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Council for Geoscience

INSIDE:

Exceptional Representation of CGS Scientific Expertise at the CAG30 Colloquium in Nairobi

The Council for Geoscience (CGS) participated in the Colloquium of African Geology (CAG30) held in Nairobi, Kenya from 23–27 September 2025. The conference theme, Unveiling Africa's Geological Resources: Forging a Path for Sustainable Development, was an excellent launchpad for CGS's comprehensive, multidisciplinary research themes, which span critical minerals, precious metals, energy, hydrogeology, structural geology, geohazards, establishment of the CGS digital core library using hyperspectral imaging, and effective geoscience communication strategies.

The CGS team was led by Mr W. Meintjes (Executive Manager: Integrated Geoscience Development), Ms S. Buthelezi (Executive Manager: Geoscientific Services), Dr T. Ntholi (Manager: Scientific Resources), Ms M. Mukwevho (Manager: Knowledge Management), Mr Mbuyiseni Ngcobo (Communication and Stakeholder Relations), Ms M. Mathabatha (Marketing Officer), and Ms Z. Sibewu (Technical Assistant: Integrated Geoscience Development). The scientific team comprised Ms V. Nengovhela, Mr C. Groenewald, Mr M. Ncume, Mr C. Ndou, Mr T. Radzuma,

Figure 1. Team that represented the CGS at the CAG30 conference. Front row (left to right): Ms M. Mathabatha, Ms C. Setladi, Mr T. Radzuma, Mr C. Groenewald, Mr C. Ndou. Back row (left to right): Mr R. Chauke, Ms V. Nengovhela, Ms Z. Phikiso, Ms Z. Sibewu, Ms S. Buthelezi, Mr W. Meintjes, Mr M. Ncume, and Ms M. Mukwevho.

Ms Z. Phikiso, Mr R. Raselavhe, Ms C. Setladi, and Mr R. Chauke, who presented research findings across various conference themes.

The topics and themes that resonate with CGS's scientific programme include: Critical Minerals for the Green Transition – Africa's Hidden Wealth and Global Leverage; Smart Exploration Frontiers – Integrating Geophysics, Geochemistry, and Geotechnics for Precision Resource Exploration in Africa; Pan-African Orogeny, Plate Tectonics, and Earth Processes; Engineering Geology and Geotechniques and Geohazards; and Geoheritage, Geodiversity, and Geotourism. In these discussions, emphasis was placed on coordinating policy development that fosters public-private sector partnerships in geoscience research and mineral exploration, integrating various geoscience research methodologies, and promoting regional collaboration amongst African countries using existing regional structures and institutions such as the Organisation of African Geological Surveys (OAGS) to establish research collaboration corridors.

As the world transitions towards renewable energy, a surge in demand for critical minerals, such as lithium, cobalt, manganese, and graphite, are reshaping mineral exploration priorities and expenditure. The Critical Minerals session presentations highlighted that Africa holds some of the largest untapped reserves of critical minerals, e.g. cobalt in the Democratic Republic of Congo, manganese in South Africa and Gabon, lithium in Zimbabwe, and rare earths in Malawi and Tanzania. Geoscience research aimed at understanding mineralizing systems and resource estimation for these critical minerals is important for socio-economic emancipation on the continent. To achieve this, exploration/mining activities must be linked to energy generation/security, mineral beneficiation, and industrialisation initiatives. These measures will shift continental export from raw materials to refined metals with higher economic value.

Geothermal energy systems are an important facet of energy security in Africa where most countries are reliant on single-source energy-generation systems, such as coal-fired power stations. Diversifying energy sources with carbon-neutral alternatives would increase energy security and promote the industrialisation of African economies. The East African Rift Valley geothermal energy programmes presented at the conference are prime examples of investment in developing this resource and using modular power plants to generate additional capacity on the grid.

Geoscience research has a critical advisory role in geo-hazard preparedness across the continent. Most African countries are experiencing the harsh effects of climate change, for example heavy rainfall that leads to landslides. Severe weather, coupled with seismic events, threatens infrastructure development initiatives. The Engineering Geology and Geotechniques and Geohazards session emphasized that multidisciplinary, site-specific geoscience assessments are critical to enhancing infrastructure development decision-making, disaster preparedness, and risk-reduction strategies.

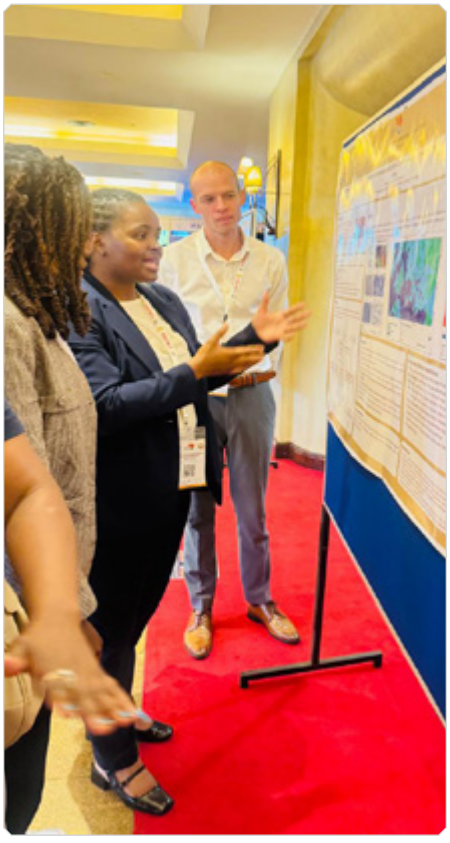

Figure 2. Ms Z. Phikiso giving a poster presentation.

Figure 3. Interactive discussions with various stakeholders at the CGS information booth.

Conference highlights:

- CGS received special recognition from the conference organizers for its outstanding contributions to the event. The CGS was lauded for the exceptional quality of its presentations and impactful participation in various sessions, which showed expertise and a commitment to advancing geoscience in Africa. CGS was also commended for its members' dedication to serving in diverse roles to ensure the smooth running of the conference.

- Mr Clement Ndou served as a panellist in the session titled Smart Exploration Frontiers – Integrating Geophysics, Geochemistry, and Geotechnics for Precision Resource Exploration in Africa, where he provided valuable perspectives on innovative exploration techniques. Mr Ndou also delivered the closing declaration, emphasizing geoscience's pivotal role in Africa's development, with a focus on transparency, value addition, and Pan-African collaboration for sustainable resource utilization.

