals that forms rocks, the classification of igneous, sedimentary and metamorphic rocks, their constituents, and how and where they were formed. The main geological formations in South Africa are also described with the aid of a simplified geological map and a new geological time scale, incorporating internationally recognized Epochs, in the place of now obsolete Eras. Furthermore the method of naming and dating the various geological formations are discussed in a separate coloured box. Geological processes including the rock cycle, plate tectonics and the formation of geological structures like folds, faults, fractures and joints are explained. This is followed by a welcome expansion of the previous explanation in "Geological Journeys "of the presence of and the formation of different landforms and landscapes of South Africa. It includes a map of the various landforms found in South Africa as well as an excellent summary of the most recent interpretation of Maud in 2012 of the major geological events, related time periods and land-surface development, since Gondwana rifting.

In comparison to "Geological Journeys", where geological sites are relatively loosely organized along certain road routes, the 50 sites in this book are very well divided into chapters according to 7 regions, namely the Western, Cape, Southern and Eastern Cape, Central KwaZulu-Natal, Mpumalanga, Limpopo, Gauteng, North West Province and the Northern Cape. The main geology of every region is discussed and it is accompanied, with the exception of the Northern Cape, by excellent geological and landscape maps provided by the Council for Geoscience. The omission of maps of the Northern Cape is understandable as this area is very large and only 5 sites from this area are discussed.

For every site a clear road map and GPS coordinate is provided to locate it and access to the locality is discussed, stopping just short in the provision of contact names and telephone numbers. Last mentioned is understandable as in many instances private individuals may be concerned. Information from every site includes key geological features, geological heritage, landscape and rock formations, topics of local or historical interest and things to do at the site and surrounding area. The last mentioned issue is strongly weighted in favor of visitors who are interested in geology.

The book include several interesting anecdotes; for example that the oldest movable piece of art probably originated from South Africa; the presence of a disjointed world heritage site, separated by hundreds of kilometres; and that artist Thomas Baines painted the crushing of rock at the first gold mine of South Africa. Although the number of 50 might suggest that the description of geological sites in the context of the diverse geology of South Africa is limiting, this book contains a huge amount of geological detail spanning the best known and important geological superlatives, reflecting a major portion of the countriy's geological history. Gavin Whitfield was clearly thorough in the compilation of the book as he incorporated the latest research and interpretations regarding the geological formations in South Africa. I was especially impressed that he showed the correct position of the Black Reef Formation in relation to the Wolkberg Group in the vicinity of the Blyde River Canyon site and at Bourke's Luck potholes. Something that was not achieved by some previous authors and tourist guides. Near the back of the book is a glossary that explains many of the technical terms.

It is hard to criticize a book containing such a wealth of information which is so adequately supported by photos, descriptions and maps. It achieves far more than Gavin Whitfield's initial aim of describing and interpreting sites of geological interest and introducing the reader to geology and geomorphology. As a reviewer, considering that this is a popular guide to geology, you have to dig very deep to criticize this book or find ways on how it might be improved in the future. In order to make further reading more convenient it might be suggested that the list for further reading could be at the end of every site or region. The addition of a vegetation- or veld- type map would be

highly beneficial to those people who want to compare plant distribution with the excellently produced geology and geomorphology maps.

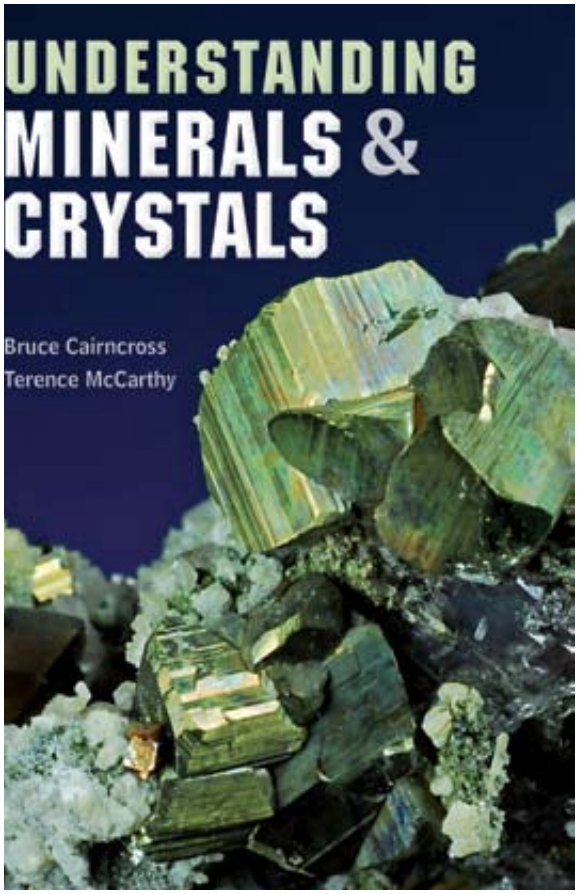
The wealth of geological data in the book that is beautifully illustrated with photographs and graphs will immediately capture the attention of students, professional geologists, amateur geologists, geo-tourists and the general public with a keen interest into geology and scenic South Africa. It will serve as an excellent introduction to geology as a subject, especially from the perspective of Southern Africa's geology. It is foreseen that it may be used by students and laymen as an aid in learning general geological principles, but also to refresh and remind the professional of the basic geologic principles and theory. Some people may use it as a list to tick of places of geological interest that they have visited and use it in their planning of places to visit, while others may use it as an aid to a virtual visit when they read it in their offices or homes or visit the area with Google Earth. The book will go a long way to help popularize geology and to make South Africans and visitors from abroad aware of our rich, deep and interesting geological heritage and superlatives and the publication is timely, with the IGC a few months away.

The book covers the best known and also some of the lesser known geological sites of South Africa and I look forward to a book covering a further 50 sites of the lesser known and "hidden" geological sites of South Africa.

Pieter Bosch

book review: 2

Understanding Minerals and Crystals by Bruce Cairncross and Terence McCarthy



Understanding Minerals and Crystals is written by Profs Bruce Cairncross from the University of Johannesburg and Terence McCarthy from the University of the Witwatersrand. Both are well-known to the larger geo-community as they have previously authored and co-authored popular books about Southern African geology. Their new book presents minerals as the building blocks of rocks, and as the source of much of the raw materials utilized by the global economy. It introduces the science of mineralogy and mineral identification in a very approachable and well-illustrated format that should appeal to a wide audience, from geology students to enthusiasts with a general interest in the world around them.

Understanding Minerals and Crystals comprises two distinct halves: the first half consists of seven chapters

that cover the first 100-odd pages of the book, and presents a comprehensive and detailed introduction to the science of mineralogy. It is followed in the second half of the book by nine chapters spanning a further 200 pages, devoted to describing a variety of common and interesting or important minerals.

