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contents

Front cover photo:
General view of the terrain at Riemvasmaak. The view is looking west, from a hill where fluorite was being exploited by local artisanal diggers. Some of the spoils piles are evident on the right. Vehicle for scale down in the valley. For more about fluorite from Riemvasmaak, see Mineral Scene on pg. 40. (Photo: Bruce Cairncross)

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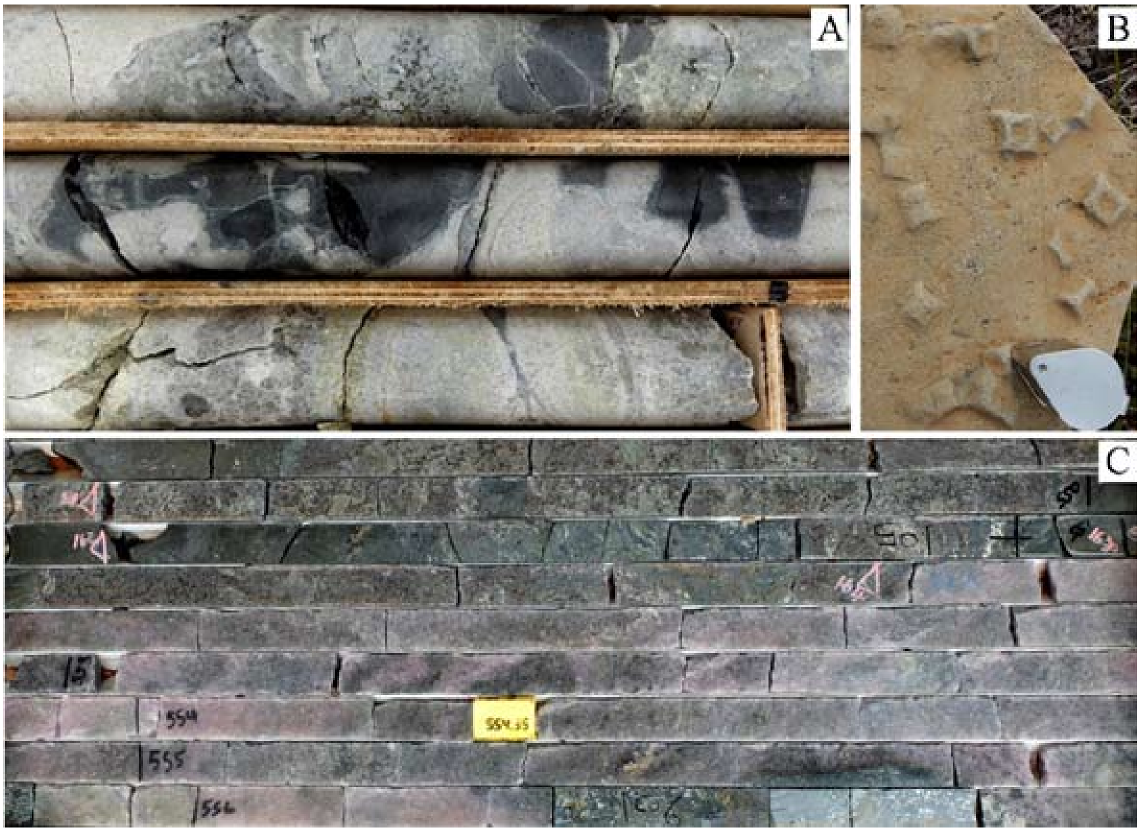
guest editorial

Where does all this sulphur come from? Sulphur sources in super-large magmatic sulphide deposits

Marina Yudovskaya

Almost 90% of the world's PGE reserves are concentrated just in three largest magmatic complexes—the Bushveld Complex, Norilsk-type intrusions and Great Dyke.[1] The first two complexes are parts of Large Igneous Provinces, in which enormous PGE-Cu-Ni resources are correlated with unprecedented volumes of mafic–ultramafic magma that was involved in the ore-forming process in the course of migration, mixing and storage within the plumbing system. The continental crust is depleted in PGE and Ni; therefore, the deep mantle is thought to be the source of these metals, although the silicate mantle is depleted in siderophile (metal-loving) elements compared to the Earth's core. Siderophile metals fractionate into a metallic liquid core, as inferred from the compositions of iron-rich meteorites, believed to be the fragments of the cores of differentiated planetesimals. At the same time, PGE and Ni are mined and extracted from magmatic sulphide ores where they are concentrated along with Cu and S, which enrich both the core and the crust with respect to their reduced concentrations in the mantle. Therefore, the complex PGE-Ni-Cu-sulphide ores may require their components to be derived from different sources, unless an unusual single source provides their combined accumulation. It is widely agreed that the most efficient collector is immiscible sulphide melts that extract these metals from cognate silicate magma. The vast majority of the magmatic sulphide deposits are, indeed, characterised by a mantle-like S-isotope composition that is almost identical to the S-isotope composition of the core. The narrow variations in S-isotopes in most magmatic sulphides of different ages indicate that the upper mantle source was isotopically homogeneous through geological time and the conditions of ore deposition were similar. However, rare examples among the magmatic sulphide deposits demonstrate significant deviation of their S-isotope composition from the mantle and range towards the isotopic characteristics of crustal S. These PGE-rich sulphide deposits with

The lower strata of the at least 3.5 km-thick Siberian trap basalts, crosscut by the Imangda River, Norilsk ore region.

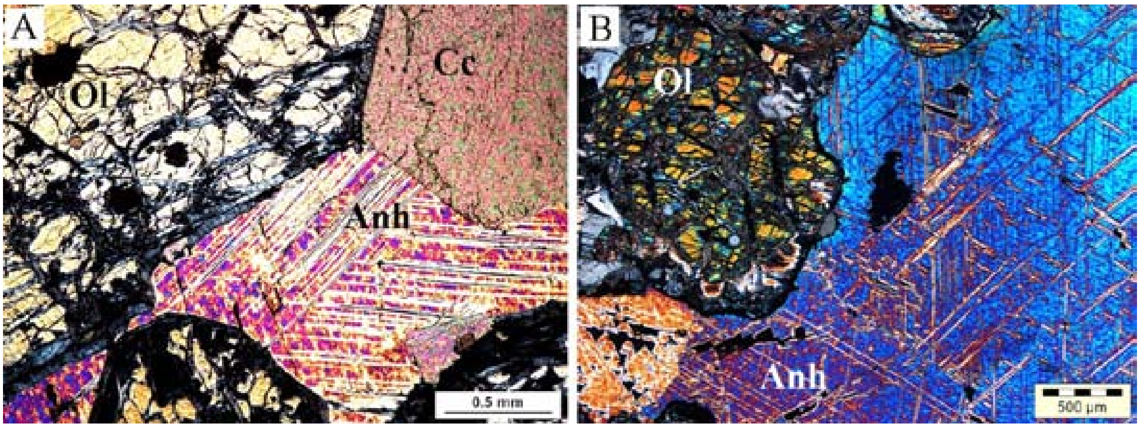


Evaporite occurrences in host rocks of the Bushveld and Norilsk magmatic complexes. A) Metamorphosed anhydritic marl with an apophysis of chilled gabbrodolerite (black) (Norilsk ore region, Mikchangda area, borehole MD64, 1384 m depth). B) Halite casts in Ordovician dolomite (Norilsk area, Chopko R.). C) A 5 m-thick layer of violet anhydrite within halokinetic breccia in the metamorphosed footwall of the Platreef Unit (Turfspruit, borehole UMT10, 548–556 m depth interval).

anomalous non-mantle S enriched in the heavier ^{34}S isotope with respect to the lighter ^{32}S isotope are known from the Norilsk and Bushveld ore provinces, which together contribute ¾ of the global PGE resources, along with the lion's share of Ni, and significant Cu and Co.

Sulphide ores of the Lower Triassic Norilsk deposits in the northwestern part of the Siberian platform are enriched in the heavier ^{34}S isotope relative to the ^{32}S isotope, which is attributed to assimilation of ^{34}S-rich sedimentary sulphates.[2] The Norilsk ore-bearing magmas intruded Cambrian–Devonian and Carbonaceous–Permian sedimentary sequences that comprise a significant proportion of salts, gypsum and anhydrites, intercalated with argillites, marls and carbonates. The enrichment of evaporite in the heavier isotope is a result of preferred ^{34}S-isotope fractionation into sulphate, whereas light ^{32}S partitions into reduced S compounds. The assimilation of Palaeozoic sulphate S by ore-bearing magmas is supported by other evidence such as (i) the mantle-like S-isotope composition of S-poor comagmatic basalts, which did not have time for interaction and assimilation during subaerial eruptions; (ii) the correlation between the amount of sulphide in a specific intrusion and the enrichment in ^{34}S; (iii) the presence of semi-digested anhydrite xenoliths in the ore-bearing intrusions; and (iv) the enrichment of the marginal rock series in CaO and sulphides as a result of $CaSO_4$ (anhydrite) dissolution. The reduction of oxidised S was facilitated by Fe^{2+}/Fe^{3+} redox reactions in magma or conversion of organic matter and coal, abundant in the upper part of the sedimentary cover, to CO_2.

The anhydrite occurrences in the Transvaal Supergroup sequences, which host the Bushveld Complex intrusions, are not as widespread as in the Palaeozoic strata of the Siberian platform. Archaean to Palaeoproterozoic carbonates of the Transvaal Supergroup are known to contain an appreciable amount of ^{34}S-rich carbonate-associated sulphate that includes both anhydrite molecules in a carbonate lattice, as well as physically trapped inclusions and absorbed particles. The evaporitic strata, however, are not observed in the surface exposures, although pseudomorphs after mirabilite and halite, common in evaporitic



Anhydrite in ore-bearing intrusions. A) Imangda intrusion, Norilsk ore region (borehole ZI30, 852 m depth). B) Platreef on Turfspruit, northern limb of the Bushveld Complex (borehole UMT336, 1452 m depth). Anh – anhydrite, Ol – olivine, Cc – calcite.

sequences of the Norilsk region, were described in Transvaal Supergroup rocks, indicating a sporadic saline sabkha environment.[3,4] The absence of sulphates from Archaean rocks is consistent with low sulphate concentrations in Archaean oceans prior to the ~2.43 Ga Great Oxygenation Event[5] that records the onset of rising O concentration in the atmosphere. In the Archaean, the amount of oxygen was not sufficient to form marine sulphate, however, the increasing O concentration in the Palaeoproterozoic resulted in the deposition of anhydrite layers of the Duitschland Formation, one of the oldest marine evaporites on Earth. During the deep drilling exploration program on Turfspruit in the northern limb, meter-thick layers of anhydrite and anhydritic marls of the Upper Duitschland Formation were intersected beneath the Flatreef PGE-Cu-Ni deposit discovered by Ivanplats. Similar, albeit smaller-scale, anhydrite occurrences were noted earlier in the deep boreholes from the Akanani Project area, east of Sandsloot, which suggests a regional spread of evaporitic sediments. Whereas the PGE reefs at the top of the Platreef have mantle-like S-isotope compositions similar to that of the Merensky Reef and UG-2 sulphides in the western and eastern limb, basal PGE-Cu-Ni mineralisation of the Platreef shows ^{34}S enrichment throughout Townlands to Sandsloot that indicates the involvement of sulphate-derived S in the formation of Platreef sulphides. The highly variable S-isotope composition of the basal Platreef mineralisation, depending on the changing footwall along strike,[6,7] indicates that the sulphate was not the only source of S; however, the scale of sulphate assimilation in the central Platreef is comparable to that seen in Norilsk sulphides, where almost half of the S is sedimentary-derived. Similarly, anhydrite xenoliths are common among Platreef mineralised rocks, whereas contaminated magmatic varieties reveal enrichment in Ca compared to uncontaminated rocks.

Ancient evaporites are rarely well preserved, although their former presence could be deciphered based on halokinetic structures, halogen anomalies, specific skarn (scapolite- or tourmaline-bearing) associations and compositions of fluid inclusions. Along with Bushveld and Norilsk, some magmatic deposits of the Central Lapland belt of Fennoscandia, such as Kevitsa and recently discovered Sakatti, are hosted by the evaporite-bearing Savukoski Group and bear ^{34}S-enriched sulphides[8] suggesting sulphate assimilation.

