GSSA
Geological Society of South Africa

# geobulletin

QUARTERLY NEWS BULLETIN ~ SEPTEMBER 2026

VOLUME 69 NO 3

## news

- How critical is geoscience in our dynamic world?
- Meet the Overberg Geoscientists Group (OGG)
- Most explored metals—long-term trends
- Minerals as Art

# REGISTRATION WITH SACNASP

South African Council for Natural Scientific Professions

**01** LEGAL COMPLIANCE NSP ACT (27 of 2003)

**02** RECOGNITION AS A PROFESSIONAL

**03** PUBLIC CONFIDENCE IN YOU AS A SCIENTIST

**04** MARKETABILITY (EMPLOYERS REQUIRE REGISTRATION)

**05** CODE OF CONDUCT – TRUST FOR ETHICAL VALUES

**06** INPUT TO GOVERNMENT – SACNASP VOICING SCIENTISTS' INPUT AT MINISTERIAL LEVEL

**07** NETWORKING – WEBINARS, WEBSITE NETWORKING PORTAL

**08** POTENTIAL FAVOURABLE RATES FOR PROFESSIONAL INDEMNITY INSURANCE

**09** CAREER ADVERTISEMENTS – EMPLOYERS ADVERTISE VACANCIES ON SACNASP WEBSITE AND SOCIAL MEDIA

**10** VOLUNTARY ASSOCIATION EVENTS – NETWORK WITH FIELD OF PRACTICE PEERS AND GAIN VOCATIONAL CAREER ADVICE

**11** FACILITATES LIFELONG LEARNING THAT IS CRUCIAL TO A PROFESSIONAL'S CAREER PATH – CANDIDATE MENTOR PROGRAMME

**12** CONTINUING PROFESSIONAL DEVELOPMENT – ONLINE LEARNING

Volume 69 | Number THREE | SEPTEMBER 2026

# contents



**Front cover photo:**

*Polished 'pietersite', chalcedony with embedded fibres of amphibole minerals with varying degrees of alteration. Field of view is 11.5 cm. (Photo: Bruce Cairncross)*

*For more spectacular natural pieces of art, see 'Mineral Scene' on pg. 34.*

*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.*

Geological Society of South Africa

**GSSA**
**Postal/Physical Address:**
Building 10, Thornhill Office Park,
94 Bekker Street, Vorna Valley,
Midrand, Johannesburg, 1686

**Phone:**+27 (0) 10 143 2096

**e-mail:** info@gssa.org.za
**Web:** www.gssa.org.za

**COMMITTEE**

| | | |
|---|---|---|
| Convener & Editor: | Trishya Owen-Smith ........ 011 559 2677 |
| Advertising: | GSSA Office ................ info@gssa.org.za |
| Design & Layout: | Annerine Lubbe ............. 071 897 6240 |
| All submissions to: | Trishya Owen-Smith geobulletin@gssa.org.za |

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

Contributions for the next issue should be submitted by:
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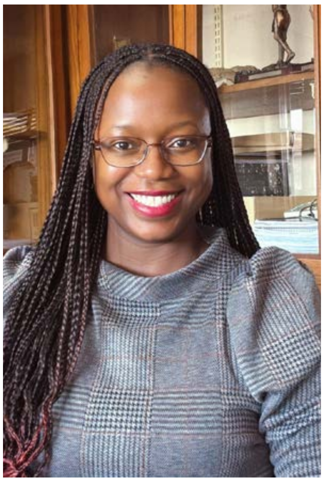
SOCIETY NEWS

# guest editorial



*Dr Valerie Nxumalo*

## How Critical is Geoscience in Our Dynamic World?

It took me some time to appreciate the critical role geosciences play in our world, but every day now I see how geoscience demonstrates that everything is interconnected. Listening to astronomers explain how they observe and understand the universe has also helped me appreciate that our planet is part of a much larger interconnected system. The more I learn, the more I realise that geoscience is not simply about understanding the Earth beneath our feet; it is about understanding how our world functions and how our future depends on it.

**It starts with understanding**

Everything begins with understanding the fundamentals. To appreciate the processes that shape our planet, we must first understand the science behind them. Geoscience enables us to understand the Earth's evolution, natural resources, climate change, groundwater, optimal land use and spatial planning, geo-tourism (geo-heritage), geoscience for health, geoscience for diplomacy, natural hazards and the environment. More importantly, it enables us to translate scientific knowledge into practical solutions that benefit society and strengthen economies.

Geoscience has contributed to economic development for generations—from mineral exploration and mining to infrastructure development, environmental management and water security. It provides the scientific evidence required to guide policies, support land-use planning, improve disaster risk reduction and inform decisions on climate resilience and sustainable development.

Today, some of the strongest indicators of a growing economy are investments in resilient infrastructure: modern buildings, reliable transport systems, durable roads and railways, energy infrastructure and sustainable cities. Behind many of these developments is geoscience.

**Innovation for a changing world**

Technology and innovation are transforming the geosciences today. Artificial intelligence and digital platforms are changing how the discipline is practised and applied. Given these innovations, we should consider establishing integrated geoscience hubs that bring together geoscientists, engineers, industry, government and entrepreneurs to collaborate to solve national challenges. Innovation should not only focus on developing new technologies, but also on making geoscience information more accessible and ensuring that our scientific outputs create measurable value for society.

**Geoscience must help solve South Africa's challenges**

South Africa continues to face the triple challenges of poverty, inequality, and unemployment. These realities require us to ask difficult questions.

How can geoscience contribute to reducing unemployment? Are career opportunities limited to mining, consulting, academia, geological surveys and universities, or can geoscience become a catalyst for entirely new industries? How do we contribute to food security? How do we support solutions to the country's energy challenges? How do we ensure that our science informs government policy and national planning? What role should geoscience play in building a more resilient and inclusive economy?

These are questions that geoscientists should be asking themselves every day.

**Mining, conservation and development can coexist**

Geoscientists sometimes shy away from engaging robustly in one of society's most important debates: how to balance mining, environmental conservation and sustainable development. Yet this is precisely where geoscience should provide leadership.

Why can we not responsibly mine an area while protecting biodiversity and conserving our natural heritage? Why can we not fully understand the mineral deposits we are extracting, deploy cleaner mining and mineral processing technologies, create employment and industrial opportunities, and at the same time restore and protect the environment? Imagine a landscape where mining exists alongside thriving nature reserves, tourism, agriculture and local communities. Imagine geologists, mining engineers, metallurgists, environmental scientists, tourism practitioners, agricultural specialists and policymakers working together to maximise the value of the land while protecting it for future generations.

Such an integrated approach could simultaneously create jobs, strengthen local economies, improve food security, conserve biodiversity and ensure that natural resources are developed responsibly.

**A shared vision for geoscience**

When we are united behind a common vision for geoscience in South Africa, that is when we will achieve the impact we all aspire to achieve. Geoscience should become a strategic national asset that enables sustainable development, drives economic growth, informs policy, protects communities and improves lives.

**Measuring impact differently**

The way we evaluate our research also deserves reflection.

We continue tracking and monitoring our scientific publications, both locally and internationally, and rightly celebrate academic excellence. This is an important practice for any geoscientist. But should success only be measured through peer-reviewed publications within our professional environment?

What about research and peer-reviewed publications that change livelihoods and that influence public policy? Research that helps communities prepare for natural hazards? Research that improves livelihoods in rural communities, supports urban development, strengthens industries and informs better decisions? When ordinary citizens begin to experience the benefits of geoscience in their daily lives, then we can truly say that geoscience has made an impact.

**Collaboration, communication and funding**

We already have many platforms that allow us to exchange ideas and develop new thinking. These platforms should increasingly produce concrete value propositions that clearly demonstrate the relevance and contribution of geoscience to society and the economy.

Geoscientists conducting research in South Africa should not constantly struggle for funding. Sustainable funding for geoscience research should increasingly come from those sectors and stakeholders that directly benefit from geoscience because they understand its value to economic growth, environmental protection, infrastructure development and public safety.

Equally important is the way we communicate our science. Communication must become a strategic priority. Scientific knowledge should not remain within technical reports or academic journals; it should be translated into language that policymakers, industry leaders, educators, communities and ordinary citizens can understand and apply. Imagine a young person growing up in Bushbuckridge understanding why gold occurs in Barberton and Pilgrim's Rest, why mountains have different shapes, why some areas contain rich biodiversity while others are suitable for agriculture, tourism, town planning or mining. That is when geoscience has truly reached society.

**Geoscience for the future**

I am always encouraged by the poster *Geoscience for the Future* by the Geological Society of London, as it clearly illustrates how fundamental geoscience is to society and our future. It reminds us that geoscience is not simply about studying rocks or understanding the Earth's history. It is about enabling sustainable development, protecting communities, strengthening economies and improving people's lives.

Ultimately, the future of geoscience lies not only in advancing scientific knowledge but in demonstrating its relevance to and impact on society. Our success should no longer be measured solely by the number of publications we produce or projects we complete, but by the extent to which our science influences policy, creates employment, strengthens economies, and contributes to a more sustainable and resilient future for all. This shift depends on how effectively we communicate our science – to policymakers, to industry, and to the public whose lives it affects

If we work together, collaborate across disciplines and institutions, and begin measuring the societal impact of our work, geoscience will become recognised not only as a scientific discipline but as a national asset that shapes the future of South Africa and improves the lives of its people.

***Dr Valerie Nxumalo***
*Council for Geoscience*

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Geological Society of South Africa

# manager's corner

*Tania Marshall*

## GSSA Member Demographics: Shaping the Future

One of the criticisms often levied at professional bodies is that they are perceived as being the domain of old white men. Well, I am pleased to report that our numbers tell a powerful story: our membership is becoming younger, more diverse, and more gender-balanced than ever before. From seasoned Fellows who built the foundations of our discipline, to the energetic students shaping tomorrow's discoveries, the GSSA is evolving before our eyes. Whether you've been part of the society for decades or are just beginning your journey, these shifts signal a vibrant future—one where every voice has a role in shaping the geosciences.

The GSSA is undergoing a profound demographic transformation. Recent projections highlight how shifts in age, race, gender, and membership type are reshaping the society's profile and pointing toward an exciting future.

**Race**

The age–race breakdown reveals a generational shift. Older cohorts remain predominantly White, while younger members are overwhelmingly Black, with Coloured and Asian representation also increasing. This trend signals a more diverse society in the years ahead, reflecting the broader demographic realities of South Africa.

**Gender**

Gender composition is also evolving. While older age groups are male-dominated, younger groups show a growing balance, with women making up a significant share of new members. This move toward gender parity suggests that women will play an increasingly prominent role in the society's leadership and professional community.

**Age**

Membership type varies strongly by age. The under-35 group is the largest, driven by students and early-career members. Middle-aged cohorts are more established, with Fellows and senior members forming the backbone of professional expertise. Older members are concentrated in retired and life membership categories, reflecting decades of contribution to the society.

**In summary**

Together, these trends paint a clear picture: The GSSA is becoming **younger, more diverse, and more gender-balanced**. Leadership will evolve to reflect this diversity, bringing fresh perspectives and energy to the society's mission.

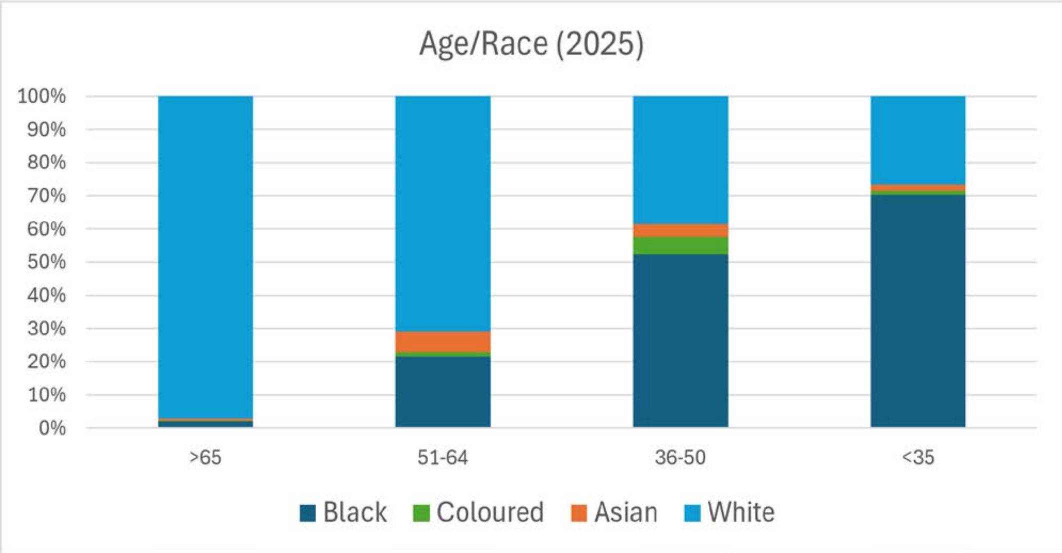
The GSSA is not just adapting to change—it is embracing it. The society's future lies in nurturing its diverse, dynamic, and youthful membership, ensuring that the next generation of geoscientists is empowered to lead.

As the GSSA's membership grows younger and more diverse, the future of the society will depend on these emerging voices stepping forward. Today's students and early-career professionals are not just the backbone of tomorrow's membership—they are the leaders in training. By embracing opportunities to contribute, learn, and take on responsibility now, younger members can ensure they are prepared to guide the society into its next chapter.

To this end, I would encourage our younger members to become involved in one or more of the GSSA committees, branches and/or divisions. Put your hand up to join Council and be part of shaping the future of the GSSA. Contact us at info@gssa.org.za for more information.

