GSSA
Geological Society of South Africa

geobulletin

QUARTERLY NEWS BULLETIN ~ MARCH 2011

VOLUME 54 NO. 1

GSSA Awards: 2009 Winners
A year on Gough Island
Impact craters in Libya

news

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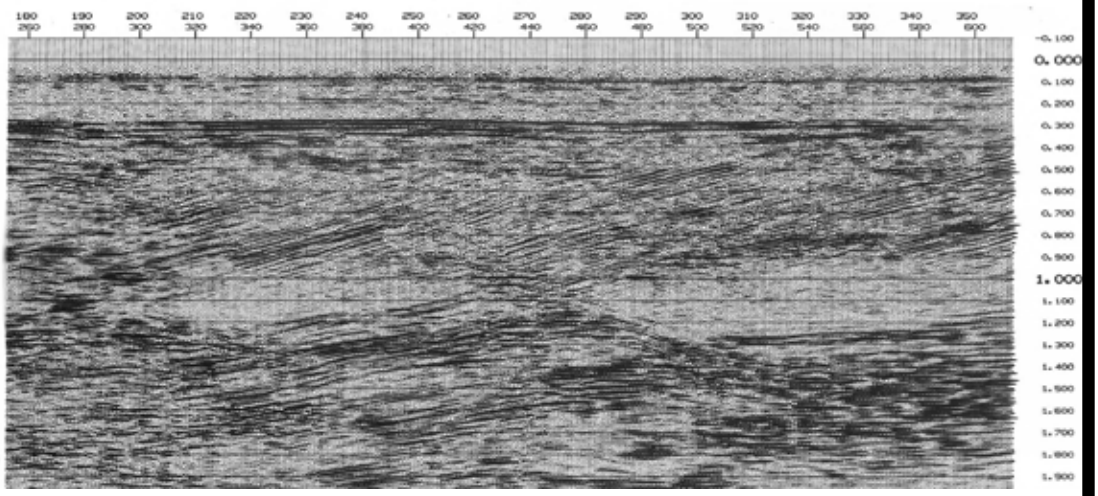

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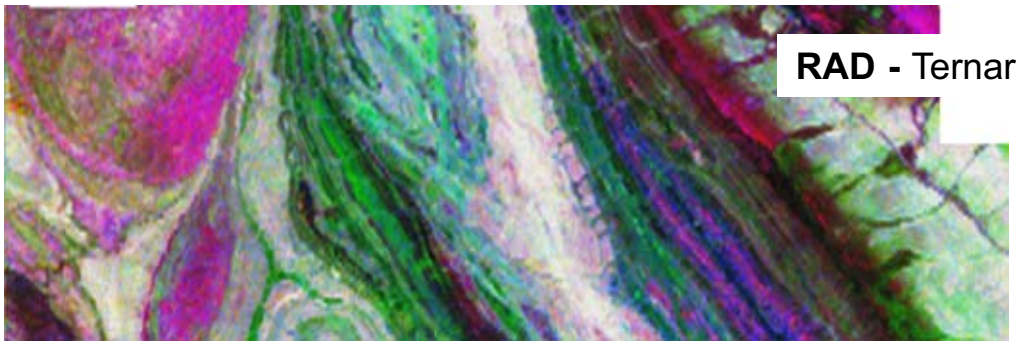

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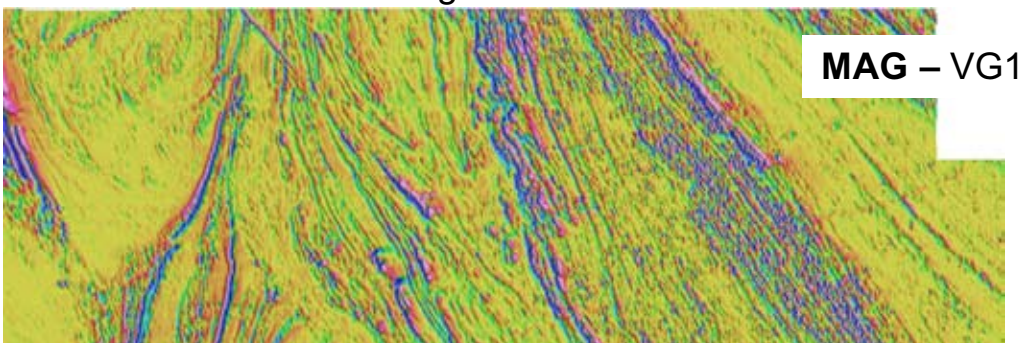

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Part of the reconstructed city of Pompeii with views of Vesuvius in the background. (Roger Scoon)

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Geological Society of South Africa

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from the editor's desk

Steve Prevec

Greetings from Grahamstown once again. While it has been wonderful to be home in South Africa again after half a year in Canada, the news generally from the geoscience sector has not been all that encouraging. The outcomes of the 'exploration moratorium' remain unclear, the government continues to allow nationalisation to remain an open question, our neighbours in Zimbabwe having recently already taken the next step in that direction, and the Council for Geoscience, who were also going to be tasked with regulating much of this, have found themselves in dire straits as a consequence of financial constraints which appear to have become progressively worse over the past few years. On top of this, the prospect of a national mining company, the African Exploration Mining and Finance Corporation (AEMFC), looms.

In the mid-1970s in Canada, the country controversially established a national petroleum company, Petro-Canada, which was subsequently gradually privatised after about 15 years, but which managed to participate successfully in the oil industry without, ultimately, causing any crises (outside of Alberta, at least). During my recent stint in Canada I was also exposed to examples of both government "meddling" in corporate affairs (the refusal to allow BHP Billiton's hostile takeover of the Potash Corporation of Saskatchewan in November, on the basis of perceived insufficient benefit to the host country), and cases where meddling might have avoided later anguish; CVRD's takeover of Inco Limited was followed by a 14 month long labour strike in Sudbury, seemingly precipitated by both sides' apparent revelations about the other which could have been readily foreseen, although its subsequent resolution in August and promise of significant investment by Vale in their new Canadian operations has cooled things significantly (or warmed them, in a good way, if you prefer). In contrast, Xstrata's roughly contemporaneous takeover of Falconbridge left relatively few feathers ruffled in Sudbury (perhaps by contrast). Although it was very strange to spend time in Sudbury with both "founding" companies now in unfamiliar hands, the extent of local or national control over their activities in the decades before that was probably much less than I'd like to think, anyway (although Xstrata Nickel remains Toronto-based).

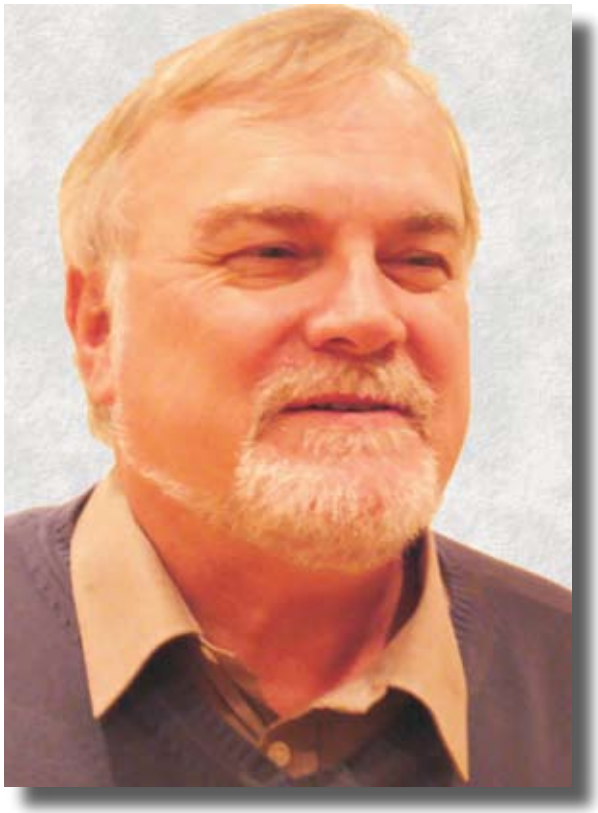
It will certainly be tragic if the current high metal prices and recovery from the global economic crisis are subsequently smothered by opportunistic corruption and what could be perceived as government-facilitated profit-skimming; it is clearly in the geoscience community's interests that government (and it's arms, such as the CGS) continues to facilitate and encourage, rather than impede, exploration, growth and development of our natural resources in a way which is both globally and nationally constructive. These are rarely clear-cut issues, in spite of appearances. Let us hope (and where possible, actually influence, rather than just hope) that pending activities result in constructive developments.

In this issue, Craig Smith comments on these issues from the GSSA offices, as well as on SACNASP compliance, perhaps more relevant than ever under the circumstances, and Paul Nex notes related items in his Presidential column. Reports on the CAG and IMSG in January, with the pending Geosynthesis in Cape Town in late August (see President's column) suggest a relatively healthy geoscience climate in general. Notes on the SAJG, a year on Gough Island, the Pilanesberg, and Libyan impact craters (this is not the first time that geological visits to impacts have preceded bombing raids in these pages) also feature, as well as the return of (now retired) Antony Cowey as our Media Monitor after one issue of "rest" (welcome back!), part two of the Geotraveller in Naples, impact-related poetry, and two book reviews.

'til next time...

executive managers corner

Craig Smith



I would like to address three separate topics in this issue, which I believe deserve some air time in early 2011.

The first topic concerns the short term and long term outlooks for geology jobs in South Africa. Two events have just unfolded that will affect our members and the immediate future of geology in South Africa. The outcomes of both events are still to be debated and unpacked, the nuances are not yet fully understood, and the messages are mixed. The Mining Indaba in Cape Town closed yesterday, after hosting some 6000 visitors for the three day event. And President Zuma presented his state of the nation address last night.

The GSSA as an organization looks after the professional interests of its members, in both academia and industry, as one of its objectives, dating back to the founding of the Society in 1895. That means we are concerned about jobs in geology and the quality of careers in geology. South Africa is the most richly endowed country in the world as regards mineral resources, being some 2.5 trillion dollars in value at last count. It takes effort, wisdom, long-term planning and long-term investment to bring this to account for South Africa. Geologists are key players in this process, and in the long term the future has to be so bright that we should all be wearing sunglasses (to misquote a popular tune of a decade or two ago).

In the short term, however, I fear that things are not so bright. Of those elements necessary for success, investment is the one that is not entirely within South Africa's control. Investment is essential to keep our members employed. Investment is the one area for which neither Indaba or the state of the nation speech provides any short term optimism, the government of the day seemingly not understanding the link between investment and job creation. Despite having no history of success or sustainability anywhere in the world, South Africa continues to insist that the nationalization debate remains an open question. The ANC promises to have a decision sometime in 2012, but to the people with investments to make now, and with a resource boom happening now, continuing to dither and delay over this issue is extraordinarily negative, and undermines any statement to the effect that nationalization is not government policy. There will be less investment, there will be jobs lost in the sector, and our geologists and resource companies will be going elsewhere. Sense will ultimately prevail, because it has to, but over the next two years irreparable harm may be done to the resources industry and to South African geology. It is a time for concern; South Africa missed the last resource up-cycle and that is about to happen again.

The second topic I would like to comment on is ethics. These days it seems that ethics means different things to different people, but the GSSA has a very strong code of ethics that all members are obliged to adhere to. The Code is posted on the website, and it's worth re-visiting every now and again to test yourself against. In brief the code is designed "to commit members to uphold and enhance the honesty, honour, integrity, and dignity of their professions, such that the members and their professions merit the highest esteem by the community." In short this comes down to:

- Acting with regard to the welfare of the public
- Demonstrating honesty, honour, dignity and integrity
- Working only in your specific areas of technical competence
- Developing your reputation on merit
- Not being involved in conflicts of interest
- Continuing professional development throughout your career
- Acting in compliance with all local and international laws

None of this should be difficult or extreme for a true professional, in academia, government or industry. And it translates to simple actions, such as not misrepresenting your intentions to landowners during field studies, not engaging in plagiarism, not taking or offering bribes, and ensuring that you act within the letter and spirit of contracts entered into. Note also that practicing geologists in South Africa need to be SACNASP registered; if you are not you are committing a criminal offense. You may not like it – but it's the law (not a bad one in hindsight). Would you be willing to seek help from a non-registered doctor?

Ethics has become topical over the last few months, because we are getting reports of people who are neither GSSA members nor SACNASP- accredited passing themselves off as experts, and even allegedly forging signatures of people who are bona fide, accredited, experts. We are watching this space closely.

Finally, I would like to close with a word of sympathy for one of South Africa's most influential and respected companies, AngloGold Ashanti. It seems that an organization calling itself the Public Eye Award is run as a counterpoint to the World Economic Forum in Davos, obviously hoping to generate publicity by associating itself with the Davos meeting. AngloGold Ashanti was given the global award for "contamination of land and people with its gold mining in Ghana", with a further claim that over 50 rivers have been destroyed. AngloGold Ashanti even beat out BP (destroying the Gulf of Mexico; I have to wonder about other agendas!). The organizations behind the Public Eye Award seem to be something called the Berne Declaration, another called the Friends of the Earth, replaced in 2009 by Greenpeace. Is this ethical behaviour on the part of these organizations? How does this impact some of the (supposedly?) good things Greenpeace is involved in? Makes you think, doesn't it.

