

geobulletin

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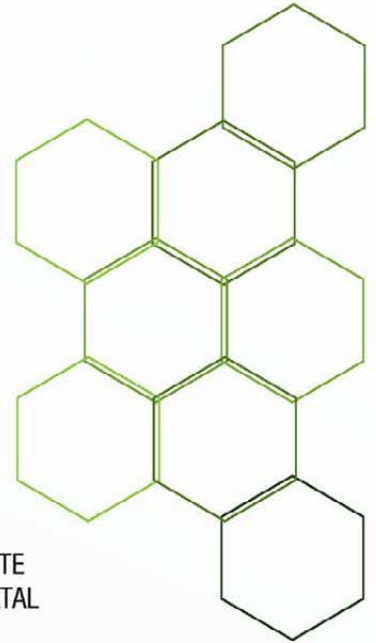
news

- The role of geoscientists in the energy transition
- Unlocking the secrets of the Bushveld Complex
- The Game of Plates and Plumes
- The Witwatersrand gold debate

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Front cover photo:

A 'contact migmatite'—interleaved mafic (greenstone) and granitoid rocks—exposed in the Komati River, which was the topic of much convivial debate at this year's Igneous and Metamorphic Studies Group Meeting in Barberton (see pg. 12).

Would you like to see your photo feature as the cover image to Geobulletin? Please send your high-resolution, portrait-format images of geological features or geologists in action, with an appropriate caption, to geobulletin@gssa.org.za.



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Attach Word .doc + individual high resolution .jpg's for images

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guest editorial



Thapelo Tladi

Geoscientists and the Energy Transition

'King Coal is back.'

When Mineral and Petroleum Resources Minister Gwede Mantashe made this declaration at the 21st Annual Southern African Coal Conference earlier this year, he was not indulging in nostalgia. He was stating a reality. Coal remains deeply embedded in the global energy system. It continues to provide roughly a third of the world's electricity, and in South Africa, nearly 80%

of power generation still depends on it. The coal value chain in South Africa supports around 90,000 mineworkers and their families, anchoring entire local economies. I know this reality firsthand. I began my career as a geologist on an underground coal mine in Witbank—now eMalahleni—in Mpumalanga.

For towns like eMalahleni, coal is more than just a commodity that town has been blessed with in abundance; it is the town's economic lifeblood. Like many resource-dependent towns, its fortunes are tightly bound to a single commodity.

But so are its vulnerabilities.

Living and working in eMalahleni, the environmental costs of coal were impossible to ignore. The air quality was visibly poor; the water was often unsafe (due to uncontrolled acid mine drainage). One afternoon in 2015, I returned home from work only to be met by load shedding—a stark reminder of the fragility of the very system coal was meant to sustain. I found myself at the time asking a difficult question: what would become of eMalahleni without coal? Was such a future even conceivable?

At the time, global attention was shifting toward COP21 in Paris, where governments were preparing to commit to limiting climate change. The question no longer felt abstract. If addressing climate change requires reducing greenhouse gas emissions—and coal remains

one of the largest contributors—what would that mean for communities built on it? And even if coal extraction and utilisation were to persist, could it be done in ways that do not come at the expense of public health and environmental integrity?

These tensions—between economic dependence and environmental sustainability—are not theoretical. They are lived realities in places like eMalahleni.

A personal pivot and a global turning point

My time in coal mining sparked a deeper curiosity about the broader energy system. I wanted to understand how energy, economics, and sustainability intersect—and why resource-rich communities so often struggle with underdevelopment. The concept of the 'resource curse', where natural resource wealth coexists with socio-economic underdevelopment and environmental degradation, felt particularly relevant to a town like eMalahleni.

In 2015, I left mining to pursue a Master's degree in International Energy at Sciences Po in Paris. There, I encountered the idea of the energy transition—not as a distant concept, but as a defining global challenge. I soon came to understand during my time as a student in Europe that my personal questions about coal were mirrored in policy debates, boardrooms, and academic discussions around the world. That same year, COP21 culminated in the Paris Agreement, a landmark global accord to limit temperature rise to well below 2 °C. The message was clear: a future reliant on unabated fossil fuel use, particularly coal, is incompatible with climate stability. The energy transition was no longer optional—it now seemed inevitable.

More than a fuel switch

Yet the term 'energy transition' is often misunderstood. It is not simply a shift from fossil fuels to renewable energy. It is a systemic transformation involving infrastructure, technology, policy, and society itself.

Crucially, this transition does not unfold uniformly across the globe. In developed economies, that

have industrialised off the back of decades of fossil-fuel use, the energy transition narrative is largely driven by decarbonisation targets, net-zero commitments, and technological innovation. In developing regions, particularly in Africa, the priorities are different—and more immediate. Energy access, affordability, and economic development remain paramount. Nearly 45% of Africa's population still lacks access to electricity, despite the continent's vast energy resource endowment. For many, the transition is not about replacing existing energy systems—it is about building them in the first place.

This creates a fundamental tension. Africa has contributed the least to global greenhouse gas emissions, yet it is among the most vulnerable to climate change. Any meaningful energy transition must therefore balance climate imperatives with developmental realities. A one-size-fits-all approach will not work.

The expanding role of geoscience

For geoscientists, this moment represents both continuity and change.

Historically, geoscience has been central to the discovery and extraction of fossil fuels. That role will not disappear overnight. Global reliance on coal, oil and gas remains significant and is likely to persist for decades, particularly in developing economies.

However, the scope of geoscience is rapidly expanding.

Geoscientists are increasingly critical to emerging energy solutions. These include geothermal energy development, carbon capture and storage (CCS), hydrogen storage, and the exploration of critical minerals essential for batteries, electric vehicles, and renewable energy infrastructure. The transition to a low-carbon economy is, in many ways, resource intensive—and geoscience sits at the heart of that reality.

Beyond technical roles, new opportunities are emerging in policy, environmental, social and governance (ESG) frameworks, and development finance. There is also a growing intersection between geoscience and digital technologies, including artificial intelligence and the Internet

of Things, enabling more sophisticated analysis of complex Earth systems data to inform the development of energy projects.

The energy transition is redefining the role of geoscientists!

A decade of perspective

Over the past decade, my own career has reflected this shift. From coal mining, I moved into energy and sustainability consulting, then into managing international climate and energy programmes at the UK's Foreign, Commonwealth & Development Office, and later into leading global clean energy initiatives at the World Economic Forum's Centre for Energy and Materials.

Throughout this journey, my geoscience training has remained foundational. Yet it has also had to evolve. The pace and complexity of the energy transition demand continuous learning, collaboration across disciplines, and a willingness to move beyond traditional professional boundaries. This is perhaps the defining feature of the transition: it is not only technological, but deeply interdisciplinary.

A discipline reimaged

What sets geoscientists apart is our systems-level understanding of the Earth—its resources, processes and limits. This perspective is increasingly valuable in a world facing overlapping environmental and social crises.

But it also comes with responsibility.

Geoscience can no longer be defined solely by the extraction of resources. It must also encompass their stewardship. Whether dealing with water, minerals, hydrocarbons, or subsurface storage, the challenge is not just to locate and utilise resources, but to do so in ways that are sustainable, equitable, and aligned with long-term planetary health.

This raises an important question: how should geoscience be redefined in the context of the energy transition?

The answer lies in moving from a purely extractive paradigm to one that integrates sustainability at its core. Geoscientists must play a central role in shaping how resources

are managed—balancing economic needs with environmental constraints, and short-term demands with long-term resilience.

This is particularly important in countries like South Africa, where the legacy of resource extraction is intertwined with both economic development and environmental degradation. The challenge is not to abandon resource-based industries, but to transform them.

From dependency to opportunity

The story of eMalahleni is not unique. Across the world, communities built on fossil fuels face uncertain futures as the energy transition accelerates. The question is not whether change will come, but how it will be managed.

A just transition—one that protects workers, supports communities, and ensures inclusive economic growth—is essential. This requires deliberate policy choices, investment in new industries, and a commitment to reskilling and economic diversification.

Geoscientists have a role to play here too—not only in technical solutions, but in shaping the broader transition. Their insights into resource systems, environmental impacts, and long-term sustainability can inform more balanced and realistic pathways forward.

An opportunity we cannot ignore

We are living through a period of profound transformation. The energy transition is reshaping economies, industries, and societies at an unprecedented pace. For geoscientists, it presents both a challenge and an opportunity.

The challenge is to adapt—to expand skills, embrace interdisciplinarity, and engage with new domains. The opportunity is to lead—to apply a unique understanding of the Earth to one of the most pressing issues of our time.

The future of energy will not be determined by technology alone. It will be shaped by how we manage resources, balance competing priorities, and navigate complex trade-offs.

Geoscientists are uniquely equipped to contribute to this effort.

The question is whether we are ready to step into that role.

Thapelo Tladi

Programmes Lead: Energy and Materials, South Africa Centre for Industry and Technology (SACIT)

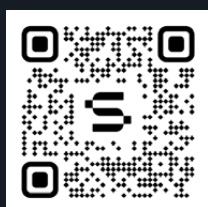
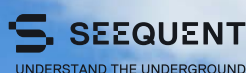


GSSA
Geological Society of South Africa

FOSSILS BY FIRELIGHT

Welcome to fossils by firelight - a series of conversations with South Africa's geological legends where they unearth their discoveries, their learnings, memories, interesting stories (and maybe a few tall tales) to chronicle our history and inspire the next generation of geological heroes.

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**Tania
Marshall**

In early March we sent out a survey questionnaire, asking our members a number of questions on their opinion of what the GSSA offers its members and what you would like to see improved, to make the GSSA more relevant. I would like to thank those of you who provided valuable feedback—we are unpacking your comments and will be implementing several of your suggestions over the forthcoming months.

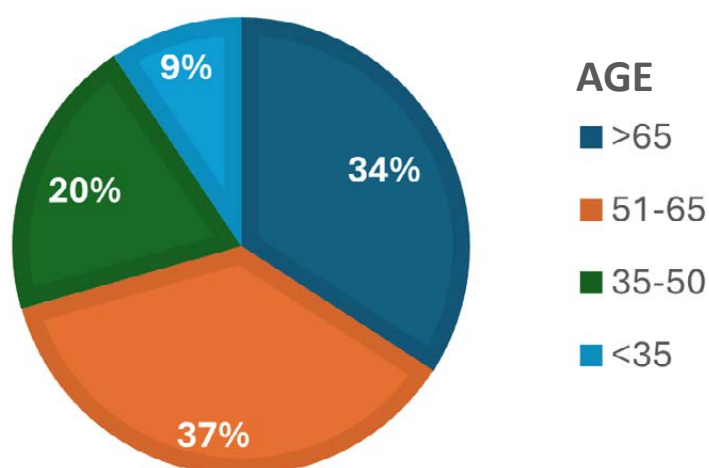
In this *Geobulletin* article, I would like to provide some high-level feedback on some of the answers provided. Also to highlight how we are implementing of some of the things requested.

Many responses highlighted different aspects of **geoheritage**. The GSSA has been in conversation with many of the Geopark, geosites and ecotourism communities in South Africa over the past couple of years. Many of these conversations have been behind the scenes, but the GSSA is now ready to do more to openly promote our activity in this field. We would like to draw your attention to the FREE geoheritage webinar that took place on

19 May. This was an introduction to many of the geoheritage organisations active in South Africa and it showcased some of the amazing projects that are being undertaken by these different organisations. This will be followed up by a geoheritage workshop and fieldtrip attached to the 2027 Geocongress in KZN. Please keep an eye out for these events in upcoming mailers and on the website.

There were also many **requests for courses** on various aspects of AI. The introductory AI in Geology course will take place on 24 June. It will be the first in many more such focussed AI courses. Other courses requested include structural geology, project management, MPRDA and related environmental legislation, field mapping, geotech, groundwater, sedimentology, oil and gas, coal, CRMs, to name but a few. While we do provide courses on many of these topics already, the suggested list has been handed over to our Meetings Committee for planning the 2027/2028 programmes and beyond. Please note that all of our events are online (or hybrid). This is so that members can access them from wherever they may be located. All events are also recorded and available (either for free or paid) on our YouTube channel for members who might not be available for the live event. While we are attempting to have more

RESPONDENTS



in-person events, these are necessarily more expensive, are currently less well attended, and are only readily available in Johannesburg and, to a lesser extent, in Cape Town. Our Branches are responsible for providing events (in person and online) in their areas of influence.

All of our courses, workshops and events carry CPD credits, claimable under both the GSSA and the SACNASP system. Note that while logging CPD credits is highly recommended for all practicing geoscientists, it is not obligatory (unless you are registered with SACNASP; this is a SACNASP requirement, not a GSSA one). For GSSA members, the only time CPD is obligatory is if you are a Chartered Member/Fellow.

Lower fees and more member perks: What specific perks would you like to see? We will send out a follow-up survey in due course and we would like to ask you to think about what additional member perks you would like to see. Please be specific, so that we can see how we can provide what you want.

As regards lower member fees, the GSSA is registered as a not-for-profit Voluntary Association. As such, our income almost exactly matches our expenditure. For a professional society like the GSSA (benchmarked against local and international organisations), staff costs are commonly around 50–70% of revenue, and an additional 20–25% on office overheads. Note that the GSSA spends $\pm 50\%$ on staff and administration combined—there is no room for wasteful or extravagant expenditure on non-essentials. Membership fees account for only around 30% of our revenue. We must source additional funds to provide for current membership benefits. If we decreased membership fees, we would be hard pressed to provide even the benefits we do.

Almost one-quarter of our members are Student Members, who do not pay membership fees, but who have access to all member benefits in an attempt to assist them to kick-start their professional careers.

- Graduates also receive one year's free membership when they transfer from Student to full Corporate status, in recognition of the economic realities of graduates.
- Another 20% of our members are Retired and/or Life Members who enjoy discounted

(and/or free) memberships. This is done in recognition of the fact that many retired members live on fixed incomes.

- Decreasing member fees would mean that we would not be able to provide some relief to the most economically vulnerable of our members (students, graduates and retirees). It would also mean that we would not be able to channel money into outreach programmes, geoheritage programmes and other strategic projects.

More free events: While we would love to make every event free for all comers, we do have to cover costs. We are very aware of the cost of living in South Africa (and the rest of Africa) at the present time, but I would urge you to compare the costs of our paid events with other local and regional events. Please note that for any of our events, we do not pay speakers or assist with their travel and accommodation expenses—these are all provided by the speakers themselves as part of volunteering their time and expertise; all money that comes in through delegate fees is either used to cover operating expenses for that and other events, or goes into a pool to support other projects. We provide all our speakers with free registration and we also currently sponsor up to six university students for registration for every event. This sponsorship is provided by the REI fund and is gratefully acknowledged. Further discounted fees are provided for all students, academics and retirees (whether or not they are GSSA members).

In an attempt to keep physical conference fees as low as possible, we do not use high-end hotels and conference centres (we hold all our in-person events at the Johannesburg Country Club, Auckland Park, where we receive preferential rates). Drinks and after-event networking events are supplied only when we can obtain corporate sponsors—we would like to thank our annual and event sponsors, their sponsorship helps us keep event fees as low as possible. We know they are also hurting economically but still choose to sponsor us—thank you very much.

More networking events have been requested by a few respondents. While networking events have, since COVID, typically been poorly attended, we will review the model and see how we can improve these offerings. However, we would ask that the membership support such

networking events (where feasible). *Please start with the AGM on 16 July.*

A couple of respondents suggested a platform where experienced geologists can share their knowledge with the younger generation. This will be added to our 'ask a mentor' module due to be released on our website in due course. We also have related panel discussions a few times per year where younger members, mentees and any interested parties can ask questions and interact. If you would like to participate, please send us an email requesting further details.

Some members have recommended expanding our interaction to regional and international organisations. This is a high priority for the GSSA. Historically, we have developed MoU's with a number of organisations, both directly and through our association with the Global Geoscience Professionalism Group. However, it is true that this needs greater input from our side.

Outreach to schools should be the prerogative of every one of our members, not just left to the Management Committee. You know your community; please do not hesitate to get involved in giving formal or informal lectures that promote geoscience (and the GSSA). If every GSSA member gives a presentation or an informal talk at one school in their immediate vicinity, that's over 3,000 contacts.

We would also ask our members to provide short articles for the *Geobulletin* and/or monthly Newsletters. What we would really like to see are articles showcasing the activities and achievements of geoscientists in their organisations. Also, simple articles about geoscientists doing their jobs—things that seem ordinary and unimportant to you can be very interesting to outsiders and our Affiliate members. They don't need to be long articles—half a page and perhaps a photograph or two.

One of the most pertinent comments made by many respondents was that the GSSA needs to attract more youthful and energetic members to the management teams. We couldn't agree more! And we would ask that the under-50-year members please put your hand up to get more involved with driving the GSSA. We do appreciate that members in this age group are very busy with families and careers. It is generally easier for older (retired) members to spearhead GSSA activities, but they are fully aware that they are not so in-touch with the current generation's needs. To remedy this, I would ask (beg) members of the younger generations to put their name down when the GSSA sends out a call for Council Members in May. Please come and join us in managing the present and the future of the GSSA. Attending Council Meetings (2 hours every second month) not only provides insight into what the GSSA is already doing, but it also affords you the opportunity to drive policy in determining the future direction of the GSSA. Not only Council, but we also need younger members to sit on/drive the following committees:

- All Branches
- Geoheritage Division
- ESG Division
- Young Geoscience Professionals Division
- Student Division
- Outreach programmes
- Social media
- Meetings Committee
- Regional Societies

Please volunteer for any of these committees (and any new one that you would like to be part of). Please contact us directly at info@gssa.org.za and let us know where you would like to assist.

Tania Marshall



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Unearthing Excellence: Celebrating People, Purpose and Progress in South Africa's Mining Industry

South Africa's mining sector is about far more than minerals and markets—it is a story of people, innovation and discovery. In this column, I celebrate the individuals whose resilience and vision continue to shape the industry, the organisations investing in sustainability and environmental stewardship, and the scientific breakthroughs expanding our understanding of the world beneath our feet.

*Together, these stories highlight mining's enduring role as a driver of progress, transformation and opportunity in South Africa. In this edition, **Dr Robert Trumbull, Prof. Susan Webb and Stuart Hill** discuss the Bushveld Complex Drilling Project.*

Drilling into Deep Time: Unlocking the Secrets of the Bushveld Complex

Few geological features on Earth rival the scale, complexity and economic significance of the Bushveld Complex. Stretching across large parts of South Africa and hosting the richest deposits of platinum-group elements, as well as chromium, tin and vanadium, the Bushveld Complex has fascinated geoscientists for decades.

The Bushveld Drilling Project (BVDP) forms part of the International Continental Scientific Drilling Program (ICDP), a global initiative that supports scientific drilling projects aimed at answering some of Earth science's most fundamental questions. Under the ICDP model, projects receive partial international funding, while research teams secure substantial co-funding from national institutions and industry partners.

The BVDP set out with an ambitious vision: to recover a complete drill-core profile through the approximately eight-kilometre-thick Rustenburg Layered Suite (RLS), one of the largest layered

intrusions on Earth. Such a continuous geological reference section would provide an unparalleled opportunity to study the formation of magmatic layering, mineralisation processes, crustal evolution, groundwater systems and even deep microbial life.