***Tania Marshall***

*Step up, stand out, shape the future*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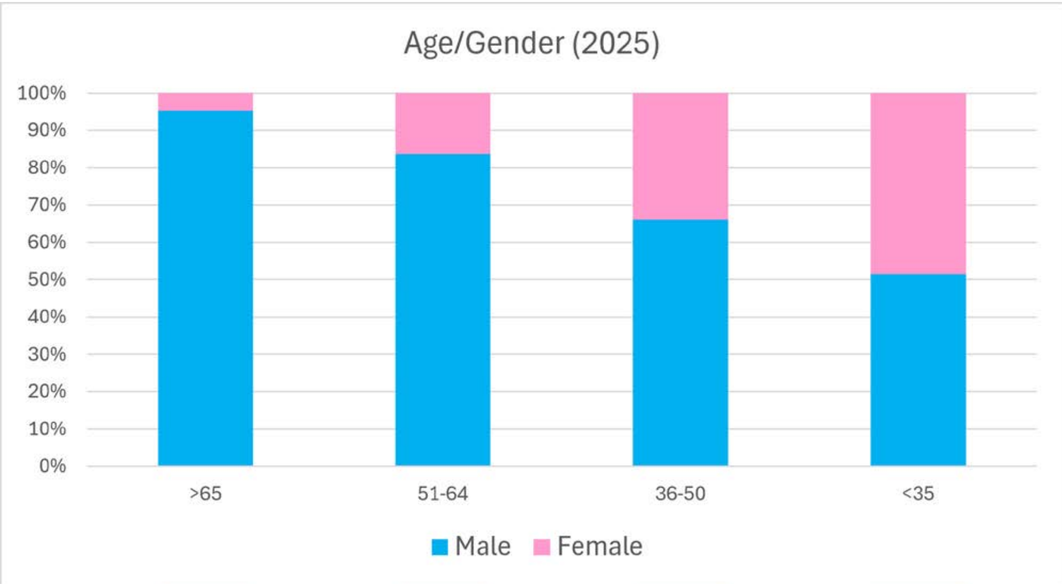
Age/Gender (2025)
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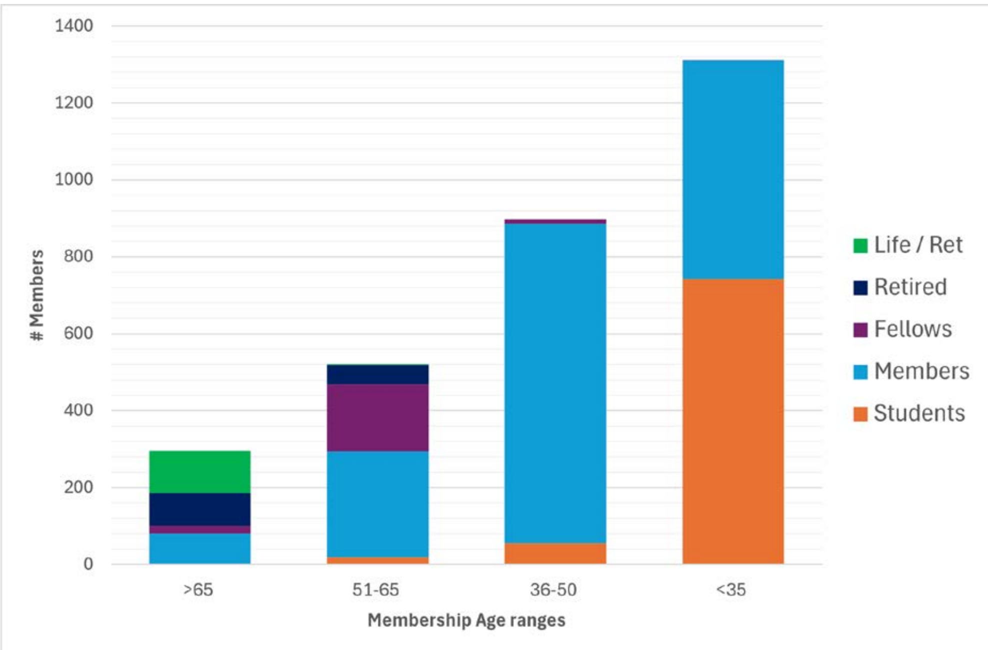
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Membership Age ranges
Life / Ret
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Fellows
Members
Students

# the president's profiles

*Noleen Pauls*

**Unearthing Excellence: Celebrating People, Purpose and Progress in South Africa's Geoscience Community**

*South Africa's geoscience community is about far more than minerals and mines—it is a story of people, innovation, discovery and service. Through this series, I hope to shine a spotlight on the individuals, organisations and initiatives that quietly but profoundly shape our profession. Some are internationally recognised, while others work tirelessly behind the scenes, yet they all play a vital role in advancing geoscience and inspiring future generations.*

*For this month's article, I am delighted to feature an organisation that I know well—not only as President of the Geological Society of South Africa (GSSA), but also as a member. The* ***Overberg Geoscientists Group (OGG)*** *is an outstanding example of what can be achieved when geoscientists unite around a shared passion for learning, collaboration and community engagement.*

*To tell its story, I spoke with fellow OGG member and respected geologist* ***Dr John Bristow****, whose career spans academia, exploration and mining, applied research, and science communication. John reflects on the origins of the OGG, its evolution into a thriving community organisation, and its commitment to making geoscience accessible and relevant to people of all ages and backgrounds.*

## The Overberg Geoscientists Group (OGG)

### A simple idea that grew into something extraordinary

The OGG's story began in 2017 after John and his wife relocated to Hermanus. What started as informal gatherings of retired and semi-retired geologists, together with their partners and friends, soon evolved into something much more. Conversations about memorable field experiences, South Africa's remarkable geology and the desire to remain active within the profession revealed a shared ambition—to continue contributing their knowledge and experience.

Interest grew rapidly. Geological presentations were added to the social gatherings, followed by excursions to explore the spectacular geology of the southern Cape. As enthusiasm spread, a wider network of geologists and like-minded individuals became involved, leading to the formal establishment of the OGG as a non-profit organisation in 2018.

### Building a community around geoscience

What distinguishes the OGG is its commitment to sharing geology beyond the professional community.

Its activities bring together geologists, educators, engineers, environmental practitioners, students and members of the public through lectures, field excursions and informal coastal walks. The emphasis is not simply on sharing scientific knowledge, but on encouraging curiosity, discussion and a deeper appreciation of the landscapes around us.

John highlighted educator and naturalist John Roff as someone who exemplifies this philosophy. His ability to translate geological processes into engaging stories demonstrates how effective science communication can make Earth science both accessible and inspiring.

### Learning beyond the classroom

Education has become one of the OGG's defining strengths.

The group regularly supports university field excursions, mentors students and early-career geoscientists, assists schools with educational programmes and creates opportunities for emerging professionals to learn from decades of practical experience.

Educational resources, including Barry Bryant's *Box of Rocks* collection and accompanying guidebooks prepared by Nick Norman, have become valuable tools during many of the group's outreach activities.

One of the OGG's most enduring contributions has been the development of permanent geological interpretation displays in partnership with organisations including SANBI's Harold Porter National Botanical Garden, the African Penguin and Seabird Sanctuary near Gansbaai, and most recently the De Hoop Nature Reserve.

These displays explain Earth's 4.6-billion-year history and the geological evolution of the southern Cape through clear language, illustrations and carefully selected rock samples. They invite visitors to see familiar landscapes through new eyes, while recognising the connections between geology, biodiversity, water resources and human history.

**Geology begins with rocks—but ends with relationships**

Throughout our conversations, one message stood out: geology is ultimately about people as much as rocks.

John believes that successful geoscientists require far more than technical expertise. They must be observant, adaptable and effective communicators who can work with landowners, communities, engineers, environmental scientists, policymakers and many others.

The OGG has fostered exactly this collaborative spirit by creating opportunities for discussion between professionals, educators, students and local communities. These conversations encourage the exchange of ideas, break down disciplinary silos and demonstrate how geology contributes to informed decision-making on issues such as groundwater, infrastructure, climate resilience, critical minerals and sustainable resource management.

John also believes geology deserves greater prominence within South Africa's education system. A better understanding of the Earth equips society to make informed decisions about the resources and environments upon which we all depend.

**Looking ahead**

Like many volunteer organisations, the OGG recognises that sustaining momentum requires succession planning.

Much of its success has been built on the remarkable generosity of retired professionals who continue to share their expertise, time and leadership. At the same time, the growing participation of younger members is bringing fresh perspectives and renewed energy.

John believes South Africa has an extraordinary opportunity to harness the experience of retired geoscientists through regional initiatives that encourage mentoring, community outreach and public engagement. The OGG offers an inspiring model of how this can be achieved.

**Why this matters for the GSSA**

As a member of the OGG, I have had the privilege of experiencing first-hand the generosity, enthusiasm and professionalism of its members. The organisation reflects many of the values that define the GSSA: scientific excellence, lifelong learning, mentorship, collaboration and service to society.

If this column is about recognising those who make an lasting contribution to South African geoscience, then the Overberg Geoscientists Group is a fitting place to begin. Through its commitment to education, mentorship and public engagement, it demonstrates that our greatest legacy is not simply what we discover, but the curiosity, knowledge and opportunities we create for those who follow.

***Noleen Pauls***

*Participants in the OGG Onrus River/ Hemel & Aarde 1-day Geological Excursion (6 June 2026)*

*Dylan Blake, Kobus Venter and John Blaine discussing the exceptional aquifers of the Table Mountain Group during the OGG Onrus River/ Hemel & Aarde 1-day Geological Excursion (6 June 2026)*

*OGG member John Atkinson and Tshepo (our local painter) repairing playground apparatus at Nomzamo ECD School in Zwelihle Township, Hermanus (June 2026)*

*Mike Dormer of the OGG leading young scholars from Ruens College (Bredasdorp) on a tour of De Kelders Caves, a world class anthropological site on the north-eastern shoreline of Walker Bay (Southern Cape Coast).*

# professional affairs




## Why Professional Registration Matters More Than Ever

I'll be honest. For many geoscientists, professional registration is something we think about when we need it. Perhaps a new role requires it, a client asks for it, or we're simply ready to take the next step in our careers.

But professional registration is much more than a box to tick or a designation to add to a business card. Professional registration is about trust.

As geoscientists, we are often asked to provide opinions and recommendations that carry significant weight. Our work influences mining projects, water resource management, environmental decisions, infrastructure development, and public safety. People rely on our expertise to make important decisions, often involving substantial investment and long-term consequences. Professional registration lends trust to this expertise

In South Africa, registration with the South African Council for Natural Scientific Professions (SACNASP) provides assurance that a geoscientist has met recognised standards of education, experience, and professional practice, and is committed to working within an established ethical framework.

In a world where anyone can publish an opinion online, professional registration helps distinguish professional judgement from personal opinion. It tells employers, regulators, clients, and the public that your work is backed by verified qualifications, demonstrated experience, and professional accountability, a distinction that is becoming increasingly important.

The geoscience profession is changing rapidly. New technologies are reshaping the way we work. Artificial intelligence, machine learning, advanced modelling, and ever-expanding datasets are creating exciting opportunities, but also new responsibilities. As professionals, we need to ensure that technological advances enhance good scientific judgement rather than replace it.

At the same time, society is looking to geoscientists to help solve some of the world's biggest challenges. From critical minerals and the energy transition to groundwater security and climate resilience, geoscientists are playing an increasingly visible role.

The public expects professionals to be competent, ethical, and accountable. Professional registration demonstrates that commitment.

Beyond statutory registration, I believe there is also tremendous value in professional recognition through our professional society. This is where the Geological Society of South Africa's Chartered Status becomes particularly important.

GSSA Chartered Status recognises advanced professional competence and experience. It signifies that an individual has demonstrated a high level of expertise, maintains professional development, and upholds the standards expected of the profession. It is an important marker of professional excellence and provides additional recognition of an individual's standing within the geoscience community.

SACNASP registration and GSSA Chartered Status can be seen as complementary. SACNASP registration establishes professional standing within a statutory framework, while Chartered Status provides peer-recognised acknowledgement of advanced professional achievement and ongoing commitment to excellence in our industry. Both reinforce fundamental credibility to our profession.

Another aspect of professional registration that is sometimes overlooked is the commitment to continuous learning. None of us can rely solely on what we learned (or didn't) at university. Our profession evolves too quickly. Maintaining professional competence requires ongoing development, curiosity, and a willingness to adapt.

Fortunately, geoscientists are lifelong learners by nature. Whether through CPD activities, technical conferences, mentoring, or professional society involvement, we are continually building our knowledge and improving our practice.

For early-career professionals, I encourage you to view registration not as a hurdle but as an investment in yourself. The process helps you develop professionally, connect with mentors, and establish credibility early in your career.

For experienced professionals, registration and chartership demonstrate leadership. They send a message to colleagues, employers, and the next generation that professional standards matter and that excellence is worth striving for.

Every geoscientist who pursues registration, maintains their professional development, and upholds ethical standards helps strengthen the reputation of geoscience in South Africa. Every professional who mentors a younger colleague or pursues Chartered Status contributes to a culture of excellence that benefits us all.

In an era where trusted expertise has never been more valuable, professional registration matters more than ever.

***Natalie Brand***

# SAMCODES Quarterly Snaps

### The focus for SAMCODES in Q2 2026

During Q2 2026, SAMCODES continued to focus on the planned update of the SAMREC Code, including preparation for industry consultation and alignment with evolving international reporting standards. Work also progressed on the integration of ESG guidance, education and training initiatives, and broader stakeholder engagement.

The SSC also advanced its promotion and sponsorship activities, while preparing for upcoming CRIRSCO, SAMREC/SAMVAL and other SAMCODES-related events.

**LinkedIn**

The SAMCODES LinkedIn page continues to be used to share current developments, industry updates and recognition of contributors. Appreciation posts are being prepared for long-serving SSC contributors, including Annalie de Bruyn and Rob Ingram.

**SAMCODES app**

- The App continues to provide a convenient platform for accessing current SAMCODES information.
- The updated SAMCODES App User Guide is being maintained on the SAMCODES website, with refreshed guidance to support users. Committee quiz questions are also being developed, with previous examples being circulated to help avoid duplication.

**Committee updates**

| | |
|---|---|
| SAMREC THE SOUTH AFRICAN CODE FOR THE REPORTING OF EXPLORATION RESULTS, MINERAL RESOURCES AND MINERAL RESERVES | The SAMREC Committee is preparing the pre-update survey and progressing the Code rewrite. Follow-up engagement with SAMESG is planned to resolve outstanding ESG Guideline matters. |
| SAMVAL THE SOUTH AFRICAN CODE FOR THE REPORTING OF MINERAL ASSET VALUATION | Planning continues for a SAMREC and SAMVAL Advanced Workshop, with further details to be confirmed. |
| SAMOG THE SOUTH AFRICAN CODE FOR THE REPORTING OF OIL AND GAS RESOURCES | The proposed SAMOG Governance and Mandate review submitted by Andy Clay is under review. |
| SAMCODES SAMCODES STANDARDS COMMITTEE THE SOUTH AFRICAN MINERAL REPORTING CODES | Engagement between the SAMREC and SAMESG Committees is continuing to address outstanding matters relating to the SAMESG Guideline and its integration with the forthcoming SAMREC Code update. A follow-up meeting between the committees is planned to resolve outstanding issues. |
| SAMCODES SAMCODES STANDARDS COMMITTEE THE SOUTH AFRICAN MINERAL REPORTING CODES | Annalie de Bruyn retired from the JSE in July 2026. Zakaria Rashid will succeed her as the JSE representative on the SSC. Rob Ingram has retired as Chair of the JSE Readers Panel, with Andy McDonald succeeding him. |

**Training and development**

A Compliance and Reporting Rules Course, MINN7052A, was offered from 20–24 July 2026 through Wits University and coordinated by Dr Tania Marshall. The aim of the course was to upskill and create awareness on compliance requirements and Mineral Reporting Codes.

**International liaison**

UNECE Resource Management Week 2026 was held from 27 April to 1 May 2026, highlighting the importance of UNFC classifications and resource management frameworks.

The AMREC-PARC-UNFC Workshop was held on 12–13 May 2026, with Tania Marshall invited to present on SAMREC. The next CRIRSCO AGM is scheduled for 7–11 September 2026 in Türkiye and will incorporate an IMVAL event.

The SSC is also progressing engagement with key South African stakeholders, including the Council for Geoscience and Minerals Council South Africa, with meetings to be scheduled.

**Management update**

The SSC Annual Report covering June 2025 to May 2026 has been completed. The SSC is also reviewing its Governance and Mandate documentation, confirming member representation, and preparing the October 2026 update to the GSSA and SAIMM. Joseph Mainama continues as SSC Chair, supported by Jacques Nel as Deputy Chairperson.