The link between evaporitic basins and large magmatic sulphide deposits would be considered a mere coincidence if three major magmatic sulphide provinces were not involved. These magmatic complexes were emplaced in extensional environments with associated rifting within the cratons. There is evidence that long-lasting subsidence, which is typical of the Kaapvaal and Siberian cratons' interiors during the Palaeoproterozoic and Palaeozoic respectively, is controlled by mantle dynamics or convection that could be accompanied by magma upwelling.[9] The continental rifting supports basin extension and sediment accumulation, as well as intracontinental magmatism and volcanism. However, it is difficult to resolve which process was primary and whether the rifting initiates the heat influx and magma generation or vice versa. Assimilation of sulphates is more efficient, as sulphate solubility in magmas is higher than the solubility of reduced S;[10] therefore, the availability of sulphate in post-GOE times became an important factor for massive sulphide formation. The occurrences of evaporitic sequences in the rift-related basins, therefore, should be considered as one of the major favourable prerequisites during greenfield exploration for magmatic sulphide mineralisation.

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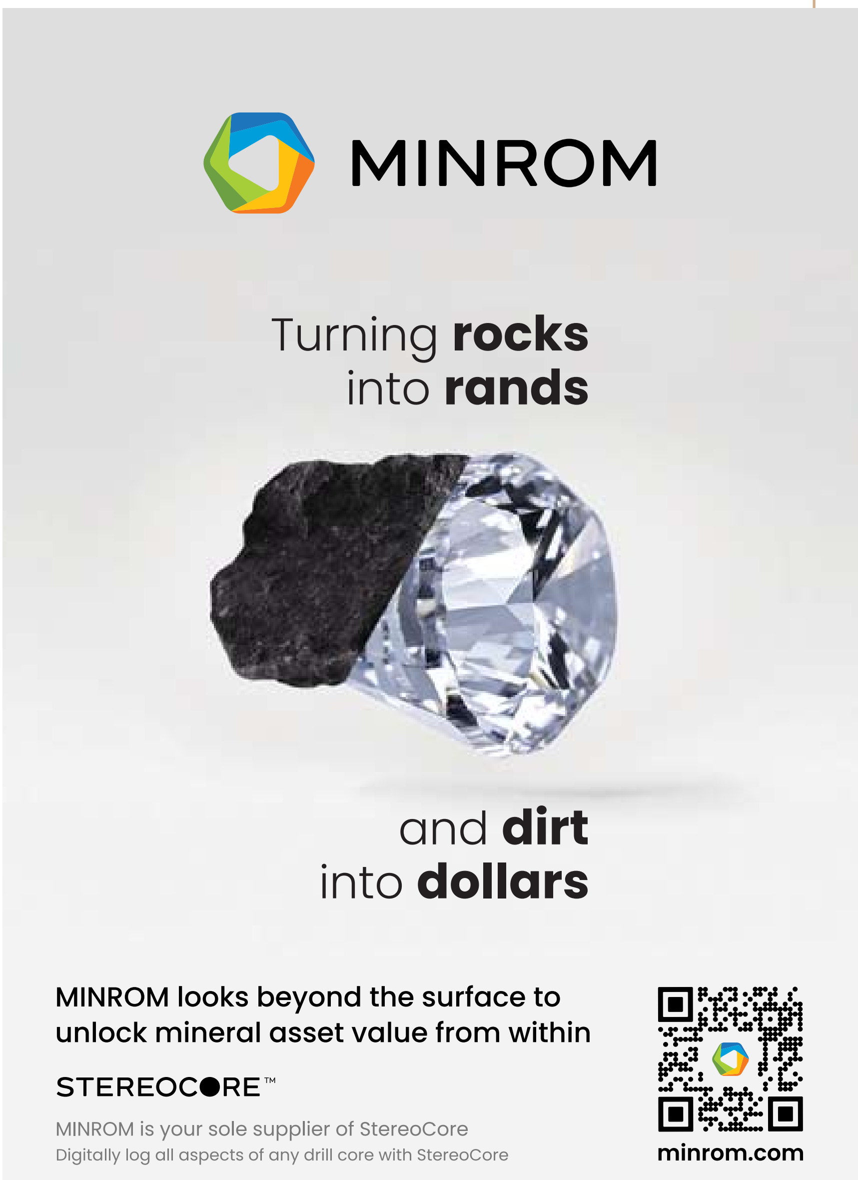

executive manager's corner

Craig Smith

In the first week of November, voters in the United States handed Donald Trump both the popular and electoral college victory in what is likely to become a tectonic shift in just about every aspect of life in the USA. The world will not be isolated from the changes; nor will South Africa. As I write this, many of Trump's cabinet choices are now known—and some of them are shockers. From climate change denialists, anti-vaxxers, anti-science conspiracy theorists and industry leaders with very clear conflicts of interest, through to untested if not outright incompetent picks, the worst of these will create havoc in the world order for decades to come. Unless of course they perform so badly that Trump has to get rid of them early in his term. And this time around the Republican Party also has control of both the House of Representatives and the Senate. The far right has a mandate to change the USA and by extension, the world.

It is impossible to predict what effects this election will have on Africa in general or South Africa in particular. Given Trump's apparent disdain for Africa as a whole, we are likely to see the dismantling of AGOA, and increased tariffs on most exports, including minerals. This will not necessarily be a negative if we can keep the operating costs lower than other countries. Mitigation of the effects of climate change will not be a concern for this administration and could well lead to backtracking on emissions levels by the South African government. On the other hand, the world's richest man who manufactures electric vehicles is sitting in the same cabinet as the most ardent fossil fuel producer.

As regards international relationships, we can reasonably expect China to try to expand its influence in Africa more intensively than it already has, as the US pulls back from its role as global watchdog and Europe becomes preoccupied with the Russian threat.

It is possible that we will see less American funding for global research programs, such as the International Continental Drilling Program or Antarctic research. On the other hand, there could be benefits to Africa that we have not foreseen. It is likely that there will be pluses and minuses, and we will not want to miss the opportunities that come our way. We enter 2025 with hope, but not with unrealistic expectations.

The GSSA has completed its events programme for the year, having staged a successful Fellows Dinner and the Annual Exploration Projects in Africa programme. Both events had to be moved from the more traditional venue at the Auckland Park campus of the Johannesburg Country Club because of the fire at the JCC. Both events are covered elsewhere in this issue of *Geobulletin*.

Looking forward, the calendar of events for 2025 is being developed by the Meetings Committee, and annual and meetings sponsors are being sought. For the first time, a Fellows Lunch will be held in the Western Cape on February 1 at Beyerskloof Wine Estate. Geocongress is to be staged in in Bloemfontein mid-year, and the centenary celebration of the discovery of diamonds in

Namaqualand will be held at Vanrhynsdorp in mid-March. Sponsorship packages are available for all of these events, and annual sponsors will be given exposure at all events. Contact info@gssa.org.za for further information.

As we wind down for the year end, may all of our member and sponsors enjoy a safe and relaxing year-end break.

Craig Smith

The GSSA is pleased to announce that Geocongress 2025 will be hosted in Bloemfontein from 24–27 June next year! We look forward to seeing you there! Please save these dates and keep an eye on updates, which will be shared on the Geocongress2025 website.

CALL FOR SESSIONS

For Geocongress 2025 to be a success, we need the input of the southern African Earth Sciences community! If you are interested in proposing a scientific session at Geocongress 2025, please use the "Sessions" tab on the congress web portal to create an account and to submit your proposal. The deadline for proposing a session is 9 July 2024. We look forward to receiving your proposals so that we can put together an exciting and diverse scientific programme.

FIELDTRIP QUESTIONNAIRE:

For us to decide on which fieldtrips to run, we ask that you indicate your fieldtrip preferences by completing the questionnaire provided on the "Fieldtrips" tab on the congress web portal as soon as possible.

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SOCIETY NEWS

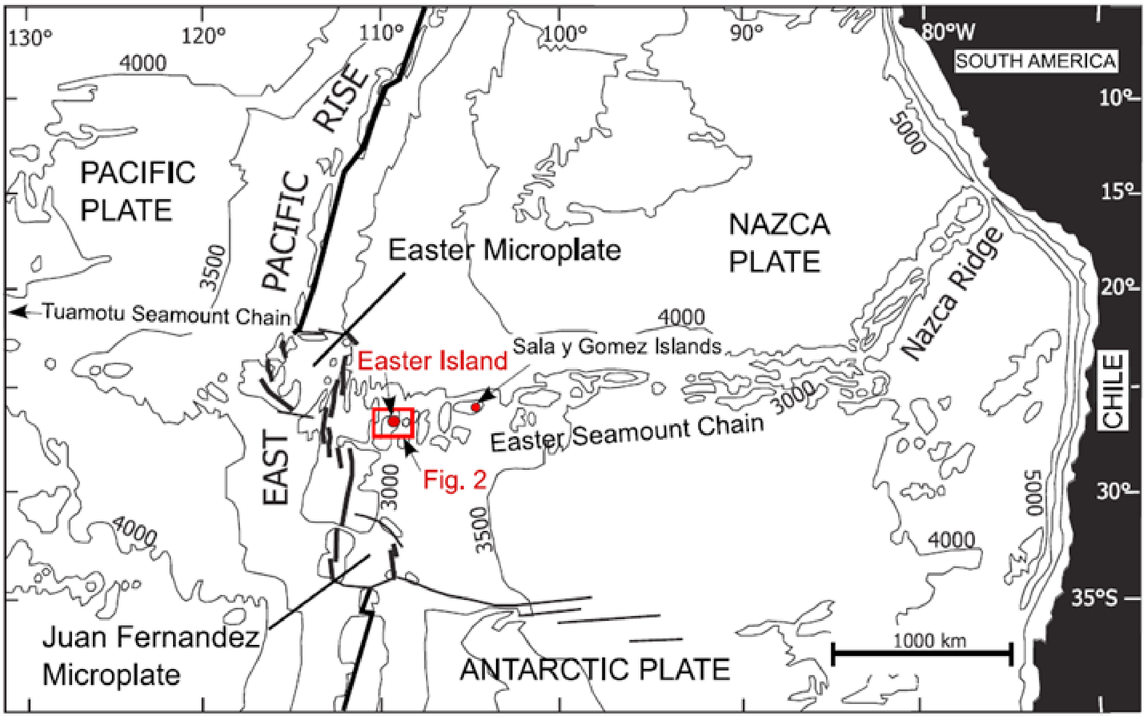
president's column

Steve McCourt

An important tenet of Phanerozoic plate tectonics is that the oceanic lithosphere in current ocean basins is young, and as a result zircon grains extracted from oceanic crust should fall into a narrow age spectrum coinciding with the magmatic age of that crust.[1] By contrast, U-Pb zircon ages derived from continental crust often record billions of years of geological history.

Of interest, therefore, are recent publications documenting zircon populations collected at mid-oceanic ridges and from remote oceanic hotspot volcanoes that are far older than the ocean crust they reside in. Pilot *et al*.[2] were the first to report Palaeozoic and Proterozoic zircon grains from the Central Atlantic mid-ocean ridge and since then populations of Mesozoic to Archaean zircons have been collected from the Central Atlantic and Southwest Indian ridges.[1] Zircon grains older than the age of the hotspot islands where they have been found have also been reported in Hawai'i[3] and Galapagos.[4] These old zircons cannot have formed from magma generated at the much younger mid-ocean ridges or in the oceanic crust below the hotspot volcanoes, thus have been interpreted as xenocrysts or "ghost" grains. These "ghost" grains are linked to subducted sedimentary zircons entrained in fossil mantle wedges, detached sub-continental lithospheric mantle that floats in the asthenospheric mantle or old magmatic zircons that formed during crystallisation in the mantle of plume-related melts.[1,4]

The most recent description of zircon xenocrysts in oceanic crust was published in *AGU Advances* in October 2024 and is based on a reconnaissance study of soils, regoliths and beach sands from Easter Island (Rapa Nui), located in the Pacific Ocean Basin some 3,800 km west of South America.[1]



Map showing the location of Easter Island (Rapa Nui) at the westernmost end of the Easter Seamount Chain on the Nazca Plate.[7]

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Easter Island/Rapa Nui lies on the western edge of the Nazca Plate, close to the East Pacific Rise that forms the spreading ridge between the Nazca and Pacific plates. The Easter hotspot is thought to result from a deep mantle plume that originates at ~2,900 km depth near the core-mantle boundary.[5] The youngest seamount chain linked to the Easter hotspot is on the Nazca Plate and is part of the 2,900 km-long Easter Seamount Chain, with the active Easter-Salas hotspot at its western tip. Eastwards, the Easter Seamount Chain connects to the Nazca Ridge, which represents an older portion of the chain.