Figure 4. Mr C. Ndou delivering the closing declaration of the conference.

- Mrs Zama Sibewu co-chaired the Geothermal Energy session, driving insightful discussions on sustainable energy solutions.
- Ms Muneiwa Mukwevho expressed heartfelt gratitude for the recognition and for CGS's role as a sponsor, further highlighting the critical importance of geoscience, networking, and collaboration in driving the continent's scientific progress. CGS's contributions during the conference not only left a lasting impact on the conference attendees but also highlighted the organization's commitment to ensuring the advancement of geoscience in Africa.

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CGS Participates in the 11th International Conference of the AAWG

Background

The Council for Geoscience participated in the 11th International Conference of the African Association of Women in Geosciences, which was hosted in Kampala, Uganda, from 1–5 October 2025. The conference, themed Geosciences and the Future of Africa: Emerging Technologies, Innovations, and Inclusive Growth, explored how advances in the geological sciences could contribute to sustainable development across the continent. The conference celebrated the 30th anniversary of the AAWG's establishment in 1995. The inaugural international conference of the AAWG took place in Cape Town, South Africa in 2002 and paved the way for women geoscientists in Africa to meet and discuss geoscience-related issues biennially.

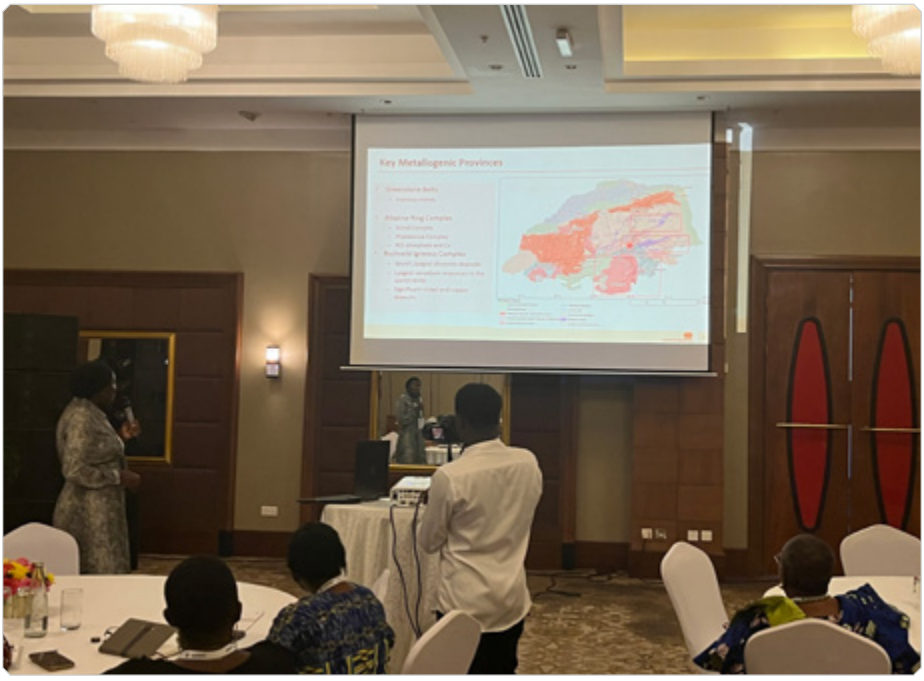

Figure 1. Ms Ndivhuwo Mukosi, delivering a presentation on Integrated and multidisciplinary geoscientific mapping of the key metallogenic provinces in the Limpopo Province, South Africa, titled Implications of Derisking Exploration of Critical Minerals.

The objectives of this year's conference were to:

- Promote the advancement of scientific and technological knowledge in the geosciences
- Increase the participation of women in geoscience fields and leadership positions
- Encourage research and training to support women in their geoscience careers
- Cooperate with African governments in formulating policies for geoscience development
- Create a platform for networking and knowledge-sharing among women geoscientists

A total of 212 delegates, representing 25 countries, were in attendance, mostly from Uganda, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Morocco, Nigeria, and Kenya. CGS was represented by Ms Ndivhuwo Cecilia Mukosi and Ms Naledi Chere. The conference consisted of two days of technical sessions followed by a field trip in Western Uganda.

Technical sessions and workshops

Senior government officials, including Ms Grace Nassuna of the Ministry of Energy and Mineral Development, Dr Callist Tindimugaya of the Ministry of Water and Environment, and Dr Lyoidah Kiconco of the Uganda National Oil Company, gave opening remarks and contributed to the panel discussions on both days of the conference proceedings.

The technical sessions consisted of parallel sessions that were focused on the following sub-themes: Geosciences for Climate Resilience, Critical Minerals and the Green Economy, Emerging Technologies in Oil and Gas, Digital Transformation in Geosciences, Water Supply and Geosciences, Urbanization and Resilient Infrastructure, Geoethics and Inclusive Development, and Geoscience-Driven Policies in Natural Resource Management.

Figure 2. Ms Ndivhuwo Mukosi (centre left) and Ms Naledi Chere (far right) leading a panel discussion during a workshop entitled Bridging the Gender Gap in African Geoscience: From Education to Leadership.

Figure 3. Delegates and the salt miners at Kibiro Springs, the picturesque view of the Western Limb of the East African Rift – a site of active continental rifting.

Ms Chere and Ms Mukosi both participated in Session 1. Ms Mukosi gave a presentation on "Integrated and multidisciplinary geoscientific mapping of the key metallogenic provinces in the Limpopo Province, South Africa." This presentation focused on the status of the Integrated and Multidisciplinary Mapping Programme (IMMP) in the Limpopo Province, highlighting the considerable progress that has been made as well as the programme's implications for strengthening mineral exploration initiatives and providing scientific solutions to the region's socio-economic challenges (Figure 1).

The technical sessions were dynamic and provided insight into the current status of the various sub-themes of each session and demonstrated the importance of geoscience knowledge and its impact on the development of the country as well as other government and socio-economic imperatives.