***Jacques Nel***

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# branches & divisions

## Branches

**Barberton Branch**: Galaxy Gold and Barberton Mines hosted underground visits by students from the Wits Honours Class and a surface visit including a trip along the Makhonjwa Geotrail by 3rd year students from the University of Wutivi (Mozambique). Geology Honours students from the University of Mpumulanga visited Sheba and Galaxy Mines. Talks were offered by Prof Mathieu Lapotre of Stanford University (USA) and visiting students on July 9th and by Prof Christoph Heubeck of University Jena (Germany) and postgraduate students from his research group on July 30th.

The **KZN Branch** held its AGM on August 20th at UKZN and online via Zoom. A call for nominations for positions on the Executive Committee was circulated to members ahead of the meeting. The AGM closed with a lecture by UKZN postgraduate student Nazneen Ebrahim, entitled 'Flush, Forget, and Find: Tracing Emerging Contaminants in Durban's Groundwater'.

**Northern Cape Branch:** The membership database is currently being updated to support the launch of a WhatsApp Channel. The NCB will hold an online talk during August (date and details to follow) and the AGM will be held in November.

**Western Cape Branch**: The website has now been totally rebuilt and relaunched. This was a group effort from multiple committee members and the services of a professional web-designer**.** The new logo for the branch has been formally adopted and can be viewed on the website. A student get-together (UCT, UWC and SU) is planned for 19–20 August. The AGM is scheduled for September 3rd.

**UNIVEN Branch**: This branch is driven by a committee of energetic students from the Department of Earth Sciences at the University of Venda in Thohoyandou, under the guidance of Mr Mokie Mokgotho (Chair) and Ms Ayanda Mkhombo (Secretary). Since my last report, the committee has represented the GSSA at the Bahananwa and Maleboho Career Expo at the Maboi Primary School near Vivo, Limpopo Province, organised a very successful workshop on AI and GIS in Geosciences held at the University of Venda, initiated a stationery drive to help students at exam time and presented several events as part of their Geo-Talks Series.

## Divisions

The **ESG** was relaunched in June and a new, energetic, Executive Committee chaired by Joshua Kilani is in place. 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. A logo for the ESG Division is currently under development.

**MinSA:** An online quarterly talk was held on June 25th and the popular Night at the Museum was held at the Ditsong Museum in Pretoria on 26 and 27 June, with 48 attendees. The AGM took place on August 19th, at which Steve Prevec took over as Chair of the Division. The AGM closed with a lecture by Prof. Dr Gerhard Franz, entitled 'The Volyn pegmatite field (Ukrainian Precambrian Shield)—from gemmology to geo-bio interactions'.

A visit to the mineralogical laboratories at Mintek was organised for student members on August 27th. The third circular advertising the 6th Southern African Mineral Symposium has been sent out to members. The symposium will take place at the Origins Centre, University of the Witwatersrand, on Saturday 5 September 2026.

**Geoheritage:** The GSSA Geoheritage Stakeholder Booklet, a product of the recent 'Meet and Greet Webinar', is close to completion and should be published in the final quarter.

Chair of the Geoheritage Division (Khodani Matshusa) has met with local stakeholders to discuss future activities for the Division, including a potential geoheritage workshop. Khodani recently visited South Korea and is positive about future collaboration on geoheritage.

***Steve McCourt***

# most explored metals



## Most Explored Metals on an Annual Basis from 1900 to 2026: Top 5 Per Year

Based on comprehensive analysis of historical mineral production statistics, exploration expenditure data, and metal consumption trends, here is the annual ranking of the top 5 most explored metals from 1900 to 2026. 'Most explored' is quantified by *annual global mine production tonnage*, which directly correlates with exploration activity—metals with the highest production volumes receive the largest exploration budgets and drilling programs.[1-3]

**Overall dominance pattern**

Throughout the entire period (1900–2026), the top 5 most explored metals have remained remarkably consistent in identity, though their relative rankings have shifted:

| Rank | 1900–1945 | 1945–1990 | 1990–2026 |
|---|---|---|---|
| #1 | **Iron (Fe)** — steel as backbone of industrialisation | **Iron (Fe)** — postwar reconstruction boom | **Iron (Fe)** — Chinese demand explosion |
| #2 | **Copper (Cu)** — electrification | **Copper (Cu)** — electrical & construction | **Copper (Cu)** — renewable energy & EVs |
| #3 | **Gold (Au)** — monetary standard | **Aluminum (Al)** — lightweight materials | **Gold (Au)** — financial hedge & electronics |
| #4 | **Lead (Pb)** — batteries & plumbing | **Gold (Au)** — electronics & investment | **Aluminum (Al)** — transport & packaging |
| #5 | **Zinc (Zn)** — galvanisation | **Lead (Pb)** → **Zinc (Zn)** | **Zinc (Zn)** / **Nickel (Ni)** (since 2000s) |

**Detailed analysis by period**

*Early 20th Century: 1900–1920*

The dawn of the modern mining era was dominated by metals fuelling the Second Industrial Revolution.

| Rank | Metal | Annual Production (approx.) | Primary Uses |
|---|---|---|---|
| 1 | **Iron** | 70–80 Mt | Railroads, bridges, construction, machinery |
| 2 | **Copper** | 0.5–1.0 Mt | Electrical wiring, telegraph, coinage |
| 3 | **Gold** | 400–600 t | Monetary gold standard, jewellery |
| 4 | **Lead** | 0.8–1.0 Mt | Batteries, plumbing, paint pigments |
| 5 | **Zinc** | 0.5–0.8 Mt | Galvanised steel, brass alloys |

Iron dominated global mining overwhelmingly, constituting over 90% of total metal tonnage mined.[4,5] Pig iron production in major economies (USA, Germany, UK, France) grew rapidly in this period, with the US alone accounting for approximately 42% of world iron production by 1950.[6] Copper exploration surged with electricity grid expansion. Leong's index of mineral production shows that from 1880–1948, iron and steel production formed the largest component of global mineral volume.[7]

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*Interwar Period & WWII: 1920–1945*

| Rank | Metal | Approx. Annual Production | Notes |
|---|---|---|---|
| 1 | **Iron** | 80–130 Mt | Dip during Great Depression, surge for WWII |
| 2 | **Copper** | 1.0–2.5 Mt | Military applications (shell casings, wiring) |
| 3 | **Gold** | 600–900 t | Great Depression drove gold exploration |
| 4 | **Lead** | 1.0–1.5 Mt | Battery demand, ammunition |
| 5 | **Zinc** | 0.8–1.2 Mt | Galvanised military equipment |

This period saw significant fluctuations due to the Great Depression (1930s) and WWII (1939–1945). Sampson's analysis of mineral production trends shows that wars and depressions caused 6–12-year recovery periods for most metals.[5] Gold exploration intensified during the 1930s as nations abandoned the gold standard and gold prices rose. Aluminium emerged as a strategic metal during WWII (used in aircraft), with bauxite production surging from ~1 Mt in 1930 to ~10 Mt by 1944.

*Postwar Boom: 1945–1970*

| Rank | Metal | Approx. Annual Production (~1960) | Key Drivers |
|---|---|---|---|
| 1 | **Iron** | 250–500 Mt | Postwar reconstruction, steel for cars & buildings |
| 2 | **Copper** | 4–6 Mt | Electrification of homes, telecommunications |
| 3 | **Aluminium** | 5–10 Mt (bauxite) | Aircraft, packaging, construction |
| 4 | **Gold** | 1,000–1,200 t | Bretton Woods system, jewellery |
| 5 | **Zinc / Lead** | 2–3 Mt each | Alloying, batteries, anti-corrosion coatings |

The postwar era saw a dramatic increase in exploration for all metals. World iron ore production increased from 274 Mt in 1950 to over 500 Mt by 1970.[8] Aluminium surpassed gold by total tonnage due to the explosive growth of bauxite mining. Bauxite consumption grew more than eleven-fold between 1950 and 1980.[6] Copper exploration intensified globally for electrical applications.

*Late 20$^{th}$ Century: 1970–2000*

| Rank | Metal | ~1980 Production | ~2000 Production |
|---|---|---|---|
| 1 | **Iron** | 800–900 Mt | 1,000–1,100 Mt |
| 2 | **Aluminium (bauxite)** | 80–90 Mt | 130–140 Mt |
| 3 | **Copper** | 7–8 Mt | 13–15 Mt |
| 4 | **Gold** | 1,200–1,400 t | 2,500–2,600 t |
| 5 | **Zinc** | 5–6 Mt | 8–9 Mt |

Nickel and manganese also became highly explored, with nickel production rising from ~0.5 Mt (1970) to ~1.2 Mt (2000).[9,10] The 1970s oil crisis spurred exploration for all metals as commodity prices rose dramatically. From the 1980s onward, gold exploration boomed again with rising prices. Australia's gold exploration expenditures rose substantially from 1976–2003, finding several world-class deposits (>100 t contained gold).[3,11]

*Early 21st Century: 2000–2015*

| Rank | Metal | ~2010 Production | Notes |
|---|---|---|---|
| **1** | **Iron** | 2,500–2,700 Mt | Driven by Chinese steel demand |
| **2** | **Copper** | 16–18 Mt | Chinese infrastructure boom |
| **3** | **Gold** | 2,600–2,800 t | Price surge post-2008 financial crisis |
| **4** | **Aluminium (bauxite)** | 200–250 Mt | Lightweight automotive trend |
| **5** | **Zinc** | 11–13 Mt | Galvanisation for infrastructure |

China's rapid industrialisation fundamentally reshaped global metal exploration. Total iron ore production increased 1.77 times from the 1970s to 2010s, with an average annual growth rate of 2.24%.[12] For copper alone, more metal would need to be produced in the 25 years after 2012 than had been used since industrialisation began.[2]

*Modern Era: 2015–2026*

| Rank | Metal | ~2020 Production | ~2024–2026 Production (est.) |
|---|---|---|---|
| **1** | **Iron** | 2,600–2,800 Mt | 2,800–3,100 Mt |
| **2** | **Aluminium (bauxite)** | 350–400 Mt | 400–450 Mt |
| **3** | **Copper** | 20–21 Mt | 22–25 Mt |
| **4** | **Gold** | 3,000–3,200 t | 3,300–3,600 t |
| **5** | **Nickel** | 2.3–2.5 Mt | 3.0–3.8 Mt |

Nickel has overtaken zinc in the #5 position since ~2015, driven by lithium-ion battery demand for electric vehicles.[13,14] Cobalt, lithium and rare earth elements have seen the fastest growth in exploration budgets, but their absolute tonnage remains small compared to the top 5.[15,16]

**Key shifts in exploration priority**

- **1900–1940s:** Iron dominated for heavy industry; gold for monetary purposes; copper for electrification.
- **1940s–1970s:** Aluminium entered the top 5 as a lightweight structural metal; uranium briefly spiked for nuclear energy.
- **1970s–2000s:** Gold exploration surged during price liberalisation; zinc surpassed lead for corrosion protection.
- **2000–2026:** Nickel entered the top 5 due to stainless steel and battery demand; lithium, cobalt and rare earths grew rapidly in exploration spend but remained low in tonnage.

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**Long-term trend summary (decadal averages)**

| Decade | #1 | #2 | #3 | #4 | #5 |
|---|---|---|---|---|---|
| 1900s | Iron | Copper | Gold | Lead | Zinc |
| 1910s | Iron | Copper | Gold | Lead | Zinc |
| 1920s | Iron | Copper | Gold | Lead | Zinc |
| 1930s | Iron | Copper | Gold | Lead | Zinc |
| 1940s | Iron | Copper | Gold | Lead/Al | Zinc |
| 1950s | Iron | Copper | Aluminium | Gold | Zinc |
| 1960s | Iron | Copper | Aluminium | Gold | Zinc |
| 1970s | Iron | Aluminium | Copper | Gold | Zinc |
| 1980s | Iron | Aluminium | Copper | Gold | Zinc |
| 1990s | Iron | Aluminium | Copper | Gold | Zinc |
| 2000s | Iron | Aluminium | Copper | Gold | Zinc |
| 2010s | Iron | Aluminium | Copper | Gold | Zinc/Ni |
| 2020s | Iron | Aluminium | Copper | Gold | Nickel |

*Note: 'Aluminium' refers to bauxite ore production. Gold is in tonnes; all others in million tonnes.*

**Conclusion**

Throughout 1900–2026, **iron** has consistently been the most explored metal globally by tonnage, driven by steel production for construction, transportation, and manufacturing. **Copper** has held a steady #2 position due to its essential role in electrical systems. **Aluminium** (bauxite) rose to #2/#3 after WWII. **Gold** has remained in the top 5 throughout due to its monetary and jewellery value. **Zinc** occupied #5 for most of the 20th century, but **nickel** has overtaken it since ~2015 due to the electric vehicle and battery boom. The most dramatic change in the 21st century is not in the identity of the top 5, but in the absolute scale—iron ore production grew from ~70 Mt/year in 1900 to over 3,000 Mt/year by 2026, a ~40-fold increase.

***Mark Burnett***

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# A Karoo-aged sill or lava?

## Platberg, Harrismith, eastern Free State—a Karoo-aged sill or lava?

### Introduction

Possibly the best-known geological feature in the eastern Free State is a flat-topped hill immediately north-east of Harrismith, known at Platberg. Its exposed length (northwest–southeast) is about 7 km and up to 1.5 km across. It is documented in the maps of the Council for Geoscience as the base of the lavas of the Drakensberg Group, Karoo Igneous Province, immediately overlying the pale-yellow sandstones of the Clarens Formation. The Harrismith map (grid reference 2828) has an accompanying explanation sheet[1] and contains descriptions of lavas and intrusive bodies, but does not specifically refer to Platberg. However, other publications suggest that Platberg is a dolerite sill (e.g. McCarthy and Rubidge[2]) intruding close to the top of the Clarens Formation. Two articles in *Geobulletin* have presented arguments for these different views, by Whitfield[3] that it is a sill and Roelofse and Odendaal[4] that it is lava.