'The Bushveld Complex is not only a geological treasure for South Africa—it is a global scientific laboratory.'

From the outset, collaboration between academia, government and industry proved essential. A major turning point came when Impala donated drill core that covered the upper 2/3 of the RLS geological profile and provided access to their property for the drilling site. This contribution dramatically reduced project costs and allowed researchers to focus new drilling on the missing portions of the geological sequence.

The project itself evolved from discussions and proposals dating back more than a decade. Following a workshop hosted by the University of the Witwatersrand in 2014, the scientific objectives were refined around several core themes: petrology, geochemistry, geophysics, hydrogeology and geomicrobiology. After overcoming logistical and financial challenges—including the disruptions caused by the Covid-19 pandemic and the complexity of contracts and procurement—the project gained ICDP approval in 2019 and secured co-funding and support from South Africa (National Research Foundation and others), Germany, Japan and Switzerland.

Drilling officially began in April 2024 and was completed in August 2025 at a depth of 1,877.2 metres, short of the target 2,500 metres due to geological and technical complications that exhausted the funding.

The programme has already yielded valuable scientific material and unexpected discoveries. Among the most intriguing findings were highly fractured zones that contain deep groundwater systems. At approximately 1,100 metres depth, researchers also encountered an unusual light greenish-yellow, sulphide-bearing rock interpreted as a fragment of the magma

chamber floor—potentially torn loose and transported upward during the emplacement of the Bushveld magmas two billion years ago.

Perhaps even more remarkable is the growing evidence of microbial life deep within the igneous rocks of the Bushveld Complex. Single-celled organisms have been identified at depths exceeding 800 metres below the surface, challenging long-held assumptions about the limits of life in deep geological environments. This discovery alone has the potential to reshape aspects of geology, microbiology and our understanding of subsurface ecosystems.

‘What makes the Bushveld Drilling Project extraordinary is that it combines world-class science with opportunities for South African students, researchers and communities.’

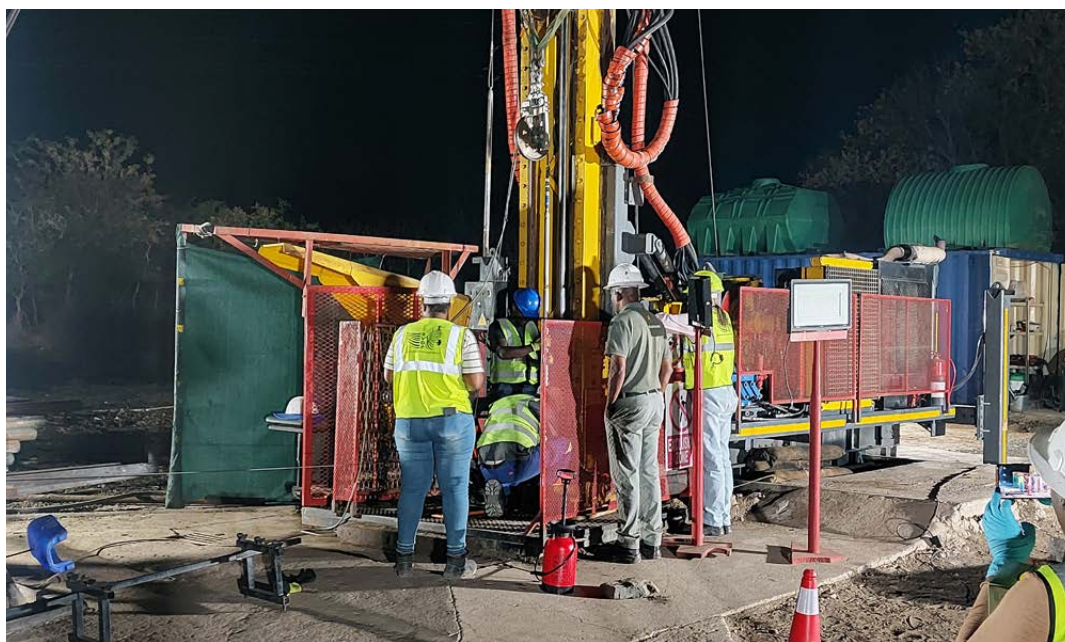
Yet the scientific questions driving the BVDP extend far beyond any single discovery. Researchers are investigating how the immense magma chamber was filled, how its layers formed, and why some horizons became richly mineralised while others did not. Geophysicists are studying variations in density, magnetism, seismic properties and heat flow with depth, while hydrogeologists examine groundwater systems and microbiologists explore life in extreme subterranean environments.

Importantly, the BVDP is not only about scientific discovery—it is also about building South Africa’s geoscience future. The University of the Witwatersrand has played a leading



Logging the drill core (Mr K Mathopa).

scientific and administrative role, particularly in geophysics, while researchers from the University of the Free State, Stellenbosch University and the University of Limpopo have contributed expertise in geochemistry, mineralogy, hydrogeology and microbiology. The project has created opportunities for postgraduate students, early-career



Collection of ground water samples at end of hole (September 2025).

researchers and local community members through fieldwork, training programmes and international collaborations within the ICDP network.

The significance of the project also extends to public education and geoheritage. The Bushveld Complex represents one of South Africa's most extraordinary natural assets, and the drill cores and datasets generated by the BVDP will be permanently archived at the Council for Geoscience and available to the local and global research community for further scientific study.

Although the original goal of drilling into the floor rocks of the magma chamber was not achieved, researchers remain optimistic about a possible second phase. Drilling deeper could reveal the composition of the earliest magmas that entered the chamber and provide critical insights into how the Bushveld Complex formed and interacted with the surrounding country rocks.

'The real legacy of this project may not only be what we discover today, but the generations of geoscientists who will continue learning from these drill cores decades from now.'

Fifty years from now, the Bushveld Drilling Project may well be remembered as one of the defining scientific enterprises in South African geology: a project that not only advanced global understanding of layered intrusions and mineral systems, but also strengthened the country's geoscience community and established a lasting platform for international research collaboration.

In many ways, the greatest discoveries of the Bushveld Drilling Project still lie ahead—preserved within thousands of metres of drill core and waiting to inspire the next generation of Earth scientists.

Noleen Pauls

*Student outreach—
at a local school
in the vicinity of
Marula Platinum
Mine.*



letters

On behalf of Rhodes University, I would like to thank the GSSA, Prof. Robyn Pickering (this year's Du Toit Memorial Award Lecturer), and Dr Nicolas Tonnelier and the team at Nelson Mandela University for this year's Du Toit Lecture. The Eastern Cape event, the last one of Prof. Pickering's tour, was held on Wednesday afternoon at the beautiful new Science Centre, on NMU's Ocean Science campus. Although Nicolas and I together motivated for the Eastern Cape event on behalf of both Rhodes University and NMU, I skilfully deflected the hosting to NMU where Dr Tonnelier, who did all of the actual organising and hosting of this event, did all the actual work.

Prof. Pickering's presentation was well-crafted, and an excellent showcasing of South African-driven and conducted cutting edge research, with particular emphasis on the central (almost exclusively so, in fact) role of women (mostly South African) as the primary researchers, a theme that Prof. Pickering emphasised in the conclusion to her presentation. The research that was represented, going back over a decade and a half or so, encompassed a multi-disciplinary and international approach to a field-based analytical study with implications

ranging from analytical method development, analytical and personal capacity development, to clarifying our hominid ancestry and with implications for climate change analysis (i.e., our hominid future).

The talk was well attended (I saw people counting heads, but I wasn't one of them), and the venue was immaculate and well suited to the event. Prof. Pickering fielded the questions with compliments and aplomb, and gave a very good ambassadorial impression of her research team and her institution (UCT).

We look forward to future GSSA activities in the Eastern Cape, which has historically been 'a bit tricky' as we have three geological science departments each separated by 1.5-3 hours of driving, which makes collaborative geoscience 'events' difficult to facilitate logically. A busload of Rhodes staff and students attended this event, courtesy of funding support from the Dean of Science at Rhodes. We hope to better engage all three departments again at future such opportunities.

Steve Prevec

Department of Geology, Rhodes University



This photo, liberated from archdaily.com courtesy of Ray Truter, looks like one of those AI-generated artist's conception drawings, but is in fact pretty much just what it looked like, and in fact we even had an actual rainbow over the campus when we drove in on Wednesday.

SAMCODES

SAMCODES Quarterly Snaps

The focus for SAMCODES in 2026

In 2026, the SAMCODES and its committees will prioritise monitoring and providing feedback on developments arising from the JORC Code review and associated updates. The SSC will also focus on the review of the SAMREC Code guidelines, while continuing to advance discussions on international liaison initiatives, particularly with neighbouring jurisdictions such as Mozambique and Botswana.

In addition, the SAMREC Committee will maintain its ongoing collaborative engagement with CRIRSCO to support alignment with global reporting standards.

LinkedIn

A dedicated LinkedIn page for SAMCODES is maintained and regularly updated to ensure that members and interested parties remain informed of current developments and industry updates: <https://www.linkedin.com/company/samcodessa/>.

SAMCODES app

- The App offers a useful platform to access current SAMCODES information.
- The SAMCODES application has recently undergone an update, and the latest version is now available for download on the Google Play store. Check out the SAMCODES App User Guide for step-by-step instructions: <https://lnkd.in/emT8976z>.



Committee updates

	The SAMREC Committee is currently in the process of finalising a Memorandum of Understanding (MOU) with neighbouring countries, such as Mozambique and Botswana, which are seeking support in the development of their respective reporting codes. Emphasis is being placed on the adoption of the SAMREC Code, where appropriate, to minimise duplication of existing work and ensure alignment.
	The Committee held a joint workshop with the SAMREC Committee in December 2025 to review the comprehensive 200-page JORC Code survey and will provide detailed feedback in a formal report.
	SAMOG Code updates were sent for public comments, and the launch event will be communicated in due course.
	The Committee discussed strategic initiatives to diversify SAMCODES membership, with a particular focus on increasing participation from early-career professionals.
	Rob Ingram has announced his retirement as Chair of the JSE Readers Panel after 26 years of dedicated service to the Johannesburg Stock Exchange and the broader minerals industry. Andy McDonald has assumed the role of Chair from 1 March 2026. We extend our sincere appreciation to Rob for his distinguished career in the mining industry and for his exemplary leadership as Chair since 2012. His meticulous record-keeping, professionalism and unwavering willingness to assist others have made a lasting and meaningful contribution to the industry.

International liaison

The UNECE Resource Management Week 2026 will be held between the 27 April and 1 May 2026, emphasising the importance of UNFC classifications for strategic projects in the EU.

SSC representatives attended the Annual General Meeting of CRIRSCO that was held online on 16 March 2026.

The China Association of Mineral Resource Appraisers was officially approved as the 16th member of CRIRSCO on 16 October

2025. This development has coincided with a significant increase in traffic to the SAMCODES website, particularly from users based in China.

Management update

Joseph Mainama who has been deputy chairperson of the SSC has taken over from Sifiso Siwela. The handover took place at the February 2026 SSC co-patrons oversight meeting. Jacques Nel has assumed the role of deputy chairperson.

Sam Moolla

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branches & divisions

In April, the WCB and KZN Branches hosted the biennial AL du Toit Memorial Lecture and the NCB hosted a successful 2-day copper and base metal event in Okiep.

For MinSA, the highlights of the 2nd quarter were the online lecture by renowned mineralogist and astrobiologist Robert Hazen from the Carnegie Institution in Washington, USA, entitled *Mineral Evolution: A Case Study of a New Law of Nature*, and the launch of a lexicon containing mineralogical, geological, and geomorphological terms in South Africa's eleven spoken national languages. The lexicography initiative represents an important step forward for public participation in the geosciences, and gives researchers, students and educators access to a specialised vocabulary in their preferred language. The project was championed by Bjorn von der Heyden from the Department of Earth Sciences at Stellenbosch University, with funding from the 35th IGC Legacy Fund. The resultant word bank will be available to the public through an open-access platform hosted on the webpage of the South African Centre for Digital Language Resources (SADiLaR) and can be accessed at <https://doi.org/10.5281/zenodo.19131345>.

The Ground Water Division (GWD) offered regular training courses on water governance and the water use licence applications and authorisation system (WULAAS) at various centres throughout South Africa and, together with North-West University, hosted a webinar for students on borehole drilling and development with Francios Bertone from the World Bank Group

The YGP is dedicated to connecting and supporting young (< 35 years) members of the

GSSA, in both industry and academia, to help them negotiate the challenges they face as young professionals, foster networking, and to highlight and promote the interests of these members within the GSSA.

The purpose of the ESG Division is to create a professional platform for environmental and social practitioners within the geosciences, enabling professional affiliation, knowledge sharing and, over time, the development of a code of conduct and ethics. The growth of the Division will primarily be through conferences, workshops, webinars and site visits. As part of the relaunch of the ESG, the new Chair (Joshua Kilani) held an online Extraordinary General Meeting in May.

In February 2026, Manco appointed Dr Khodani Matshusa as Chair of the Geoscience and Society (Geoheritage) Division, and in this capacity he attended the 'Deep Time Tourism' Workshop at the Golden Gate National Park in the Free State. On 19 May 19, Khodani hosted a 'Geoheritage Meet and Greet Webinar' via the GSSA's Zoom platform. This meeting included a keynote address by Dr Matshusa, in which he outlined the strategic vision of the Geoscience and Society Division, provided an opportunity for speakers to share current and future projects and activities on geoheritage, and introduced the members of the recently formed GSSA Geoheritage Committee. This committee will serve as the GSSA's voice in discussions, at the national level, around proposals for the possible establishment of Geoparks in South Africa. Members interested in learning more about the Geoheritage Division can contact Khodani on geoheritage@gssa.org.za.

Steve McCourt

the geological hot pot

Regular readers of my column will remember my explanation of what a hot pot is, and in the past month I have come across the real thing twice!

The first was when I stayed with my brother-in-law in Cape Town on holiday in April. He is a keen chef, and on a chilly evening, he decided to improvise a hot pot meal indoors. The pot over the charcoal fire contains a spicy broth. During the meal, thinly sliced pieces of lamb and beef are dipped in the boiling mixture and taken out using chopsticks and eaten. Green vegetables are also dipped in the broth, as are small pork dumplings, fish balls, calamari and tofu (bean curd). All eaten with white rice, making a delicious and filling meal overall.

The second time was at a Chinese restaurant in Lusaka, Zambia in May. I was on my way home after a two-week visit and my host decided to

put me up in what he called a 'hotel' in the capital city. This was an overnight stay, and to my surprise, a strange sight awaited me when I arrived at the premises—Mongolian yurts!

The owners of the premises are Chinese, and I presume that they cater to Chinese clients. They have an outdoor restaurant, and on the Saturday evening that I was there, there were quite a few Oriental customers.

One family sat around a table with a hole in the middle of it that was the receptacle for hot charcoal.

It was an unusual, not to say surreal, end to a very pleasant trip to Zambia, staying in a yurt in the middle of a busy African city!

George Henry

Editor's Note: And next time back to the more scientific 'hot pot', George!



Home-style
hot pot

*Mongolian yurts
in Lusaka*



*The outdoor
restaurant with
the bar behind
the tree.*





The hot pot table the next morning. Notice the mini-chimney to conduct smoke away.



Close-up of the charcoal receptacle. The hot pot was placed in it for the previous evening's meal.

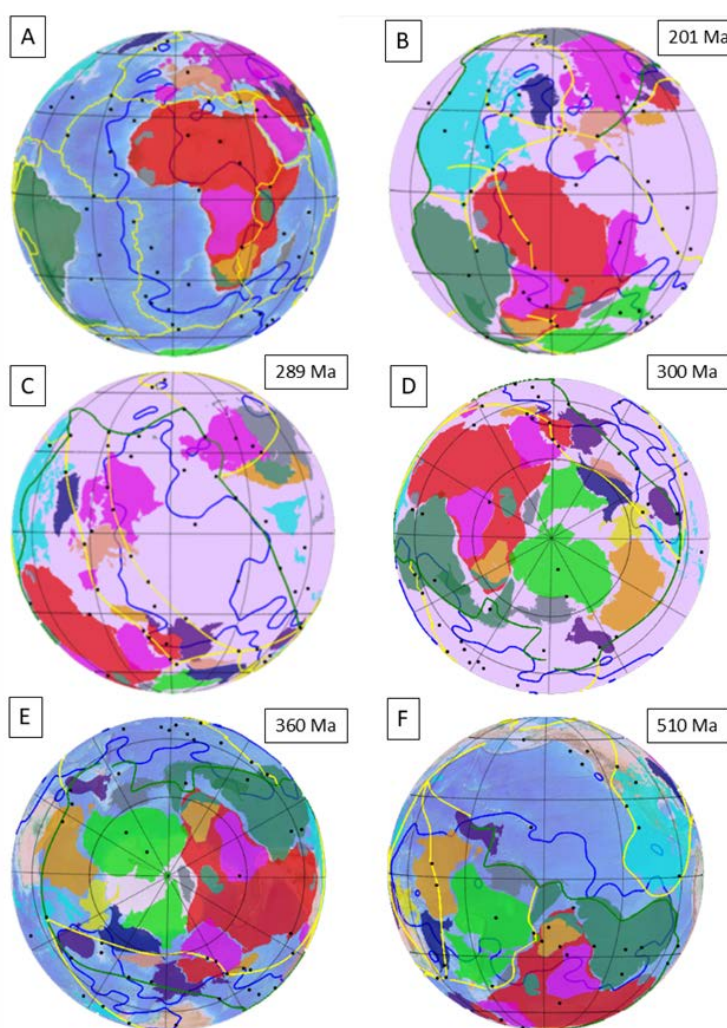
The Game of Plates and Plumes

The Game of Plates and Plumes: Continental Drift of the Kaapvaal Craton

Plate margins and plume traces emerged as serious scientific terms in the 1960s and enabled the Earth Sciences, in particular, to swing with the rest of society, evoking nascent paradigms meshed in a framework of novel technologies, frantically measuring oceans, continents and space. Since that time, much of Earth Science research has ensconced the rock record in an ongoing saga of plate, plume and impact tectonics, often in parallel or, if the evidence demands, in sequence, highlighting the ebb and flow of causative energies.

The global plate-tectonic engine is thought to be driven by convection in the upper mantle, where a mobile asthenosphere is sectorised into many turbulent cells, all actively transporting planetary heat (produced from gravitational collapse and long-lived radioactivity) from the interior into space. The number and size of asthenospheric convection cells are thought to have varied throughout Earth history, perhaps starting out with many small cells commanded by higher planetary temperatures and rates of heat loss, producing relatively thin lithosphere and characterised by rapid recycling. Cell merging, splitting and lateral migration over time is assumed, based on the physics of convection and laboratory experimentation.

GPlates graphic output tracking the African continent (containing the KVC in beige) as it drifts across the globe during the last 500 Myr. Present-day plate boundaries are in yellow. Within-plate hotspots are black dots. LLSVP domains are shown in blue. In A–C the projection is centred on the Equator and Greenwich Meridian vertical. D is rotated to the south-pole view to follow Africa. E has the 150-degree meridian vertical to show Africa in relation to the Pacific LLSVP (at top). F shows the drift of Africa over the Pacific hotspots.