In line with geoheritage restrictions, rock sampling is not allowed on Easter Island; thus, the samples analysed by Rojas-Agramonte *et al.*[1] were of detrital material, eight from soils and regoliths in the island's interior and four from beach sands, and of these, nine samples yielded variable amounts of zircon grains.[1]

Rapa Nui is built on Pliocene ocean floor ~3–4.8 Myr old, thus the oldest zircon grain that would have formed during island volcanism or the formation of the underlying oceanic crust would be ~4 Myr old.[1] The samples collected by Rojas-Agramonte *et al*. (op. cit.) yielded 347 zircon grains and of these 88% are younger than 4 Ma, with the great majority less than 1 Ma.[1] The zircon population from 4–165 Ma, with a spike at ca. 165 Ma, has εHf(t) and $\delta^{18}O$ signatures typical of mantle zircon, similar to those from the 0–4 Ma time interval, indicating that, like the latter, they come from the erosion of the mantle-derived volcanic products.

Rojas-Agramonte *et al.*[1] interpret these similar isotopic signatures to indicate that the zircon population from 0–165 Ma crystallised from plume-related magmas generated by the Easter Hotspot, which they argue was initiated at ~165 Ma (Middle Jurassic) and interpret the large number of zircon grains with ages of 165 Ma as dating the impingement of the plume at the base of the lithosphere to form a Large Igneous Province (LIP). The zircon grains older than 165 Ma are Early Jurassic (~190 Ma), Triassic (~222 Ma), Carboniferous (~314 Ma), and Precambrian (~640–2,500 Ma) and have εHf isotopic values ranging from 0 to negative, typical of continental magma sources or of juvenile magma contaminated with continental crustal material.[1] Rojas-Agramonte *et al*.[1] note that ancient zircons with diverse compositions were also reported from Galapagos[4] and Hawai'i[3] and are best explained as detrital zircons taken down into the mantle by subduction. Although Galapagos is located in the vicinity of a subducted slab, no slabs are known below Hawai'i and Easter Island,[1] thus if the zircon grains from Easter Island resulted from subduction, they were either transported over large distances by mantle flow, as was interpreted for Hawai'i[3], or they were introduced into the mantle when continents were still nearby.[1]

According to Rojas-Agramonte *et al.*,[1] the geochemistry of central Pacific hotspots reveals geochemical traces of continental crust subducted in the late Precambrian to early Paleozoic[6] and thought to be present in the plume source. This would suggest that these xenocrysts could have been trapped in the ambient upper mantle for hundreds of millions of years,[3,4] presumably enclosed within mineral grains to allow them to remain stable at these depths.

The "ghost" grains of Easter Island, Galapagos and Hawai'i add an interesting twist to the concept of a simple layer-cake stratigraphy for oceanic crust.

Steve McCourt

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SOCIETY NEWS

samcodes

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Training programmes

Introduction to the SAMCODES and updates to other Codes is planned for February/March 2024, to coincide with the 25th anniversary of the SAMREC Code.

An ESG integration into SAMCODES presentation was given at the SAIMM ESG conference from 16–17 October 2024.

SAMCODES ESG Working Group Activities

Draft documents from the SAMCODES ESG Working Group have been released for comments. The documents provide reviews of the disclosure requirements for incorporation into the SAMCODES. The Working Group wishes to close off its mandate by December 2024.

International Liaison

The Australasian Joint Ore Reserves Committee (JORC) has released the draft JORC Code for public comment and final review prior to the update of the JORC Code. The public feedback period was open for three months, and closed on 31 October 2024.

The CIM MRMR Conference, where the SSC was represented and immediately followed the CRIRSCO AGM, was held in October 2024 in Vancouver.

JSE Section 12 Simplification

The JSE proposed amendments for simplification of the Section 12 Listing Requirements. Stakeholders submitted initial comments and the JSE is currently reviewing these. This process is ongoing and expected to extend into the new year following the consultations.

Sifiso Siwela

Committee updates

SAMREC	Continuation of incorporation of ESG Factors into SAMCODES and recommendations for additions into SAMREC Table 1 and SAMVAL
SAMVAL	Liaison with IMVAL for planning of conferences is ongoing
SAMOG	SAMOG Code updates continued and will be finalised this year
SAMESG	Draft updates to the SAMESG Guidelines 2.0 and ESG definitions is out for comment
INDUSTRIAL	Progress is being made on the update of the Industrial Minerals Guidelines and a draft working document has been circulated for comment

branches & divisions

SOCIETY NEWS

Northern Cape Branch

NC Commodity Day 2024

"Every memory we create is a footprint on the path of a life we make together"

Special thank you to our **Speakers** for their exciting talks – **Errol Smart, Louw van Schalkwyk, Richard Hornsey, Prof. Bertus Smith** and **Graham Duncan** – the diversity in interesting talks were well incorporated and fitting for the Northern Cape. Including thanks to **Palesa Boikanyo, Kabelo Mongalo, Eveline Kekana** and **Lorena Tafur**.

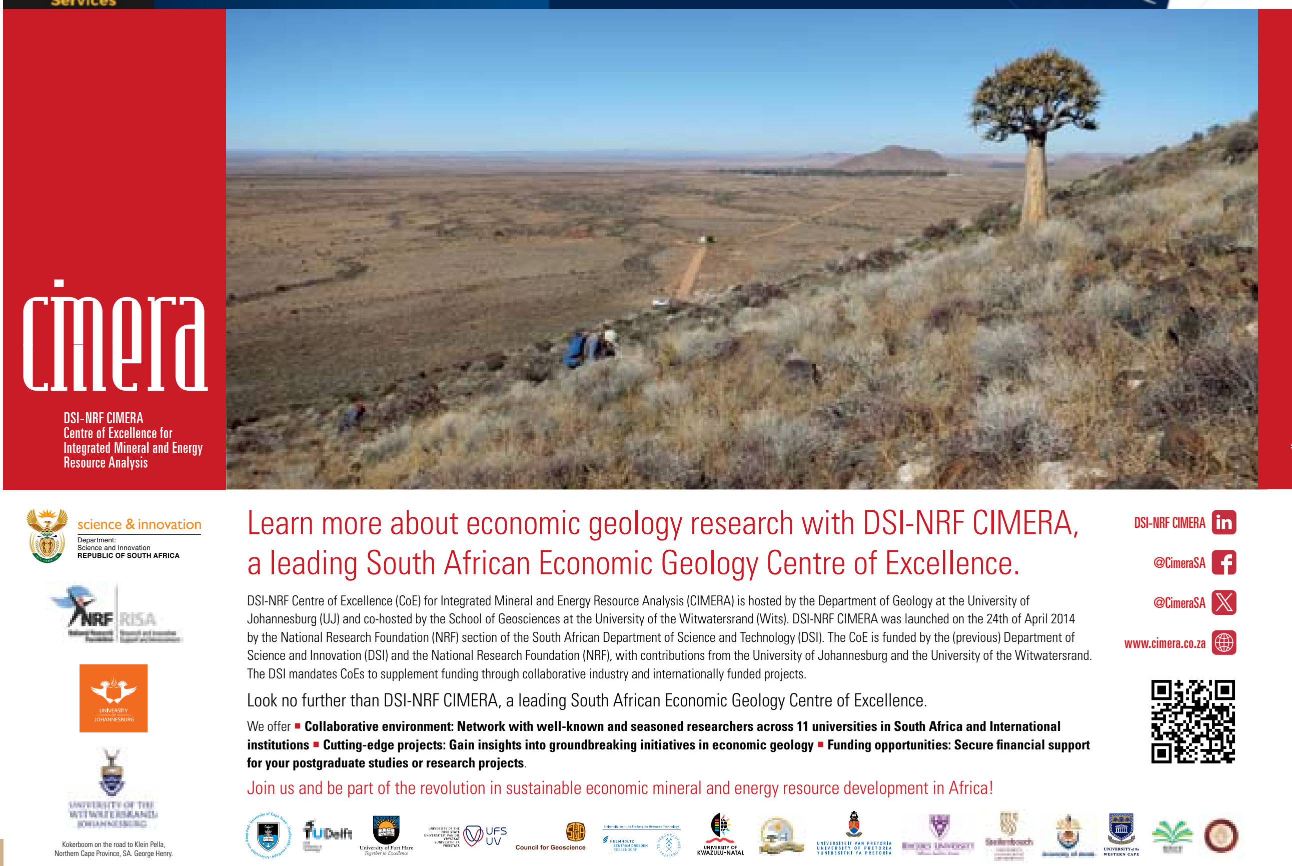
To **Assmang Khumani Mine (Sakkie van Niekerk/Wilstie van Wyk)** and **Afrimat (Johan Pretorius)** for hosting the field and mine site visits.

To all the **Delegates**, thank you for sharing the event with us - what an amazing time with you all!

Thank you to our **Sponsors**, your contribution was greatly appreciated.

Loni Gallant – NC Branch Chairperson.

NC Chairperson Farewell



Kokerboom on the road to Klein Pella, Northern Cape Province, SA. George Henry.

japanese porcelain

INHIGEO Excursion to Northern Kyushu, Japan (September 2024), Part 1: Arita, birthplace of the Japanese porcelain industry

The 37th International Geological Congress, organised by the International Union of Geological Sciences (IUGS), took place in Busan, SE Korea, in the last week of August 2024. At this meeting, Professor Hassina Mouri of the University of Johannesburg was elected as the first female, and first African, president of IUGS. During this IGC meeting, one of the main commissions falling under the IUGS umbrella, the International Commission on the History of Geological Sciences (INHIGEO), organised several symposia dealing with Earth Science History, and also held the annual meeting of its Board of Management.

I attended the INHIGEO symposia and board meeting in my capacity as INHIGEO Vice-President for Africa, and as a Keynote Speaker in a session

Google Maps image showing the location of Arita in Kyushu, Japan (red pointer).

Rhyolite Dome intrusive into Palaeogene sandstones and shales at Arita.

on History of Geoscientific Travels in Asia and Beyond. My keynote talk was entitled: "Takla Makan, Pamirs, Karakorams, Indogangetic Plain, Singhala and Java: The Buddhist topography of Faxian (Fa-Hien), at the beginning of the 5th Century CE". I gave another talk in that same session, on "The first geophysical studies, and descriptions of mineral deposits, in Thailand: The French Jesuits under Guy Tachard, and Simon de la Lubère, at the Siamese Court in 1687 and 1689". At the INHIGEO Board of Management meeting, a new board was elected. The President of INHIGEO, Ezio Vaccari from Italy, was re-elected for another four years, as was the Secretary-General, Martina Kölbl-Ebert from Germany. I was re-elected as Vice-President for Africa. My proposal to host the 51st INHIGEO Symposium at Victoria Falls, Zimbabwe, in early December 2026, was accepted.