Craig Smith, February 2011

GSSA
Geological Society of South Africa

president's column

Paul Nex

Welcome to the New Year and I am sure it will be as busy as last year. Certainly there have been two highly successful conferences in January; the 23rd Colloquium of African Geology at the University of Johannesburg and the Igneous and Metamorphic Studies Group annual meeting at Stellenbosch. The organizing committees of both of these deserve our congratulation and appreciation for running such events. I attended the 23rd CAG and thoroughly enjoyed meeting old friends and listening to a tremendous variety of presentations. It was perhaps slightly disappointing that industry delegates were not prominent at either conference in spite of several talks directly applicable to exploration and the genesis of ore deposits; perhaps they were saving themselves for Indaba. It does beg the question as to how conferences can be made more relevant to all our members. Indaba is not known for its technical presentations and seems to be more of a meeting place; it may be that this is perceived as more important. It is therefore pertinent to draw everyone's attention to the combined SAGA, GASA and GSSA conference to be held in Cape Town in association with ILP (International Lithosphere Program) and Inkaba yeAfrica: GeoSynthesis 2011: Integrating the Earth Sciences, and I would urge you all to book-mark the website www.geosynthesis.org.za. It's certainly a date we should all put in our diaries and support the efforts of all involved. Please note that the deadline for short abstract submissions is March 31.

Mineral Rights in South Africa continues to get a lot of attention in the media. Not withstanding disputes about prospecting and mining rights I am sure we all welcome the DMR's initiative on the new electronic mineral management system and in particular the possibility that it will include "GIS-based spatial information which for the first time allows the public to view the locality of issued rights, and land in respect of which applications are being considered, at any given time". This will certainly be a major difference and can only increase transparency and hopefully more time-effective mineral rights applications. Certainly there may be teething problems with the system although I am sure we are all waiting for the end of the moratorium and the implementation of the new system.

At this half-way stage of my presidential term it is also relevant to comment on a couple of the initiatives that have been underway for several months. The new website continues to improve on an almost daily basis and Byron van der Walt and Johan Krynauw are thanked for all their efforts. The constitution and by-laws are in the final throes of amendments, and it will be a major achievement when these can be circulated to the wider membership for comment. The GSSA council has approved the creation of a Vice-President for academic affairs and one of our next major tasks will be to identify a suitable individual. Alternatively, if there is someone with a desire to be involved with the society in this capacity please let myself or Craig Smith know.

Paul Nex

letters

GSSA AWARDS: 2009-2010

This summarises the awards and medals offered by the GSSA in recognition of outstanding achievement, and the 2009 winners (awarded in 2010). The call for 2010 nominees (to be awarded in 2011) is provided elsewhere in this issue.

AWARDS OF HONOUR

Draper Memorial Medal: Dr. Chris Lee

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

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

Unlike his namesake the British actor Christopher Lee, who has become famous for playing screen villians such as "Dracula", "The Man with the Golden Gun" (James Bond), and Lord of the Rings villain Saruman, our Chris Lee is rather more famous for his contributions to the geological understanding of the Bushveld.

Chris commenced working for JCI in 1978 and retired in 2003 when at that time he was responsible for the direction the Amplats organisation took in its exploration of its local and foreign mineral inventory. He had a profound influence on the thinking of the deposit styles and possible genetic implications to the layered economic horizons, particularly the PGM horizons. He stimulated work into the understanding of the many structural and syngenetic disturbance features which influence the extractability of ore bodies.

Chris developed a career style whereby the balance of academic understanding was complimented by his practical approach to finding and assessing deposits. Chris' engaging personality and interpersonal skills in mentoring staff of all levels allowed his expertise to be sought in a variety of fields. Locally and abroad he promoted a range of opportunities to the Amplats organisation.

Chris' significant contribution is apparent in several papers, including those in the 2nd Volume of the Mineral Deposits of Southern Africa and many other publications. Chris was one of the first geologists to delineate the Bushveld Complex-related structures utilising remote sensing at a time when it was cutting edge technology. This contribution has been fundamental and many of his ideas espoused in his papers are still in current use.

Chris' endeavours extend well beyond the ambit of the Anglo group and he has consulted to a range of commodities under consideration for many years.

The award will be formally presented to Chris at the Fellows dinner in November, 2010.

Des Pretorius Memorial Award

The Des Pretorius Memorial Award was introduced by the Geological Society during 1998 in memory and in recognition of the pioneering work of the late Professor Des Pretorius, for work in economic geology to geologists working in Africa.

The Des Pretorius Memorial Award for 2009 has been awarded to Roy Corrans in recognition of his outstanding contribution to his endeavours in the field of Economic Geology in particular.

Roy Corrans joined Anglo American Corporation of South Africa Limited as a graduate geologist in 1966. He was initially based in Zimbabwe, working on base

metals, precious metals and industrial minerals. During this period, he discovered the Epoch nickel deposit.

He moved to Beaufort West in 1977 and spent two years on uranium exploration in the Karoo before moving to Namibia in 1979. During his three and a half years in Namibia, Roy and his colleagues discovered and explored the Skorpion zinc deposit.

Roy relocated to Head Office in Johannesburg in 1983 and in 1988 he succeeded the late Dr Louis Coetzee as Consulting Geologist for the New Mining Business Division. He retired in 2002 as Senior Vice President, Exploration (Africa). During his tenure at head Office, Roy was also credited with the discovery of St George's Helium field in South Africa and the Sadiola Gold Mine in Mali.

Since 2002, he has been pursuing several interests in the geological and mining world. He never "retired" and firmly believes that there are other big deposits to be found. He was instrumental in building up African Copper, a junior mining company now listed internationally and successfully developing and exploiting the Mowana mine in Botswana.

Roy is not only a highly respected and successful geologist, but also excelled in building a dynamic exploration team, which in the 1990's carried out intensive prospecting in some 31 countries in Africa. His pioneering spirit, vision and enthusiasm were always evident when leading his geologists into remote and often dangerous parts of the continent. He was prepared to explore in remote parts of Angola, Mozambique, Central and West Africa, at a time when other companies opted for lower risk and safer countries. His targeting was based on a sound knowledge of the metallogenic provinces and belts of the African continent and he was successful in convincing Anglo's directors during many hours of discussions to commit expenses to these often high-risk ventures. He always remained optimistic, even when exploration budgets were the first to suffer during periods of economic downturn.

Roy also worked hard at building multi-disciplined teams of geologists and geophysicists, backed by high level research scientists and organisations to ensure that every exploration target could be tested thoroughly. He took the lead in arranging annual conferences and workshops where all his staff could meet, present their projects and share ideas with geologists from the Anglo Group. Roy also clearly understood the support that could be given to his exploration efforts by related earth science disciplines and actively encouraged cooperation across a broad spectrum and vigorously promoted R and D projects. Roy and his prospecting teams made several significant discoveries, with some currently being developed by other mining companies.

He is considered by many of his colleagues and friends in the geological community as one Africa's great economic geologists. His enthusiasm to explore, his incredible memory, broad general knowledge and compassion for those close to him also make him a loved and respected friend, a people's person.

The award will be formally presented to Roy at the Fellows dinner in November, 2010.

HONORARY FELLOWSHIP

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

Frank Gregory (past president of the GSSA and currently MD of The Mineral Corporation), has proposed that special recognition be given to Bernard Renier Van Rooyen for his lifelong service to the mining industry in South Africa and elsewhere in Africa. Mr. Van Rooyen is not a geologist by training, and therefore is not eligible for either the Draper Medal or the Des Pretorius Award, but he has experience that covers all aspects of mining, including 24 years as board member of Gold Fields. He has been involved in building mines, corporate finance, commercial, legal, mineral economics, exploration, administration, project development and production management. He was responsible for designing and commissioning Black Mountain in the northern Cape, restructuring of the Tarkwa Gold Mine in Ghana, creation of Banro Corporation, and the listing of Mvelaphanda Resources. He is featured in the 2008 edition of "Rainmakers and Potstirrers" and is one of the personalities of the mining industry in South

Africa. The Fellows Committee recommends that Mr. Van Rooyen be awarded Honorary Fellowship in the Geological Society of South Africa.

The award will be formally presented to Mr. Van Rooyen at the Fellows dinner in November, 2010.

PRESIDENTIAL AWARDS

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

Council has ratified Honours Awards to be made to Shane Hunter and Henk du Hoop during 2009-2010.

Neither are geologists; Shane works as a gold analyst at Barnard Jacobs Mellet, and Henk works in Business Development, Resources, Rand Merchant Bank. Their contribution to geology has been conceiving, implementing, and managing, on an ongoing basis, the First Thursday Club, held on the first Thursday evening of every month at the Wanderers Club in Johannesburg. Those of you who have attended these events will know that this has developed into one of the foremost networking opportunities for the earth science community anywhere. The focus is on mining and exploration and not science or research, but interested academics also participate. On any given evening, 100 to 200 people (sometimes more) attend, and it's a great place to catch up with colleagues based in Johannesburg as well as with those who are based elsewhere but travel through Johannesburg. First Thursday is a must-do destination for geologists as well as for the investment community involved in funding resource projects.

Further, Shane and Henk are responsible for scheduling the host sponsors, which change every month. The ongoing event is very successful, and the earth science and economic geology communities owes them a vote of thanks.

SCIENTIFIC AWARDS

Jubilee Medal

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

The award for the best paper published in the Journal in volume 112 is given to PHGM Dirks, EG Charlesworth and MR Munyai for a paper entitled "Cratonic Extension and Archaean Gold Mineralisation in the Sheba-Fairview Mine, Barberton Greenstone Belt, South Africa". This paper documents field work of exceptional detail in one area of a mature mining district that is being revitalized thanks to the gold price increase. Detailed structural mapping provides evidence for new ideas on the mineralization in the area, which may have an impact on the future exploration and exploitation of gold in the Barberton district. The work challenges the established idea that the Sheba shear zone controlled mineralization at the mine, and the authors suggest instead that the shear zone is reactivated by normal faulting that controlled late mineralization. The authors further propose that mineralization accompanied porphyry emplacement and occurred after greenstone belt geometry was established. The gold deposits at Sheba, traditionally classified as compression related orogenic gold deposits are rather extension related deposits formed after the Kaapvaal Craton had formed, and are not linked to the formation of the greenstone belt.

Student Awards

The Society gives awards to students on an annual basis, including the John Handley award, the Corstorphine Medal, the Haughton award, and Best 4th Year Student award. None need necessarily be awarded on an annual basis, if outstanding candidates are not submitted. For the 2009 academic year, the theses submitted were all of high quality, with fourteen submissions from nine universities. Competition was intense.

Corstorphine Medal, and the John Handley Award

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

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

The MSc thesis of Warwick Hastie, entitiled "Rock Fabric Study of the Northern Lebombo and Rooi Rand Dyke Swarms - Regional and Local Implications", University of KwaZulu Natal (supervised by Mike Watkeys) was the 2009 winner of the John Handley award. The MSc degree was awarded summa cum laude for this work, which quantified directions of magma flow in the dyke swarms at emplacement, using field evidence, anisotropy of magnetic susceptibility, and mineral shape preferred orientation measurements.

In addition, the thesis was adjudicated to be of outstanding quality, which made it a worthy recipient of the Corstorphine Medal of the GSSA.

Warwick also won the Haughton award in 2006, and far as we are aware, he is the first South African student to win both awards.

Haughton Award

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

As is the case for the MSc award, the submissions for Haughton are all of high quality, as judged by the ajudicators.

Bjorn P von der Heyden (University of Stellenbosch; supervised by AN Roychoudhury) was given the 2009 award for his thesis entitled "Characterization of Mn-slag and Investigation into the Mechanochemical Interactions between Mn-wastes and Anthracene". The subject of this thesis is 'mechanochemistry', and the work documents a combined environmental geochemical, mineralogical and metallurgical experiment on degrading anthracene, an organic common in polluted soils. It was shown that Mn-slags would not be suitable for soil remediation (negative result), but the experimental methods and documentation thereof show an exceptional understanding of scientific process.

2

To the Membership of the Geological Society of South Africa:

Nominations for 2011 Awards

The Fellows Committee and the Council of the GSSA are soliciting nominations for 2011 awards to deserving Members. A notice has gone out to Department Heads for nominations for the various student awards. The process of selecting a Jubilee award winner (best paper in the South African Journal of Geology) has been initiated.

We call for nominations from the membership in the following categories:

Draper Medal
Recognition of an exceptional member of the Geological Profession who in the spirit of Dr. David Draper has excelled in the advancement of South African Earth Science. This is the most prestigious award of the GSSA, and was instituted in 1932.

