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Geological Society of South Africa

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news

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Front cover photo:
Vibrant pink ephesite overgrown and intergrown with dark wine-red, cleaved mangan-diaspore. Field of view is 3.6 cm. Specimen from Gloucester Mine. (Specimen and photo: Bruce Cairncross)
For more about ephesite from the Postmasburg manganese field, see Mineral Scene on pg. 34.

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guest editorial

Matt Mullins

The Scarcest Orebody Is People—and South Africa Is Falling Behind

We're entering a constrained-growth era, where capital and skills are the bottlenecks, not geology.

Mining is once again being declared "strategic". Governments want critical minerals, investors want exposure to copper, lithium, graphite, nickel and rare earths, and the energy transition has re-branded the industry as essential rather than extractive. Yet beneath the rhetoric lies an uncomfortable truth: the global mining industry is entering a decade defined not by geology, but by constraints.

Not capital alone. Not commodity prices alone.

But people constraints, compounded by chronic under-investment, and nowhere is that tension more visible than in South Africa.

This is not a future problem. It is already here.

At the recent Future Minerals Forum in Riyadh, and at the Mining Indaba in Cape Town, a number of these trends were hotly debated.

Trend 1: The talent shortage is structural, not cyclical

For decades, mining talent ebbed and flowed with the commodity cycle. Booms attracted students, busts drove them away. The assumption was always that supply would recover "next time".

That assumption is now broken.

Across the major mining jurisdictions—Australia, Canada, Chile, the US, the UK, South Africa and others—the pipeline of geologists and mining engineers has thinned, aged, and in some cases fractured entirely.

Australia offers the clearest warning signal. Despite being one of the world's most mining-dependent economies, it employs only around 6,500 professional geologists and about 10,000 mining engineers today.[1] That is a surprisingly small number for a country that dominates global exploration and mining finance. More alarming still is what sits behind that figure.

In the Australian *Mining Research Bulletin* (January 2026),[2] the Mining and Automotive Skills Alliance (AUSMASA) states that between 2014 and 2023, enrolments and completions in mining engineering degrees declined, with the steepest drop occurring between 2014 and 2018—enrolments fell from 2,420 to 770 (a ~68% drop) and completions declined by about 65% over the same period. A decade on, enrolments have not rebounded meaningfully. The result is a missing generation of professionals now colliding with mass retirements. The shortage of geologists and mining engineers is now cited as a structural risk for future mining development in strategy discussions.

The United States tells a similar story. Long-term data from the American Geosciences Institute[3,4] show that geoscience degree output peaked years ago and has struggled to keep pace with replacement demand, even before accounting for competition from environmental consulting, data science and renewables.

According to the *Enrolment in crisis* strategy report jointly published by University Geoscience UK and the Geological Society of London in 2023,[5] the number of geology students at UK universities has declined year-on-year since 2014, with a cumulative drop of around 43%, prompting concern from universities and professional bodies that entire departments may disappear without interventions to arrest the trend.

On the positive side, mining engineers are now some of the highest earners in Australia, ahead of company directors. According to data released by the Australian Taxation Office (ATO), the nation's mining engineers rank seventh out of Australia's highest-earning occupations, with an average taxable income of AU$206k—just edging out legal professionals by $15 and earning more than the average chief executive officer or managing director.[6]

South Africa is not immune—and is arguably more exposed.

The South African mining industry employed approximately 473,484 people directly as of 2024, according to the Minerals Council of South Africa[7]—almost identical to the 464,174 in 2017.

But specialist skills—exploration geologists, resource modellers, rock engineers, mining engineers—are thinly spread, globally mobile and increasingly expensive. Unlike labour, skills migrate to certainty, not potential.

And certainty is precisely what South Africa has struggled to project.

Historically, South Africa's mining industry benefited from robust apprenticeships and in-service training systems embedded within major mining companies and supported by technical colleges and industry-aligned training centres.

These programmes produced artisans, technicians and junior professionals with practical, mine-ready skills, and formed a critical pipeline between academic qualification and operational competence.

Over time, many of these apprenticeship- and graduate-development pathways have been scaled back or discontinued, often because of cost-cutting during prolonged commodity downturns, outsourcing of technical functions, and declining confidence in long-term project pipelines. The result is a widening disconnect between formal qualification and industry readiness.

South Africa continues to produce a significant number of mining engineering and geology graduates each year. However, many struggle to secure entry into the industry due to limited exposure to site-based training, mentoring and practical work experience. At the same time, mining companies increasingly seek experienced graduates who can add immediate value, creating a structural bottleneck at the point of workforce entry.

This dynamic has created a paradox: a country with capable universities and strong academic output, yet a growing cohort of technically qualified graduates who remain under-employed or excluded from the sector, while industry simultaneously reports acute skills shortages.

Trend 2: The world is under-investing in mining—quietly and persistently

If talent is the first constraint, capital is the second.

Despite the narrative of a "supercycle", the mining industry has spent much of the past decade in capital discipline mode. After the excesses of the early 2010s, boards and investors demanded restraint. Projects were delayed, exploration budgets trimmed and risk tolerance narrowed.

Global exploration spending fell again in 2024, to approximately US$12.5 billion, down from its peak of US$13.1 billion in 2022.[8] While lithium exploration surged post-2020, gold still dominates exploration budgets and base-metal investment remains uneven.

At the top end, capital expenditure by the 30 largest mining companies reached about US$109 billion in 2023, up modestly from the prior year—but forecasts suggest a flattening or decline beyond 2024.[9]

This is not the capital posture of an industry preparing for exponential demand growth.

The result? A thinner project pipeline precisely as demand signals strengthen.

The International Energy Agency has been blunt: investment momentum in critical minerals weakened in 2024, with exploration activity plateauing despite repeated warnings about future supply gaps.[10]

This matters because mines are not built quickly. From discovery to production takes an average of 16 years.[11] Under-investment today is not a rounding error—it is a future supply shock waiting to happen.

In a country attracting less than 1% of global exploration capital, this lag is especially dangerous.

Trend 3: South Africa's exploration problem is now a competitiveness problem

If global under-investment is worrying, South Africa's position within it is alarming.

South Africa currently attracts less than 1% of global exploration spending—approximately 0.9%, according to the Minerals Council of South Africa.[7] In 2023, exploration finance amounted

South Africa's Share of Global Exploration Spend and Contribution to GDP

Year	Global Exploration Budget $bn[8]	South African Exploration Budget $M[8,12,13]	SA % Share (Approximate)	Mining as a % of South Africa's GDP[7]
2016	6.9	96.3	1.4%	7.3%
2017	8.0	86.6	1.1%	6.8%
2018	10.1	97.9	1.0%	8.1%
2019	9.8	97.4	1.0%	8.3%
2020	8.3	77.4	0.9%	7.1%
2021	11.2	85.1	0.8%	7.6%
2022	13.1	104.8	0.8%	7.3%
2023	12.9	117.0	0.9%	6.3%
2024	12.5	121.3	1.0%	6.0%
2025	12.5	N/A	N/A	N/A

to just US$117 million (or 0.9% of the total), compared with US$2.4 billion in Canada and US$2.2 billion in Australia. This compares to about 5% in the early 2000s.

The data tell the story clearly (see table above).

This is not because South Africa lacks geology.

It is because capital prices risk, and exploration capital is the most risk-sensitive money in the mining value chain.

The irony is stark: mining still contributes roughly 6% of South Africa's nominal GDP, making it far more economically significant than in many peer economies. Yet exploration—the foundation of future mining—is starved. We are harvesting the benefit of past exploration and development expenditure in our historically long-life mining operations.

South Africa's government and industry have targeted a return to ~5% share,[14] but without clear actionable objectives on how to achieve this there is a high likelihood that this will not be realised.

Canada, Australia and Chile offer stark contrasts. In Canada, mining contributes 5% to GDP and attracts 19% of global exploration spend ($2.55bn); in Australia, mining accounts for 13.6% of GDP and attracts 12.7% of global exploration spend ($1.62bn); and in Chile, mining accounts for roughly 12% of GDP and exploration investment amounts to 6.5% of global exploration spend ($832m). These jurisdictions benefit from world-leading exploration finance ecosystems, regulatory clarity and efficient permitting. Flow through investing and tax treatment of exploration expenditure assists these jurisdictions, but this is only part of the story.

South Africa, by contrast, has allowed policy uncertainty, licensing delays, cadastral failures and infrastructure bottlenecks to compound, sending a clear signal to global explorers: deploy capital elsewhere.

Africa as a whole has been consistently overlooked in global mineral exploration investment, despite offering some of the highest returns per dollar spent. Its share of global exploration spending has declined consistently, falling from 13 percent in 2016 to just 10.4 percent in 2024.[13] This drop is striking given that Sub-Saharan Africa is the most cost-effective region globally for mineral exploration.

The situation in the Kingdom of Saudi Arabia (KSA) reflects the government's desire to diversify their mining sector. It is a core industrial pillar of Vision 2030 aimed at reducing oil dependency and building new revenue streams. The government's strategy includes regulatory reforms (like new mining laws and tax incentives), geological surveys, exploration incentives and licensing to attract investment.

Exploration budgets have grown from $21 million in 2022 to $146 million projected in 2025, with KSA (through Ma'aden) planning to invest $100bn through to 2035.

Trend 4: Capital markets are selective—and South Africa is losing visibility

Mining capitalisation data reinforce the same story. Annual reviews such as PWC's *Mine* series show a consistent pattern: value has concentrated in fewer, larger, jurisdictionally "safe" companies.

The global mining industry's listed value has recovered from the 2015 trough, but it has not diversified geographically. Australia, Canada, and a handful of emerging jurisdictions dominate mining equity markets. South African exposure has steadily declined in global portfolios.

This matters for talent as much as capital.

Young professionals gravitate towards companies with growth projects, share-based incentives, and international optionality. When South Africa loses visibility in capital markets, it also loses mindshare among the next generation of geoscientists and engineers.

The commodity cycle is sending a warning signal

Commodity prices have been volatile but broadly supportive over the past decade. The IMF Primary Commodity Price Index shows strong cyclical swings—a collapse in 2015–2016, recovery through 2018, a pandemic dip, and a powerful surge from 2021–2022 driven by stimulus, supply disruption, and energy-transition demand.

Yet price signals alone are not enough to mobilise investment or skills. Without confidence in project delivery, prices simply inflate margins elsewhere.

The risk is clear: the world may enter the 2030s with strong commodity demand, high prices—and insufficient supply, skills and projects to respond.

What this means for South African geologists

For South African geologists, this moment is paradoxical.

On the one hand, our skills have never been more globally valuable. The world needs exploration expertise, resource definition, mine optimisation and geological judgement.

On the other hand, South Africa risks becoming a training ground rather than a destination—exporting skills while importing commodities at higher cost.

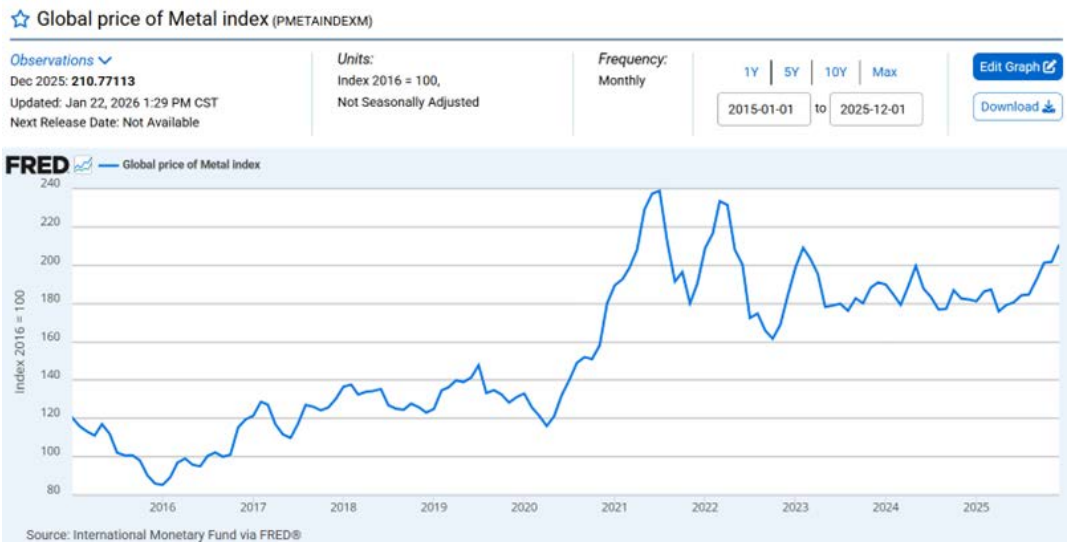
This is not inevitable. But it requires action.

A South Africa-specific call to action

If South Africa wants to remain a serious mining jurisdiction—not just a legacy producer—five things must happen urgently:

1. Fix the cadastre—completely

Exploration cannot recover without a transparent, functional, digital mining cadastre. This is not optional. It is table stakes.



IMF Primary Commodity Price Index (2015–2025). Source: International Monetary Fund, Global Price of Metal index

For more than a decade, successive commitments have been made to modernise South Africa's mining cadastre. Yet as of the 2026 Mining Indaba, the system remains delayed, with data integrity issues still hindering rollout.

2. De-risk early-stage exploration

Junior explorers need certainty, speed and access to land. Streamlined permitting, clear timelines and predictable regulation matter more than incentives. Tax incentives for exploration expenditure are essential.

3. Invest in the skills pipeline

Universities, industry and government must treat geology and mining engineering as strategic disciplines, not legacy ones. Scholarships, industry-funded chairs and modernised curricula are essential.

Building the career pathway will require shared responsibility: mining companies willing to invest beyond immediate productivity metrics, academic institutions aligned more closely with operational realities, and policy frameworks that recognise early-career training as a strategic investment rather than a discretionary cost.

4. Compete for talent—globally

South Africa must accept that it is competing with Australia, Canada, Chile and others for people. That means addressing visa certainty, professional recognition, safety and career mobility.

5. Rebuild confidence

Above all, capital and skills follow confidence. Policy coherence, infrastructure delivery and consistent messaging matter. Mining cannot be treated as a political football and be expected to thrive.

Conclusion: the window is narrow

Mining cycles are long. Skills cycles are longer.

The world is entering a decade of mineral competition, not abundance. Countries that secure talent and investment now will define supply for the next generation. Those that hesitate will import scarcity at premium prices.

South Africa still has extraordinary geology. It still has world-class professionals.

But geology alone does not build mines.

If we do not act decisively, the scarcest orebody in South Africa will not be copper, lithium, or platinum. It will be people.

Matt Mullins
Executive Consultant, Snowden Optiro

Please note that the views expressed in this article are those of the author and not of the company he represents.

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manager's corner

Tania Marshall

If you go back to the early history of the GSSA, it was always managed by a Council (dominated by men in suits). The day-to-day operation of the Society was handled by volunteers, but this eventually became too onerous as the membership numbers grew and the range of activities expanded.

In July 1994, the GSSA embarked on a rejuvenation exercise. In this study, five crucial areas were identified:

- The need to place the Society on a solid business foundation
- To involve more members in the management and operations of the Society
- To integrate the aspirations of the divisions/branches with the overall strategy of the Society
- To provide a professional service to the members in accordance with principles adopted globally
- To streamline the management and delegate authority, responsibility and accountability.