The first half of the book introduces crystallography and mineralogy at a level that is technical and in-depth enough to be useful to university students doing courses in mineralogy, but is written such that it can be understood by anyone with a rudimentary background in natural science. The topics covered include a description of atoms, the various types of chemical bonds and crystal structures, followed by explanations of the various crystal forms, crystal classes and the physical properties of minerals. Many useful diagrams and photographs are provided to explain key points, and help to make the text even more approachable. A particularly thoughtful detail is an appendix of crystal models that can be photocopied, cut out and assembled in 3D as a hands-on demonstration of the various crystal forms and types of symmetry.

The second half provides descriptions for some 80 minerals and is divided into chapters according to the Dana classification system. Understandably, the emphasis of this section is on colourful minerals that may appeal to collectors or enthusiasts, although many of the more run-of-the-mill rock forming minerals are included as well. Each chapter begins with a brief explanation of the chemical composition and crystal structure of the mineral group, but the main focus of these chapters is on the presentation of specific minerals. Each mineral is introduced with the etymology of its name and a table of its crystallographic and physical properties, before its diagnostic physical properties, geological association, notable occurrences and uses and applications are briefly discussed. However, the most impressive feature of the mineral descriptions is the ubiquitous large-scale full-colour photographs of museum specimens that vividly bring each mineral to life. The quality of the photographs (and the print production) is typical of what one would expect from a 'coffee table' book, and the photographs alone should be enough to give the book a very general appeal.

Overall, Understanding Minerals and Crystals includes enough science to function as an introductory textbook to mineralogy, rather than just a guide to mineral identification, but it is also approachably written and contains enough spectacular photographs to be of interest to anyone who appreciates the colours, forms and elegance of the natural world.

Johann Diener

obituaries:

Nick Steven

It is with profound sadness that we have to announce the untimely death of our colleague and Life Member of the Geological Society of Namibia, Dr Nick Steven, Consulting Geologist and Directing Member of Rockwater Consulting cc. Nick passed away in Cape Town on Saturday morning, 12 September 2015. Our thoughts and prayers are with the bereaved family, in particular his wife Möwe. May the Lord give them strength during this difficult time.

Nick has had a long-standing association with Namibian Geology, starting off as an exploration geologist in Namibia in the 1980's. His Ph.D. thesis in the early 1990s grew out of this initial work in Namibia and was entitled "A Study of Epigenetic Mineralisation in the Central Zone of the Damara Orogen, Namibia, with Special Reference to Gold, Tungsten, Tin and Rare Earth Elements". Thereafter he worked on numerous exploration projects in Namibia, and was well known for his expertise, in particular his understanding of gold mineralisation. Nick was also a very active member of the Geological Society of Namibia, has given many a talk, and more recently served on the organising committee for the Roy Miller Symposium. His contributions will be sorely missed and we will always have fond memories of him as a colleague and friend. May his soul rest in eternal peace!

Colleagues from the Geological Society of Namibia

David Lester Roberts

14 May 1949 – 25 September 2015

It is with great sadness that we have to report that Dr Dave Roberts passed away in Cape Town on the 25th of September 2015 in a tragic accident at his home in Noordhoek.

Dave was born in London on 14 May 1949. His parents immigrated to South Africa when he was six years old. He always recalled fondly the trip over from England in one of the old mail-ship ocean liners, with him and his brother Andrew having the time of their lives.

Dave matriculated in 1969 at Franklin D. Roosevelt School in Johannesburg. He completed his BSc at Wits in 1975 then obtained a job at Soekor where he worked as a well-site geologist (he was reportedly asked to leave after taking one too many swims off the side of the floating drill rig - something which was "strictly against the rules" - the sort of phase Dave never had much time for. He also worked as a geologist at Gencor (1978 - 1980) and Western Areas Gold Mine (1981 - 1982). Always an academic at heart, Dave left work on the mines to pursue post graduate research at the University of Natal where he was awarded his MSc (1981) and PhD ("Depositional framework and controls on peat accumulation in the Vryheid Formation of Northern Natal (Utrecht and Newcastle areas") in 1985. During his PhD fieldwork he developed an abiding interest in archaeology and palaeontology. This part-time research culminated in his discovery of 'Eve's Footprints' in the West Coast National Park in 1995. The discovery made world headlines.

Dave started work at the Council for Geoscience (CGS) in Pretoria in 1986, working in the Fossil Fuels (coal) Section before transferring to the Cape Town office in 1993. Here he started a research program on Cenozoic geology. His interests also included the palaeoenvironments and palaeoclimates of the Neogene, Pleistocene and Holocene.

Dave explaining the geology around "Eve's footprints" near Langebaan Lagoon.

During this period he undertook extensive field work on the coastal deposits of South Africa and developed new ideas and avenues of research into the Quaternary geology and coastlines of southern Africa. Establishing a marine terraces chronology using OSL dating was one of his major contributions to geoscience. In this regard he distinguished himself as a top-rate geoscientist, making significant contributions to our understanding of the geology of the region both nationally and internationally. This knowledge was invaluable in his neotectonic studies for the determination of seismic hazard in the Eskom Nuclear New Build Programme, the results of which supported a stable continental setting for Southern Africa. His research also linked in with, and contributed substantially to, archaeological stone-age research on the west and south coasts of South Africa. Dave will be remembered as the discoverer and preserver of 'Eve's footprints', a popular name for the set of fossilized footprints found on the shore of Langebaan Lagoon, in 1995. They are thought to be those of a female human and have been dated to approximately 117,000 years ago. This makes them the oldest known footprints of an anatomically-modern human. Dave also worked in Gabon and Madagascar - he was always in search of new scientific challenges and ways to forward our understanding of the recent evolution of our planet and the evolution of paleoclimates.

Dave (right) lowering "Eve's footprints" into the display case at Iziko Museum.

Dave was a man with an abiding passion for the great outdoors, with hiking in his beloved Cape Mountains, and trout fishing in its crystal streams, being amongst his favourite weekend activities. He was always environmentally conscious and was intensely involved in clearing alien vegetation in the Noordhoek area, and surrounds. Dave kept himself in good shape and was a keen runner, having completed several Comrades ultra-marathons in his younger days.

Dave had recently retired from CGS and was looking forward to continuing his research as a Research Fellow at the Department of Geography, University of the Free

☞

Dave and Claire Browning (CGS colleague) stabilise fossil trackways in the Pleistocene aeolianite on the southern cape coastline. Dave felt a strong sense of duty to preserve palaeontological heritage.

State, and had several new projects and publications in the pipeline. He was involved in many diverse research initiatives which ranged from archaeology, Miocene palaeoenvironments, to contributing to a paper on the evolution of the white rhino, as well as assorted geological projects. His contributions to the sciences were substantial and his insights will be greatly missed.