Des Pretorius Memorial Award
Recognition for work in Economic Geology to geologists working in Africa. The award is based on contributions in research impacting on economic geology, teaching, development of exploration technology, and the development of mineral resources through exploration, mining geology, or discovery. The candidate must have a minimum of a BSc (Honours) degree, and is encouraged to publish the results of the work that lead to this award. The award was introduced in 1998 in memory and recognition of Professor Des Pretorius.

Honours Award of the Geological Society of South Africa
Recognition of an individual who has made a particular contribution to the running and organizational affairs of the Geological Society of South Africa. More than one award may be made in a given year. Note that the current President or current office holders in Council or Manco are ineligible for the award.

Honorary Membership in the Geological Society of South Africa
Recognition of an exceptional member of the geological community.

A letter of motivation should be included with any nominations, to reach the offices of the Geological Society by end March, 2011. The Fellows Committee shall vet all nominations, with Council ratifying proposed awards. Note that an award may not necessarily be given every year.

Best Regards,

Andy Rompel, Chair, Fellows Committee

3

Radioactive bathing and Geomedicine

Dear Dr Prevec,
Re: GeoBulletin September 2010, Vol 53. No. 3. Society News, Article No.2, Page 7, by P.D. Toens – "Some aspects of Geo-Medicine"

Please will you consider printing my response to the above letter in the next GeoBulletin. In this article Mr Toens refers to "radioactivity emanating from the hot springs in this country which, to the best of his knowledge, have never been evaluated. For example, at the Montagu Springs in the Western Cape, there is a notice apparently dating back to the 1940s announcing that Professor Hahn of UCT found that the springs are almost as radioactive as the famous hot springs of Austria. The public is therefore led to believe that all this is good for their health and people quite happily sit in the warm water breathing in radioactive radon gas, a decay product of uranium."

Regarding work that GEOSS has completed on the hot spring water there is a comment on a 1944 certificate of analysis which states: "The main water in the underground Main Spring gave a radio-activity corresponding to 19.0 Mache Units". Muller (1944) states "the radio-activity of these springs is greater than any other thermal springs examined in South Africa".

Based on discussion with Mr P. Beukes of iThemba LABS, the Department of Health does not have set standards for radioactivity levels in natural spring water, but the Department of Water Affairs and other organisations do have radionuclide standards for radioactivity in water. However, a reference standard of some European countries, USA and Canada, indicates the allowable activity of a given radionuclide per litre. The maximum allowable activity for the mentioned nuclides, according to the standard, is ± 20 Bq/L for the range of primordial radionuclides and their daughters excluding 222Rn which allows a further 1 000 Bq/L over and above the 20 Bq/L. The sample from Avalon Spring, Montagu (1944) contains

256 Bq/L in total (i.e. 19.0 Mache Units). In essence the Montagu Spring sample therefore meets the standard as set overseas, if the bulk of the activity in the sample is made up of 222Rn, which is suspected to be the case. In conclusion, recent works shows the Montagu hot springs are quite safe for bathing and the public needn't be alarmed.

Yours sincerely
Julian Conrad (MSc, Pr Sci Nat), Hydrogeologist

4

The Editor
Dear Sir,
Further to my note reflecting on some aspects of geo-medicine, which appears in the September 2010 issue of the Geobulletin, readers may be interested to note that ironically, in November 2010, two months later, I was diagnosed with mesothelioma; malignant cancer associated solely with blue asbestos.

I stress that I never worked on a crocidolite mine. However, I recall visiting an asbestos mine in the early 1960s in the Kuruman area. It was here that I was exposed to a single cloud of asbestos dust shortly after blasting operations. My doctors tell me that an exposure of this nature is sufficient cause for mesothelioma.

Yours Sincerely,
Dr PD Toens
Consulting Geologist
Somerset West
pdtoens@helderberg-village.co.za

CALL FOR PAPERS

for a

Special Issue of the South African Journal of Geology

on

Topics in Economic and Exploration Geology, and the geology of Namaqualand

Dedicated to Professor John Moore

Submission deadline: October 31, 2011
Expected publication date: middle of 2012

Guest Editors: Dr Steve Prevec (Dept of Geology, Rhodes University)
and Prof. Chris Harris (Dept of Geology, University of Cape Town)

Context: Prof. John Moore

After obtaining his B.Sc. and Honours at UCT, John worked for most of the next decade in exploration, mostly for Phelps Dodge, with stints at Broken Hill (Aggeneys, South Africa) and in Nevada (U.S.A.), before obtaining his M.Sc. and later his Ph.D. at UCT. He was subsequently employed there as a Research Associate (Precambrian Research Unit), then from Research Officer to Senior Research Officer in Economic Geology. In 1991 he was lured to Rhodes University in Grahamstown to take over the Professorship of the prestigious Exploration and Economic Geology M.Sc. programme, which he ran very successfully for the following twenty years. During this time, the course produced more than 100 graduates, in addition to a significant number (>20) of research M.Sc. and Ph.D. students. John also published on the order of 30 papers related to economic geology and a similar number of conference abstracts. His research has included topics such as ore deposit genesis in general, petrology of silicate alteration and replacement and ore mineralisation in hydrothermal ores, geomorphology and the African landscape (relating to placer deposition), kimberlite erosion, and the geology of Namaqualand. His teaching expertise and topical influence on his graduates has been broader still, encompassing the wide field of ore deposits and exploration in general. John's contributions were recognised most recently by the awarding of the Pretorius Medal of the Geological Society of South Africa in 2009. John took early retirement at the beginning of 2010, while battling an aggressive cancer which he continues to fight to the present day, and which he has managed with inspiring courage and class.

Accordingly, we are inviting contributions that honour John's contributions to South African geology over the past 40 years, including economic and exploration geology (not restricted to Africa necessarily), and/or related mineralogy, and the geology of Namaqualand. Normal editorial and submission policies and layout practices of SAJG will apply.

5

To the Editor:

Pilanesberg desecration and subsidence

A short while ago I visited the Pilanesberg Reserve in the company of Michael de Villers and guard Chipewa (which enabled us to go far afield of geosites and other localities).

Vein quartz fragments:

As during previous visits, I was horrified at the abundant large quartz fragments adorning low-lying areas; this, in an alkaline complex which consequently no knowledgeable geologist would recognise as such while confined to a motor vehicle. This is a prime example of geological pollution brought about by ignorant humans. The entire drainage of the Complex is radially outwards, precluding the possibility of water transport of extraneous material naturally into the Complex. Wind transport is negligible and confined to insignificantly small particles. This previously geologically pristine area has been desecrated. During field study spread over six years, and later visits before game restrictions, the only quartz located consisted of small grains in a small alkali granite plug near the centre of the Complex, and one small quartz vein on the top of the hill Thabayadiotsa. The internal roads were apparently metalled with vein quartz. I informed Platinum Professor Grant Cawthorn of this some years ago, but he seemed dubious.

This situation obviously cannot be remedied – the quartz has migrated over large low-lying areas. What can be remedied, however, is the false information displayed on several boards at various sites erected by FOPS (Friends of the Pilanesberg) advised by some senior geologist. FOPS was informed of some of these errors nut no action resulted. Some of these are given below. The heavy upright print below represents what is displayed on boards in the Complex area, while the heavy print in italics gives correct information and some comments.

Ratlhogo Hide:

Pilanesberg Complex has a diameter of 26 km (actually N-S 24, E-W 28). More seriously, the Complex is the largest known (actually the third largest; surface areas: Khibini 1140 km2, Lovozero 640 km2, Pilanesberg 531 km2, Ilimaussaq 150 km2, plus or minus). I have done study tours of both the first two on the Kola Peninsula, south of Murmansk, at the invitation of the University of St Petersburg. The Pilanesberg is certainly the most perfectly developed ring structure. The surface geology and topography of the others are hardly superficially recognizable as those of ring structures.

Geological site G2:

Porphyritic Nepheline Syenite dyke. The rock is certainly not porphyritic and its coarse crystals hardly correspond to those of a normal dyke. It is, in fact, part of the Green Foyaite cone sheet recognized by Shand (1928), Retief (1963) and Lurie (1974). While the major rocks of the Pilanesberg area can be classified as nepheline syenite, the Green Foyaite can justifiably be classified as a foyaite in light of its often trachytic texture, or even as lujavrite when it contains cudyalite.

Complex subsidence (unrelated to the above)

My contention that the Complex has subsided generally, expressed originally 36 years ago, has apparently not been accepted yet. This despite the conclusion of Rittman (1962) that volcanoes often subside. I have a simple question for the fraternity. The early ejectmenta (including Waterberg/Bushveld granite breccias and some lava) were laid on Waterberg rocks overlying Bushveld granite. The survival of these breccias along the periphery (and some remnant volcanic over central parts of the Complex) is surprising after the vicissitudes of 1300 m.y., and now apparently in contact with granite. How so? Surely, this can only be a fault contact – the Waterberg having been entirely removed and the breccias having been brought into contact with the granite by faulting. Interestingly, in neither of the two similar Kola complexes, the one one-half and the other one-quarter the age of the Pilanesberg, are there surviving volcanics at all.

Emeritus Professor Jos Lurie

Editorial glossary:

- road metal: the crushed rock (gravel) used for road beds, walkways and paths, foundations, and railway embankments, among other things.
- trachytic texture: in extrusive rocks, it is characterised by minute tabular feldspar

crystals preferentially-orientated by lava flow, in an aphanitic groundmass.

- foyaite: a nepheline syenite composed mainly of potassium feldspar.
- lujavrite: a trachytoidal melanocratic sodalite-nepheline syenite; the black variety is the rare earth element and uranium ore-bearing phase targeted by exploration activities at Ilimaussaq (Greenland).
- eudyalite: a Ce-rich Ca-Fe-Na-Zr-bearing hydrated cyclosilicate, typically red in colour.
- nepheline syenite: go on, read a book...

6

SAJG under scrutiny

Sir,

It is often quite an involved and taxing process nowadays to get a paper accepted and published in a reputable scientific journal. Reviewers are sometimes difficult to please and manuscripts are rarely accepted for publication without at least some revision being asked of the author/s. It is with this in mind that I wonder if the Editor/s of the South African Journal of Geology would care to offer an explanation as to how a recent paper published in the SAJG slipped through the system with such an extraordinary number of errors, inconsistencies and dubious geological findings? Not only does this detract from the status and credibility of the journal, but it could impact on the choice made by future contributors in selecting the SAJG as a publication forum. There has been an undeniable decline in standards in many walks of life in South Africa in recent times and it would be reassuring to learn that this malaise has not overtaken the SAJG.

Carl Anhaeusser

SAJG South African Journal of Geology

DPP events for 2011

GSSA DPP Events for 2011
Provisional Schedule

Date	Event	Venue	Organiser
24-25 February	Basic Drilling	Glenhove (Booked - Upper Glen Hove)	Colin Rice
18 March	Gold Projects in Africa	Glen Hove (Provisionally booked - Auditorium)	CBS, AB, PNx
9/19/11 March	Basic Drilling	Zambia	Colin Rice
24 & 25 March	Geotechnical Investigation	Glen Hove (Provisionally booked - Upper Glen Hove)	Colin Rice
7 /8 April	Coal Projects in Africa		LdK, RPV
May	Rara Earth Elements		Jock Harner
2 /3 June	Basic Geological Skills	Glen Hove (Provisionally booked - Auditorium)	LdK, JPH
27 August	Basic Drilling	Workshop at Geosynthesis 2011	Colin Rice
28 August	Geology of Uranium deposits in Africa	Special Session at Geosynthesis 2011	Judith Kinnard
29 August	Analytical Mineralology	Workshop at at Geosynthesis 2011	Sabine Verryn
30 September	Platinum Projects in Africa		JPH
October	Diamond projects		CBS
November	Geological Software Applications & GIS		AB et al

Discussions are underway concerning MRM and mining geology workshops aimed at junior and senior level.

a year on Gough island

Gough Island comes to the Bushveld Branch

On 19 October 2010, The Bushveld Branch hosted an event with a difference, entitled "A year in the life of the sub-Antarctic Gough Island" by Stephan Laubscher, kindly sponsored by Sealchem.

This report briefly summarises the research activities as well as the personal experiences of the team that participated in meteorological and biological research carried out on Gough Island weather station between September 1995 and October 1996.

History and Background

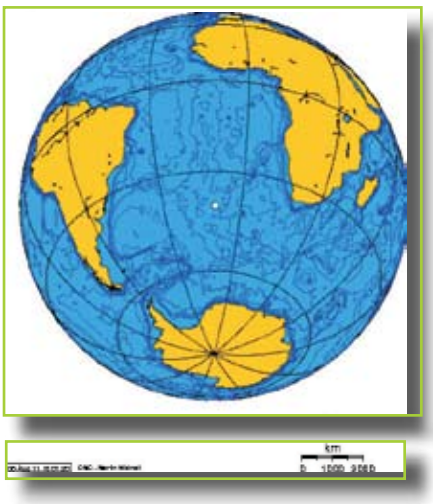
The first recorded discovery of Gough Island was by Goncalo Álvarez in 1505 or 1506. Captain Charles Gough of the British ship Richmond reported the discovery in 1731, but placed the island 400 miles to the east of Goncalo Álvarez's recorded position. Fifty years later, cartographers realised that the two islands were the same. Despite the priority of the Portuguese discovery and the greater accuracy of the position given by them, "Gough's Island' was the name adopted (Heaney & Holdgate, 1957).

