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## Geoscience research meets geopolitics, technology, and investment strategies: A peek into the 2026 Investing in African Mining Indaba

A CGS delegation led by CEO, Mr Mabuza, members of the board, and executives participated in the annual geoscience and mining investment pilgrimage to Cape Town. The 2026 Mining Indaba (MI26) was held in the Cape Town International Convention Centre (CTICC) and provided a platform for networking and collaboration where the mining industry interacted with stakeholders, including investors and policy makers. Critical minerals dominated the discussions throughout the MI26, with the opening statement by Minister Hon. Gwede Mantashe emphasising unity and collective action amongst African countries and underscoring the

theme of “Stronger Together: Progress through Partnerships.” The African Minister’s Critical Mineral Roundtable is one such unifying structure that convened during the MI26. Through the Roundtable, African countries will continue to assess which minerals are critical for economic growth, export earnings, and industrialization, thus shifting the mining industry from pure extraction to refinement in order to spur industrialization through mineral value-addition practices. The Minister highlighted important factors that have a significant impact on the mining industry in Africa, namely, geopolitical tension, public-private sector partner-



Figure 1: CGS CEO Mr. Mosa Mabuza and Limpopo Province Premier Dr. Phophi Ramathuba discussing the launch of the virtual core library at the CGS booth.

ships, strategic collectivism amongst African countries, formalising artisanal mining, and investment in science, technology, innovation, and exploration.

## Geopolitics

The current geopolitical tension between America and China has strained the global minerals supply chain. China currently dominates mineral processing and beneficiation, controlling over 90% of REE and between 60–70% of lithium and cobalt processing. On the African continent, Chinese companies control about 70% of cobalt mining in the DRC as well as a significant share of various strategic commodities such as copper, lithium, and chromium. This dominance by a single country risks the global provision of mineral supply, which is prone to geopolitical instability. As nations seek to ascertain critical mineral feedstocks and supply chains, new alliances such as the Minerals Security Partnership are being conceptualized. However, countries and regional structures such as the European Union (EU) are also securing their critical mineral supply chains through bilateral agreements and strategic investment partnerships with the aim of gaining direct access to Africa's critical minerals.

The CGS participated in the SA-EU Investment Seminar that showcased some of the investment partnership agreements for critical mineral processing in South Africa. The EU pledged to invest in greenfield exploration, research and development, and skills transfer with a €12 billion investment fund to develop and secure reliable critical minerals for the EU.

This is in line with their critical mineral strategies, which are directed towards defence, the green energy transition, and digitalization of the future economy. This bilateral seminar recognized the need to conglomerate SADC mineral processing into a single country instead of each country having its own processing plant for the same commodity.

## Investor strategies for promoting mineral exploration

In the JSE and Norton Rose Fulbright Investment Seminar, representatives from the CGS, DMPR, PIC, BHP Xplor, JSE, and NRFSA discussed various investment strategies geared towards attracting mineral exploration investment to SA. Over the past decade, mineral exploration investment in SA has dropped to below 1%. Before this, SA attracted well over 5% of the global exploration share. To reduce investment risk in exploration, the South African government, through the PIC, IDC, and DMPR-CGS, launched a public-private sector partnership called the Junior Mining Exploration Fund. The R400-million fund is aimed at reviving investment in exploration. This exploration programme is leading geoscience research and data collection in partnership with the junior mining companies. Dr Tshibubudze, a senior specialist scientist at CGS, highlighted the success of this project and emphasized that the initial projects are currently progressing into the second exploration phase.

As part of these discussions, BHP highlighted their Accelerator Xplor Programme which provides a US \$500 000

equity-free grant for junior mining companies in their exploration stages. This programme offers technical and business support and mentorship to assist junior miners in scaling up and accelerating business growth. In SA, this fund has been released for exploration in the Northern Cape Province where Orion Minerals is exploring for sulphide deposits.

The JSE, through its Private Placement platform, aims to increase mining listing following a decade of declining listings. The fund allows junior mining and exploration companies to raise capital from South African investors. Four companies, Shuka Minerals PLC, Copper 360, Orion Minerals, and Mantengu Mining, have been listed through this platform.

There is a huge push on the African Continent to steer away from pit-to-port mining activities that have stripped the continent of its mineral resources and hindered economic growth. African countries are leaning towards mineral beneficiation within the mining country or regional beneficiation. As the continent aims to minimize raw materials export, several key enablers must be addressed. Chief amongst them is reliable infrastructure development, transportation, and reliable electricity. The Liberty, Simandou, and Lobito corridors are examples of corridor infrastructure connecting countries to ports. The corridors are important for cross-country trade and envisioned development of Special Economic Zones (SEZ). The success of South Africa's Kumba-to-Saldanha-Bay port corridor highlights the value of public-private sector partnerships, which can be used as a benchmark for future corridor infrastructure development plans. Electricity generation and transmission remain a continental problem. However, the future of energy generation will require a balance between decarbonization strategies, micro-grids, and market liberalization to meet electricity demand. Regional partnerships were proposed to create electricity corridors across the continent whereby electricity will be shared. Examples of electricity corridors already exist in the EU, where eight corridors connect countries to various power generation sources.



Figure 2: Networking session hosted by the CGS in collaboration with Sequent.





Figure 3: CGS Senior Specialist Scientist, Dr Asinne Tshibubudze, formed part of the “Africa’s exploration hotspots – critical minerals on a critical timeline” panel discussion.

### Strategic partnerships

CGS signed MOUs with BHP, Ghana, Gabon Ministry of Mining, key private-sector stakeholders, and key international geoscience research partners to drive exploration initiatives, decarbonization, and collaboration. These partnerships enhance CGS’s technical capacity, expand access to data and funding, strengthen global positioning, and support innovation, enabling improved service delivery and sustainable resource development.

### Technology

The role of technological advancement in geoscience research and mineral exploration was a major point of discussion. To fully facilitate geoscience research, technological approaches must have four attributes: they must be swift, accessible, precise, and cost-effective. With these attributes in mind, the CGS launched the Virtual Core Library with the aim of enabling geoscience research and mineral exploration in South Africa. The VCL is designed to shorten decision-making time-frames and cost related to exploration for the explorers-wannabe and explorers.

The CGS also attended the Deep-time Digital Earth (DDE) technical session, a science programme focusing on the applications of artificial intelligence to better understand and interrogate Earth’s 4.6-billion-year geological history. The platform uses data-driven systems to

model mineral resource prediction, map landforms, and reconstruct paleo-topography and paleo-coastlines, to name a few. The programme is open to partnership with African researchers, allowing geological data to be used to model and understand Africa’s cratons and mineralizing systems. The first African programme began in 2023 in partnership with the International Union of Geological Sciences (IUGS) and has developed a 1:5-million-scale geoscience information and mineral evolution map and also the open-source GeoGPT AI model designed specifically for geoscience research.