Dave was admired by his colleagues and students for his passion and dedication to science and his ability to explain complex concepts simply. As a person he kept himself extremely fit and trim with all his outside activities, and his appearance and demeanour belied his 66 years. Dave's youthful vigour and vitality makes his passing so much the harder to assimilate. Dave was a man with an impish sense of humour and a keenly attuned sense of the ridiculous. He had no time for humbug and ceremony at all and remained as refreshingly informal in manner and dress as a second year geology student, even when he became a member of the CGS staff. He was a cheery person for whom the phase "do your own thing" might have been invented. He will be sadly missed by the many friends and colleagues whose lives he enriched along the way.

Written by colleagues and friends – compiled at the CGS Bellville

Dave with CGS colleagues sampling river sediment in Gabon.

media monitor

MINING AND EXPLORATION NEWS

Copper

Intrepid Mines has completed an options study for its 100%-owned Kitumba copper project in Zambia that confirms the economic potential. The updated development plan is based on a reduced throughput of between 1.5 and 2.0 Mt per annum at an average head grade of 2.2% copper, producing an average of 37 kt of copper cathode per annum over a 13-year mine life. The project development costs are estimated at US$433 million, a 35% reduction on previous estimates. Intrepid is continuing drilling of high-priority targets in the area surrounding Kitumba in an effort to find additional resources that would further enhance the project economics, and will decide whether to take the project on to full feasibility early in 2016 following the completion of exploration drilling and metallurgical test work.

Gold

Randgold Resources and AngloGold Ashanti have agreed to form a joint venture to redevelop and operate AngloGold Ashanti's Obuasi gold mine in the Ashanti region of Ghana. Obuasi is a large, high-grade deposit with Proven and Probable reserves of 24.53 Mt at 6.70 g/t for 5.29 million ounces. In 2012, AngloGold Ashanti began a programme aimed at transforming the mine into a modern, mechanised operation, and started to develop a decline ramp to help de-bottleneck the underground operation. However, at the end of 2014, the company converted Obuasi to limited operations, ceasing underground production but continuing to process tailings, and started a feasibility study on the redevelopment of the mine. Work on the decline ramp also continued. The development plan, which will be led and funded by Randgold, will build on this feasibility study and is expected to take about four months to complete. If the plan meets both companies' investment criteria, Randgold and AngloGold Ashanti will then be jointly responsible for funding the redevelopment of Obuasi.

INDUSTRIAL MINERALS

Sovereign Metals completed a scoping study of its Duwi flake graphite project in central Malawi, confirming the potential for an operation producing approximately 110 kt of graphite concentrate per annum over an initial 20-year mine life. The initial capital investment would be US$112 million, with a 1.7-year payback, and the life-of-mine operating cost is estimated at US$498 per ton of concentrate (including transport costs FOB Nacala Port in Mozambique). Duwi is one of the world's largest high-grade flake graphite deposits, with resources of 77.3 Mt (35.2 Mt Indicated, 42.1 Mt Inferred) at 7.2% total graphitic carbon (6.13 Mt contained graphite) in the Duwe Main and Duwi Bend deposits, on which the study was based. These deposits make up only about 2.2 km of the overall Duwi trend, which is mineralised over 24 km of strike

Danakili Ltd (previously South Boulder Mines) has established a 347 Mt rock salt resource, (including 28 Mt Measured and 180 Mt Indicated) at an average grade of 96.5% NaCl at area A of the Colluli potash project in Eritrea. The rock salt directly overlies the high-value potassium-bearing salts, and must be extracted but is currently considered waste material in the mine plan and project economics. Mine planning work to date indicates the volume of rock salt to be mined is between 1 and 2 Mt/a for a 425 kt/a sulphate of potash production module. Danakili plans to further evaluate the long-term potential for a large-scale salt business to complement the planned sulphate of potash development following completion of the definitive feasibility study, which is scheduled for the fourth quarter of 2015.

Iron ore

Ferrum Crescent has concluded an earn-in and joint venture agreement with Business Venture Investments No. 1709, a sister company of Ovation Capital, for the completion of the bankable feasibility study on its Moonlight iron project in Limpopo Province. The previously announced memorandum of understanding with Principle Monarchy Investments has been terminated. In terms of the agreement, BVI will fully fund the feasibility study to earn a 43% interest in the project. The study will be conducted in two phases, with the first phase commencing in the fourth quarter of 2015.

PLATINUM GROUP ELEMENTS

Anglo American Platinum agreed to sell its Rustenburg mining and concentrating operations to Sibanye Gold for at least R4.5 billion. The move is in line with the company's strategy to focus on its core assets and shift towards low-cost mechanized operations. The Rustenburg operations consist of the Bathopele, Siphumelele, and Thembelani mining operations, two concentrating plants, an on-site chrome recovery plant, and the Western Limb Tailings Retreatment plant. Through the transaction Sibanye, which is South Africa's largest gold producer and one of the top ten globally, will become the fifth largest global PGM producer, with over 800 000 ounces of annual 4E PGM production. All concentrate produced by the Rustenburg operations will be sold to Anglo American Platinum until the end of 2018, after which Anglo American Platinum will undertake the smelting and refining operations on a toll treatment basis. Subsequently, Sibanye announced a recommended US$294 million (R4 billion) cash offer for Aquarius Platinum, which owns stakes in the Kroondal mine and Platinum Mile retreatment facilities near Rustenburg and the Mimosa joint venture with Impala Platinum in Zimbabwe. The company said that the transaction would enable it to realise synergies between the PGM assets in the Rustenburg area, as well as providing an entry into Zimbabwe, which hosts the world's second largest platinum reserves.

Uranium

A technical study of A-Cap Resources' Letlhakane uranium project in Botswana has shown that the project would be economically viable based on a forecast uranium price of US$81 per pound U_3O_8 . The project would target a production of 3–3.75 million pounds of U_3O_8 per annum over the first five years, gradually decreasing thereafter, with operating costs averaging about US$40 per pound over the 18-year project life. Initial capital costs are estimated at US$351 million, with a payback period of three years from start of production. The study was based on the 2012 resource estimate of 32.6 Mt at 274 ppm Indicated plus 110.7 Mt at 287 ppm Interred, for a total of 89.7 million pounds of U_3O_8. However, an upgraded resource estimate incorporating the 2014 drilling results increased the total contained U_3O_8 to 102.9 million pounds at a higher cut-off (300 ppm vs 200 ppm). The new estimate utilised localized uniform conditioning, which takes into account mining and grade control selectivity.

Vanadium

Bushveld Minerals is acquiring the Brits vanadium project on the western limb of the Bushveld Complex from Sable Metals and Minerals for US$600 000. The project comprises prospecting rights for vanadium, iron ore, and rutile and is located adjacent to Vametco Alloys' primary vanadium mining and processing operation near Brits. The Main Magnetite Layer and associated magnetite layers, including a number of footwall units, have been identified on the property, and carry vanadium values similar to those at the group's flagship Bushveld Vanadium Project in Limpopo Province.