In 1996, the initiative was presented to the Council; a new constitution was drafted and was put into practice following the appointment of the first professional Executive Manager in 2003.

- **Leopold Bosch** was the first to be appointed to this position. Leopold joined the GSSA in 2003 as the Executive Manager, retiring from that post in 2009. Leopold had developed a number of practices and processes for governing the Society. He was an early proponent of Geoheritage and South Africa's mining history. And, what was more fascinating to me in terms of what was to follow, Leopold dabbled in diamond geology.

- **Dr Craig Smith** took over from Leopold when he stepped down in 2009. As a result of his experience in corporate management, his focus was on keeping the Society on a sound financial footing. During his time at the helm, the Society has progressed from strength to strength in achieving the goals identified by the 1994 review. Craig, too, is a diamond geologist, having spent over 15 years in service to the diamond exploration sector.

- Fast forward to 2026 and the appointment of the first female Executive Manager and, coincidently, also a diamond geologist, having spent some 30 years in exploration and mining of (primarily alluvial) diamonds.

I step into this position with a mixture of gratitude, excitement and trepidation. Gratitude for the trust placed in me; excitement for the opportunities to serve and grow the geoscience community; and trepidation at the weight of responsibility that comes with stewarding an institution that represents the heart of South African geology. Taking on the role of Executive Manager of the GSSA is a moment of profound honour for me—to follow in the footsteps of Dr Craig Smith, whose leadership and dedication have shaped the Society in immeasurable ways, is both inspiring and daunting. His leadership, dedication, and vision have left an indelible mark on the Society, and I am fully cognisant of the responsibility that comes with continuing this legacy.

I come to this role at a time of great possibility. We are navigating a world marked by global geopolitical uncertainty, where shifting alliances, conflicts, and supply-chain disruptions continue to influence commodity prices and reshape the landscape in which geoscientists operate. These global pressures are felt acutely here at home, where economic challenges and rising costs have created real hardship for many of our members. I am deeply mindful of these issues, and I come committed to ensuring that the GSSA remains a source of stability, support, and professional strength, providing the best value for our members at the lowest possible cost.

As Isaac Newton once said, *"If I have seen further, it is by standing on the shoulders of*

giants." I am acutely aware that my journey is made possible by the giants who came before—leaders, mentors, colleagues, and the countless geoscientists whose passion and perseverance have built the GSSA into what it is today.

This role is not about me alone, but about us together: advancing our science, nurturing transformation, and celebrating the diversity and excellence of our profession. I look forward to walking this path with humility, learning from those around me, and contributing to the continued growth and relevance of the GSSA.

At the beginning of this journey, I looked at the areas of improvement identified back in 1994. All these goals have been achieved to some degree. I intend to continue with the good work done by those before me; my focus, especially initially, will be to try and involve more of our members in the management and operations of the Society. The more volunteers we have in the various committees and working groups, the easier it will be for everyone. And the volunteers we are looking for come from all demographics.

Intergenerational involvement strengthens the GSSA. Younger geoscientists bring fresh perspectives, digital fluency, and the bold curiosity that drives innovation, while older professionals contribute deep institutional memory, technical mastery, and the wisdom that comes from decades of field, research, and industry experience. When these strengths meet in shared programmes, the Society gains continuity, mentorship, and a richer diversity of ideas. It also builds a culture where knowledge is actively transferred, leadership pipelines are strengthened, and transformation becomes a lived practice rather than an aspiration. Blending generations ensures that the GSSA remains both rooted in its legacy and agile enough to shape the future of South African geoscience.

Tania Marshall

the president's profiles

Noleen Pauls

South Africa's mining sector has always been more than just rocks and revenue. It is a space where people rise above tough conditions, where companies are rethinking their role in caring for the planet, and where science is constantly uncovering new wonders beneath our feet.

In this column, I aim to spotlight the people whose ambition and resilience inspire the industry, the organisations that go beyond extraction to invest in sustainability and environmental care, and the scientific breakthroughs that are pushing the frontiers of geoscience. This is a celebration of mining not just as an industry, but as a catalyst for innovation, transformation, and hope in South Africa.

South African mining legislation—most notably the Mineral and Petroleum Resources Development Act (MPRDA) and Mining Charter III (2018)—rightly requires companies to contribute to the socio-economic development of host communities and to promote inclusive participation in the benefits derived from mineral resources.

Many companies across the sector are responding to these obligations with commitment and integrity, recognising that responsible mining must extend beyond extraction. While it is not possible to profile them all, Minrom is highlighted here as one example of a company taking this further—placing people and places at the centre of decision-making and showing how moving beyond compliance can create meaningful change for mining-affected communities while shaping a more responsible mining profession.

In Conversation with Oscar van Antwerpen, CEO of Minrom

For Oscar van Antwerpen, mining has never been only about what lies beneath the surface. As founder and CEO of Minrom, he believes the true measure of success is the legacy mining leaves behind—for people, communities, and the environments in which it operates. That belief has shaped Minrom's evolution over the past fifteen years into a purpose-driven organisation working across Africa and beyond.

From geological consultancy to purpose-driven partner

Minrom began as a geological exploration consultancy, founded by Oscar, with a strong technical focus. Over time, the company expanded into an integrated, end-to-end mineral resource partner, supporting projects from open-cast operations to deep underground deposits exceeding 3 000 metres.

Yet Oscar is clear that technical delivery is only part of the story. "Our goal has always been to help clients unlock the full value of their projects while subscribing to high ethical standards and supporting sustainable regional development," he says.

Today, Minrom's footprint spans the DRC, Zambia, Uganda, Namibia, Botswana, Mozambique, West Africa, and the Arabian Shield. Alongside innovation and the adoption of AI-driven tools, the company has earned a reputation for revitalising mature or marginal operations by digitising and reinterpreting legacy datasets—revealing potential others may have overlooked.

A commitment to giving back

While legislation sets important minimum standards for social responsibility, Minrom's approach is intentionally voluntary and personal—aimed at creating lasting value rather than meeting regulatory thresholds.

At the core of Minrom's identity is a firm belief that mining must contribute meaningfully to society. This conviction led to the establishment of the NGO 'Be The Good', which focuses on uplifting rural communities—particularly young children and women.

Through 'Be The Good', Minrom supports early childhood development initiatives, feeding schemes, school supplies, clothing and blankets,

as well as sports sponsorships, mentorship programmes and borehole installations that improve access to clean water. These initiatives are designed to deliver sustained benefits rather than one-off assistance.

Minrom also works closely with university students through lectures and mentoring, helping to bridge the skills gap in mining and geology while investing in the next generation of professionals. "It's about building a future that is empowering," Oscar explains.

This commitment extends into the professional heart of the industry. Minrom maintains a long-standing relationship with the Geological Society of South Africa (GSSA), supporting student initiatives, professional events, and technical forums. Oscar views this not as philanthropy, but as a responsibility—believing that strengthening the geoscience profession is essential to building a future-ready mining industry.

Diversity, inclusion and women in mining

Diversity and inclusion are not treated as corporate ideals at Minrom—they are embedded in how the company operates. Oscar is particularly passionate about advancing gender equity in a sector where women remain underrepresented.

Minrom actively supports Women in Mining South Africa (WiMSA) and designs programmes that uplift women and young girls through education, skills development, and leadership opportunities. By embracing cultural and gender diversity, the company strengthens its teams and contributes to resilient communities.

Community impact in the Northern Cape

Some of Be The Good's most meaningful work is taking place in the Northern Cape towns of Fraserburg and Williston. These initiatives focus on early childhood development and women's empowerment, and include feeding schemes, school supplies, clothing and blankets.

Oscar traces the origin of these projects to a visit to Fraserburg that left a lasting impression. Witnessing the daily challenges faced by local families sparked a deep commitment to invest in these communities.

Looking ahead

As Minrom continues to support mineral development projects across Africa, Oscar remains clear about what ultimately defines success.

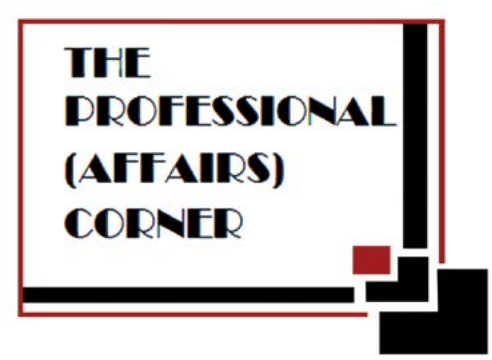
"As we unlock value in mineral assets, we remain equally committed to uplifting people, celebrating diversity, and ensuring our work leaves a long-lasting, positive impact," he says.

Noleen Pauls

Diversity & Inclusion at Minrom

- *Women in Mining:* Active supporter of WiMSA and women-led initiatives
- *Inclusive Workforce:* Teams aim to reflect South Africa's cultural diversity, valuing multiple perspectives in decision-making
- *Community Upliftment:* Focus on empowerment through education, mentorship, and skills development
- *Leadership Opportunities:* Creating pathways for underrepresented groups in mining and geology
- *Celebrating Heritage:* Integrating cultural awareness into outreach programmes to strengthen community relationships

professional affairs



GSSA Launches *First Shift* Mentorship Programme

We have launched a new mentorship initiative called **First Shift**, aimed at supporting students and early-career geoscientists as they make their transition from academic study to professional practice. The programme connects students and recent graduates with experienced professionals from industry, academia and consulting sectors to provide practical insight, career guidance and real-world perspective. Through these mentor-mentee pairings, participants gain actionable advice on navigating the early stages of their geoscience careers, building confidence, and developing the professional networks that are essential for long-term success. We are actively recruiting both mentors willing to share their experience and mentees seeking direction and support in the foundational years of their careers. *First Shift* underscores the GSSA's commitment to nurturing the next generation of geoscientists and strengthening the future of the profession in South Africa.

Here we share a few experiences from mentors from our past mentorship collaboration programmes:

"A lot of people are capable long before they feel legitimate. Sometimes the most meaningful thing you do as a mentor is shorten that gap, lending confidence until they generate their own. And I love that moment when they stop asking *What should I do?* and start saying *Here's what I'm thinking*—and they're right. That's when you realise your work here is done." — *Noleen Pauls*

"Participating in the mentorship program has been a truly enriching experience. It brings a sense of accomplishment to contribute value to young professionals' careers by sharing knowledge and life lessons from personal experiences, helping them accelerate their career growth and avoid potential career pitfalls. Moreover, mentoring also facilitates mutual growth and introspection for mentors. Programmes like this have a profound and lasting impact, serving as a powerful tool for nurturing future leaders in the country." — *Joshua Kilani*

"My experience of the mentorship programme has been rewarding and has exposed me to a wider network of mentees through the various social gatherings, and therefore not only making a difference to one mentee. It has enabled me to contribute to and guide some of the future heroes in geological sciences. Lastly, it has equipped me with knowledge of current challenges and therefore how to be a better geologist in the new age through some soft skill mentorship workshops. It was indeed a learning experience on both sides." —*Sifiso Siwela*

"It's an unexpected exchange where a mentor shares their experience, skills and knowledge but gains so much on humanity and humility from the mentee experiencing the industry for the first time. Needless to say this programme should be a prerequisite for any manager or aspiring leader in the geosciences." — *Nompumelelo Mgabisa*

- Become a Mentor
- Become a Mentee

Natalie Brand

SAMCODES

SAMCODES Quarterly Snaps

25th anniversary of the SAMREC Code

March 2025 marked the 25th anniversary of the SAMREC Code. Celebratory events were held during the year to celebrate this milestone. The events are highlighted on the SAMCODES, SAIMM and GSSA websites.

LinkedIn

A SAMCODES page is available on LinkedIn to keep up to date with current developments: https://www.linkedin.com/company/samcodessa/.

SAMCODES app

- The App offers a useful platform to access current SAMCODES information.
- The new quiz has been uploaded. Test your proficiency and know-how on the SAMCODES by doing the effective and informative quiz. It will take only a few minutes to complete. Check out the SAMCODES App User Guide for step-by-step instructions: https://lnkd.in/emT8976z.

Training programmes

- The SAMREC/SAMVAL Compliance and JSE Reporting course was presented on 29 & 30 September 2025.
- The SAMVAL Mineral Asset Valuation Conference was held from 1–3 October 2025.
- A combined SAMREC and SAMVAL Workshop to deliberate on the impact of Inferred Resources in life-of-mine planning was held on 5 December 2025. Outcomes and proposals of this process will be shared in due course.

International liaison

A JORC Code amendment feedback session was held on 10 September 2025. Proposals have been incorporated into the working draft and will be communicated in due course.

- SSC representatives attended the CRIRSCO AGM that was held in Perth from 1–5 September 2025.
- The SSC is pleased to announce China has joined CRIRSCO as a National Reporting Organisation.
- Mozambique is looking at developing a CRIRSCO-aligned mineral reporting code and there is therefore an opportunity to collaborate with the SAMREC Committee.

Management update

Joseph Mainama, who has been deputy chairperson of the SSC, will be taking over from Sifiso Siwela. The handover will occur at the February 2026 SSC co-patrons oversight meeting. Jacques Nel will become deputy chairperson.

Sifiso Siwela

Committee updates

SAMREC THE SOUTH AFRICAN CODE FOR THE REPORTING OF EXPLORATION RESULTS, MINERAL RESOURCES AND MINERAL RESERVES 25TH ANNIVERSARY	The process of integrating ESG factors into the SAMCODES is continuing for planning for imminent SAMREC Code updates.
SAMVAL THE SOUTH AFRICAN CODE FOR THE REPORTING OF MINERAL ASSET VALUATION	The Committee hosted a Valuation Conference in South Africa in October 2025. AusIMM were joint organisers of the event and participation was good.
SAMOG THE SOUTH AFRICAN CODE FOR THE REPORTING OF OIL AND GAS RESOURCES	SAMOG Code updates were sent for public comments, and the launch event will be communicated in due course.
INDUSTRIAL	The Industrial Minerals Guidelines were completed and ratified by the SSC.

branches & divisions

GSSA Branches and Divisions

Regional Branches and Specialist Divisions (Bs and Ds) are the means by which the Society stays in contact with its members and an important way in which it promotes geoscience to the general public. The GSSA has 7 Regional Branches, 3 Student Branches and 5 Specialist Divisions, with members engaged in a variety of activities including networking events, technical talks and field trips.

Branches have a particular geographical focus, whereas Divisions are underpinned by a specialist interest. Branches are typically supported and managed by members of the GSSA, while Divisions often include people from informal interest groups who are not members of the GSSA. Both groupings are supported by professional geoscientists in mining, consulting, the science councils and academia, with some Universities hosting dedicated student branches of the GSSA.

Branches and Divisions of the GSSA are governed by GSSA By-Law 7 and in terms of these By-Laws, Branches are represented by Regional Members of Council (minimum of one per branch) and each Specialist Division is entitled to one representative on Council. Importantly, the representative of each Regional Branch and Specialist Division must be a full member, in good standing, of the GSSA. Although Branches and Divisions are managed by their own elected Executive Committee, they are still affiliated to the GSSA and as such must comply with the relevant By-Laws, and abide by the Code of Ethics of the Society. Neither Branches nor Divisions can be independent of the Society.