Gough Island is a British territory and World Heritage Site which is uninhabited by humans except for the presence of the meteorological station which was established in 1955 by the first British expedition and permanently manned by annual expeditions from South Africa from 1956 onwards. It has been described as one of the least disrupted ecosystems of its kind and one of the best shelters for nesting birds in the Atlantic. It is also one of the most remote places with a constant human presence (Wikipedia, 2010).

Gough Island is one of four islands in the Tristan Group of islands. The others are Tristan da Cunha, Inaccessible Island and Nightingale Island. The islands are volcanic, associated with hot spot activity in the Walvis Ridge west of the southern African coast.

Gough Island is situated about 400 kilometres southeast of the other islands in the Tristan da Cunha group, about 2700km west of Cape Town and about 3200km east of south America. It is in the roaring forties and on the 40th latitude, compared to the 36th latitude of Cape Town. The weather is mostly wet and windy and the islands receive in excess of 2500mm of rain annually.

Environmental impact is kept to a minimum, with the base built on scaffolding and every non-biodegradable object being stored and sent back to South Africa for disposal. The island is, however, home to one of the largest marine bird populations of many species in the Atlantic Ocean, some endemic to the island. The island is also home to elephant seals, sub-Antarctic fur seals, as well as colonies of rock hopper penguins.



Orthographic projection of Earth with the position of Gough Island shown as a white spot in the Atlantic ocean.

Meteorological duties include hourly observations of wind speeds, temperatures, cloud types and quantities, as well as the more important upper-air measurements. These data are used directly for short and long-term forecasts for aviation, shipping, agricultural and public usage within South Africa and surrounding areas.

This data also feed directly into the global climate prediction models. Because of the remoteness and strategic locality of the island, the continued usage of the base is of very high importance.

Personal experience

During my Honours degree at Geology at Rand Afrikaans University, now the University of Johannesburg, I wanted to do something else for a while before committing to a lifelong career in geology. Bridging years or Gap years were not common then, as SA had just become part of the global community; my overdue compulsory conscription year was also not required anymore after finishing my studies. Thus a year doing meteorological research on a remote island in the middle of the Atlantic Ocean with only six other team members seemed quite fun and challenging and almost daunting. The anticipation of things to come usually seems worse than actually just grinding down and going through the motions, hour by hour, day by day and eventually month after month.

It feels like just recently that I stayed on Gough Island for about 14 months, 15 years ago; my memories are still vivid and fond though.

The team comprised a three member meteorological

team (one full-time meteorologist and two observers), a medic, a diesel mechanic, a radio operator and a radio technician. This was the last year that the radio operator was still required, after this, it was all satellite communication only.

Our daily tasks were not too challenging, but we were selected as being able to survive the year medically and psychologically without throwing someone or ourselves off the island. However, no "test" is fool-proof until you really put people in different and difficult situations.

Two months before we departed from Cape Town to Gough, we went to the Irene weather station for training; I then met the two other meteorological team members. We were introduced to the rest of the team two weeks before we left on the SA Agulhas, also unofficially known as the "red taxi". We then went for cooking lessons and more survival training and briefings on marine mammal and bird research for the Universities of Pretoria and Cape Town respectively.

The coastline of Gough Island (Courtesy of Beneke de Wet & the South African Department of Environmental Affairs and Tourism).

The team, which comprised individuals with completely different backgrounds and careers, only met then and were not even friends yet. We were expected to make it work and that was probably the best motivation for surviving the year. Any negative energy we put into the team would stay in the team, thus we had to keep the energy more positive. In normal society, people can throw around any kind of energies and may get away with it, because of larger distances and life routines that divide and define human interaction. What was not sorted out during the day or at compulsory team dinners, was sorted out over a beer and maybe a game of pool or darts in the evening at the base's bar.

The overwintering team is usually dropped off between August and September, and then picked up again 12 months later. In our year, there were all kinds of delays, the ship was late for two months, and we only went home in November. That was the worst time of our year, when everyone was expecting to go home and were told every week for two months that delays are continuing. We were mentally preparing for a second Christmas on the island; we had enough provisions fortunately, for another year or more.

We left just after the euphoria of the 1995 World Cup and with our families' support and blessing. We had minimal contact with the outside world for the duration of our stay. Ignorance to all developing problems in the world and South Africa was perceived as bliss. It was the weirdest feeling seeing the last group of people fly of the helipad near the base with Oryx helicopters and thinking that this is it. We would not be exposed to the diversity and interaction of society for a whole year.

Activities during the year included many selfish and team pursuits. There was a dark room for developing slides, black and white photos, etc., and a well-stocked library, as well as a video library and 16mm film library. A pool table and dart board for healthy competition, a gym, a bar with a never-ending supply of provisions brought in by the team- members themselves. There were many opportunities to hike, scuba and snorkel, tagging and ringing of birds and the weighing and census of seal pubs and just plain exploring. There was also the most time ever to just sit back, enjoy the scenery, and watch wildlife continue the same way it has for millennia. Every story from everybody was also told and heard in many different versions. People had to be more creative with their stories and activities while the year progressed.

It was one of my best and most selfish years' experiences ever, and I would love to go back, this time just for a tad shorter.

Stephan Laubscher

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Getting close to a yellow-nosed albatross in general local vegetation.

ADVERTORIAL

The Drilling Industry Certification Authority of South Africa (DICASA) is a voluntary association, launched in March 2010, with the sole purpose of developing training programs and a certification framework for people involved in the drilling industry. The result of an intensive development program is the DICASA Certification Framework and Training Program that was launched in November 2010.

The Certification Framework recognizes that boreholes are drilled using a variety of different methods and so 10 distinct drilling specializations have been incorporated into the framework. These specializations include:

Diamond Core Drilling – Surface operations – Medium and Deep Level
Diamond Core Drilling – Underground operations
Geotechnical Investigations
Blasthole Drilling – Rotary and Percussion
Rotary Percussion and Dual Tube Reverse Circulation Drilling and
Raisebore Drilling.

The certification process involves the assessment of candidates against a set of criteria that have been developed by industry professionals and assessed by DICASA registered Assessors. Certification is then issued which very clearly states the drilling specialization for which the candidate has been assessed.

In addition to certifying competence in defined drilling specializations, the DICASA initiative seeks also to provide a development pathway along which people working in the industry can progress based on their knowledge, skills and experience and therefore to provide a mechanism through which all people working in the industry can be recognized for their skills and experience.

Phase2 of the DICASA initiative is focused on upgrading the skills and knowledge of Site Supervisors and Site Managers through a modular training program including subjects such as: Basic Geology, Drilling Methods, Drilling Engineering, Drilling Problems, Directional Drilling, Hazard Identification, Incident Investigation and many others. These training modules are offered at different venues around the country and we believe that this initiative will result in the entrenchment of enhanced standards of practice and will ultimately make the drilling industry a more attractive one, resulting in new people being attracted to our rapidly “greying” industry.

Further information can be obtained by calling Colin Rice on 011-4763262 or by visiting the DICASA website: www.dicasa.co.za

Colin Rice Exploration & Training

all the news fit to print

University of Stellenbosch, Dept of Geology

The significant developments to report at Stellenbosch are:

1. In mid-January, we held a very successful meeting of the Igneous and Metamorphic Studies Group, with an associated field trip to the Peninsula granite pluton, sponsored by GSSA. This was all highly appreciated by the attendees, and a full report is published elsewhere. IMSG will be held at Wits in 2012, and we are presently investigating a more formal link with GSSA.

2. Immediately following the IMSG meeting, we also held a well-attended and excellent shortcourse in petrological Perple_X thermodynamic modelling, presented by Dr Mark Caddick of ETH, Zürich.

3. We are currently hosting Prof. Neil Phillips, of Phillipsgold, who is presenting an industry-orientated shortcourse on gold deposit genesis.

4. For 2011, we have our largest-ever, first-year, Earth Science intake, with 86 students registered. Likewise, our Honours enrollment is the highest ever, with 33 students, at present count. This brings pressures but also rewards, not only for US but, we trust, for the industry consumers of our "product".

Contributed by John Clemens

University of Pretoria, Dept of Geology

1. Aon Benfield Natural Hazard Centre Africa

Prof Andrzej Kijko, the Director, and Ansie Smit, his assistant, run the Aon Benfield NaturalHazard Centre in Africa at the University of Pretoria. This centre specializes in largest risks facing the people, government and insurance community in South Africa: earthquakes. With South Africa being in the spotlight during the 2010 FIFA World Cup the Centre used three of the most representative building class types in urban areas and the Green Point stadium in Cape Town as case studies to illustrate the potential damages resulting from the occurrences of earthquakes.

2. Water Research Commission (WRC) Project.

The Engineering and Environmental Geology Section has just completed a multimillion rand research project for the Water Research Commission (WRC) on the characterization of aquifers in the Basement granites in Limpopo Province. An additional smaller project completed for the WRC focused around flow in the unsaturated zone with input from the honours group in engineering and environmental geology and the data were used for community involvement projects.

3. Complex Deformational History

Associated with the Pan African Event In December 2009, Dr. Adam Bumby travelled to Khartoum to meet his PhD student, Montasir Ibin Oof, who lectures structural geology at Al Neelain University. Together they travelled into the Nuba Mountains in the Kordofan district of South Central Sudan, to examine the complex deformational history associated with the Pan African event. Mr Ibin Oof has now travelled to South Africa to continue his research at the University of Pretoria.

4. Geodynamics of Ore Deposits at UP

The Kumba-Exxaro Chair in Geodynamics of Ore Deposits at UP was newly installed in July 2009, with Wlady Altermann from the Ludwig-Maximilians University of Munich, Germany. Wlady has taken over the courses Geodynamics of Ore Deposits (3rd year) and Economic Geology (BSc Hons), and the 1st year course in Physical Geology, with a class of 475 students from Geology, Mining Engineering and Civil Engineering.

5. Awards

- Prof Pat Eriksson received the Continental African Union Scientist Award in 2010.
- Prof Roland Merkle has received an award on his joint paper on the Platinum Group Mineralogy of Ultramafics from the Sukinda Chromite Belt, Orissa and the Sittampundi Complex, Tamilnadu. This award was presented to him on 6th May 2010 by the Sekhar Award Committee.
- An MSc student, Mmathapelo Selomane, received the award for the best student Honours project earlier in 2010 from the South African Institute for Engineering Geology and the Environment at a gala awards dinner in Midrand.

IMSG 2011

Report on IMSG 3: The 3rd annual Igneous & Metamorphic Studies Group meeting, Stellenbosch 2011

The third meeting of the Igneous and Metamorphic Studies Group was held on the 16th to the 19th of January 2011, in the Department of Earth Sciences at the University of Stellenbosch, with sponsorship from the GSSA and the Western Cape Branch. It was rather well attended, with more than 50 delegates, including some from overseas, coming as it did directly after the CAG23 meeting held in Johannesburg. The icebreaker reception showed, yet again, that while snack food can be ordered in sufficient quantity, it is impossible to adequately cater for the liquid refreshment side of such events, such are the capacities of geologists and geology students.

The three keynote lectures were Prof. Chris Harris (UCT: "Oxygen Isotopes and the Origin of Granites"); Prof Steven Foley (Mainz: "Minor and Trace Elements in Olivines as Probes into Early Igneous and Mantle Melting Processes") and Cynthia Sanchez-Garrido (Stellenbosch: "The petrogenesis of unique, low-Ca Archaean rhyolites from the Barberton greenstone belt: New insights from information contained within zircon" – student keynote). These addresses were greatly appreciated. The general scientific sessions were also of particularly high quality, with numerous excellent talks by researchers and research students, covering the whole spectrum of igneous and metamorphic petrology (liberally defined).

The winners of the two student prizes of R1000 each (donated by the WC Branch) are:

Best M.Sc. presentation:

Corné Koegelenberg (Stellenbosch) "Chromite-sulphide melt interaction in the Bushveld Igneous Complex, South Africa – implications for platinum mineralization"

Best Ph.D. presentation:

Natalie Deseta (Wits) "Geochemistry of blueschist-facies ultramafic and mafic pseudotachylites"

The regular sessions were, for the first time, followed by a field trip to visit some of the classic localities in the S-type granites of the Peninsula Pluton. The 50 participants saw amazing cordierite and garnet accumulations, monster alkali feldspar phenocrysts, graded magmatic layering, the unconformity with the overlying Cape Supergroup and the complex magma injection and contact metamorphism revealed at the famous Sea Point contact with the Malmesbury Group metasediments. In the evening the weary field trip participants slaked their thirsts and fed their inner persons at a delightful snoek braai hosted at the Kriel farm on in the hills overlooking the Stellenbosch valley. For some, the allure of the swimming pool was irresistible.

