

Heavy mineral exploration on the continental scale

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INTRODUCTION

Heavy minerals (HMs) (i.e. minerals with a density greater than ~ 2.9 g/cm³) are widely used by mineral explorers and researchers in upstream exploration and geological provenance studies (e.g. Averill 2001; McClenaghan et al. 2016; Salama et al. 2016). Some HMs, referred to as 'indicator' minerals, can be indicative of specific environments of formation or processes such as hydrothermal alteration and mineralisation (e.g. Nowicki et al. 2007; McClenaghan et al. 2014; Mao et al. 2017). The use of HMs in mineral exploration typically involves the systematic sampling and analysis (geochemical and mineralogical) of drainage sediments, however the applicability of these methods in Australia is poorly understood due to the variable and, in places, protracted history of physical and chemical weathering across the continent, as well as the possibility that geomorphic drainage patterns and erosion cycles have evolved significantly over geological time (Pillans 2007; Pain et al. 2012).

The Heavy Mineral Map of Australia (HMMA) project is a joint Geoscience Australia-Curtin University initiative designed to define a heavy mineral baseline for the Australian continent. The starting materials utilized were 1315 floodplain sediment samples collected from drainage catchments covering $\sim 81\%$ of the Australian continent (Caritat 2022). A pilot study (Caritat et al. 2022) carried out on a subset of National Geochemical Survey of Australia (NGSA) samples determined that the largest volumetric component of the sediments was quartz and feldspar group minerals, which are of minimal diagnostic value in mineral exploration or determining basement geology. The heavy mineral fraction, separated from the bulk sediments using gravity separation techniques, was found to contain mineral assemblages of potential utility in defining protolith sources and geological processes related to magmatism, metamorphism, metasomatism/alteration, and mineralization. The Caritat et al. (2022) study determined that it was feasible to generate heavy mineral maps of Australia (HMMA) as a new pre-competitive asset of potential interest to industry, government, and academic researchers. The derived mineralogy from the HMMA project will provide explorers with a better understanding of background mineral abundances and geoscientists with new insights into the composition and evolution of the Australian crust.

MATERIALS AND METHODS

The samples analyzed in the HMMA were collected as part of Geoscience Australia's National Geochemical Survey of Australia (NGSA) using the sampling methodology of Lech et al. (2007). The NGSA sample collection comprises a total of 1315 samples (including field duplicates) of catchment outlet sediments collected from 1186 catchments across Australia, with a sampling density of 1 sample per approximately 5200 km². Catchment outlet sediments are deposited outside riverbanks as floodwaters recede and may be modified by aeolian processes following deposition (Caritat 2022). The HMMA utilizes splits of the bottom outlet sediments (BOS) collected at each sampling site; BOS samples were taken at an average of ~ 60 – 80 cm depth in floodplain landforms, and are well-mixed, fine-grained composites of major soil and rock types present in the upstream catchment(s), unaffected by post-depositional anthropogenic inputs (Caritat 2022).

The 1315 BOS samples were processed and analyzed at the John de Laeter Centre at Curtin University following the processing and analytical methods described in Walker et al. (in prep.; Fig. 1). The samples, ranging in mass from approximately 17–1000 g, were dried and sieved to extract the 75–425 μ m grain size fraction, from which a novel heavy mineral extraction process featuring liquid nitrogen and centrifugation was used to extract contained heavy minerals (density $\sim > 2.9$ g/cm³) (Walker et al. in prep; Caritat et al. 2023). The resulting heavy mineral concentrates (HMC) were fixed in cylindrical 25 mm epoxy mounts with embedded 3-sided plastic templates for sample navigation purposes and a label featuring sample identity details plus a scannable QR code. Where an HMC produced for a sample exceeded ~ 0.5 g, the HMC was riffle split into HMC1 and HMC2, with the former archived; where the mass of HMC2 still exceeded that necessary for mounting, the 'cone and quarter' method was used to generate a representative subsample with the remainder archived. All of the mounts were polished and carbon coated prior to analysis by electron microscopy.

Automated mineralogical analysis of each mounted sample was completed using the TESCAN Integrated Mineral Analyzer (TIMA) in the John de Laeter Centre at Curtin University. The TIMA comprises four fully integrated silicon drift Energy Dispersive Spectroscopy (EDS) X-ray detectors linked to a TESCAN MIRA field emission gun (FEG) platform. It is optimized for high data throughput and utilizes combined backscattered electron (BSE) and energy dispersive spectrometry (EDS) inputs to rapidly identify sample mineralogy.