### Women in mining

DMPR Deputy Minister, Ms Phumzile Mgcina, hosted the DMPR G20 Women in Mining event aimed at accelerating female leadership in the mining sector. The CGS ladies participated in this informative session that drew on lessons and experiences of women in various roles in the mining sector. The message from

this session was that the DMPR is committed to promoting fairness and equity in the sector using education, mentorship, and development programmes such as leadership and executive training. This is aimed at increasing the number of women in technical positions in the sector. The session concluded with an announcement and signing of a pledge between the DMPR and the MQA to promote continuous education and skills development, foster economic independence and literacy, prepare women with skills and resilience, advocate for women’s rights and safety, and promote transformation to enable women leadership.

### Marketing and communication activities

The CGS successfully implemented a digital, PR, and stakeholder engagement campaign around Mining Indaba 2026 (MI26), anchored by the campaign platform

#GroundedInCollectiveProgress. The campaign was guided by clear strategic objectives aligned to CGS’s in-stitutional mandate and broader industry priorities. This year at MI26 we set out to achieve the following:

- Position CGS as a thought leader and authoritative voice in critical minerals, geological mapping, and exploration investment.
- Showcase CGS’s strategic programmes, including the Virtual Core Library and Junior Mining Exploration Fund.
- Elevate the visibility of CGS leadership and technical experts participating in Mining Indaba sessions.



Figure 4: Partnership in action. Mosa Mabuza (CEO, CGS) and Tim O’Connor (Group Exploration Officer, BHP) signing an MoU to drive exploration initiatives.



- Strengthen relationships with stakeholders, partners, and investors.
- Amplify CGS's presence across digital and media platforms.
- Mobilise internal staff to serve as advocates and extend campaign reach.

The campaign positioned the CGS as a central authority in advancing South Africa's exploration agenda, strengthening partnerships, and enabling investment in critical minerals and exploration. Through coordinated digital storytelling, media engagement, leadership profiling, and stakeholder activation, the CGS amplified its institutional role, advancing South Africa's geoscientific position by showcasing key strategic programmes including the

Virtual Core Library (VCL) and the Junior Mining Exploration Fund (JMEF). The CGS leadership and technical experts actively contributed to high-level industry conversations, reinforcing the CGS's position as a trusted scientific partner in enabling mining investment and sustainable resource development.

The campaign delivered strong visibility across social and stakeholder platforms, strengthened relationships with partners and investors, and created a foundation for sustained narrative leadership beyond MI26. Media coverage included radio interviews by Ms Sipelele Buthelezi on Power FM, Thobela FM, and Ukhozi FM, and by Dr Asinne Tshibubudze on Channel Africa. Television coverage featured Mr Sakhiseni Simelane on Newzroom Af-

rica and Mr Mosa Mabuza on eNCA and CNBC Africa. In addition, the CGS was profiled in online and print articles published across various platforms, including Africa Press Agency, Daily Maverick, Mining Magazine, BizCommunity, Mining Review Africa, and the Sunday Times.

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## CGS launches Africa's first Virtual Core Library at Mining Indaba 2026

On the eve of the official opening of the 2026 Investing in African Mining Indaba, the Minister of Mineral and Petroleum Resources, Hon. Gwede Mantashe, hosted a Ministerial Gala Dinner attended by industry executives, ministerial delegates from various countries, the Deputy Minister of Mineral and Petroleum Resources, other government ministers, and distinguished guests. The event provided the platform for the official launch of the Virtual Core Library (VCL), led by the Council for Geoscience (CGS) under the leadership of CEO, Mr Mosa Mabuza, together with the Chairperson of the CGS Board, Mr Kelepile Dintwe, and members of the CGS executive management team.

During the launch, Ms Sipelele Buthelezi, Executive Manager at CGS, highlighted the significance of the initiative, noting that the VCL represents a major step in modernizing South Africa's mineral intelligence landscape. The platform is Africa's first virtual core library, marking a significant milestone in the digital transformation of geoscience data management and accessibility.

After addressing the official opening of the Mining Indaba, the Honourable Minis-

ter, accompanied by the Deputy Minister, Hon. Phumzile Mgcina, and the Minister of Water and Sanitation, Hon. Pemmy Castelina Pamela Majodina, conducted a walkabout at the Brand South Africa exhibition stand. During the visit, Mr Clement Ndou (CGS) presented a brief demonstration of the Virtual Core Library, showcasing its functionality and highlighting its potential benefits to the Ministers.

By way of background, South Africa's National Borehole Core Depository, managed by CGS, houses one of the largest drill core repositories on the African continent, containing more than one million metres of drill core. These cores represent decades of geological exploration and constitute a national scientific asset of immense strategic value.

However, physical access to this material has historically been constrained by several factors, including geographic distance, logistical challenges, weathering of samples over time, and the high costs associated with travel, handling, and storage. As a result, the optimal use of this valuable geological data by industry, researchers, and government stakeholders has often been limited.

The introduction of the VCL directly addresses these challenges by transforming physical drill core into a high-quality digital resource. Through a secure, web-based viewer, users can now browse, search, and visually interrogate drill core samples from multiple locations across South Africa without the need to physically access the depository.

The VCL currently provides high-resolution core photography for all scanned boreholes. This visual dataset alone represents a major advancement, enabling users to conduct continuous downhole viewing, assess lithological changes, identify structural features, and perform preliminary geological interpretations remotely. For emerging explorers and junior mining companies in particular, the platform significantly lowers the barrier to entry by providing access to high-quality geological information without the prohibitive costs traditionally associated with core logging and sampling campaigns.

In addition, a more comprehensive suite of datasets is available to mineral rights holders on a commercial basis. These datasets integrate hyperspectral mineralogical products, downhole





Figure 1: Hon. Minister Gwede Mantashe interacting with guests at the Ministerial Gala Dinner.

geochemical analyses, geophysical logs, and detailed lithological logs. This tiered access model ensures that sensitive or proprietary data is appropriately managed while maximizing the value of the national drill core archive.

For mineral rights holders, access to these integrated datasets provides powerful opportunities to reinterpret legacy data, refine exploration models, and reduce the need for costly duplicate drilling programmes.

Beyond improved accessibility, the VCL also plays an important role in the long-term preservation of South Africa's drill core heritage. In an era when digital innovation is rapidly transforming the mining value chain, the Council for Geoscience's Virtual Core Library represents a forward-looking investment in South Africa's mineral future.

By unlocking the value of existing geological data through advanced digital technologies, CGS is not only enhancing exploration efficiency but reinforcing the role of geoscience as a cornerstone of sustainable mineral development in South Africa and across the African continent.