The meeting was combined with, and followed by, a well-attended and highly successful workshop on Perple_X thermodynamic modelling, delivered over 2 days by Dr Mark Caddick (ETH, Zürich).

Special thanks go to Prof. Gary Stevens for organising the scientific sessions and leading the field trip, the latter ably assisted by former student Arnaud Villaros (Saint-Étienne, France) and postdoc Dr Federico Farina.

The other unsung heros of the meeting were Stellenbosch Ph.D. students Angelique Laurie, Cynthia Sanchez-Garrido and Jeanne Taylor, for their assistance during registration, etc., and Mrs Loxie Conradie for organising practically everything and correcting and compensating for academic errors and oversights.

The 2012 IMSG will be hosted by Wits, and we all look forward to a strong future for the meeting, with continued support from the GSSA.

contributed by John Clemens

IMSG
Igneous & Metamorphic Studies Group

CAG 23: a personal perspective

In January, for the first time, the Colloquium of African Geology was held in South Africa, at the University of Johannesburg, and Hassina Mouri and her organizing committee are to be congratulated on bringing this event to South Africa and successfully running an enjoyable and entertaining meeting. With five simultaneous sessions, 6 plenary lectures, and many keynote presentations the ~500 delegates were spoilt for choice. There are always clashes and conflicts at such large gatherings, however the sessions were logically arranged with lecture theatres in close proximity which made attending consecutive talks in different sessions much more easier than anticipated. The UJ venue was a particularly excellent choice.

> "At ca. 500 delegates, the CAG23 was one of the largest CAG meetings hosted in Africa, or indeed in Europe"

On the first evening, following welcome speeches by members of the organizing committee, a review of the history of the colloquia by Peter Bowden was useful to put the event in context. This highlighted the efforts of several notable individuals, particularly Russell Black at the Pierre et Marie Curie Université, Paris, and Tom Clifford at the University of Leeds in the UK, who were instrumental in the early days of the Geological Society of Africa and the colloquia. In the early years, the Colloquia were based in Europe and it is only in more recent years that they have been organized in Africa (so far Swaziland, Zimbabwe, Morocco, Tunisia, Mozambiquwe, and South Africa).

The official opening ceremony of the conference, held at UJ's Soweto Campus, was somewhat long-winded; however, this culminated in a refreshing and inspiring speech by the Minister of Science and Technology, Mrs. Naledi Pandor. This reiterated the ministries' commitment to geosciences education and also challenged practicing geoscientists to increase and improve the public's awareness and knowledge of geology. The full text of the speech can be found in the latest newsletter of the Geological Society of Africa (website: www.geologicalsocietyofafricas.org).

For me, the highlights of the conference, which obviously reflect my own interests, included the Russell Black memorial session on "The nature and significance of the Pan-African orogeny and the relationships of alkaline ring complexes to orogenies", innovative talks on granite genesis by speakers from the University of Stellenbosch, and the diversity of opinions, as always,

CAG delegates at UJ (photo courtesy Hassina Mouri).

on the enigmas of the Bushveld Complex. Judging by the controversy that was generated I was disappointed not to have been able to attend the session on "Kimberlite magmatism in Africa", however, I was busy listening to talks on the Pan-African fold belts of Africa.

At most conferences it is possible to detect new trends in research. The two 'buzzwords' or phrases I heard most often were "SubContinental Lithospheric Mantle" (SCLM) and 'delamination'. This was particularly noted in plate tectonic and orogenic sessions where in several talks something was delaminated (lower crust, or SCLM?) although the precise mechanism and exactly how this happened did not seem to be stringently addressed. I was left with the impression that further constraints on these processes or how the geological community can test these hypotheses will be most welcome.

Fortunately it is likely that there will be several special publications arising out of this conference, I believe that two Geological Society of London, Special Publications have been proposed and I hope this will lead to more widely disseminated African geological knowledge and information. It was truly an African conference with delegates attending from almost 60 countries worldwide. The number of industry geologists attending was rather low and perhaps disappointing as many of the presentations had direct relevance to exploration and mineral deposit targeting. The next Colloquium of African Geology will be held in Ethiopia in January 2013 and I am sure that we all hope it will be as much a success as the 23rd CAG held in South Africa.

Contributed by Paul Nex

impact craters in libya

First joint Libyan-German-South African Expedition to the Oasis Structure, Libya

The Oasis Structure is one of two circular geological features in the Sahara Desert of southeastern Libya that were proposed as impact structures in the 1960s-1970s. Named after the Oasis Oil Company, whose geologists visited the Structure in the 1960s, Oasis is centred on 24° 35'N, 24° 24'E. It is marked in its centre by a partially degraded ring of hills approximately 5 km in diameter that rises up to 100 m above the surrounding desert plains and by ~50 m over a largely flat, ca. 3 km wide, interior (See photo, pg 22). French et al. (1974) cited the presence of shock deformation lamellae in quartz and possible microscopic glass occurrences in highly altered rocks from the centre of the Structure as proof of an impact origin and described the Structure as dome-shaped, with generally shallow outward dips of strata in the hilly terrain.

Oasis and its smaller neighbour, the BP Structure lying 80 km further north, were speculatively proposed as being related to one-another by French et al. (op cit.), who also suggested that their formation might be linked to the enigmatic Libyan Desert Glass found 150 km to the east in southern Egypt. However, apart from a few short visits by Libyan geologists engaged in regional mapping, and a very brief visit of a few hours by Uwe Reimold and Christian Koeberl in 2002, no systematic geological study of the Oasis Structure has ever been conducted. Following the First Arab Impact Cratering and Astrogeology Conference (AICAC) held in Jordan in November 2009, a proposal was submitted by Dr Mohamed Baegi to the LCRSSS (Libyan Centre for Remote Sensing and Space Science, Tripoli) for a joint expedition by scientists from the Centre and German (Uwe Reimold) and South African (Roger Gibson) researchers. With the financial support of the Director of the LCRSSS, Eng. H. Gashout, as well as the NRF and the Museum fur Naturkunde (Berlin), the expedition of 5 scientists (Baegi, Reimold, Gibson, and Messrs Eshaab Shbeli and Abdurazzag Eshwehdi from the LCRSSS) and a support team left Tripoli on 26 October in a convoy of two 4WD vehicles and 3 trucks for a bone-jarring two-day, 1800-km, trek east to Ashbadiyah and then south to Kufrah Oasis. After a short half-day rest in Kufrah, the expedition headed

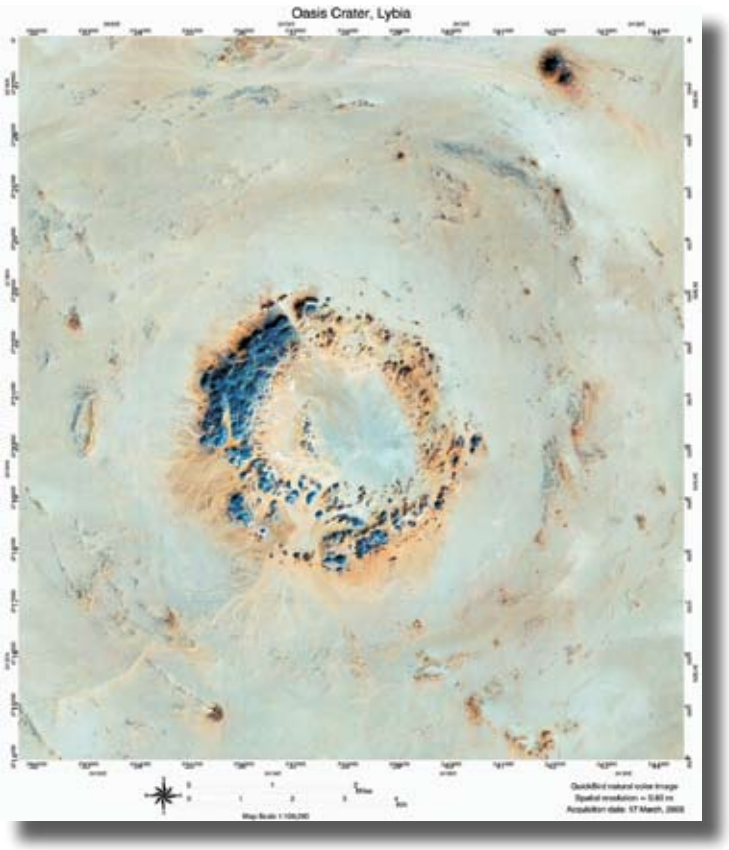

Figure 1: The Quickbird image of the central parts of the Oasis Impact Structure shows the central ring of hills, 5.1 km in diameter, surrounding a central depression and surrounded by a flat plain in which large fold structures are visible. Koeberl et al. (op cit.) suggested that the NW-trending lineaments seen on the left of the image were truncated by the Structure and defined its radius as <9 km; however, this study has shown that the lineaments are Tertiary faults that cut the Structure, and that folding is present up to 12.5 to 18 km from the centre. Image is 12.8 km wide.

120 km east-northeast into the desert for 10 days of mapping. Camp was established in a wadi in the shelter of the inner hills to provide some protection from the persistent winds. The scientists were very ably cared for by the 7-man support team who were responsible for driving, meals, logistical support (notably the repairing of numerous flat tyres!) and round-the-clock lookout duty for possible smugglers following the well-"trodden" routes between Niger, Chad and Egypt that pass close to the Structure!

The scientific team very quickly dispelled several misconceptions about the geology of the Oasis Structure. The first of these was that the Structure is located entirely within the sandstones of the Lower Cretaceous Nubia Formation (now renamed the Al Hawaish Formation) – in fact, Upper Carbonifeous rocks underlie most of the Structure with only a thin veneer of overlying Nubian sandstones in places. The second relates to the size of the Structure. French et al. (op cit.) suggested a size between 5.1 and 11.5 km, whereas interpretation of Radarsat imagery led Koeberl et al. (2005) to suggest a diameter between 11.5 and 18 km. However, radial field traverses identified deformation effects as far as 12.5 to 18 km from the centre of the Structure, suggesting a diameter of between 25 and 36 km. A high-resolution Quickbird image acquired by the LCRSSS and processed by Professor Alvaro Crostá of the University of Campinas (Figure 1) also provided insight into a complex fold interference pattern that intensifies

Roger Gibson inspecting a large breccia along the proposed southwestern edge of the Oasis Structure. In addition to the faults, the rocks in the Structure preserve a complex fold interference pattern not seen regionally.

towards the centre of the Structure but that extends beyond the limits identified by previous workers. Field mapping confirmed ubiquitous tangential and radial folds, ranging from metres to approximately 500 m in wavelength, which are cut by a complex fault network.

Although the search for shatter cones yielded no conclusive evidence (despite some tantalising wind-ablation features), intensive sampling of the core of the Structure has turned up several interesting breccias. The first thin sections of these rock specimens have revealed a plethora of shock deformation features in quartz. This confirms French et al.'s (op cit.) findings and interpretation of Oasis as an impact structure.

The structural mapping indicates that Oasis does not display the conventional central peak or peak-ring morphology seen in impact structures of similar size in crystalline basement targets. Nonetheless, the centrifugal and centripetal motions inferred from structural vergences are best reconciled with the complex movements and stresses that typify impacts. The predominance of porous, fluid-filled sedimentary rocks in the target may be the reason for the anomalous crater structure. This will be explored further through a second field expedition in 2011, as well as through remote sensing and numerical modelling studies.

The expedition also provided opportunities to experience some of the sights, sounds and tastes of Libya, thanks to the generosity of our hosts. Tripoli literally means 'Three Cities' and refers to the ruins of three significant ancient settlements dating from nearly 2000 years ago that lie along the Libyan coast. We had the opportunity to visit Leptis Magna (Figure 3), a World Heritage Site some 120 km east of Tripoli, dating from the Third Century A.D., as well as the Old City and Medina (market) of Tripoli. October is probably the best month for field work in the Sahara, with daytime temperatures averaging 35 °C, but tempered by the wind (luckily, the hamada dust storms only blew on our return journey) and nighttime temperatures between 5 and 15 °C. We discovered that, with the right spices, even chicken heart can be turned into a palatable field dish for conservative Western palates, and that seeing a tree after nearly two weeks in the deep desert with no scrap of vegetation can be a mystical experience! Above all else, we were treated royally during our visit and we look forward to a return visit in 2011 and an expansion of the project with our Libyan colleagues to include other aspects such as stratigraphy, remote sensing and geophysics.

Please note that the Second Arab Impact Cratering and Astrogeology Conference (AICAC II) is planned for mid-November 2011, to be held at Casablanca (Morocco). As soon as the dates are confirmed, we will report in Geobulletin.