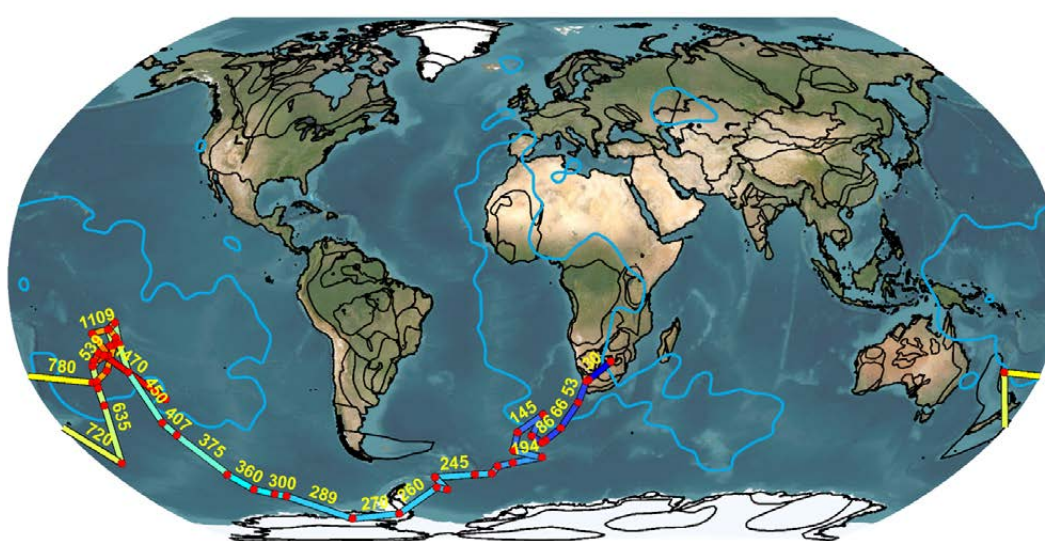


These early proto-plates of the Hadaean Eon were additionally modified by a higher impact flux and any plume upwellings that pierced the asthenosphere from the lower mantle and core.

Progressive cooling during the Hadaean is thought to have led to fewer asthenospheric convection cells, larger and thicker lithosphere, condensation of the hydrosphere, subduction of hydrated oceanic lithosphere and production of light continental crust. Impact flux also diminished dramatically and ceased as a major influence in planetary evolution, being restricted to more localised superficial modification of lithosphere (notwithstanding dramatic global effects in surrounding surficial spheres). Only those who do not accept the existence of mantle plumes at all would rule out the operation of post-Hadaean plumes from the deep Earth, but the most important question is whether there have been long-lasting plumes located in a fixed position relative to the core-mantle boundary that have persisted to the present day. There is still much debate concerning this, including the number of fixed plumes throughout Earth history, the possibility of whole-mantle drift relative to core and lithosphere, and its effect on plume location and migration. An important caveat of lithospheric subduction is the accumulation of material bearing a fractionated signature, including a surficial ingredient, at the base of the asthenosphere convection cells, or maybe even deeper into the lower mantle. Anomalous

zones in the mantle have been detected through their seismic properties and described as 'core-mantle boundary heterogeneities', or 'Large Low-Shear-Velocity Provinces' (LLSVPs), or just 'Superswells'. Two prominent domains occur under the African Plate and in the Pacific. It has been argued that ancient subduction could assemble additional sources of plume upwelling, augmenting and maybe interfering with those long established at deeper levels. These latter-day subduction plumes may show diverse character, perhaps affecting wider, more diffuse areas of lithosphere, and lead to complexities that are difficult to decipher as plate or deep plume effects.

A very early expansion of continental lithosphere to cover roughly 30% of the Earth's surface is thought to have been maintained since the early Archaean, but only 30% of global Archaean continental lithosphere still remains, pointing to significant destruction by recycling back into the mantle, dispersion of relict grains into younger sedimentary basins, or loss to the hydrosphere, atmosphere and biosphere. Younger juvenile continental crust has been added and partly preserved during later Archaean, Proterozoic and Phanerozoic supercontinental cycles along divergent and convergent plate boundaries. The cycle of continental crust creation and destruction continues today, driven by plates and sub-lithospheric activity, with much less assistance from extra-terrestrial impacts.



Legend

Kaapvaal Drift path		183 - 201	492 - 635	1110 - 1180
Age		202 - 289	636 - 720	1181 - 1310
30	290 - 360	721 - 780	1311 - 1470	
31 - 100	361 - 450	781 - 900		
101 - 182	451 - 491	901 - 1109		

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

GPlates graphic output showing the proposed trace of the KVC (marked with red triangle) back through geologic time (0 – 1470 Ma) as a consequence of continental drift. The blue-bordered domains are the African and Pacific LLSVPs.

Although, in the case of the latter, our still active planetary surface may have removed a lot of evidence.

The tracking of supercontinental amalgamation and breakup has been traditionally based on the recognition and characterisation of plate-tectonic features preserved in the rock record, such as correlation of once-continuous sedimentary sequences, structural piercing points, rift zones and orogens. Evidence for plate migration across the surface of the globe includes palaeoclimatic indicators, palaeomagnetic polar wander and plume traces, with all depending on some fixed frame of reference, such as the Earth's spin axis, obliquity, orbital plane, geomagnetic poles and the distribution of mantle plumes sourced from the core boundary. Of particular significance is the intimate association of plate rift traces and upwelling plumes, often described as active rifts in continents, characterised by heightened magma flux and emplacement as a large igneous province. The added influence of the mantle plume impacting the sub-continental lithosphere along a linear rift can impart a greater volume and geochemical diversity in the magmatic products, as well as adding a radial structure of faults, greater domical uplift, subcrustal underplating, enhanced fluid flow and associated mineralisation.

Within-plate-tectonic quiescence was one of the hallmarks of the new paradigm, but soon many apparent anomalies were discovered that demanded explanation, and so testing the ingenuity of adherents and the robustness of the model. Mobility far from plate boundaries arose by so-called far-field effects, perhaps transmitted across plates via ancient lineaments, some extending from oceanic transforms, changes in pole of spreading leading to within plate flexure, as well as latent properties of the lithosphere, triggering a response long after plate formation. Plume tectonics rapidly arose as an augmentative process, easily accepted as a sub-lithospheric source of plate modification, but also at plate margins, particularly those undergoing rifting. Certainly, a lot of within-plate mobility and particularly point-source magmatism has drawn attention to the possible existence of hotspots either below or within the lithosphere.

Early Archaean basement rocks exposed in South Africa formed before 3.2 Ga, and together with

their geophysical expression under younger cover, were first described as the Kaapvaal Craton (KVC) in the 1960s. Now defined as products of crustal events between 3.7 and 2.7 Ga, the craton, together with the adjacent Limpopo Belt and Zimbabwe Craton, represents one of the best preserved and most instructive relicts of the Earth's earliest continents. The KVC bears the scars of protracted engagements with plate separation and collision, as well as impacts, both endogenic and exogenic, surviving inexorable attempts at destruction, through mantle reclamation or erosive dispersal, again and again.

Walking in the air

My young grandson has a father who is a pilot for a major airline, and their home happens to be located under the approach flightline to a major international airport runway. Consequently, every plane is greeted by a child's excited cry and pointed finger. Inevitably, the family has occupied one of those very planes and that child has been directed to view their own house, which, to him, looked to be moving, causing dismay and confusion, leading to an inciteful comment about 'the snowman song' and 'walking in the air', as well as another experience 'watching fish while floating in a glass bottomed boat'.

GPlates (www.gplates.org) is a computer toolkit that allows us to model the movement of plates as per the control of their margins, first adopting a published and circulated animation (e.g., Merdith et al.¹ and links therein). Snapshots of plate distribution and the evolution of the plate margins at selected time lapses can be recorded (essentially the view from a fixed point in space), periodically adjusting the global orientation, so as to allow for the selected plate of interest (that which contains the KVC) to remain in view, as well as to avoid confusing distortion of spherical projection. The timeline can be forward or backward. Additionally, an adopted fixed mantle hotspot framework can be superimposed, which is tantamount to viewing from the bottom of the lithosphere, as if it is a glass-bottomed boat, at the mantle structure passing by. Hotspots, thinspots, superswells, subductions, all backdropped by the face of the core. Finally, a transparent veil providing the current meridional grid, providing a link with today's geographical markers.

In the case of the African continent, and the KVC in particular, drift back in time toward the south pole, as well as to the west past the Prime Meridian, requires rotation of the projection from equatorial/0 meridional to polar, then equatorial/180. Fixed meridional views can allow hotspot tracks crossing the KVC and environs, or the track of the KVC across the globe, forward or back through time. Ultimately, the KVC can be viewed as plate boundaries pass across, hotspots pass under, leading to a historical compilation of when the KVC was protected within-plate, affected by plate margin events, as well as drift vector parameters between the temporal snapshots.

Tectonic history of the Kaapvaal Craton—plate growth stages

It is convenient to structure the historical timeline of the KVC in a plate tectonic context first, focussing on plate margin processes like rifting, collision, subduction and transform faulting, and separate these events, thereby revealing periods of intra-plate setting. The ages are approximate based on current knowledge of radiometric dates and chosen for the purposes of the model.

0–133 Ma: African Plate Stage (KVC within plate)

Birth of the African Plate commenced with West Gondwana separation into South America and Africa between 135 Ma and 120 Ma. Ocean spreading in the Mozambique Channel switched eastwards beyond Madagascar and built the SW Indian Ridge. Coupled with the opening of the South Atlantic, the oceanic part of the nascent African Plate spread northwards, with the African continent migrating in concert.

The Azanian craton of southern Africa would have watched the girdle of mantle hotspots drift SW together with the plate-marginal upwelling curtain. A sense of clockwise continental rotation would have been produced by the differential growth of oceanic crust beyond the passive margins. From space, the complementary tracks of the hotspots would cut a swathe across the continent and then feature as seamount chains offshore. The KVC would mimic the south Atlantic hotspots by tracking SW to higher southern latitudes.

Southward development of the Afar–East Africa active continental rift system has been traced

by seismic mapping and reveals the likelihood of future plate rupture. Splitting of the African continent to form two new subplates (Somalian and Nubian) seems to follow an old Proterozoic orogenic weld separating the Congo and Tanzania cratons, as well as similar belts that border the Zimbabwe Craton in northern Mozambique. While the KVC may avoid any modification in this construct, the likelihood of a separate arm of continental rifting across NW Zimbabwe (Kariba) into Botswana (Okavango) might result in serious modification, especially if the new split follows the Quathlamba line of seismic epicentres crossing the Transkei coast into the Mozambique Channel.

133–183 Ma: West Gondwanaland Plate Stage (KVC at plate margin)

Separation of East from West Gondwana manifested itself by splitting the KVC–Limpopo–Zimbabwe ‘cratonsae’ from a more extensive Archaean lithosphere now preserved in India, Australia and Antarctica. This was an important plate margin experience for the diminished-size KVC fragment, although the presence of an accreted and reworked Pan-African Mozambique Belt probably controlled the development of the split along the Lebombo Monocline.

An interesting example of ‘latter day’ extra-terrestrial impact tectonics involving the KVC is the Morokweng structure, which is masked by Kalahari sands and associated alluvial/aeolian deposits, but detected by remote-sensing techniques, particularly airborne magnetic anomaly analysis. The concentric structural and geopotential field patterns attracted enough interest to investigate by diamond drilling, revealing a subsurface body of impact melt-rock bearing shock metamorphic features and even fragments of the achondritic impactor. Radiometric dating of the melt-rock yielded an impact age of 145 Ma and thus Morokweng represents a major crust modifying event with a substantial rock record.

Probably the largest preserved example of such an extra-terrestrial event is the Sudbury structure, located within the Archaean Canadian Shield (Superior Province), dated at 1850 Ma and thought to have excavated down to the MOHO, and generated a substantial melt-rock crater floor and a central uplift of depressurised subcontinental lithosphere.

183–220 Ma: Gondwanaland Plate Stage (KVC within plate)

The first major reorganisation of the Pangaea supercontinent was the separation of Gondwanaland from Laurasia along the proto-Tethys rift system, stretching from the central Atlantic, where N Africa drifted away from North America and Europe, towards the east, generating oceanic lithosphere between Asia and East Gondwanaland.

Essentially, the KVC–Limpopo–Zimbabwe cratons remained distant from active plate boundaries during this period, thus prolonging this status acquired with the assembly of Pangaea.

220–520 Ma: Pangaea Supercontinent Plate Stage (KVC within plate)

As far as the KVC craton is concerned, this period was a relatively protracted within-plate experience, stemming from the assembly of the Pangaea supercontinent during what is locally referred to as the Pan-African orogenic cycle. Collisional belts that developed between the Neoproterozoic Congo and Kalahari cratons saw the KVC–Limpopo–Zimbabwe nucleus playing its role as bolstering the latter. Most likely the Pan-African East African orogen contained Mesoproterozoic components from an earlier supercontinental cycle, which in turn may well have inherited even older KVC crust.

520–750 Ma: Kalahari Plate Stage (KVC within plate)

The early stages of the Pan-African orogenic cycle involved a widespread pattern of continental rift belts splitting up the Mesoproterozoic Rodinia supercontinent. Of particular importance was a series of interconnected rifts that opened through what today is recognised as sub-Saharan Africa, forming extensional tectonic boundaries (Damara–Lufilian–Zambesi–Mozambique belts) between the Kalahari Plate, recognised as a combination of the KVC, Zimbabwe Craton and the Rehoboth terrain to the south, and the Congo Plate to the north.

750–1350 Ma: Rodinia Supercontinent Plate Stage (KVC Within Plate)

Much of the KVC again played a within-plate role during the assembly of the Rodinia supercontinent, with most of the tectonic action played out in encircling Palaeoproterozoic

to Mesoproterozoic juvenile crust being caught up in Mesoproterozoic collisional belts (Namaqua–Natal–Mozambique). Integrity of the KVC–Limpopo–Zimbabwe cratons was largely preserved at this time, although parts of the southern margin were affected by Mesoproterozoic reworking (East Namaqua front zone, Tugela thrust belt).

Only in the north did the Archaean component of the Kalahari Plate experience plate margin remobilisation, where the Zimbabwe craton was affected by Pan-African rifting and closure.

Beyond the Mesoproterozoic, the resolution of continental plates and their active boundaries is less well defined, and radiometric age spectra are more difficult to interpret in terms of supercontinent assembly and mechanisms of dispersal. Several names have been used for the pre-Rodinia supercontinents proposed, sometimes attached to different time periods, so those that have been used were chosen arbitrarily for this thought experiment.

1350–2200 Ma: Kaapvaal Plate Stage II Nuna Supercontinent (KVC within plate)

This was another largely within-plate period that saw the KVC avoiding tectonic disruption, except for possible active continental margin activity in the west, where successive, mainly juvenile, magmatic arc complexes accreted (Sperrgebiet–Richtersveld–Gladkop) over the period 2020–1820 Ma, marking a substantial period of plate tectonism on the western flank of the KVC. Consolidation of these Palaeoproterozoic lithospheric proto-continents may have prepared for later Mesoproterozoic interaction with the western margin of the KVC.

Remote from these Palaeoproterozoic juvenile accretional orogens and deep within the KVC, arguably the most spectacular large igneous province was terminating the growth of an equally spectacular intracratonic volcano-sedimentary superbasin at 2050 Ma. Within the mineral exploration fraternity, usually around an African campfire, a popular fanciful query addresses the likelihood of finding another Bushveld Complex under cover. Recasting this question, what could be the surface expression of an actively forming counterpart? That precious metal accumulation (Merensky Reef) could cryptically underlie a vast rhyolitic ignimbrite field (Rooiberg Group) is counterintuitive, to put it mildly.

Probably the most significant crustal-scale modifying extraterrestrial impact event still preserved on Earth is the Vredefort structure, dated by analysis of shock-metamorphic melt-rock (pseudotachylite) at 2020 Ma. The impactor was big enough to excavate a huge deep crater into several kilometres of cover-sequence sediments (Transvaal, Ventersdorp and Witwatersrand) and the underlying KVC basement. Apart from widespread brittle fracture, the ductile central uplift rebound is thought to have extended to the MOHO and produced a radiative concentric fold/fault collar. While not necessarily responsible for the fabulous concentration of an estimated 40% of the world's gold, the Vredefort event is thought to have contributed to its preservation.

3–2.2 Ga: Kaapvaal Plate Stage 1 Superia Supercontinent (KVC at plate boundary and within plate?)

Much of the local rock record in southern Africa for this protracted time period contains evidence of repeated intra-cratonic volcano-sedimentary basin development, some of which has spawned plate margin interpretations. For example, collision between the Zimbabwe Craton and KVC has been held responsible for the Mesoarchean (2.9–2.8 Ga) Witwatersrand–Pongola sedimentary sequence, as well as ‘Himalayan-style’ high-P–T metamorphism in the Limpopo Belt (2.7 Ga). Far-field transpressive structures propagating from the Limpopo collision have been proposed for the Ventersdorp volcano-sedimentary basins (2.7 Ga). Geophysical lineaments identified in the KVC under cover have been likewise interpreted as Archaean accretionary boundaries (e.g., Colesberg trend, Kalahari Line).

Pre-3 Ga Kaapvaal crustal development: Ur Supercontinent (KVC at plate boundary and within plate?)

Since the majority of greenstone belts within the KVC are early Archaean (>3.4 Ga) and thus not necessarily comparable with the global ~2.7 Ga event preserved in other cratons (including Zimbabwe), classic plate-tectonic interpretations are difficult to apply. Nevertheless, a primitive form of ocean-floor spreading, hydration and crustal thickening

(imbricate stacking, A-type subduction, downwelling along margins) of a microplated post-Hadaean Earth that might be described as ‘vertical tectonics’ seems the most popular model.

The state of the game

The above breakdown of the plate tectonic chapters in the life of the KVC indicates a substantial history of ‘passive’ within-plate residence. Apart from the relatively short period during which the East and West Gondwana plates separated, essentially breaking the ancestral KVC into two, post-Archaean accretionary belts provided ‘protection’ from continued fission. Any events in the KVC rock record from around 3.0 Ga to ~183 Ma, and after ~133 Ma to the present day, can be classified as ‘within-plate’.

Consequently, there is ample scope to analyse these time periods for the operation of ‘non-plate boundary’ processes, such as various types of centralised hotspots, solitary or curvilinear chains of mantle plumes, plume-induced triple-junction spreading centres, ‘superswells’, or maybe even cryptic Vredefort/Sudbury-scale exogenic impacts during the late Archaean and Proterozoic.

This review was inspired by the chance, offered by retirement, to re-read (properly) the marvellous book compiled by Terry McCarthy and Bruce Rubidge, ‘The Story of Earth and Life’,² which really highlights southern Africa, and the KVC in particular, in the eternal Game of Plates and Plumes!

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^bBrenton-on-Sea, Knysna

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The Witwatersrand

The Witwatersrand: model and data

Many ore bodies are highly forgiving, until they are not.

Scientific outcomes are often shaped, unintentionally, by the way an experiment is designed, a workflow is chosen, or data are normalised. This opinion piece considers the impact of data collection methodologies and interpretative rigour on the continuing debate over whether the gold system is best interpreted as placer or hydrothermal and the consequences for the future of exploration in the Witwatersrand.