Figure 2. Ministerial gala dinner guests.





Figure 3. Mr Clement Ndou giving a demonstration of the Virtual Core Library (VCL) to the Minister and his delegation.



Figure 4. From L-R: Minister Gwede Mantashe, Deputy Minister Ms Phumzile Mgcina, Minister of Water and Sanitation, Ms Pemmy Majodina, and CGS CEO, Mr Mosa Mabuza.



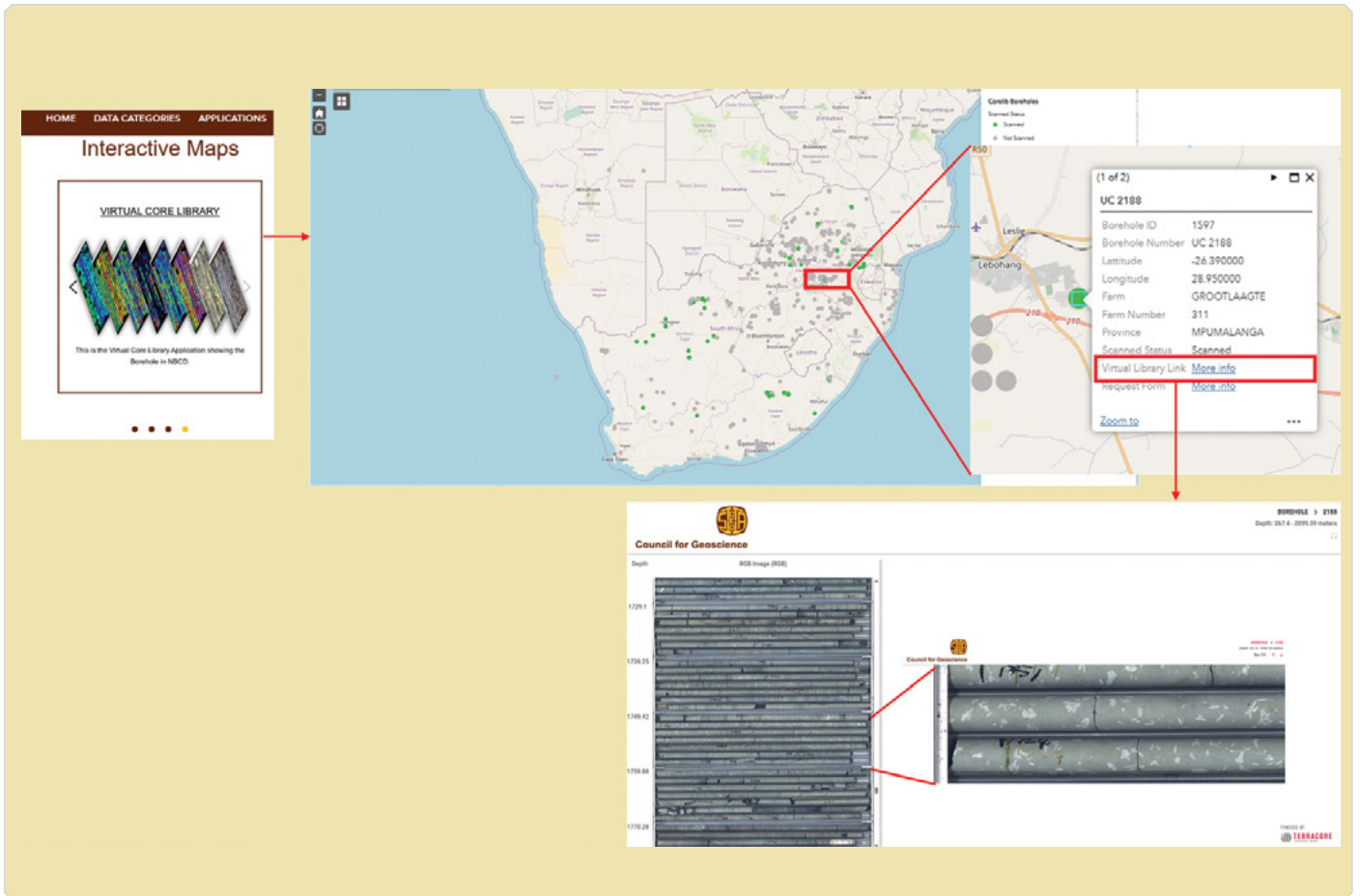


Figure 5. VCL access through the CGS's Data Management Portal with web-viewer showing high resolution RGB photography of a selected borehole.

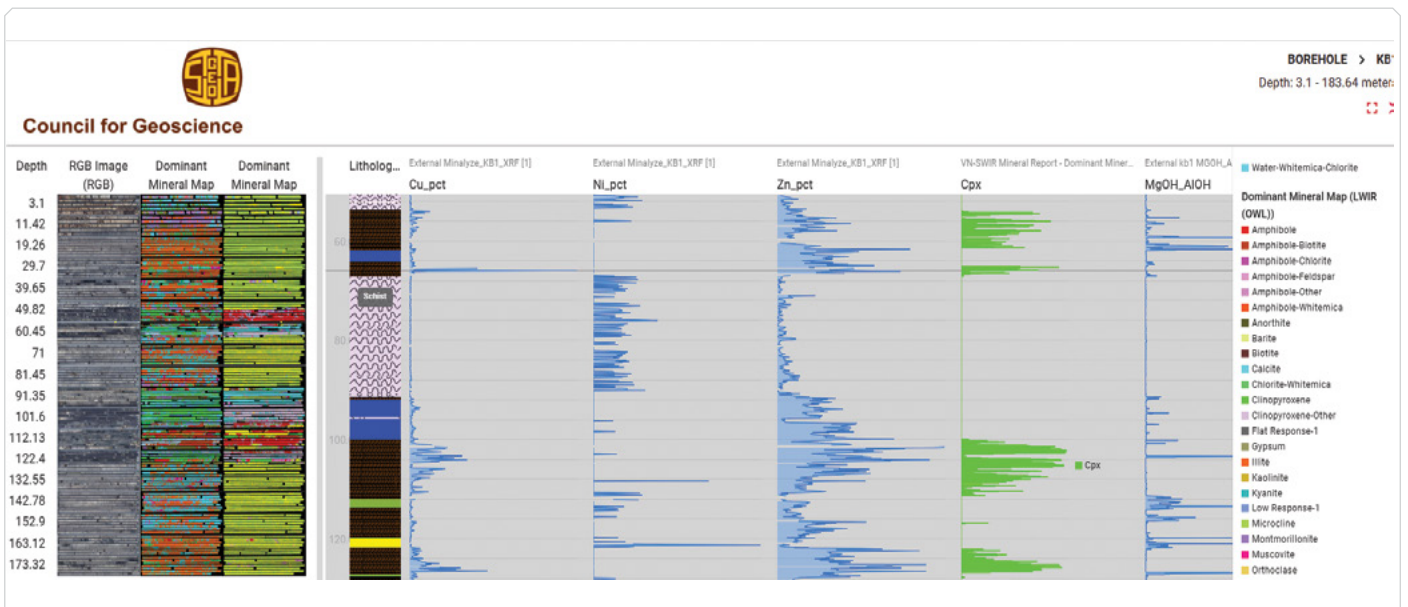


Figure 6. Comprehensive dataset showing the integration of hyperspectral data with geochemical data (pXRF) and lithology (available to rights holders only).