Antony Cowey

Please note that Media Monitor provides an overview of the mining industry; figures quoted in Media Monitor are not necessarily SAMREC compliant. The resource/reserve statements can be sourced from the individual compliant company releases

Troy & Ephesus, Turkey.

THE GEOTRAVELLER

By Roger Scoon

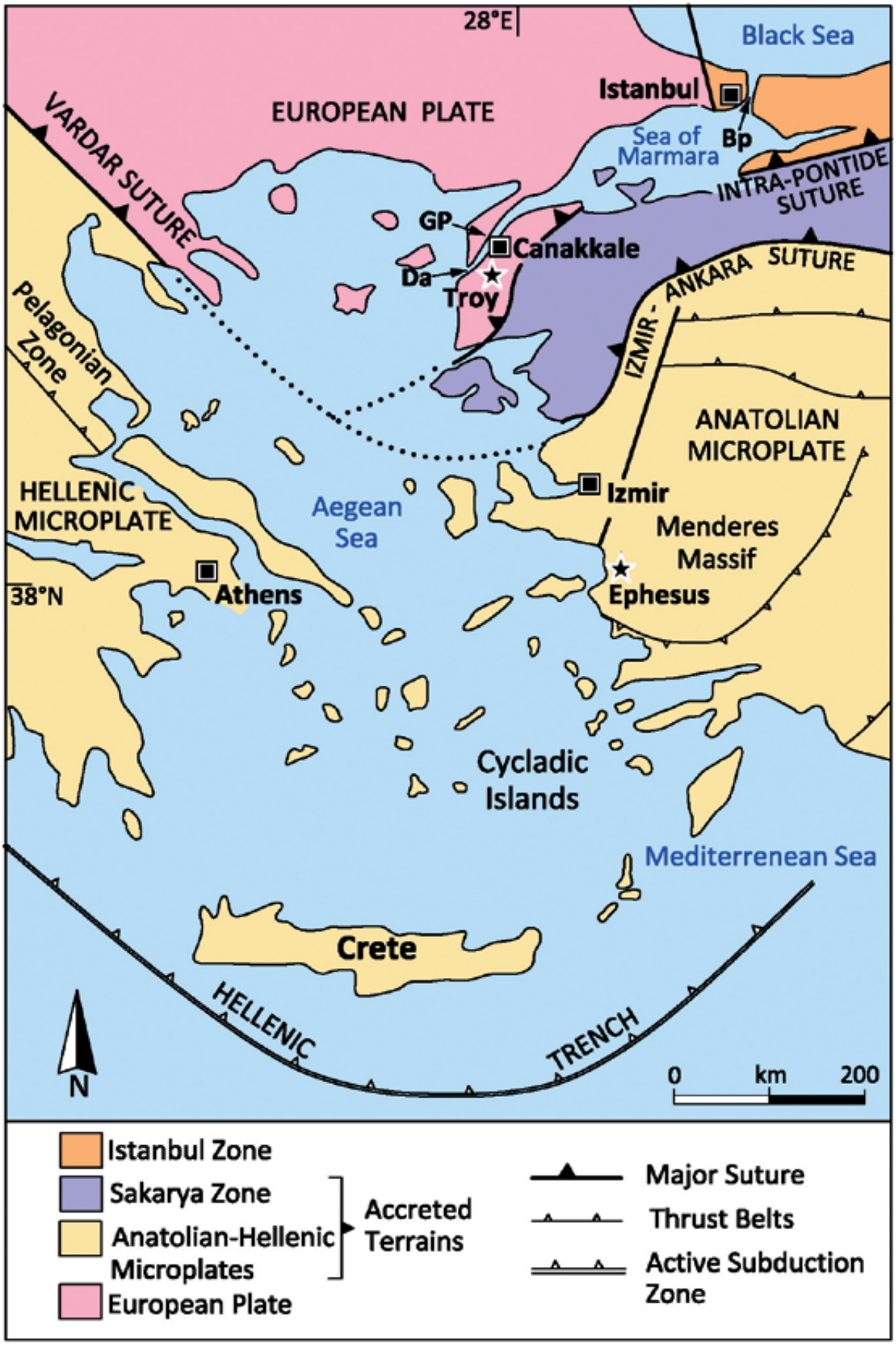
GEOLOGY OF SOME HISTORICAL SITES IN WESTERN TURKEY:
Changeable Landscapes and Tectonic Activity

View from Troy looking north over floodplains toward the Dardanelles. Hills of the Gallipoli Peninsula visible in background.

Western Turkey, including the part that was included in the ancient Greek state of Thrace has a long history of civilization. Present day landscapes at classical sites may differ from historical descriptions due to sedimentation patterns and tectonic activity. Geological reconstruction by Kraft and colleagues of two ancient sites, Troy and Ephesus has proved to be consistent with classical descriptions. The geology of Gallipoli, the peninsula north of the Dardanelles and opposite the ancient site of Troy is also described. Ephesus is possibly the best preserved of the ancient Greco-Roman cities and is located in the valley of the Küçük Menderes River, south of Izmir.

Tectonism in western Turkey is in part driven by north-eastward and westward movements of the African plate and Anatolian microplate, respectively. Extension during the Neogene created pronounced curvilinear regional structures. These include the Hellenic Arc, an active subduction zone, as well major sutures, some of which are shown on the attached map. Troy is located in a terrain defined by regional sutures, Izmir-Ankara to the south and Intra-Pontide to the north. Okay and Tüysüz described these sutures as having formed during Early Tertiary continental collision following northward subduction of the Tethys oceanic lithosphere. They were reactivated during the Palaeocene (Izmir-Ankara) and Eocene (Intra-Pontide) and take up significant modern-day stress associated with relative movements. The Late-Miocene–age North Anatolian fault is aligned with part of the Intra-Pontide suture. This faulting has created the Sea of Marmara and the Dardanelles, a narrow passage that connects to the Aegean Sea. The Gallipoli Peninsula is part of the European Plate. Crustal extension has created Pleistocene- and Holocene-age grabens associated with recent earthquakes.