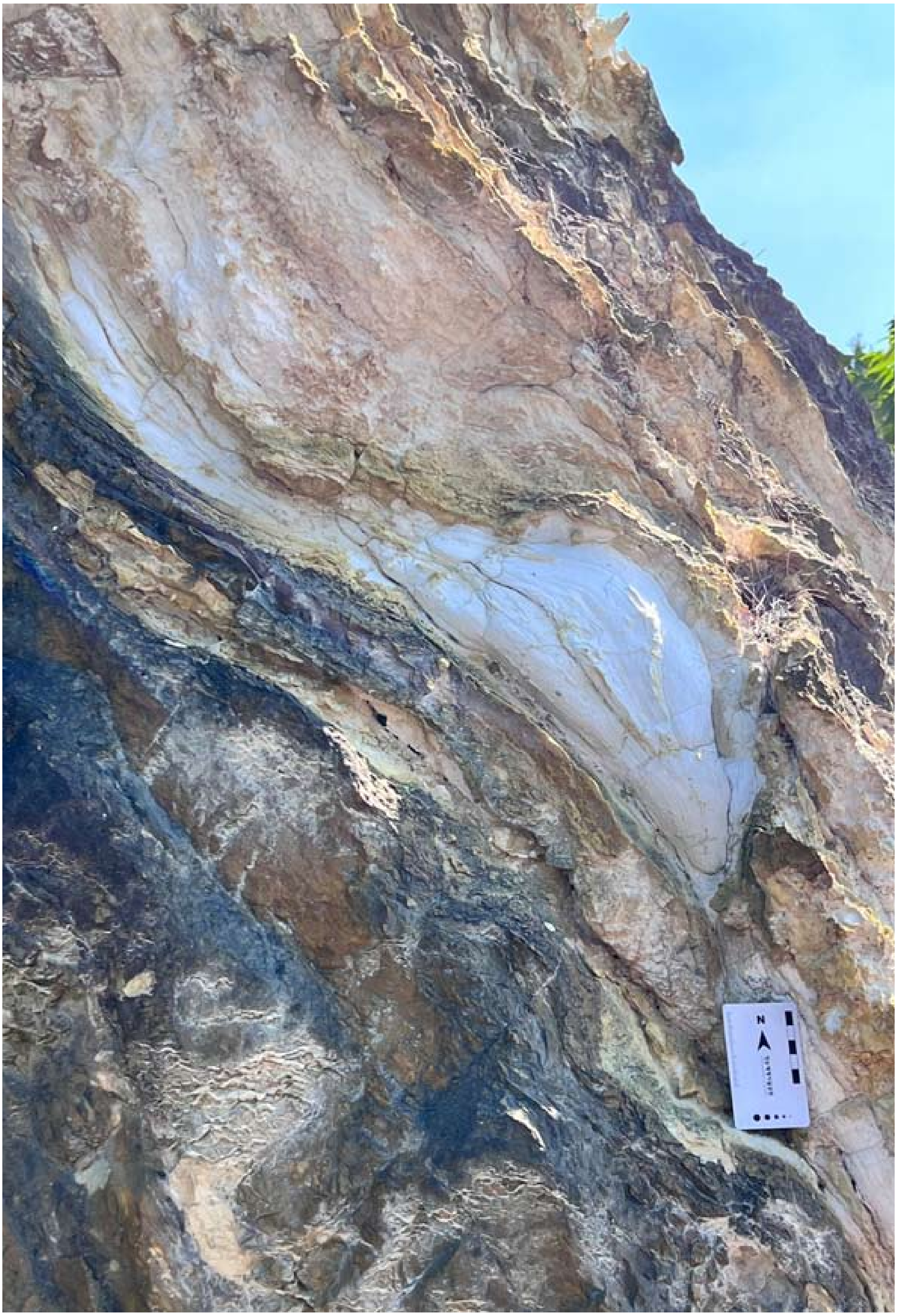
The town of Arita, in NW Kyushu – the birthplace of the Japanese porcelain industry.

Izumiyama Quarry, where kaolinite mining first started in Japan in 1613.

Entrances to two adits in the Izumiyama Quarry.

Among the highlights of every annual INHIGEO Symposium are the field excursions associated with them, to visit places of geological, historical and cultural interest, and this year's meeting was no exception. Because there are currently no INHIGEO members in Korea, there was no INHIGEO excursion in the vicinity of Busan, although the city itself is situated within the Busan Geopark area. The veteran and indefatigable septuagenarian Japanese INHIGEO member, Michiko Yajima, took it upon herself to organise a private excursion to Kyushu, Japan, following the end of the IGC in Busan. She

Flow-banded rhyolite – protolith and host of the Izumiyama kaolinite deposit. Scale is in mm and cm.



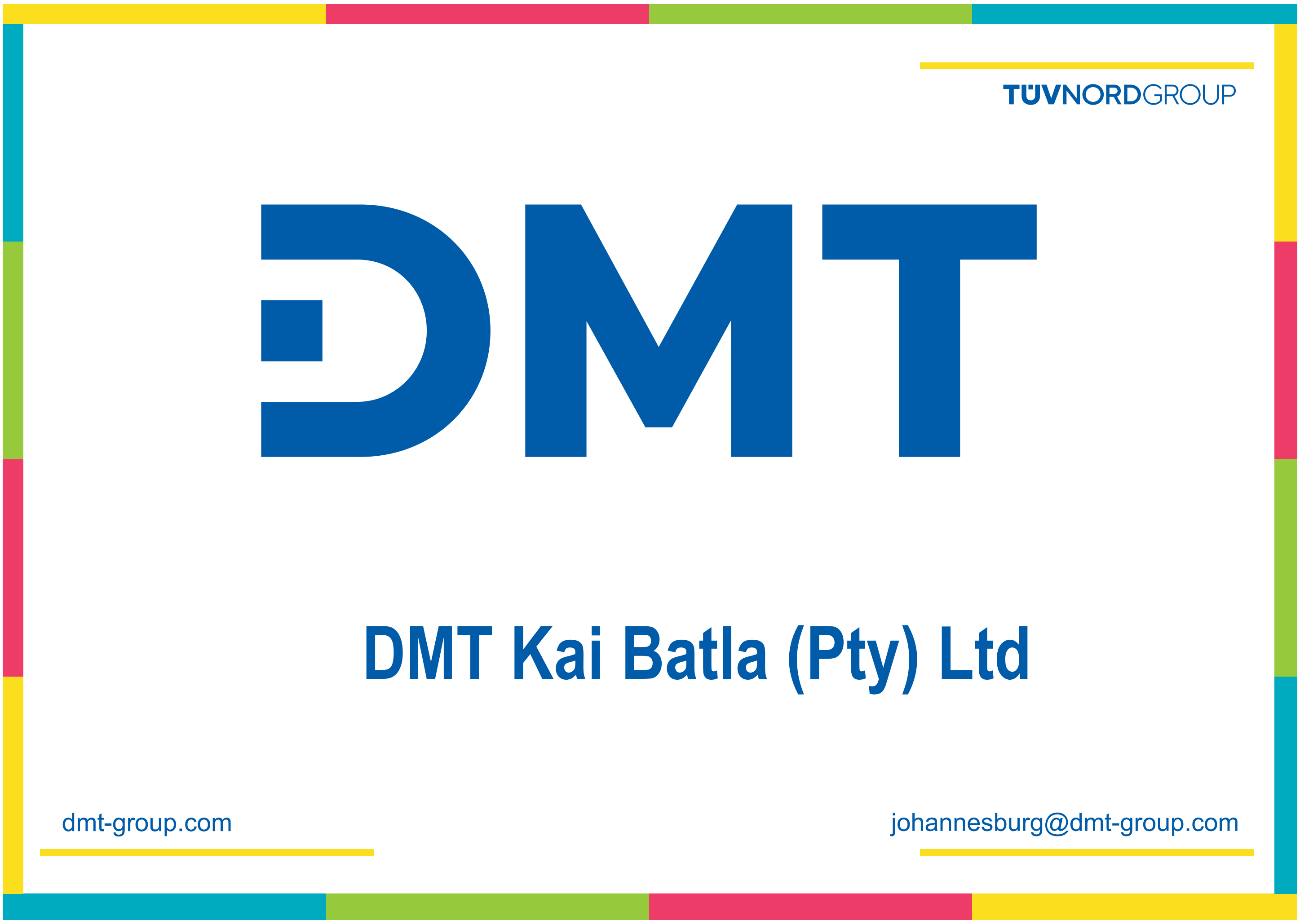
Close-up of white kaolinite band, interbedded with sericite and quartz-rich altered rhyolite, Izumiyama Quarry.

Potter at work in Imaemura pottery works, Arita. Note the electric kiln on the right for final firing of overglazed Iro Nabeshima porcelain.

had previously been involved with a very successful INHIGEO meeting in Tohoyashi, Japan, in 2011.

Our post-conference INHIGEO North Kyushu Excursion started with an overnight ferry from Busan to Fukuoka, arriving on the morning of the 2nd of September at Hakata Port. I and my partner Michèle had arrived the previous morning by air from Busan, since electronic visas are not issued by Japan for those arriving by sea (and I had managed to get my visa by spending a whole day at the Japanese Embassy in Pretoria, on the day before my departure for Korea). We had spent the previous day visiting the Fukuoka Asian Art Museum, which had a fascinating exhibition on Modern Asian Pop Art.

Having assembled at the Hakata Port of Fukuoka at 8 AM, we then boarded a waiting bus for the start of our Japanese excursion. We drove for two hours from Fukuoka through rolling volcanic hills densely covered in luxuriant green vegetation, on the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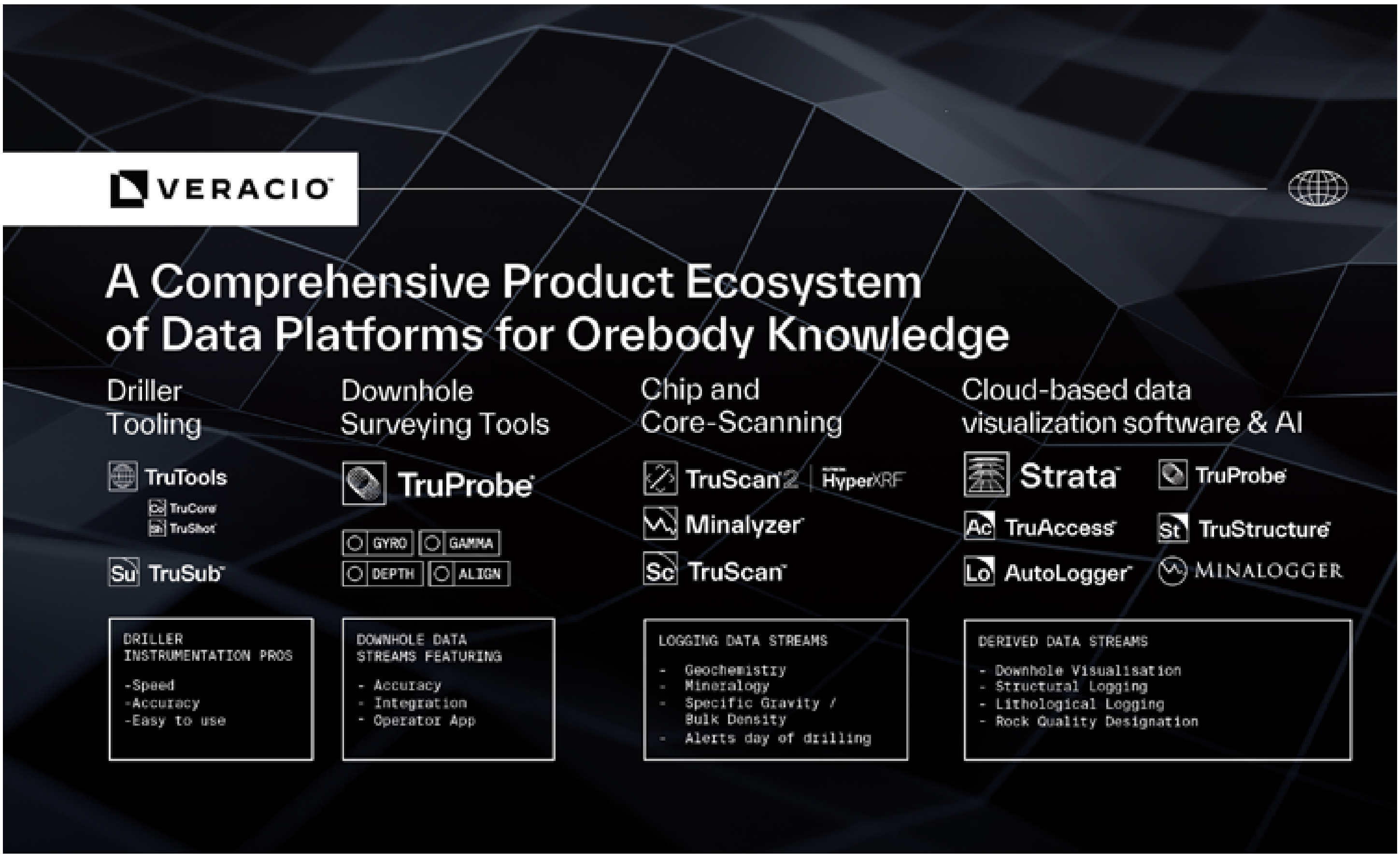
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TruAccess
TruStructure
AutoLogger
MINALOGGER
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-Speed
-Accuracy
-Easy to use
DOWNHOLE DATA STREAMS FEATURING
- Accuracy
- Integration
- Operator App
LOGGING DATA STREAMS
- Geochemistry
- Mineralogy
- Specific Gravity / Bulk Density
- Alerts day of drilling
DERIVED DATA STREAMS
- Downhole Visualisation
- Structural Logging
- Lithological Logging
- Rock Quality Designation

Clay-brick-lined kiln used for firing pottery at 1300°C

southeastern flank of a coastal range trending NE–SW. Every valley we crossed afforded vistas of the flat Japanese countryside occupied by rice paddies and fields of other crops, and quaint villages with homes in traditional Japanese style. We were headed for the town of Arita, which is situated some 20 km east of Sasebo in NW Kyushu. This was the birthplace of the Japanese porcelain industry.