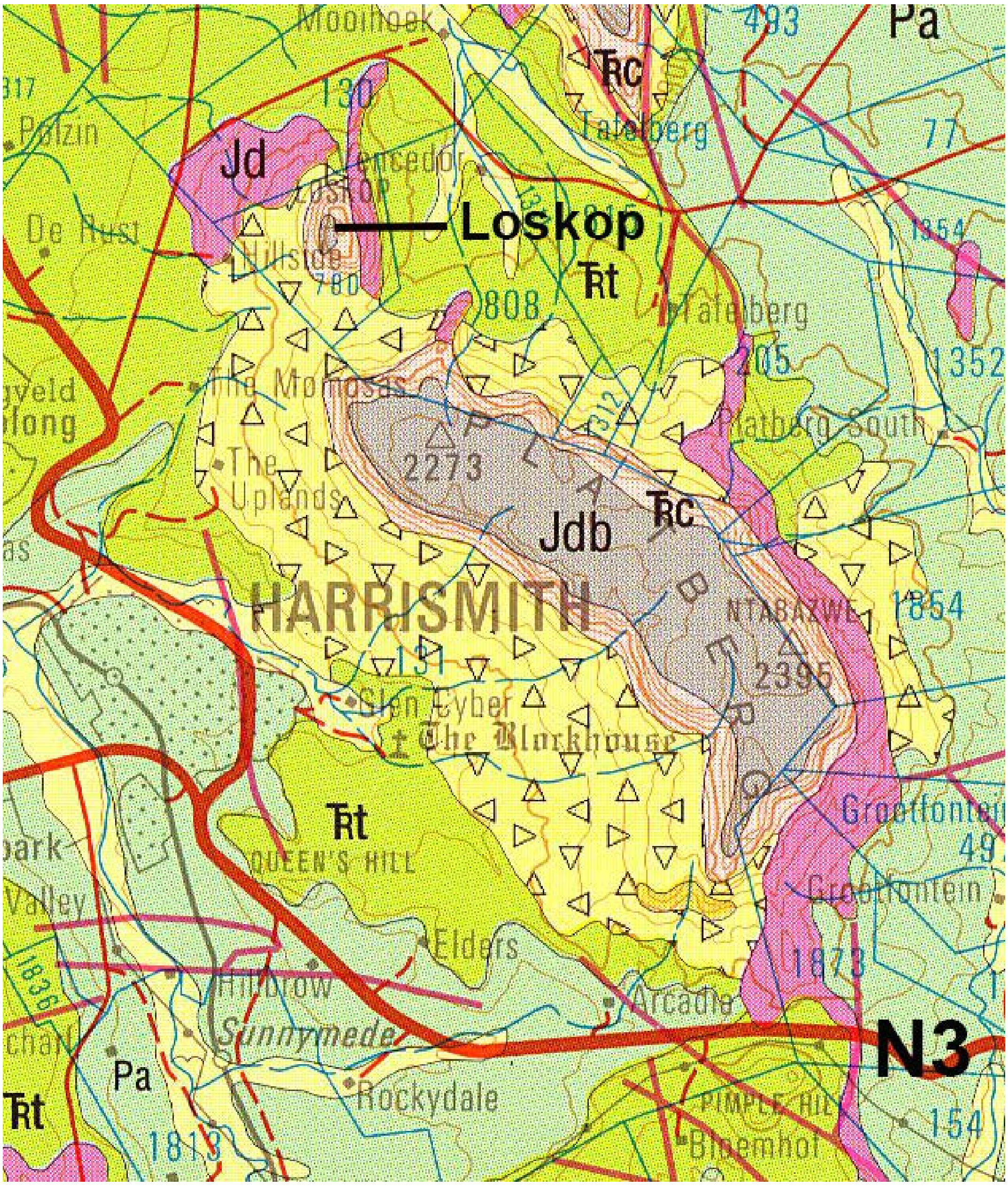
Here I examine the relevant geological features and offer comments about this debate.

A part of the Harrismith geological map (sheet 2828) is shown on the next page. Platberg is shown as being Drakensberg basalt, as is the body on Loskop, less than 1 km to the northwest, although there are numerous bodies of dolerite in the vicinity. (The area shown as basalt on Loskop is extremely difficult to see on the map because of its small area.) Both hills can be clearly seen in the photo below.

Roelofse and Odendaal[4] argue for Platberg body being eruptive based on the observation of amygdaloidal mafic material close to the top. I asked ChatGPT if any 'intrusive dolerites' contained amygdales. I was given the answer: Deccan Traps, Tasmanian dolerites, Pallisades sill and *Karoo 'especially where emplacement was shallow*'.

*General view of Platberg (right) and Loskop (left) from the southwest. Visible length of Platberg is about 2 km.*

Whitfield[3] referred in his Fig. 11, which I have also photographed here (on Loskop), to features claimed by him to prove discordant intrusion of dolerite. In a true geological paradox, I show (on the next page) an identical relation that was drawn by Archibald Geikie in 1897 in the Hebrides in Scotland, and described as lava infilling a pre-existing valley. No reference was given, but the figure and text were used by Francis[5] (p. 361). By analogy, the relations on Loskop could then be interpreted as a lava cutting its own valley into, or filling, an eroded channel in the sandstone, or an intrusion. Thus, both claimed lines of evidence for both interpretations should be challenged as not being definitive.

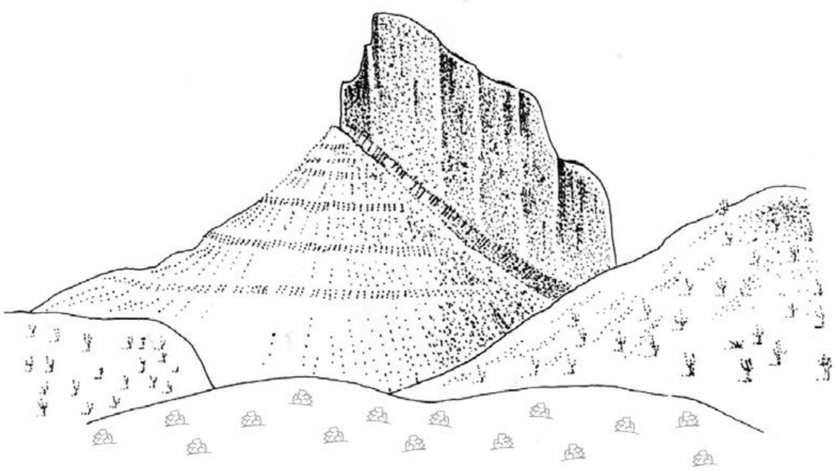



*Geological map published by the Council for Geoscience of the Platberg body. Pa, Tkt and Jdb are Adelaide subgroup, Tarkastad subgroup, and Drakensberg basalt. Pale yellow with triangles is scree. Deep purple is dolerite. The hill called Loskop is highlighted, but its insipid colour is hard to identify, but it is shown as Drakensberg lava.*

*View of northern end of Loskop from the west. Columnar jointing, well-developed throughout all 60 m, is underlain by large-scale planar bedding of Clarens Formation sandstone. Width of view about 0.5 km.*

The Platberg itself is a flat-topped mafic body over 60 m thick (using Google Earth), the base of which is heavily draped in scree of the same material. Whatever was overlying it has been eroded (except in one place, see below). Hence, the exposures that could be most definitive of whether it is a sill or lava, i.e. basal and upper contacts, are not accessible.

A number of features from Loskop at the north end of Platberg, are described here. The photograph above is taken from the west and appears to be a single body. As close as one can get to the base, the rock is massive and devoid of vesicles/amygdales. A major part of the body shows variably good columnar jointing, which may occur throughout or be discontinuous. I would argue that the very first eruption of a new volcanic province is unlikely to be a homogeneous (no xenoliths), massive, thick flow, free of vesicles.



*Line drawing by Geikie in 1897 showing a lava infilling a sedimentary channel on Scuig of Eigg in Scottish Hebrides, and reproduced by Francis.5*

An aerial view of Loskop (below) shows a ledge around the top of the hill composed of the igneous body, with a topographic dome in the centre, with outcropping sandstone. The contact between the mafic body and sandstone is nowhere exposed. What I take to be the top contact of the mafic body is shown in the photo over this page. It is weathered to pale brown, almost perfectly horizontal and quite smooth, with numerous cracks and contains no vesicles, or indication of brecciation. I suggest that this surface is the upper (intrusive) contact to the (now largely eroded) sandstone. The horizontal distance between the outcrop of mafic material and sandstone to the north is about 100 m and at approximately the same elevation.


*Aerial view of Loskop (from Google Earth Pro). Field of view about 1 × 1 km. The face shown in the photograph is on the left. In the central area, Clarens Formation sandstone is preserved. (The locality of the sandstone is at 28°13′05′′ S; 29°09′11′′ E.) There are smaller isolated remnants of sandstone on the plateau toward the south-west. It cannot be proven whether they are inclusions within the mafic rock or lie above it. On the north-east side of the hill, the continuity of the underlying sandstone is breached for about 100 m by injection of basic rock, which continues to the north and south for about 50 m as (probable) wedge-shaped injections into the sandstone.*

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I would suggest that a sill intruded at the level just below the top of the hill. Some of that liquid injected to a higher level (shown at A–B) through its sandstone roof where it spread out into short wedges (sills) at its southern and northern edges. Thus, the partial collar of sandstone around the top of the hill would have been a floating raft in the mafic material. I suggest that all the observations shown in the photographs here are strongly supportive of this mafic body being a sill.

*Bird's eye view of presumed upper surface of the mafic rock, which is quite smooth, with jointing, but no brecciation (at point X in the aerial view).*

**R Grant Cawthorn**
*School of Geosciences, University of the Witwatersrand (Grant.Cawthorn@wits.ac.za)*

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# A VIP (very important paper)

## A VIP (Very Important Paper) Contribution in the June Issue of *SAJG*

Over the last two decades shale gas exploration and production generated much controversy in the United States in particular, mainly concerning induced seismicity and groundwater contamination. South Africa was not spared public criticism when international corporates estimated that the Karoo Basin might contain as much as 300 to 400 trillion cubic feet (tcf) of recoverable gas. This would have made the Karoo play one of the larger resources in the world at that time. The controversy was such that a moratorium on shale gas exploration and production was initiated in 2011. The moratorium has now been lifted, as announced by the DMRE Minister, Gwede Mantashe, in his budget speech in May of this year.[1]

The initial estimates took no account of the potentially destructive effects on recoverable gas of the Cape Fold Belt or the intrusive sills of the Karoo Large Igneous Province (LIP) event at 180 Ma. Hence, a circa 400 tcf potential is likely a serious over-estimate, possibly by at least a factor of ten. Subsequent estimates were as low as 13 tcf.[2] However, the significantly lower estimates were based on only two drill holes on the margins of the basin, and one near Philippolis in the Free State drilled by Goldfields. The latter hole is characterised by extensive dolerite sills.

The Council for Geoscience (CGS) has completed a single drill hole in one of the supposed 'sweet spots' near Beaufort West, as the first leg of a five-phase project. The result of that project phase was the June publication in the *SAJG* by Mosavel *et al*.[3]. This is an important benchmark contribution, and like much scientific work, the results clearly indicate more work (specifically drill testing) is needed before the South African government or the private sector invests in infrastructure to support production. The target stratigraphy is the Whitehill Formation in the Ecca Group, but the results of this first hole are marginal at best. A possible maximum estimate highly dependent on the lateral extent of the play, maturation levels and nitrogen content of the gas is 30 tcf (to name a few variables)—but this could easily be reduced (or expanded) with more extensive testing.

The DMRE has engaged the Petroleum Agency of South Africa (PASA) to select and manage contractors for the next phases of the project. These are improving resource estimation, establishment of a baseline groundwater monitoring network, risk assessment of abandoned wells, and establishment of a seismic monitoring network.

Let's not get ahead of ourselves with infrastructure development or environmental protests before there is a real resource located and tested with more drilling. If there is little or no recoverable gas, constructions of pipelines to nowhere will not only be extremely expensive but will become political liabilities. Given the amount of work that needs to be done, another decade to a final decision is not an unreasonable time frame. The Karoo Basin is possibly unique in its hydrocarbon potential in having been affected by the Cape Fold Belt and the Karoo LIP event; hence caution and considerably more work are needed.

Given the high cost of further work, it makes sense that it should be a joint public–private effort. Industry needs assurance that the risk capital invested is secured with long term-extraction rights. Possible development needs to be environmentally sound; water availability in the water-stressed Karoo is of particular importance.

***Craig Smith***

*The opinions expressed in this contribution are those of the author and not necessarily the views of the GSSA.*

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# Wits legacy project workshop

## Wits Legacy Project workshop (June 17–18 2026): A workshop report and future plans

The **Wits Legacy Project** is a new initiative that aims to ensure the continued availability of geological data that has been generated in the exploration and mining of quartz pebble conglomerates of the Witwatersrand Basin. After over 140 years of mining, the Witwatersrand Basin still holds the biggest gold resources on Earth. Since its discovery in 1886, billions of rand (in current monetary terms) have been invested to generate geological data of the gold reefs and host rocks. Thousands of kilometres of drill core and seismic lines, extensive geochemical and geophysical datasets, and numerous scientific reports were generated, much of which were deemed secret and highly confidential at the time, and they have never been unveiled to academia and the general public. It is urgent to curate this significant amount of exploration data, which covers a billion years of geological history from 3.0 to 2.0 Ga as preserved in the Witwatersrand, Ventersdorp, and Transvaal supergroups and includes overlying Karoo strata.

The Wits Legacy Project intends to bring together the disparate data into a single system to preserve one of the most significant mineral datasets in the world. A well-curated and accessible database of borehole cores and geochemical and geophysical datasets is paramount for the protection and dissemination of geological knowledge to the general public, academia and the mining industry. The undertaking of long-term multidisciplinary research will upskill South African post-graduate students and allow scientific and mineral resource discoveries. The project aims to:

- inform any future gold exploration efforts in the Witwatersrand Basin, avoiding the risk to the exploration process to start from scratch;
- further constrain the evolution of the Witwatersrand Basin and the conditions under which the rich gold reefs were formed;
- improve stratigraphical correlation of sedimentary cover successions of the Kaapvaal Craton, which will shed light on the interplay between early continental evolution and surface processes in the Archaean and Palaeoproterozoic.

The Vision of the Wits Legacy Project is to transform the Witwatersrand Basin from a collection of historical mining assets into the world's first AI-enabled digital basin. The establishment of a living geological laboratory will support research, exploration, education, innovation, resource discovery and preservation of geological heritage.

In a 2-day workshop held on 17 and 18 June 2026, the Wits Legacy Project was introduced to representatives of mining houses, academia and government entities. The programme consisted of a field trip to Sibanye Stillwater's Oberholzer core yard and data storage warehouse on Day 1. Day 2 of the workshop was dedicated to a morning session of presentations and an afternoon discussion held at the Johannesburg Business School. Funding of the workshop was made available via grants from the GSSA Research, Education and Investment (REI) Fund and the DSTI-NRF Centre of Excellence for Integrated Mineral and Energy Resource Analysis (CIMERA). We thank Philip Staley, Lindelani Mudimeli, and Mark Metcalfe of Sibanye Stillwater for the opportunity to visit their operation, for excellent hospitality and for leading the core yard visit.

**Day 1,17 June: Core yard visit**

The visit was limited to a group of 26 people, which included representatives of different mining companies, government and universities. The participants met in the morning at the University of Johannesburg in Auckland Park and continued to Carletonville in UJ Geology minibuses. The group was welcomed at the Driefontein Mine Geology Boardroom, and a presentation on the data depository facilities at Driefontein and Oberholzer was given by Philip Staley (Contract Geologist, Sibanye Stillwater).

*Warm welcome of the group at the Driefontein Mine Geology Boardroom*

The Sibanye Stillwater core and data storage facilities consist of the Driefontein Geobase ('the sheds'), and core yards at Oberholzer and Potchefstroom. The Driefontein Geobase was created in 2023, following its move from the Oberholzer core yard due to security reasons. It accommodates over 100 years of geological and survey information from Goldfields South Africa operations and overseas exploration. Currently, it hosts around a million items, of which only a handful are documented.