In terms of Society governance, the Branches and Divisions are represented on the GSSA management committee by a Vice President, currently me. An important part of this role is to provide support and oversight to the Branches and Divisions to ensure that all events, finances, and communications linked to Branches and Divisions align with the GSSA's governance and operational standards, i.e. to ensure compliance and best practice.

Of the 7 GSSA Regional Branches, the most active are those in the Northern Cape and the Western Cape. In 2025, these branches organised online lectures and field trips and were active in both geoheritage and outreach. This commitment has carried forward to 2026 with the WCB organising a talk, on January 29, dealing with Climate Change in the Mesoarchaean by a visiting researcher from Wurzburg University in Germany, and the committee of the NCB are working hard putting together a 2-day meeting in April focussing on Copper Geology in the Northern Cape. The committee in the Western Cape is rooted in academia, with members, including student representatives, from each of the universities in that region. In contrast, the committee of the Northern Cape Branch comprises a team of industry professionals, as befits the mining focus in that region.

Although not currently as active as the NCB and WCB, I have been in contact with committee members linked to the Eastern Bushveld, Barberton and KwaZulu-Natal Regional Branches and am confident that there will be a resurgence of these Branches in the next few months.

Currently active branches

- **Eastern Bushveld**: Contact address: easternbushveld@gssa.org.za. Committee: Sipho Majola (Chair), Mlungisi Buthelezi (Deputy Chair), Esther Maluleke (Secretary), Rodgers Munyai (Deputy Secretary), Thato Marumo (Treasurer), Lucky Xaba (Deputy Treasurer) and Oupa Mkhondo (Additional Member).
- **Barberton**: Contact person: Chris Rippon. Barberton is a small but long-standing Branch, with the majority of members linked to the mining companies active in the Barberton Greenstone Belt, but now also includes geologists from the University of Mpumalanga and the Mpumalanga Tourism and Parks Authority.
- **Northern Cape**: Committee: Palesa Boikanyo (Chair), Mothusi Boihang

(Deputy Chair), Leahn Pieterse (Treasurer), Lutendo Mavhungu (Secretary), Leonita Kuhn (Communications), plus 4 additional members, Cornelia Gous, Kutlwano Moetsi, Nkosinathi Mthethwa and Eveline Kekana.

- **Western Cape:** Contact address: www.gssawc.org.za. Committee: Rob Muir (Chair), Chris Lambert (Deputy Chair), Steve Richardson (Treasurer), Mogammad Yaaseen Hendricks (Secretary), Leonard Gardener (Geoheritage), Wendy Taylor (Education and Outreach), Shaunique Kanemeyer, Caitlyn van Wyk and Tebogo Masweneng (Social Media and Marketing); student representatives from UCT (Robyn Liversage), UWC (Tshireletso Khasuli), and SU (Hans Otter).
- **KwaZulu Natal**: Committee: Riaan Botes (Chair), Willem Kruger (Secretary), Debbie Abel (Treasurer), Chris Hatton (Talks and Trips), Nazeem Ebrahim (student representative).

Within the student community, only the branch at the **University of Venda** in Thohoyandou is currently active. This branch is led by Mashudu Matsa, supported by a committee comprising Zwivhuya Masibigiri, Tshephanang Mashiane, Phindile Lengoati, Zwivhuya Mulaudzi, Omphulusa Banda and Mokie Mokgotho—all students from the Department of Earth Sciences. Mashuda and his team have already produced a preliminary calendar of events for 2026 that includes workshops and field trips and I will work with them to ensure the events are a success. The branch will represent the GSSA at the Bahananwa and Maleboho Career Expo to be hosted on 26 February by Maboi Primary School near Vivo, in the Limpopo Province.

Divisions

The 5 Divisions of the GSSA fall into two distinct groups. MINSA and GWD are well established and have international associations. MINSA (minsa@gssa.org.za) is associated with the International Mineralogical Association (IMA) and the Groundwater Division (gwd@org.za) is associated with the International Association of Hydrogeologists (IAH). In February, the GWD offered a series of webinars dealing with hydrogeological site characterisation, water quality monitoring and TEM applications in groundwater exploration, and they have scheduled training courses on water governance (CBSS) at various centres throughout March. The highlight of 2026 for MINSA is the 6th Southern African Mineral Symposium to be held on 25 September at the Origins Centre at Wits. Details of the events organised and hosted by both MINSA and GWD are available on their respective websites.

The second group of divisions, comprising the ESG (Environmental, Social and Governance), Geoheritage and YGP (Young Geoscience Professionals), have a much shorter association with the GSSA (circa 2022) and face challenges establishing traction within the geoscience community. Committees for each of these divisions need to be strengthened and resourced. The GSSA is committed to this task. More details will be given in the next issue of *Geobulletin*.

Steve McCourt

University of Venda Branch

GSSA UniVen Branch Paves the Way for Student Empowerment Through Debt Relief and Mentorship

The branch clears nearly R120 000 in student debt and launches a new impact-driven direction

The Geological Society of South Africa University of Venda Branch (GSSA UniVen), operating under the Department of Earth Sciences, serves students in the Hydrology and Water Resources (HWR) and Mining and Environmental Geology (MEG) programmes. Guided by its mission to empower students through professional development, academic excellence, industry exposure and collaboration, the branch continues to demonstrate its commitment to making a tangible difference in students' lives.

In 2025, the GSSA UniVen Branch marked a historic milestone by assisting two students in clearing outstanding academic debts amounting to nearly R120 000. The initiative forms part of the branch's renewed focus on social impact through financial relief, mentorship and industry engagement.

"This is not just about paying off fees; it's about restoring hope and creating a bridge for students to achieve their dreams," says the GSSA UniVen Branch Secretary.

GSSA UniVen Branch Executive Committee with one of the funding recipients.

Empowering students beyond the classroom

The initiative began as part of the Branch's strategy to establish meaningful partnerships that support student success. One of the Branch's committee members connected with Mrs Thobeka Maseko, a youth development advocate dedicated to helping students across South Africa access higher education. In collaboration with Mrs Maseko, the Branch facilitated debt relief for Mr Tshepo Khota, a second-year MEG student, and Mr Phumudzo Masibigiri, a first-year MEG student. The two students recently signed contracts with a company that pledged donations toward their academic expenses—a partnership that resulted in the clearance of nearly R120 000 in student debt and allowed the students to continue their studies.

"I am really thankful; I was concerned about how I would be able to register next year," says Tshepo Khota.

Mrs Thobeka Maseko

A strategic evolution: implementing mentorship and industry placement

Beyond financial relief, the GSSA UniVen Branch is shifting its focus towards holistic student empowerment and professional readiness. The branch is developing a structured mentorship programme that connects students with alumni and industry professionals to strengthen technical competence, workplace confidence and soft skills.

Through this programme, members will gain exposure to real-world industry challenges, site visits, and professional networks that complement their academic learning. This approach aligns with the branch's new mission to ensure that students not only excel academically, but also transition seamlessly into the workforce.

"Our goal is simple, to make a lasting impact on the lives of students and ensure they step confidently into hydrology and mining industries," say the GSSA UniVen Branch Committee.

The sustained success of the UniVen Branch is a powerful testament to the impact of unified action. Through its dedicated initiatives, the Branch continues to embody the principle of collective resilience, ensuring the support and success of students upon entering the professional landscape.

The Branch is currently finalising an opportunity for eight students to undertake industrial attachments in Burgersfort, where they will gain hands-on experience required for the MEG3200 module. This initiative underscores the Branch's commitment to bridging the gap between education and industry, while fostering a culture of collective resilience and professional excellence.

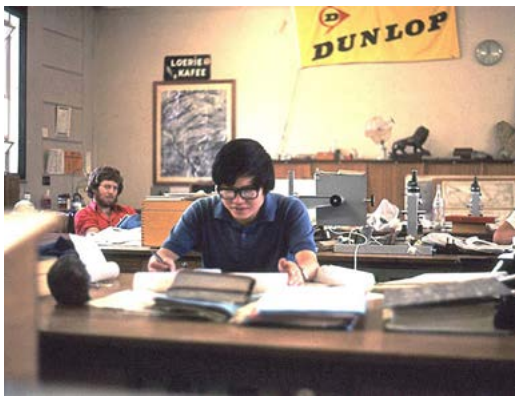
GSSA UniVen Branch members in a strategic planning meeting.

the geological hot pot

This month's Hot Pot will allow me to do some snippets of autobiography that I hope will be of interest to you, our readers. This occurred to me while I was trolling through my usual science websites for attention-grabbing articles but not finding enough to write about. Then, Bingo! This year is the 50th Anniversary of the University of the Witwatersrand Geology Honours Class of 1976. We were a small class: Mark Brown, Dave Dingemans, Jac Genis, Jenny Guerin, the late John James, Neil McLean, Greg Patterson, Dave van Nierop and me. After our graduation, we went our separate ways and lost contact over the years. I joined Esso Minerals Africa to start my career as an exploration geologist, looking for calcrete uranium in the Northern Cape, and then sandstone-hosted uranium in the Karoo Supergroup rocks.

As to the whereabouts of my former Wits classmates, if any of you are reading this, or if anyone knows one or more of them, please drop us an email (ghenry@uj.ac.za). I would love to organise an online reunion just to catch up on our careers. I expect most of us are retired by now, and so should have a bit of time in hand for reminiscing.

On a sad note, I met John James at a Geological Society Fellows Dinner a few years ago and he passed away not long after. He was with his daughter Kate James-Kleynhans who is now on the staff of the GSSA.



The Wits Geology Honours lecture room in 1976 with me at my workspace and John James at left back.

Which brings us to the second commemorative event in my career that takes place this year, the 45th Anniversary of the Rhodes University MSc in Exploration Geology Class of 1981. I was retrenched (if that word is still acceptable) from Esso at the end of 1980 because the company was stopping their exploration activities in South Africa. I had read about the relatively new MSc course that was run by Professor Bob Mason and applied to do it. I was pleasantly surprised to be accepted and in early January 1981 moved from Beaufort West, my last posting, to Grahamstown, now Makhanda, to begin the course. To say that the course involved very hard work on the students' part is an understatement. Our small class of seven, comprising John Empsall, Bruce Fletcher, Claude Ginet, Ciaran Halpin, Ian McGeorge, Andrew Milne and myself, had an intensive course in ore deposit and exploration geology that included many seminars that required diligent preparation. So it was not unusual for us to work late into the night to prepare for the next day. And any weekends off were a rare luxury.

What made the Rhodes MSc course outstanding were the two long field trips that encompassed almost all the different types of ore deposits in South Africa and Namibia. Professor Mason and his staff are to be congratulated and thanked for organising such intensive trips that included many underground visits. A look at the two tables below gives an idea of what fantastic ore deposit geology we were fortunate to see first-hand—a real privilege that would be almost impossible to repeat nowadays. It goes without saying that we had to prepare write-ups on the places we visited and then do a comprehensive report afterwards with the inclusion of the information we got from the trip. I am sure that you have heard the apocryphal saying "The best geologist is the one who has seen the most rocks". I can say without reservation that my year at Rhodes served me very well later in my career and can just hope that the university can resurrect the course one day.

I tried to organise an email 40th Anniversary reunion in 2021 and managed to contact Ian, who is consulting in Botswana, and Ciaran, who is working in Saudi Arabia. Again, if anyone knows the whereabouts of my other classmates, I would like to hear from you.

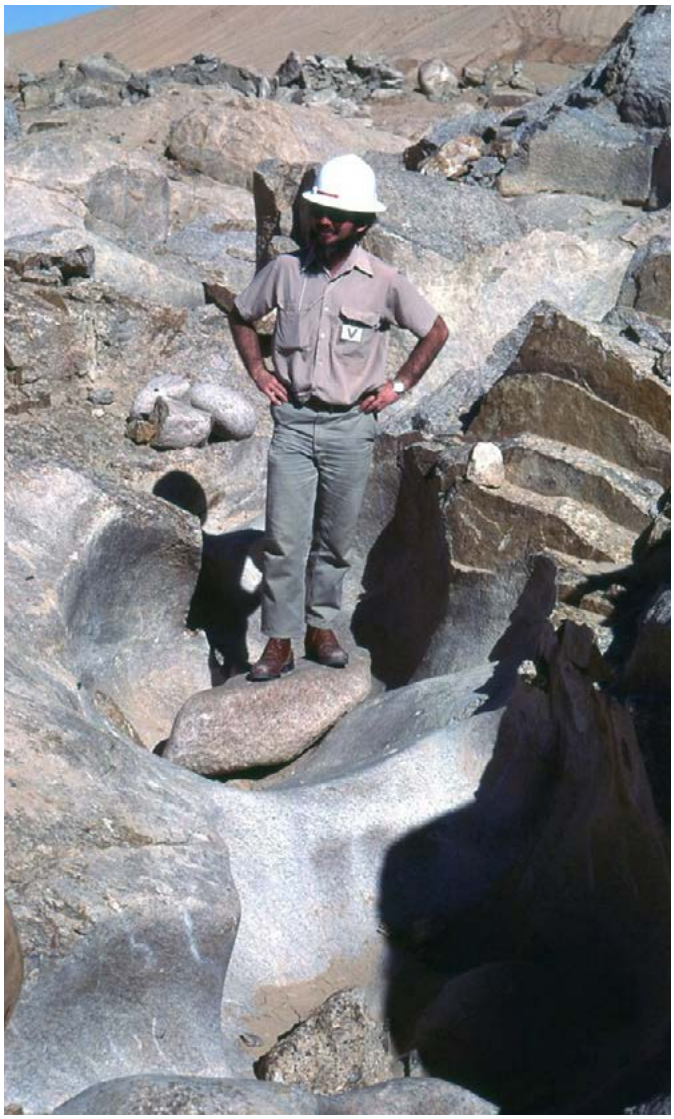
George Henry

My class somewhere in the old Transvaal Province. Front row: Bruce, Ian, Ciaran and Andrew. Back row: Me, Bob, John and Claude.