Upon arrival in Arita, we headed straight for the historic Izumiyama Quarry, which was the place where good quality kaolin was first discovered and mined in Japan. At the end of the 16th Century, a local warlord Toyotami Hideyoshi invaded Korea and brought back Korean potters to Japan. One of these potters, by name of Ri Sanpei, discovered the outcrops of kaolin, which is required for good

Kiln lined with stacked containers with pottery ready for firing.

Master potter, the 13th Imaemura, a Japanese "Living National Treasure".

Left: Close-up of Iro Nabeshima platter showing the intricate patterns of coloured overglaze on blue underglaze.

Iro Nabeshima-style multicoloured overglaze platter – selling for a price of R360,000, at Imaemura pottery works, Arita.

porcelain, at Izumiyama in the early 17th Century.[1] The kaolin deposit formed as a result of intense acid hydrothermal alteration of layered rhyolite on the flanks of a rhyolite dome intruded into Palaeogene shale and sandstone.[2] Its mineralogy consists of kaolinite, sericite and quartz.[3] Exploitation of the deposit commenced in 1613 and it was mined for the next four centuries, forming the basis of a porcelain industry that is still found around the town of Arita, whose fine productions have a reputation in Japan akin to that of Meissen in Germany and Wedgewood and Royal Doulton in England. In particular, there is a type of pottery called Iro Nabeshima that was developed in the

Iro Nabeshima-style vase from Imaemura pottery works.

Iro Nabeshima-style vase similar to one that was presented to US President Ford by the Emperor of Japan in 1975. In Imaemura pottery works collection.

Detail of Iro Nabeshima-style porcelain piece from Imaemura pottery works.

kilns of Lord Nabeshima, feudal lord of Saga Domain in the early Edo Period (1603–1868), which is highly esteemed worldwide as a type of porcelain with multi-coloured overglazed paint on blue underglaze, that combines elaborate techniques, innovative design and elegance. Lord Nabeshima granted the Imaemon family the sole hereditary right to produce the overglaze Iro Nabeshima pottery, and it is still in the hands of the same family, with the 13th Imaemon designated a "Living National Treasure" in Japan. We had the privilege of meeting the 13th Imaemon, and of visiting his pottery studios with expert craftsmen at work, and the wood-burning kilns (some of which were up to 340 years old) lined with refractory clay bricks. The pottery is placed in round containers stacked into pillars in the kilns and fired at a temperature of 1300°C (higher than the melting point of basalt!) and cooled for three days before being opened to retrieve the fired pottery. These blanks are then painted in different patterns and colours (the "overglaze"), and then fired again in electric kilns.

To follow: Part 2 – Unzen volcano, Kyushu, Japan

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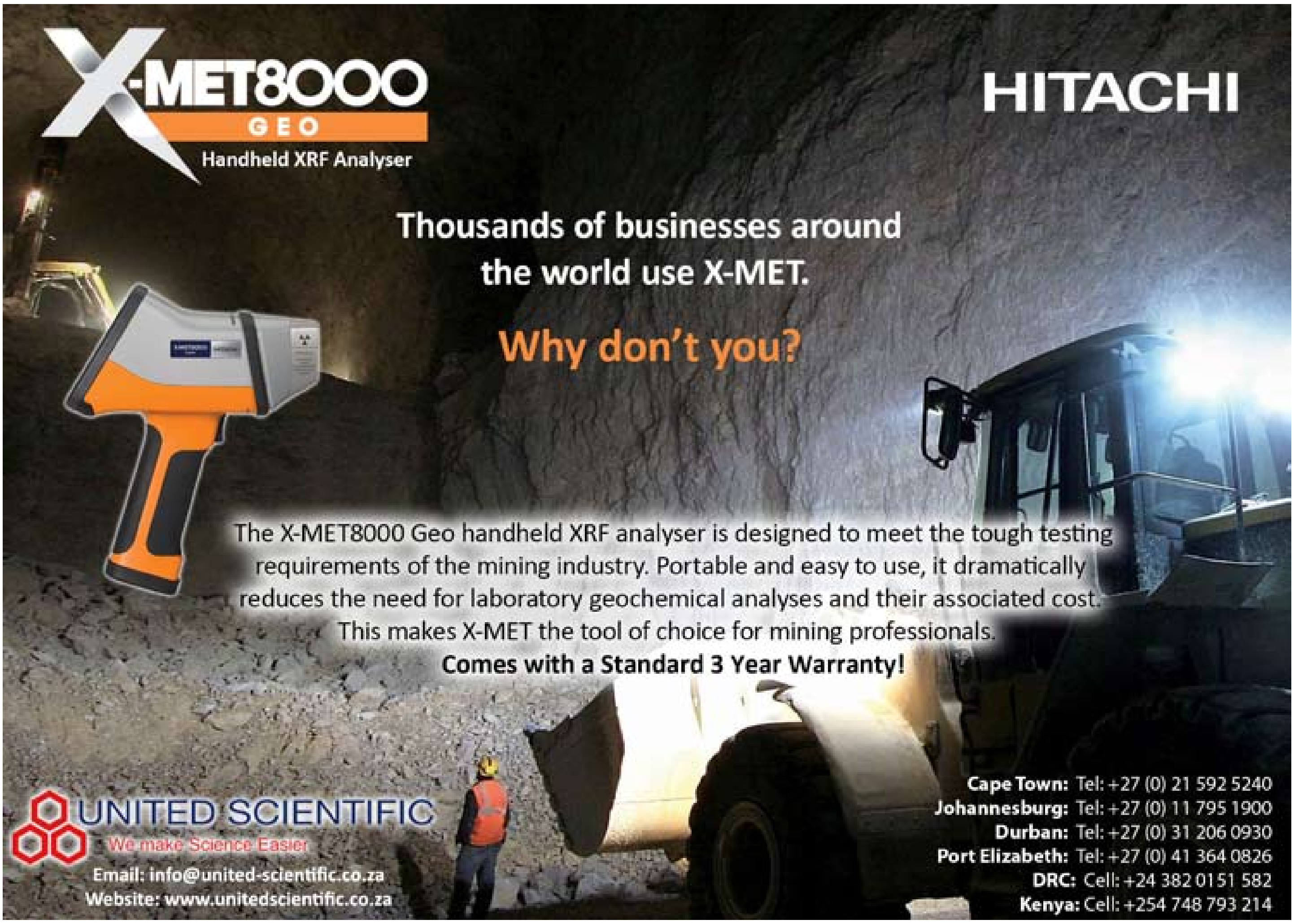

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meteorite fall

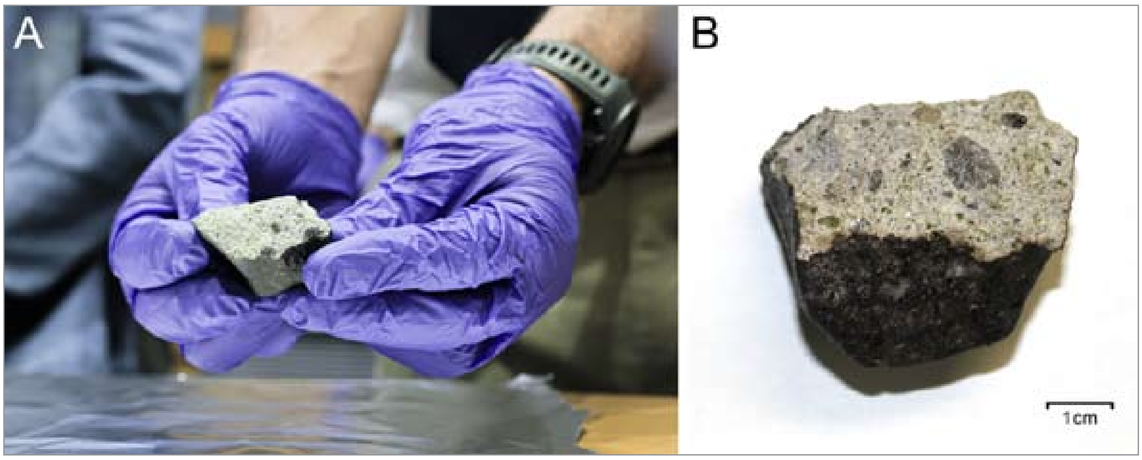
The Nqweba Meteorite Fall

The morning of Sunday 25 August 2024 delivered a memorable geological phenomenon for the people of Nqweba (formerly Kirkwood) and the broader Gqeberha region. Shortly before 09:00 local time, residents of the coastal region from Mossel Bay to Gqeberha witnessed a fireball that was visible for more than 5 seconds as it streaked along an ENE trajectory. Minutes later, those who saw the fireball, and many who didn't, were surprised by a loud noise that they compared to "rolling thunder". This noise was reported by some to have lasted longer than 30 seconds and even to have been accompanied by ground vibrations.

At the same time near Nqweba, 9-year-old Eli-zé du Toit was talking with her grandmother on their porch when she heard the thunder-like noise. Shortly thereafter, she noticed an object fall out of a tree in the garden. Curious, she went to investigate and found a small (~4 cm) rock with a shiny black crust and light grey interior, which she likened to concrete. The interior of the rock was cold to the touch, but the crust was warm. Eli-zé showed her mother, Jesica Botha, who posted pictures of the rock on social media at midday. By mid-afternoon, researchers from the Nelson Mandela University, Rhodes University, the University of the Witwatersrand, and members of the South African Astronomical Society (ASSA) were already collecting reports on the fireball, responding to public queries, and attempting to secure the samples in accordance with the meteorite recovery protocol of the National Heritage Resources Act (NHRA, No. 25 or 1999).[1]

Image from a video that captured the fireball that was recorded from Cape St Francis (photo: Zoë van der Merwe).

The fireball of the 25th of August may have captivated the people of the Eastern Cape, but fireballs and meteorites have captured the attention and imagination of people from antiquity. From an iron meteorite dagger found in the tomb of Pharaoh Tutankhamun,[2] and the Campo del Cielo ("*Field of Heaven*") event that was witnessed 4,000 years ago in Argentina,[3] to the recent considerations of asteroid mining[4], meteorites have permeated societal narratives. These are a few of many examples that illustrate how meteorites have woven into cultures, each reflecting the blend of cultural interpretation and natural phenomena that characterises humanity's relationship with the cosmos. Yet, these events and rocks are more common than conventionally thought, with up to 54 tonnes of planetary material estimated to enter Earth's atmosphere per day.[5] Most of the materials are dust- to pea-sized particles, although around one or two objects large enough to produce a fireball event occur per month.[6] These rocks



The Nqweba meteorite. A) The press conference meteorite reveal at the Nelson Mandela University (photo: Wits University). B) Macroscopic photograph of the Nqweba meteorite.