The Basement of Western Turkey includes the Menderes Massif and other mountain ranges dominated by Palaeozoic-age granite-gneiss and mica schist, together with Mesozoic-age quartzite and marble. These



The structural framework of western Turkey is related to development of complex microplates between the northward-moving African plate (not shown) and the European plate. Curvilinear sutures and subduction of the African plate (Hellenic Trench) are ascribed to differential movement of microplates. The Aegean microplate (correlates with the Aegean Sea) is moving southwest and the Anatolian microplate is moving west. Location of Troy, Ephesus and Gallipoli Peninsula (GP) in western Turkey also shown, as are the Dardanelles (Da) and Bosphorus (Bp), the narrow channels that link the Sea of Marmara with the Aegean Sea and Black Sea, respectively. Simplified from Okay and Tüysüz (1999).

crystalline rocks were extensively quarried for dimension stones used in construction of classical sites. They are overlain by softer, Neogene-age conglomerate, limestone and sandstone. Younger sedimentary rocks also occur in grabens, such as the Dardanelles and Küçük Menderes valley. Uplift during the Neogene, particularly in the Pleistocene period, triggered extensive erosion.

The bulk of Neogene-age sediments carried by rivers flowing into the Aegean Sea from the interior of Western Turkey were deposited in deltas on the margins of grabens. Locally they may attain thicknesses of up to 30 m below present sea level. Sea-level changes associated with the Pleistocene glaciations affected sedimentation patterns. At the glacial peak when the sea level was some 120 m lower, the Black and Marmara Seas were freshwater lakes and the Bosphorus and Dardanelles were part of a major river system. Rapid increases in sea-level during the last major spurt in melting, at around 11,000 BP resulted in connection to the Aegean; there is a strong westerly current in the Dardanelles driven by the river-fed inland seas.

Flood plains adjacent to Troy and Ephesus are associated with sedimentation by the Kara Menderes/Dümrek and Küçük Menderes rivers, respectively. ("Menderes" is the Turkish translation of the Greek noun meander; the name of the snake-like River Menderes in western

Reconstruction of Troy has identified nine cities represented by Levels I through IX. The Homeric city is Level VI (pink).

Turkey was popularized into modern usage.) During the last ice age some of these rivers were part of much larger, ancient river systems, for example, associated with draining of the Black Sea. Channels were deeply incised into coastal plain so that subsequent rises in sea level caused the Dardanelles (at Troy) and the Aegean (at Ephesus) to encroach and create broad estuaries. The sea level reached a maximum, relatively stable stand at around 5000 BP.

Possibly the most evocative of all ancient sites associated with Mediterranean cultures is that of Troy, or Troia, located on the south-eastern shores of the Dardanelles. There is debate as to whether this corresponds to the city (Ilias) of the Homeric classic (the Iliad), written in the 8th century BC although based on much earlier oral poetry, and even existence of the Trojan wars as

Part of the Schliemann Trench, one of the earliest excavations at Troy was cut down to Level I. The red bricks at the top of the trench are remains of the Roman Level IX.

One of the few walls remaining of the Homeric city (Level VI) at Troy.

a historical event has been questioned. The Iliad does, however, include descriptions of the siege and battles, mostly pertaining to the last few days of the ten year long war, which give clues about the geography. Descriptions of the site were subsequently expanded upon by Strabo, writing in the 1st century AD, at which time Troy was known as New Ilium.

Troy is located on the crest of a 30-m high hill known as Hisarlik ("castled place"), near the modern town of Cannakale. The hill is currently some 4.5 km from the shoreline and affords views of the Dardanelles and coastal plains. This site was formerly of great strategic importance, as the Hellespont (the classical name of the Dardanelles) was one of the great crossroads of the ancient world. The out-flowing current and prevailing north-easterly wind caused most ships to stop over in Besika Bay (or Beşik Bay) on the Aegean shoreline whilst waiting, possibly weeks for favourable sailing conditions.

The general acceptance of Troy as the classical site is accredited to Heinrich Schliemann who carried out archaeological work in the 1870's. The Schliemann Trench, as one of the original excavations is described, did considerable damage. Gold and valuable artefacts were appropriated, and the layer thought to correspond with the Homeric period was misidentified. This early work did, however, lend weight to the Iliad as a historical event. Since 1998 an international team led by Turkish archaeologists are continuously excavating and these newer finds substantiate the claims.

Troy was occupied over many years, between approximately 3000 BC and 500 AD. Nine different levels (cities) have been identified. An early Bronze-age site (2920-2450 BC) is correlated with Level I. This culture spread rapidly throughout large parts of the Eastern Mediterranean. Level VI (1700-1250 BC) is the Middle to Late Bronze-age Homeric city. This was rebuilt after a severe earthquake. Level VII (1250-1000 BC) is a Late Bronze-age and early iron-age culture that had some continuity with the previous phase. Levels VIII (700-85 BC) and IX (85 BC–500 AD) correlate with the Greek and Roman cities of Ilium and New Ilium, respectively.

The geology of the site has been investigated in great detail by Kraft and colleagues. They found that the Hisarlik and low plateaus adjacent to modern day rivers

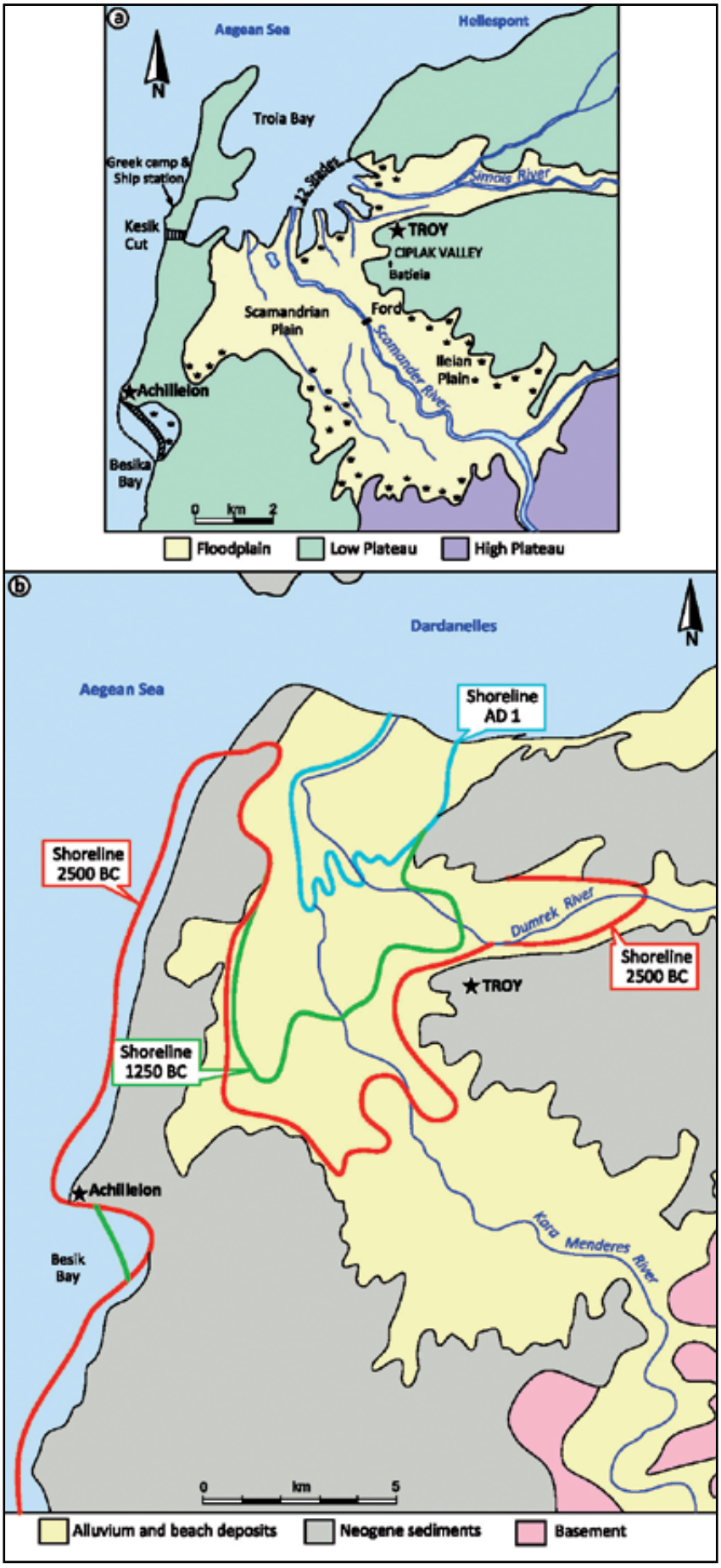
Part of the Greek (Level VIII) – lower left - and Roman (Level IX) – centre and upper right - cities in an area at Troy known as The Sanctuary.