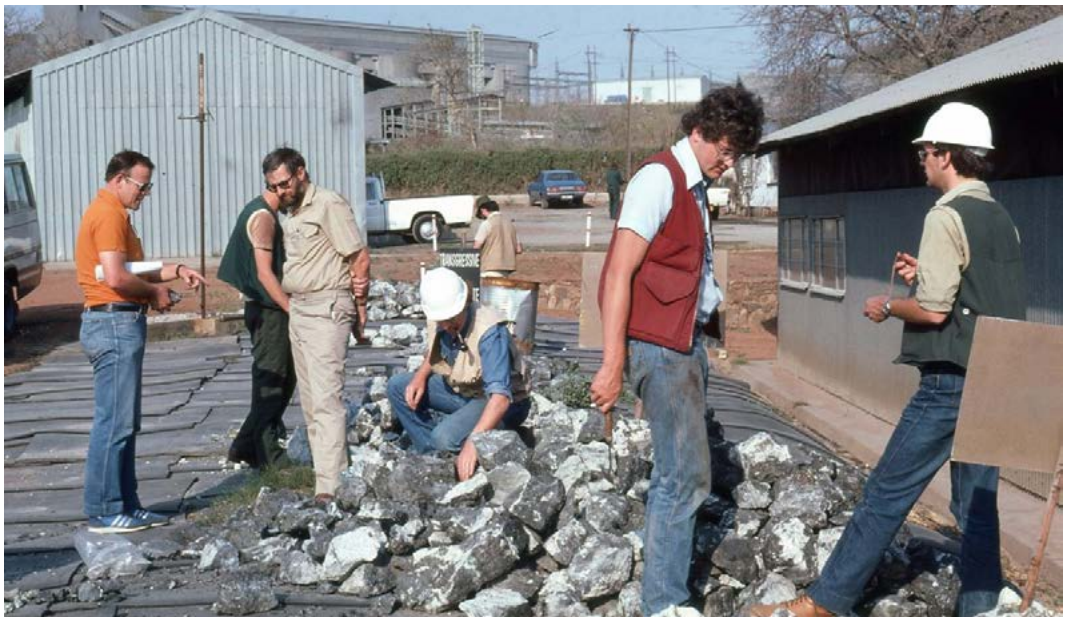
The old Glossam manganese mine in the Northern Cape. The ore occurs in sinkholes in dolomite. Rhodes geology lecturer Ivan Reynolds is at centre.

The extensive Kleinzee diamond excavations on the Northern Cape west coast.

One of the potholes developed in bedrock below the recent sand cover at Kleinzee. The diamonds are trapped in them and in other irregularities on the bedrock surface.



The Broken Hill Mine in the Aggeneys area in the Northen Cape in 1981. Underground mining started about two years previously.



Palabora core yard in the Northeastern Transvaal. Bob is at left talking to an unidentified mine geologist. John, Ciaran and Ian are studying the foskorite, the local name for the apatite-rich phosphate ore.

The bus that was used by the Rhode University MSc MinEx Class of '81 on both their field trips. This was taken in mid-September somewhere in the central Transvaal.

Itinerary of the Rhodes University MSc in Mineral Exploration field trip to the Northern Cape and Namibia in April–May 1981.

Date	Mine/prospect	Commodity
21-Apr-81	Prieska	Zinc, copper
22-Apr-81	Van Rooi's Vlei	Tin, tungsten
23-Apr-81	Aggeneys	
24-Apr-81	Broken Hill	Lead Zinc
	Big Syn	Lead Zinc
25-Apr-81	Broken Hill	Lead, zinc
	Black Mountain, Gamsberg	Copper, zinc
26-Apr-81	O'okiep	Copper
27-Apr-81	O'okiep	Copper
28-Apr-81	Carolusberg mine	Copper
29-Apr-81	Kleinzee	Diamonds
30-Apr-81	Haib	Copper
01-May-81	Rosh Pinah Mine	Zinc
02-May-81	Rosh Pinah to Hardap Dam	
03-May-81	Hardap Dam	Rest day
04-May-81	Matchless Mine	Copper
05-May-81	Otjihase Mine	Copper
06-May-81	Gorob	Copper
07-May-81	Donkerhoek granite, etc.	
08-May-81	Vendome, etc	Copper
09-May-81	Valencia	Uranium
10-May-81	Langer Heinrich, Namib Lead mine	Uranium
11-May-81	Tumas U Prospect	Uranium
12-May-81	Rossing Mine	Uranium
13-May-81	Krantzberg	Tin tungsten
13-May-81	MTD Prospect - Joumbira	Copper
14-May-81	Tsumeb	Copper, Lead, Zinc
15-May-81	Tsumeb area	Copper, Lead, Zinc
16-May-81	Tsumeb to Grootfontein	Copper, Lead, Zinc
17-May-81	Tsumeb to Oamites	
18-May-81	Oamites	Copper
18-May-81	Klein Aub Mine	Copper
19-May-81	Back to Rhodes University	

Itinerary of the Rhodes University MSc in Mineral Exploration field trip to the Northern Cape and Transvaal in August–September 1981.

Date	Mine/prospect	Commodity
31-Aug-81	Glossam	Manganese
01-Sep-81	Sishen	Iron
02-Sep-81	Gefco	Crocidolite asbestos
03-Sep-81	Hotazel	Manganese
04-Sep-81	Mamatwan	Manganese
05-Sep-81	Witkop	Fluospar
06-Sep-81	Armco	Fluospar
07-Sep-81	Rustenberg Platinum Union section	Platinum group metals
08-Sep-81	Rooiberg Tin Mine	Tin
09-Sep-81	Bushveld tin (Dr Ian Crocker)	
10-Sep-81	Union Tin Mine / Buffalo Tin Mine	Tin
11-Sep-81	Zaaiplaats Tin Mine	Tin
12-Sep-81	Platreef	Platinum group metals
13-Sep-81	Potgietersrus to Messina	Travel
14-Sep-81	Messina Mine	Copper
15-Sep-81	Sand River, etc.	Archaean geology
15-Sep-81	Maranda Prospect	Copper, zinc
16-Sep-81	Murchison Antimony Mine	Antimony
17-Sep-81	Maranda core, etc.	Copper, zinc
18-Sep-81	Phalaborwa	Copper, phosphate
19-Sep-81	Kruger National Park	
20-Sep-81	Kruger National Park	
21-Sep-81	Penge mines	Amosite asbestos
22-Sep-81	Fairview gold mine	Gold
23-Sep-81	Three Sisters Mine	Gold
24-Sep-81	Msauli Mine	Chrysotile asbestos
25-Sep-81	Onverwacht type section	Archaean geology
	Sterkspruit prospect	Chrysotile asbestos
26-Sep-81	Bushveld tin (Martin Sharp/Steve Gain)	Tin
27-Sep-81	Bushveld	Rest day
28-Sep-81	Dilokong Chromite mine	Chromite
29-Sep-81	East Driefontein Gold Mine	Gold
30-Sep-81	Deelkraal Gold Mine	Gold
01-Oct-81	West Driefontein Gold Mine	Gold
	Back to Grahamstown	

DSTI-NRF CIMERA

DSTI-NRF CIMERA "Translate Your Research" Writing Competition 2025

One of the challenges facing the sciences is our limited ability to write and share scientific research suitable for non-scientific audiences. For a number of years, DSTI-NRF CIMERA has hosted a writing competition, challenging geoscience postgraduate students to 'translate' their research into a format more digestible for the general public. The competition guidelines include a word count limitation, the need for a catchy title, and a writing style that is not technical, but doesn't lose the scientific importance of the work, and appeals to the imagination. A few brave postgrads and postdoctoral fellows have taken up this challenge, and we are delighted to share two winning articles written by our 2025 finalists. Watch for posts about this competition on LinkedIn to help share our science more widely.

Green Gold: How Natural Plants Transform Mine Waste into Valuable Treasure

When most people look at an abandoned mine, they see piles of dust and rock, lifeless scars left behind by years of digging. But what if those same piles held a secret solution to two big challenges: cleaning the environment and recovering valuable metals? That's exactly what this research set out to explore in Limpopo's Giyani Greenstone Belt, once home to bustling gold mines but now scattered with toxic tailings dams.

Tailings are the leftover crushed rock and waste from mining, and they are far from harmless. At the Klein Letaba tailings dam, these leftovers are laced with dangerous metals like lead, arsenic, nickel and cadmium, substances that can poison soil, water, and even people. The problem does not disappear with time. In fact, these silent pollutants continue leaking into the environment long after the mines shut down.

Instead of turning to expensive, heavy-duty machines or chemicals to clean them up, this study explored a greener option: phytoremediation, a big word for a simple idea. It means using plants as natural cleaners. Some plants have a remarkable ability to pull metals from the soil through their roots, store them in their stems or leaves, and even stabilise contaminated areas so metals do not spread further. Imagine plants acting like vacuum cleaners or filters, drawing toxins out of the ground while still looking like ordinary patches of grass or shrubs.

To put this idea to the test, we collected soil and plant samples from Klein Letaba tailings dam, focusing on 80 plants growing directly on the tailings dam. We also ran controlled potted plant experiments at the South African National Biodiversity Institute (Thohoyandou Botanical Garden Nursery), imitating tailings conditions in flower trays and watching how different plant species responded over seven months.

Three dominant native plants stood out: *Combretum imberbe* (Leadwood tree), *Cynodon dactylon* (Bermuda grass), and *Sporobolus africanus* (Rat's tail grass). These species were not just surviving in harsh, metal-rich soils, they were actively taking up metals. For example, the roots of *Combretum imberbe* absorbed copper and zinc, while *Sporobolus africanus* pulled in arsenic and chromium. Most of the metals stayed concentrated in the roots, suggesting these plants act more like stabilisers, holding pollutants in place rather than spreading them into above-ground parts. That is important for reducing risks of metals moving into the wider environment.

But the story gets even more exciting when we consider the potential for phytomining. Some of these plants, especially *Combretum imberbe*, showed the ability to accumulate

economically valuable metals like copper, zinc and iron in their leaves and stems. These are not just pollutants; they are industrial resources. With metals like nickel currently worth about $7.11 per kilogram and copper at $4.83 per kilogram, harvesting plants could one day become a small-scale way to reclaim metals while restoring damaged land. Imagine a system where polluted mine waste is slowly cleaned up while also producing raw materials that can be recycled back into the economy.

Our findings show that these unassuming native plants aren't just survivors, they are silent heroes with double potential: cleaning the land and unlocking economic value. Compared to costly methods like digging up tailings or using harsh chemicals, phytoremediation is cheaper, safer, and even visually pleasing. Instead of barren, toxic landscapes, we could see green patches of life slowly healing the scars of mining.

Why does this matter beyond Klein Letaba? Because abandoned mine sites are not unique to Limpopo, they are scattered across South Africa and the world. Communities living nearby often face contaminated water, unsafe soils, and limited land for farming or development. By tapping into the power of plants, we can move toward healthier ecosystems, safer communities, and even new opportunities for livelihoods through phytomining.

This research is more than science; it is a vision for turning yesterday's waste into tomorrow's resource. It shows us that the path to a cleaner, more sustainable future might just be rooted in the ground beneath our feet.

*The above article was submitted to the DSTI-NRF CIMERA 2025 'Translate your research' writing competition. The author is **Dr P.G. Munyai-Matshotshi**, a DSTI-NRF CIMERA-sponsored PhD graduate from the Department of Earth Sciences, Mining and Environmental Geology, University of Venda. This entry was placed tie-first.*

The Nickel Sulfosalt Chronicles

Deep in the Limpopo Province of South Africa lies the Murchison Greenstone Belt, a rugged stretch of ancient rocks that has fascinated geologists for generations. It is a place where volcanoes once roared, where tectonic plates danced, and where mineral-rich fluids carved their way through the crust, leaving behind veins of treasure: gold! But recently, this geological story has revealed a long-kept secret that is changing how we think about gold extraction.

For years, scientists believed that a mineral called arsenopyrite was the main hiding place for "refractory gold", that is, the gold that is locked so tightly inside minerals that it cannot be extracted using normal methods like cyanide leaching. Arsenopyrite was the usual suspect, the one blamed for making gold recovery expensive and complicated. If you wanted that gold, you had to roast the rock, pressure cook it, or use bacteria to break it down. Not exactly easy or cheap.

But what if arsenopyrite is not the only player in this narrative? What if there are other stars? Picture this: you are deep in the Murchison Range, boots dusty, compass in hand, chasing the whispers of ancient hydrothermal systems. You sample a sulphide-rich vein, expecting the usual role player arsenopyrite, the classic gold star, to be loaded. But when you fire up the LA-ICP-MS, a fancy lab instrument that tells you the chemical composition of a solid material, the results are scandalous. Arsenopyrite? Practically gold-starved. Meanwhile, other obscure minerals ullmannite (gold range = 0.008 ppm to 9.15 ppm) and gersdorffite (gold range = 0.07 ppm to 0.85 ppm) are glittering with hidden treasure, some grains clocking over 8 parts per million of gold. That is a lot, especially when arsenopyrite barely registered a trace in these samples (gold range = 0.001 to 0.02 ppm).

If gold is hiding in ullmannite and gersdorffite, then mining companies need to rethink how they process gold-bearing ore from this region. These nickel-bearing sulpharsenides are not just side characters; they are the real stars. With their antimony and arsenic-rich structures, they offer prime real estate for gold atoms, whether through substitution, nano-inclusions, or some sneaky mechanism we are still decoding. And they are doing it quietly, tucked between other minerals, like smugglers in a mineralogical masquerade?

It is not just about processing. It is also about exploration. The presence of these nickel-rich minerals suggests that the fluids that formed the gold deposits were different, maybe hotter, deeper, or richer in certain elements compared to more typical gold deposits. That gives us new clues about where to look next. Ullmannite and gersdorffite could become the new signposts for hidden gold.

There is something thrilling about overturning a long-held assumption. About finding gold not only where it is supposed to be, but also where it wants to be. Ullmannite and gersdorffite are not flashy. They do not sparkle in hand samples or dominate the textbooks. But they are quietly rewriting the rules, showing us that gold behaviour is more rebellious, more complex, and more fascinating than we thought. The Murchison Greenstone Belt has always been a geological treasure chest, but this discovery adds a new layer of intrigue. It challenges the orthodoxy, flips the script, and reminds us that gold does not care about our assumptions. It goes where the chemistry is right, where the lattice is welcoming, where the conditions whisper “come hide here.”

The above article was submitted to the DSTI-NRF CIMERA 2025 ‘Translate your research’ writing competition. The author is ***Thabo Kgarabjang,*** *a DSTI-NRF CIMERA-sponsored PhD candidate from the Department of Earth Sciences, University of Limpopo. This entry was placed tie-first.*

Resource Classification

Mineral Resource Classification: A View

"The only true wisdom is in knowing you know nothing." —Socrates

Introduction

The fundamental value of a mining enterprise is intrinsically linked to the quality of its mineral deposits and the efficiency of their exploitation—Bernard Swanepoel was oft quoted as saying "there are no potholes in our ore bodies" (the streets around the Harmony operations tended to be a bit bumpy at times, however). Unlocking the value that has been discovered, against all odds, by the exploration team, is a long-term, capital-intensive journey. Current industry analysis indicates that bringing a significant new mine online from discovery to production requires a decade or more.[1] Furthermore, the required capital investment ranges from several million USD, for early-stage projects, to billions of USD for constructing a large-scale operation.

The geological model is the foundation upon which all subsequent activities rest, including the mineral resource estimate. As we all know, a geological model is an interpretation, intuited and built from sparse, and often inconsistent data, both in terms of completeness and origin. As George E.P. Box (a British statistician) is alleged to have said, "All models are wrong, but some are useful". We attempt to communicate this uncertainty using standardised terminology (Inferred, Indicated, or Measured), when we classify the deposit. In the South African context this is done using the South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves (the SAMREC Code, 2016[2]).

However, the concept of "value" is not related to money at all. Value is defined as the intrinsic importance or worthiness of something—it is a subjective concept and as such the understanding of the value of mining becomes a source of tension between the local community and the mining company. We should actually be talking about "worth"—how much money can you potentially make by digging up and concentrating the commodity of interest and selling it for a profit.