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are remnants of our solar protoplanetary disc or fragments of other rocky bodies, such as planets, moons, or asteroids that were ejected by impacts. The meteoroids enter the atmosphere at an average approximate velocity of 20 km/s,[7] which leads to frictional heating/melting of the rock and ionisation of atmospheric molecules. This results in a bright streak of light called a *meteor*—"shooting star".

The rock responsible for the Nqweba fireball was initially estimated to be "car-sized" based on the duration and brightness of the flare, but more detailed analysis of the Centre for Near-Earth Object Studies (CNEOS) data suggests it was more likely to have been approximately 1 m wide.[8] The unusual duration of the fireball is now attributed to the low angle of entry into the atmosphere, resulting in a longer atmospheric traverse and flaring, explaining eyewitness accounts 600 km away, as far as the southern Free State and Western Cape near Ceres. The measured total energy release of the Nqweba fireball is 92 t of TNT and it was the 20th fireball of 2024.[6] The largest fireball this year was recorded directly south of South Africa, over Antarctica, with a calculated total impact energy of 5,100 t.[6] The Nqweba event was strong enough to have produced a sonic boom over 100 km from its trajectory and to induce ground vibrations that were detected by several of the Council for Geoscience's seismometers in the area.

An extraterrestrial rock that survives entry to land on Earth's surface is called a *meteorite*. *Undifferentiated* meteorites, also known as *chondrites,* constitute almost 90% of all recovered meteorites.[9] Most are considered to originate from parent bodies that never melted and differentiated, and thus they represent materials aggregated in our solar system's protoplanetary disk. They are composed of mafic silicates, some Fe-Ni alloys, and chondrules that represent spherical melt-droplets of protoplanetary material that have undergone varying degrees of (re)crystallisation or alteration.[10,11] They represent the primary building material of the terrestrial planets, rocky moons and asteroids, with the best constrained age for their formation to be approximately 4.567 Ga, from dating Ca-Al-rich inclusions (CAI)—the first condensates of the protoplanetary disk.[10,12] In contrast, *differentiated* meteorites originate from rocky bodies that grew large enough to induce internal melting, resulting in the density-driven formation of internal layers, i.e. a silicate crust, mantle and siderophilic core.[11,13] The oldest age from a differentiated meteorite (Erg Chech 002), and thus the oldest evidence for the solidification of differentiated planetesimals, is within 3 Myr after CAI formation,[12,14] suggesting that magmatism in planetesimals occurred "geologically soon" after solar system formation. *Differentiated* meteorites are significantly less common than chondrites, and include three broad subcategories:

- *Achondrites* (stony) include the Howardite-Eucrite-Diogenite (HED) group, lunar, martian, and other asteroidal meteorites, and are analogous to many mafic crustal and mantle

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terrestrial rocks. Most of these rocks are severely shocked and brecciated through impacts and reworking on the parental body, and are thus commonly polymict breccias.[10,11]

- *Pallasites* and *mesosiderites* (stony irons) are examples of meteorites that have an intergrown texture of silicates (olivine and/or pyroxene) and Fe-Ni alloys in equal proportions. These meteorites are considered samples of the core-mantle boundary of differentiated planetary bodies that were exposed and ejected through collision events.[10,11]

- *Iron* meteorites are a range of Fe-Ni metal and Fe-sulphide meteorites that represent the metal cores of differentiated planets and asteroids. They are subdivided into various categories based on the textural intergrowth of kamacite ($Fe_{\pm 90}Ni_{\pm 10}$) and taenite ($Fe_{\pm 80}Ni_{\pm 20}$), and the bulk composition of the sample.[10,11]

The Nqweba meteorite is an important addition to the meteorite heritage of South Africa. As part of the public engagement facet of the project, the meteorite was unveiled at a live-streamed press conference on the 3rd of September 2024.[15–17] The meteorite has a dark, glassy, 1 mm-thick fusion crust, which is the result of surface melting during atmospheric entry. The interior shows many light and dark green mineral grains set within a light grey, fine-grained matrix. These are characteristic of some achondritic breccias, suggesting that it is likely part of the HED group. These meteorites are thought to have originated from 4 Vesta, the second largest asteroid in the asteroid belt[18,19]—the source of the Motopi Pan meteorite that also arrived as a fireball over Botswana on 2 June 2018.[20] Once the description and name have been submitted by the research team and formally accepted by the international Nomenclature Committee of the Meteoritical Society, the meteorite will become the 52nd officially recognised meteorite in South Africa and the first recovered fall in over 50 years (after the Lichtenberg chondrite, North-West Province 1973[9]). Given the proximity of the fall site to Nqweba, its name will most likely be after the town, as per nomenclature requirements.

The petrographic and mineral chemical analysis of the Nqweba meteorite are essential steps before an application to the Nomenclature Committee of the Meteoritical Society for official recognition in the Meteoritical Database.[9] Thereafter, more detailed and advanced geochemical, isotopic, and other analyses will be used to fully explore the meteorite's origin, petrogenetic history, and the broader scientific questions that may be investigated. In addition, analysis of geophysical aspects, such as the infrasound and induced seismic activity records, will add to the narrative. Beyond the scientific significance of the meteorite itself, the event as a whole holds a particular social importance for the people of South Africa, especially the residents of the Eastern Cape. Although we ultimately protect heritage items for the benefit of current and future generations in South Africa and globally, the public rarely has the opportunity to participate directly in such projects. In this case, however, the curiosity and engagement of the people of South Africa have already contributed meaningfully to both preserving this scientific find and adding to this event's scientific significance. The Nqweba fireball could serve as a contemporary case study on how such events resonate within a community, both on- and offline, and how actively involving communities can foster a shared investment in the scientific journey.

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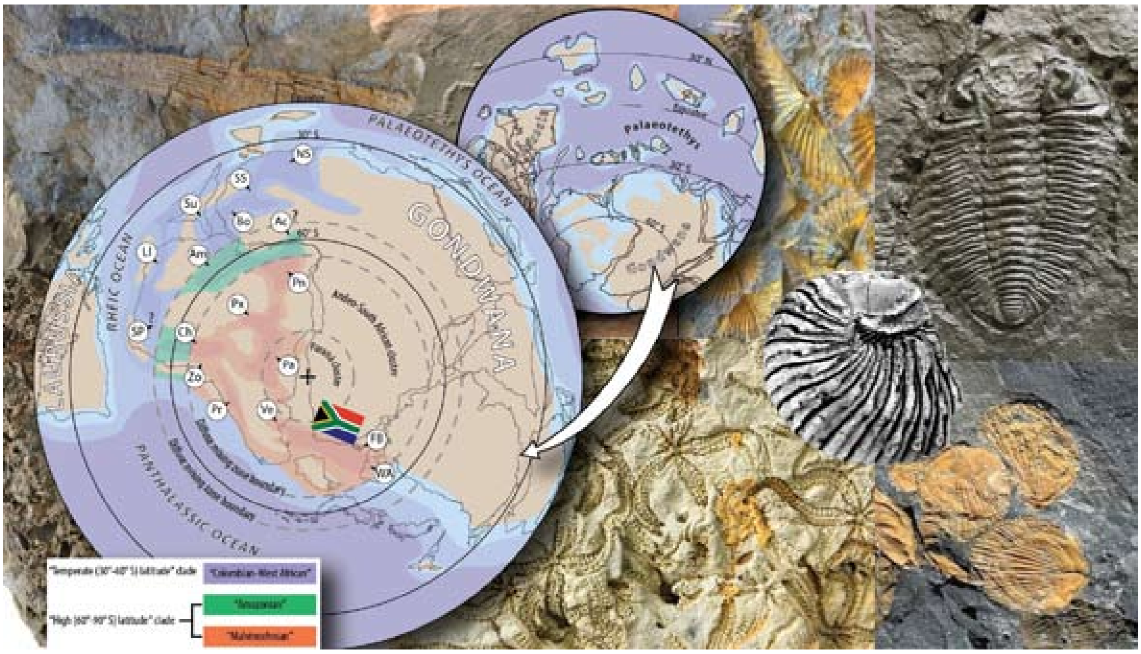
palaeontological society

Report on attendance at the 22nd conference of the Palaeontological Society of Southern Africa (Graaff-Reinet: 8–13 September 2024)

On 8 September 2024, the southern African palaeontological community descended upon the "capital of Gondwana", Graaff-Reinet, for the 22nd Conference of the Palaeontological Society of Southern Africa (PSSA). This week-long conference brought palaeontologists from near and far to discuss research that is currently being undertaken on palaeontological discoveries both in southern Africa as well as many other corners of Gondwana. Here, presentations and keynote addresses were given on a range of topics representing the near-complete spectrum of Life on Earth. A diverse array of presentations awaited attendees, with talks given on research covering Precambrian microbialites and early animal fossils in the Ediacaran to early Palaeozoic, to parareptile, therapsid and dinosaur palaeontology, as well as Cenozoic palaeontology covering hominid palaeontology and archaeozoology among others. This has been the first PSSA conference in a long time to include presentations on such a vast array of topics, and hopefully not the last either! The conference concluded with a fieldtrip led by Bruce Rubidge and Roger Smith, to visit sites in the Cistecephalus, Daptocephalus and Lystrosaurus declivis assemblage zones, inclusive of the Permo-Triassic boundary.

The GSSA REI fund generously provided funding to Cameron Penn-Clarke and his student, Cole Naamdhew, to attend the PSSA conference. At the conference they (alongside their collaborators) gave three well-received presentations on their



Palaeobiogeographic map of Gondwana during the Early–Middle Devonian showing the distribution of the Malvinoxhosan, Amazonian and Colombian–West African bioregions with South Africa located near the South Pole. Fossil images include those of typical taxa from South Africa (and Malvinoxhosan bioregion) at this time: trilobites Eldredgeia, Burmeisteria, brachiopods Australospirifer, Australocoelia, Rhipidothyris, and ophiuroids Strataster, as well as occasional acanthodian fish.

current research pertaining to the recognition of major events and crises in the Devonian record of South Africa.

Cole Naamdhew gave a poster presentation on his honours project entitled "Spatiotemporal distributions of Devonian benthic communities in South Africa", where he is exploring the use of GIS to reveal any potential distribution patterns of Early–Middle Devonian invertebrates in relation to changes in environment through time. He further presented a provisional biostratigraphic map for the Lower–Middle Devonian of South Africa, as well as a database and structure that was devised in-house as part of his research. Cameron Penn-Clarke gave two presentations on current research that he is undertaking with collaborators. The first presentation (entitled "End of Days at the End of the World: U-Pb detrital zircon geochronology of high-latitude Devonian regions suggest extinction events were globally extensive" in collaboration with Clarisa Vorster at UJ and David Harper at Durham University) concerned age estimates for the Lower–Middle Devonian of South Africa and their implications in relation to the timing of mass extinction events in the Bokkeveld Group. The second presentation (entitled "Earliest coal beds from the Silurian-Devonian Terrestrial Revolution at high-latitudes: Evidence from the Middle Devonian of South Africa" in collaboration with Marion Bamford at ESI WITS and Nikki Wagner and Itumeleng Matlala at UJ) focused on preliminary findings of ongoing research on early coal beds from the Cape Supergroup and their implications in terms of the timing of terrestrialisation in southern Gondwana.

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Attendees at the PSSA conference

geoheritage

Landscape of the Barberton Makhonjwa Mountains.

Giant meteorite impacts and the fate of early life

The Barberton Makhonjwa Mountains, part of the renowned Barberton Greenstone Belt, are recognised as a UNESCO World Heritage Site for their unique contribution to our understanding of Earth's history. These mountains are spectacular in many ways, but hold invaluable clues to the evolution of life, oceans and crust, particularly to researchers of the early Earth. Our research team is especially interested in the record of giant meteorite impacts, and how those affected the evolution of the early Earth. In our recent study,[1] we not only record the effects of a giant meteorite impact on the ancient surface environment, but also provide a record of life's resilience in the face of such a catastrophic event.