In addition, the Uganda National Chapter's hosting of the anniversary event, marking 30 years since the inception of the AAWG, served as a vibrant celebration. The event provided a platform for reflection on the organization's significant contributions to scientific advancement and capacity-building across the African continent over the past three decades, while also looking forward to future initiatives.

Figure 4. Delegates at the Kabalega Industrial Park Project site.

Women in Geoscience Workshop

In line with the theme of the conference, the AAWG hosted a workshop on 2 October 2025. The workshop brought together women from diverse backgrounds and underscored the vital role that women play in geoscience programmes in their respective countries. The keynote speaker at the workshop was Dr Juliette Tea from Côte d'Ivoire. A pioneer and certified specialist in the field of geological studies, Dr Tea made a significant contribution to the early geological surveying and petroleum development of Côte d'Ivoire. She started her career as a geological engineer in 1981 and became Deputy Director of Exploration in 1998. Throughout her career, Dr Tea has been a strong advocate for women in her field and has mentored many young women. Dr Immaculate Ssemanda, one of the founders of AAWG, shared insights into the growth and evolution of the AAWG and its 1st Biennial Conference, held in Cape Town in 2002. She also reflected on her role as a geosciences lecturer at Makerere University, where she supervised a significant number of female graduate students. The panellists comprised Prof. Oga (Cameroon), Ms N. C. Mukosi and Ms N. Chere (both CGS), Prof. Errami (Morocco), and Dr Tea (Côte d'Ivoire) (Figure 2).

Figure 5. Delegates and salt miners at Kibiro Springs, the picturesque view of the Western Limb of the East African Rift – a site of active continental rifting.

Figure 6. A visit to the Kingfisher Oil & Gas Project led by the Petroleum Authority of Uganda (PAU) and China National Offshore Oil Corporation (CNOOC)..

The workshop explored the current standing of women in the geoscience

Figure 7. Delegates attending a site briefing at the Tilenga Oil & Gas Project site.

Figure 8. A view of one of the "silent walking" rigs developed for the TotalEnergies' Tilenga Oil & Gas Project.

field, showcased available opportunities, and highlighted notable success stories. During the workshop, an online survey was launched to gather information about the current status of women in geoscience in Africa, which will enable geoscientists from across the continent to participate and contribute. The results of the survey will be shared at follow-up workshops. The survey link has been shared on the AAWG website (www.aawg.org) and its social media channels.

Post-conference field trip

Ms Chere and Ms Mukosi participated in a three-day post-conference field trip to Western Uganda from 3–5 October 2025, which explored the Uganda Albertine Graben. This included visits to some of the renowned geological sites and resource exploration and development areas, such as the Kibiro Geothermal Hot Springs located at the base of the western limb of the East African Rift. Other areas included the Kibiro salt mining sites, Kabalega Industrial Park, CNOOC King Fisher Facility, TotalEnergies Tilenga Oil Project, and the Murchison Falls National Park (Figure 3-9).

The field excursions kicked off at the base of the western portion of the East African Rift System, known for its picturesque geological landscapes, traditional salt mining operations, and its natural hot springs. The Kibiro Hot Springs are being considered for large-scale geothermal energy extraction. The water reportedly reaches temperatures of 100° C and is used by the community for domestic purposes, including direct ingestion and cooking. Nearby, villagers use indigenous knowledge systems – custom salt pads ("gardens") – to mine and process salt for sale in local town markets. The salt mining economy is the villagers' primary livelihood in this region.

The second leg of the journey was to the Kabalega Industrial Park and the Kingfisher Development Area Project under the guidance of the Petroleum Authority of Uganda. The final configuration of the industrial park will comprise Uganda's second international airport, crude oil export hub, Uganda Refinery, and petrochemical and fertilizer industries, among others. Parts of the airport, such as the runway, have already been completed.

The Kingfisher oil and gas development, for which CNOOC Ltd is the lead operator, will comprise four well pads – a total of 20 production and 11 injection wells drilled to target depths ranging from 3,500–7,000 m b.g.l. (meters below ground level). Oriented production wells are being utilised and aligned with the key geological features to enable maximum extraction of hydrocarbons. At peak, the oil field is expected to produce 40,000 barrels per day, and a central processing facility (CPF) has been designed to separate the hydrocarbons extracted from the production wells into crude oil, gas, and water. It is envisioned that the crude oil will be refined at the Kabalega Industrial Park refinery, while the water will be treated on site. An estimated 70,000 jobs are expected to come from this development.

The third and final day of the excursion included a visit to the Tilenga Oil & Gas Project and the Murchison Falls National Park. The Tilenga Oil & Gas Project lies within the Buliisa and Nwoya districts in the Lake Albert Region of Western Uganda. It was previously led by Heritage Oil and Tullow Oil, but the

Figure 9. Delegates during a geological excursion to the Murchison Falls National Park, a prominent geological feature of the of the Albertine Rift Valley.

current lead developer is TotalEnergies. At peak, the development is projected to produce 190,000 barrels of oil per day, to be processed at the CPF before transmission to the Kalabega Industrial Park Refinery. Uganda will retain a portion of hydrocarbons from both the Kingfisher and Tilenga projects for domestic use and industrial applications. The remaining, larger portion will be transferred via the 1,443-km East African Crude Oil Pipeline (EACOP), currently under construction, to the city of Tanga, Tanzania. From there, the crude oil will be exported to international markets.

The trip concluded at the Murchison Falls National Park, situated at the apex of Lake Albert along the White Nile River within the Albertine Rift Valley. The central feature of the park is a narrow gorge through which the Nile River runs with force. The field team hiked through the park, observing the escarpments, river terraces, and geological strata along the trail.

Conclusion

CGS delegates were recipients of two awards. Ms Mukosi was awarded a Certificate of Excellence in recognition of her outstanding paper presentation, and Ms Naledi Chere was awarded a Certificate of Recognition for active participation in the Geoscience and Future of Africa session. During the closing ceremony, the Democratic Republic of the Congo was announced as the host country for the 12th International Conference of the African Association of Women in Geosciences, which will be held in 2027.

Overall, the conference and the field trip provided delegates with an opportunity to share experiences, expand their professional networks, and present their technical work. The conference also provided a learning platform and an enabling environment conducive to potential collaboration.

Remember to complete the AAWG survey!