The 2025 and 2026 Overberg Geoscientist Group (OGG) lecture series on the Witwatersrand, together with the new Witwatersrand book (Phillips, in press)¹ and field trips to gold placers in Otago (New Zealand) and Victoria (Australia), have highlighted how differently scientific questions may be approached in academic, commercial and government settings.

The OGG talks are recorded and may be accessed on [YouTube](#).

Debate over the Witwatersrand still rests in part on inherited workflows and interpretations at times treated with greater certainty than the underlying data may warrant. For example, two-dimensional kriging, by definition, excludes any gold mineralisation outside the chosen plane and, through smoothing, may obscure the abrupt grade changes that commonly occur across structures.

This is the central scientific issue. A robust geological model should be open to disproof, but where a circular logic reinforces its starting assumptions, its value as a critical scientific test becomes limited.

The following sections offer direct and useful responses to some obvious questions about the Witwatersrand.

How important is the Witwatersrand?

Having produced some 1,700 Moz, the Witwatersrand remains historically the most important gold province in the world, although

its practical importance has declined. South Africa is today ranked tenth as a gold producer, with about 3 million ounces per annum; no major new mines have been found in fifty years, and there has been only limited redesign of what is mined or how it is mined.

How forgiving is the Witwatersrand?

Ore bodies can be forgiving (or unforgiving) in two rather different ways. The first is geological and operational: a deposit may be evaluated on imperfect data, given a practical outer shell, and then mined successfully enough that occasional unpredicted high-grade intersections improve the overall outcome. The second is economic: if the commodity price rises sufficiently, as gold has recently, then poor data, incorrect assumptions and uncritical kriging matter less than they otherwise would.

Is Witwatersrand gold lithologically or structurally controlled?

The Witwatersrand host rocks occur within mineralised gentle anticlines and contain a series of meso- to micro-fractures that were probably close to optimal for fluid supply, flow and precipitation. These developed within a package of strata that focused fluid into these sites at both local and basin scales. Most, though not all, mineralisation in the Witwatersrand occurs in strata beneath the massive Ventersdorp lavas, where deformation is dominated by bedding-plane slip and by the contrasting mechanical behaviour of incompetent shales and competent strata such as conglomerate and quartzite. The preferred Witwatersrand hosts for high-grade gold are conglomerates, quartzites and carbon seams. The conglomerates and quartzites are strong in compression but very weak in extension. As hydrothermal fluids reacted with stressed quartz and carbon, which may have supplied the electrons required for reduction, gold was precipitated in the meso- to micro-fractures.

Lithology influences rheology, and for that reason sedimentary and structural analyses are both central to interpretation. Yet in practice, the structure has not always received the attention it deserves.

How good are Witwatersrand data?

Considerable confidence is at times placed in interpretations built on incomplete, inaccessible, or only lightly examined data. In one notable moment of candour during OGG 2025, a former employee of a major mining house questioned the reliability of some in-house assay laboratories. More broadly, much of the raw information remains difficult to access, poorly integrated, or confidential long after the most obvious commercial reasons have passed.

What can be done to improve Witwatersrand science at low cost?

A great deal can be done without major expenditure, corporate decisions, or government intervention. A research student, mine geologist, or exploration geologist could materially improve the science by collecting better and more systematic structural data, assaying complete drill holes and mine exposures including material assumed to be uneconomic, documenting gold positions more carefully, integrating raw grade data with structural interpretation, and clearly distinguishing measured data from geological inference.

What value creation could be achieved in the Witwatersrand by big companies or government?

Considerable value may be unlocked simply by reducing unnecessary confidentiality, improving data collection, integrating datasets, and making better use of what is already known. To this end, the author is aware of a promising initiative with seed funding and involving mining companies, the University of the Witwatersrand and University of Johannesburg, to preserve drill core and mine and exploration data. There is a supporting Project Workshop at the Johannesburg Business School, Auckland Park, 17–18 June.

If Witwatersrand gold is hydrothermal, that has important implications for the most likely path to future economic mining. In Archaean hydrothermal deposits globally, while a few important greenfields discoveries add to the national inventory, much of the increased output comes from brownfields exploration: finding new positions, adapting and changing mining methods, re-interpreting legacy gold intersections, and recognising lower-grade

rocks that have become economic as the gold price has risen.

How should the debate continue?

The choices before us are reasonably clear. The debate over Witwatersrand gold genesis could continue along established lines, or greater emphasis may be placed on methodology, falsifiable tests, raw data and structural geology. In the Witwatersrand, the most clearly falsifiable science lies in the structural geology. For example: (1) Critically comparing sedimentological observations, folds, faults and related structures on the same reef and at the same time, rather than relying on sedimentological interpretation alone, thus providing a much stronger basis for testing competing models by examining the distribution of gold around deformation and sedimentary structures. (2) To measure and document any systematic links between alteration and mineralisation. And finally, (3) the location of the gold itself should be examined in detail. For the hydrothermal model, it is clearly argued that the gold occupies positions created after diagenesis.

Progress in the Witwatersrand Basin, and in gold science more broadly, will come not from defending long-established assumptions, but from returning to the primary raw data, improving structural analysis, and subjecting interpretations to genuinely falsifiable testing.

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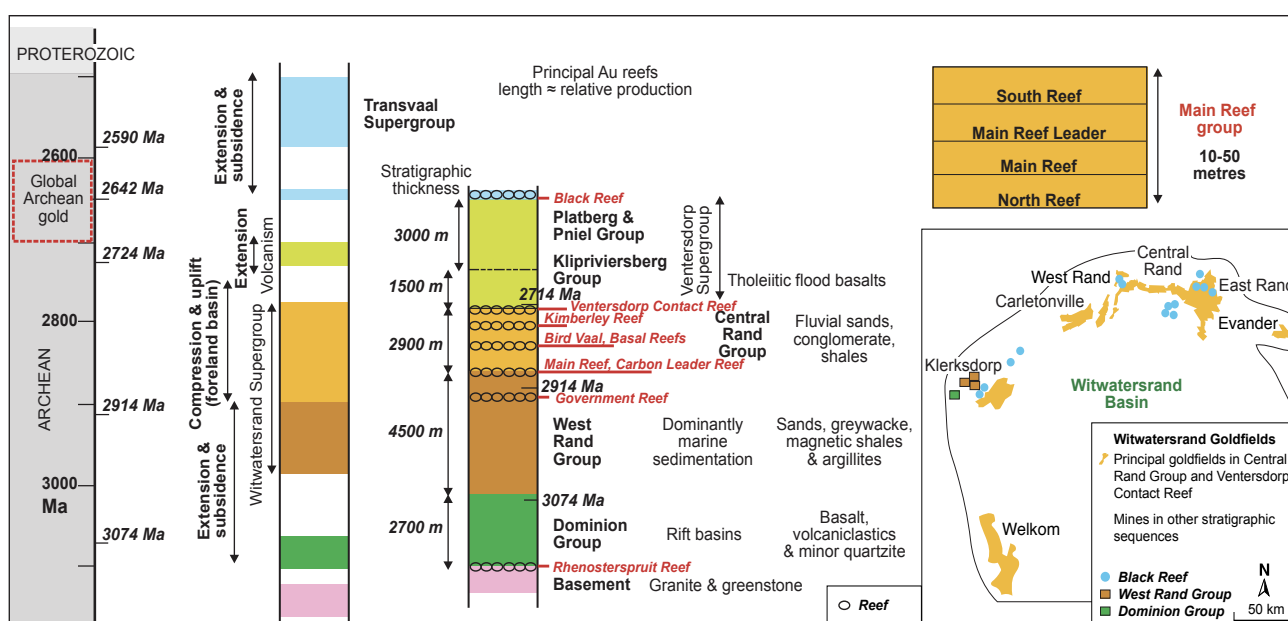
Acknowledgements

John Bristow coordinates the OGG talks with flair and skill. Critical comments from Dave Craw, Jonathan Law and Neil Phillips helped focus this opinion piece on the data and science. Andy Barnicoat and Graham Phillips are thanked for the Carbon Leader images.

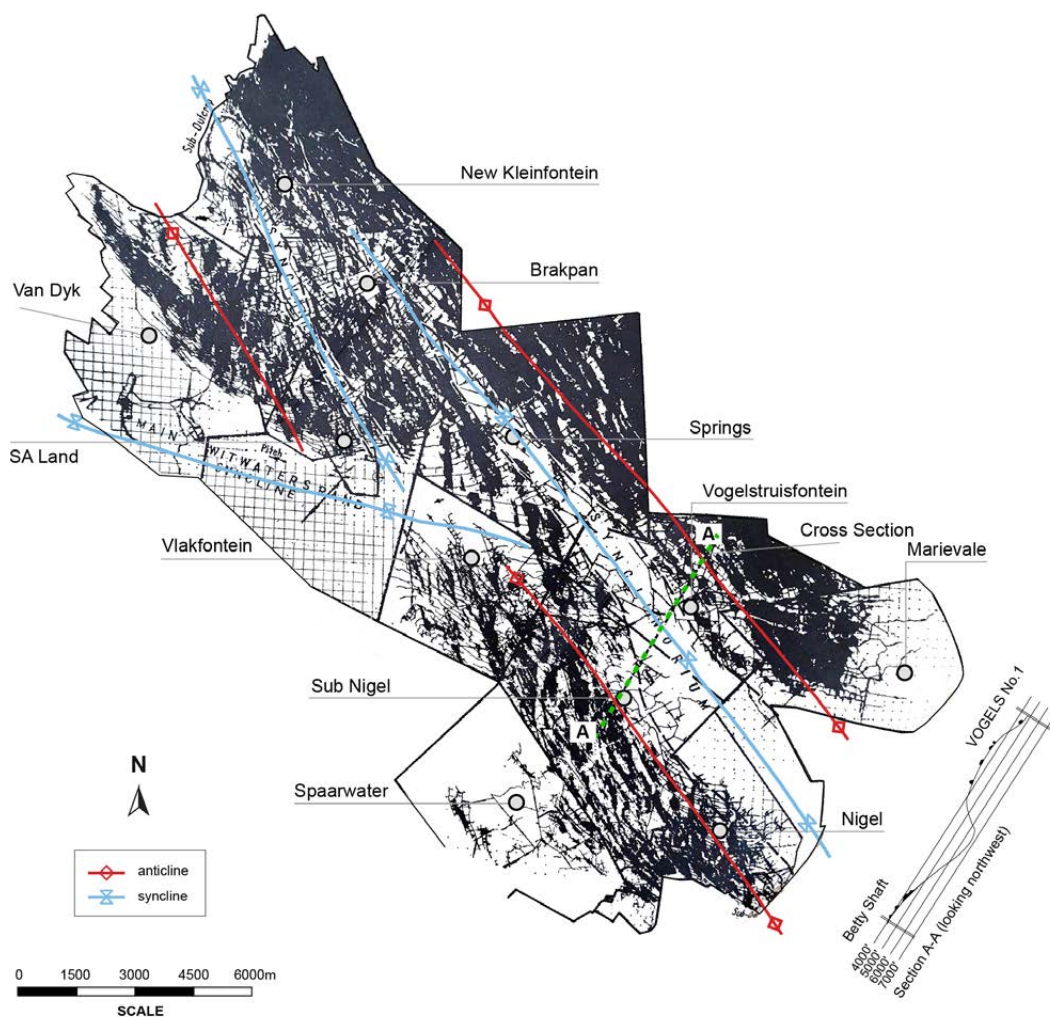
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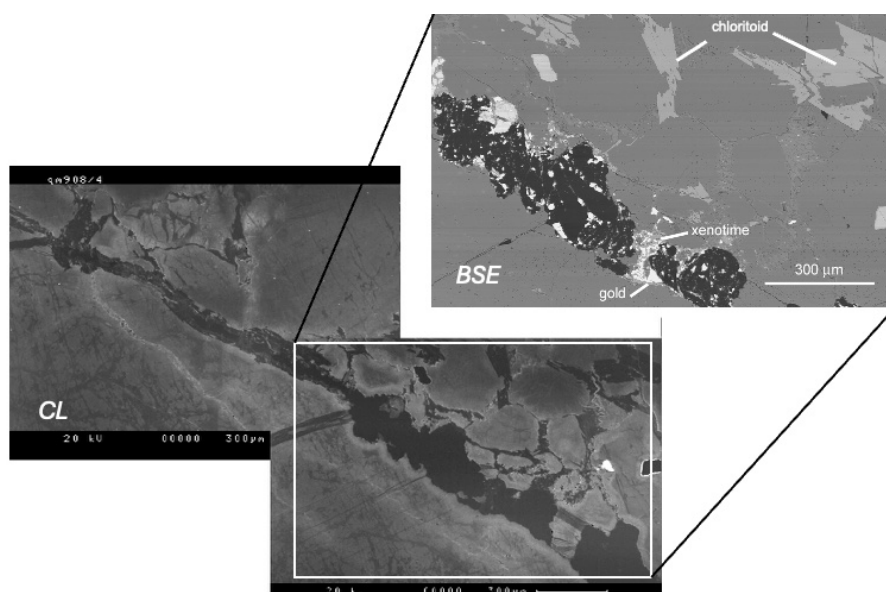
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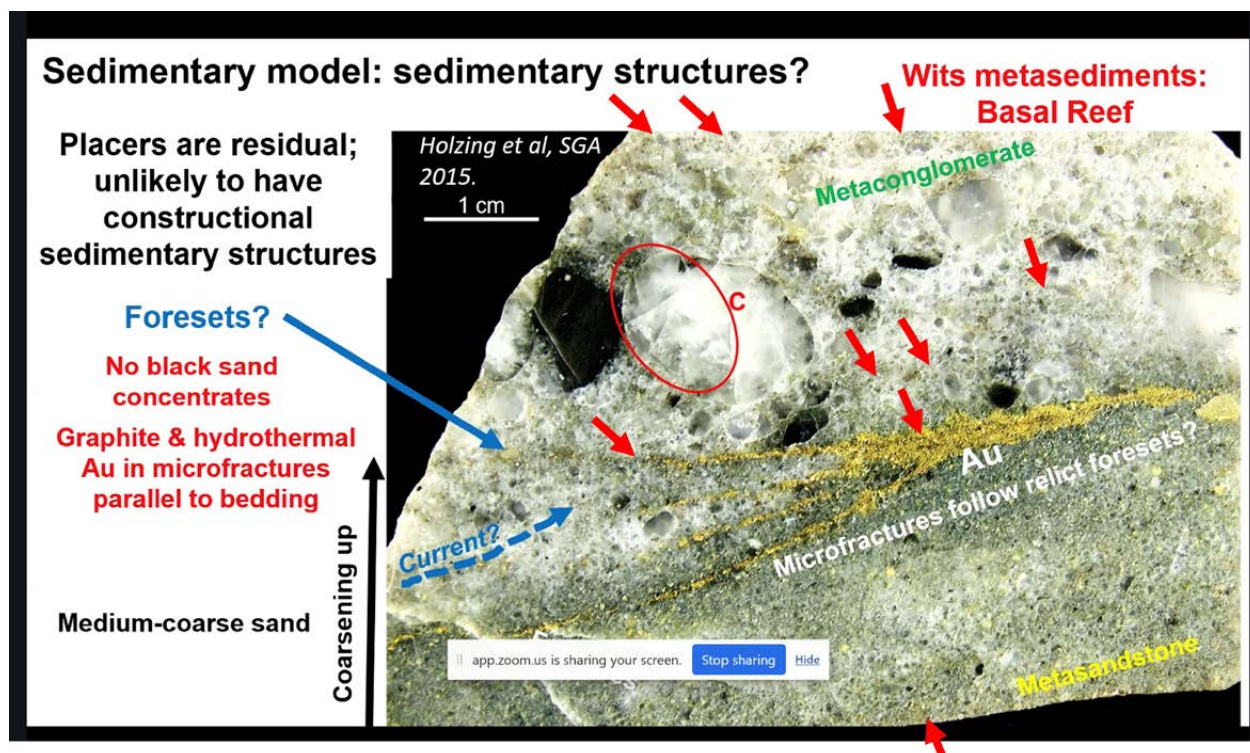
Strata columns 1 and 2 (from left): Stratigraphic components on the Kaapvaal Craton. The fill of the Archean successor basins is shown in relative chrono-logical position and contemporary tectonic context. Column 3 (from left): The same stratigraphy is arranged by thickness, with the four reef groups in the upper Witwatersrand, Central Rand Group, and three minor reef groups accentuated. Top right: Schematic breakdown of the Main Reef Group of the Central Rand goldfield showing the four reef packages over a thickness of tens of metres. Bottom right: Map of the central Kaapvaal Craton showing the sub-surface extent of the Witwatersrand Supergroup, seven main goldfields, and occurrences of the lesser reefs throughout the stratigraphic section (the Dominion Group, lower Witwatersrand West Rand Group, and Black Reef).



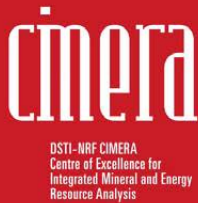
Structure–gold relationships of the Main Reef position, overlain with gold workings for the northern part of the East Rand goldfield. The underlay original is from Greenberg² and reproduced in Vearncombe et al.³. The dark areas are where Main Reef has been worked out and fully developed, and the white areas are where the reef has been developed but was not payable. We have rotated the original diagram so north is directly up-page and annotated the fold structures. There is extensive reef working along the anticline and an absence of workings along synclines in the East Rand goldfield.



Witwatersrand gold is systematically hosted in small fractures, none of which existed at the time of diagenesis.⁴ The Carbon Leader sample (Western Deeps Levels mine) is illustrated by two images of the same specimen. The larger image (labelled CL) is a SEM cathodoluminescence image; most of the greyscale area is quartz, including two veins trending WSW (left side) and SW (more central, extending toward the right edge). Enhanced luminescence around the main NW–SE fracture reflects radiation damage associated with uraninite, which occurs principally within the carbon in the fracture. The upper (top right) BSE (backscattered electron) image shows carbon in black, with bright inclusions of uraninite. Gold occurs within the fracture vein, nestled between globules of carbon. Acknowledgements: Andy Barnicoat and Graham Phillips.



Witwatersrand reef-hosted gold has been argued to lie along foresets, although these features may also represent fractures. Here the sedimentology remains sufficiently poorly understood that there is still no agreement on the way-up of this sample, and there are different ways to interpret the apparent concentration of gold along foresets. Also shown are the ubiquitous microfractures that characterise Witwatersrand gold ores. These permit optimal fluid flow, both lateral and vertical, and precipitation within selected horizons of low tensile strength, thereby producing pseudo-stratigraphic ore bodies.