are comprised of Neogene-age sediments. Basement rocks crop out on a higher plateau to the south. The floodplains are covered by Holocene-age alluvium. The estuary associated with the Kara Menderes and Dümrek Rivers developed after stabilization of the sea level around 5000 BP. The sea continued to regress since this time due to persistent sedimentation. During Neolithic times (2500 BP) the estuary was extensive. During the time of the Trojan wars (1250 BC), Troia Bay was well developed and included prominent headlands. By Roman times (AD 1) the city was some 3 km inland.

Some of these changes were tracked by radiocarbon dating of fossils. Samples were obtained by drilling the estuarine sediments, mostly distal and proximal prodelta muds. Sedimentation rates were found to be low, although parts of the Scamander floodplain are 20 m below the current surface. These data indicate the landscape changed from shallow marine, into a prominent estuary, a brackish lagoon, and finally into an area of seasonal swamps.

These investigations enabled Kraft and colleagues to identify some important historical sites associated with the Iliad. The attacking Greek army camped west of the city on the shores of the Aegean. They forded the river on the Scamandrian Plain to the south of Troy. Descriptions by Strabo have been corroborated as to estimates of the distance of the city from the army camp (4 km) and the occurrence of marshland and saltwater lagoons at the landing site. Kraft and colleagues also identified a high mound called Thorn Hill (Batieia) where the Trojans mounted their defence. The Kesik Cut, a defensive line described in the Iliad as including a wall and ditch has also been located. The classical site of Achilleion on the Aegean coast southwest of Troy was famous in antiquity for its association with Achilles, after whom it was named, and also with Alexander the Great.

The Gallipoli Peninsula is visible across the Dardanelles from Troy. Part of this area was incorporated into a



(A) Geographical reconstruction of Troy during the Homeric times when the city was perched directly above Troia Bay and surrounded on three sides by floodplains of the Scamander and Simois rivers (simplified from Kraft et al., 2003). Position of some historical sites including Besika Bay, the ford over the Scamander River, the Kesik Cut, and landing place of Greek armies also shown.
(B) Geological map of present day area around Troy showing geology and migration of coastline (from Higgins and Higgins, 1996).

View northward from Anzac Cove, Gallipoli Peninsula. Badlands erosion of Neogene-age sediments visible in background.

National Park in 1973 to commemorate the Dardanelles Campaign of 1915-6. This unsuccessful attempt by the Allied Powers to wrestle control of the sea route from Europe to Russia away from Turkey failed in part on lack of knowledge of the terrain. The beaches where the landings occurred comprise narrow strips at the base of rugged cliffs. The Turkish government has officially changed the name of the landing site of the Australian and New Zealand Army Corps, the most known part of the campaign, to "Anzac Cove". The cliffs above the cove, as well as the scrub-covered ridges directly inland where the Turkish mounted their defensive lines are comprised of poorly-consolidated, relatively soft Neogene-age sediments. Rapid erosion due to uplift on the margins of the Dardanelles graben has created a badlands topography.

Steep cliffs of Neogene-age sediments with prominent gravel beds, Gallipoli Peninsula.

Excavations at Ephesus in the Central Aegean region of Western Turkey have revealed centuries of history, from the Attic colonists in the 10th century BC through to the Byzantine period. In Hellenistic times, Ephesus was one of the famous twelve cities and housed the Temple of Artemis (the Artemision), one of the seven wonders of the ancient world. Only the foundations of this remain as it occurs in a particularly swampy area. Ephesus was the Mediterranean's main commercial city during Roman times. Sites of interest include the 500 m long and 11 m wide-street linking the Sacred Harbour and Great Theatre, the latter being originally constructed during the Hellenistic period in the 3rd to 1st centuries BC and then rebuilt by the Romans. The Roman-age library is well preserved. Ephesus was partially destroyed by earthquake in 614 AD but the main reason for its decline was that the harbour persistently silted up.