Link below:
https://www.surveymonkey.com/r/72CKHFH

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The 52nd International Association of Hydrogeoloists Congress 2025

The Council for Geoscience participated in the 52nd International Association of Hydrogeologists (IAH) Congress in Melbourne, Australia, from 15–19 September 2025. The theme of the congress was Groundwater Now and for the Future and was intended to foster sustainable groundwater management and governance by bringing experts and professionals together to share insights and facilitate discussions on critical issues such as climate change, water quality, population growth, and the development of science-based policies. Additionally, the event endeavoured to promote the development of emerging researchers and professionals. The primary objective of attending the IAH Congress was to present the work of the CGS, provide training opportunities, and gain insights into advancements in geoscience research through engagement with other scientific organisations and experts at the conference. This was also an opportunity for CGS delegates to learn about innovative practices and methods from other organisations that could enhance current and future projects at CGS.

CGS was represented by Ms Lufuno Ligavha-Mbelengwa and Ms Naledi Chere, both from the Minerals, Energy, Environment, and Groundwater Unit. Ms Ligavha-Mbelengwa participated in one of the pre-congress field trips, the

Daylesford Field Trip, on 15 September, which aimed to take the IAH delegates around some of the mineral springs in the Daylesford region of Western Victoria. Ms Ligavha-Mbelengwa delivered an oral presentation titled “Application of a multi-tracer approach to assess groundwater flow discontinuity.” This presentation highlighted the significance of integrating multiple groundwater flow tracers and other datasets when assessing hydrogeological connectivity in complex settings, particularly those characterised by geological structures such as dykes.

Figure 1. Ms Lufuno Ligavha-Mbelengwa and other IAH delegates at one of the mineral springs during the field trip

Some of the highlights and lessons from the congress, which could be implemented in CGS projects, are as follows:

Research about emerging organic contaminants (EOCs) in groundwater is ongoing worldwide, yet their occurrence, sources, and fates are not fully understood. To date, EOCs have been included in the Mine, Environment and Water Management Programme (MEWMP) as part of the ingress control studies where these compounds were used as tracers of surface water and groundwater ingress into mine voids. EOCs were successful tracers for mapping ingress. However, there were gaps associated with the inability to apportion these to their specific sources due to the variability in concentrations and the complex environmental interactions in the Eastern Basin. EOCs could further be useful to MEWMP in understanding the influence of mine-contaminated water on shallow aquifers, especially in areas where surface discharge is a challenge during flood periods, as in the Western Basin.

Figure 2. Ms Lufuno Ligavha-Mbelengwa delivering an oral presentation

Hydrogeological mapping projects at CGS only assess inorganic water parameters and do not investigate the presence of EOCs in groundwater. This, too, is a gap, especially because the occurrence, transport, and behaviour of EOCs are still understudied in the aquifer systems. Integrating these compounds into the mapping programs will enhance the map products, since these will provide a better understanding of the overall status of the groundwater quality and the distribution of EOCs in aquifer systems, which is something that has

Figure 3. Ms Naledi Chere and Ms Lufuno Ligavha-Mbelengwa at the IAH congress venue

generally not been considered when mapping groundwater resources. This will provide a baseline understanding of their occurrences, especially for the purposes of groundwater protection and management.

As part of the hydrogeological baseline studies in the Carbon Capture Utilisation and Storage (CCUS) project, multiple applications of novel tracers, including hydrochemistry, environmental isotopes, EOCs, and age-dating tracers, can be included as complementary tools. The integration of these tools could better characterise aquifer systems by providing information about the origin and recharge history of the groundwater. Furthermore, these will provide the natural background concentrations of various chemicals, which will aid in assessing the influence, if any, of CO_2 injection on the surrounding groundwater systems. In addition, the integration of multiple novel tracers could provide valuable insights into hydraulic connectivity and groundwater flow paths, both of which are crucial for understanding the potential migration of CO_2 between the subsurface systems. The application of novel tracers could also be extended to the MAR project, to improve the understanding of natural attenuation processes for these compounds.

The IAH Congress 2025 was an invaluable experience that exposed the CGS delegates to cutting-edge research being conducted in hydrogeology and related disciplines.

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CGS Delegates Participate in the Timing Earth Processes Masterclass at the University of the Witwatersrand

Representatives from the Council for Geoscience attended the geochronological masterclass on timing Earth processes at the University of the Witwatersrand (Wits University) in Johannesburg that took place from 27 to 29 October 2025. CGS was represented by a team comprising junior and senior scientists from the Mineral, Energy, Environment and Groundwater Unit (MEEG). This event signified a pioneering development on our shores, with international experts in geochronology being invited to educate scientists on different techniques and benefits for dating rocks. This component is of pivotal significance to CGS, insofar as it provides support for the CGS high resolution integrated multidisciplinary mapping programme. The programme finds application in a variety of fields, including the enhancement of the understanding of South African stratigraphy in geological mapping, the guidance of mineral exploration in numerous mineral systems, and the support of environmental and archaeological studies. The collaboration between Wits University and CGS has been commended for taking the lead in the geochronology project, with the aim of producing future geochronology publications.

Figure 1. The CGS team led by the Geochronology Project Leader, Dr Thomas Muedi, visited Wits University for a geochronology masterclass along with team members Ms Zoleka Sibeko, Ms Samukelisiwe Mtshali, Ms Yasmeen Abrahams, Dr Robert Netshitungulwana, Mr Tshimane Mofokeng, Mr Conrad Groenewald, Mr Neo Moabi, Mr Mawande Ncume, Ms Matamba Tsanwane, Mr Senzo Ndumo, and Mr Sifiso Bucibo.

The international experts who were invited included **Prof. David Chew**, who is Deputy Director of the Irish Research Centre at Trinity College, Dublin. His remit includes geochronology and isotope geochemistry, with a focus on addressing various issues in the field of geoscience. Dating using the LA-ICPMS on carbonites and appetites demonstrated the use of the IsoplotR for geochronology raw data plotting. Additionally, he delivered a lecture on the principle of beta decay, with particular reference to geochronology and petrochronology. A practical group exercise was conducted to interpret a dataset of varying levels of complexity. The session concluded with a review of the appropriate interpretative workflow, after which notes were shared to facilitate further learning.