Given the multiple ways in which worth can be determined, I will argue that it is critical that the work undertaken and signed off by the Competent Person (CP) is reliable, has been undertaken in a diligent and competent manner and that all risks and uncertainties in the estimate have been clearly articulated. The acid test: would you be happy if your grandmother used your report to make an investment decision? If she were to invest, what is her upside as well as downside risk? Can she, uber techno gogo that she is, easily determine her Minimax Regret criterion (Savage criterion)? Does the use of single values in the Mineral Resource table provide her, or any other investor, with an indication of how variable the grade distribution in the deposit is?

To understand why some of these practices have developed, we need to delve into the psychology and environments of both the CP and the investor. What drives them? Do the "rules" drive CPs to become lotophages: applying standardised process flows and methodologies like Králové's robots because "that's how we do things around here"? Are investors mere Mini Me caricatures of Gorden Gekko, driven by the mantra that "greed [for lack of a better word] is good"? Has 25 years of CRIRSCO codes and JSE regulation resulted in CPs who are over-conservative, striving for defensible, auditable work that will win the Golden Squirrel, and in so doing stifling innovation and eroding both value and worth?

Value in mining

Given that most people use "value" and "worth" interchangeably, I will use "value" for the remainder of this article.

How do we perceive "value" in the mining industry? Historically, mining was not solely a utilitarian pursuit. Like hunting, it was often a community and cultural activity and the extraction of minerals and metals from Mother Earth, such as gold, jade, emerald, and rubies, held symbolic and religious significance far exceeding their value. The Maya, as an example,

valued obsidian and jade above gold and silver; the conquistadores primarily valued gold and silver.

In the present era, the perception of value is predominantly utilitarian, framed within either capitalist or socialist paradigms. From a capitalist viewpoint, value is dictated by supply and demand. A mineral deposit is a financial asset, its value (correctly worth) being defined by the price its commodity can realise. Profits are seen as a justified return on both capital and geological risk, with the opinions and feelings of local residents typically considered externalities, as they have not assumed financial risk—one of the reasons for the disconnect between companies and local communities. Communities are talking value; mining companies are actually talking worth. Same word—different meaning.

The CP uses codified systems such as CRIRSCO to guide them in determining value and worth, both schemas being representative of a capitalist world view, designed to protect the investor (i.e., capital). In the CRIRSCO universe, of which SAMREC is a member, increasing worth is implicitly assumed to be a function of the increase in geoscientific confidence (by default a reduction in risk and uncertainty), which is bundled into a series of neatly stacked confidence categories (Inferred, Indicated and Measured)—geological matryoshka dolls. The downside of this approach is that this methodology can oversimplify the inherent complexity and unpredictability of mineral deposits.

This limitation was publicly demonstrated by the results from the Harry Parker Challenges, a test—the brainchild of R. Mohan Srivastava—designed to understand how human biases impact geological modelling and mineral resource estimation and subsequent classification.

Cognitive Bias and Agency Theory

To understand the drivers of a CP, we need to revisit the theoretical framework that underlies decision-making in geology. We are "Earth Detectives", as we rely on limited data (clues), and are always looking at past events (crime scenes) that will never be repeated. Geology is thus (like archaeology and palaeontology) an interpretive and historical science, where we rely on observations that are interpreted through a theoretical framework to form conclusions,[3,4] a subjective process dependant on whim, emotion and competence—i.e., susceptible to cognitive bias.

Common forms of cognitive bias include:

- *Over-Optimism Bias*: The tendency to become overconfident in a project's prospects;
- *Confirmation Bias*: Seeking or interpreting data in a manner that confirms your pre-existing interpretation;
- *Anchoring Bias*: Relying too heavily on an initial piece of information when making subsequent decisions;
- *Authority Bias*: Giving undue weight to the opinion of a perceived expert;
- *Sunk Cost Fallacy*: Continuing to pursue a project based on the amount of money you have invested in it, rather than its future potential, like the loss-chasing behaviour seen in people with a gambling addiction.

These biases are often exacerbated by Agency Theory—the conflict of interest that occurs between principals and agents. Agents are often incentivised to promote projects in an overtly positive way (the good story to sell) to secure funding or agreement for a project to continue or commence. This can lead to a systematic underestimation (and declaration) of risk and uncertainty, and a downplaying (or ignoring) of negative data and information—referred to as "agency cost." As this is a power relationship, there may be implicit or even explicit pressure exerted on the CP to gussy up the numbers.

The herding instinct

To understand the concept of herding and why people herd, we need to understand what drives the behavioural patterns of the two groups of interest—CPs (in this case geologists) and investors.

The geologist

Geologists pride themselves on being independent thinkers—the proverbial "two-handed geologist" who can see multiple perspectives. Yet, when a project moves to resource estimation and classification, there's a powerful drift towards low-risk, "tried and true" methods. Why?

The Safety of Precedent: Geometric methods like drill-hole spacing (DHS) are an easy go-to—easy to document, defend, and audit (everyone

wants that nice clean audit, don't they?). A review by Silva and Boisvert[5] found that 80% of CPs rely on a variation of DHS for their classification needs.

Corporate and Cultural Pressure: As already noted, there is often implicit, and sometimes explicit, pressure for the resource estimate to support "the story"—whether for fundraising, a merger, or pleasing shareholders.

Personal Risk Aversion: The CP carries significant personal liability under SAMREC and Johannesburg Stock Exchange (JSE) requirements. This can incentivise conservatism, prioritising a defendable audit trail over the most accurate or value-reflective model. The result? A "gun-shy" culture that may safely classify resources but will destroy project value.

Following the revision of SAMREC in 2004, the resulting mineral resource reclassifications led to material revisions of company valuations. While it may not have been justified, there was a widespread perception that CPs had collectively over-promised and that reliance on 'industry-accepted practice' was not a substitute for rigorous, critical analysis.

The Parker Challenge

The results of the Harry Parker Challenges (2023 Copper Porphyry, 2025 Carlin Gold) came as a surprise to the geological community. The 2023 challenge, using a dataset from Rio Tinto's Hugo Dummett South copper–gold exploration project near the major Oyu Tolgoi mine in Mongolia, showed a 500% variance in the estimates of contained metal.[6,7]

One of the aims of the competition was to try and determine how human bias, or "person-to-person variance" impacted a mineral resource estimate, specifically how practitioners assessed and manipulated primary data. One of the more interesting observations was that an expert could tell which software was used for the mineral resource estimation just by looking at the workflow. As Scott Dunham observed, "that's wrong, because software is a tool and we should be using it as a tool as opposed to it telling us how we should be doing the work".[8]

A critical insight from the 2023 Parker Challenge was the concept of "interaction uncertainty", where subjective choices in domaining, compositing and selection of estimation parameters compound overall estimation variability.[7] The 2025 challenge confirmed that interpretative variability is a persistent, deposit-agnostic challenge.

The domaining dilemma

Given the results of the 2023 and 2025 Parker Challenges, can we argue that there is a "herding" instinct? Sterk *et al.*[9] found that 67% of MREs they reviewed used grade-shells for domaining, often based on arbitrary cut-off grades with little geological input. A more detailed analysis revealed that 49% of MREs reviewed used grade-shell models as the basis for the geological model using:

- "Common practice"
- "Analogous settings"
- Arbitrary or nominal values

The use of a grade-shell approach is a classic symptom of groupthink—it is simple and auditable, but often produces models that are fundamentally misleading. (Everyone is doing it, so we should as well.)

A study by Stoch *et al.*[10] demonstrated that the blind use of the grade-shell methodology, specifically when modelling structurally complex gold deposits, could result in volumes (and by default tonnes and contained metal) being overestimated as much as 18 to 40%.

McManus *et al.*[11] conducted a comprehensive review of 142 ASX press releases. They noted that all reports used vague qualitative terminology, such as "high confidence", "robust," or "good" when describing geological uncertainty. These terms are subjective and do not allow the reader to understand the quality of the geological data used ("core recovery was acceptable") or the impact that alternative models may have on the estimate, let alone what "good" actually means.

Classification methodology

The final product—the basis for the value that is placed in the mineral resource estimate—is the classification. As previously noted, DHS is the default for the majority of CPs; however, let us delve a little more deeply into this. The behaviours exhibited, indeed the methodological approaches used, are themselves a function of "industry-accepted practice" (often referred to as "best practice"), CP competence, as well as the influence of

Agency Theory and the prevalent regulatory (and legislative) environment.

The tool set used by CPs to classify their estimates is in and of itself a product of the prevailing regulatory and legislative environment. For all intents and purposes, CRIRSCO has achieved hegemony in public reporting and, in doing so, has established circular causal processes—both recursive ones as well as cause-and-effect feedback loops.

The proliferation of rules, regulations and additional guidance can further foster a culture of minimum compliance, where CPs focus on meeting the letter of the SAMREC code rather than embracing the core tenets of transparency and materiality. This is an environment where the CP begins to "paint a dog to look like a duck"—technically compliant, but fundamentally misleading.

The investor

Investors herd for different reasons, driven by markets and information gaps:

Fear of Missing Out (FOMO) or "Greed is Good": Hot commodities or jurisdictions attract capital, often decoupling a commodity or share price from technical fundamentals. Investors chase return on their investment so will invest in commodities and jurisdictions that are either in vogue or showing higher than average market returns. This behaviour may result in market bubbles. The classic example of this behaviour is Tulip Mania (1634 to February 1637), considered to be the first recorded asset bubble. The mining industry has its own bubbles—notably the Poseidon NL Boom and Bust (resulting in JORC), as well as Bre-X (NI 43-101).

The Information Cascade: Investors who lack technical expertise frequently follow large funds on the assumption that as company X is investing in company Y it must be a good thing, so they will invest in company Y as well. Similar to FOMO, a price bubble may form based on perceived, rather than validated, confidence.

Short-Termism and Tick-Boxing: For many investors, a Mineral Resource statement simplifies to: Measured & Indicated = Good, Inferred = Bad. The more M&I there is, the better and more robust the project is. The nuance of geological complexity is lost, reducing a complex system to a binary tick list based on a single table in the technical report.

Convergence

Both groups, despite different drivers, crave certainty. The geologist may over-classify using simplistic methods to get a "bankable" number, or under-classify so as to avoid being the "tall poppy". The investor, suffering from authority bias, accepts the "bankable" number because a "reputable" CP has signed off on it. This convergence creates a shared illusion of confidence that lasts until the project commences production and things fall apart.

CRIRSCO: defining the pale

The CRIRSCO template can be construed as a conceptual boundary that can assist us in determining what qualifies as "value" in mining. Drawing on Fredrik Barth's work, which used borders as constructs to define the "other," we can view CRIRSCO in a similar manner—social constructs that are maintained by ongoing interactions between regulators, template writers, users (the CPs) and investors.

CRIRSCO provides an international template for publicly reporting exploration results, mineral resources and mineral reserves, emphasising transparency and consistency to inform investors about a deposit's economic potential. It frames value (correctly worth) through a classification system that incorporates "modifying factors" such as economic, legal, environmental, social and technical considerations to convert mineral resources into Mineral Reserves. Mineral Resources are categorised by geoscientific confidence (Inferred, Indicated, Measured), while Mineral Reserves are classified as Probable or Proved.

Just as Barth's borders persist through selective emphasis on differences, CRIRSCO boundaries sustain value by distinguishing economically viable "valuable" material (ore) from "non or limited value material" (mineralised inventory and waste), often influenced by power dynamics like corporate interests or environmental regulations (the application of the modifying factors). This boundary is maintained through stakeholder interactions—geologists, investors, regulators and communities—who negotiate classification confidence via audits, compliance and revisions. However, we must also acknowledge that a key differentiator between

Mineral Resources and Mineral Reserves and the category that the CP assigned to them is based on risk and uncertainty.

From minimum compliance to leading practice

The SAMREC Code sets a necessary minimum standard. But as the cynical "dog and duck" accounting analogy warns—where you paint a dog to meet the technical checklist for a duck—compliance is not the same as truth. We must be guardians of the Code's spirit, not just its letter.

The timeless Latin question, posed by Juvenal, "*Quis custodiet ipsos custodes?* ("Who guards the guardians?"), lies at the heart of any self-regulating body.

In order to move beyond our painted duck, and move away from subjective, qualitative statements that we use to convey risk and uncertainty, should we consider adding conditional simulation and scenario modelling as a fundamental part of our practice?

Presenting our geological interpretations, grade estimates, as well as classifications as ranges, rather than a single, apparently precise number, could be considered as a far more honest and robust representation of geological uncertainty and risk. The CRIRSCO Codes do not prevent a CP from doing this…

And we need to ask the hard questions:

- Is a "Measured" Resource always geologically attainable or desirable for geologically challenging deposits?
- What do we really mean by "economic" or "reasonable prospects" in our reports?
- Are we mentoring and developing the next generation of CPs to be critical thinkers or just proficient software operators?

Conclusion

The results of the Parker Challenge, combined with academic research by Sterk, Stoch, McManus and others, have demonstrated that bias—conscious or otherwise—remains a reality when undertaking geological interpretation, mineral resource estimation and deposit confidence classification, especially when the CP defaults to a software-driven approach.

Compounding the behavioural patterns seen is the impact of circular causal processes, such as feedback loops (negative and positive) and recursion. These include the use of standardised reporting structures that have developed with time (recursion), the very real fear of audit failure and professional liability (feedback loops), the subtle but persistent pressure of agency relationships, and human tendency to follow the crowd.

However we don't need to rip up the past. The SAMREC Code provides an excellent template for reporting risk and uncertainty; we just need to re-engage with the core principles again—transparency, materiality and competence—and not view it as another check list that needs to be ticked though to ensure that your dog has transformed into a duck.

Uncertainty and risk need to be quantified and not hidden behind weasel words and slippery qualifiers. Grade and certainty ranges, as well as alternative scenarios, should be presented. And just because you can get a continuous grade shell using 0.3 g/t, is that really a geological model?

As Donald Rumsfeld once said, "Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns. There are things we know we know. We also know there are known unknowns. That is to say, we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know."

So next time you put the finishing touches to that report, use the Gogo test—would you let her invest in the project based on your report?

Mark Burnett *(markburnett2000@proton.me)*

Note: Mark writes this in his personal capacity. The use of AI software to assist in the structuring and writing of this article is acknowledged.

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REGISTRATION WITH

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12 CONTINUING PROFESSIONAL DEVELOPMENT – ONLINE LEARNING

mineral scene

Ephesite, Postmasburg Manganese Field

When it comes to the number of known mineral species and in particular, aesthetic minerals, the Postmasburg manganese and iron ore deposits are seen as the step-child of the more northerly located Kalahari manganese field. Even so, the history, geology, and in particular the minerals of the Postmasburg deposits have recently been decribed[1] and one of the attractive minerals found in the region is ephesite.