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Note from the Editor

Welcome to the first EXPLORE issue of 2024. This issue features an article describing a first-of-its-kind heavy mineral map of Australia and its use for mineral exploration on the continental scale. It was written by Alexander Walker, Brent McInnes, Patrice de Caritat, and Evgeniy Bastrakov.

EXPLORE thanks all those who contributed to the writing and/or editing of this issue, listed in alphabetical order: Elizabeth Ambrose, Steve Amor, Dennis Arne, Al Arsenault, Evgeniy Bastrakov, Chris Beckett-Brown, Patrice de Caritat, John Carranza, Steve Cook, Jane Graham, Brent McInnes, Jessey Rice, Dave Smith, and Alexander Walker.

Beth McClenaghan
Editor

Steve Cook,
Business Manager



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President's Message

Welcome to the first issue of EXPLORE of 2024. I started my two-year term as President of the Association in January 2024, and I would like to take this opportunity to thank the AAG executive and Councillors who have made the last two years successful for the AAG. Special thanks to the AAG executive, John Carranza, Gwendy Hall, and Dave Smith. Renguang Zuo is the AAG's new Vice-President, and I welcome him to the role, and our Past President John will now take over the role of Chair of the AAG's Awards and Medals Committee from Dennis Arne under whose leadership we had a few medals awarded. We are going to miss the services of long time AAG Office Manager Al Arseneault, who has retired from this position. Al had been our manager for many years; in fact, he and previously his wife, Betty, had been managing the AAG office for 30 years, and we are extremely grateful to Al for all his work during those years. In January, we welcomed Jane Graham as the new AAG Office Manager. Jane has vast experience that she brings to the role, that includes bank manager, investment manager, tax accountant, local Council member and President of several local societies. We all look forward to meeting and welcoming Jane in our first AAG Council meeting in March.

Many thanks to Beth McClenaghan and Steve Cook, for their ongoing work on managing the EXPLORE newsletter (and I strongly encourage you to submit an article on applied geochemistry research to EXPLORE!), and Elizabeth Ambrose, our AAG website master. I am very grateful to Scott Wood, Editor-in-Chief of GEEA, for all his hard work not only managing the journal, but raising the profile of applied geochemistry which is evident from a significant rise in GEEA's impact factor. I would also like to thank our AAG 2023–2024 Councillors Ray Lett, Aaron Baensch, Ryan Noble, Pim van Geffen and Paul Morris, for all their efforts over the past years, and welcome new Councillors for 2024–2025: Alexander Seyfarth, Cliff Stanley, Patrice de Caritat, Mark Arundell, and Behnam Sadeghi. AAG Regional Councillors are João H. Larizzatti, Brian Townley, Xueqiu Wang, Pertti Sarala, Benedetto De Vivo, Iftikhar A. Malik, Theo Davies, Silas Sunday Dada, and Kate Knights.

This year our Association will host the 30th International Applied Geochemistry Symposium (IAGS) in Adelaide, South Australia, from the 14th to the 18th of October. The IAGS is commonly run on a biennial basis and is a significant gathering of geochemists from all over the world. It usually attracts over 250 representatives from industry, universities, research organisations, government departments and consulting companies along with a strong contingent of recent university graduates and current students. Australia hosted one of such event back in 2005, and it is a great honour to host the 30th IAGS event in Australia in 2024. This chance to host the IAGS once again in Australia will present many opportunities to advance geochemistry and its application to exploration and the environment, promote the exchange of scientific knowledge and encourage research and development, and foster geochemistry as a profession through supporting students as well. I would like to thank the Local Organising Committee, chaired by Anna Petts, for all their hard work to date in shaping the event and positioning it for success.

The AAG and the IAGS 2024 are committed to fostering an inclusive and diverse environment that welcomes and values individuals from all backgrounds, cultures, and perspectives. We firmly believe that a diverse community brings forth a multitude of ideas, experiences, and talents that are vital for advancing the field of applied geochemistry. We strive to create a symposium that promotes equal opportunities and encourages the participation of individuals irrespective of their race, ethnicity, nationality, gender, age, sexual orientation, religion, (dis)ability, or socioeconomic status. We are dedicated to ensuring that everyone feels safe, respected, and included throughout the symposium.