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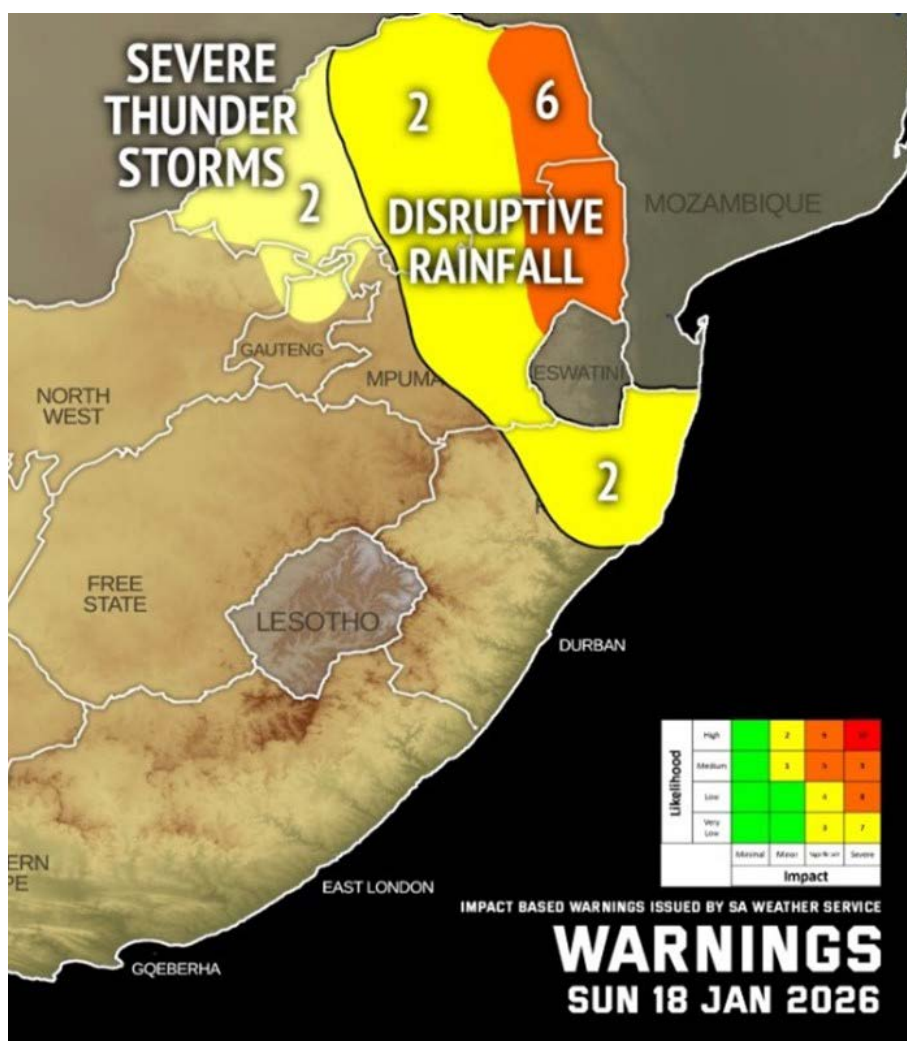
IMSG 2026

IMSG 2026: Digger's Retreat, Barberton

From Sunday 18 January to Wednesday 21 January, the who's who, or at least the who's available, of South African igneous and metamorphic petrology gathered at Digger's Retreat, about 15 minutes north of the town of Barberton (Mpumalanga), for the annual Igneous and Metamorphic Studies Group (IMSG) meeting. The meeting, which was the 14th of its kind, consisted of a field day in the eManzana (Badplaas)–Tjakastad area on Monday, and two days of talks (40 of them) at Digger's Retreat, all organised by the Wits Geosciences hosting committee, led by Ben Hayes (thanked properly at the end of this article).

The conference proper commenced for the majority of the participants with a bus ride from O.R. Tambo airport in Johannesburg out to the conference site, a journey of about 350 km, mostly on the N12 and N4 highways, so according to Google Maps, about four hours. In this case, thanks to 'inclement weather', the bus arrived after about six hours, but all safe and sound. Everyone was promptly housed, fed and 'watered' upon arrival.

In fact, there were formal warnings issued during the meeting about flooding and potential failures or breach of a dam about 20 km upstream on the Suid Kaap River, which would have affected the area of our conference and local access, but in the event, the dam held and the high water did not unduly affect the conference.



SA Weather Service Level 6: Disruptive rainfall resulting in flooding of roads and settlements (formal and informal), mudslides, rockfalls and soil erosion, danger to life due to fast-flowing streams, damage to property, infrastructure, loss of livelihoods and livestock over parts of Limpopo and Mpumalanga.

The Monday field outing, which was attended by the majority of the conference participants (at least 50, in a combination of bus and private vehicles), involved a 1.5 hour drive down south to the area around the village of Tjakastad (named for Shaka Maseko, the local headman of eSwatini's King Sobhuza I in the early 1800s; Tjaka + stad for 'Shaka's homestead'). The outing was divided into two parts, consisting of a visit to the vicinity of the 'type location' of komatiites of the Onverwacht Formation, and after a short drive, to the interdigitated mafic volcanics and granitoids of the Theespruit Formation.

The weather was excellent for the day, in spite of the threat of rain, and there were no access or transport complications. The section along the Komati River feeder creek (spruit, in Afrikaans) exhibits a sequence of modest but distinct spinifex-textured komatiitic basalt (thus probably pyroxene spinifex rather than olivine, but this is not identifiable in outcrop, and sampling there is forbidden), overlain by cumulus olivine (not well exposed). Higher in the sequence are well-preserved pillow sequences, which, as is characteristic of ultrabasic volcanics,

are (in my opinion) somewhat smaller in size than those found in basalts (so more like throw pillows, rather than 'standard' pillows). I might have expected that komatiitic lavas, being lower in viscosity, would flow farther and/or faster in the same amount of time before being chilled into immobility than would a less-magnesian basaltic lava, but perhaps the higher temperature gradient between more magnesian flows (with komatiites at $>1600\text{ }^{\circ}\text{C}$, potentially) and basalts (more like $1300\text{--}1400\text{ }^{\circ}\text{C}$) with water (umm, $15\text{ }^{\circ}\text{C}$?) causes them to quench and therefore immobilise faster? Possibly someone has looked into this, but I haven't checked... A few metres higher in the section finds us in nicely preserved ocelli basalts, before exposure along this section vanishes. This stop featured discussion on the origins of spinifex texture, the evidence for subduction-derived versus plume-derived melts, and the pronunciation of 'ocelli', among other things. This section of the field outing was preceded by an introductory speech by Ben Hayes, and closed by a speech by Sharad Master that provided historical context for the discovery, including mention of historical gold discoveries.

Your correspondent in mid-spiel concerning the distinction between thermal gradient and cooling rate in the origins of spinifex textures. Or having a moment of digestive uncertainty.





The Theespruit, with higher than usual but not prohibitive water levels, in the green and rolling ancient Barberton hills.



Ben Hayes appreciates pillowed flows and tries to remember the name of the white bits in between (selvedges are the dark chilled pillow margins, and the white stuff reminiscent of the rheum in your eyes in the mornings is made up of low-temperature hydrated minerals including zeolites, hydrated silica and carbonate. We are not sure if there's a name for it. Seepages?).



'I'm telling you they're pronounced oh-chell-eye.' Martin Klausen and colleagues, discussing the finer points.

Ocelli structures, variably weathered. Compass for scale. (Photo: S. Büttner)



En route to the second stop, looking southwest, with distant rainfall behind the characteristically eroded late-intruding alkalic granite stumps, which intruded older, low-weathering trondhjemite-tonalite and greenstone sequences.



Lit-par-lit (bed by bed, in French).





Brittle and ductile, intrusive and intruded, all together. Hence, a contact migmatite. (Beer cap for scale in upper right.)



This texture was intriguing, with cm-scale quartz and feldspar euhedra growing radially from the contact of the granitoid (top) into the host aplitic dike. Note the subparallel medium-grained equivalent a few centimetres lower, consistent with migrating thermal and fluid regimes. Compass for scale. (Photo: S. Büttner).

The second section for study was the wonderfully photogenic interlayered or lit-par-lit sequence of mafic rocks (greenstones, and probably not komatiites per se) interleaved with granitoid rocks, in the form of a so-called contact migmatite (a 'mixed rock', as defined by Sederholm), with evidence of post-emplacement deformation oblique to the layering, evidenced by attractive boudinage features.

These outcrops provided fodder for fascinating and on-site discussion-worthy aspects such as, are these actually komatiites? (no); is there any evidence of in situ melting, and how much of a migmatite proper is this, in fact? (it would be, at best, an *injection migmatite* where melts are introduced into higher-level unmelted rocks, and not *in situ migmatite* where the neosome and the palaeosome are both present); did the granitoids intrude the mafic rocks or the other way around? (some evidence supports either

textural relationship); and, is it lunch time yet? (yes). The section required about a 1.5 km stroll each way across farmland to access, and by the time we got back to the vehicles, everyone had had a full and pleasantly tiring day of rocks and exercise and discourse. A very useful 6-page colour handout was provided with background for the stops (in advance, not here at the end, where I've mentioned it).

The conference itself, which ran for Tuesday and Wednesday, consisted of 40 talks, preceded by introductions by Ben Hayes on behalf of the Wits organising committee, Steffen Büttner (IMSG President) on behalf of the IMSG, and our host, Mark Seady, on behalf of the venue.

The sessions were themed as follows, in order of appearance, from Archaean & Proterozoic, Metamorphic Processes, Kunene Complex and Geochronology, and Magmatic Processes (which included a talk on the exhumation of

Chilean supergene porphyry copper deposits, which is stretching the magmatic banner pretty thin) on Tuesday, followed by two hours of poster appreciation. On Wednesday we featured Felsic Magmatism and Geochronology, Mafic-Ultramafic Magmatism, and after lunch, the Bushveld Complex (followed by more poster appreciation before dinner).

Notable research developments in the community included those from the School of Geosciences at Wits, BUGEMET, Rais Latypov's new industry-funded Bushveld research thinktank, and the Kunene anorthosite (Angola, Namibia) research team, with industry support and many postgrad projects in evidence at this meeting.

The early evenings (after the talks, before dinner) were spent in animated discussions around the posters, which were, as a rule, excellent. Other evening activities included cultural exchange, such as is illustrated (below) by Rais Latypov (Wits) singing songs in Russian, appropriate for, in his words, 'a critical mass of Russians', which we had achieved (we had three). In addition, Willem Kruger (UKZN), also shown below, provided some David Kramers, and JP Hunt

(Orion Minerals) offered some Canadian 'Spirit of the West'. Your correspondent also plucked a string or two. And look, geology posters in the background, so we were learning all the time.

The recent tradition of a conference cricket match took place, with the umpire keeping a wary eye on the weather. The light being deemed sufficient and the thunder far away, play was enabled, featuring 'North' (mostly by representatives of non-cricket-playing countries, with some ringers) vs 'South' (South and southern Africa). South batted first and was 69 for 5, while North was 52 all out, including some liberal counting of overs and outs to attempt to balance the scales.

The dinner braai featured some kind of slaughtered mammal as I recall. This was followed by our closing ceremony, consisting of thank you's and awards.

Prizes (in ZAR) were awarded for the best student talk and poster of the conference. The Best Student Talk prize went to Rowan Walker, who is conducting her MSc at Stellenbosch University, entitled '*Intrusion mechanism and magma differentiation of the Timbavati*





Anton Kutyrev (Wits) sinks into a deep Russian reflection, while Sourav Bhattacharjee (Rhodes) strums melodic.



Gabbro'. The Best Student Poster award went to Tokollo Kekana (MSc at Wits University) who presented, very enthusiastically, which is also how he received his award (he didn't stand still long enough for me to get him into focus) on *'Testing multiple hypotheses for the origin of the "Strange Rock": a fine-grained pigeonite gabbro in the Critical Zone of the Eastern Bushveld Complex*'.

The conference was attended by just over 70 registered participants, plus some visitors from the nearby Fairview gold mine and some of their neighbours on the first day. Of the registered

attending participants, 27 were postgrad students, representing just over a third of the group.

Eight South African geoscience departments were represented (from west to east, UCT, UWC, Stellenbosch, Rhodes, UJ, Wits, Pretoria and UKZN), as well as a group of French researchers from Géosciences Environnement Toulouse (GET), the French National Research Institute for Sustainable Development (IRD), LMV (the Laboratoire Magmas et Volcans) at the Université Clermont Auvergne, the CNRS, and Géosciences Environnement Toulouse (all

in France) who were conducting fieldwork in the Barberton area prior to and following the meeting. In addition, Oxford University was represented (UK, c/o Wits). Sadly, we had nobody from UFS this time, presumably still recovering from last year's Geocongress, and NMU and UFH participants are still to be enticed. Notable absences included John Clemens, who was temporarily medically incapacitated but is fine; Grant and Trishya who were expecting the birth of an actual child, which was delivered the weekend after the meeting, and Elizaveta and Matthew down in KZN. We had hoped for new contingents from U. Limpopo and from Botswana who had expressed interest, but couldn't attend for various last-minute reasons. We look forward to seeing representatives from the new geoscience departments at U. Mpumalanga (Mbombela) and Sol Plaatjies U. (Kimberley) in the fullness of time, as well. In addition to the academic stream, we also had representation from Orion Minerals, the Council for Geoscience, Shango Solutions, and Barberton Mines. We hope to see the breadth of participants continue to broaden in future. On which subject, the team from UCT has agreed to host the 2027 version of IMSG, with the possibility of another, as yet undetermined, field destination in mind.

We would like to thank the organising committee, consisting of Ben Hayes, Grant Bybee, Kofi-Anan Mkumla, Kealeboga Matea, and Sarah Glynn, all from the School of Geosciences at the University of the Witwatersrand and its new spin-off, Earth Quest Solutions (EQS). We must also thank the generosity of the sponsorship recruited by the committee, which included the GSSA, BUGEMET (Bushveld Geology and Metallogeny Research Chair, courtesy Prof.

Rais Latypov) Pan African Resources, DSTI-NRF CIMERA, Unique Core Products Africa (PTY) LTD, Orion Minerals (courtesy JP Hunt), Shango Solutions, Wirsam Scientific, Geo-Explore Store (PTY) LTD, and MinSA.

Note that there are both benefits and risks to field location-hosted conferences. The obvious benefit is that the conference is not tied to the geology within an hour or two of the host department. For many of our departments, those sites have been visited repeatedly already in the course of these meetings (such as for all of the Cape Town-area departments), or sometimes there are no notable igneous or metamorphic rocks within an hour or two (e.g., Makhandia). Also, hosting a conference 'at home' means that affordable accommodation and restaurants can be found close by at the discretion of the attendees. However, with universities now treating conferences as a prospective and desperately needed revenue source, hosting a conference 'at home' is not the savings it once was. In addition, because the venue has to become, effectively, inclusive (providing all accommodation, meals, etc.), deposits must be paid, requiring significantly increased sponsorship, and late cancellations become money lost to the conference that had to be paid to the host venue, instead of simply potential money lost to the hosting city. We will probably need to take deposits early on in future to avoid financial costs to IMSG from late cancellations or no-shows.

And then it was back to the airport by bus, for the majority, and a final goodbye at the departure gates, for some. 'Til next year!

Steve Prevec

Next year's host committee; pre-planning phase. Before they woke up at home and sober and realised that they offered to be next year's hosts...



Rhodes celebrates 120 years

Rhodes Geology Department celebrates 120 years of existence, at the national geological conference, Geocongress 2025, in Bloemfontein

In June 2025 the national meeting of South African geoscientists, the Geological Society of South Africa's biennial Geocongress, took place at the University of the Free State, in Bloemfontein. The event attracted around 200 participants from South African and international academic institutions, museums, and from industry, including about 140 oral presentations spread over three days. I am aware that this event took place last year, but since there's no Geocongress this year, I thought it was useful to share fond remembrances of last year to keep us in the mood for the next one, to be held in KwaZulu-Natal in 2027.

The Department of Geology of Rhodes University featured prominently at the meeting, and was anecdotally (and as far as I can tell, correctly) adjudged to have contributed the most academic research staff of any South African university to the meeting (we had three permanent

academic staff—Profs Prevec and Büttner and Mr Mavuso), one emeritus professor (Prof. Harmer), one staff-awaiting-work-visa-who-is-now-a-permanent-employee (Dr Madondo), one technical officer (Mr Lehloenyia), and if we count the Rhodes EMU facility manager (Dr van Niekerk) as ours (we did originally employ him), we had six; no other department had more than three academic staff members, in spite of Rhodes being by far the smallest participating academic department (probably by a factor of two). *[Editor's Note: Hey Steve, UJ contributed six academics... but we get the point!]* The six academic staff were accompanied by current and former research postgrad students, and in total, contributed twelve oral presentations on their current or recent original research, and co-authored others.

Rhodes graduates and former staff also featured throughout the conference, with the conference-opening plenary address on '*Kimberlitic olivine as a tool for constraining deep mantle processes and diamond preservation*' being given by Dr Geoff Howarth (UCT), a BSc, Hons, MSc and PhD (2013) graduate of Rhodes Geology.



Rhodes staff (specifically Prof. Prevec) served as convenor for sessions on 'Bolides, impacts and shock phenomena', and as co-convenor on 'Petrogenesis and metallogenesis of layered intrusions', but from a Rhodes Geology promotional perspective, the highlight would be the session convened by Prof. Prevec entitled 'celebrating 120 years of the Geology Department at Rhodes University'. The Department of Geology was established in 1905, one year after the enfranchisement of Rhodes University, with Prof. E. Schwartz as the Head of Department. The latter session actually contained more talks than either of the other two, surprisingly, and was very well attended in spite of taking place on the final day of the conference. Eleven presentations were offered, consisting of four by current Rhodes Geology staff, three by Rhodes current and former students, and three by Rhodes alumni, including Prof. Wolfgang Maier (PhD Rhodes Geology 1991), Prof. James Roberts (Rhodes Geology BSc & Honours, 2000, although James, now Head of Department at the University of Pretoria's Geology Department, was unable to attend because of late scheduling conflicts), and Dr Chris Hatton (Rhodes BSc & Honours, 1974).



Above, Prof. Steve Prevec 'in action' as a session chair.



Dr Deon van Niekerk (Rhodes EM Unit) and Prof. Roger Gibson (Wits) in discussion during the 'impacts and meteorites' session, presenters of two of the three talks on the Nqweba meteorite that fell near Nqweba (Kirkwood) in the Eastern Cape in 2024.



Above, Mr Silindo Mavuso wraps up his presentation on sedimentology of a part of the East African rift valley from Kenya.



Rhodes Geology BSc graduate (2013), and now a post-doc at the University of Münster, Germany (insert humorous 'it was a Muenster Mash' reference here), Dr Chris Harris presents his current research findings from the Makhanda area, here highlighting the affiliated research team of Dr Robert Gess (Rhodes Geology research associate and BSc graduate).

Other notable Rhodes Geology graduates at the conference included Mr Robin Baxter-Brown, who graduated from Rhodes Geology in 1955(!). Mr Baxter-Brown is now 90 years of age, at the time of the congress, and remains active. He is described in literature as a 'legendary explorer', and was the discoverer of the lower Orange River diamond fields near South Africa's northwest coast in the mid-1960s, among other things. At the other end of the age spectrum, we also encountered Ms Avela Mantshontsho, who, according to her, decided to become a geologist after participating in the Rhodes high school internship program (run by this author) when she was a Grade 10 student in Makhanda back in 2015.



Mr Robin Baxter-Brown (Rhodes Geology BSc, Hons; 1955) with Dr Mike De Wit (a leading consulting geologist in diamond exploration) on a field expedition to their old stomping grounds near Alexander Bay, in 2022. (Photo: M. de Wit)



Ms Mantshontsho, completing her MSc thesis in Geology at the University of Pretoria as of 2025, with Profs Prevec and Büttner of Rhodes Geology (left to right).