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# CGS delegates participate in the 2026 Igneous and Metamorphic Studies Group Conference

## Introduction

The 14<sup>th</sup> edition of the Igneous and Metamorphic Studies Group (IMSG) conference, founded in 2009 by a group of South African-based researchers in hard-rock geology, was hosted by the Geoscience Department of the University of Witwatersrand (Wits). This 14<sup>th</sup> IMSG conference was held at Digger's Retreat Hotel in Barberton, Mpumalanga from 18 to 22 January 2026. The IMSG meetings provide an opportunity for postgraduate students, established researchers, and industry experts in geoscience to present their work in a conference setting that emphasises discussion and networking.

The conference featured oral and poster presentations by postgraduate students from various South African universities (e.g., Wits, UKZN, UCT, Rhodes, and Stellenbosch) and by established researchers and industry experts. The presentations were excellent and focused on igneous and metamorphic processes as well as related topics, including Archean and Proterozoic crustal evolution, magmatism, structural geology, geochronology, and economic geology. The presentations reflected a diversity of research approaches, ranging from field-based investigations to analytical and modelling studies.

## Conference highlights

The conference programme was well-balanced and in addition to the presentations included a field trip to two important geological sites in the Barberton area (Figures 1, 2, and 3). The presentations looked at, among other things, the basic concepts of igneous and metamorphic geology as well as petrography and phase diagrams showing the stability fields of minerals, liquids (magma), and gases based on temperature, pressure, and chemical composition under equilibrium conditions. Phase diagrams are crucial for interpreting igneous and metamorphic rock formations, defining cooling histories, and predicting mineral assemblages.



Figure 1: Theeboom Formation granite–greenstone contact migmatite.

The field trip was undertaken to examine some of the oldest rocks of the Barberton Greenstone Belt and the early research conducted in the Barberton region (Figure 1). The field trip was informative and its structure was conducive to learning. The sites visited included:

- Upper Komati Section (25° 58' 20.37" S; 30° 50' 12.78" E), located on the north side of the Komati River within the Komati Formation, Onverwacht Group, where a narrow spinifex-textured komatiite flow overlain by pillowed Barberton-type komatiite was observed along the stream.
- Theeboom granite–greenstone contact migmatite (26° 01' 17.87" S; 30° 44' 37.58" E) (Figure 1). The three lower komatiite-dominated formations of the Onverwacht Group were intruded, dismembered, and metamorphosed between 3.2 and 3.4 Ga by several diapirically emplaced tonalite–trondhjemite–granodiorite (TTG) plutons. These TTG plutons are a distinctive light-coloured, sodium-rich variety that intruded mainly into the lowermost Sandspruit and Theespruit formations.

## CGS participants

CGS was represented by Ms Matamba Tsanwani and Mr Mawande Ncume who gave poster and oral presentations, respectively, on their PhD work (Figure 2). Ms Tsanwani's presentation titled, "The Petrography, Geochemistry and Thorium Potential of the Glenover Carbonatite Complex, Limpopo Province, South Africa," and highlighted the progress of the project. Mr Mawande Ncume discussed "The emplacement, subsurface extent, and geometry of the Sithilo Complex within the Tugela Terrane, based on field evidence and 3D geophysical modelling."

## Exposure and opportunities

Attending the IMSG 2026 conference provided participants with an opportunity to present their research to fellow students, expert academics, and industry representatives (Figure 3). This exposure offered valuable insights into emerging trends in data collection, analysis, and interpretation, while also broadening the participant's understanding of the diverse research being undertaken within the country, across various parts of Africa, and in Antarctica. Through expert feed-



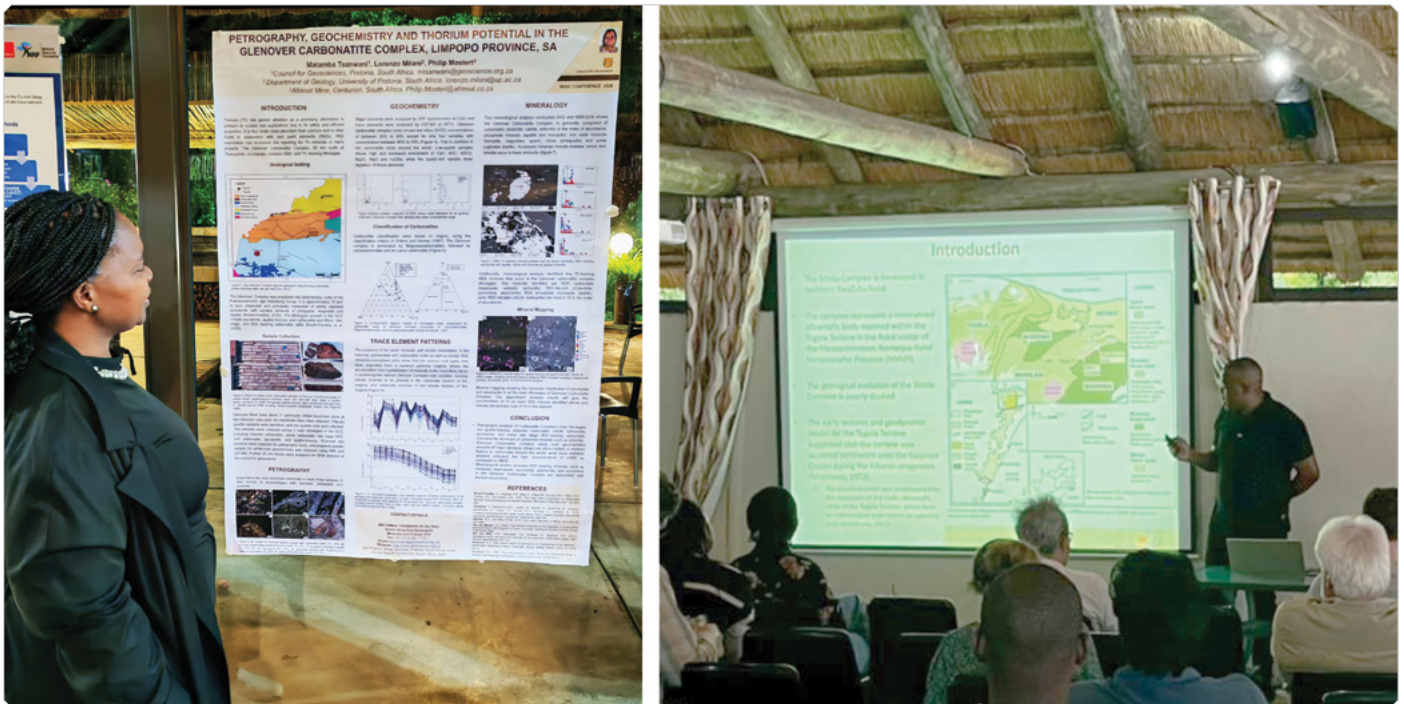


Figure 2: Ms Tsanwani discussing her poster with some of the IMSG participants (left) and Mr Ncume delivering an oral presentation (right).