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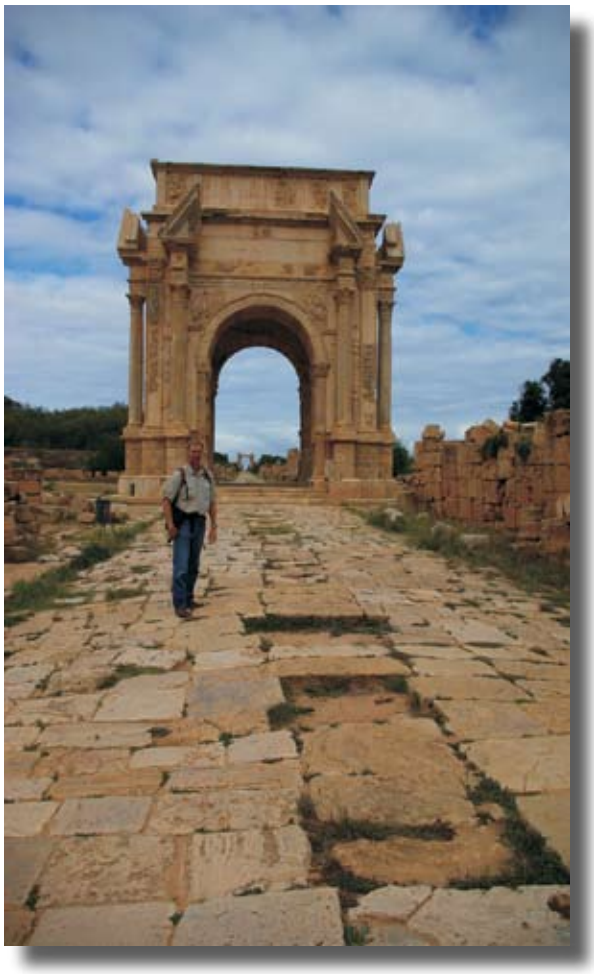
Roger Gibson and Uwe Reimold

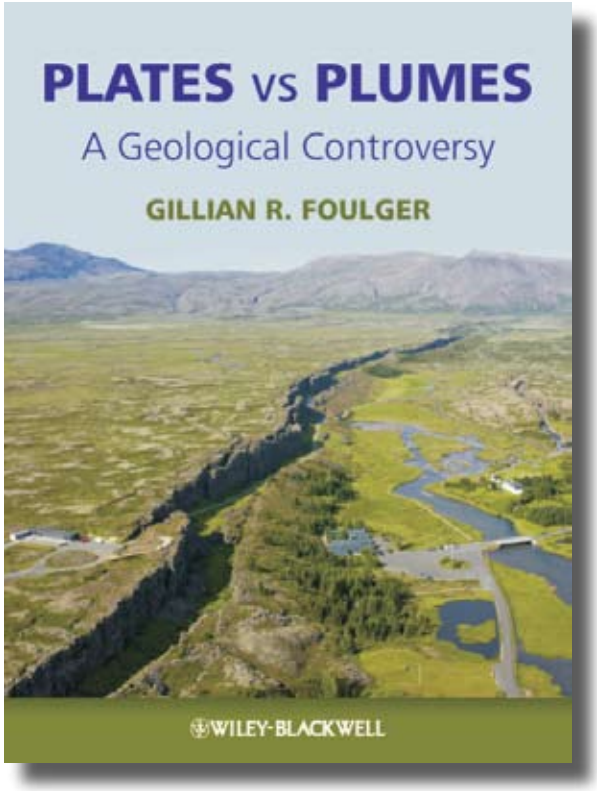
The Arch of Septimus Severus, Roman emperor in the early Third Century A.D., at Leptis Magna.



book reviews:

PLATES vs PLUMES: A Geological Controversy by Gillian Foulger (2010)

ISBN: 978-1-4051-6148-0
Paperback, 364 pages
Wiley-Blackwell
Currently retailing at ca. £39.95 / $47.90



The great debate between the "Neptunists" and "Plutonists" set the tone for an unintended but long-continued tradition in the development of geology as a science, with diametrically opposing schools of thought offering radically different proposals to explain a common observation. Such divergence of opinion should in principle be a stimulus to design research to validate, reject or reconcile opposing viewpoints. The reality in many of the great geological debates has often been the development of entrenched opposing camps, defending respective paradigms with the fervour of prophets of religious dogma, with little constructive dialogue, despite the potentially wide-reaching implications for our understanding of Earth processes.

Modern examples of this remarkably fitful process of advancement of geological understanding are the early debate surrounding continental drift, and the issue of extra-terrestrial impacts vs volcanism in explaining mass extensions. In the case of continental drift, the idea represented a major challenge to entrenched prejudices of the solid, dependable physical characteristics of the planet, which only collapsed long after the completely compelling geological field observations had been tabled. In contrast, in the case of the linking mass extinctions to catastrophic impacts, early widespread acceptance reflected the seeming elegance of the model in explaining a variety of associated observations – such as the widespread Ir anomaly that is broadly coincident with the K-T extinction boundary. Scientists suggesting a causative link between the coincidence of mass extinctions and major volcanic events received short shrift as modern-day heretics.

The Plume Hypothesis, initially proposed to explain the time-progressive Emperor-Hawaii volcanic chain, is a further example of an idea which received early widespread acceptance because of its apparent geological elegance. It appeared to answer a major Plate Tectonics quandary – how to account for volcanic activity in the interior of plates, well away from spreading ridges and subduction zones. Early challenges were made to the Plume model – for example the "Membrane Tectonics" concept of Oxburgh and Turcotte. These authors suggested that plates moving over a non-spherical globe would fracture to accommodate the resultant stresses, leading to deep mantle pressure release, which would trigger volatile fluxing, and in turn lower the peridotite solidus, initiating melting. Propagation of fractures linked to plate migration thus provided an alternative "top-

down" or "permissive" mechanism to explain time-progressive volcanic chains. However, so entrenched was the Plume "silver bullet" that such tectonic (or Plate) models received little early support.

Almost 50 years after Tuzo Wilson suggested that the Emperor-Hawaii volcanic chain formed by the motion of the Pacific Plate over a "hot spot" in the mantle – the forerunner of the Jason Morgan's subsequent 1971 "Plume" concept, a growing group of "plume-sceptics" is voicing concerns over observations that are perceived to be at variance with the model. One of these is Gillian Foulger, who recounts how she puzzled over a low-wave-speed anomaly beneath Iceland. This terminated in the transition zone, rather than in the lower mantle, as would be envisaged by the classic Plume model. She recalls being dumbstruck with astonishment when Don Anderson (a noted Plume-sceptic) suggested that perhaps the widely assumed plume beneath Iceland did not exist. However, despite the importance for the Earth Sciences of establishing the primary cause of intraplate volcanism, "Plumists" and "Plume-sceptics" appear to have settled rather comfortably into two diametrically opposed camps, with little mutual discourse.

In order to stimulate debate, Foulger played a major role in setting up and maintaining on an ongoing basis the website www.mantleplumes.org. The aim of the website is to provide a forum for general debate and critical commentary on the origin of "anomalous" volcanism, and it is open to all interested parties. This has now been followed up by a book on the subject, providing a uniform overview of all aspects of the debate, aimed at educators, students and research scientists. This is Foulger's very timely and thoughtful book titled PLATES vs PLUMES: A Geological Controversy, published by Wiley-Blackwell in late 2010.

Throughout the book, a major theme developed is the lack of agreement as to what actually constitutes a plume, and their modern-day expressions. Morgan originally suggested that there were "about 20 plumes", sourced below the asthenosphere, that were fixed in the mantle relative to one another, although he identified only 16 of these in his original publication. The number of plumes proposed by different authors grew rapidly, achieving a world record of 5200 based on fractal arguments. A further development is that plumes have been invoked to account for volcanism ranging over eight orders of magnitude from small individual centres to large igneous provinces (LIPs). Foulger points out that it is difficult to envisage a single mechanism that can explain volcanic provinces as different as Iceland and Hawaii. Semantics present a further source of confusion, and to avoid the loosely defined concept of a "hot spot" to describe a centre of volcanism, she proposes the non-genetic term "melting anomaly."

Foulger points out that a major problem in addressing the Plume model is that the concept, as developed by different authors, has increasingly invoked a variety of ad hoc explanations to deal with inconsistencies. Thus, when it was appreciated that the putative plumes invoked to explain the Emperor-Hawaii chain and Iceland could not be relatively fixed in the mantle, it was proposed that they had been displaced by "mantle winds". Pulsing plumes (presently not pulsing) were proposed to explain away the embarrassing absence of a seismic anomaly, while channelled plumes were offered as an explanation for volcanism away from the inferred plume head. Foulger questions whether the result is a hypothesis that is intrinsically not falsifiable as a practical matter.

In order to address this problem, Foulger devotes separate chapters in the book to the predicted effects of plumes on vertical crustal motions, volcanism, time progression and relative fixity of melting anomalies, seismology, temperature and heat and petrology and chemistry. In each, she contrasts the predictions of the Plume model with those of the Plate model, and compares these with actual observations. Her conclusion is that the observations are often inconsistent with predictions of the Plume model, and more readily explained by the tectonic triggers embodied in the Plate concept. For convenience, a table in the final chapter summarizes the predictions and fits (or otherwise) of the two models with the observations.

An example of this logical treatment of the debate is that a plume head approaching the base of the lithosphere would be expected to produce surface doming a few million years prior to the onset of volcanism. Such precursory uplift is not required by the Plate model. Constraining the timing and magnitude of uplifts is notoriously difficult. Nevertheless, where there are tight geological controls – as for example provided in the Atlantic Tertiary Igneous Province by oil drilling programmes, major uplift followed rather than preceded the initial phase of volcanism. Further, the pattern of uplift in this province showed a poor fit to a domal pattern, and was centred on the coast of Greenland, over 1000 km from the postulated plume impact position. Geological evidence showed that eruption of the Eastern Siberian Traps was associated with subsidence rather than uplift, and that negligible if any uplift was related to eruption of the Emeishan basalts of southwest China.

The chapter on seismology will be particularly valuable to non-geophysicists, as it spells out many of the hazards entailed in data interpretation and presentation. Thus, numeric modelling of seismic data is faced with the problem that VP and VS seismic wave-speeds are strongly affected by the presence of a partial melt in the mantle. Chemical effects have the second largest effect, with a 1% change in olivine Fo content producing a change in seismic velocity comparable to a 70oC change in temperature. In fact, temperature has the weakest effect on seismic velocity. Simplified models, which assume (because of uncertainties in other variables) that seismic wave speed is proportional only to temperature are thus indefensible. Colour enhancements of data have to also be viewed cautiously, to distinguish between what is a strong, significant anomaly and what is merely graphics-enhanced noise or a carefully chosen cross section that is, in reality, misleading. Huge vertical exaggerations, sometimes used in cross sections, also give false impressions.

The potential pitfalls in the interpretation of seismic data can be highlighted by two major low velocity shear wave (VS) velocities just above the core-mantle interface. These are widely ascribed to anomalously hot and buoyant zones of the deep mantle, and they have been interpreted to be "superplumes", held responsible for initiating volcanism ranging in magnitude from large-volume LIPs to relatively insignificant volume kimberlite pipes. Nevertheless, the interpretation of these anomalies as "superplumes" has been called into question. They are associated with positive anomalies in the elastic bulk modulus, which like VS, will decrease with increasing temperature. Thus, they cannot be due to the effects of temperature alone, and may primarily reflect chemical heterogeneity, and be dense, rather than buoyant. Seismologists are severely challenged in teasing out the temperature component associated with these seismically-defined bodies.

In general, I found the book crisply and clearly written, easy to read, and liberally illustrated. It is also a wonderful summary of a wide range of volcanic provinces in time and space, as well as a provocative review of what we think we know and don't know of Planet Earth and deep mantle dynamics. It will be an invaluable resource for teachers of Earth science, ranging from geomorphologists to volcanologists.

Whether it will convert avowed Plumists in their views is of course an open philosophical question. What cannot be questioned, is that Foulger has unfurled the Plume-sceptic colours, and outlined issues challenging the plume paradigm, which require debate. These are multi-disciplinary, and some will undoubtedly not be easily resolved – the timing and magnitude of crustal uplift is a case in point. If such debate is stimulated, the book will have well served its purpose. At issue is whether a major paradigm-shift is required in how we interpret geological and particularly magmatic processes.