Rhodes staff also participated in research and professional community events involving CIMERA, the Gauteng-based economic geology research organisation, and MinSA, the Mineralogical Society of South Africa. Profs Büttner and Prevec are participating members of the former organisation (CIMERA), and Prof. Prevec is the quarterly magazine editor, currently the Vice-Chair, and soon the Chair of the latter (MinSA), from August.



Rhodes Geology staff 2026: from left to right, Silindo Mavuso, Steffen Büttner, Pelele Lehloenya, Steve Prevec, Joe Madondo and Eugene Grosch.

On behalf of the department, I would also like to take this opportunity to note that for the first time in five years we are now full staffed again as of 2026, and looking forward to celebrating our departmental 200-year anniversary in the year 2104.

Steve Prevec
HoD of Rhodes Geology

Geoscience for all

Geoscience for all: translations and collation of a geoscience word bank in South Africa's 11 spoken national languages

The Mineralogical Association of South Africa (MinSA) is proud to announce the successful completion of a pioneering lexicography exercise that has collated geoscience terminology across South Africa's 11 spoken national languages.

The project, funded by the 35th International Geological Congress (IGC) Legacy Fund, represents a major step toward inclusivity and accessibility in the Earth sciences. It brings together specialised vocabulary from the fields of mineralogy, geology, geomorphology, and related Earth sciences, uniting words that define the environment in which we live with South Africa's rich linguistic diversity.

The intervention has run over two years and started as a grass-roots initiative in which universities, professionals and community contributors submitted words through an online survey link. The second phase relied on the involvement of a professional translation service, the Stellenbosch University Language Centre, who played a key role in the translation and verification process. The collaboration resulted in collation of almost 2000 geoscience terms being documented across the various languages. Of these, just under half were collated from existing words, whereas the other half were transliterations provided by the professional translators.

The project was inspired by a quote from Pip William's novel *The Dictionary of Lost Words*, particularly the poignant and motivating quote 'Words define us, they explain us, and, on occasion, they serve to control or isolate us.'

According to project lead Prof. Bjorn von der Heyden, an Economic Geologist from Stellenbosch University and MinSA co-opted member, 'The aim of the study was two-fold; we wanted to create a safe repository for all existing

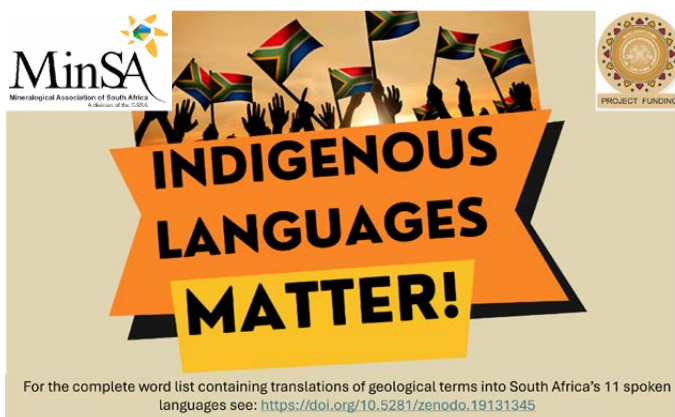
geoscience terms for prosperity's sake, and we hope to inspire broader participation and understanding of South Africa's geological heritage among our diverse population.'

The final geoscience word bank will be made publicly available through an open-access platform hosted on the webpage of the South African Centre for Digital Language Resources (SADiLaR). This word bank is a step in the right direction towards enabling researchers, educators and students to engage with geological sciences in their preferred language. This achievement marks an important milestone in making the geosciences more available, accessible and inclusive.

Chairperson of MinSA, Lethuxolo Dubazana, said, 'In a country where the sciences remain inaccessible to many, this repository serves as a vital step toward bridging the gap in collective scientific literacy. MinSA is proud to present a unified public resource that brings together terminology which may be familiar to some and entirely new to others, enabling exploration and comparison across South Africa's indigenous languages. A rock is not just a rock; it represents our history and our present and by bringing these words to life, we ensure that geology becomes part of our shared future.'

The Mineralogical Association of South Africa expresses its gratitude to the 35th IGC Legacy Fund for financial support and to the Stellenbosch University Language Centre for their expert linguistic contribution.

For more information and access to the word bank, please visit: <https://doi.org/10.5281/zenodo.19131345>.



GSSA Logo and Coat of Arms

The GSSA Logo and Coat of Arms

For years you have all seen the GSSA logo and/or coat of arms. But have you ever wondered what they actually mean?



GSSA logo

The GSSA logo comprises a number of strong colours:

- The primary colours are dark blue and grey. The deep blue casts a veil of introspection and quiet authority, stability, professionalism, competence and authority. Shades of grey were added to the colour palette as overarching neutral colours, being the colour of intellect and of compromise.
- Bright yellow as a highlight relates to acquired knowledge. Yellow is the scientist, constantly analysing, looking at both sides before making a decision, methodical and decisive. The other highlight colours are green (signifying nature, environment and sustainability) and red (signifying the emotion and passion that we feel for the geosciences; embodying the energetic spirit that our volunteers put into the promotion and operation of the GSSA). The white bands within the shield reflect the ethical boundaries, governance and the connective tissue of the Society's diverse community.

The wavy, tapering forms resemble stratigraphy—a nod to sedimentary layers, tectonic movement, and the dynamic processes of Earth. This evokes the GSSA's scientific foundation in geology and its commitment to understanding Earth's history. The overall shape suggests protection, legacy and institutional strength. It positions the GSSA as a guardian of geoscientific integrity, ethics and public benefit. The tapering ends imply forward movement—

transformation, progress, and the Society's evolving role in a changing South African and global context.



GSSA coat of arms

Granted officially on 7 June 1974, the arms combine geological symbolism, national heritage, and the Society's mission into a single visual language. Heraldry traditionally uses colours and geometric divisions to convey meaning. The GSSA's shield uses these conventions to echo the structure of the Earth itself.

The shield: a geological cross-section in heraldic form

The circled cross on the shield is the astronomical symbol for the Earth and is probably of Medieval origin. It also serves as a simplified emblem of the Society when the full coat of arms is not required.

The heraldic colours and two so-called "metals" are used to symbolise the four elements according to Aristotle's philosophy: air = white, water = blue, earth = black, fire = red and yellow. The four elements not only represent the ingredients of the material world, but also characterise the fundamental geological environments, namely the atmosphere, hydrosphere (together with the exosphere), the lithosphere and the endosphere.

These four regions are shown in their normal sequence from top to bottom. Exosphere and endosphere also agree with the two main subdivisions of geology, namely the study of sedimentary (soft) and the plutonic (hard) rocks,

respectively, and with the classical geological issue between the Neptunists and Plutonists, which is continued in modern form in the battle between transformationists and magmatists. The contrast between the exosphere (alternating waving bands of air and water) and the endosphere (angular alternating bands in the colours of fire) are thus accentuated.

- *Blue upper field (Azure)*: Blue is widely associated with knowledge, truth and scientific inquiry. In a geological context, it also evokes the sky and hydrosphere—reminders that geology underpins all Earth systems.
- *Gold lower field (Or)*: Gold represents excellence, value, and the mineral wealth that has shaped South Africa's history. It also reflects the economic geology heritage of the country, from gold and diamonds to platinum and chromium.
- *Black horizontal band (Fess Sable)*: This central band resembles a stratigraphic layer—stable, ancient and foundational. Black in heraldry often signifies constancy and wisdom, aligning with the Society's long-standing role in advancing geoscience since 1895.
- *Two silver wavy bars (Bars Wavy Argent) in the upper section*: These wavy lines represent water—rivers, oceans, and the processes of erosion and sedimentation. They remind us that geology is inseparable from the movement of water across and through the Earth. At the same time, the wavy bands can also be interpreted as a symbol of the relatively small deformation styles of soft rocks.
- *Two red angular bars (Bars Dancetty Gules) in the lower section*: The angular, zigzag form suggests tectonic forces, faulting, and the dynamic nature of the Earth's crust. Red traditionally symbolises energy and transformation—apt for a science concerned with heat, pressure and change. The angular bands can also symbolise more intense deformation that originates at great depths

The crest: a springbok bearing the symbol of science

Above the shield sits the *springbok head*, collared in black and marked with the same astronomical symbol found on the shield.

- The *springbok* is a national icon, linking the

Society to South Africa's identity and natural heritage. At the suggestion of the Bureau of Heraldry, a neck band that repeats the central motif has been added to distinguish between the Springbok head appearing on sport arms.

- The *astronomical symbol*—a circle with a cross—has long been used to represent Earth in scientific diagrams. Its placement on the springbok's collar symbolises the unity of national identity and Earth science.

The mantling: silver and red

The decorative cloth flowing from the helmet uses *silver (Argent)* and *red (Gules)*—the same colours found in the shield. Mantling traditionally represents protection and dignity. Here, it visually ties the crest to the shield, reinforcing the unity of the design.

The motto: Terram cognoscendo progredimur

This translates as 'By understanding the Earth, we progress' (we go forward by knowledge of the Earth). This motto captures the Society's purpose. It asserts that geological knowledge is not merely academic—it is foundational to societal advancement, economic development, environmental stewardship and national resilience.

Why this matters today

The GSSA's coat of arms is not a relic of yesteryear; it is a compact narrative of the Society's identity: scientific, South African and deeply rooted in the Earth. In an era defined by climate change, critical minerals, water scarcity, and the need for sustainable development, the GSSA's heraldic identity feels more relevant than ever.

- The *wavy bars* speak to hydrology and climate.
- The *angular bars* speak to tectonics and the energy beneath our feet.
- The *gold field* speaks to mineral resources and economic geology.
- The *central roundel and cross* speak to scientific method and global perspective.
- The *springbok* speaks to national responsibility.
- The *motto* speaks to the future.

Both the GSSA logos and the coat of arms are trademarked.

Tania Marshall

Missing papers

We are asking any member who has a physical (or digital) copy of any of the following papers to contact info@gssa.org.za. We want to expand the SAJG collection on GeoScienceWorld back to 1987 and we are missing these papers. We would like to borrow these documents, digitise them as PDFs and will then return them to the owners.

- 1998, SAJG v101 n3 p237–253: W.D. Maier, S.J. Barnes, S.A. de Waal. Compositional variation of laurite at Union Section in the western Bushveld Complex.
- 1995, SAJG v98 n2 p119–125: L.A. van Heerden, J.J. Gurney, P. Deines. The carbon isotopic composition of harzburgitic, lherzolitic, websteritic and eclogitic paragenesis diamonds from Southern Africa; a comparison of genetic models.
- 1990, SAJG v93 n3 p505–513: C. Buehmann, D. Buehmann. Clay minerals as palaeoenvironment indicators exemplified on a Karoo Sequence from the Bothaville area, South Africa.
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mineral scene

Waterhouseite, N'Chwaning I Mine, Kalahari Manganese Field

When this 'Mineral Scene' column started in 2016, ten years ago, the first featured mineral was the very rare species gatehouseite, $\text{Mn}^{2+}_5(\text{PO}_4)_2(\text{OH})_4$, which had recently been described from the manganese mines in the Northern Cape. As a tenth anniversary, the species described here is also extremely rare, and was only discovered last year: waterhouseite, $\text{Mn}^{2+}_7(\text{PO}_4)_2(\text{OH})_8$.¹ The chemical similarity to gatehouseite is obvious, as both are manganese phosphates. The mineral is named after Frederick George Waterhouse (1815–1898), first Director of the South Australian Museum (Adelaide), in recognition of his contribution to the preservation of the natural history of South Australia, and celebrates the continuing work of the Waterhouse Club in their support of the South Australian Museum.²

The type locality is the Iron Monarch Main Pit in South Australia, and only two other occurrences are known, South Africa and Romania. Waterhouseite is monoclinic, has a hardness

of 4, specific gravity of 3.55 and forms orange-brown to dark brown vitreous crystals. The specimens from Australia and South Africa are very similar in appearance, forming small, flat orange crystals, typically arranged in radiating clusters. The specimens featured here are typical for the species.

Bruce Cairncross

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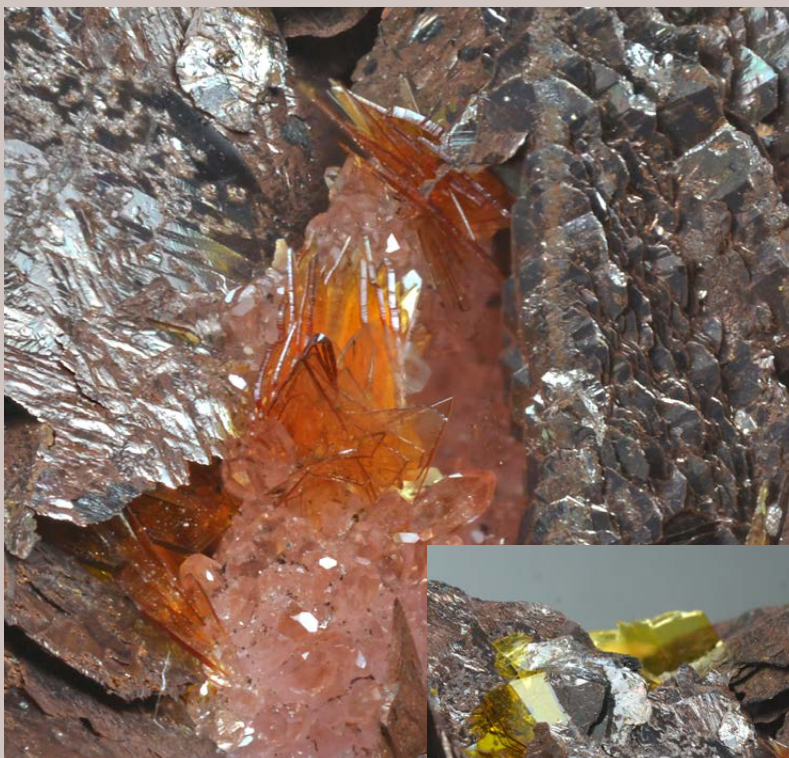
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A 4-cm specimen of semi-parallel layers of dark, platy pyrochroite, pale pink rhodochrosite and khaki sussexite. The small cluster of orange waterhouseite can just be seen left of centre. See close-up in the next figure. (Specimen and photo: Bruce Cairncross)





Close-up of the waterhouseite nestled on the matrix of khaki sussexite, pink rhodochrosite and pyrochroite. Field of view is 11 mm.



Another specimen of orange waterhouseite on pink rhodochrosite, surrounded by dark brown pyrochroite. The yellow crystals are shigaite. Field of view is 7 mm. (Specimen and photo: Bruce Cairncross)



The same specimen as in the previous figure, but with a broader field of view (20 mm).

the geological detective



The Geological Detective: A Study in Phosphate

The Sahel—flat, yellow and dry—rolling on forever. Svetlana had been focussed on her laptop for most of the journey from Saint Louis, occasionally sipping strong, black tea from the thermos she was sharing with Petr. The soundtrack from the Rocky Horror Show played softly in the background.

‘Something’s bothering me, Perviy’, Svetlana said, not looking up.

‘The Djolof Chicken?’ asked Petr.

‘No, the blanks. The certified reference materials (CRMs) results are fine. A few data points are beyond the limits, but nothing to worry about. The repeats are all fine, but those blanks...’

Svetlana paused, gazing into space. ‘The blanks make no sense—they are failing and there is no pattern to the failures, and I can’t link the blank failures to the CRMs. It doesn’t help that there is no metadata... I can’t see if a person or a specific period of time is related to the failures. All they have is the sample number, nothing else.’

‘And the assay lab?’ Petr asked.

Svetlana started to nibble her ponytail, a bad habit she had when deep in thought...

‘Immaculate. Modern, well-organised. I don’t think the laboratory is the problem.’

‘I agree’, growled Petr. ‘The assay laboratory was spotless, clean as a teardrop.’

They arrived at the mine to find François, the Project Geologist, waiting at the entrance to the core yard. Lean and clad in khaki, he was the epitome of the louche colonial, sporting an indigo-coloured turban to protect against the dust that had turned the sky a milky white.

‘No relaxing, no sightseeing, and definitely no banya before we start’, Petr grumbled.

He looked out at the bleak landscape, where lethargic goats grazed on thorny bushes beribboned with black plastic.

‘Welcome to our little piece of paradise on the Sahel’, François said. ‘You have arrived on a very special day—the Harmattan has begun.’

‘I was wondering about that’, said Petr. ‘This dust gets everywhere’.

‘En effet’, said François. ‘I assume you’ve been through the data I sent you?’ gazing in longing at Svetlana.

‘We have,’ said Svetlana, ‘however, I need to understand your geology first. I was surprised at the low levels of cadmium, arsenic and uranium, and also almost no silica or organic carbon.’

François nodded, ‘C’est ça. Our deposit is an Eocene sedimentary phosphate. Nice grades too—routinely above 30% P_2O_5 . However—zut alors! Très complexe! Chert boulders, desiccation cracks that turn into sand dykes, soft-sediment deformation features and hard pan lenses. It’s not easy geology, that I can promise you.’

‘I was wondering why you were drilling your grade-control grid on a 20-by-20-metre collar spacing’, said Petr. ‘I know you geologists like core, but that did appear a bit excessive... You know, sometimes the best is the enemy of the good?’ Petr remarked.

‘Yes, if we didn’t have such strict quality requirements, I would open the grid up. It costs us a lot of money and effort—we are drilling using sonic core as well, so you can imagine, but...’ François gave a Gallic shrug. ‘C’est comme ça, I need to make certain the product that we ship makes spec’, he said.

Petr had been only half-listening, soft-rock geology bored him. For a mining engineer, it was just a dirt-moving exercise. You don’t romance the rock, you wrestle it... And if you were going to shift tonnes, he preferred something with a bite, like a BelAZ 75710—a truck so large it made other trucks look like wheelbarrows.

A grey fragment embedded in a nearby core caught his eye.

‘What’s this?’ he said, pointing at the grey anomaly.

François smiled. ‘A shark tooth. These types of deposits tend to have a basal layer, which we refer to as a bone bed. Shark teeth are common here. We have identified over 30 species, including proto-whales.’

Ignoring the talk about fossils, Svetlana walked towards the sample preparation area, stopping at a large, clear, plastic bag slumped against the wall, its top flopped open. A fine orange-yellow dust had settled on the exposed white powder.

‘Is this your blank material?’ Svetlana enquired.

‘Boric acid’, François confirmed. ‘Phosphate-free, none of the other nasties, consistent matrix—a good blank.’

‘It was a good blank; it is now a blank no more’, she said quietly. Crouching, she scooped some of the powder from the bag and held it up. The boric acid was visibly contaminated.

‘This a dead blank—as the English would say, it is a dead parrot. With all the dust around, you are getting contamination. This explains why the blanks are failing, as well as the reason why I couldn’t find a pattern in your data. The contamination is a function of how much dust is in the air and how long the bag has been left open.’ She paused. ‘We have the answer to your problem.’

François stared at the bag. ‘I should have caught this. C’est tout à fait évident!’