*The Driefontein Geobase preserves legacy documents such as maps, reports, borehole logs, and books in an industrial warehouse.*

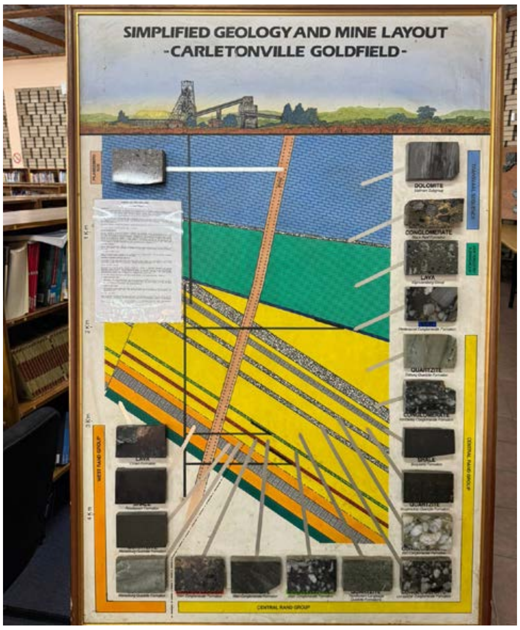
The group then moved to the Oberholzer core yard, part of the former Oberholzer Geological Centre, which was created in the late 1980s to house core and data from Goldfield's exploration activities. It contains exploration core mainly from the West Rand areas. A lot of core boxes are stored outside the sheds, and exposure has taken its toll. Due to repeated cable theft, the core yard does not have electricity. Core inside the sheds can thus not be moved.

*Aerial view of the Oberholzer Geological Centre (courtesy of Philip Staley). The central square building was the old offices from where the records, now stored in the Driefontein Geobase, were relocated. The two large sheds in the bottom right host historical core.*

*Inside the Oberholzer historical core yard sheds. Piles of core boxes in variable conditions of preservation are stacked around the sheds.*

After a geologist-style lunch of cheese sandwiches and a group photo, the group visited the reefs exhibition at the Carletonville public library that was inaugurated in 1988. Not much information remains available for this collection. Apparently collected by Jochen Schweizer, it consists of a nice selection of samples of reefs with footwall and hangingwall for each mine in the area. Some cleaning and relabelling are required, but the exhibition is in remarkably good shape for its age.

*Group photo at the Oberholzer core yard*




*A panel of the collection of reefs at the Carletonville public library. Part of the exhibit is a simplified geological cross-section of the Carletonville goldfield with polished specimens of the main lithologies.*

**Day 2, 18 June: Workshop**

The workshop included representatives of mining houses, government agencies and academia. The purpose of the workshop was to:

- raise awareness of the delicate and precarious state of Wits Basin geological legacy;
- plan strategies for preservation, core cataloguing, and curation;
- identify future study directions;
- discuss fundraising.

The event was hybrid. About 35 people attended in person at the Johannesburg Business School in Auckland Park and about 20 people connected online via Teams. The workshop consisted of 2 parts: a morning technical program with presentations and an afternoon open discussion.

After a warm welcome and opening remarks by Linda Iaccheri (Wits), Vaughan Chamberlain (Amira Global) outlined how Amira brings together mining companies, research organisations and government agencies to collaborate on research projects, and how it provides a platform for the mining industry to share their knowledge. Matt Mullins (Snowden) then emphasised in his presentation on the geology of the Wits Basin the importance of the Wits Legacy Project by urging the participants, ‘Let’s get started!’. Two Geology Honours Students from Wits University (Lungani Ndimande, Nomcebo Dubazana) presented their projects linked to Wits Basin geoheritage, such as the preservation of the Des Pretorius sample collection.

*Nomcebo Dubazana presenting her Honours project to the audience.*

After a coffee break, Ntsako Mhlarhi (CGS) outlined the Council for Geoscience’s data portal and the core storage facility at Donkerhoek. Dian Snyman (Veracio) presented on XRF core scanning technology, and Keagan Lamb (iGlobe) explored solutions for digitising analogue mine plans. Nicodimus Sebisha (Toronxameric) discussed his experience of digital preservation of Witwatersrand legacy data. In the last presentation, Axel Hofmann (UJ) introduced the Southern Kaapvaal Craton Drilling Project, an international initiative that will require access to legacy datasets from gold exploration under deep Karoo cover. Following a Q&A session, the delegates walked across to the Piza e Vino restaurant next to UJ business school for a lunch break.

*Lunch break at Piza e Vino restaurant. Various pizzas and salads were on offer.*

The afternoon discussion was led by Bernard Swanepoel. The discussion started with a summary and overview of the 2-day event by Linda Iaccheri, then Bernard took the lead to challenge the audience on several themes:

- Ownership of the legacy data, the role and (storage) limits of the Council for Geosciences, curation of private collections, and trust;
- Preservation of the legacy data, at risk by closure of mining operations, deterioration and loss of core storage facilities, and loss of institutional memory by retirement;
- Condition of geological data, the amount to be preserved, platforms for its consolidation and data mining capabilities;
- Economic opportunity, as data-driven exploration allows for reduced discovery costs, evaluation of historically marginal reefs, and machine-learning assisted target generation;
- Onboarding of mining companies to contribute to the initiative for their benefit (data availability, new discoveries, stratigraphy improvement, education and training).

*The open discussion in the afternoon raised fundamental questions and issues that need to be addressed as a geological community for the common good of future generations.*

**Future plans**

The Wits Legacy Project is proposed to move forward as an Amira Global project, which offers an experienced collaboration platform. An Expression of Interest to mining houses and interested parties for the proposed Amira Project P1378 Wits Basin Geoheritage Project—*Preserving 140 Years of Geological Knowledge for Future Generations*—has been compiled and is available on request from Vaughan Chamberlain (vaughan.chamberlain@amira.global). A full project proposal and budget are in development and will be shared with interested parties.

***Linda Iaccheri, Axel Hofmann*** *and* ***Vaughan Chamberlain***


*Amira Global connects researchers, industry, government and funding partners to foster innovation, reduce fragmentation, and drive sustainable, high-impact solutions across the entire mining value chain. For more information on completed and running projects, visit https://amira.global.*

# mineral scene

## Minerals as Art!

For the 40th anniversary of this column, I thought I would digress from featuring a specific species and instead concentrate on 'Minerals as Art'.

There has been a revolution in the mineral-collecting market in recent years, with the ultra-high-end dealers offering their very best (read most expensive!) mineral specimens as works of art and not necessarily as minerals as such. This implies that it is possible to invest in mineral specimens, in addition to artworks, rare coins, fast cars, etc. Danny Trinchillo, one of the world's leading mineral dealers, recently published an article on this topic.[1] The justification for this is that the finest mineral specimens are now achieving prices equal to that of fine artworks. One of the criticisms of this trend has been that this approach is driving high-quality mineral specimens beyond the reach of the average collector. It also has had an effect on 'average' or good quality specimen's prices rising when these are being punted as the best to buy.

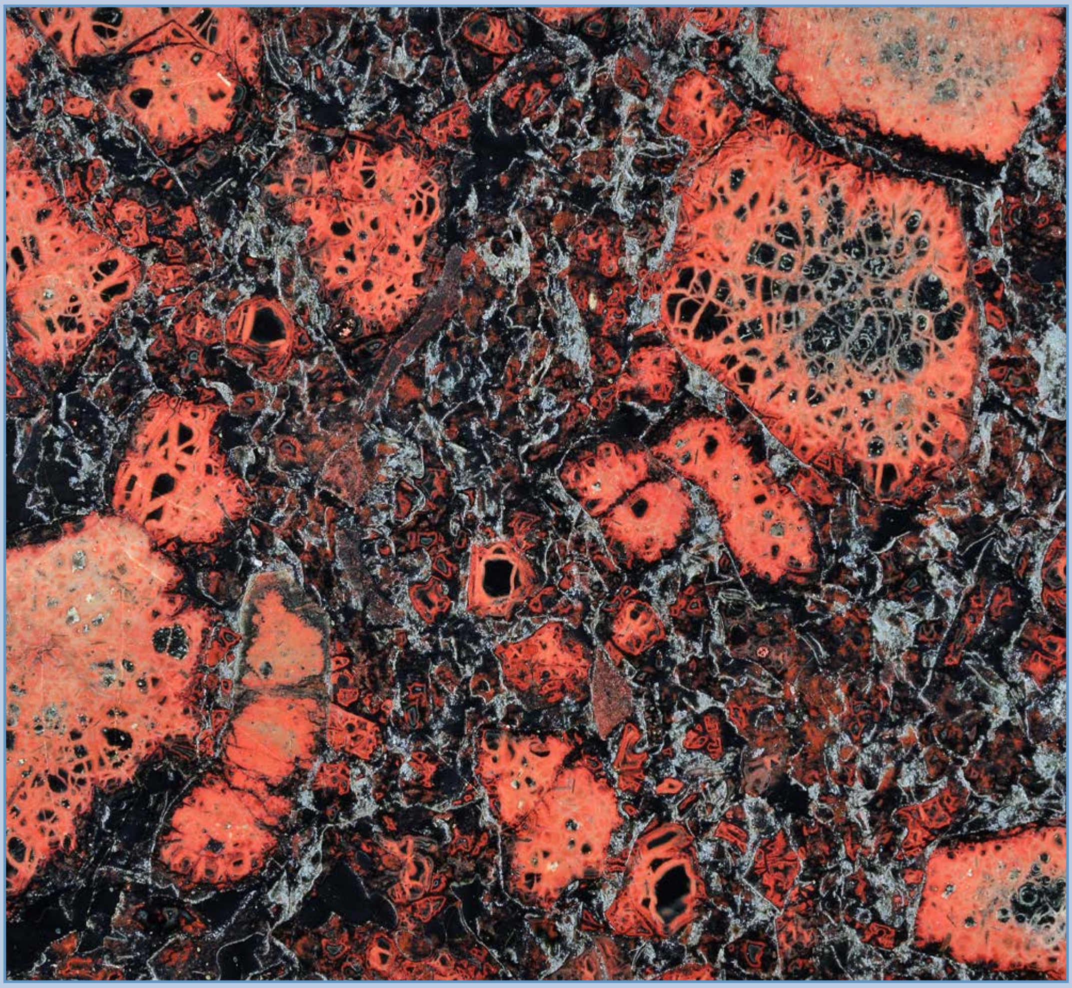
I am not in the market for the upper stratosphere of mineral collecting, but even within the 'mundane' mineral specimens there is artistic beauty that can be appreciated. Therefore, this feature shows some of these. All are close-up photographs to show the details of each specimen.

***Bruce Cairncross***
*Department of Geology, University of Johannesburg (brucec@uj.ac.za)*

### References

1. Trinchillo, D. (2025). Crystals & the fine arts: a contemporary comparison. *Mineralogical Record* 56 (5), 637–656.

*Partly haematised volcanic breccia (hyaloclastite) from the top of the Ongeluk lava. Field of view is 7 cm.*

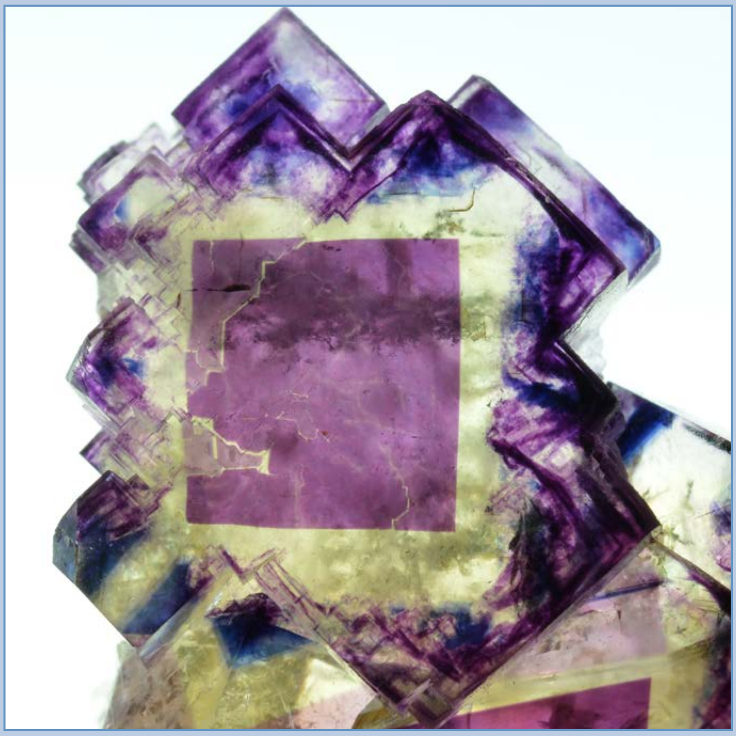


MINERAL SCENE

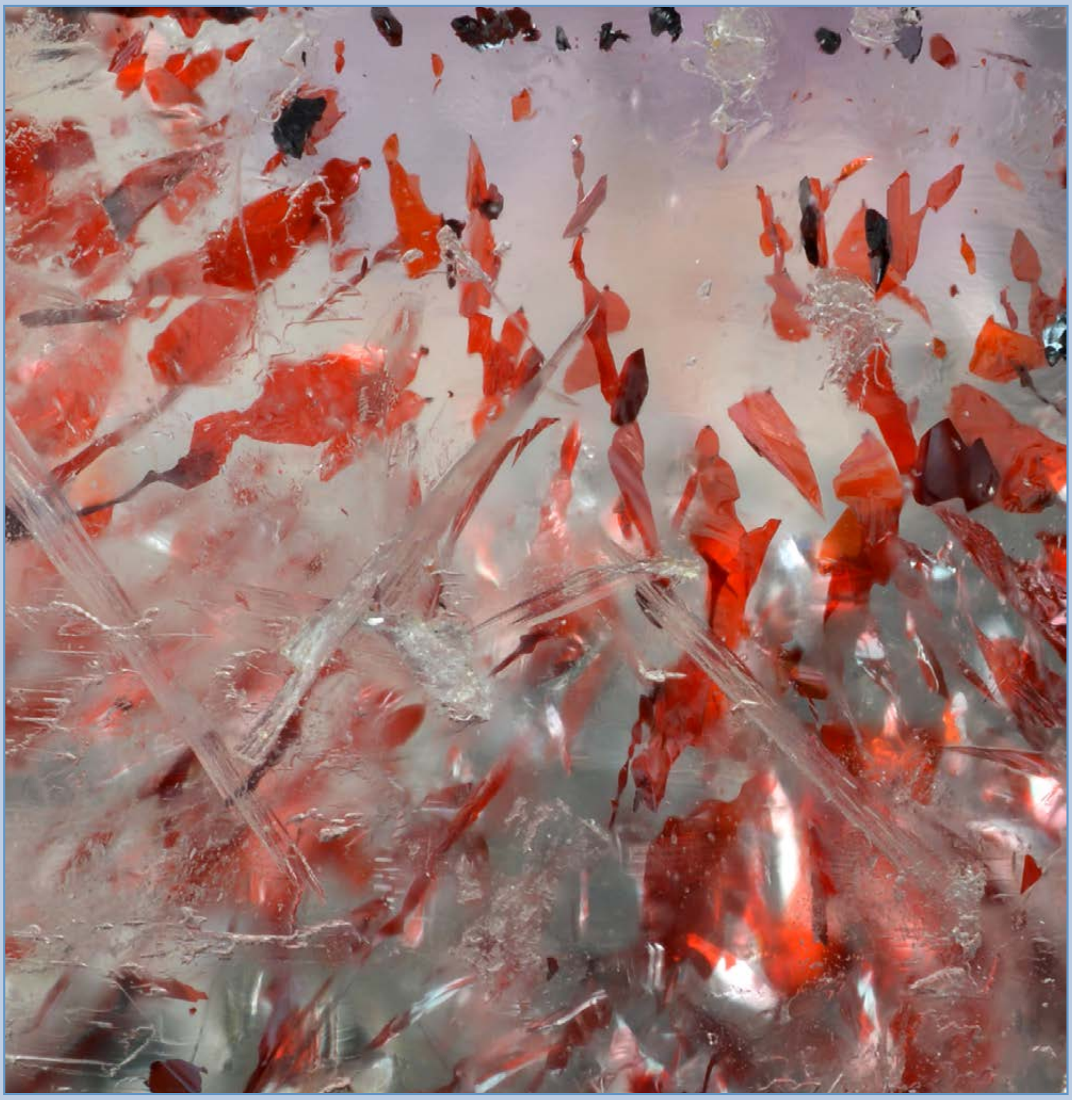
*An 'arid landscape'. Polished slab of Namibian sandstone with liesegang staining. Field of view is 14 cm.*

*An 'astral sky'—polished Brazilian agate displaying what appears to be a view over an ocean. Field of view is 6 cm.*

*A 'golden river'. Veins of pyrite and siderite transect a polished core sample of coal. Field of view is approximately 12 cm.*



*Internal colour zoning in fluorite from Okorusu mine, Namibia. Field of view is 3 cm.*



*Tiny platelets of haematite included in amethystine quartz from the Etendeka lavas, Goboboseb Mountains, Namibia. Field of view is 2.8 cm.*

*Fractures in jasper filled by grey-green andradite garnet and quartz. Griquatown district, Northern Cape. Field of view is 5 cm.*

Polished slab of malachite from the Democratic Republic of the Congo. Field of view is 14 cm.