back and constructive discussions, CGS participants were able to strengthen their analytical frameworks, acquire additional skills, and explore potential opportunities for future collaborative research.

**Conclusion**

The 2026 IMSG conference was a highly successful and academically robust event, offering immense value to post-graduate students, researchers, and CGS scientists. With its diverse range of topics and scientific depth, the conference catered to the broader geoscience community while fostering collaboration between academia and industry and providing excellent networking opportunities.

Participation in the IMSG conference not only enhances technical skills and analytical frameworks but also exposes employees to the latest research trends and potential collaborative opportunities. For CGS, sending staff to such events is an investment in professional growth, scientific excellence, and the continued advancement of the CGS geoscientific expertise.

**Recommendations**

CGS’s values, including excellence and continuous learning, closely align with the



Figure 3: Attendees of the 2026 IMSG conference listening to an oral presentation at the Digger’s Retreat Hotel, Barberton.

objectives of the IMSG conference. The event provides an excellent opportunity for CGS to send early-career scientists and interns to acquire valuable skills in emerging trends in data analysis, modelling, and interpretation. Further, these events are strategic platforms to build collaboration and strengthen research partnerships.

The conference is held annually and is organised by different universities at a dif-

ferent venue each year. The 2027 IMSG conference will be hosted by the University of Cape Town, with further details to be announced later this year.

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# Changing the narrative: CGS and DHET join forces to secure South Africa's academic infrastructure

On 2 December 2025, the Council for Geoscience (CGS) and the Department of Higher Education and Training (DHET) convened for a landmark hybrid seminar at the Council on Higher Education Auditorium in Pretoria. Attended by over 100 participants, the event was born of an urgent invitation from the DHET for the CGS to help address persistent challenges in infrastructure planning and delivery. The seminar's driving theme – “Changing the narrative from ‘the geotech could not pick it up’ to ‘the geotech picked it up’” – challenged the status quo of infrastructure failures.

## Challenges faced by institutions

The seminar opened with a striking observation from the Chairperson, the DHET Director of Infrastructure Support, Mr Tshimao Moleme, who noted a frustrating contradiction, namely, that despite tertiary institutions' housing of the very academic programs that produce top-tier specialists, they often fail to use those programs' knowledge and skills for their own sustainable infrastructure projects. This disjuncture has frequently led to critical oversights, such as geotechnical investigations failing to detect large quantities of rock with “shallow bedrock and ground excavability difficulties,” which are only encountered during construction, causing massive delays and budget overruns.

CGS Executive Manager, Mr Meintjes, responded by emphasising that geosciences must be the bedrock of every project. He further highlighted that CGS is available to advise and guide institutions of higher learning, not only on geotechnical investigations but also on geoscience professional training. The CGS team also highlighted the need to “enlighten decision-makers about compliance obligations” to avoid the “costly design errors, construction failures, and long-term maintenance issues” currently plaguing the sector.



Figure 1. Executive inputs during the DHET-CGS seminar.

## A foundation of law and mandate

The partnership is founded on a robust legislative framework designed to protect both the state and the public. Under Section 24 of the Constitution, the state is obligated to protect the right to a healthy environment, a mandate further specified by the National Building Regulations and Building Standards Act (Act 103 of 1977). This law requires that if ground conditions show a possibility of becoming dangerous, CGS, as the national custodian of geological information under the Geoscience Act (Act 100 of 1993), which was significantly bolstered by the Geoscience Amendment Act of 2010, must provide the essential geoscientific oversight and advice needed to navigate and comply with these legal requirements.

## Mapping geohazards and leveraging geoscientific data

The technical sessions highlighted the invisible geohazard threats beneath South African soil, including expansive clays, collapsible sands, landslides, and the inherent instability of dolomitic land, amongst others. Thousands of sinkholes have occurred in South Africa over the last 50 years, causing immense damage to infrastructure, disrupting economic activity, and resulting in loss of life. To combat this, the CGS showcased its National Geohazard Mapping Programme

(NGMP) and user-friendly Geoportal, which offer access to critical geological maps and hazard layers. These tools allow institutions of higher learning to integrate geohazard considerations into the earliest stages of infrastructure planning.

## Proven resilience in action

The CGS demonstrated the value of these sound geotechnical investigation practices and compliance through successful real-world applications across various built-environment projects nationwide. Investigations for the rehabilitation of the N14 sinkhole in Kuruman were highlighted as a critical success in restoring vital transport arteries. Strategic geotechnical oversight was also provided for high-value assets, including the structural design of the Zuikerbosch purification plant and the De Hoop gravity dam. Furthermore, road upgrades in the Sekhukhune District were safeguarded through specialised bridge site investigations and assessments of borrow pits for road construction materials. Collectively, these sites investigated by CGS in the past prove that thorough geotechnical evaluation strengthens infrastructure resilience and prevents costly failures.

## A future of collaborative growth

Looking ahead, the partnership will move beyond the auditorium and into the field,





Figure 2. Capturing a moment of unity with representatives from DHET, CGS, TVET colleges, and universities following the workshop.



Figure 3. Reflecting on the wisdom of Kgosi Jantjie’s closing core message at the seminar, “stewardship, collaboration, and long-term planning.”

and move towards formally establishing this strategic partnership through the IGR framework to strengthen infrastructure planning and resilience in South Africa.

The CGS and DHET have committed to establishing a seamless communication channel between institutions of higher learning and the CGS to enable the provision of efficient advisory services and capacity-building for institutional teams.

To ensure this knowledge reaches every corner of the sector, the teams plan to host regional seminars that bring these vital geotechnical insights directly to universities and TVET colleges across the country.

**Acknowledgements**

This seminar was underpinned by the technical excellence of CGS’s Infrastructure and Land Use team, led by Ms Nomvelo Mkhize, whose members authored and delivered the six core presentations and abstracts that constituted the event’s specialised and insightful content.