‘Now you have’, Svetlana said, in the voice of a Russian schoolteacher who has seen the same mistake made the tenth time by indolent students. ‘You do realise the implications—all of the time and money spent getting us here, as well as the re-assaying you have done could have been easily avoided by just following your own standard operational procedures. That is why you have standard procedures!’

‘And there’s your metadata problem’, she added, turning her tablet to show a spreadsheet riddled with blank cells and inconsistent formatting. ‘How can you analyse your data with this? You have no dispatch dates, no record of when samples arrived at the laboratory, when they were analysed, or even when results were returned. You don’t even know which geologist logged or sampled the core.’

Petr smiled, this was the side of his boss that people didn’t usually see. The pretty blonde with the big blue eyes had a cold, analytical brain—a tsarina who took no prisoners when she encountered fools and sloppy work.

Svetlana continued, ‘If you don’t have the data, root-cause analysis is impossible: you don’t know where the blank failure has occurred. Was it in the field or in the laboratory? Who was the responsible person? You can’t tell me.’

‘Let me be very clear—you are flying your Antonov blind—you have no instruments to tell you where you are going to.’ Svetlana nodded gravely, folded her arms and shifted her weight like a woman used to hard winters and the lonely business of ruling a vast, ungrateful country—‘Rodina-mat’ zovyot!’ come to life on the desiccated plains of the Sahel.

François gestured toward the offending bag. ‘This, this is the cause of all my problems! An open bag!’

‘Exactly. All of your problems were due to someone not following procedure and YOU not doing your job’, said Svetlana, her eyes sparkling with passion. ‘This should never have happened.’

Petr’s smile grew wider—this will be fun, he thought. Svetlana was now in full teacher mode.

‘First,’ said Svetlana, wagging her forefinger in François’ startled face—he had never been in a position like this—‘you protect the blank. Treat it like your queen in a chess game. The queen is the most powerful piece on the board and, like a blank, can be a game changer—as we have just seen. It brought us half way round the world to find this.’ Svetlana gestured at the half-open bag.

‘Dispose of the contaminated material and split the large bag into small sachets like the ones you use for the CRMs. It isn’t ideal—the blank should be certified, like your CRMs, and should match the physical characteristics of the ore you are shipping, in terms of particle size, colour and density. As we say, a clean boot goes faster!’

‘That isn’t possible for us’, said François.

‘I agree with you—I did say it wasn’t ideal’, snapped Svetlana. ‘However, the contaminated blank and the fact that I was unable to analyse

your database in any meaningful manner points to more fundamental problems. This should never have happened, if you were following your procedures and analysing your QAQC data when it came back from the assay laboratory and not at the end of the drilling program. Trust, but verify!’

Svetlana paused, drawing a deep breath. ‘And, you have no chain of custody. You have no idea who may have left the bag open as you have no record of who logged the core, who sampled it, what type of sample it was, when the samples were sent to the assay lab, when the sample was analysed and when the assay results were returned. This is a typical example of—how do you put it in French—travail bâclé—sloppy work.’

Her eyes now blazing, she stepped closer to François, stabbing him in the chest with her forefinger. Petr sniggered. This was a lot more fun than he thought it was going to be. The snake had met the mongoose.

‘You don’t even record the batch number in your...’ Svetlana stopped, grimacing in disgust, ‘excuse for a “database”. An Excel™ spreadsheet is NOT a database. You need a proper relational database.’

François nodded slowly, taking a deep breath. ‘I guess I have a lot of work to do to fix this.’

Petr picked up the boric acid bag. ‘Ladno!’ he said. ‘Alright, you win boss, let’s fix the blanks first... but I do want a closer look at those shark’s teeth.’

The rest of the trip was spent mentoring and training François and his team, and helping them to fix their ‘database’ until a professional software solution could be purchased.

Before Svetlana and Petr left the mine, François presented Petr with a selection of shark’s teeth and Svetlana with a dress-length of brightly coloured bazin.

‘I hope these small gifts are acceptable’, said François. ‘We are eternally grateful to you for solving our problem, even though it was self-inflicted.’

As they drove away from the mine, Petr turned to Svetlana. ‘You were a bit harsh on him, don’t you think?’

Svetlana turned, looking at Petr in silence, then said, ‘You know how I feel about lazy people, even very good-looking lazy people.’

‘Well tzarina, you catch more flies with honey than with vinegar, you should know that by now. Anyway, next stop...’

‘Don’t say it, don’t even think it!’ said Svetlana, knowing Petr’s love of old movies...

‘We are stopping in Casablanca on the way home... So “here’s looking at you, kid”’, Petr smiled... ‘Did you really think I was going to say “play it again Sam”? That’s not even in the movie.’

The next adventure

The Antonov droned westward, leaving the charms of Casablanca behind. Petr slumped in his seat, staring at a shark’s tooth he had been flipping between his fingers for the past hour.

‘What’s next on the case-list, boss?’ he asked, releasing a sigh so heavy it could have sunk a dredge. ‘Because if it’s another sedimentary phosphate deposit, I will personally volunteer to be locked in the core shed. At least there you can die of boredom. Listening to geologists say “interesting” at the same time... Well, I’d rather drink bleach with my borshch.’

Svetlana didn’t look up from her tablet. ‘Tianshan–Xingmeng Orogenic Belt. North China. We have to solve the assay bias case to help our comrades.’

‘Ah’, Petr said, perking up slightly, ‘real rocks. Mountains. Something with a spine.’

‘Molybdenum’, she added.

Petr groaned. ‘Molybdenum. The tofu of metals. It’s greasy, doesn’t corrode, and nobody writes songs about it. I’ve been in worse places with worse orders. At least this time, the ambush comes from a spreadsheet.’

Mark Burnett (markburnett2000@proton.me) and **Ekaterina Pelenkova**

Profile image courtesy of ChatGPT.

Additional reading

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obituaries

Allan Henry Wilson

2 September 1947 to 4 February 2026

Professor Allan Henry Wilson will be remembered as one of southern Africa's most distinguished geologists, a mentor to generations of students, an academic leader, and a man whose love for the region's rocks and landscapes never waned.

Allan Wilson was born in Bulawayo, Zimbabwe, on 2 September 1947. His fascination with geology began at the age of six when his mother took him to the Bulawayo Museum, where he met Dr Geoffrey Bond, then the museum's curator. At Northlea School, he founded the Archaeological Club—affectionately known as the 'Bones and Stones Club'—and joined the Exploration Society. In 1963, Allan and his school friends made a remarkable discovery in the Nyamandhlovu area: a new species of early Jurassic dinosaur later named *Syntarsus rhodesiensis* (now *Megapnosaurus*). This youthful achievement foreshadowed a lifetime of groundbreaking work.

He pursued the study of geology at the University of Rhodesia (now University of Zimbabwe), inspired by Professors Geoffrey Bond and Jimmy Wilson, and on graduating with a BSc (Special Hons) in 1971, received the prestigious Macgregor Award for outstanding achievement. He then embarked on studies that led to the award of the degree of Doctor of Philosophy in 1977, his thesis topic being the

petrology and mineral chemistry of the Hartley Complex of the Great Dyke in Zimbabwe, a geological feature that became the centrepiece of his career. Allan's meticulous observations and descriptions of this mafic-ultramafic complex, ranging from geomorphology, weathering profiles, petrology, layering and alteration, combined with his keen imagination, enabled him to decipher and model the magma chambers from which platinum group metal (PGM) ore deposits were generated. His work on (sub-)chambers established the nomenclature still in use today. He thus contributed directly to the economic exploitation of the Great Dyke, the benefits of which have had exceptional impact on communities in Zimbabwe, and which will continue to do so into the future.

Following post-doctoral research on the Great Dyke as a Beit Fellow at the University of Oxford, Allan started his academic career in 1979 at the University of Natal in Pietermaritzburg. At the time, the Department of Geology was very small with only six or seven fulltime academic staff, led by Professor Don Hunter. Allan joined with tremendous enthusiasm for developing research capacity, working tirelessly even within the department's modest early facilities. He continued his careful work on mineral separations—'a magnetic mineral separator vibrating forever in his office'—and carried out geochemical analyses using an ageing Phillips XRF. These efforts contributed directly to his landmark 1982 paper on the Great Dyke of Zimbabwe, published in the *Journal of Petrology*.

Allan working on drillcore with Dr Steven Shirey of the Carnegie Institution of Washington.



Almost immediately after arriving in Pietermaritzburg, he began fieldmapping projects. Early work focused on the tectonically disrupted Proterozoic layered mafic–ultramafic intrusions of the Tugela Valley, where the Namaqua–Natal Orogeny had thrust large nappes onto the Archaean craton. He then turned his attention to the Archaean Nondweni greenstone belt, supervising two PhD projects on stratigraphic successions of komatiites, komatiitic basalts, volcanoclastic rocks and rhyolites—work that led to several significant publications. He also guided several research studies of the Pongola Supergroup, one of the earliest known intracontinental volcanic and sedimentary sequences.

Especially intriguing for Allan were the komatiites of the Comondale greenstone belt, first mapped in 1987 in a regional PhD project in northern KwaZulu Natal. He returned to this, his special and favourite area, many times over 30 years to map and follow separate lava flows. These are unique, ultra-depleted komatiites in which olivine is still locally present in pristine condition, as reported in his 2003 paper published in *Nature*—another benchmark. Allan’s fascination with Comondale komatiites continued, resulting in another highly significant paper published in *Geology* in 2022 (along with Robert Bolhar) on the origin and nature of komatiitic olivine, using major and trace element concentrations measured by LA-ICPMS at Wits University, a facility for which both had secured NRF funding several years earlier.



Drone mapping of komatiite flows in the Comondale greenstone belt in 2018.



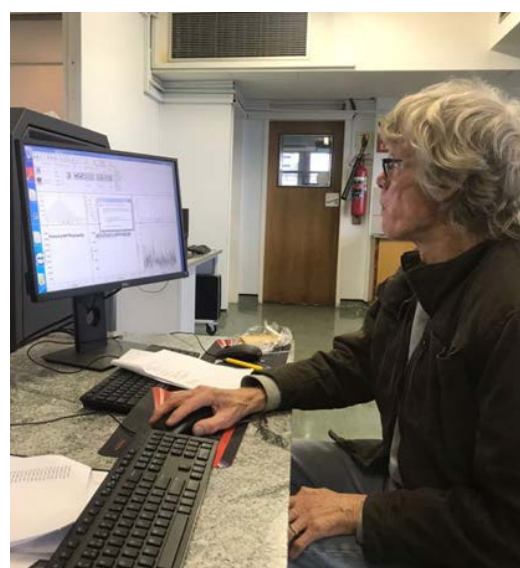
In 1983, Allan secured funding to develop a more advanced XRF geochemistry laboratory at the University of Natal, enabling a substantial increase in analytical work for postgraduate research. The department flourished, with numerous MSc and PhD projects in igneous petrology—particularly on Archaean volcanics in northern KwaZulu Natal, as well as on the Bushveld Complex. Collaboration with major exploration companies further strengthened the research programme, and the acquisition of new, state-of-the-art XRF equipment in 1993 expanded the department's geochemical capabilities even further.

In 1993, Allan was appointed Head of the Pietermaritzburg Geology Department, which in the same year closed to amalgamate with the Geology Department of the University of Natal's Howard College Campus in Durban—a challenging process he approached with interest and enthusiasm. In 1999, Geology was combined with Computer Sciences, and Allan became Head of this newly formed School. Following the merger and re-organisation of the Universities of Natal and Durban-Westville that led to the formation of the University of KwaZulu-Natal (UKZN) between 2003 and 2004, the Howard College and Westville Geology departments merged in 2005, and together moved into refurbished buildings on Westville campus in 2006. Allan played a central role in these university-wide transformation processes and was the first Head of the School of Geological Sciences at UKZN.

During his years in Pietermaritzburg and Durban, Allan expanded international collaborations on the nature and origin of nickel and PGM mineralisation in mafic-ultramafic intrusions of South Africa, Zimbabwe and China. His work integrated geological, mineralogical and geochemical datasets to model ore-forming processes and identify fertile magmatic systems, always with a focus on field observations. In particular, his studies of the Great Dyke of Zimbabwe and the Bushveld Complex in South Africa greatly advanced understanding of magma chamber processes. An important discovery, published in his favourite journal, the *Journal of Petrology*, in 2012 was the observation of a magmatic chill sequence in drill core from the eastern Bushveld Complex that provides deep insight into the nature of the parental magmas. These and similar research discoveries refined exploration models for some

of the world's most important PGM resources. His engagement with industry was extensive and impactful. Over more than two decades, he collaborated with major mining companies, including Anglo Platinum, Anglo American and BHP Billiton, sharing his expertise in PGM and nickel deposits and development of exploration strategies. His overseas collaborations included major trips to China, which he thoroughly enjoyed. Being a person who had a keen interest in history, a visit to the Terracotta Army in Xi'an, Shaanxi Province, was one of his fondest memories. Memorable were also the tastings of the high-octane rice distillates he brought back to South Africa.

In late 2006, Allan moved to the University of the Witwatersrand (Wits). There he served as Head of the Economic Geology Research Institute and Director of the Earth Lab, where he established and led a world-class analytical facility. This newly established laboratory was equipped with multiple XRF and quadrupole ICP-MS instruments, clean laboratory environments, mineral separation and rock preparation facilities, and became a cornerstone for high-precision geochemical research and advanced training. Apart from being an expert igneous petrologist and geochemist, his ability to establish, operate and manage such facilities placed him at the forefront of analytical geoscience in South Africa. He was exceptionally conscientious and meticulous about the entire data acquisition process.



Allan setting up a LA-ICPMS experiment to measure ultra-low concentrations of trace elements in Commondale olivine in the Earth Lab, Wits University, in 2021.

Aside from his analytical capabilities, Allan was a field geologist at heart. Some of his regional mapping and sampling projects stretched over many years before he considered them ready for publication. Allan was keen to apply new methods, and, for example, saw the potential in using drones for detailed surface mapping of lava flow successions. He applied this method extensively to Archaean volcanic successions. His work on the Pongola Supergroup and komatiitic sequences of greenstone belts contributed to understanding early crust formation, mantle plume activity and the thermal evolution of the Earth's mantle. He was one of the principal investigators of the International Continental Drilling Program's Barberton Drilling Project, researching drill cores of the Komati Formation in the Barberton greenstone belt.

Allan enjoyed teaching and mentoring of students. He (co-)supervised 28 MSc and PhD students, and more than 65 Honours research

projects, shaping a generation of geoscientists who have gone on to contribute to academia and industry. He also found it rewarding both consulting to and working with the mining sector in South Africa and overseas. He believed that this relationship was essential for reconciling academic research with the needs of the industry, and also in generating much needed funding for research and student support. Allan was successful in securing large research grants. Between 2000 and 2007, he secured more than R10 million in competitive research funding (from the National Research Foundation and Technology and Human Resources for Industry Programme), with over R4 million raised in 2006–2007 alone for equipment and student support. He served on numerous national and international advisory and evaluation panels, including the NRF Scholarship Committee, the Australian Research Council and the NRF Innovation Foundation, reflecting the high regard of his expertise.



Allan at Spinifex Stream in the Barberton greenstone belt, explaining komatiite formation to an international group of scientists in 2012.

While we acknowledge Allan's seminal contributions to geoscience and his commitment to his students, his professionalism was always accompanied by a generous and respectful collegial attitude, a good sense of humour and a readiness to have a good time once the work was done. Going on research or student field trips with him was always fun. Unforgotten is his role and attention to dress code as Frank-N-Furter at one of the notorious end-of-year geology dinner parties in Durban. Those who knew Allan and Julie privately enjoyed the warm welcoming atmosphere on numerous occasions at their homes in Durban, and later in Johannesburg.

Colleagues and post-graduate students were inspired by Allan's dedication to his research—his unwavering attention to detail, his insistence on data integrity, and his curiosity about new projects and possibilities. Back at camp after long days of unforgettable fieldwork on the outcrops where he had identified so many magmatic and volcanic features often presented the opportunity to sample his signature Irish stew. He had a deep interest in students and excelled as an enthusiastic lecturer, delivering presentations that made igneous petrology one of the most exciting parts of geology. His clarity in explaining what minerals, textures, settings, and compositions could reveal made the subject come alive. His enthusiasm for discovery was infectious, and it is no surprise that many students chose to pursue postgraduate studies under his supervision.

As a prolific and influential scholar, Allan authored about 150 full-length publications in leading international journals, several field guides, and hundreds of industry reports. His work reinforced the global significance of southern Africa in Precambrian research and shaped enduring frameworks for both academic inquiry and mineral exploration. Likewise, he maintained long-term active collaborations within and outside South Africa, including collaborators in the USA (Carnegie Institution of Washington, Massachusetts Institute of Technology), Australia (University of Melbourne), and Europe (Ecole Normale Supérieure de Lyon, Freie Universität Berlin, Max Planck Institute in Mainz).

Allan's interests, talents and activities extended far beyond his time in the field, laboratory and

lecture room. He had a rich family life, and was a loving husband, father and grandfather. He enjoyed adventure and travelling, and was the convoy leader of large groups of family and friends on camping safaris to Namibia and Botswana, road trips with Julie to visit their favourite places in the Drakensberg, family getaways in South Africa and numerous trips to Australia to visit family and friends. Allan was a collector of cameras, a talented craftsman who handcrafted furniture in his early years, and then on moving to Johannesburg became an enthusiastic gardener, specialising in roses. He enjoyed an eclectic range of music from The Sisters of Mercy to Mozart, and attended regular concerts of the KZNPO in Durban and the JPO in Johannesburg. He was a keen follower of tennis, MotoGP, Formula 1 and the rugby, and these, along with enjoying a whisky with friends at the end of a dinner party or braai, were some of his favourite past times. An athlete from his schoolboy days, he had a keen interest in weight training and competitive marathon running in South Africa, participated in marathons while working overseas, ran for the Natal Province and finished three Comrades Marathons with silver medals. After bowing out of competitions, he ran for personal pleasure and particularly enjoyed running for kilometres barefoot along Durban's beaches.

Allan was diagnosed in 2017 with Motor Neuron Disease, which led him to live a progressively less active life. He was determined to live life as fully as possible and showed great courage and resilience while facing down this cruel disease. He was not able to continue his life-long passion for running or field work after 2022, but Allan's deep interest in science persisted, which is underlined by the fact that he was never deterred from writing and publishing while his health had already deteriorated dramatically. His 2025 paper on the layered mafic–ultramafic complexes of the Tugela Terrane published in *Lithos*, showing amazingly detailed field maps, and submitted only a year ago, testifies to that.

Allan was awarded the Draper Memorial Medal in 2005, the highest award of the Geological Society of South Africa, a University of KwaZulu-Natal Fellowship in recognition of distinguished academic achievements in 2006, and the Jubilee Medal in 2013 for his *South African Journal of Geology* paper on volcanic rocks of the Pongola

Supergroup. Allan was also a Phaup Awardee and an honorary member of the Geological Society of Zimbabwe, in recognition of his lifelong contributions to the nation's geology.

Allan Wilson passed away peacefully at his home in Johannesburg on 4 February 2026. He is survived by his beloved wife, Julie, and his sons Greg and Andrew from his former marriage to Jenny. Greg and Andrew and their families

reside in Melbourne, Australia. His brother, Mark, lives in Bulawayo, Zimbabwe.