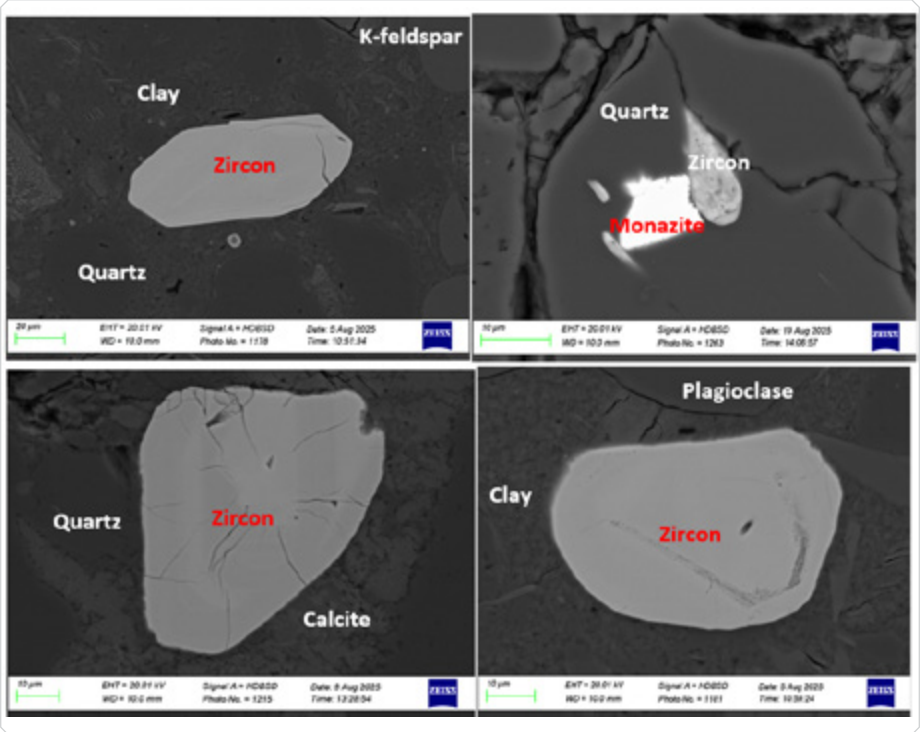

Figure 2. Zircon, monazite, clay, plagioclase, and quartz grains imaged using the CGS Scanning Electron Microscope (SEM) in Backscattered Electron (BSE) mode. The grains on these polished stubs were obtained from samples collected from the Lesotho Drakensberg mafic volcanic rocks. They display a range of morphologies including variations in size, color, and texture, and their origins remain contentious.

Figure 3. Photos showing masterclass participation and an IsoplotR demonstration for plotting geochronology data by Dr Scott MacLennan, as well as Prof. Maria Ovtcharova and students presenting their work during the sessions.

Prof. Urs Schaltegger was one of the masterclass experts on geochronology, specifically ID-TIMS, and he works with Prof. Maria Ovtcharova from Geneva University, Switzerland. He gave a lecture on how thermal ionisation mass spectrometers (TIMS) work, and an introduction to zircon characteristics, fundamental decays, and advantages and disadvantages of the LA-ICPMS and ID-TIMS techniques. He also highlighted the importance of using the spikes produced at both Massachusetts and Princeton Universities as they are the only ones that are reliable for precision enhancements.

Prof. Maria Ovtcharova detailed the precision and accuracy in ID-TIMS dating and revealed that we have few ID-TIMS dating techniques around the world. Additionally, she explained that the only ID-TIMS geochronology dates by a South African were from the Karoo dolerites published in 2019 and 2022 on high-precision U-Pb geochronology applied to the biological and environmental disturbances during Earth history by Dr Thomas Muedi from the CGS, Dr Scott MacLennan at Wits University, and the late Prof. Maarten de Wit of Nelson Mandela University. Practical experiments and exercises regarding the ID-TIMS U-Pb data were also demonstrated.

Finally, delegates were led by **Prof. Robert Bolhar** from Wits University who gave a lecture on the trace element analyses and interpretations from the LA-ICPMS data.

Take-home message

It is important to consider rock dating for mapping and exploration as it gives an understanding of the mineralized zones and mineralization systems of South Africa. Rock age data alone rarely provides all the facts; they must be combined with lithological mapping, structural geology, geochemistry, geophysics, and other datasets to build a robust exploration model.

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CGS Delegates Attend 2025 Joburg Indaba

The 2025 Joburg Indaba, held on 8–9 October at the Inanda Club in Sandton, marked its 13th year as one of South Africa's most prominent mining industry gatherings. The event brought together mining companies, investors, government departments, state-owned entities, and legal experts for a high-level dialogue on the country's mining landscape. With a programme shaped around emerging sector priorities, investment needs, and policy considerations for the minerals industry, the Indaba continued to serve as a significant platform for the future of the mining industry.

Figure 1. CGS delegates at the Junior Indaba 2025 (L–R): Dr Asinne Tshibubudze, Mr Hakundwi Mandende, Mr Tumisang Sekhonyana, Ms Mahlako Mathabatha, Ms Luyanda Ngcobo, Mr Mbuyiseni Ngcobo, and Mr Ngqondi Nxokwana.

Day one of discussions focused on improving South Africa's policy and investment climate. Delegates stressed the importance of regulatory certainty, predictable licensing systems, and stable policy frameworks in attracting exploration activity and strengthening investor confidence. South Africa's potential for positioning itself as a key supplier of critical minerals, specifically platinum group metals (PGMs), manganese, and chromium, was a recurring theme in the context of the global energy transition. Beneficiation, industrialization, and local value addition were highlighted as crucial to driving employment and supporting broader economic development. Infrastructure constraints, from power reliability to logistical inefficiencies, remained a central concern, with strong calls for effective public-private partnerships. Transformation and community upliftment were emphasized as essential components of an inclusive mining sector.

Figure 2 (L–R). Mr Ngqondi Nxokwana, Ms Luyanda Ngcobo, Ms Mahlako Mathabatha, Mrs Keabetswe Lehong, and Mr Mbuyiseni Ngcobo.