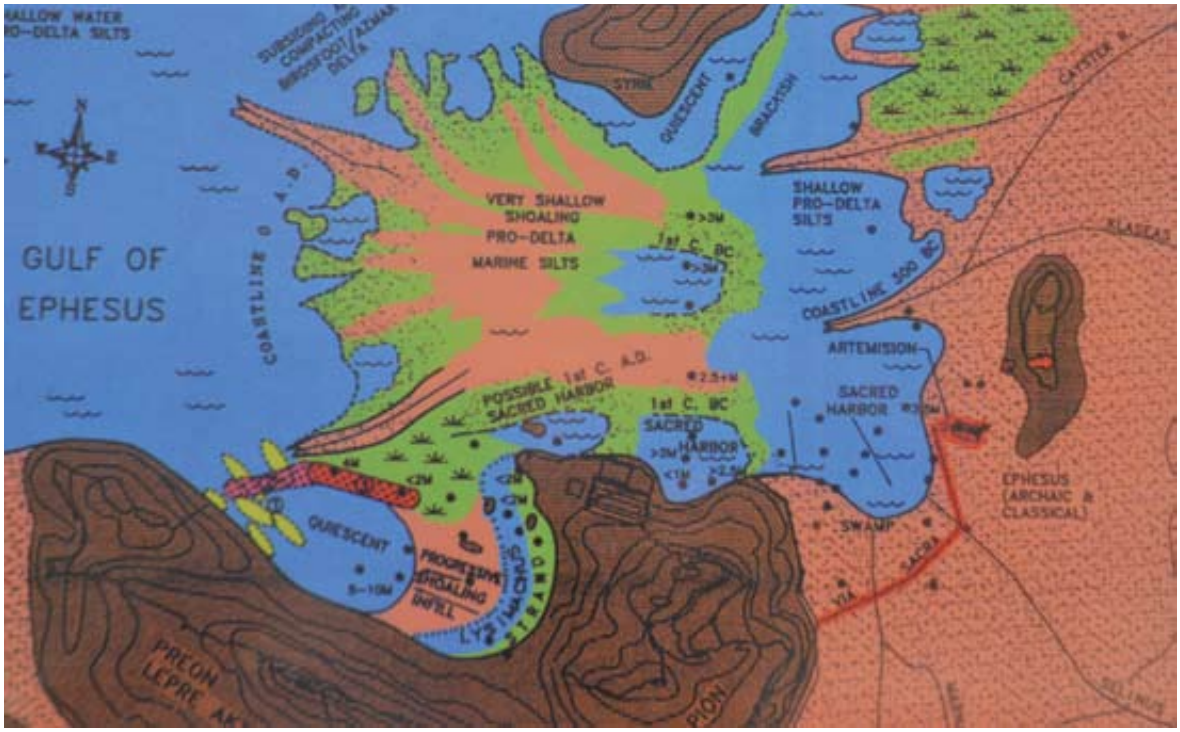
Ephesus is located some 5 km from the present coast line, occurring in an area of rugged hills. The existence of the harbour is well known, in part from accounts of a famous siege in 190 BC. At that time, the city was located near the coast on a large estuary. The Roman historian Strabo noted attempts to restrict entrance to the harbour by a long mole. This increased the problem of sedimentation. Mapping of the sediments in the lower part of the river and floodplains has enabled Kraft and colleagues to delineate the ancient shoreline and harbour. Over the two thousand years of inhabitation the city was continuously being adapted to suit changes in the landscape and the

View looking west along Arcadian (Harbour) Road at Ephesus within the Küçük Menderes graben. The grassy area (centre) corresponds with location of the Sacred Harbour during Roman times and Mount Bülbül (or Preon) (back left and centre) is part of a horst block of Mesozoic marble. Aegean Sea, just visible (background, right) below prominent headland, originally formed a large bay extending to the harbour.

site of the harbour was moved several times. During the Hellenistic and early Roman times, the sea lapped against the north-eastern flank of Mount Pion several km east of the main city. The prograding delta has continuously pushed the coastline westward.

The analysis by Kraft and colleagues of changes in the geomorphology at some of the ancient sites of Western Turkey provides evidence of localized patterns of sedimentation in discrete tectonic basins, rather than global changes in sea level. The progradation and aggradation of deltas of rivers that drain into the Aegean Sea commenced around 5000 BP. This period correlates with the onset of intensive agriculture and major deforestation in Western Turkey. The impact of cycles of coastal erosion and deposition, from the Bronze Age through to Byzantine times are particularly well represented at Troy and Ephesus.

Photographs by the author



Geological map mounted in a display board at Ephesus (from Kraft et al., 2003) showing westward migration of the Sacred Harbour at Ephesus. The Great Theatre is located on the lower, western slopes of Mount Pion (near Lysimachus). This reconstruction raises issues about the site of the Artemision (located east of the main city to which it was connected by the Sacred Way) as the city was moved several times to accommodate the changing position of the harbour. Width of view approximately 5 km.

The Roman library at Ephesus including columns comprised of marble breccias.

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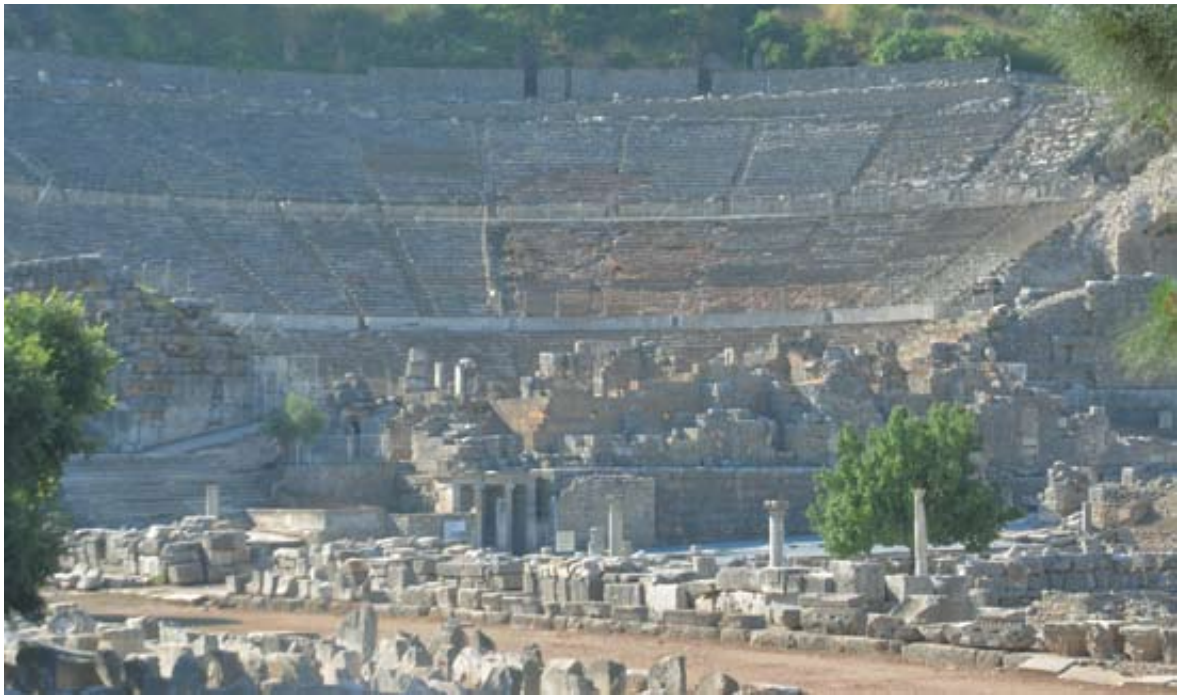

View of the Great Theatre at Ephesus cut into Mount Pion

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December issue:	9 November 2016

6. CANCELLATIONS

Four weeks prior to deadline

7. ADVERTISING AGENCY COMMISSION

Excluded

8. CIRCULATION

Geobulletin is issued and dispatched at no additional charge to all of the various members of the Society and its local and overseas exchange partners. **The circulation list exceeds 2,800 (this is not a reflection of readership as it is read by a far wider audience - students in libraries, all geologists in a single company)** and reaches all of the decision-makers in the geoscience and mining community; the geological consultants and leaders in the Mining Groups, the Mining Industry and Government Institutions, universities, private, public and state libraries. Electronic versions of the GB are freely distributed through the society's web page.