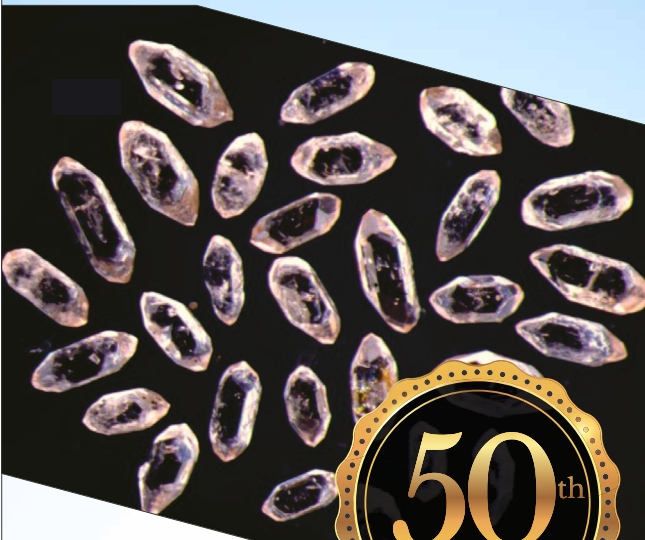
The theme for the IAGS 2024 is “**Applied geochemistry for a sustainable future**”. Our organising committee has been working hard to promote abstract submission with the portal now open, and the registration portal will open shortly. We are already receiving high quality abstracts from researchers, industry and professionals from Australia as well as international submissions. I encourage you all to check the IAGS2024 website (<https://iags2024.com.au/>), consider submitting an abstract (or two) and attending the event in beautiful Adelaide. There will be several field trips and workshops as well.


Wishing you a great year ahead and looking forward to working with you all!


Yulia Uvarova
President



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New AAG President and Vice President for 2024–2025

Yulia Uvarova, AAG President

Yulia is the AAG's new President for 2024–2025. She obtained her B.Sc. in Geology from Moscow State University in 2001 and her Ph.D. in Geology from the University of Manitoba in 2008. From 2000–2002, she worked at the Vernadsky Institute of Geochemistry and Analytical Chemistry, Moscow, Russia as a Research Assistant. From 2003–2008 she was a teaching assistant at the University of Manitoba. From 2008–2012, Yulia worked at Queens' University, in the Queen's Facility for Isotope Research, where her research focused on geochemistry, mineralogy, petrology, and genesis of economic mineral deposits, uranium in particular; development of new exploration tools for search of U deposits; behaviour of HFSE in high-temperature systems; geochemistry of non-traditional isotopic systems and application of these systems to elucidate processes responsible for deposit formation. Yulia holds a Research Scientist position in CSIRO Mineral Resources, Perth, and works in a team of researchers developing new workflows and techniques for mapping the distal footprints of metalliferous mineral systems through drilling and sampling and developing the science of understanding large geochemical footprints of mineral systems and their detection on the surface.



Renguang Zuo, AAG Vice President

Renguang is the AAG's new Vice President for 2024–2025. Professor Renguang Zuo received his B.S. and Ph.D. degrees from the China University of Geosciences (CUG), Wuhan, China, in 2004 and 2009, respectively. He is currently a full professor at the State Key Laboratory of Geological Processes and Mineral Resources, CUG. In 2014, he was a Senior Visiting Fellow at James Cook University, Australia. Professor Renguang Zuo became a Fellow of AAG in 2016 and has held several positions within AAG Council, including Councilor of the Association in 2017–2018, 2019–2020, and 2022–2023, Associate Editor for *Geochemistry: Exploration, Environment, Analysis* (2017–2018) and Editorial Board for *Geochemistry: Exploration, Environment, Analysis* (2019–present). He is a Councilor of the International Association for Mathematical Geosciences (IAMG) (2020–2024).

Professor Renguang Zuo has received fellowship status from the Society of Economic Geologists and the Geological Society of London. He has been heavily involved in the editorial boards of several SCI-indexed journals, including *Natural Resources Research*, *Computers & Geosciences*, *Ore Geology Reviews*, *Journal of Geochemical Exploration*, and *Journal of Earth Science*.

The focus of Professor Renguang Zuo's research is big data analytics and machine-learning-based mineral prospectivity mapping and geochemical anomaly identification. Professor Renguang Zuo has published over 160 peer-reviewed journal papers and 6 books and book chapters. He has been the Guest Editor of 8 special issues in high-quality international journals and his publications have amassed over 7,500 citations (Google Scholar).