Day two continued these conversations by examining how to harmonize meaningful transformation and economic growth. Delegates reinforced the need for a balanced energy combination that recognizes the importance of coal in the energy mix while scaling up renewable energy solutions for the dual goal of long-term energy stability and economic growth. Human capital development emerged as a priority, with an emphasis on stronger collaboration between industry, academia, and government to build technical skills and prepare the next generation of mining professionals. The importance of innovation, Environment, Social, and Governance (ESG) leadership, and transparent stewardship was also highlighted as key to securing the industry's global competitiveness. Infrastructure and energy-related challenges remained a persistent theme, accompanied by renewed commitment to collective long-term solutions.

The closing address by Minister of the Department of Mineral and Petroleum Resources (DMPR), Mr Gwede Mantashe, reinforced the sector's importance to South Africa's economy. He highlighted improvements in mineral rights administration, ongoing regulatory reforms, and renewed momentum in exploration initiatives. The Minister acknowledged persistent infrastructure and energy challenges, emphasized the need for strengthened mine safety measures, and called for collective commitment to driving inclusive, responsible, and sustainable growth across the industry. The Minister further

Figure 3. Dr Asinne Tshibubudze presenting an update on the Junior Mining and Exploration Fund.

Figure 4. Panellists (L–R): Bernard Swanepoel, Ntsiki Adonisi, Mzila Mthenjane, Tseliso Maqubela, Nolitha Fakude, Lemogang Pitsoe, and Mosa Mabuza.

emphasized the importance of strategic geological data collection for unlocking South Africa's exploration potential and driving sustainable mineral development.

The CGS delegation, which was led by the CEO, Mr Mosa Mabuza, included Dr Asinne Tshibubudze, Mr Mbuyiseni Ngcobo, Mr Hakundwi Mandende, Ms Mahlatse Mononela, Mr Ngqondi Nxokwana, Mrs Keabetswe Lehong, Ms Luyanda Ngcobo, Ms Mahlako Mathabatha, and Mr Tumisang Sekhonyana (Figures 1 & 2). Dr Tshibubudze delivered an impactful presentation detailing the achievements of the first call of the Junior Mining and Exploration Fund, which supported seven exploration projects targeting critical minerals such as copper, nickel, graphite, lithium, and rare earth elements across five provinces (Figure 3).

Mr Mabuza participated in a high-level panel discussion about how to create an enabling environment for current and future mining opportunities in South Africa (Figure 4). He highlighted the need for stricter oversight in issuing and retaining prospecting and mining rights, noting that unused or dormant rights hinder active exploration and economic growth. He emphasized that streamlining these processes is essential for ensuring that mineral resources are developed efficiently and responsibly.

The 2025 Joburg Indaba provided critical insights into policy reform, investment opportunities, critical minerals, and sector sustainability. The discussions were strategic, the perspectives forward-looking, and the collective commitment to transformation clear, reaffirming the central role of mineral exploration in South Africa's economic renewal of mining as a sunrise industry and the importance of critical minerals in the energy transition.

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CGS Strengthens Its Migration from ArcMap to ArcGIS Pro Through Training and Capacity Building

The Knowledge Management business unit is actively supporting the transition from ArcMap to ArcGIS Pro. ArcMap has long been used as the primary GIS desktop application, which has now reached its final release at version 10.8.2. Esri has confirmed that ArcMap and the ArcGIS Desktop suite will be fully retired on 1 March 2026, after which no updates, patches, or security fixes will be provided. Continued reliance on ArcMap beyond this point increases operational and cybersecurity risks, as unsupported software becomes vulnerable and incompatible with evolving technologies.

Esri introduced ArcGIS Pro in 2015 to replace ArcMap and meet modern GIS requirements. ArcGIS Pro is built on a 64-bit, multi-threaded architecture that delivers significantly improved performance for large datasets and advanced geoprocessing. It integrates 2D and 3D capabilities within a single platform and provides a modern ribbon-based interface that improves workflow efficiency. The software also connects seamlessly with ArcGIS Online and ArcGIS Enterprise, supporting the industry shift toward web GIS mapping.

Knowledge Management delegates represented the Council for Geoscience at the Southern African Esri User Conference 2025, held from 28 to 31 October in the Drakensberg, South Africa, with a focus on the theme 'Connect. Innovate. Map', highlighting the following:

- AI and machine learning (ArcGIS Pro, Survey123 AI, computer vision)
- Real-time GIS (ArcGIS Velocity for Enterprise)
- Spatial analytics workflow to automate and streamline tasks for integrating diverse spatial data

To prepare CGS GIS users for this transition, the Knowledge Management business unit has been hosting targeted capacity-building activities. On 6 November 2025, a workshop facilitated by Ms Bongiwe Nhlapo from Esri South Africa introduced GIS users to the advanced functionality of ArcGIS Pro, demonstrated future tools, and highlighted the security risks of continuing to use ArcMap beyond its retirement. It was confirmed that all future enhancements, including emerging capabilities such as Geospatial Artificial Intelligence (GeoAI), will be developed exclusively for ArcGIS Pro. This workshop helped create awareness of the need for migration and encouraged users to adopt ArcGIS Pro as their primary GIS platform.

Figure 1. Attendees on Day 1 of the ArcGIS Pro Intermediate Training held at CGS War Room, Pretoria Office, 3 December 2025.

Figure 2: Attendees on Day 2 of the ArcGIS Pro Intermediate Training held at CGS War Room, Pretoria Office, 3 December 2025.

Following this, the Knowledge Management business unit hosted a two-day intermediate internal training session from 3 to 4 December 2025. The training focused on essential ArcGIS Pro skills such as georeferencing, working with File Geodatabases, manipulating attribute tables, and using geoprocessing tools and ModelBuilder. The aim was to build confidence and ensure that GIS users are equipped to perform routine tasks efficiently in ArcGIS Pro.

To further strengthen these capabilities, an advanced ArcGIS Pro training session is scheduled for 11 to 12 February 2026, ensuring that CGS scientists are well equipped to make full use of the ArcGIS Pro in data management, analytics, cartographic, and web-GIS functions.

Through these initiatives, CGS is taking proactive steps to ensure a smooth and secure transition from ArcMap to ArcGIS Pro. The Knowledge Management business unit remains committed to supporting GIS users as the organisation embraces modern tools, future-focused capabilities, and industry-aligned GIS practices.