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# CGS scientists present at the third International Online Conference on Mineral Science

The CGS participated in the third International Online Conference on Mineral Science (IOCMS 2026), which was held virtually from 10 to 12 March 2026. The online format enabled broad global participation and fostered an inclusive and accessible environment for scientific exchange. It provided an effective platform for researchers from different regions and disciplines to present their work, engage in discussions on emerging developments in mineral science, and explore opportunities for collaboration within the international mineralogical community. The conference attracted strong international interest, receiving 161 paper submissions from researchers, academics, and industry professionals worldwide who shared and discussed recent advances in mineral science. Of these submissions, 110 papers were accepted for oral and poster presentations, with a total of 594 participants registering for the event.

The conference programme was organised into six thematic sessions over three days:

- Mineral Geochemistry: Environmental Applications and Recent Advances
- Mineral Systems and Ore Deposits: From Formation to Exploration
- Nanominerals and Clays: Emerging Applications in Materials Science
- Minerals in Extreme Environments: From Earth's Depths to Space
- Mineral Processing and Metallurgical Innovations: From Extraction to Refinement
- Emerging Frontiers in Mineral Science: Breakthrough Areas and Future Directions

Collectively, these sessions showcased cutting-edge research spanning crystal chemistry, environmental mineralogy, mineral processing technologies, and studies of minerals formed under extreme terrestrial and extraterrestrial conditions.

The CGS was represented by two researchers, Dr Sameera Mohamed and Prof. Frédéric Doucet. In the session titled *Mineral Processing and Metallurgical Innovations: From Extraction to Refinement*, Dr Mohamed delivered an oral presentation entitled "Utilization of plagioclase in mine residues as a silica source for the synthesis of high-purity silica nanoparticles." This research formed part of her PhD studies conducted in collaboration with the University of Pretoria, under the co-supervision of Prof. Doucet (CGS) and Prof. Van der Merwe (University of Pretoria). The study explores the potential of recovering valuable materials from mining residues by converting plagioclase-rich waste into high-purity silica nanoparticles. This work supports the development of more sustainable and value-added approaches to mine waste management while contributing to the growing field of advanced functional materials. The presentation stimulated constructive discussion and received valuable feedback from international participants, providing new perspectives

**Utilization of plagioclase in mine residues as a silica source for the synthesis of high-purity silica nanoparticles**

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Sameera Mohamed

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Prof. Dr. Luis Alberto Cisternas

Figure 1. Screenshot of the cover slide of the CGS presentation on plagioclase-based silica nanoparticles at IOCMS 2026, and stills of the presenter, Dr Mohamed (CGS), and the session chairperson, Prof. Cisternas (University of Antofagasta, Chile).



that will help guide and refine ongoing research. In particular, the insights gained will support further investigations into the synthesis of silica nanoparticles from other types of mining residues, an area with considerable potential for both environmental remediation and the production of high-value materials.

Participation in IOCMS 2026 provided valuable insights into emerging trends, innovative methodologies, and new

directions in mineralogical research. The conference emphasised the central role that mineral science plays in supporting the minerals industry, improving environmental management practices, and advancing our understanding of the geological processes that govern the formation and evolution of mineral systems. Such engagement also strengthens the CGS's international research visibility and fosters opportunities for future collaboration.

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## Screening of asbestos in Mpumalanga Province

### Introduction/Background

Asbestos mining in South Africa, which began in the 1930s, has left an unfortunate legacy of environmental degradation and public health challenges (Hartt, 1988). Abandoned and unrehabilitated mine dumps continue to release asbestos-contaminated airborne dust into surrounding communities, potentially exposing them to inhalable particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>) and fibrous silicate minerals. Although asbestos mining has been banned, historical waste dumps still contribute to widespread contamination, especially when these dumps have not been rehabilitated (Schapira et al., 2023). Reports link asbestos mining to health effects associated with airborne asbestos dust and fibres, including asbestosis, mesothelioma, lung cancer, and other respiratory illnesses. (Department of Employment and Labour, 2020; Noonan, 2017). Understanding how asbestos fibres disperse from mine dumps is therefore critical for assessing exposure risks, informing rehabilitation priorities, and guiding protective measures for affected communities. This study investigates asbestos detection at varying distances from a legacy asbestos mine dump, providing baseline data essential for effective environmental management and public health protection.

### Problem statement

Asbestos, a chemically inert fibrous silicate mineral, was mined in South Africa for decades until operations



Figure 1: Asbestos analyser in use for asbestos detection.

ceased due to confirmed health risks such as asbestosis, mesothelioma, and lung cancer (Ndlovu et al., 2013). Short fibres discarded in waste dumps remain major sources of airborne contamination. Rehabilitation has been adopted as a mitigation strategy, yet the extent of asbestos dispersion

and community exposure remains insufficiently characterised.

### Aims and objectives

The study's aim was to detect and monitor the presence of asbestos at varied distances (0.5 km to 5 km) from



the asbestos source, a former asbestos mine, using a calibrated handheld asbestos analyser.

### Materials and methods

At each screening point, five asbestos readings were taken within a 1-m<sup>2</sup> area to ensure representativeness. Directional screening was guided by practicality, accessibility, and the precautionary principle, as illustrated in Figure 1. Measurements were performed using the microPHAZIR AS, a near-infrared (NIR) handheld analyser specifically designed for rapid identification of asbestos-containing materials. This instrument enables non-destructive, on-site analysis in under ten seconds and can detect all six regulated asbestos types: chrysotile, crocidolite, anthophyllite, tremolite, actinolite, and amosite. Calibration of the asbestos analyser was performed before measuring each new site and, whenever prompted by the instrument prior to detection, using the asbestos reference and white reference calibration materials (see Figure 2). This systematic approach ensured consistency and reliability in the detection of asbestos at varied distances from the asbestos dump.

Surface screening for asbestos was conducted at varied distances from legacy asbestos mine dumps. Measurements were taken at 0.5 km intervals starting from 0.5 km to 5.0 km from the asbestos dump in all accessible directions (north and south in this study area) (see Figure 3). Upon completion of the detection, the specific asbestos mineral type (e.g., chrysotile) was recorded in field notebooks and subsequently entered into a spreadsheet for analysis and interpretation.

### Results and discussions

The detailed results table (not shown) contained asbestos detection data collected over a 12-month period from January 2024 to January 2025 at the investigated site in Mpumalanga Province. Detection percentages were calculated using the following method: For each sampling distance (0.5 km, 1.0 km, etc.), the total number of positive chrysotile detections was counted and summed. The percentage of positive



Figure 2: On-site calibration of the MicroPHAZIR asbestos analyser.