Allan's legacy will endure in the geological maps, research papers and generations of scientists he inspired.

Robert Bolhar, Axel Hofmann, Julie Dunsford, Juergen Reinhardt, Caston Musa and Bruce Groenewald, along with contributions from former colleagues in Zimbabwe and South Africa



Allan on safari in Namibia in 2012 with family and friends.

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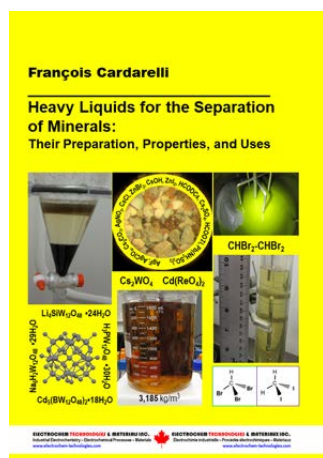
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book review



Heavy Liquids for the Separation of Minerals: Their Preparation, Properties, and Uses

Author: *François Cardarelli*

Publisher: *Electrochem Technologies & Materials Inc., Montréal*

ISBN: 0000 0005 1247 3654

Pages: xxiv, 537 pages, 285 tables, 76 figures B/W and colour

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Listed price as of Oct 2025: \$207.67 CDN paperback; \$221.35 hardcover on Amazon.ca

Extracts from preface taken from the Amazon sales site:

This monograph describes the main physical and chemical properties of heavy organic liquids (e.g., bromoform, tetrabromoethane, diiodomethane), dense aqueous solutions of inorganic salts (e.g., halides, sulphates, nitrates, perchlorates, formates, molybdates, tungstates, tantalates, polyoxometalates, metatungstates, polytungstates, heteropolytungstates, perhenates, etc.) and heavy suspensions used in mineralogy, metallurgy, and chemistry for the separation by gravity of minerals, metallic ores, graphite, coal macerals, fossils, diamonds and gemstones, along with plastics, glass, ceramics and other synthetic materials. Moreover, dense solutions of caesium and rubidium salts used in biology for the separation of nucleic acids, and other biological molecules of interest by centrifugation using density gradients are also described.

For several heavy liquids, it provides a detailed description of the laboratory methods,

and industrial processes utilised for their preparation, along with the most efficient recovery and recycling techniques. Moreover, when available, the occupational health and safety information for toxic and hazardous chemicals used as heavy liquids is also provided to ensure safe practices in the workplace.

Finally, their potential utilisation in other fields such as X-ray and radiography contrast agents, radiation shielding agents, non-destructive testing, 'water-in-salt' electrolytes used in energy storage applications, oil drilling fluids, ballasts and counterweights due to their high density are described.

The information has been presented in such a form that mineralogists, chemists, geologists, palaeontologists, biologists, metallurgists, mineral processing engineers, scientists, professors, and technologists will have access to relevant scientific and technical information supported by key data gathered from several disseminated sources.

The book review proper:

The book commences with a preface, containing a short summary of contents, physical properties, preparation and treatment methods, and applications.

In the introduction, 'Heavy liquids from past, present & future' (p. i–v), a personal connection to the author is offered, presenting his mineralogical motivations and establishment of a very impressive institutional-level home laboratory in his parents' apartment in France, and subsequent application thereof to his personal sample collection of ores from around the world. This section, preceding the formal Table of Contents, is a particularly enjoyable and quite inspiring read, which nicely connects the reader to the author's motivations and immediately distinguishes this compendium from a standard reference book.

A short digression

After reading a little beyond this part, I communicated to the author that I was finally engaging with this review, and noted 'in passing' that 'The mix of basic chemical

theory, underlying principles and application is nicely balanced. A question that I feel must be addressed as a reviewer is how to justify “why own a book in this day and age, instead of looking facts up as you need them online (for nothing)”, and my feeling is that this book is very accessible and very practical, and provides information in the right context and relevance. I also suspect that the old “Rubber Book” (as my MSc co-supervisor Alan Dickin used to call it)—the Goodyear volume of physical properties—is in need of updating, and is also probably no longer as universally accessible as it used to be.’ Unexpectedly, the author responded with detailed and, in my opinion, valid answers to those questions, which it seems wasteful not to use, if somewhat expedient and possibly irresponsible to get the author to review their own book. Nonetheless, here is the (slightly edited) response I received:

‘I am very pleased that you liked my personal introduction about building my lab, something that will be impossible these days! By the way, if you look at the tape in the window crack on the left in Figure 1, this is the result of the preparation of ca. 50 grams of nitroglycerine that went very bad, with the glass shard from deflagration ending in my shoulder!!!

To answer your relevant question “*Why own a book in this day and age, instead of looking facts up as you need them online (for nothing)?*”:

1. First, the data in the CRC Handbook of Physics and Chemistry and the Lange’s Handbook of Chemistry, for instance, are not enough to cover the full set of physical and chemical properties of the heavy liquids described in the monograph. For instance, the properties of several polyoxometalates (e.g., hexatantalates, heteropolytungstates, perrhenates, methanesulfonates, etc.) are scarce and thus you have to rely on the original articles, patents, or hard-to-find industry reports and old proceedings. Moreover, the experimental correlations between the density or the solubilities vs temperature are not addressed in these two books and thus you rely on a deep search in other handbooks or the IUPAC data series on solubility (65 volumes). When you are looking at the crystallographic and optical properties of the inorganic salts, you need X-ray diffraction data from the NBS and mineralogical tables. Finally, you also need

to access atlases of phase diagrams for the binary mixtures of molten salts that are often on a pay-per-view basis.

2. Using Google or other search engines so far doesn’t provide the deep coverage required (unless it cites the excerpt from the book content on GooglePlay) and most of the time they direct you to the publisher site where you can purchase the article for \$40 or more. If you look at the hundreds of original references used in the article you will find that buying the book is much cheaper.
3. Historically, especially for the aqueous solutions of salts and heavy suspensions of solids, the formulations of heavy liquids were prepared from recipes, and thus I tried to bring to light the fundamental chemistry hidden behind the theoretical calculations to predict the density of solutions and mixtures, and to provide the industrial preparation routes along with safety information allowing the reader to reproduce the results.
4. Finally, in short and most importantly, I am old school! (I still use my 12-in-long slide rule from Faber-Castell, the 44th edition of the CRC Handbook (1961–1963), because it is the last handy version published; I calculate square and cubic roots by hand and use logarithmic tables (just for fun). I love reading and writing scientific books, and I always looked for one like this my entire career, thus I wrote the book hoping it will be useful to others.’

I found this to be a very useful and much more specific explanation than I would have come up with. What I do find with online hunts for physical properties, is that a lot of reconciling of units, and of the specific contexts of the physical data, are required, so that building an internally consistent data set for geological calculations and modelling is fraught with potential uncertainties.

On with the review

Chapter 1 goes right back to first principles, commencing with a definition of the density, or mass density, as ρ (spoiler alert) = m/V . From there the text proceeds with the fundamental chemical basis of temperature dependence of densities (both of liquids and solids), and from

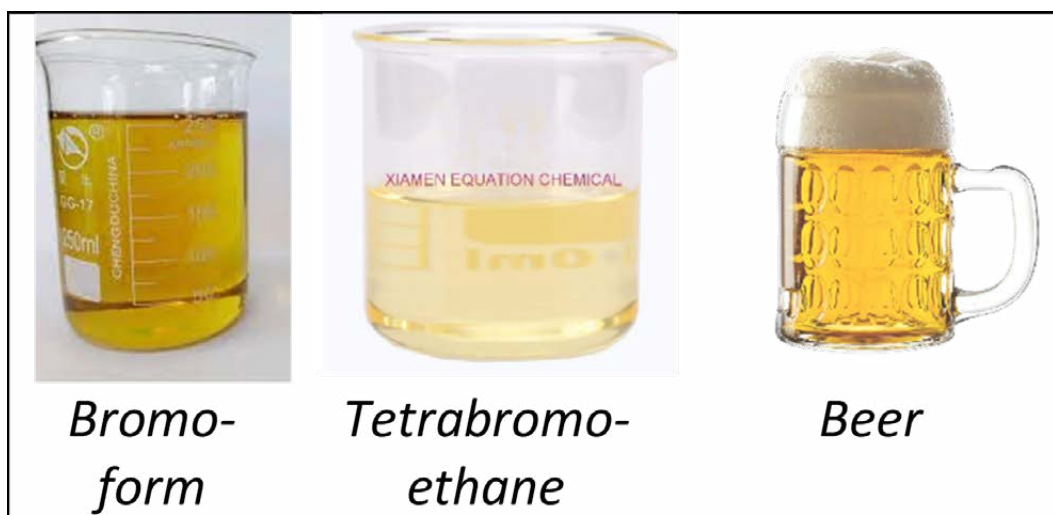
there becomes more relevant and eclectic by introducing apparent density in which porosity is taken into account (i.e., recognising the distinction between real materials and idealised ones). This chapter continues along these lines, introducing basic concepts at an undergraduate level of chemistry, providing reference to the underlying principles, and complementing it with relevant applications and associated physical equipment (illustrated with figures) as deemed appropriate. (Note that here, the user can indeed look up other current examples online, should they so desire, having been provided with the appropriate terminology and context. The author of this catalogue is not pretending to introduce every relevant item with specific illustrations, which would be expensive to produce, contain the risk of linking each item to competing and/or transient corporate suppliers, and also potentially quickly redundant.) By page 44, I was already finding things I was unfamiliar with, and looking them up (specifically in this case, calibrated density marker beads). Stokes' law and the Reynolds number make their appearance on page 67–68, supplemented by laws to accommodate turbulence and Brownian movement, with various different laws recommended for different grain size ranges. Formulas for calculating settling rates for both free and hindered (where the cylinder walls and other grains get in each other's way) grain settling are provided.

In Chapter 2, the text moves from the underlying principles to the actual heavy liquids themselves, commencing with the halogenated solvents (i.e., those involving the halogens, such as Br and I, familiar to geological users). Helpfully, bromoform is described as sweet in

odour and taste, but readers are warned not to test this, as this is toxic. The implication is that somebody must have, though. All of these halogenated solvents are normally stored and used in fume hoods and ventilated areas, although my former PhD supervisor used to test which amber liquid was in the no-longer-legibly labelled ancient Erlenmeyer flask by wafting it under his nose. He didn't test it on the palate, though. (He lived into his 80s and outlived 2.5 wives, in case you're wondering.)

Temperature dependence on density, and the (non-linear) effects on liquid density of dilution with other solvents (such as methanol, ethanol, acetone and chloroform) are provided. We don't find out how 1,1,2,2-tetrabromoethane or diiodomethane (more commonly known in my circles as methylene iodide) tastes, so the originators must have learned their lesson, or at least not to prepare solvents when they were thirsty, after making bromoform. It probably didn't help that these liquids are historically known as 'liquors'.

In section 2.2, the principles and application and properties (2.3) of dense (saline) solutions, and of inorganic salts, are presented. These include metal fluorides and chlorides, relevant in the geosciences in the context of silicate dissolution, for example, where residual undissolved fluorides, commonly dominated by complexes of aluminium, are also a potential reserve of other refractory elements of interest. In addition, most cation elemental chemistry involves the dissolution and stabilisation of elemental complexes in solution as cationic or anionic chlorides (most commonly for solid-source mass spectrometry), or as nitrates



(common for the various types of ICP analysis) or even fluorides (for some HF chromatography, for example). Silicate dissolution by BrF_5 vapour is traditional for stable isotope studies. The actual elemental salts ionised in solid-source mass spectrometry are chloride salts, whose vaporisation and ionisation properties are highly relevant in terms of thermal fractionation and differential elemental fractionation during analysis. For example, I would traditionally have analysed the isotopic composition of rubidium as RbCl salts, it turns out a fatal dose of which would be 4,400 mg taken orally (by rat). That knowledge would have made these analyses more interesting, and probably made me pay better attention to ventilation while loading samples by evaporation onto heated tantalum filaments. Selected hydroxides, carbonates, sulphates and selenates are also featured, as well as compounds of alkali metals with tin, molybdenum, tungsten and rhenium (perrhenates).

Applications beyond laboratory-based mineral separation studies

Chapter 2.2 deals with dense aqueous solutions of salts, which has the potential for use in analogue modelling studies of the interactions (fluid hybridisation via mixing and mingling effects, buoyancy-driven instabilities such as plumes), between different fluid reservoirs, ranging from waters of different temperatures and salinities in modern oceans, to magmas and melts in the Earth's crust, mantle and outer core. In terms of application of these principles to magmatic settings, regimes for fluidisation of suspended particles are provided (Ch. 1.11.7.3), which introduces the basic principles underlying its potential application to magmatic fluid movements as liquid + crystal slurries and to convection and settling regimes for magma chambers and magma injections (into solids and into crystal–melt mixtures).

The section on Other Uses (Chapter 3) is particularly interesting. This explains the principles behind the use of various, mostly inorganic heavy liquids in industrial applications. These include their use in drilling muds, although not in 'fracking' (although presumably they have some relevance there as well, particularly in identifying non-toxic compounds that are fit for purpose). The use of heavy liquids as vibration dampers in high-performance motorsport is noted.

A decent bibliography is provided, citing literature dating from the 1920s to 2020s. This is followed by a very useful appendix of physical reference data.

I found this to be a useful and interesting book to review, with its balance of theory and application, and of accessibility and relevance. The book is also relatively free of errors or typos, with only the very occasional grammatical awkwardness noted. The layout and organisation are sensible and systematic, with internal referencing of related content, making it practical as a reference book.

In his original invitation for a review, the author described the publication as follows: 'As an industrial chemist, my recent monograph could be of interest to other members in the fields of determinative mineralogy, gemmology, petrology, geochemistry and mineral processing.' I would agree with this, and personally, I would strongly recommend that any chemistry and geology (and/or Earth Sciences, in whatever form) department (within a university or in industry) and serious mineralogist would benefit from owning a copy (hard, soft or 'e').

Steve Prevec
Rhodes University

About the reviewer:

Prof. Stephen Prevec is a practicing geoscientist at a university geology department, and has over his career made personal use of various heavy liquids (including their preparation and density measurement thereof, in some cases) for 20 years or so in numerous laboratories in the pursuit of mineral separates for radiogenic isotope research relating to the quest for petrogenetic insights into (mostly) mafic igneous rocks. These liquids have included tetrabromoethane, bromoform, methylene iodide and sodium polytungstate (the latter of which one can evidently safely ingest, in contrast to the former three, although I never tried. In spite of more than two decades spent interacting closely with these compounds, as well as with acetone and a wide range of acids, all of my chronic ailments can be attributed to old sports injuries, and none from 'chemistry').

GSSA events 2026

Upcoming GSSA Events

Date	Event	Venue
24 June	AI in Geology	Online
16 July	GSSA AGM	JHB Country Club
29 July	Beyond the Rocks: Essential Skills for Geoscientists	Online
4 August	Field-to-Findings: A Complete Course in Drilling, Sample Handling and Result Interpretation	Online
TBC August	Mineral Resource Mastery	Online
8 September	Professionalism & Code of Ethics Workshop	Online
10–13 September	Lichtenburg 100	Council for Geosciences
19–20 September	Structural Geology Course & Field trip	Southbroom, KZN Coast
8–9 October	Data Analytics & Machine Learning	Online
20–21 October	Advanced SAMCODES Workshop	JHB Country Club
18–19 November	African Exploration Showcase	JHB Country Club



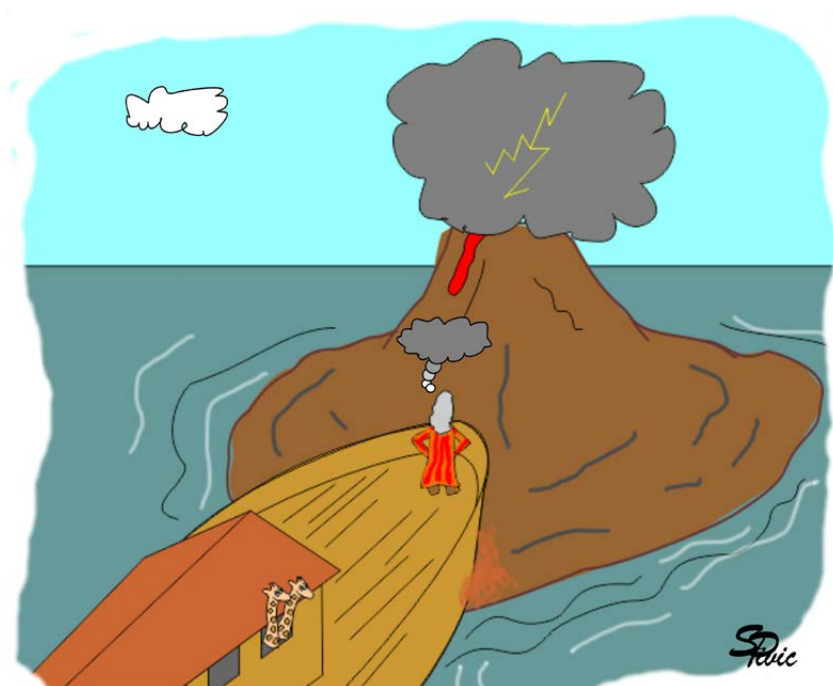


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**2026
Rates**

rates card 2026

incl VAT

1. ADVERTISING RATES (Incl. VAT & Agency Commission)

Geobulletin is published by the Geological Society of South Africa (GSSA) and appears quarterly during March, June, September and December each year in digital format.

	Per issue	Annual (4 issues)
Size		
Full Pg	R3 000.00	R9 000.00
Half Pg	R2 400.00	R7 200.00
Quarter Pg	R1 200.00	R3 600.00
Banner (horizontal)	R600.00	R1 800.00

Special Positions

	Per issue	Annual (4 issues)
FP Inside front/back cover	R5 000.00	R15 000.00

Business Cards:

Size:	Per issue	Annual (4 issues)
45 x 90 mm wide	R500.00	R1 500.00

Advertorial rate per page:

R2 500.00

2. MECHANICAL DETAILS

Trim Size:	297 mm x 210 mm
Full Bleed	297 mm x 210 mm + 5 mm all round Full
Type Area:	Page: 275 mm x 190 mm
Half Page:	135 mm x 190 mm wide (Horizontal ad)
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Banner:	210 mm x 75 mm (Horizontal) + 5 mm all round
Screen:	300 DPI or more
Material:	E-mail high resolution PDF in CMYK

Material to be supplied as a digital PDF file. Accompanying images should be high resolution in CMYK format (NO RGB or Pantone colours). Any full page material to be trimmed to 297 x 210 mm must include a bleed of 5 mm all round. Any modifications to supplied material will be charged to the advertiser at R300.00 per hour. Ads may contain a link to advertiser's website.

3. DEADLINES FOR COPY AND ADVERTISING MATERIAL

March issue:	1 February 2026
June issue:	1 May 2026
September issue:	1 August 2026
December issue:	1 November 2026

4. CANCELLATIONS

At least 4 weeks prior to deadline

5. CIRCULATION

Geobulletin is issued in digital format to all members of the GSSA and its local and overseas exchange partners. The electronic version is available as an open access download on the GSSA website.

6. ADVERTISING BOOKINGS AND SUBMISSION

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