Polished 'pietersite', chalcedony with embedded fibres of amphibole minerals with varying degrees of alteration. Field of view is 11.5 cm.

Swirling layers of vanadinite and descloizite from Kabwe mine, Zambia. Field of view is 4.2 cm.

# the geological detective



## The Geological Detective: The Moly Bias of China

*'To know what you know and to know what you do not know—that is true knowledge.'*
*—Confucius, The Analects*

They landed at Hohhot Baita International Airport, swapping the Antonov for a vehicle Petr did not recognise—a block of electric metal with tyres that looked like they belonged on a mining haul truck.

'What in the name of the Motherland is this?' Petr asked, circling it warily.

'BYD Yangwang U8', Svetlana said, not looking up from her tablet. 'One thousand two hundred horsepower. The Chinese have built a spaceship that drives on roads.'

'Can it float?'

'Allegedly. Don't even think of trying, Perviy. We have a schedule. And a molybdenum assay bias problem to solve. You are driving.'

Petr climbed into the driver's seat, which he suspected was capable of heating, cooling, massaging, and probably playing a full Tchaikovsky symphony if you knew the right commands. 'My Lada Niva has a choke and a prayer', he muttered. 'This thing looks like the bridge of the *Enterprise* D.'

'It reminds me more of a machine that the Shadows would build', said Svetlana, ensconcing herself in the passenger seat. 'A proverbial space monster.'

'A *Babylon 5* reference. Will wonders never cease.'

Svetlana ignored him as they drove east through a landscape God had abandoned—barren grey-brown hills, dust-devils waltzing over blighted land.

'Educate me, Oh Great One', Petr said, trying to stay awake.

Svetlana rattled off from memory. 'The Tianshan–Xingmeng orogenic belt is the eastern segment of the Central Asian Orogenic Belt—eight hundred million years of plate collisions. It contains the largest porphyry molybdenum deposits in the world. Chalukou. Daheishan. Caosiyao. All hosted in granites and granodiorites that were emplaced when the Mongol-Okhotsk Ocean was closing and the paleo-Pacific plate was doing something complicated that I will not bore you with because your eyes are already glazing over.'

Petr listened, just alert enough to catch the key phrases: '...complex alteration assemblages... potassic cores, phyllic halos, propylitic fringes. Biotite, muscovite, chlorite, K-spar.'

'Big orogens. Lots of moly. Got it. Geology—the mother of all sciences. I am part of the family. But I do not have to love the lectures.'

'Marriages of convenience fail in a crisis', Svetlana declared. 'You will love geology when it buys you a new Lada or even a Volga.'

Petr smiled. There she goes again, he thought. The expert has spoken. The Chinese are going to just love her.

The final hours were exquisite torture. How he missed the Senegalese suicide goats—at least they gave you something to watch out for.

When they reached the mine, Petr initially thought they had got lost and had ended up at a military base—the perimeter was laced with razor wire and was so heavily guarded that the commandants of the Gulag would have thought they had won the lottery. Waiting at the checkpoint was Comrade Doctor Wei, the Chief Geologist—a wiry man with spectacles thick enough to stop a bullet.

'Comrade Doctor Rudakova, Comrade Perviy', Wei said, bowing slightly. 'Welcome to our operation. We have... a problem.'

'Let us dispense with the formalities, Dr Wei. It is Svetlana and Petr. And your problem has a perfectly precise name—bias.'

Dr Wei grimaced, his voice dropping to barely a whisper. 'Twenty to twenty-five percent. Our check assays at an external laboratory come back higher than our own results. Twelve thousand samples, five percent check assays—six hundred comparisons. The bias is consistent, significant, and we no longer know which number is telling the truth.' He paused, swallowing hard. 'We thought we knew our resource. Now we know nothing. If we cannot explain this, the project may not be viable.'

Svetlana planted her hands on her hips like a *barynya* displeased with her serfs. 'Six hundred check assays. That is a robust dataset. And you only now call me?'

Petr watched her from the corner of his eye, biting his cheek to keep from grinning. Magnificent, he thought. She has perfected the pose. Give her a *sarafan*, a *kokoshnik* and a riding crop, and she would be complete. The embodiment of Pushkin's Baryshnya-Krestyanka.

Dr Wei shifted uncomfortably. 'The dataset was only completed recently. We send samples for external check assays only after we finish the drilling campaign. This year, the campaign ran long. We received the full year's check results a few weeks ago.'

'I examined your purchased synthetic CRM results. No surprise—they show perfectly good performance', Svetlana said flatly. 'Show me your core. Walk me through every stage a sample passes through before it ends up in your database.'

A day of detailed audit followed. Every stage was scrutinised—from core arrival through marking, logging, photography, splitting, crushing, pulverising, and finally to the bagged powder. Petr was in his element. Sample preparation was his secret passion—the crushers, in particular, inspired him. He watched each machine with the reverence of a pilgrim in a cathedral.

The verdict: flawless. Core sampling protocols were best practice. Preparation methods met industry-leading standards.

Svetlana looked tired but inspired. 'Now that we have cleared all the witnesses', she said, 'let us move to the prime suspects. Tell me about your primary and check laboratories.'

'A commercial ISO-certified laboratory in Tianjin is our primary', Dr Wei said proudly. 'A brand new ICAP 7600 ICP-OES spectrometer. American engineering, German optics, Chinese efficiency. Detection limits at parts per billion.'

'And your check laboratory?'

'Another ISO-certified laboratory in Guangzhou. Even better—ICP-MS. Mass spectrometry. Parts per trillion if you need it.'

Svetlana stopped walking. 'So both laboratories are excellent. World-class instruments. Best methods.'

'Exactly.'

'Then tell me specifically. What digestion method are they using? Aqua regia or four-acid?'

A silence hung in the air, a proverbial Led Zeppelin.

Dr Wei adjusted his glasses. 'I... I would need to check that. I have never thought about it.'

'Don't you see the assay certificates?' Svetlana asked, bemused. All this efficiency, *2001: A Space Odyssey* technology, and now this?

'We only see the data. All certificates are kept in Accounting', Dr Wei said. 'Printed and stamped copies. For audit purposes. We pay per certified certificate, you understand.'

Svetlana stared at him, her blue eyes gimlets. 'The digestion method for molybdenum is stored in Accounting?'

'Yes. With the invoices.' Dr Wei looked startled.

'And no one in your team knows if your samples are being dissolved in hydrofluoric acid or simple aqua regia? Has anyone ever talked to the laboratory managers about your host rocks? Before you signed the contracts, did anyone ask: 'What is the best way to measure molybdenum in a silicate-rich porphyry?' Or did the accountants choose the cheapest line on the price list?' She paused. 'Did anyone challenge the bean counters, or are you *diū xī guā, jiǎn zhī ma*—throwing away the watermelon to pick up sesame seeds?'

Dr Wei flinched. He had not realised she could speak Chinese.

Svetlana smiled, the cold grin of a barracuda. '*Shì de, Wèi bóshì, wǒ néng dú, xiě hé tīng dǒng zhōngwén, zhǐshì fāyīn bù tài hǎo.*' (Yes, Dr Wei, I can read, write and understand Chinese. I just don't pronounce it very well.)

The silence stretched. Petr buried his face in his hands—not from embarrassment, but to hide his laughter. She is going to eat them alive, he thought. And they deserve every bite.

Svetlana folded her arms. Her blue eyes had gone the colour of a Siberian winter.

'So', she said, 'you have two excellent laboratories. Both with ICP instruments that cost more than a dacha in Barvikha. Both with accreditations requiring more paperwork than a Soviet tractor factory. Yet your results disagree by twenty-five percent. No geologist ever asked about digestion. No one discussed geology before choosing a method. Accountants picked the price, and you signed.'

Petr blinked, lost in a daydream of gorilla trekking in the Virungas. 'Digestion? Is it lunchtime already, boss?'

He knew exactly what digestion meant. He also knew that watching Svetlana's eye twitch was one of life's pure joys.

Dr Wei spread his hands. 'We are geologists. We don't go into the chemical processes—'

'But you have to', Svetlana said, her patience thinning. 'Your ICAP 7600 needs a liquid to work. How that liquid is created is critical. The machine can only tell you what you feed it. Nothing more, nothing less.'

Dr Wei looked as though he had never considered this. Petr looked as though he was thinking about lunch—because he had understood the problem ten minutes ago and was letting Svetlana educate the unwilling. But first, they had to pay a visit to Accounting.

Half an hour later, after a brief and decidedly uncomfortable detour, Svetlana had her answer: the primary lab had been using aqua regia; the check lab, four-acid digestion. Exactly as she had suspected.

She returned to the room, folded her arms and delivered the verdict: 'Aqua regia—$HNO_3 + 3HCl$—is cheap. It dissolves sulphides beautifully. Molybdenite dissolves like sugar in hot *chá*. The problem is that your molybdenum is not all in molybdenite.'

Dr Wei frowned. 'But our mineralogy—'

'Your mineralogy includes biotite, muscovite, chlorite and K-feldspar—silicates capable of incorporating molybdenum into their crystal structures. Four-acid digestion with hydrofluoric acid dissolves silicates. Aqua regia does not. Your routine lab measures only molybdenite-hosted molybdenum—that is what dissolves and is detected by the machine. Your check lab, using total digestion, measures everything—including the molybdenum locked in alteration silicates. That is your twenty-five percent uplift. You are not missing molybdenite. Your missing metal is *jìng huā shuǐ yuè*—flower in a mirror, moon in the water. Unless you fundamentally change your extractive technology, you will never recover it; it will remain a Potemkin village.'

Petr nodded, his stomach reminding him that while planetary assay was nice, lunch would be nicer.

'So the routine lab was not wrong. They were just not digesting everything.'

Dr Wei clutched his chest. 'Twenty-five percent! We have been underestimating our resource by twenty-five percent for an entire year! Twelve thousand samples! Six hundred check assays! All that data—and we have been reporting too low!'

Petr watched, mildly concerned the man might expire on the spot. 'Good Lord', he muttered. 'This isn't a mine—it's a bloody opera.'

Svetlana raised a hand. 'Dr Wei, stop. You are wrong. You are not underestimating anything. Aqua regia dissolves molybdenite—that is what you can float, concentrate, and sell. The silicate-hosted fraction stays in the tailings. Your routine lab measured your economically extractable resource. The check lab measured the total geological inventory. Both are valid. They answer different questions.'

Dr Wei blinked. 'But... twenty-five percent...'

'Is not a loss. It is a mineralogical fact.' Svetlana folded her arms. 'CRIRSCO reporting principles are clear: you report what is economically viable to extract. If you cannot recover it profitably with today's technology, it is not a Mineral

Reserve, and it does not go into your Life of Mine plan. China is now a member of CRIRSCO through the Chinese Association of Mineral Resource Appraisers (CAMRA). Same principles: transparency, materiality and competence apply. A Mineral Reserve must be economically viable—that is to say you can recover it in the plant and make money. You don't book what you can't recover.'

Dr Wei blinked. 'So the aqua regia values are not a mistake. They are the correct values for our Mineral Resource reporting.'

'Correct. Your routine lab was right for processing. The check lab was right for mineralogy. The only mistake was assuming one was 'right' and the other 'wrong'. They are both right—they just measure different things.'

Dr Wei exhaled. 'So my career is not over.'

'Not today', Petr muttered.

Dr Wei adjusted his spectacles, a faint smile creeping onto his face. 'We should do paired analysis by domain and report the recoverable fraction separately. My reputation is intact.'

'More than intact. The silicate-hosted molybdenum is real, but not recoverable with your current technology. Describe it, quantify it, explain it—and leave it out of your Life of Mine planning. That is not a mistake. That is demonstrating competence.'

Dr Wei straightened his spine. His shoulders squared—a general of the Han Dynasty who had just learned that Mongol scouts were riding through the Jade Gate, and had decided to lead the counterattack himself, the vanguard of the forlorn hope. 'I will ensure that everyone in this company—from the geologists to the accountants—knows what they know, and knows what they do not know.'

Svetlana inclined her head, her voice dropping to something quieter, weightier. 'Now you are beginning to understand. That is what CRIRSCO and CAMRA expect. That is what the very spirit of science demands. Confucius knew it two thousand years ago. And now, so do you.'

She turned and walked toward the door without looking back.

Petr watched her go, then leaned toward Dr Wei with a conspiratorial whisper. 'You can relax now. She's finished. The lecture is over. You don't have to stand like you're defending the Wall anymore. The Golden Horde has passed. And can we PLEASE go to lunch now?'

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That evening, the mine hosted a banquet. Lamb skewers. Noodles. Dumplings. Baijiu flowed.

Dr Wei raised a glass. 'To Doctor Rudakova—Svetlana. Who taught us that a spectrometer with a laser is only as good as the acid.'

Petr raised his. 'To digestion. It matters.'

Svetlana sipped her *chá*. 'One more thing. The bias is not uniform. High-grade cores—molybdenite veins—show less difference. Low-grade halos—molybdenum in silicates—show more. Map the spatial distribution. Do not apply a blanket correction. Do paired analysis by domain. Report what you can extract now. Describe the upside separately. That is what CRIRSCO and CAMRA require.'

Dr Wei nodded. 'We have learned our lesson.'

'Good. Next time, I want a new and interesting failure.'

Petr raised his glass again. 'To new and interesting failures. Something honest. Something I can fix with a hammer and tape. Not something hiding in a crystal lattice where no self-respecting mining engineer would look.'