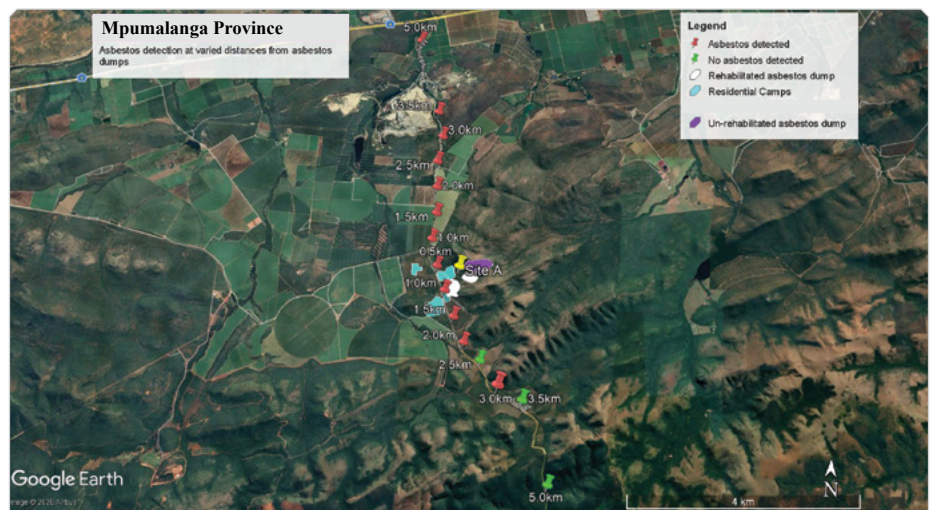


Figure 3: Directional, varied-distance asbestos screening.



asbestos detections at each distance over the period was then calculated by dividing positive asbestos detections by the total number of sampling points and multiplied by 100 to get a percentage.

Chrysotile asbestos is the predominant type detected. This aligns with expectations, given that chrysotile fields occur in Mpumalanga Province where historical mining activities primarily focused on chrysotile asbestos.

Percentage of asbestos detection at varied distances from the asbestos dump

The asbestos screening confirms strong directional and distance-based differences in asbestos dispersion. Chrysotile asbestos was most frequently detected between 0.5 km and 3 km from the asbestos dump. In the southern direction, positive detections were less frequent and more variable, with several points showing no asbestos detected, suggesting lower but unpredictable risk. In contrast, the northern direction consistently showed high positive asbestos-detection rates across months and distances, likely driven by prevailing winds and surface runoff, which carry asbestos fibres. Overall, proximity to the dump strongly influences asbestos presence, while wind direction amplifies contamination northwards, underscoring the need for targeted monitoring and mitigation at high-risk distances and in high-risk directions (see Figure 2).

*Correlation between the distance from a dump and the positive asbestos presence*

The site showed a pattern with detection rates ranging from 60% to 100%. These correlations show that, as the distance away from the dump site increases, the percentage of positive asbestos detections generally decreases. The scatter plot confirms moderate negative correlation between distance from the asbestos dump and positive asbestos detection. The trendline ( $y = -7.41x + 96.01$ ,  $R^2 = 0.45$ ) shows that positive asbestos-mineral detection rates decline as distance increases, with the strongest contamination being observed close to the dump (0.5–1 km) and a secondary hotspot being observed around 3 km away (Figure 3).

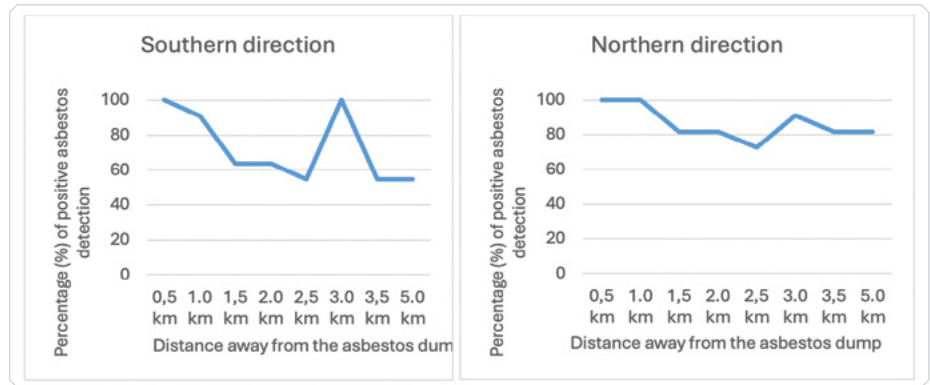


Figure 4: Percentage of positive asbestos detection at varied distances from the asbestos dump.

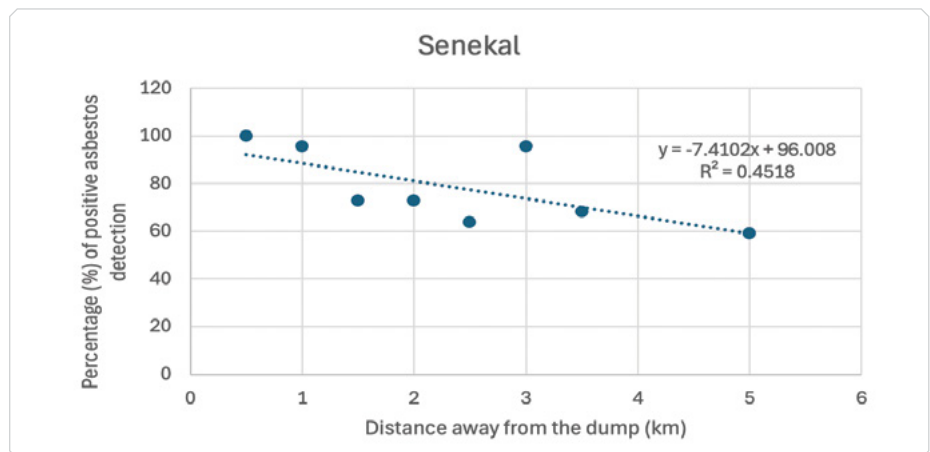


Figure 5: Correlation between the distance from a dump and the positive asbestos presence, for January 2024 to January 2025 at Mpumalanga.

**Conclusion and findings**

This study presents asbestos detection data gathered over 12 months at varied distances from a selected asbestos dump in Mpumalanga Province. The data characterised the spatial and directional patterns of asbestos contamination associated with an unrehabilitated asbestos mine dump.

Chrysotile asbestos was the dominant mineral type detected at the site, which is consistent with the province’s chrysotile mining history. Proximity to asbestos dump sites showed the strongest positive asbestos detection, with near 100% positive detection rates within a 0.5 km to 1.0 km radius. The positive asbestos detection rates generally declined with increasing distance, as confirmed by negative correlation coefficients ( $R^2 = 0.4518$ ).