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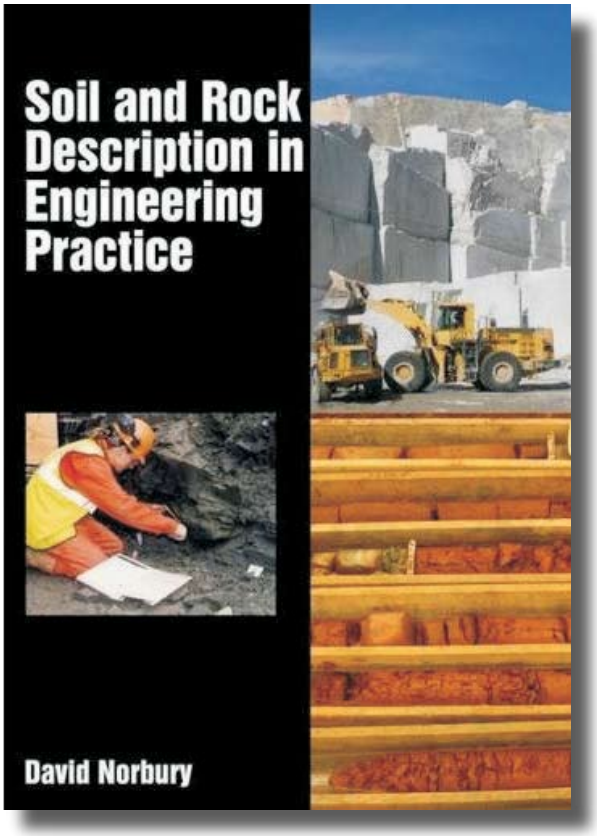
2

Soil and Rock Description in Engineering Practice
by David Norbury (2010)

ISBN 978-1904445-65-4
Published by Whittle Publishing, Caithness, Scotland
Hardcover, 288 pages
Currently retailing at ca. £76



A quote by Dick Gosling in the introduction saying that 'A site investigation lives and dies by its field logs' aptly sets the tone for this reference book. The book provides a excellent manual for the logging of soil and rock exposures and boreholes. As the title suggests, it is directed at the engineering geologist and geotechnical engineer, but will also be an indispensible reference for the geologist exposed to this nature of work. The book is aimed at both the graduate geoscientist starting out, as well as at the senior professional and mentor who will find it invaluable to get up to date with current trends and standards of description. The material for the book was developed over a period of two decades from courses offered by the author and is a comprehensive work on the subject.

A historical background of codification of soil and rock description is given in Chapter 2. The systematic procedure of description is discussed in Chapter 3. Chapters 4 to 9 are devoted to the details of the description of materials and followed by the description of mass aspects in Chapter 10 to 13. Chapter 14 discusses the description of made ground such as earthfills, landfill, asphalt and concrete. The classification schemes for soil and rock are reviewed in Chapter 15. The book concludes with a chapters on the practical tools and process in the description of boreholes and field exposures. A useful feature of the book are the coloured text boxes, which present tips and additional background information relevant to the chapter in question.

The standards and practice based on British and European norms with some reference to usage in other parts of the world. The book is written for the European practitioner and this limitation means it does not include, nor reference the local conventions, which are exclusively used by local practitioners in the engineering description of the South African soil profile.

Despite this omission this is a valuable and comprehensive guide reflecting modern practice in the description of soil and rocks and one which I would insist on having on my bookshelf.

John Stiff

Black Swan

On First Looking into the Tswaing Meteorite Crater

In single file we climbed the narrow trail,

Through bramble thicket to the crater's rim.

Where warming sun cast shadows on the brim,

And bathed the bushveld scrub and scattered shale.

Concealed beneath the gently waving grass,

By saline lake, the haunt of duck and plover,

Lay snakes and lizards in the rain-soaked clover,

On diaplectic quartz and feldspar glass.

In prehistoric stone-age time of yore,

At hypersonic speed a chondrite fell

On thunderstruck impala and gazelle,

And vaporized upon the forest floor,

Black swans are not so rare, I heard you say!

Beware! One may befall this very day!

With my best wishes
Keith Moffatt
25 Jan 2011

Professor re-visits old haunts

On the 1st of February 2011 retired Professor Willem van Biljon invited himself to tea in the Department of Geology in the School of Geosciences at Wits University. What, you might ask, is so significant about this? Well, exactly 60 years previously, on the 1st February 1951 Willem began work as a lecturer in the Geology Department at Wits, having been offered the post of Junior Igneous Petrologist in the Department by the then Head of Geology, Professor T.W. Gevers. Willem had just graduated from the University of Pretoria with a B.Sc degree in Geology at the tender age of 21. He recounted, to an interested group of staff and students, how he had been approached by Prof Gevers to join Wits, but as he had subsequently heard nothing further about the job, he decided to join the Geological Survey in Pretoria. Subsequently, Gevers contacted him and asked why he had not come to Wits? Eventually, Gevers came to an arrangement with the Director of the Geological Survey, Dr Louis Nel, and Willem crossed the Jukskei and began his illustrious academic career as a junior staff member earning double the salary (£52.00 a month) that he would have earned had he remained at the Survey.

Willem was engaged to replace Dr J.C. 'Koos' Dunne and worked under Dr R. A. P. Fockema, then the Senior Petrologist in the department. Willem went on to describe the Geology Department in the 1950s, pointing out that it had initially shared the present Botany/Zoology building at Wits until the move across campus to the newly constructed Geosciences Building, which was occupied for the first time in 1962. He also reminisced about the staff of the Geology Department, among them being Professor Edgar Mendelssohn, involved with Economic Geology, Dr Edna Plumstead renowned for her work on Coal Petrology, and Dr H. B. S. (Basil) Cooke who had a strong interest in Quaternary Geology and whose textbook (together with G. N. G. Hamilton) entitled "Geology for South African Students" became the standard text for South African geology students for many years. Also in the Department was an old stalwart, Miss Jeanne de V. Little, who over the years compiled the invaluable Indices of the Transactions of the Geological Society of South Africa, and who assisted Prof Mendy, who held the dual role of Secretary of the Geological Society (1933-1968) and Honorary Editor (1933-1960). In later years John McIver and Hugh Morris joined the staff.

A highly animated and enthused Prof Willem van Biljon explaining his ideas on how the Bushveld Complex was emplaced. Also in the photograph, from left to right, are Tony Naldrett, Morris Viljoen, Willem, Grant Cawthorn and Roger Gibson. Photograph supplied by Carl Anhaeusser.

Willem left Wits in 1963 to take up the Chair of Geology at the University of the Orange Free State. Two of his former students were present at the tea party, namely Prof. Morris Viljoen and this writer, and during his address he praised the Wits Geology Department for the numerous valuable contributions it had made over the years to teaching and research across a wide range of geological endeavours. Willem turned 82 later in February, but despite his age he still exudes an enthusiasm and passion for geology that contributed to him being such a popular teacher and colleague to all that were fortunate to have known him and who experienced the special manner in which he interacted with his students and everyone else.

We hope that Willem van Biljon will visit the School of Geosciences at Wits University on many future occasions and wish him and his wife Sophie well in the years to come.

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School of Geosciences,
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Johannesburg

media monitor

MINING AND EXPLORATION NEWS

Copper and cobalt

Tsodilo Resources resumed drilling at its Gcwihaba project in northwestern Botswana, where the results to date document the presence of base and precious metals, rare earth minerals, and uranium. Recent dating by the AEON research group at the University of Cape Town has highlighted the presence of Archaean granite-gneisses (ca. 2550 Ma) intruded by Palaeoproterozoic granites (ca. 2000 Ma), which have been tectonically interlayered with Pan-African meta-sediments (ca. 535 Ma), strengthening suggestions of a correlation between the mineralised Pan African rocks and basement in Ngamiland with those of the Central African Copper Belt and the Matchless Amphibolite Belt in Namibia.

Papua New Guinea has granted the world's first deep-sea mining lease to Nautilus Minerals for the development of its Solwara 1 project in the Bismarck Sea. The lease covers an area of approximately 59 km2, where Nautilus intends to mine high-grade copper and gold deposits on the ocean floor at depths of approximately 1600 m. Solwara 1 has a resource of 2.2 Mt of ore, including 870 kt in the Indicated category at grades of 6.8% copper and 4.8 g/t gold. Production is expected to start about two and a half years after full project sanction, at an annual rate of more than 1.3 Mt of ore containing approximately 80 000 t of copper and 150 000-200 000 ounces of gold.

Gold

A preliminary assessment of Banro Corporation's Namoya heap leach project, located on the Twangiza-Namoya gold belt in the DRC, has shown that it could double the gold production expected from Twangiza's Phase I project within a year to around 250 000 ounces per annum. Highlights include an average annual production of 124 053 ounces per annum over seven year mine life, with average total cash operating costs of US$359 per ounce. The initial capital cost is estimated at US$118.2 million. Banro envisages that the combined cash flows from Twangiza and Namoya would fund the hydro-electric plant required to support the proposed Twangiza Phase II project, which would enable the company to target a production of up to 500 000 ounces per annum. A full feasibility study on Namoya is scheduled for completion by the end of 2011. Phase I of the Twangiza project is expected to begin operations in late 2011.

Stratex International has acquired a new Exclusive Exploration Licences in the prospective Afar region in eastern Ethiopia, where it has identified further epithermal-style veining, alteration and pyrite-gold mineralisation. The company now has a total land position in the region of 3 292 km^2, including 138 km^2 in the Main Ethiopian Rift. Preparations are underway for a 3000 m drilling programme at the company's flagship Megenta hot spring epithermal gold discovery under the joint venture with Thani Ashanti, an AngloGold Ashanti Limited joint venture company.

Iron ore

London Mining has increased the primary resource at its Marampa iron ore project in Sierra Leone by 70%, to 906 Mt grading 31.7% Fe, with 379 Mt in the Indicated category and 527 Mt Inferred. A further 20 000m of drilling is planned to upgrade Inferred resources to the Indicated category. The new resource also includes 131 Mt of weathered ore (35-38% Fe) that can be considered for inclusion in the Phase 1 mine plan. London Mining is developing Marampa in two phases, with the first phase processing the tailings from previous operations and weathered ore to produce 3.6 Mt/a of high grade concentrate for blast furnace sinter production, beginning in the last quarter of 2011. The company has signed a five-year offtake agreement with Glencore International for the first phase of production.

African Aura Mining announced an increase in the Inferred mineral resource estimate at its Putu iron-ore joint venture with Severstal Resources in Liberia, to 2.4 billion tons of predominantly magnetite-itabirite ore at a grade of 34% iron. A major drilling campaign, expected to total more than 60 000 m, is under way in support of the pre-feasibility study. The company also released a maiden resource estimate of 1.04 billion tons at 34% iron at its 100%-owned Nkout project in southern Cameroon.

Xstrata has exercised its option to take a controlling interest in the 3.3 billion ton Zanaga iron-ore project in the Republic of Congo from AIM-listed Zanaga Iron Ore Company Ltd, in return for a commitment to fund a feasibility study to a minimum of US$100 million. Zanaga together with the projects acquired as part of Sphere Minerals, in which it currently has a 75.5% stake, gives Xstrata control of a resource base of more than 7 billion tons of iron ore.

Manganese

Australian-listed Jupiter Mines announced a AS150 million placement to fund the development of its 49.9%-owned Tshipi project in the Kalahari Manganese Field, and to fast-track the Mt Ida magnetite and Mt Mason iron-ore projects in Western Australia. Jupiter's portion of the capital required to onstruct the mine, plant and infrastructure at Tshipi is expected to be US$100 million, out of the US$200 million total needed to enable a production of up to 2.4 Mt of manganese lump and fines per annum. The directors of Tshipi gave the go-ahead for construction of the project at the beginning of February.

Drilling at Aquila Resources' Avontuur manganese project in the Kalahari Manganese Field has lifted the Gravenhage resource by more than 60% to 107 Mt at 38.5% manganese. Approximately 56% of the resource is in the Measured and Indicated categories, and a significant proportion is high-grade manganese, with approximately 59% of the resource grading 40%. A feasibility study for an initial open-pit mine, to be followed by an underground operation, is due for completion in the third quarter of 2011.

Nickel and cobalt

African Eagle Resources announced a significant resource upgrade at its Dutwa nickel project in Tanzania, with more than three quarters of the Wamangola resource (the larger of the two deposits at Dutwa) now in the JORC Indicated category. Of the total Dutwa resource of 98.6 Mt (46.2 Mt at 0.93% nickel and 0.03% cobalt, 47% is now in the Indicated category, and can be used to derive probable mining reserves for the pre-feasibility study, which is due for completion by the third quarter of 2011.

PLATINUM GROUP ELEMENTS

Platinum Australia (PLA) has increased the total mineral resource at the Rooderand platinum project in the western Bushveld Complex by 40% to 28.83 Mt at 4.55 g/t 4E (platinum , palladium, rhodium and gold) for 4.22 million 4E ounces. PLA has earned an initial 30% in the project from Atla Mining Resources, and will earn a further 35% for funding and completing a definitive feasibility study. The pre-feasibility study, which is currently being completed, is based on an initial 1.5 Mt/a open pit operation with a life of up to eight years, with the ore being treated through an on-site processing plant, followed by underground mining for up to ten years further.

Wesizwe Platinum concluded a US$877 million (R6.2 billion) financing package, consisting of a combination of debt and equity, with Jinchuan Group Ltd and the China Africa Development Fund (CADFund). The company said that the package provides a total financing solution for the development of its core Frischgewaagd-Ledig project, which has a current resource of over 13 million PGE ounces and the near-term potential to produce up to 350 000 PGE ounces per annum.