9. ADVERTISING BOOKINGS AND SUBMISSION

contact person:	Jann Otto
telephone:	082 568 0432
e-mail:	Jann.Otto@mweb.co.za

10. ADDITIONAL CONTACT INFORMATION

EDITORIAL OFFICE

Dr. C. Hatton
Council for Geoscience
(physical address: 280 Pretoria Street, Silverton)
Private Bag X112
Pretoria 0001
tel: +27 12 841 1149
fax: +27 86 679 8591
e-mail: chatton@geoscience.org.za

DESIGN & LAYOUT

Belinda Boyes-Varley
cell: 079 129 7748
e-mail: bvmac@icon.co.za

SOCIETY OFFICE

Geological Society of South Africa (GSSA)
P.O. Box 61809, Marshalltown 2107
Chamber of Mines Building (5th Floor), 5 Hollard Street
tel: +27 (11) 492 3370 fax: +27 (11) 492 3371
e-mail: info@gssa.org.za
website: http://www.gssa.org.za/
Johannesburg, South Africa

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Geohydrology for Geologists:	10 June
Annual General Meeting	7 July
Structural Mapping – Andy Killick:	11 July
Target Generation Day:	7 August
IGC:	27 Aug - 4 Sep
Drilling Methods and Techniques	23 Sep
Petroleum Geology:	14 Oct
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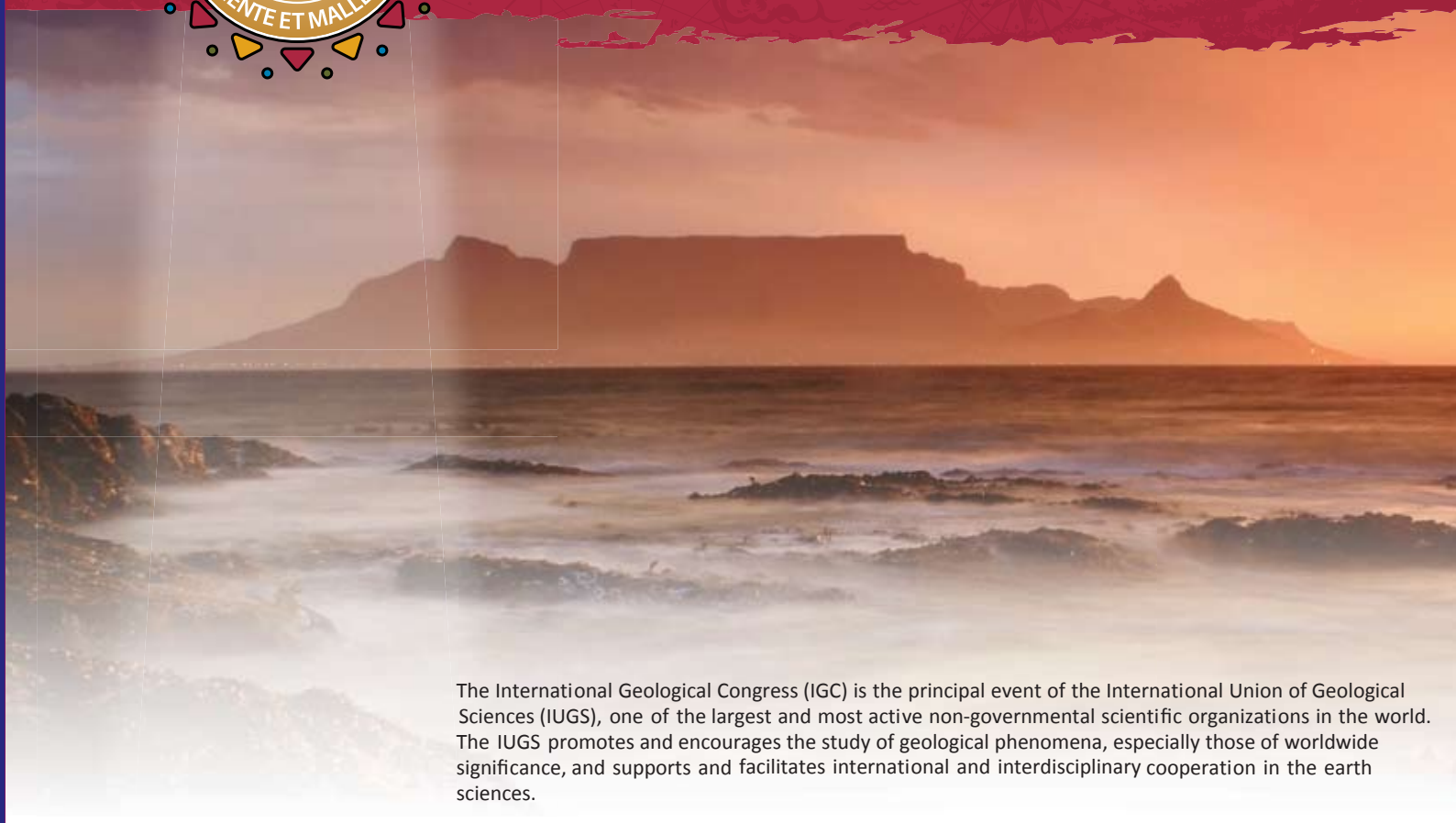

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IUGS International Union of Geological Sciences

GSSA Geological Society of South Africa

Council for Geoscience

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Under the patronage of UNESCO

This poster shows a scene in South Africa between 200 and 183 million years ago. At the time, the continents were splitting apart and there were many volcanic eruptions (1). The climate was drying and there were sand dunes (2). Treeferns (3), yellowwood (4), monkey puzzle (5), and ginkgo trees (6) formed patches of forest. Early dinosaurs like this egg-laying Massospondylus (7) are shown fending off a hungry Coelophysis (8). Heterodontosaurus (9) was different from the other dinosaurs because it had incisor, canine and molar type teeth for cutting, biting and grinding their plant food. The name Heterodontosaurus means "different types of teeth" and this interesting small animal may have had quills like a porcupine In the scene three Heterodontosaurus are fleeing a kill made by a crested dinosaur called Dracovenator (10), a relative of Diloposaurus. The Dracovenator is being threatened by a Ceratosaur (11). The herbivorous Aardonyx dinosaurs (12) in the background are foraging peacefully. Dinosaurs were not the only animals alive at the time. Megazostrodon (13) was a small insect eating animal closely related to the earliest mammals. Tritylodon (14) was a mammal ancestor with teeth like a dassie. The animal that looks like a lizard (15) is a small armoured land-dwelling crocodile called Protosuchus.