Ephesite, $NaLiAl_2(Al_2Si_2O_{10})(OH)_2$, is the sodium-rich analogue of margarite ($CaAl_2(Al_2Si_2O_{10})(OH)_2$) and was originally described[2] from specimens collected in Turkey, and named for the ancient city of Ephesus. The first description of Postmasburg ephesite was published in 1926:[3] "A beautiful delicately rose-coloured mica … discovered by Captain Shone on Aarkop (Magoloring), where it occurs in compact dark bluish-grey ore as thick, short, columnar aggregates not unlike little "books" of mica with pseudo-hexagonal outlines, and showing characteristic perfect basal cleavage…". This was originally thought to be manganophyllite[4], a variety of biotite, but chemical analyses proved that the chemistry was incompatible with that of manganophyllite and showed it to be ephesite.[5]

As the figures show, Postmasburg ephesite specimens consist of masses of cleaved micaceous crystals commonly several millimetres in size, although bipyramidal crystals up to 4 cm in diameter have been reported.[6] Some vuggy samples contain beautiful, transparent, well-formed pseudohexagonal crystals. The most common associated species is mangan-diaspore. The colour varies from vibrant bright red, to pale-red, pink and orange-pink.

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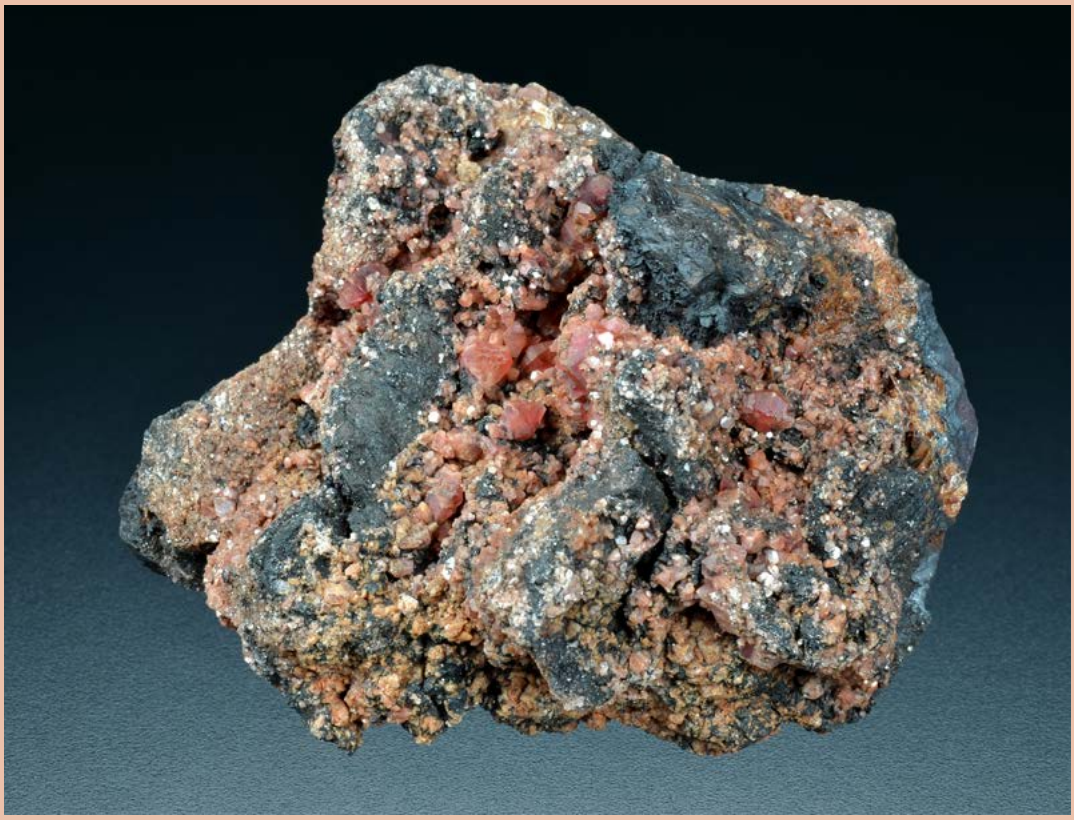
A flat surface on manganese ore covered by ephesite crystals. 13 cm specimen from Gloucester mine. (Specimen and photo: Bruce Cairncross)



Brecciated manganese ore with surfaces and vugs containing pink to light brown ephesite. 9.2 cm, Lohathla mine. (Specimen and photo: Bruce Cairncross)

Vibrant bright red-pink cleaved ephesite crystals incorporating grey bixbyite ore. 7.5 cm, Gloucester mine. (Specimen and photo: Bruce Cairncross)

Pink ephesite crystals with white kaolinite. Field of view is 1.4 cm. Lohathla mine. (Specimen and photo: Bruce Cairncross)

Vibrant pink ephesite overgrown and intergrown with dark wine-red, cleaved mangan-diaspore. Field of view is 3.6 cm. Gloucester mine. (Specimen and photo: Bruce Cairncross)

Close-up of bright pink ephesite. Some of the crystals are perfectly formed, transparent and gemmy. Field of view is 9 mm. Lohathla mine. (Specimen and photo: Bruce Cairncross)

the geological detective

The Geological Detective: Tales of Bias, Fraud and Deception

"Wrong does not cease to be wrong because the majority share in it." —Leo Tolstoy

Moscow

Svetlana understood something many mining teams learn the hard way: most problems are not geological—they're human.

Her assistant, Petr Perviy, a taciturn former combat engineer and hard-core Muscovite, who had swapped combat tours in Afghanistan for St. Petersburg Mining University, was more direct: "People lie to themselves and each other every day. They believe what they want to believe, regardless of what the data says."

The Pilbara—when your sample is too small to matter

The call for assistance came one late Moscow afternoon as the sun was beginning to set over Gorky Park, flecking the entrance columns with pink and orange. The problem, now six months old, was both familiar and depressing. There was a grade gap that no one could explain, and now the CEO was calling for heads to roll—starting with the Geology Superintendent.

What they found was not poor geology, it was confirmation bias—the tendency to seek reassurance that our belief is true regardless of what the evidence is telling us.[1,2,] In this case, the QA/QC programme relied almost entirely on pulp duplicates, which showed excellent repeatability.

The problem? They were checking the precision of a biased process and in so doing had become "prisoners of their own assumptions".

Svetlana made a simple request: "Show me your ore—not the assay data."

Under the microscope, the problem was obvious. The gold was coarse and free, with visible grains up to 4 mm. Beautiful geology. Terrible sampling practice.

"And your assay practice?"

"No worries, mate, it's all best practice—ISO-accredited laboratory and fire assay with ICP-OES finish," said the Superintendent, perspiring faintly in his bright orange high-vis gear.

Svetlana raised an eyebrow. "Has anyone visited the assay laboratory at all?"

There was a moment of silence, then a slightly worried but faintly hopeful response: "Not yet. Do you think that's where the problem is? Do you think I should have visited the assay lab? They are ISO-accredited, so I never really worried about that? Aren't they supposed to know what they are doing?"

"In my experience, knowing what is happening to your samples is a good idea. I once had a case where the laboratory manager was splitting out the blanks and reference materials and processing them separately; and then there was the laboratory that had special blanks reserved for some of their clients, however that is a different story…

I suspect that there are a number of things that need to be done, however let's start with the ore. You have coarse to very coarse gold in your deposit. That is a problem in and of itself and I suggest you research Dr Simon Dominy's work on the subject, he is one of the world's leading experts on the subject."

"What do you mean coarse gold, I needed a microscope to see most of it?" said the Superintendent, wondering if those lectures on Sampling Theory he skipped to visit Little Creatures had been worth it. He vaguely remembered terms like 'heterogeneity testing' and 'nomograms'.

"Coarse gold is when you have particles ranging from 100 µm to 2,000 µm in size, more than that is considered very coarse gold. The material you showed me has particles up to 4 mm in length (4,000 µm), so if the assay laboratory is following standard practice and you haven't

told them otherwise, they will be using a 30 g aliquot. That doesn't just increase variance—it introduces systematic bias."

"But won't using more aliquots help?" the Geology Superintendent asked hopefully, wiping sweat from his brow as a distant RAB rig snarled in the background.

"Unfortunately not; Geoffery Lyman demonstrated this—no amount of additional 30 g samples can fix this problem when the material is nuggety.[3] Trying to represent tonnes of ore with 30 grams of pulp is like drilling three RAB holes and claiming you understand the deposit. It ignores the heterogeneity that Gy's theory warns about, and that's before we get to other errors like incorrect sample extraction or delimitation."[4]

The Geology Superintendent sagged, seeing himself handing in his letter of resignation much sooner than he planned, the weight of the arid landscape seeming to press down on him. "What now? Will we ever understand what is going on with our deposit?"

"Do not worry, all is not lost," Svetlana reassured him. "I think I have a solution; well two actually. The first is that you change to screened fire assay—you will need larger samples, however, at least a kilogram. The sample is then screened—just a fancy way of saying it is sieved—into a fine fraction and a coarse fraction. The fractions are then independently assayed. The final value is the weighted average of the gold content present in both fractions."[5]

The Geology Superintendent remained silent, calculating his odds of survival given that this new method would most certainly increase his assay costs, but… it could solve the bigger problem.

"Or", said Svetlana, breaking his train of thought, "we could go high-tech and use PhotonAssay™.[6] The sample size is smaller at 500 g and you no longer need to pulverise the sample to less than 75 µm, so you reduce preparation error. You do need to be aware that this technological marvel is not a panacea—it has its own limitations, like matrix interferences in high-density ores or initial calibration costs."

"And?" The Superintendent suspected a catch. There was always a catch, especially when new technology was involved.

"The 'and' is a positive—PhotonAssay™ is non-destructive, so you can re-analyse the samples if you need to. But remember, it's not a universal cure-all; for finer gold or different matrices, optimised fire assay or even screen fire assay might still be a better option for this deposit and the traditional methods may even outperform it.[7] The choice is yours."

"You will however need to make a few changes to your Quality Assurance and Quality Control system. I need to be brutally honest with you. It is sub-standard to say the least. Have you read Abzalov's 2008 paper?"[8]

The Superintendent stood there looking confused, shifting his weight on the uneven ground. "I... skimmed it once, I think. What specifically is important?"

"Okay," said Svetlana, briskly. "Pulp duplicates are not enough, and as we've changed the assay system, they're no longer appropriate. What we need to do is revise the system—using:

- Field duplicates to capture geological variability,
- Coarse reject duplicates to monitor preparation error,
- CRMs to verify analytical accuracy,
- Frequent blanks to detect contamination.

Blanks are often the most sensitive indicator of process failure—yet they are routinely underused. You should also incorporate umpire assays from a second lab periodically to cross-check if there is any potential bias between assay laboratories or analytical techniques."

"But won't this add costs?" the Superintendent pressed on, regaining some composure, casually waving flies away… as a murder of crows wheeled overhead, watching. "The board will want justification; it's a lot of money… and I don't have the budget."

"Short-term, yes," Petr growled, his voice the result of too many Pamirs smoked hunched in sweltering BTRs.

"Long-term? It saves millions in headaches; or think of it this way—an insurance against human error, for the future",[2] said Svetlana, wondering how the West had won the Cold War if this example of penny pinching was anything to go by.

"So, it is worth the investment, you think?", the Superintendent said.

Svetlana nodded. "Exactly. Start with a pilot on a subset of samples, track the variance, and scale up. Document everything; remember transparency builds trust."

Back in Moscow

Three months later, the results were uncomfortable but honest. Variability increased. Noise appeared. But reconciliation improved to within acceptable levels. The mine team had a clearer picture of the deposit's variability as well as it's potential.

The Geology Superintendent… he survived and finally visited the assay laboratory.

The Harmattan

"Petr, how do you feel like a trip to Senegal? A different commission this time. A phosphate mine is showing massive contamination in their blanks, but the CRM results are all within acceptable limits and they are getting good results on their duplicates and repeats."

Petr blinked slowly. Africa, a continent he had always wanted to visit, having become an avid Allan Quatermain fan during his time in Kandahar. "Africa, the mother continent… That sounds good, when do we leave?"

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

Profile image courtesy of ChatGPT.

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GSSA
Geological Society of South Africa

obituaries

Richard Pieter Viljoen

21 July 1940 to 22 November 2025

Richard Pieter Viljoen passed away on 22 November 2025 at the age of 85 following complications resulting from heart surgery. He survived his twin brother, Morris James Viljoen, by four years, Morris having passed away on 19 August 2021 following Covid-related complications (*Geobulletin* 2021, v. 64.3, 46–52). Richard is survived by his wife Miranda and his son Anthony.

The twins were born on 21 July 1940 and lived for most of their early lives in the Johannesburg suburb of Sydenham. Being identical twins, it is reported that even their father had difficulty identifying them and there are numerous stories of them being misidentified throughout their lives. As they grew older the twins developed similar interests and were close in their relationship with one another. Following schooling at Highlands North High School in Johannesburg they enrolled in 1958 at the University of the Witwatersrand, Johannesburg (Wits) and registered for a science degree in Geology and Zoology. Geology ultimately became their chosen career path and they completed their BSc degrees in 1960, followed by BSc (Hons) degrees in 1961.

An early photograph (c. 1941) of identical twins Morris and Richard Viljoen when they were about one year old and barely distinguishable from each other.

Richard (left) with mother (Constance), followed by Morris and their father (Petrus Viljoen). Tragically, the Viljoen's father died suddenly and unexpectedly later in the year, the day before the BSc (Hons) final exams were to be written.

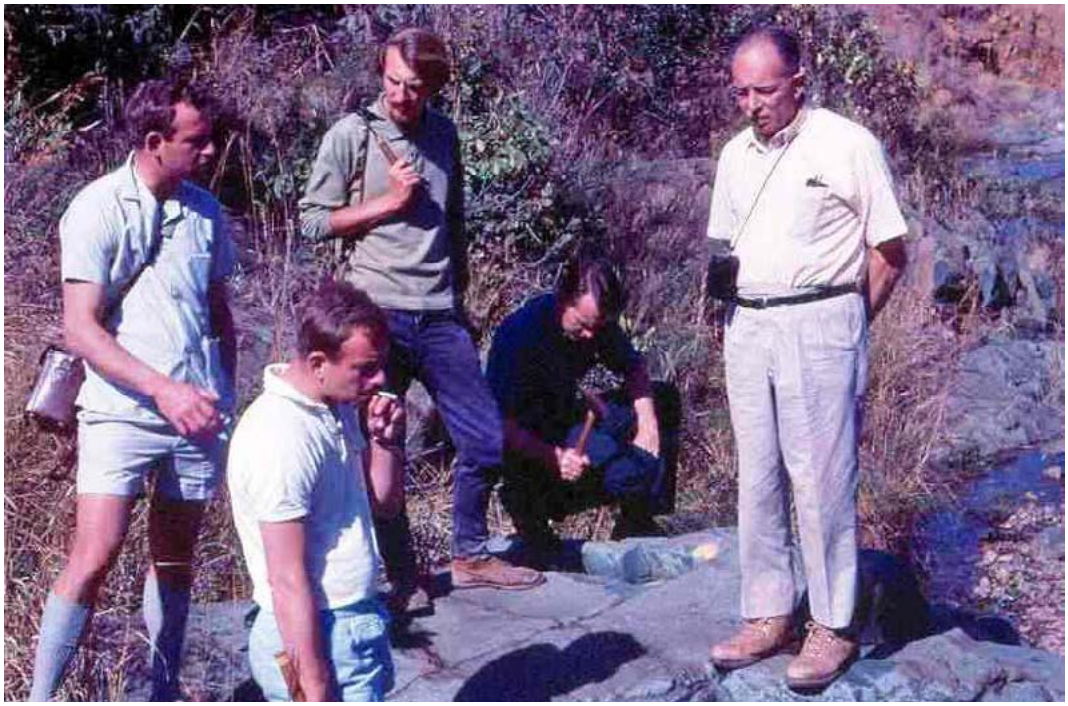
Morris (left) and Richard (right), virtually identical twins, on the occasion of their BSc graduation in April 1961. Both completed BSc (Hons) degrees at the end of 1961.