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CGS Scientists Attend GSES Workshop and UN GeoNow 2025 in China

Mr Adrian Williams and Mr Sashan Manikam, two scientists from the Council for Geoscience, were invited to attend a Deep Ocean and Ecology Workshop hosted by the Global Subseafloor Ecosystem and Sustainability (GSES) programme in Hangzhou, China. The event took place from 14 to 28 October 2025 and was hosted at the prestigious Second Institute of Oceanography with 23 participants hailing from mainly African countries.

Figure1. GSES certificates presented by Prof. Fengping Wang of the International Centre for Deep-Life Investigation, Shanghai Jiao Tong University.

Deep-Sea Ecosystems Workshop

The training covered a wide range of deep-sea science topics, including deep-sea ecosystems, mineral resources, physical oceanography, and ocean chemistry. Participants were introduced to several deep-ocean research programmes and initiatives, along with their aims, future objectives, and current progress. These included the UN Ocean Decade (2021–2030), the Deep Ocean Stewardship Initiative (DOSI), and the International Ocean Drilling Programme (IODP³). A highlight was the facilities and museum tour of the Second Institute of Oceanography.

Among the facilities included in the tour was a visit to the Key State Laboratory on Submarine Geoscience. Participants were shown models of the various research vessels, hydroacoustic and geophysical equipment at the laboratory's disposal, reflecting their extensive offshore geoscientific surveying and research capacity. There were also samples on display, collected by the institute from some of the most extreme and inaccessible environments on the Earth's surface such as hydrothermal vents, abyssal plains, and subduction zones. The workshop aimed to foster knowledge sharing and promote international collaboration in deep-sea research, with a particular focus on supporting professionals from developing countries.

UN GeoNow 2025

The second United Nations Geospatial Knowledge and Innovation Week (UN GeoNow) was held in Deqing, China from 20 to 24 October 2025. As part of the GSES Deep-Sea Workshop delegation, Mr Adrian Williams and Mr Sashan Makiam were invited by the UN GeoNow 2025 organizing committee to deliver a keynote address and engage in a roundtable discussion under a special session titled 'Geospatial Knowledge and the Blue Economy'.

Mr Adrian Williams delivered a presentation titled 'Geospatial Knowledge for South Africa's Blue Economy – A Council for Geoscience Perspective'. The keynote highlighted the importance of the CGS's offshore geoscience programme, showcasing the progress that the CGS has made since its inception. Emphasis was placed on the value of the geospatial data collected, and the geoscientific insights produced, in addressing a wide range of geospatial data collected and geoscientific knowledge produced in addressing different questions and challenges in offshore mineral resource studies, coastal erosion, and geohazard mapping in unlocking the potential of the blue economy as envisioned by Operation Phakisa. A key theme highlighted was the value of collaboration, knowledge transfer and innovation in the geospatial stakeholder space, and how strategies, policy development, and decision-making should be driven by geospatial data.

Mr Sashan Manikam participated in a roundtable discussion alongside five other contributors titled 'Deep-Sea Exploration and Future Collaboration Pathways for the Economy', which focused on how geospatial data can be leveraged to support the blue economy sustainably. The discussion explored the value of expanding

Figure 2. Mr Adrian Williams delivering a CGS perspective on South Africa's blue economy and the successes of the CGS marine geoscience programme (GeoNow 2025).

Figure 3. Mr Sashan Manikam participating in a round table discussion on the topic of 'Deep-Sea Exploration and Future Collaboration Pathways for the Economy' (GeoNow 2025).

deep-sea exploration to support blue economy growth, the need to balance economic development with the long-term sustainability of offshore resources, and effective pathways for strengthening international cooperation, with a strong focus on building robust knowledge-sharing networks.

Summary

The engagement reinforces the CGS's commitment to South Africa's blue economy initiatives, the importance of the marine geoscience programme, and building collaborations with local and international partners in the marine science community.

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Picarro G2301 Gas Concentration Analyser

Introduction

The Council for Geoscience has procured a state-of-the-art mobile laboratory for the advancement of its research capabilities, in particular for the monitoring of naturally occurring carbon dioxide (CO_2), methane gas (CH_4), nitrates, and vapour. This equipment has been added to the CGS fleet to augment the research work of the Carbon Capture, Utilisation and Storage (CCUS) project. The equipment will be used to monitor soil gas and flux – primarily in the leakage of CO_2 in the soil vadose zone before escaping into the atmosphere, and in the monitoring of the aforementioned parameters in various projects at CGS.

The Picarro G2301 gas concentration analyser

The Picarro sampler is the world's leading sampler that provides solutions for measuring and monitoring the concentrations of trace gases and stable isotopes in greenhouse gas (GHG) emissions. The Picarro G2301 gas concentration analyser is designed for atmospheric studies, air quality monitoring, and emissions. It offers simultaneous, accurate measurements of carbon dioxide (CO_2) and methane (CH_4), as well as water (H_2O) vapour at parts per million (ppm). It satisfies the performance requirements for CO_2 and CH_4 atmospheric monitoring set forth by the Integrated Carbon Observations System (ICOS) for CCUS research, and aids in finding, quantifying, and eliminating large CO_2 leakages by performing concurrent and uninterrupted assessment of these ambient trace gases.

Case studies

The Picarro G2301 gas analyser was used in past studies and has produced valuable data in gas detection. A study done by Verhulst et al. (2017) in Los Angeles, United States, titled 'Carbon dioxide and methane measurements from the Los Angeles Megacity Carbon Project', made use of this device to continuously measure CO_2, CH_4, and H_2O across 12 sites ranging from urban to coastal, desert, and mountainous . The Picarro G2301 gas analyser provided enough reliable data on the gas fluxes to conclude that GHG emissions were higher in the city compared to other areas due to anthropogenic activity.

Another study by Kharaka et al. (2018), titled 'Changes in the chemistry of shallow groundwater related to the 2008 injection of CO_2 at the ZERT field site, Bozeman, Montana, USA', focused on the detection of variations in CO_2 concentrations post-injection in a CCUS project, and showed a decrease in pH together with an

Figure 1. Installation of chambers for soil gas sampling.

Figure 2. Picarro unit sampling soil gas.

increase in alkalinity and electrical conductivity (EC). The Picarro analyser enabled the researchers to detect variations in the CO_2 that indicated leakage or migration through soil and groundwater sources.