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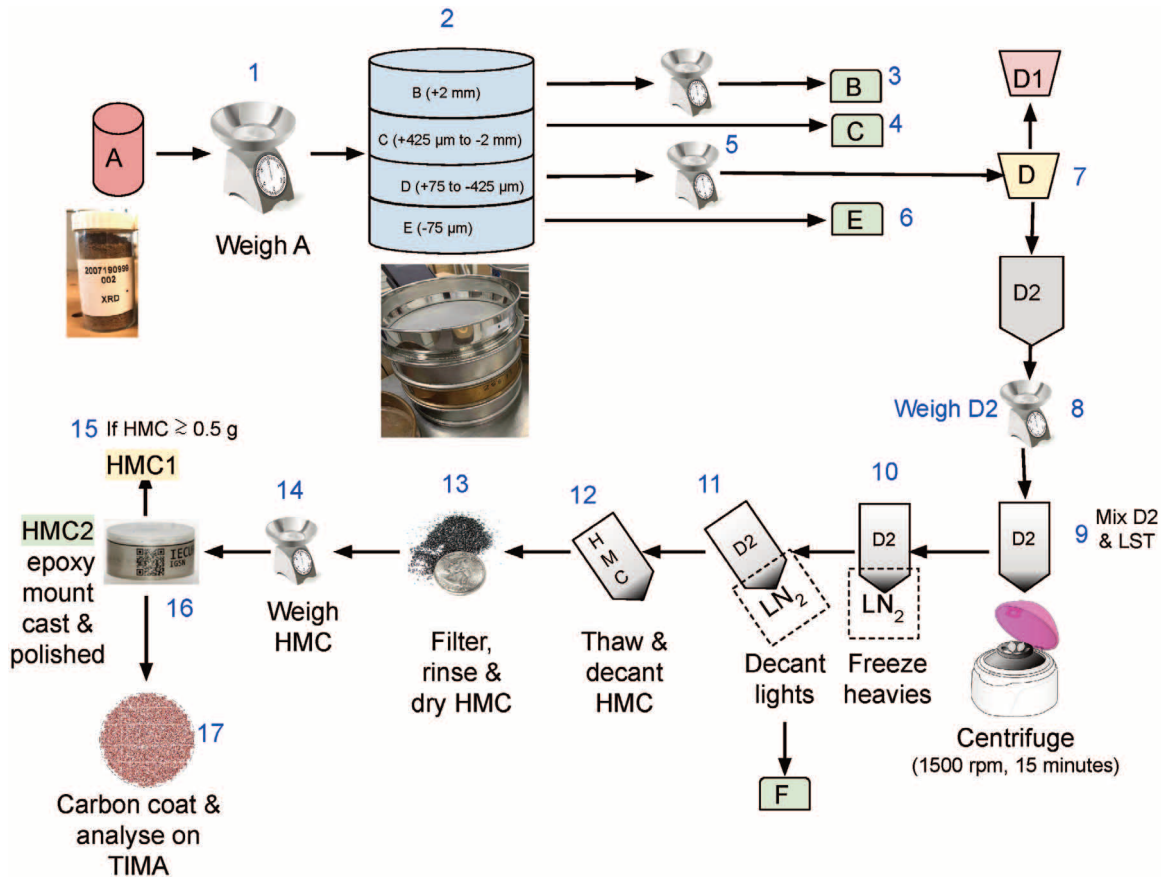


Fig 1. The sample preparation workflow for samples collected and processed for the Heavy Mineral Map of Australia (HMMA).


RESULTS

Automated mineralogical analysis of the HMMA sample set has identified approximately 160 unique mineral phases within Australian regolith and generated more than 140 million unique mineral observations. An 'observation' is defined as a monomineralic phase occurring either as a single liberated 'grain' by the TIMA, or a part of a polymineralic particle (e.g. an inclusion or a composite rock fragment) (Caritat et al. 2023). Most of these phases are unique Integrated Mineral Analyzer (IMA)-recognized minerals although several entries diverge from the IMA vocabulary. This divergence is typically due to factors such as the presence of mineral solid solutions or minerals with identical chemical compositions (e.g. the aluminosilicate polymorphs—kyanite, andalusite, and sillimanite).