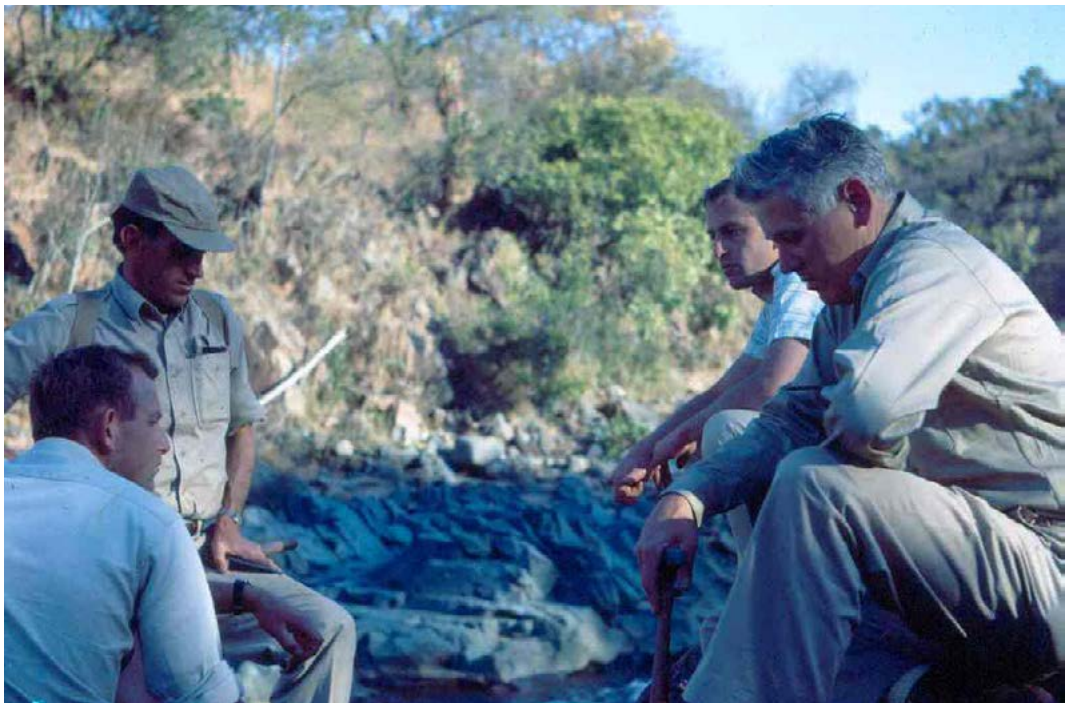
Both subsequently went on to complete MSc degrees, Morris working on a project in the Archaean Barberton greenstone belt and Richard working on a Witwatersrand-related project in the East Rand. These studies, which commenced in early 1962, followed the awarding to them both of bursaries to undertake research in the then recently established Economic Geology Research Unit (EGRU) at Wits, under the directorship of Professor Des Pretorius. Throughout their early student careers, they were closely associated with fellow student Carl Anhaeusser and this relationship, which began in early 1958, lasted for 67 years, ending with the death of Richard.

Morris, Carl and Richard, on the occasion of Carl's wedding on 20 February 1965. The photograph on the next page shows the same trio approximately 60 years later, only in this picture Richard is on the left and Morris is to the right of Carl.

At EGRU, Morris and Carl were given the task of field and structural mapping in the main gold-producing district of the Barberton Goldfield, while Richard undertook a petrographic and mineragraphic study of Witwatersrand gold reefs in the East Rand, centred on the town of Springs. Richard's supervisor was Professor Des Pretorius, a particularly demanding taskmaster. He nevertheless rewarded quality work and encouraged students to engage with the broader aspects of their research and its regional relevance. As a mentor, Pretorius could not be faulted and his inspiration and stimulus for his students, including Richard, paved the way for many successful careers.

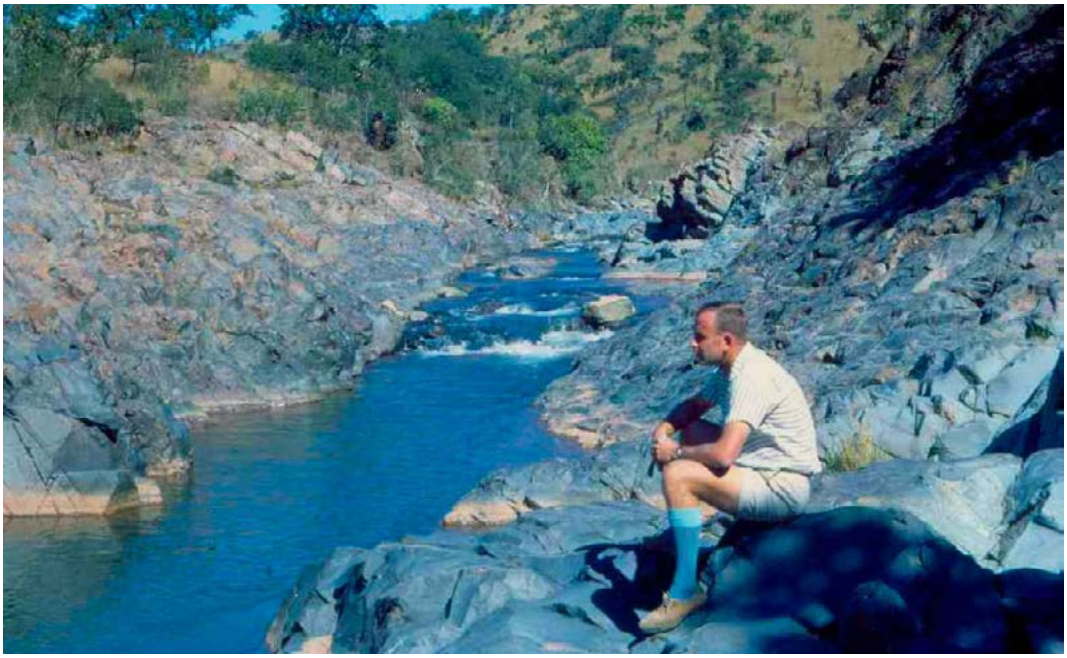
After completing their MSc degrees, Morris and Richard both joined the Johannesburg Consolidated Investment Company (JCI) in 1963. Both soon distinguished themselves in JCI and undertook work on projects involving the Witwatersrand Goldfield and the Bushveld Complex. In 1965 the twin brothers were offered a CSIR bursary by the South African Upper Mantle Committee to undertake a project entitled "Ultrabasics in fold belts in the Barberton area". Professor Pretorius was appointed supervisor of this research project which was undertaken at EGRU at Wits University. They commenced their Upper Mantle studies in the area east of Badplaas where it was determined that the volcanic sequences at the base of the Barberton greenstone belt were well exposed and relatively unaltered. Using aerial photographs, they systematically mapped the region and found they could subdivide the Onverwacht volcano-sedimentary rocks into six formations. The three lower formations, namely the Sandspruit, Theespruit and Komati Formations, constituted the Tjakastad Subgroup, and were found to consist predominantly of high-magnesium ultramafic rocks with minor sedimentary interlayers. Ultimately, the basaltic and peridotitic rocks came to be known as a new class of igneous and volcanic rocks named **komatiites** by the Viljoens (after the Komati River which traverses the region). These rocks attracted a great deal of attention and numerous local scientists and many from abroad visited the region to examine these newly defined komatiitic basalts and komatiites the latter displaying characteristic spinifex textures. These rocks were subsequently identified in most Archaean greenstone terranes worldwide.





Some famous scientists visited the Barberton greenstone belt to examine the volcano-sedimentary rocks of the Onverwacht Group. Among them was Professor Harry Hess of Princeton University (accompanied by research student John Dickey, kneeling) (bottom photo). On the right Professor Robert (Bob) Hargraves (Princeton University) and Dr Hatton S. Yoder Jr. (Director of the Carnegie Institute in Washington) discuss the field relations of the volcanic rocks of the Onverwacht Group with Morris and Richard.

Three formations were defined for the upper part of the Onverwacht succession, namely the Hooggenoeg, Kromberg and Swartkoppie formations, which together formed components of the Geluk Subgroup. These successions comprised mainly basaltic and felsic volcanic and sedimentary rocks with only subordinate ultramafic components. A full exposé of the Barberton research undertaken by the Viljoen twins was presented at the Upper Mantle Project symposium held in Pretoria in 1969. These talks also formed the basis of 12 papers, which were published in two special publications produced by the Geological Society of South Africa. The upper formations, initially defined by the Viljoens, have subsequently been revised by later workers, but the overall volcano-sedimentary stratigraphic history of the Onverwacht Group has not changed materially.



Richard sitting on massive and pillowed basaltic lavas of the Hooggenoeg Formation exposed along the Londozi River in the southeastern sector of the Barberton greenstone belt.

On 18 October 1969 Richard married Miranda Dijker and they subsequently had two children, Nicolette and Anthony. Miranda was the ideal wife for Richard as she was fully supportive of his geological adventures and extended trips to South America, New Zealand, Turkey, Namibia and Zimbabwe. She also helped with Richard's involvement with many and varied activities of the Geological Society of South Africa as well as other professional functions.

After completing their PhD research in the Barberton region, the Viljoen twins were invited by JCI to start a Fundamental Geological Research Unit in the company. This research group, established in 1969, was given the task of assessing the economic potential of large parts of southern Africa for base and precious metal mineralisation. Richard became manager of the remote sensing company Spectral Africa, based in Randfontein, and mandated to developing remote sensing for mineral exploration and target generation. During his tenure with JCI Richard travelled extensively on geological business to far flung and remote parts of the world where he made useful contacts on behalf the company.

In addition to his corporate responsibilities, Richard gave much of his time to the Geological Society of South Africa (GSSA) as well as other scientific bodies, such as the Associated Scientific and Technical Society of South Africa (AS&TS), becoming President of this organisation in 1993. He succeeded Carl Anhaeusser in 1986 as President of the GSSA and again held this office in 1995, the Centennial Year of the Society. In 2016 he, together with Jeanette McGill, acted as Co-Presidents of the 35th International Geological Congress held in Cape Town.

Richard with daughter Nicolette and wife Miranda together with son Anthony and his wife Kirsty. Tragically Nicolette (or Nikki as she was affectionately known) passed away in 2018 from cancer, leaving behind a husband and two young daughters.

Professor Carl Anhaeusser (GSSA President for 1985) handing over the presidency to Richard Viljoen, who held this office in 1986 and again later in 1995 (the Centennial Year of the Geological Society of South Africa). Also in the picture on the left is Dr John Cilliers (Secretary) and on the right is Professor Sybrand De Waal (Vice-President).

After a long and distinguished career as an assistant consulting geologist with JCI, Richard successfully applied for a position as Chief Consulting Geologist with Gold Fields of South Africa. He succeeded the outgoing Consulting Geologist, Ben Weilers, and commenced his new job at Gold Fields head office in Johannesburg in August 1983, later being officially inducted as Chief Consulting Geologist early in 1984. While with JCI Richard had been involved with several new mineral discoveries, including the Shangani nickel deposit in Zimbabwe and the Otjihase copper deposit in Namibia. In later years with Gold Fields, he was directly involved with a number of new mineral discoveries, including the Northam platinum mine in the Bushveld Complex and the Leeudoorn gold mine in the West Wits Goldfield in South Africa, as well as the Tarkwa gold mine in Ghana. Exploration commenced at newly acquired mines and mining companies, including the Okiep Copper Company in Namaqualand and the Tsumeb Company and Otjihase copper mine in

Namibia. In the Northern Cape, Phelps Dodge relinquished control to Gold Fields of the Black Mountain copper–lead–zinc mine and diamond exploration commenced in the Schweizer Reneke region. Commodities being sought by Gold Fields expanded greatly to include base metals, tin and coal, and exploration was extended to numerous localities abroad, including Ecuador and Venezuela and interest was shown in gold deposits in India and China. Richard also examined copper and other deposits in Mexico, and gold occurrences in the Falkland Islands and Kazakhstan.

Richard's life at Gold Fields was hectic, with him having to pay regular visits to the numerous company-owned mines, exploration centres and specialist units, as well as monthly reporting meetings to the Gold Fields executive under the somewhat stern and intimidating chairmanship of Robin Plumbridge. Unlike JCI, where the working conditions were relatively relaxed, Gold Fields was more structured with more rigid protocols, regulations and proud traditions under the somewhat authoritarian rule of Chairman Robin Plumbridge (who was a Rhodes Scholar, mathematician and Oxford rugby blue).

Both Richard and Morris distinguished themselves in so many ways as geologists and individuals totally committed to the geological profession in its entirety. They had a special passion for geoconservation and both contributed considerably to geoheritage projects of the Geological Society, many of these having been initiated by themselves while they were members of the Conservation Committee.

During their careers, both Viljoen twins were honoured by the GSSA and other distinguished geological organisations. Following their Upper Mantle research work they were awarded the Lindgren Award of the Society of Economic Geologists in 1979 and the Draper Award of the GSSA in 1985. Richard also received recognition with numerous other awards including the GSSA's Jubilee Medal (jointly with Prof Dick Hutchinson) and, in 2022, the Council for Geosciences Lifetime Award, as all-rounders in the Geosciences.

Richard and Professor Gillian Drennan (HOD, Wits University), joint recipients in 2022 of the Council for Geoscience's prestigious Lifetime Award as 'all-rounders' in the Geosciences.

After retiring from Gold Fields, Richard joined his brother Morris, who had established the Centre for Applied Mining and Exploration Geology (CAMEG) at Wits when he was professor of Mining Geology. Richard was appointed as an Honorary Professor of Economic Geology at Wits in 1999, where he assisted Morris in presenting lectures and supervising students. Not long thereafter Laurence Robb, then President of the GSSA, approached Richard to establish a Directorate of Professional Programmes (DPP) on behalf of the GSSA. This turned out to be a very successful venture and to this day continues to meet the demand from exploration, mining and academic geoscientific communities for professionally run courses, workshops and seminars, thus providing continuing education.

Following their involvement with academia, the Viljoen brothers were approached in 2007 by Richard's son, Anthony, to join him and his partner Fortune Mojapelo to form the Viljoen Mojapelo Investment Company (VMIC). Thus, the twins virtually commenced second careers in their retirement years, becoming technical advisors on all projects in which the company became involved over the next decade and up to the time of Richard's death. Numerous projects were initiated by VMIC, including gold exploration in South Sudan, coal in Madagascar, Mokopane iron ore (magnetite seams) in the Upper Zone of the Bushveld Complex, and tin, titanium, vanadium, phosphate, and PGE mineralisation, also in the Bushveld Complex. A very large, low-grade tin deposit associated with large pegmatite bodies was also acquired in Namibia. This deposit also contains tantalum and is one of the largest hard-rock lithium (mainly from petalite) resources in the world. To assist in the financing and development of these acquisitions two companies (Bushveld Minerals and Afritin, now Andrada Mining) were listed on the AIM exchange in London in 2012 and 2017, respectively.