***Ekaterina Pelenkova*** *(e.pelenkova@gmail.com)* *and* ***Mark Burnett***

*Profile image courtesy of ChatGPT.*

**Additional Reading**

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# obituaries

**Lew Ashwal**

**16 November 1949 to 16 March 2026**

*… a ripple in still water …*

*—Grateful Dead (1970)*

Professor Lewis D. Ashwal (known as Lew) is internationally recognised as one of the world's leading experts on anorthosites and related igneous rocks, who had a scientific career that bridged planetary science, crustal evolution, and some of Earth's most important geological terrains, including those in southern Africa. Over decades, his scholarship helped shape modern thinking on magmatic processes and global crustal evolution—work that crossed disciplines and spanned so many specialities, including enigmatic anorthosite petrogenesis, early crustal genesis, the record of Gondwana breakup in the Indian Ocean and the evolution of large igneous provinces on the Kaapvaal Craton. Lew was not only an inspirational and exceptional scientist who made us all think harder, but a generous, charming and hilarious friend to so many. His equal will be unlikely to be seen again.

Lew passed away in the early hours of 16 March 2026, at the age of 76. He was still supervising students, still writing, and still arguing about anorthosites. For those of us who worked alongside him in the School of Geosciences at the University of the Witwatersrand (Wits), his partner and closest scientific collaborator Susan Webb and their families, and for the very many colleagues around the world who knew him well, the loss is enormous, and it is difficult to know quite where to begin.

**Early life**

Lew was born in New York City on 16 November 1949, the son of Zacharia and Sylvia (Ende) Ashwal, and grew up in the Bronx. The Bronx never really left him. It was there in the accent, which four decades on another continent did nothing to soften, and in the directness, the impatience with pretension, and the willingness to tell a senior professor that an idea was nonsense in exactly those words. It was also there in the stories, that he told beautifully and often, and which his friends and students came to know almost by heart.

Chief among them was the family chocolate shop, which often served as the centrepiece of Lew's storytelling. It was a New York of small businesses, long hours, family obligation and the particular sensory world of a confectioner's back room, and he returned to it again and again, sometimes as comedy and sometimes as something much closer to tenderness.

Whatever it was that began in the Bronx produced a scientist entirely without side.

*Prof. Lewis Ashwal (16.11.1949–16.03.2026), on the Big Sur coastline of California*

Lew was as comfortable talking to a first-year student, a mine geologist, a Malagasy driver or a *Nature* editor, and he spoke to all of them in the same way.

*Lew in his early years, ca. 1955*

**Education and early career: from US training to planetary science**

Lew's formal training spans three major US institutions: a BSc from the State University of New York at New Paltz (1971), an MSc from the University of Massachusetts (1974), and a PhD from Princeton University (1979). At UMass, Lew studied under professors Peter Robinson, Stephen Haggerty and Tony Morse. UMass in those days had perhaps the most rigorous programme in the US in optical mineralogy and petrography, and igneous and metamorphic petrology in general. Although Robinson was Lew's dissertation advisor, it was likely Tony Morse who ignited Lew's lifelong fascination with anorthosites. Morse, at the time, was leading the ambitious Nain Anorthosite Project, and the sense that these rocks were both fundamental and unsolved took permanent hold. Most petrologists acquire a favourite rock at some point in their training. Very few acquire one and then spend the next fifty years refusing to let it go until it has given up rather more of its secrets than it intended to.

When Lew moved to Princeton for his PhD, he chose to work on anorthosites with Professor Robert Hargraves, on the Marcy massif of the Adirondacks, which is in many respects the type locality of the North American massif-type anorthosite problem. Hargraves was a palaeomagnetist of considerable talent and himself a product of southern African geology, and he was an inspired match. The Princeton years gave Lew a habit he never lost, of coupling very careful petrography and mineral chemistry to a much larger tectonic question. That work produced some of his earliest significant papers, including a rare-earth-element study of the Adirondack anorthosites and their associated rocks[1] and a detailed treatment of the mafic and Fe-Ti oxide-rich differentiates of the Marcy massif,[2] which was his first real engagement with the oxide-ore problem that would resurface throughout his career. Lew not only earned a PhD during these years in New Jersey, but also began a family with his wife at the time, Leslie Adams. Jesse, his son and first child, was born in Princeton (NJ) in 1977.

Immediately after his doctorate, he worked at the interface of geology and space science, first as a postdoctoral researcher at NASA's Johnson Space Center (1979–1980) and then as a Staff Scientist at the Lunar and Planetary Institute (LPI) in Houston (1980–1990). NASA had a research programme in early crustal genesis led by Bill Phinney, whose main mission was to work on terrestrial anorthosites as analogues to lunar anorthosites. The goal was comparative petrogenesis that would lead to an understanding of the major differences in lunar versus terrestrial planetary evolution. Lew's expertise in anorthosites was invaluable. The question he was handed in Houston, which is what a plagioclase-rich crust tells you about the planet that made it, is more or less the question he was still working on 45 years later.

These early appointments helped shape a research thrust that consistently linked field observations, geochemistry, and big-picture questions about crustal evolution (on Earth and beyond). The source of SNC meteorites was one of the fundamental topics investigated by Lew and Chuck Wood in the early 1980s and after 'excluding the impossible' they suggested that Mars was the likely parent body,[3] a suggestion that was subsequently strengthened.[4] It is now so thoroughly part of the textbook furniture that it takes some effort to remember how radical it was at the time to argue, on petrological grounds and well before the trapped-gas evidence settled the matter, that we were holding pieces of another planet in our hands. Lew was never much bothered about the credit. He simply liked that they had been right.


*The NASA team asking big questions of Moon rocks*

The Houston years mattered in other ways as well. The LPI was built to bring people together, and Lew developed there a lifelong talent for the productive workshop, for getting the right dozen people into a room with the right unsolved problem and letting the argument run. A great deal of his later editorial and synthesis work has its roots in that decade. His family also grew in Houston, where Jennie Ashwal, his second child, was born in 1979. Lew also met Susan Webb, who was interning at NASA, during his time in Houston.

**Moving to South Africa: building a long-term southern African legacy**

In 1990, Lew relocated to Johannesburg to take up a professorship at Rand Afrikaans University (RAU, now the University of Johannesburg), and in 2001 he moved to Wits, where he served as a senior academic, and latterly as an NRF A-rated Professor, in the School of Geosciences.

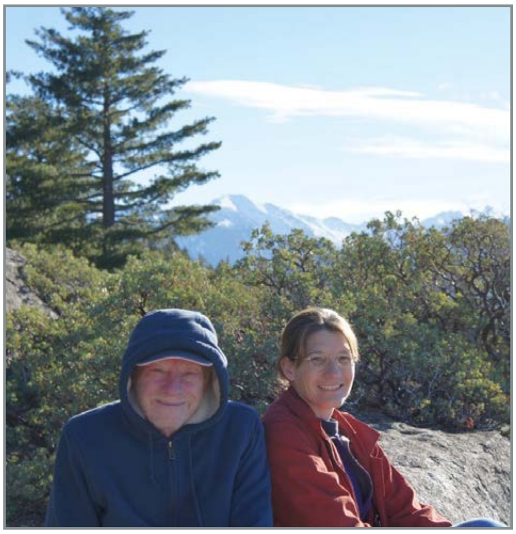
*A young Lew with his signature baseball cap*

*Lew with his former wife, Leslie Adams, and their children Jennie and Jesse, ca. 1982*

The move surprised a number of his American colleagues, because South Africa in 1990 was a country whose future was, to put it mildly, undetermined. The geological logic, though, was impeccable, and Lew simply followed it. He had spent a decade thinking about early crust and had moved to within driving distance of some of the best-preserved early crust on the planet, alongside the world's largest layered intrusion and one of its largest impact structures. He also arrived at exactly the moment when southern and East African geology was opening up to international collaboration after decades of relative isolation, and he threw himself into that opening with an energy that shaped the next 35 years of his own work and the careers of a great many other people.

Lew became renowned as a globally networked, highly cited scientist in a region whose geology is central to understanding Earth history and ore genesis. What matters just as much is that he never treated South Africa as a field area to be mined for data and written up somewhere else. He built a research group, supervised local students, published in the *South African Journal of Geology* as readily as in *Nature Communications*, served the Geological Society of South Africa (GSSA), and made Johannesburg a place that international collaborators came to rather than merely passed through. He became, in every sense that matters, a South African geologist, without ever ceasing for a moment to be a New Yorker. He also convinced Jennie, Jesse, and Sue, using his exceptional powers of persuasion, to join him on this adventure at the southern tip of Africa.

Like many great individuals, this family support and his career-long life and scientific collaboration with Sue, enabled Lew to produce his best science and follow his passion. Sue taught Lew a lot more geophysics than he would ever have known otherwise, and this cross-disciplinary partnership is evident in the many scientific papers that Lew and Sue coauthored and the students they inspired. Jennie, Jesse and Sue not only provided a foundation for a trans-Atlantic relocation, but decades later also provided the vital support Lew needed, along with his dedicated carer Dot, to continue pursuing cutting-edge science, even as his health deteriorated.



*Lew and Sue Webb in Sequoia National Park, 2012*

**Scientific legacy: anorthosites, the early Earth, large igneous provinces and crustal evolution**

***Anorthosites***

Lew is widely regarded as a foremost authority on anorthosites—unusual plagioclase-rich igneous rocks that occur on Earth and the Moon and carry deep implications for crust formation processes. They are, on the face of it, rather absurd rocks. They occur as enormous volumes of almost pure feldspar, with no obvious complementary residue, emplaced overwhelmingly within a restricted window of Earth history and then hardly ever again. Almost everything about them is contested, including the source of the magmas, the depth of differentiation, the mechanism by which plagioclase accumulates and ascends, the tectonic setting, and the reason for their distribution in time. Lew spent his career on these questions, and the way most of them are framed today owes a great deal to him.

A major pillar of his global impact is his scholarly synthesis work. His monograph '*Anorthosites*' (Springer, 1993)[5] became a foundational reference on the subject and helped define modern debates about anorthosite petrogenesis and crustal evolution. Running to more than 400 pages, it remains the standard reference more than three decades later, which is a rare thing in a fast-moving science, and it reflects both the thoroughness of the compilation and the fair-mindedness of the arguments. It is the book that made the subject accessible to non-specialists and gave a generation of students a single place to start. Almost anyone who has worked on anorthosite since 1993 has worked with Ashwal (1993) open on the desk.

He also framed what has become one of the central organising questions of the field, which is why anorthosites are distributed in time the way they are. In '*The temporality of anorthosites*' (2010),[6] and later at much greater length in '*Crustal evolution and the temporality of anorthosites*' (2017),[7] he assembled the global record and argued that the Proterozoic concentration of massif-type anorthosites is not a preservation artefact but a real signal about the secular evolution of Earth's mantle, crustal thickness and tectonic regime. Lew would have been the first to say that the debate is far from closed, but the framing has become the standard one, and the compilation itself is a piece of infrastructure that the community will be using for decades.

Alongside the synthesis ran a long series of field and analytical studies across almost every important anorthosite terrane on Earth. He worked on the Adirondacks and Nain in North America, on Rogaland in southern Norway, on the Kunene Complex straddling the Angola–Namibia border, which is one of the largest anorthosite bodies on the planet,[8] on the massif-type anorthosites of southwest Madagascar,[9] on the Archaean anorthosites of the Kaapvaal and other cratons, whose distinctive calcic and megacrystic character he did much to codify,[10] and on the anorthosites of peninsular India and Sri Lanka. He worked on them at every scale, from the isotopic composition of a single megacryst through to the global compilation of areal extent against age.

One particularly fruitful late strand concerned the giant orthopyroxene megacrysts found in many massif-type anorthosites. These have long been recognised as high-pressure passengers, but their implications had never been exploited systematically. Working with a number of us at Wits and elsewhere, Lew showed that the megacrysts and their inclusions record the Moho-level environment in which anorthositic magmas differentiate, and that their isotopic systematics can be decoupled from those of their host rocks in ways that expose lower-crustal contamination during slow ascent.[11] It was very typical of him. He took a familiar object that everybody had looked at and nobody had properly interrogated, and turned it into a probe of a process that could not be reached any other way.

*Lew in 2011 admiring the labradorescent anorthosite cladding at the Geological Survey of Newfoundland and Labrador in St John's, Canada*

***The Moon, Mars and planetary crusts***

Lew's decade in Houston left a permanent planetary dimension to his thinking, and he never accepted the disciplinary partition between terrestrial and planetary petrology. The lunar highlands crust, an anorthosite floating on a magma ocean, was for him not an exotic curiosity but the comparative endpoint against which terrestrial anorthosites had to be understood. The question he kept pressing was why two planetary bodies with broadly similar starting ingredients produced such radically different feldspathic crusts, and what that difference tells us about magma oceans, plate tectonics and the thermal evolution of rocky bodies.

The SNC work described above belongs here too, as does his continuing interest in meteoritics and in the petrology of extraterrestrial materials. Later in his career the planetary thread re-emerged whenever the terrestrial record looked anomalous. If a rock type is common on the Moon and vanishingly rare on Earth, or common on Earth in a one-billion-year window and absent outside it, then that is a planetary-scale fact and it requires a planetary-scale explanation. Very few petrologists hold both frames at once. Lew did it without appearing to think about it.

***Greenstone belts and the early Earth***

Lew's interest in early crustal genesis found its second major synthesis in '*Greenstone Belts*' (Oxford University Press, 1997),[12] co-edited with Maarten de Wit, an influential compilation that consolidated thinking on the early Earth and the evolution of some of the planet's oldest crustal fragments. It grew out of an LPI workshop and years of subsequent argument, and it appeared at the moment when the question of how, and whether, Archaean tectonics resembled the modern kind was becoming central to the discipline. That two such different and equally forceful personalities produced a coherent volume out of it is a small monument to Lew's editorial patience.

The greenstone belt work also cemented his connection to Barberton and the other Kaapvaal belts, and to the broader question of Archaean crustal architecture that runs through so much of his southern African output.

***Gondwana, Madagascar and the Indian Ocean***

From the mid-1990s, Lew became one of the central figures in the modern re-examination of Madagascar's Precambrian basement and its place in Gondwana. In a long collaboration with Robert Tucker, Michael Hamilton, Raymond Rambeloson and others, he helped rebuild the geochronological and isotopic framework for the island's Archaean and Proterozoic terranes,[13] demonstrated the presence and significance of its massif-type anorthosites,[9] and contributed to the reconstruction of the East African Orogen and the final assembly of Gondwana. That work also produced one of his more technically influential results, a demonstration of the consequences of slow deep-crustal cooling for Pb-loss in zircon,[14] which geochronologists still cite as a caution.

He extended the same approach to the Seychelles, where he and colleagues argued from geochemistry and geochronology for an Andean-type arc origin for the Neoproterozoic granitoids,[15] and to northwestern India, Sri Lanka, and the scattered basement fragments of the Indian Ocean realm. Taken together, this amounts to a sustained, decades-long attempt to reassemble a supercontinent from the pieces left behind on islands, and it required equal parts petrology, geochronology, palaeomagnetism, plate reconstruction and a sheer willingness to travel.