Record of giant meteorite impacts in the Barberton Makhonjwa Mountains

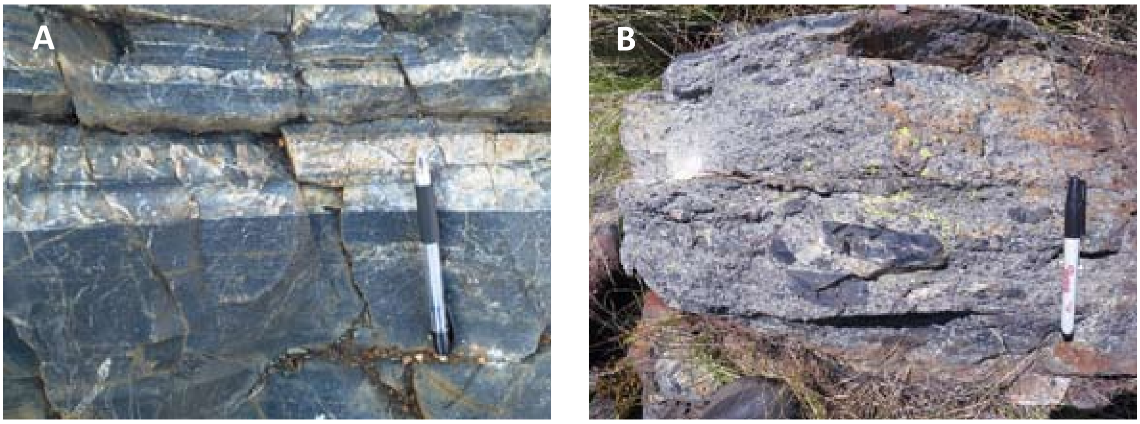
The Barberton Greenstone Belt includes some of the oldest rocks on Earth, dating between 3.6 and 3.2 billion years old. As such, these rocks are not only old but also incredibly well-preserved, allowing us to study in great detail the nature of Earth's surface and life at that time. They include evidence for at least eight major meteorite impact events.[2,3] Each of these was bigger than the famous Chicxulub meteorite that led to the extinction of non-avian dinosaurs at the Cretaceous–Paleogene (K-Pg) boundary 66 million years ago.[4]

The impact events were identified by spherule layers—sand-sized spherical particles that form from the condensation of a meteorite impact-produced rock vapour cloud. Such a spherule bed was also identified at the K-Pg boundary, and similarly exhibits iridium anomalies and extraterrestrial Cr-isotope signatures.[5] In the Barberton Greenstone Belt, the spherule beds were numbered, from S1 to S8. All of these are distal deposits, meaning that they were deposited far away from the actual impact crater.

For our study, we focused on the S2 impact that occurred 3.26 billion years ago. The impactor was a carbonaceous chondrite, similar to the Ryugu meteorite recently visited by Hayabusa2. The S2 impactor was 37–58 km in diameter,[6] much larger than the 10 km-in-diameter Chicxulub impactor. In terms of mass, this means that the S2 impactor was between ~50–200 times heavier than the Chicxulub impactor.

Life and environment during the Archaean

The Archaean Earth was quite different from today. The Earth was a water world, with few islands and only small continents emerging from the water. While life was already present, it only consisted of



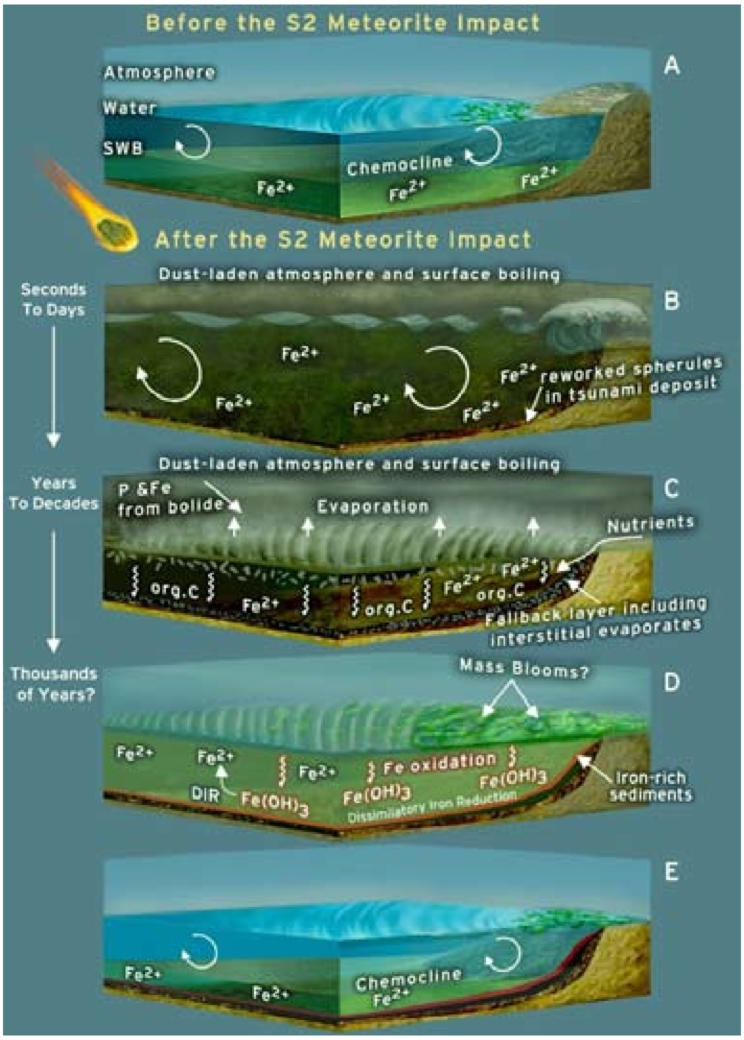
[A] Banded cherts showing a calm-water marine environment before the impact. Black layers comprise abundant organic material.
[B] Conglomerate with ripped-up chunks of the sea floor interpreted as a tsunami deposit.

Photo taken close to the Umbaumba section studied for this research. The Mpumalanga Tourism and Parks Agency kindly provided assistance in getting to the field site in the centre of the Barberton Greenstone Belt.

single-celled microbes. Life was probably much less abundant than today, in part due to a scarcity of nutrients.

Disastrous effects for the environment

The impact had many disastrous effects, including the initiation of a huge tsunami, heating of the atmosphere, and global darkness. This can be traced in the rock record. The spherules themselves are found within an unusually coarse-grained conglomerate in an otherwise calm-water environment. Such high-energy deposits are associated with almost all Archaean meteorite impact events and are generally interpreted as tsunamis.[3,7] While we do not know the impact site, it is likely that the impact occurred in the ocean, initiating a giant tsunami that swept across the globe. This tsunami mixed up the water column and inundated coastlines. Following the tsunami, the environment changed from marine to evaporitic conditions, indicating a drastic change in environment and water depth. Previous modelling has shown that impacts this large release so much heat upon impact that the atmosphere heats up above the boiling point of water.[8] Modelling



Sequence of events following the meteorite impact. (Graphic by James Zaccharia) has also shown that impacts of this magnitude eject so much dust into the atmosphere that they would turn the skies dark on a global scale.[9] These disastrous conditions would have lasted for a few years to decades, during which photosynthetic life, and especially any life on land, would have been decimated.

Surprisingly, life was not only resilient, but it also flourished

Unlike the complex flora and fauna devastated during the Chicxulub impact, early life comprised simple, yet hardy and adaptable micro-organisms. These microbes, lacking the complexity of dinosaurs, could recover rapidly due to their versatility and fast doubling rates. As soon as the conditions improved, life not only recovered incredibly quickly but it even thrived. A critical factor in this resilience was the simultaneous introduction of nutrients and electron donors. Carbonaceous chondrites can contain a substantial amount of phosphorus—a key ingredient for RNA and DNA—while the globe-encircling tsunamis brought iron-rich deep ocean water to shallow waters. Such enrichment effectively acted as a large-scale fertilisation event, triggering a bloom within the iron-metabolising microbial community soon after environmental conditions normalised. In the field, one can trace these changes by the sudden appearance of red-coloured cherts above the impact event. In addition, geochemical analyses do not only show the enrichment in iron but also in P, particularly with the deposition of the spherules.

Dr Drabon on the right with PhD students Öykü Zumra Mete in the centre and David Madrigal Trejo on the left.

Implications for early Earth's narrative

While much of the early Earth remains a mystery, it is clear that meteorite impacts occurred much more frequently, and that these impacts must have significantly affected the evolution of early life. While impacts are frequently seen as disastrous to the evolution of life, our results highlight the need to rethink this traditional paradigm. It suggests that such impacts, instead of solely being existential threats, may have actually benefitted the early evolution of life. The increase in both iron and phosphorus, allowing life to bounce back quickly, showcases the complex interplay of disastrous and beneficial forces of giant impacts affecting the evolution of life on Earth.

Showcasing the value of southern African geology: creating a new museum exhibit

The Barberton Greenstone Belt stands as a vital archive in preserving the early evolution of life on Earth. As geologists, we greatly value the stories these rocks can tell about Earth's ancient past. To communicate their value, we are excited to be working with the Eswatini National Trust Commission and the noted archaeologist Bob Forrester on the exhibit for the new Lion Cavern Museum currently being designed in Eswatini. Together with our South African collaborator, Phumelele Mashele from Wits University, and the Harvard Museum of Natural History, we will be designing an interactive exhibit to communicate not only these findings, but also other fundamental research on the evolution of the early Earth done in the Barberton Greenstone Belt. The museum will be integrated with the already existing Geotrail on the South African side of the mountains. In celebrating the rich geological and anthropogenic heritage through the Lion Cavern Museum exhibit, we hope to communicate our science to the broader public and engage all generations in the fascinating geology of the Barberton Makhonjwa Mountains.

Nadja Drabon

Department of Earth and Planetary Sciences, Harvard University

Rendering of the Lion Cavern Museum in Eswatini. (Image: Ministry of Tourism, Eswatini)

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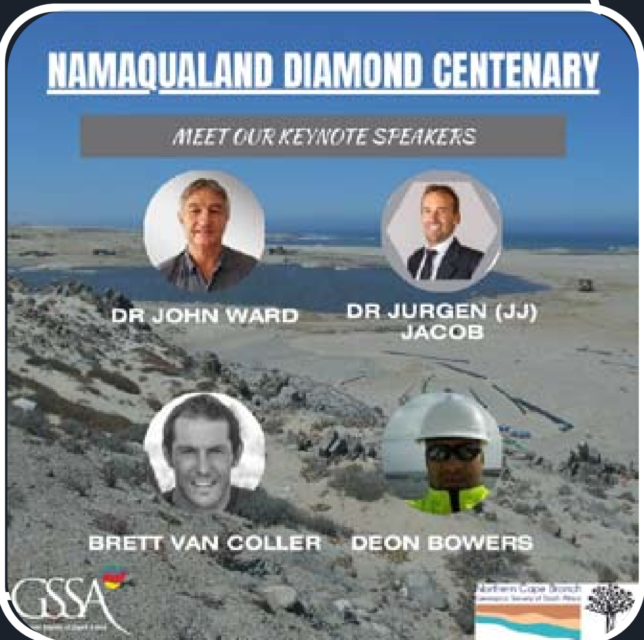

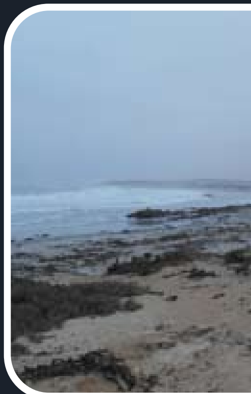

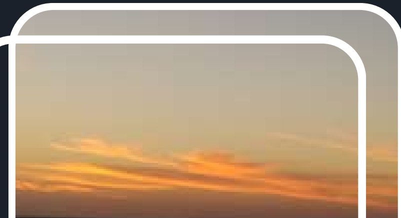

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mineral scene

General view of the terrain at Riemvasmaak. The view is looking west, from a hill where fluorite was being exploited by local artisanal diggers. Some of the spoils piles are evident on the right. Vehicle for scale down in the valley.