These findings showed that unrehabilitated asbestos mine dumps

in Mpumalanga province continue to pose a public health risk. The inhalation of airborne chrysotile fibres is associated with respiratory diseases, including asbestosis, lung cancer, and mesothelioma. In addition, the persistence of contamination at distances of up to 5.0 km from the asbestos dump showed that risk exposure extends beyond the immediate vicinity of the unrehabilitated site.

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## CGS collaborates with SAPS to evaluate closed mine openings in Mogale City Municipality, Gauteng

Over several years, the Council for Geoscience (CGS) has conducted research on Derelict and Ownerless (D&O) mines in response to a directive from the Department of Mineral and Petroleum Resources (DMPR). This work forms part of the Integrated Research into Mine Closure (IRMC) programme, which focuses on assessing state-contingent liabilities associated with D&O mines in South Africa. A key objective of this research is to evaluate the condition and integrity of mine openings that had previously been closed and confirm the effectiveness of implemented closure measures. Specifically, the inspections aim to verify that seals, barriers, and rehabilitation structures remain intact and functional; identify evidence of tampering, vandalism, or unauthorised access; detect potential safety hazards such as instability, subsidence, or structural deterioration; and assess environmental risks, including possible contamination of soil, groundwater, or air.



Figure 1. Aerial photos around Protea mine.



Figure 3. Five dangerous open holes all vertical except the middle bottom inclined shaft.



To support these efforts, CGS developed and maintains a national web-based database of D&O mines. The database serves as the authoritative repository for the location, classification, and risk status of derelict and ownerless mine openings in South Africa and supports monitoring, risk assessment, and informed decision-making. Using this database as a reference, Mintek implemented the national Mine Openings Closure Programme on behalf of the DMPR since 2019. The programme included the planning, design, and physical closure of identified mine openings, with prioritisation guided by the database maintained by CGS.

Within this framework, a field assessment was conducted in Krugersdorp, Mogale City Municipality, to monitor the condition of closed and sealed mine openings as part of routine database monitoring activities. The inspection took place from 1 to 12 December 2025 and was carried out by a coordinated inter-agency task team comprising officials from the CGS project team, the CGS Stakeholder Relations Office, and the South African Police Service (SAPS). SAPS participation was necessary to ensure the safety of personnel due to the volatile conditions in the area, largely driven by extensive illegal mining activities.

The CGS Stakeholder Relations Office facilitated coordination between SAPS and the CGS team to ensure security support in areas affected by illegal mining. Prior to fieldwork, an inception meeting was held with SAPS Krugersdorp to develop safety protocols, assess potential site hazards, and review the inventory of mine openings scheduled for inspection. This work contributes to South Africa's broader efforts to mitigate environmental hazards and protect communities living near abandoned mining sites, in line with Section 24 of the Constitution of the Republic of South Africa (1996), which guarantees the right to an environment that is not harmful to health or well-being. In areas where access was restricted due to illegal mining activities, aerial imagery provided by SAPS was used to support site assessments (Figure 2). A total of 131 sealed mine shafts in Mogale City were assessed to evaluate structural integrity and potential public safety risks. Of the mine shafts



Figure 3. A SAPS sergeant monitoring the vandalised shaft with active illegal miners underground.



Figure 4. Closed mine shaft around Windsor mine, around Krugersdorp.



surveyed, 100 remained intact with no signs of vandalism, 5 showed clear evidence of vandalism, and 26 were newly found mine shafts. In several cases, shaft landmarks could not be located, likely due to sediment burial caused by ongoing illegal mining activities, which limited effective verification and monitoring.

Evidence of illegal mining was widespread and included informal ore-processing facilities, small tailings dumps, and everyday utensils used by illegal miners. Many of the inspected shafts were clustered within confined areas, with some located within approximately 100 m of residential settlements, posing significant environmental, health, and public safety risks. High levels of volatility were observed in the study area,

particularly at Kroondraai, Boltonia, and Protea Mines, which were identified as the highest-risk regions. Persistent illegal mining activities and associated safety concerns have prompted the municipality, in collaboration with SAPS, to plan targeted operations aimed at disrupting illegal mining networks. These operations include regular SAPS-led enforcement actions to suppress illegal mining and dismantle logistical support systems, including the supply of food and materials. These high-risk sites will be formally reported to the DMPR for further intervention and closure measures to mitigate environmental hazards and safeguard nearby communities.

The findings of this assessment highlight the need for a coordinated multi-agency

task team comprising CGS, DMPR, SAPS, Mintek, and municipalities to more effectively address illegal mining. Illegal mining remains a persistent national challenge that poses significant risks to public safety, environmental protection, and the sustainable management of derelict and ownerless mine sites.

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## CGS champions soil erosion research in the Eastern Cape

Soil erosion is a serious form of land degradation and remains a threat to South Africa's land use sustainability. In the Eastern Cape, both water and wind erosion are causing significant damage to arable land, infrastructure, and pristine environmentally sensitive areas. In response to the increasing risk associated with this geohazard and in support of its mandate to provide geoscientific knowledge for responsible land use and infrastructure development, the Council for Geoscience (CGS) has invested in building scientific capacity by funding PhD-level research into the dynamics of this problem.

Two PhD studies were recently completed in the Eastern Cape: Rebekah Singh completed a PhD on wind erosion susceptibility along the Wild Coast at Stellenbosch University in March 2024, while Debbie Claassen completed a PhD on the development and evolution of gully erosion in the Mthatha area at Nelson Mandela University in December 2025. Both PhD studies focused on former South African homeland regions, where soil erosion remains under-studied, despite many areas being significantly degraded and highly vulnerable. These studies employed cost-effective geographic information systems and remote-sensing approaches and mod-



Dr D. Claassen was awarded her PhD at Nelson Mandela University in December 2025 and Dr R. Singh attained her PhD at Stellenbosch University in March 2024.



els for evaluating soil erosion in data-scarce environments, and developed erosion susceptibility models that can serve as decision-making tools for conservation planning. The studies further emphasised the risks to infrastructure and examined the environmental and anthropogenic drivers of accelerated erosion. Using multi-temporal mapping, the authors quantified the rates of erosional growth patterns to determine the principal factors influencing their progression and/or stabilisation. The two PhD studies resulted in peer-reviewed national and international journal articles, as well as conference papers, highlighting their contribution to

scientific knowledge on the topic of soil erosion in the southeastern region of South Africa.

These doctoral studies and their associated research costs were funded by CGS, demonstrating the organisation's commitment to strengthening soil erosion research, improving scientific understanding, and supporting the development of meaningful, evidence-based intervention strategies for the Eastern Cape aimed at protecting and preserving South Africa's valuable land resources from accelerated water and wind erosion.

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