Tantalum and niobium

Globe Mining and Metals has agreed to form a strategic partnership with East China Mineral Exploration and Development Bureau (ECE). The state-owned enterprise will invest A$41 million for a 51% stake in Globe, and assist the company to secure project finance for the Kanyika niobium project in Malawi from Chinese banks and funds.

Uranium

Deep Yellow Limited announced positive interim pre-feasibility study (PFS) results for its Omahola uranium project in Namibia. Production is planned at a rate of 2.2 million pounds of U3O8 per annum, beginning in 2014, and the company is targeting resources to provide a minimum mine life of 12 years. Open-cut mining of the INCA deposit would provide 80% of the feed, and surface mining of the Tubas Red Sands deposit 20%, to a conventional plant comprising crushing, grinding, sulphuric acid leaching, solvent extraction and precipitation. The capital costs are estimated to be US$324 million to US$336 million, with operating costs of US$24.90 to US$25.30 per pound of U3O8. Deep Yellow has extended the timeline for completion of the PFS to the second quarter of 2011, to evaluate the inclusion of material from the recently discovered Ongolo alaskite project as an additional source of ore.

Impact Minerals reported the discovery of uranium mineralisation hosted in Proterozoic basement granitic

gneisses and migmatites, together with widespread uranium anomalism and associated alteration in overlying Proterozoic sedimentary rocks, at its Moiyabana project in eastern Botswana. The uranium is associated with rare earth elements, with limited rock chip and drill assays of up to 1% total REE. This type of mineralisation, which has not been identified previously in Botswana, is typical of the high-grade uranium deposits in Proterozoic rocks in Canada's Athabasca Basin and the Pine Creek region of Australia.

Zinc

Sterlite Industries, a subsidiary of Vedanta Resources plc, completed its acquisition of a 74% interest in Black Mountain Mining, which includes the Black Mountain zinc mine and the Gamsberg zinc project, from Anglo American, for US$348 million. Anglo American announced the sale of its zinc business to Vedanta in May 2010. The sale of the Skorpion mine in Namibia was concluded in December, and that of the Lisheen mine in Ireland is expected to take place in due course.

Technology

Australian resources company TNG Limited, together with its metallurgical consultants Mineral Engineering Technical Services, has applied for international patent protection for a new hydrometallurgical process for recovering vanadium pentoxide, titanium dioxide and iron oxide from titaniferous magnetite ores. The process, which uses acid leaching, solvent extraction, and stripping to selectively recover the metals, is proposed as a lower-cost alternative to the conventional pyrometallurgical (salt roast – water leaching) process, which can pose environmental problems, is capital intensive, and can have a high operating cost. Successful testwork has been undertaken on ore from TNG's Mount Peake project, where the company has completed a positive scoping study .

Corporate Movements

Rio Tinto launched a recommended all-cash offer of A$16 a share for Australian-listed Riversdale Mining. The offer, which is subject to an acceptance of greater than 50 per cent, values Riversdale at approximately A$ 3.9 billion. Riversdale has two major coal projects in Mozambique: the Benga project –in which India's Tata Steel has a 35% joint venture interest, and the Zambeze project. Construction of the 5.3 Mt/a Stage 1 of the Benga project is expected to be completed in the second half of 2011.

Equinox Minerals, which operates the Lumwana copper mine in Zambia, completed its A$1.25 billion acquisition of Citadel Resource Group ,which owns the development-stage Jabal Sayid copper-gold project in Saudi Arabia. The project is forecast to have a development cost of US$305 million and to produce approximately 57,000t of copper in concentrate per year for 10 years from 2012, at an average C1 cash cost of US$0.91/lb copper produced.

Mining Finance

The International Finance Corporation, a member of the World Bank Group, announced plans to invest US$300 million in mining companies operating in Africa over the next three years to help support growth in the mining sector. The Corporation said that it would increase the amount of seed financing it provides to exploration-stage companies through its early equity mining program, as well as supporting mid-tier mining companies through project and corporate financing partnership, and would continue to work with mining majors to develop large projects with the potential to transform regional economies. IFC's global mining portfolio spans 37 countries, of which 17 are in Africa, and totals more than US$400 million. Its recent mining investments in Africa include Gryphon Minerals and Volta Resources in Burkina Faso, Helio Resource and Petra Diamonds in Tanzania; Nyota Minerals in Ethiopia, and Tsodilo Resources in Botswana. The IFC also recently invested in the Africa focused New Africa Mining Fund II to help provide funding for junior mining companies.

Sources

African Aura Mining Inc, African Eagle Resources plc ,Anglo American plc, Aqulia Resources Ltd, Banro Corporation, Deep Yellow Ltd, Equinox Minerals Ltd, Globe Mining and Metals Ltd, Impact Minerals Ltd, International Finance Corporation, Jubilee Platinum Ltd,Jupiter Mines Ltd, London Mining plc, Nautilus Minerals Inc, Nevsun Resources Ltd, Platinum Australia Ltd, Rio Tinto plc, TNG Ltd, Sterlite Industries (India) Ltd, Stratex International plc, Tsodilo Resources Ltd., Xstrata plc.

Antony Cowey

THE GEOTRAVELLER

Mount Vesuvius, Italy.

THE 79 AD ERUPTION OF VESUVIUS, ITALY: Volcanism and Archeology

The active volcano of Vesuvius is located proximal to the mega-city of Naples in southern Italy. The impact of a Plinian-style eruption on the surrounding areas could be catastrophic. Geological and archeological evidence from Roman-age cities and villas partially destroyed by the famous 79 AD eruption assists with unraveling the potential impact. This contribution is preceded by the December 2010 "Geotraveller" and is again in part based on Guide books (B28 and P14) from the 2004 Geocongress.

The observations and letters sent by Pliny the Younger to the historian Tacitus describing the 79 AD eruption have been incorporated into geological science. Pliny the Younger observed the initial stages of the eruption from Misenum, to the north of Vesuvius and provided a sketch of the enormous ash column (and compared it with the shape of an "umbrella pine"). His letters also described details of the death of his Uncle, Pliny the Elder, as resulting from asphyxiation and poisonous gases associated with the subsequent pyroclastic eruptions. Pliny the Elder was a Senator and died at Stabia, whilst with the Roman navy which he had instructed to assist the residents of Pompeii from the earlier ash falls.

Catastrophic volcanic events that include sustained ash columns accompanied by pyroclastic flows or surges are now described as Plinian eruptions. They are typically caused by evolved volatile-rich magmas associated with large, stratavolcanoes. The basal surges are considered as near-instantaneous events. Plinian eruptions also induce volcano-tectonic collapse. Thick breccia deposits may accumulate in proximal areas. They also trigger earthquakes and tsunamis which may have a regional affect. Roof collapse due to the enormous volumes of ash erupted is an additional hazard.

Vesuvius is characterized by periods of quiescence interrupted by Plinian or sub-Plinian eruptions. The 79 AD eruption occurred after 400 years of quiescence. The lack of a systematic periodicity prohibits accurate predictions. The absence of eruptions over long periods

Part of the excavated Roman city of Herculaneum with the peaks of Somma (left) and Vesuvius (right) behind the modern suburb of Ercolano.

has encouraged the extensive settlement of the slopes and surrounding areas. A combination of fertile soils and a relatively wet, yet hot and sunny climate with well defined seasons has resulted in production of up to four crops each year, another reason why the area has been so well populated over historical times.

The 79 AD eruption started on the 24th August with phreatomagmatic activity and generation of an ash plume some 32 km in height. The ash fall from this column (the Pompeii Pumice) blanketed the area to the east and south-east of Vesuvius. The first fall of fine-grained ash (A1) was followed by successive deposits of pumice (A2 and A3). These latter attain thicknesses of several metres. Historical data has yielded remarkably accurate information on the geology and timing of the catastrophic activity that followed.

The ancient city of Herculaneum located 7 km west of the crater was buried to a depth of more than 20 m during

Roman house at Herculaneum partially filled with deposits (mostly of the F3 layer) from the 79 AD eruption.

Roman house at Herculaneum with original wood beams.

the eruption. This city, which is partially overlain by the modern suburb of Ercolano, was excavated relatively recently with great attention to detail. The archaic and Roman city of Pompeii was in part rebuilt as a tourist attraction during the 19th century. Pompeii is located on a basement high some 10 km to the south of Vesuvius and was only partially destroyed. Information on the 79 AD eruption has also been obtained from excavations of Roman villas, such as Oplontis located between the two ancient cities. The area to the south and west of Naples was used by the Romans as beach resorts and there are a number of archeological sites (mostly villas) located on the shoreline.

The catastrophic surge and pyroclastic events associated with the 79 AD eruption all occurred on the 25th August. The basal surges and fall components of pyroclastic density currents reveal important differences. The surges are an incipient stage; they are more dilute than ignimbrites and involve explosive magma-water reactions. Surges generate centrifugal winds that are extremely hazardous and may even result in cross laminated ash beds. They may cause asphyxiation, whilst buildings in their path may remain intact.

Surges on the 25th August are thought to have travelled at >100 km/hr with temperatures calculated at between 350-400^{0}C. Maps of the distribution and thickness of the ash and pyroclastic deposits, as well as the limits of the surge phases have been published by Sigurdsson and colleagues. The first surge phase (S1) occurred at 01.00 hrs and is associated with a thick pyroclastic flow (F1) at Herculaneum but with reverse-graded deposits of grey ash (A4) at Pompeii. The remainder of the sequence is composed of alternating surge phases (S2-S6) and pyroclastics (F2-F6) at Herculaneum (proximal), and surge phases (S3-S6) and ash deposits (A5-A9) at Pompeii (distal). The sequence at Herculaneum was overrun by the S1 event, whereas the first surge to reach the city walls of Pompeii was the S3. The pyroclastics associated with this event buried the city of Herculaneum, whereas it was the S4 event that is thought to have caused the evacuation of Pompeii. Oplontis may, in a simplistic way, be interpreted as semi-proximal. The eruption probably continued for several weeks after the 25th and included phreatomagmatic activity.

Pliny the Younger probably documented the S6 event, the largest of the surge phases at approximately 0800 hrs (after dawn; the earlier events occurred during the night). It was this event that probably killed Pliny the Elder. Pliny the Younger sketched details of the pyroclastic F6 flow as it spread across the Bay of Naples. This caused him to flee Misenum and travel northward to a safer site near the island of Ischia.

The sequence of pyroclastic deposits is best exposed at Herculaneum in a 23 m-high wall by the entrance tunnel. The beach deposits located here include wood remains and numerous human skeletons associated with the S1 layer. The poorly consolidated S2 layer includes a high proportion of building material, including bricks, roof tiles and mosaics. Pyroclastic flows associated with these and the S3 through S6 surges are massive deposits. The S5 event is notable for prominent cross lamination. Remarkably, many of the stone or brick buildings at Herculaneum, including mosaic floors and wall frescoes survived both the surge events and pyroclastic deposits. Some of the frescoes reveal scenes of Vesuvius prior to the 79 AD eruption, as a single peak covered with trees and vineyards. (Vesuvius now reveals two, distinct peaks.)

The sequence at the Oplontis villa is some 5 m thick. Roof collapse occurred due to deposition of the A3 pumice, while the S1 surge destroyed vegetation. The S5 and S6 surges and associated pyroclastics completely buried the villa. The S6 layer includes accretionary lapilli, indicative of phreatomagmatic activity.

Part of the reconstructed city of Pompeii with views of Vesuvius in the background.

Section of ash, surge and pyroclastic deposits at the Oplontis villa. The air fall lithic-rich A7 ash (lower) is sharply cut-off by the S5 surge. The S6 surge and F6 pyroclastics (upper) completely buried the villa.

Graded beds of air-fall A7 ash at the Oplontis villa.

Pompeii was severely affected by a major earthquake in 63 AD (reports stated the city had been devastated) and restoration work was still underway in 79 AD. Studies of the city walls reveal various building phases (dating from the 6th century BC) and the effects of earthquakes and the eruption. Some of the walls were constructed from ignimbrite associated with the Campi Flegrei eruption of 39,000 BP. Information on the city and the eruption has also been gleaned from more than 400 boreholes drilled in the area since the 1800's. The geological record is complex and includes the consequences of sea-level changes and catastrophic floods as well as earthquakes and the 79 AD eruption.

There were also significant eruptions of Vesuvius in 1631, 1760, 1794, 1858, 1861, 1872, 1906, 1929, 1933, and 1944. The earlier eruptions have been recorded by means of paintings, engravings, and drawings, the more recent by photographs. Some of these have been reproduced in a book by Elio Abatino, "Vesuvio: A volcano and its history".

Reference:
Sigurdsson, H., Carey, S., Cornell, W., and Pescatore, T. (1985). The eruption of Vesuvius in AD 79. National Geographic Research I (3), p. 332-387.

Submitted by R N Scoon.
(Photographs from 2004 and 2007.)

Roman ruins of beach villas at the volcanic sand beach, Marina di Equa. Different phases of villa construction were triggered by sea-level changes and the 79 AD eruption. Deposits of the latter form the cliff face and have partially infilled the ruins.

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