Both projects demonstrated the effectiveness of the Picarro G2301 in gas and water chemistry investigations. The Picarro analyser is a reliable instrument for CO_2 detection and early identification of CO_2 leakage from CCUS storage sites.

Preliminary results of soil gas flux in CGS's CCUS project

The training and trial test on the Picarro analyser for soil flux has been conducted and preceded by a systematic sampling design for seasonal monitoring in the pre-injection phase of the CCUS. The following results were obtained.

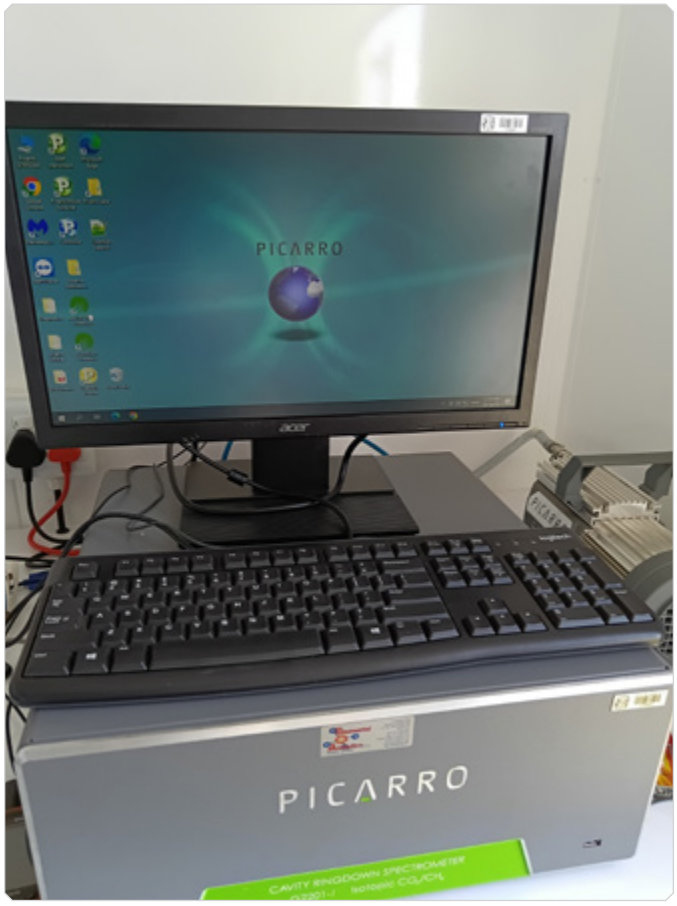

Figure 3. Desktop computer and Picarro analyser module.

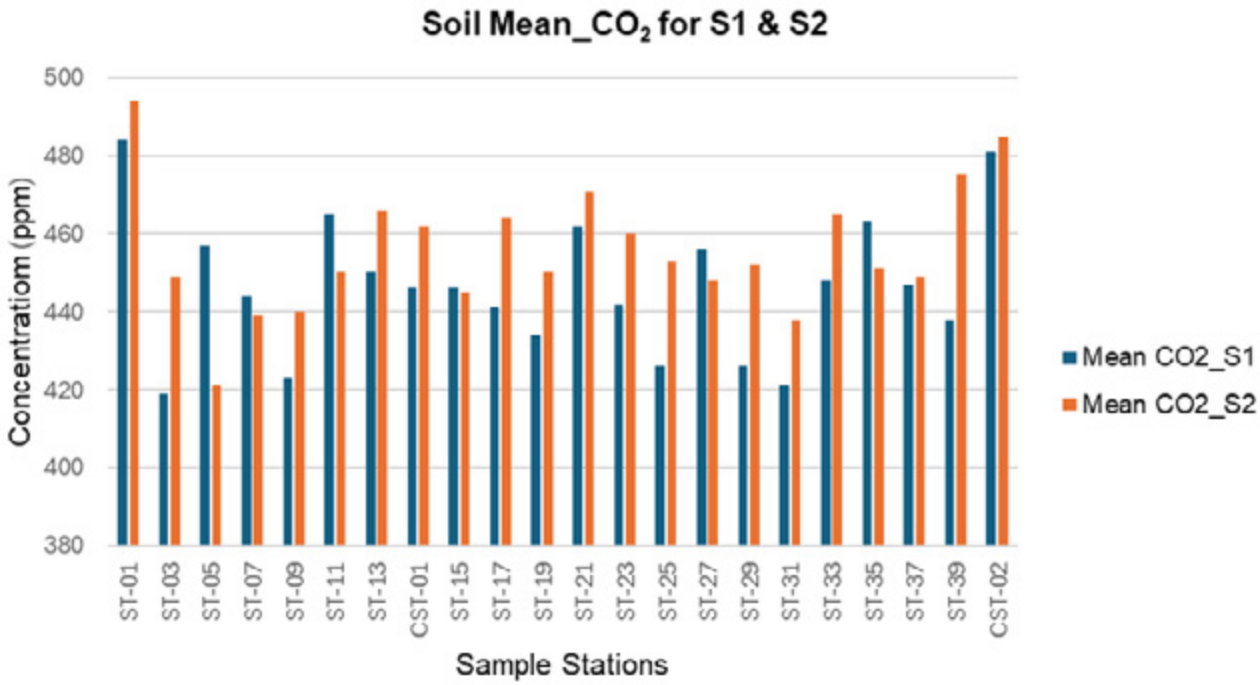

Figure 4. Initial soil gas concentration of $C0_2$ and CH_4 sampled.

The concentration of both CO_2 and CH_4 during the initial stages of sampling indicated a fluctuation range between 400 and 500 ppm mean concentrations. This is normal for South African atmospheric conditions, which range around 400 ppm for CO_2. This means that the CO_2 and CH_4 concentration levels shown or detected are normal in the sense that they have not exceeded 500 ppm.

Conclusion

The Picarro G2301 gas concentration analyser has shown that it can capture accurate and meaningful CO_2 data. Bearing in mind that South Africa does not have national ambient air quality standards for CO_2, the next step will be to distinguish if the detected CO_2 and CH_4 were triggered by previous drilling, or if they are naturally developed and dispersed to the surface ground because the injection phase is not yet implemented. More literature reviews will be conducted to support the results and contribute to the mitigation of gas pollution.

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