***The 'lost continent' of Mauritia***

That work produced the result for which Lew became widely known outside specialist circles. With Trond Torsvik and colleagues, he pursued the hypothesis that fragments of ancient continental crust lay buried beneath the young volcanic islands of the western Indian Ocean, left stranded during the breakup of Gondwana and later paved over by the products of the Deccan–Réunion mantle plume.

The clinching evidence came from Mauritius, through the high-profile discovery of ancient zircons within young hotspot-related volcanic rocks—a result that provided strong evidence for older continental crust beneath the island and enabled reconstructions of continental fragments in the Indian Ocean realm. In '*Archaean zircons in Miocene oceanic hotspot rocks establish ancient continental crust beneath Mauritius*' (2017),[16] Lew and his co-authors reported zircons up to some three billion years old, recovered in situ from six-million-year-old trachytic rocks on an island built entirely of oceanic volcanism. There is no honest way for a three-billion-year-old zircon to be sitting in a Miocene lava on an ocean island unless the magma passed through old continental crust on its way up. That work, published in *Nature Communications*, helped popularise a geochronological argument in a way that still pointed back to rigorous tectonic reconstruction and crustal affinity (e.g., links to Madagascar-scale continental fragments). It led to the recognition of the so-called 'lost continent' of Mauritia.

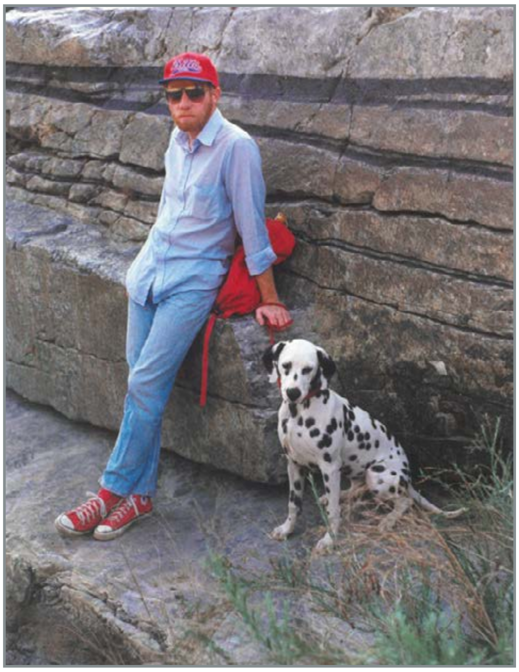
It also, delightfully, went everywhere. Lew often reflected how proud he was that this discovery made it to the headlines of his 'hometown' newspaper, the *New York Times*, but more importantly, in an interview in *Cosmopolitan*. Linked to this, his love of Taylor Swift (and good music in general), will be forever memorialised in the interview highlighting this work (watch until the end!).

***Plumes, large igneous provinces, kimberlites and old sutures***

Lew's interest in the origin of large igneous provinces (LIPs), kimberlite and hotspot magmatism was instrumental in developing novel models that attempted to link surface volcanism with processes in the deep mantle. Working with Torsvik and others, he argued that the eruption sites of LIPs and kimberlites cluster above the margins of the large low-shear-velocity provinces at the core-mantle boundary once they are restored to their palaeopositions. It is a bold claim about the coupling of the deepest and shallowest parts of the planet, and Lew rather enjoyed how bold it was.

A related and characteristically inventive contribution was the recognition, with Kevin Burke and Sue Webb, that deformed alkaline rocks and carbonatites, or DARCs, can be used to map old and otherwise cryptic sutures, because alkaline magmatism is emplaced in extensional settings and is only subsequently deformed where a suture later closes on it.[17] Earlier, he and Burke had used African topography, volcanism and lithospheric structure to argue for the dynamic support of the African plate.[18] Both papers are good examples of something Lew was unusually good at, which was taking an ordinary observation that everybody had filed away and showing that it was a fundamental clue—in this case, a mapping tool.

*Lew assessing basaltic lava flows on Réunion Island in 2019*



*Stripes and spots… with layered chromitites and anorthosites at the Dwars Rivier locality in the eastern Bushveld Complex*

***The Kaapvaal Craton, Bushveld and southern African bedrock***

Lew was a big proponent of mantle plumes. In his final eight or so years at Wits, he focused a lot of his time into unravelling the magmatic evolution of the largest LIP events on the Kaapvaal Craton—from the Ventersdorp, to the Bushveld, to the Umkondo, and finally our most recent voluminous magmatic event, the Karoo LIP. This endeavour was initially fuelled by a prestigious grant from the Oppenheimer Memorial Trust in 2019, which clearly recognised Lew's academic excellence and the significance of the research question he pursued: Why does the Kaapvaal Craton have a unique record of incredibly large, plume-driven magmatic events throughout its history?

Lew, in his publication '*Sub-lithospheric mantle sources for overlapping southern African Large Igneous Provinces*',[19] was adamant that these four major Kaapvaal LIPs were sourced from the sub-lithospheric mantle, which was melted when hot plumes rose up from the interior of the Earth. Alongside this, Lew was fascinated, like many others, by the origins of the Bushveld Complex. One of his most important contributions on the Bushveld was an incredibly meticulous mineralogical and geophysical documentation of the Bellevue drillcore, a nearly three-kilometre continuous section from the Northern Limb[20] that led to advancement to our understanding of how magmatic layering forms. Not only did he and Sue Webb meticulously log, measure and sample this drillcore, but Lew also spent thousands of hours determining in-situ mineral compositions. This, like many of the tasks he undertook, was a labour of love, enjoyed with his loving life partner and closest scientific collaborator and supporter.

He also worked on the ultramafic and chromite-bearing bodies of the craton, on magmatic ore genesis, and on the granophyre dykes of Vredefort, which was a neat closing of a circle for a man who had begun his career thinking about impact melt on the Moon.

His southern African work was consistently characterised by the same instinct, which was to place the local observation in a global comparative frame, and to insist that a rock from Limpopo be explained by the same physics as a rock from Labrador.

**Lew as teacher and supervisor**

Any account of Lew's legacy that stops at his publications misses at least half of it. He was an outstanding and unusually demanding teacher, and an exceptional research supervisor to a long line of Honours, MSc and PhD students at RAU and at Wits, as well as a mentor, formally and informally, to postdoctoral researchers and early-career staff on several continents.

Undergraduates met a lecturer who was funny, blunt, thoroughly unimpressed by memorisation, and delighted by a good question. He taught optical mineralogy and igneous petrology the way he had learned them at UMass, which was at the microscope, slowly, and with the expectation that you would look properly and describe what you actually saw rather than what the textbook told you to expect. Generations of Wits and RAU students learned from him that petrography is not a chore that precedes the real science, but that it is the science, and that the person who has looked hardest at the rock usually wins the argument.

His postgraduate supervision had a particular character. Lew gave students real problems rather than safe ones, and then gave them room, which could be alarming at first and was, looking back, the making of a great many careers. He was generous with authorship, scrupulous about credit, and completely reliable on the things that actually matter to a student. He read drafts quickly, he answered emails, he found the money, and he turned up. He also took his students into the field on a scale that is now almost unheard of, and he understood that a doctorate is partly an apprenticeship in a community, which is why so many of his students met, in his company, the people whose papers they were reading.

The measure of it is fairly simple. A very large proportion of the people currently working on anorthosites, on Madagascar and Indian Ocean geology, and on Kaapvaal magmatism either trained with Lew or were substantially shaped by him, and that is a legacy that no citation index will ever record.

**Travelling all over the globe**

Lew was a field geologist of the old and indefatigable school, and he saw an astonishing amount of the planet doing it. His work took him repeatedly across Africa, and to Madagascar and the islands of the Indian Ocean, including the Seychelles, Mauritius and Réunion. He worked in India and Sri Lanka, in Norway and Sweden, in Labrador and the Adirondacks and the American Southwest, and in most of the places where an anorthosite has ever been reported.

He was superb in the field, ferociously observant, and always the first to spot the outcrop that ruined the day's working hypothesis. He was also, by universal report, the best possible person to be stuck with (despite the complaints), whether on a washed-out road in Madagascar, in a hotel with no water, or on the long flat drive across the Highveld, when the stories would start. Lew would even try to focus on the brighter side of life when the only form of musical distraction was a Spice Girls CD during a long, boring drive across the Kalahari.

Even when he had to lumber around a portable oxygen concentrator machine in 2019, Lew still pitched up with enthusiasm for fieldwork. His final two field outings found him in the Chimanimani mountains of Eastern Zimbabwe, hunting for igneous intrusions related to the Umkondo LIP, in September 2019, before his final venture into the Indian Ocean on Réunion, to continue the hunt for Mauritia, in November 2019. Despite the visible discomfort he was in at times (and that was not just because of the bottle of Aberlour the night before!), Lew was still there—discussing plumes, magmas, plate tectonics, and everything else, on the dirt roads of Eastern Zimbabwe to the cirques of Réunion.

*Field geology, tropical island style—North Island, Seychelles, 2008*

**Music, humour, and the man himself**

Music infused Lew's life. He was a devoted and knowledgeable listener across an unusually wide range, from the Grateful Dead above all, whose lyric opens this tribute, through to Taylor Swift, an enthusiasm he defended with the same rigour he brought to petrogenesis and with obvious relish for the fact that it discomfited people who expected an eminent professor to have more solemn tastes. His seminars, his office and his vehicles all had soundtracks. He didn't just listen, however. He regaled many of his exploits as the guitarist in the band he created in Houston, officially known as 'The Bags' (although he was always quick to reveal that the actual name of the band, 'The Body Bags', was a little too edgy for the audiences back then).

*Lew in action as frontman for The Bags*

Beyond academic and intellectual accolades, and beneath his Bronxian exterior, Lew was incredibly caring and generous. The gruffness was a real part of him and it was also, quite transparently, a delivery mechanism. The same person who would demolish a weak argument in a seminar without ceremony would then spend two hours over a beer helping the person whose argument it was to build a better one. He noticed when people were struggling. He kept up with former students for decades. He wrote the reference, made the introduction, funded the trip, and never mentioned any of it afterwards.

Characteristic of Lew (and Sue's) generosity is how their home became a welcome way-station for anyone they knew working in South Africa or transitioning into southern Africa. Hundreds of friends, collaborators and students have enjoyed this hospitality and scientific rendezvous. Castle Sue-Lew, as it became known, by the frequent visitors, also hosted many epic parties.

He was very funny, in a dry, fast and frequently inappropriate way that was never unkind. He was an outstanding conference companion and a formidable presence at any dinner table. He was also, unusually for someone of his eminence, completely uninterested in status. He did not pull rank, he did not perform seniority, and he was plainly bored by academic politics. What he wanted to talk about was the science.

*Lew and Musa Manzi at one of Johnny Clegg's final open-air concerts.*

**Honours and recognition**

Lew's stature is reflected in national and international awards, including the Jubilee Medal and the Draper Medal of the GSSA, the latter awarded in 2024 and the Society's highest accolade. He was selected by the GSSA to present the 35th AL du Toit Memorial lecture series in 2018 with a lecture titled 'Wandering Continents of the Indian Ocean' that was presented at 8 venues across South Africa and in Harare, and it was a fitting subject for a man who had spent 30 years putting the Indian Ocean back together.

His long-standing A-rating through the National Research Foundation of South Africa, held continuously from 2011 and renewed for a third time in 2025, highlights the leading, internationally recognised role he has played in local and global geoscience discovery and training. Lew was one of only 4 geoscientists elected to the Academy of Science of South Africa. In 2024 he received the University of the Witwatersrand Vice-Chancellor's Research Award, the University's premier recognition of research achievement. He was a Fellow of the GSSA, a member of the American Geophysical Union, and a professional natural scientist registered with SACNASP. At the time of writing, Lew has a Google Scholar h-index of 61, with more than 13,000 citations of his work, across some 140 peer-reviewed papers and two books that have defined their subjects.

**Coda**

The work will survive, and it plainly will. There is the book that is still the standard reference 33 years on, the compilations that will be used for decades yet, and the framing of questions that the field will go on arguing about long after everybody who knew him is gone.

That is not really what his friends and family will miss, though. What we will miss is the man in the smoke-filled office and the pointed scientific argument, the laugh or booming request from three rooms away, the story about the chocolate shop, *The Bags* or fieldwork epics, and the uncomplicated pleasure he took in a good rock, a good argument and a good song.

Lew is survived by his former wife, Leslie Adams, his children Jennie Ashwal and Jesse Adams, and his long-term life partner and scientific collaborator for over 30 years, Susan Webb.

Hamba kahle, Lew.

*… a ripple in still water, when there is no pebble tossed, nor wind to blow.*

***Grant Bybee**, **Trond Torsvik**, **Ben Hayes**, **Steve Shirey**, **Freddie Roelofse** and Lew's family*

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| TBC October | Mineral Resource Mastery | Online |
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**cimera**
DSI-NRF CIMERA
Centre of Excellence for Integrated Mineral and Energy Resource Analysis
UNIVERSITY OF JOHANNESBURG
Prof Nikki Wagner
Director: DSI-NRF CIMERA
+27 (0)82 853 9780
+27 (0)11 559 4917
nwagner@uj.ac.za / cimera@uj.ac.za
Department of Geology
University of Johannesburg
PO Box 524, Auckland Park 2006
Johannesburg, South Africa
www.cimera.co.za

**INNOV-X AFRICA**
KEENAN LEWIS
+27 (0) 64 890 0591
keenan@innovxafrica.co.za
+27 (0) 10 006 0430
36 1st Ave, Dunvegan,
Edenvale, 1609, South Africa

**MAPTEK**
Dominic Muroa
Business Development Specialist
(Geoscience)
dominic.muroa@maptek.co.za
T: +27 (0)11 750 9660
M: +27 (0)73 062 5833
26 Baker Street
Rosebank
Johannesburg, 2196
South Africa

Maryke
Manager EMEA
mmaree@maxgeo.com
+27 83 745 6808
Office Block B, Ground Floor
Lifestyle Office Park,
Lifestyle Garden Centre
1 Ysterhout Drive
Randpark Ridge 2169
Johannesburg
maxgeo.com
Lets connect
@MarykeMaree

**Acquire Technology Solutions**
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Tshego Majane
Customer Success Manager, EMEA
A Floor 2, 18 Melrose Blvd, Melrose North, Johannesburg, 2196
T +277 2270 3707
E tshego.majane@seequent.com
E support@seequent.com
seequent.com

**UCP AFRICA**
Unique Core Products Africa (PTY) LTD.
Grant Wilson
Managing Director
+27 83 700 7797
grant@ucpafrica.com

2026 Rates

# rates card 2026

incl VAT

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| Full Pg | R3 000.00 | R9 000.00 |
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At least 4 weeks prior to deadline

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Contact person: Kate James-Kleynhans
e-mail: info@gssa.org.za

## 7. ADDITIONAL CONTACT INFORMATION

### EDITORIAL OFFICE

Dr. T. Owen-Smith geobulletin@gssa.org.za

### DESIGN & LAYOUT

Annerine Lubbe
cell: 071 897 6240
e-mail: info@squaredesign.co.za

### SOCIETY OFFICE

**GSSA**
Postal/Physical Address:
Building 10, Thornhill Office Park, 94 Bekker Street, Vorna Valley, Midrand, Johannesburg, 1686

Phone:+27 (0) 10 143 2096
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