The Viljoen twins excelled in their chosen profession as geologists and were outstanding role models to generations of younger earth scientists and to fellow company workers with whom they willingly and enthusiastically shared their knowledge, experience and expertise. In a tribute of this nature, it is impossible to outline the full extent of all the activities and experiences of the twins during their illustrious careers as geologists. Fortunately, an excellent account of their life adventures was made available timeously before Richard's death. A book entitled *"Reading the Rocks – Adventures of Twin South African Geologists"* compiled by Richard and first published in 2024 makes fascinating reading for anyone interested in

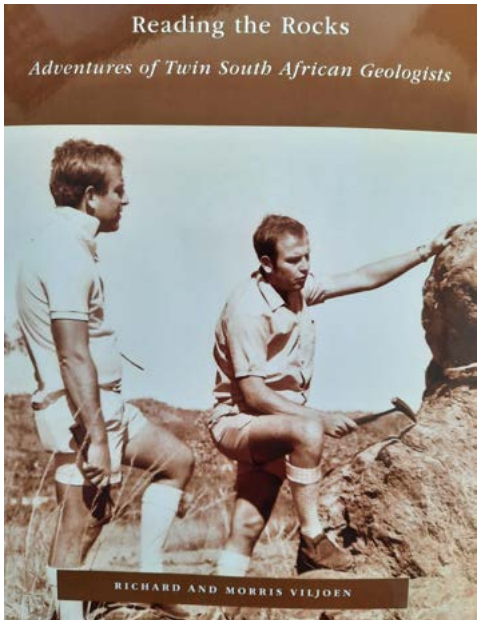
the exploits of two outstanding South African geoscientists. Both twins published their scientific endeavours in local and international journals and books, and a listing of these research articles appears in the aforementioned book.

Carl R. Anhaeusser
Professor Emeritus and former Director of the Economic Geology Research Institute, School of Geosciences, University of the Witwatersrand, Johannesburg

References

The book referred to in the previous section contains a full listing of the publications of the Viljoen brothers. Some of the more significant contributions are highlighted below.

- Ten joint papers by Morris and Richard Viljoen appeared in 1969 in the volume dealing with South Africa's contribution to the International Upper Mantle Project. See: *Special Publication 2, Geological Society of South Africa, pages 9–304.*
- Viljoen, R.P. and Viljoen, M.J., 1971. The geology and geochemistry of the layered ultramafic bodies of the Kaapmuiden area, Barberton Mountainland. In: *Special Publication 1, Geological Society of South Africa, pages 661–688.*
- Two books were published and made available at the 35th International Geological Conference held in Cape Town in 2016. In both these publications the Viljoen twins featured prominently as authors and/or editors. The one book is entitled *Africa's Top Geological Sites* and the second is *The Great Mineral Fields of Africa*, both published in 2016.



The book displayed above was prepared by the Viljoen brothers to provide a history of the Viljoen Family and their exploits over the years, and to trace their ancestry back to the family founder, Francois Viljoen, who arrived at the Cape of Good Hope as a young man in 1671. The book provides an entertaining and well-illustrated account of the geological exploits of the Viljoen twins Morris and Richard.

Lyn Whitfield and Richard at a lunch to mark Lyn's retirement from Andrada Mining in 2025. This was the last time the writer saw Richard before his sudden death in November 2025.

Stephen (Steve) Edward Haggerty

11 April 1938 to 2 January 2026

Steve Edward Haggerty was born on 11 April 1938, in Primrose, Germiston, in the eastern suburbs of Johannesburg (East Rand), South Africa. Germiston was generally regarded as a less-posh middle-class suburb of the City of Johannesburg. He was often teased about his East Rand origins. At the time of his death Steve held the position of Distinguished Research Professor, Florida International University (FIU), in Miami (USA) where he had been since 2002.

Steve's major interests were initially in reflected-light microscopy, magnetic mineralogy, and oxidation–reduction systems relevant to magmatic ore deposits and igneous petrogenesis. His research revolved around the Fe–Ti–O systematics of key lunar and mantle minerals, initially becoming an expert on the early lunar samples and meteorites and later progressing to diamonds and the evolution of the Earth's upper mantle.

He was a Principal Investigator for 10 years in the U.S. Apollo manned and Soviet Union unmanned lunar sample return programmes, and served on the Lunar Sample Analysis Planning Team. His research interests and projects progressed to Earth-bound and mantle-dedicated studies of kimberlites, carbonatites, and associated alkali rocks and their xenoliths. Beyond field projects in west and southern Africa, he also worked in Brazil, Australia, Syria, Siberia, China and Liberia.

As Steve's career progressed and lunar science work slowed, Steve reacquainted himself with his country of birth, and threw himself into diamond and mantle studies. He built important long-term relationships with the De Beers Geology Group, geoscientists at the University of Cape Town Geochemistry Department, other South African geoscience institutions and like-minded industry and university geologists and mineralogists around the globe.

In 2000, Steve was awarded a Fullbright Scholarship (September 2000 to February 2001) and, as a world-leading specialist on diamonds, he went to Hyderabad (south-central India), to conduct research in the original home of natural diamond deposits, with a history stretching back some 2000 years. He spent his Fulbright year studying Indian diamond-bearing rocks and diamonds, a project with important implications for India's economy. Some of the world's most famous diamonds have come from India. In the early years of kimberlite and lamproite research there was uncertainty as to the origin of these exceptional Indian stones, including the famous Hope Diamond. The majority of Indian diamonds were recovered from alluvial deposits in the Krishna River and adjacent drainages, and their origin was perplexing to Steve.

Subsequent field studies, mapping, sampling and petrological work on the many sparsely diamondiferous Proterozoic lamproites of Andrah Pradesh in south-eastern India, and adjacent areas, have linked the origin of these large and special Golconda diamonds to the 1200 million year (Ma) kimberlites and lamproites, fulfilling Steve's early comments about the importance of "using the appropriate levels of sophistication in our exploration".

In January 2001, following his Fullbright Scholarship and work on the diamond deposits of Africa and India, Steve participated in a White House conference on Blood Diamonds. At this conference, he provided scientific basis for the identification and recognition of sources of these diamonds, as essential for the implementation of the Clean Diamonds Act, then before Congress. "As a geologist" Steve commented, "it's an opportunity for me to play a deep role in our society. We now have the chance to play a part in terminating the source of funding for these rebels. It's something I feel very deeply about."

In 2001, Steve moved to take-up a professorship position at FIU and pursue his passion for diamonds and mantle rocks. This second part of his career is well known to his original

scientific colleagues, and younger generations of academic and industry kimberlite/lamproite explorationists, geologists, petrologists and mineralogists who had the good fortune to interact with this ''larger than life'' character. His approach focussed on using diamonds as a proverbial window to Earth's deep interior.

The early diamond mines of Kimberley, Cullinan and Jagersfontein provided unmatched windows into the Earth's deep mantle. This point was often highlighted by Steve on his South African sampling visits, and recognised by many of his famous colleagues and students of John Gurney, Peter Nixon and others. Numerous local and international research studies followed, documented in PhDs, MScs and scientific publications, helping to unlock the structure, fabric and composition of the lower crust, lithosphere and deep mantle.

Steve's research work became more wide-ranging over time, including revisiting some of his earlier pursuits. This included Brazil, India, South Africa, and West African localities, research on the Cosmos (pre-solar diamonds greater than 4.5 billion years old), and investigation of the enigmatic origin of black and porous carbonado-diamond.

Steve in the field in Liberia, standing next to the thorny Pandanus candelabrum plant that thrives in the potassium-, phosphorous- and magnesium-rich soil that sits above kimberlite pipes.

West Africa was a long-term favourite of Steve's. Initially Sierra Leone and subsequently Liberia, where he worked with long-standing friend Roger Youssef on little-known and poorly documented diamondiferous kimberlites and lamproites. Their work in Liberia also led to the identification of a specific plant, the thorny *Pandanus candelabrum*, that thrives off the potassium-, phosphorous- and magnesium-rich soils that sit above lamproite pipes. This discovery highlighted the importance of recognising non-traditional 'pathfinding' plant species to assist in the identification of lamproite and kimberlite source rocks in the heavily forested areas of West Africa. Steve's broader geological skills were considerable and given his passion for Liberia he assisted and advised from time to time on gold projects and geophysical exploration methods.

The mineral haggertyite is named after Steve. Haggertyite is a rare barium, iron, magnesium, titanate mineral ($Ba(Fe_6Ti_5Mg)O_{19}$) first described in 1996 from the Crater of Diamonds State Park near Murfreesboro (Pike County, Arkansas, USA). The microscopic metallic mineral crystallises in the hexagonal system and forms tiny hexagonal plates associated with richterite and serpentinised olivine of mafic xenoliths in the lamproite host rock. An iron(II)-rich member of the magnetoplumbite group, it is a light grey opaque mineral with Mohs hardness of 5.

Apart from being a voracious and passionate researcher, Steve was a committed and enthusiastic teacher and lecturer. His teaching style centred on making it clear to students from the outset that the origin of life on Earth is poorly understood and that once humans become extinct, we will never

reappear. Steve particularly emphasised the importance of continually striving to know more about the Earth we walk upon, live on and love.

In recent years Steve interacted regularly with young academics and students at the Department of Geosciences from the University of Cape Town (UCT). It was an environment and institution at which he spent many days and nights, interacting with well-known academics including Tony Erlank, John Gurney, Arch Reid and others, and research students, through the 1980s to 2000s.

Steve was particularly interested in facilitating access to sample material from West African kimberlites and lamproites for research work by academic staff and research students worldwide, but more specifically the young team looking to rebuild mantle and kimberlite studies at UCT. Several abstracts and papers on the Liberian and Sierra Leone kimberlites and lamproites were presented and published following the Geological Society of South Africa (GSSA) Geocongress in Stellenbosch in January 2023, the 12th IKC in Yellowknife (Canada) in June 2024, and in 2025, with Steve as a co-author.

Steve is survived by his wife Tatiana, son Mark from his first marriage, sister May and loving nieces and nephews, their spouses and children. May and niece Cheryllyn live in and care for the Guesthouse and portion of the old mine area at the famous Jagersfontein open-pit mine, first mined in 1871, in the western Free State (South Africa). This was another of Steve's favourite places that he purchased, maintained and visited whenever possible.

Steve will be remembered not only for his immense professional achievements, but for his kindness, generosity, and unwavering support for family, friends, colleagues, field assistants and employees.

Rest in peace, Steve. Your legacy in the field of geology and mineralogy, and the impact you had on all those who knew you, will endure.

***John Bristow**, colleagues, family and friends of Steve*

This is an abridged version of the full obituary compiled by the Overberg Geoscientists Group, which can be accessed here.

GSSA events 2026

GSSA Events for 2026

Date	Event	Venue
10 February	GSSA-SAIMM Breakfast	Royal Cape Yacht Club, Cape Town
4 March	From Rocks to Revenue; Entrepreneurship, Innovation & Startups in Geoscience	Online
10 March	Financial Literacy in Mineral Project Development	JHB Country Club
17 March	CPD Workshop	Online
18 March	Geotech for Geologists: understanding rock stability, geological structures and rock mechanics	Online
10 April	3D Geomodelling Workshop	Online
24 June	AI in Geology	Online
16 July	Beyond the Rocks: Essential Skills for Geoscientists	JHB Country Club
16 July	GSSA AGM	JHB Country Club
4 August	Field-to-Findings: A Complete Course in Drilling, Sample Handling and Result Interpretation	Online
TBC August	Mineral Resource Mastery	Online
8 September	Professionalism & Code of Ethics Workshop	Online
10–13 September	Lichtenburg 100	Council for Geosciences
18–19 September	Structural Geology Course & Field trip	Southbroom, KZN Coast
8–9 October	Data Analytics & Machine Learning	Online
19–20 November	African Exploration Showcase	JHB Country Club

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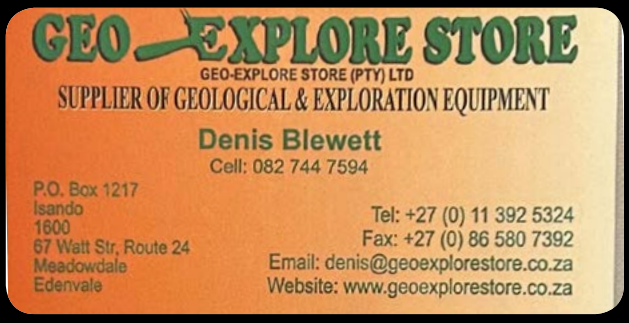

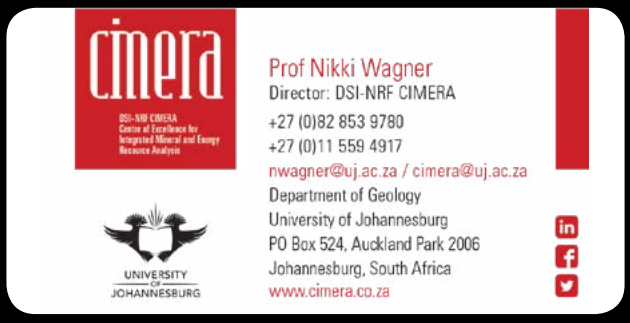

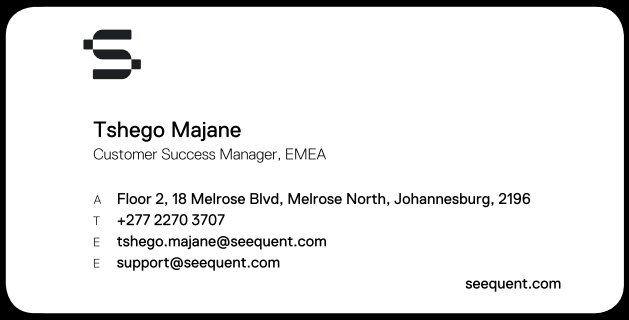

2026 Rates

rates card 2026

incl VAT

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

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

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

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

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

Advertorial rate per page:

R2 500.00

2. MECHANICAL DETAILS

Trim Size:	297 mm x 210 mm
Full Bleed	297 mm x 210 mm + 5 mm all round Full
Type Area:	Page: 275 mm x 190 mm
Half Page:	135 mm x 190 mm wide (Horizontal ad)
Quarter Page:	135 mm x 95 mm (Vertical ad)
Banner:	210 mm x 75 mm (Horizontal) + 5 mm all round
Screen:	300 DPI or more
Material:	E-mail high resolution PDF in CMYK

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

3. DEADLINES FOR COPY AND ADVERTISING MATERIAL

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

4. CANCELLATIONS

At least 4 weeks prior to deadline

5. CIRCULATION

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

6. ADVERTISING BOOKINGS AND SUBMISSION

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