Fluorite from Riemvasmaak, Northern Cape

Fluorite has appeared previously in the 'Mineral Scene' column (#10), featuring the premier Namibian fluorite deposit at Okorusu. This contribution highlights South Africa's most important specimen-producing fluorite occurrence, Riemvasmaak, close to the Orange River in the Northern Cape Province.[1,2] The literal translation of Riemvasmaak is "to tie with rawhide." The name allegedly[3] dates back to the 1900s, when some locals who lived in the area were caught stealing the local community's livestock. They were tied to a large boulder in the Molopo River with rawhide thongs (rieme in Afrikaans), but they escaped. From that time on, the area is said to have been known as Riemvasmaak, and the inhabitants as "Riemvasmakers." Another theory is that the name refers to the tying of oxen with leather thongs to an ox wagon. Apparently tying things up in the region was a common preoccupation, because a nearby locality is called "Bokvasmaak"!

The fluorite is hosted in quartz veins and pegmatites that are widespread in the area, from north of Kakamas to the Richtersveld.[4,5] The fluorite specimens have been dug by artisanal workers who live in the nearby Riemvasmaak settlement. Although this activity has declined in recent years, ten to fifteen years ago there was a frenzy of activity in the area as the fluorite specimens being

A large cuboctahedral fluorite crystal with a smaller octahedron displaying modified cube corners, 13.5 cm. Riemvasmaak, South Africa. (Specimen: Desmond Sacco; photo: Bruce Cairncross)

Octahedral fluorite crystals with quartz, 7.2 cm. Riemvasmaak, South Africa. (Specimen and photo: Bruce Cairncross)

Large group of octahedral fluorite crystals, 23.4 cm, from Riemvasmaak. (Specimen: Ronnie McKenzie; photo: Bruce Cairncross)

A 4.6 cm fluorite specimen together with an 18.04 carat faceted Riemvasmaak fluorite. (Specimen: Bruce Cairncross specimen; gemstone: Massimo Leone; photo: Bruce Cairncross)

collected entered the international collector market and created quite a stir.

Vibrant green octahedral and modified cuboctahedral crystals up to 15 cm on edge have been collected. Many are transparent and gem quality. Most are coated by a thin film of white, drusy quartz that needs to be removed to reveal the fluorite. Apart from the ubiquitous green crystals, yellow, yellow-green, and purple are found. In addition to Riemvasmaak, fluorite crystals come from various unnamed localities generally labelled as 'Orange River'. These vary in colour, as do those from Riemvasmaak, and are often associated with red, hematite-included quartz.

Bruce Cairncross
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A fluorite specimen before and after cleaning. Left: The fluorite is coated by drusy quartz that is removed using hydrofluoric acid, an extremely dangerous process. The quartz crystals are coated with wax to prevent etching from the acid. Right: the cleaned specimen. Field of view is 14 cm. (Specimen and photo: Bruce Cairncross)

GSSA events 2025

GSSA 2025 Preliminary Events Calendar

2025 Events		
Date	**Event**	**Location**
On demand	Drilling Methods and Techniques	Online through Colin Rice Exploration Drilling Advisory
On demand	Drilling Skills for Geologists	Online through Colin Rice Exploration Drilling Advisory
7 & 8 February	Marine Geoscience	Online
February	Mapmaking - (MINROM)	Online
4 March	CPD Workshop	Online Free
11 -20 March	Namaqualand Diamond Centenary (NDC) conference & Field trip	Vanrhynsdorp & Port Nolloth
March	Advanced Excel	Online
April	3D Geological Modelling	Online
May	Structural Geology Field Trip	KZN Coast (Weekend)
24 - 26 June	Geocongress25	Bloemfontein
25 - 26 June	Intro to SAMCODES workshop (at Geocongress)	Bloemfontein
July (16 & 17th) or (17th & 18th)	Youth event with YGP/mentorship group/ Student chapter	Hybrid event in conjunction with AGM
July	AB Global – Resource Modelling	Online
5 August	Intro to Drilling workshop	Online Free
August	ESG Update	Online
2 - 3 September	Intro to SAMCODES and 25th Anniversary of SAMREC	JCC (Hybrid)
9 September	Professionalism & Ethics	Online Free
September	Data Analytics & Machine learning	Online
October	New SACNASP Bill	Online
November	New Cadastre - (Minerals Council)	Online
19 - 20 November	African Exploration Showcase	JCC (Hybrid)

35IGC fund

35IGC Legacy Fund: 2025 call for grant applications

The generous support received from sponsors, donors and over 4,000 registered delegates resulted in a financial surplus after the 35th International Geological Congress that was held in Cape Town during 2016. These funds have been invested and are administered by the Board of 35IGC Legacy Fund to ensure that the legacy of this successful event will benefit the South African geoscience community long into the future.

Annual grants are advertised to promote geoheritage projects or activities in support of deserving geoscience students and researchers. A thematic focus or dedicated conference support funding is identified every year. The level of funding available annually for disbursement varies in relation to investment income and the need to maintain or grow capital from which sustainable support can be provided.

The 2025 grants are aimed at producing materials that support, promote aspects of and enhance asset management of the following themes:

1) Geoheritage/geoconservation—Products, outreach or information dissemination pertaining to significant geological features that represent past or on-going Earth processes contributing substantially to the global understanding of the planet's history and its life support systems. The primary objective is to recognise and conserve geoheritage values of international significance and to disseminate and promote this information to advance geoconservation efforts worldwide (after Brilha et al., 2024).
2) Geotourism—Products to enhance the educational experience at tourism focus sites or geological aspects of protected areas through improved explanation of geodiversity that constitutes the natural diversity of planet Earth and linkages with biodiversity.
3) Geoscience education—Products that convey information to the public, interest groups or educators/students related to the description, functioning, and conservation of geoheritage sites or resources.

- The thrust of proposals should be product-focused and applicants must outline how the grant will be utilised to establish a long-term presence that will promote activities and enhance management associated with any of the themes listed above.
- Proposals that include additional sources of funds will be favoured.
- Where proposals aim to create products in support of facilities located in a national or provincial park or conservation area, a world heritage site or any other established heritage or tourism-focused facility, the written support of the controlling institution must accompany the application.

As the quantum of available funds available is limited, compliance with the above conditions does not guarantee acceptance of the application or the award of a grant.

All provisionally successful applications will be reviewed and evaluated by the Management Committee/Board of the Legacy Fund and their decision with respect to the awarding of grants and the quantum of finance provided is final.

Applications must be made on the prescribed form (available at https://35igclegacyfund.org.za) and submitted to Peter Stiff at pstiff@jpaudit.co.za before 1 March 2025.

PROJECT FUNDING

REI fund

REQUEST FOR APPLICATIONS TO THE RESEARCH, EDUCATION AND INVESTMENT (REI) FUND OF THE GSSA

CLOSURE DATE FOR APPLICATIONS: 31 JANUARY 2025

The GSSA Research, Education and Investment Fund (REI Fund) is inviting applications from GSSA paid up-members (including post-graduate student members) for grants from the Fund, to be received at the GSSA office not later than 31 January 2025. Applications can be made using the prescribed application form available under Publications/GSSA Documentation on the GSSA web site (www.gssa.org.za) or see the link below for the online form. Supporting information required with each application includes a short description of the project, brief motivation for research and funding requested, a budget describing how funds will be used, and a letter of support from research supervisor (in cases where the applicants are post-graduate students at South African universities). Post-graduate student members applying for financial support must have been a member of the Society for at least one year. Applications from current student members with a PhD qualification are not accepted unless the applicant has applied for transfer to or is registered as a full paid-up member of the Society.

https://www.cognitoforms.com/GeologicalSocietyOfSouthAfrica/researcheducationandinvestmentfund

Grants are intended to support avariety of earth science research costs, including analytical and field costs, conference attendance, and publication costs. Projects that promote and support earth science awareness such as geoheritage, geotourism and geo-education may also be supported. Expenses related to (annual) registration and tuition fees, text books, accommodation, etc. required at Higher Education institutions are not covered. Members enrolled at non-South African universities are not eligible to apply for financial support.

In particular we welcome applications from post graduate student members and would appreciate it if Heads of Departments at Higher Education Institutions and their staff would inform their students of this opportunity. Grants are usually limited to R25 000 per application but well-motivated applications for larger amounts are also welcome. All applications will be judged on merit and/or the importance to the Society in promoting its image. Note that grants are only awarded to members/student members in good standing.

Applications are screened by the REI Fund Committee during February/March with input and ratification by the GSSA Management Committee and Council, respectively. In evaluating the applications and recommendations, the Committee considers the merit of each application, and depending on the amount of money available for that year, makes a final decision on the allocation of grants for that year. The decision of the Committee is final and no further correspondence on the matter will be entertained. By following this procedure it is anticipated that applicants will be informed during March 2024 whether or not their applications are successful. Recommendations made by the Committee require Council approval, which may delay notifications.

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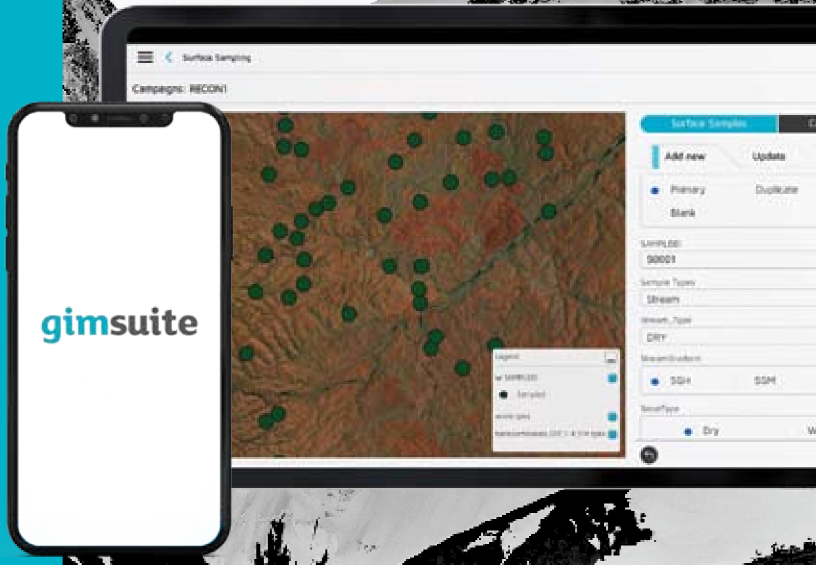

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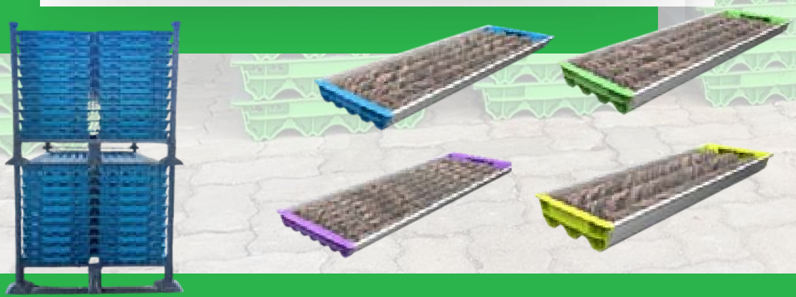

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Who We Are

MINSA was established in 1979 to foster interaction within the mineralogical community of South Africa. We are a specialist division of the Geological Society of South Africa (GSSA) and are affiliated with the International Mineralogical Association (IMA).

MINSA organises various events of interest to both professional and amateur mineralogists, geochemists and petrologists. We promote access to cutting edge developments in the field through meetings, symposia and workshops, the largest of which was the IMA2014 international conference.

Membership Benefits

- Opportunity to interact with peers in the mineralogy, petrology and geochemistry fields
- Reduced fees for attendance of symposia and workshops organised by MINSA
- Free attendance of quarterly topical talks by eminent scientists
- Participation in field trips to exciting and interesting sites, laboratories and factories of mineralogical interest, typically free of charge
- Events at which family participation is encouraged, in stimulating the interest of a new generation of mineralogists
- Quarterly newsletter of MINSA activities (The Geode) and upcoming events of interest to the community. Special themed editions are now a common occurrence
- Opportunity to address issues relating to the mineralogical community

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