Although not an exhaustive list, the detrital minerals observed in the released HMMA data that may have been derived originally from hard-rock base and precious metal mineralization include the following:


- Sulphides: arsenopyrite, bornite, chalcocite, chalcopyrite, covellite, galena, molybdenite, pentlandite, pyrite, pyrrhotite, and sphalerite;
- Oxides: cuprite, ecandrewsite, gahnite, sweetite, and zincohögbomite;
- Carbonates: aurichalcite/zincrosasite;
- Halides: simonkolleite;
- Phosphates: plumbogummite;
- Silicates: willemite, zincostaurolite;
- Alloys and Native Metals: tongxinite, gold, and platinum.

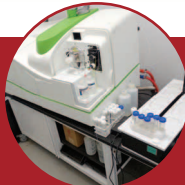


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The heavy mineral (HM) dataset (various formats) and a comprehensive heavy mineral atlas of Australia are available and free to download as part of the HMMA final report (Caritat et al. 2023).

MINERAL NETWORK ANALYSIS

The large and multi-dimensional nature of the HMMA dataset encourages the application of novel analysis and visualization techniques. Mineral network analysis (MNA) has been shown by Morrison et al. (2017) to be a dynamic and quantitative tool capable of revealing and visualizing complex patterns of abundance, diversity, and distribution in large mineralogical data sets. The HMMA project led to the development of its own bespoke MNA tool, the Mineral Network Analysis for Heavy Minerals (MNA for HM), which can be freely accessed at <https://geoscienceaustralia.shinyapps.io/mna4hm/>.

Mineral network graphs take the form of “ball and spoke” based models (Fig. 2), where the layout of the model provides key information on the relationships between heavy minerals:

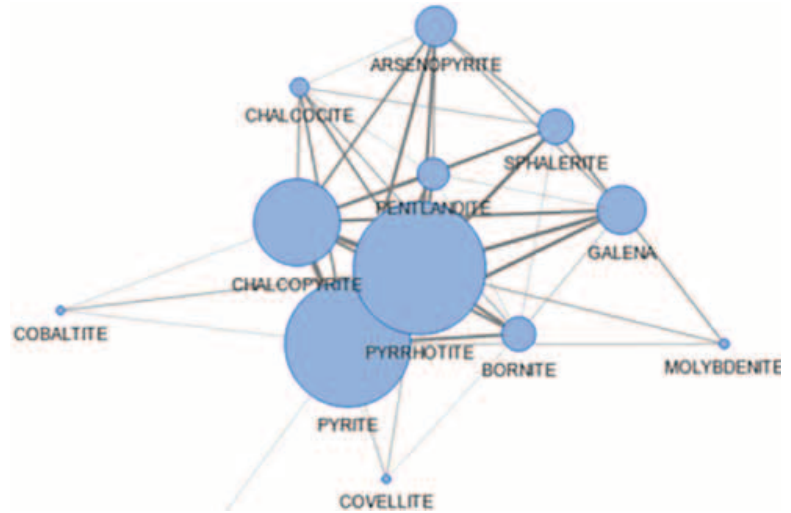


Fig. 2. Visualization of Heavy Mineral Map of Australia sulphide mineral relationships within the GA-Curtin mineral network analysis (MNA) app.

1. Mineral abundance: every mineral present in a sample is represented by a node (represented as a ball or circle in Fig. 2), with the size of each node proportional to the abundance of the mineral within the sample population, and its color representing mineral groups (e.g. sulphides in blue). In Figure 2, pyrrhotite (714 samples), pyrite (645 samples), chalcopyrite (305 samples), and galena (96 samples) are amongst the most abundant sulphide minerals observed.
2. Mineral co-occurrence: minerals that co-occur in at least one sample are linked by connectors or spokes (represented as straight lines in Fig. 2), whose thickness is proportional to the number of samples where the minerals are found to co-occur. In Figure 2, the pyrite-pyrrhotite pair co-occurs in 433 samples, whereas the pyrite-galena pair only co-occurs in 29 samples.
3. Mineral exclusivity: node proximity and connectivity is a reflection of the exclusivity of a mineral co-occurrence. An example of mineral exclusivity in Figure 2 is the association of cobaltite with only pyrite, pyrrhotite, or chalcopyrite out of the eleven cobaltite-sulphide mineral pairs possible, relegating cobaltite visually to the rim of the network. Another observation that can be made is that no sample contains both bornite and arsenopyrite, as visualized by the lack of a connector between the bornite and arsenopyrite mineral nodes (Fig. 2).

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ZINC MINERAL NETWORKS

Australia's Curnamona Province and Delamerian Orogen host significant Zn-Pb deposits within metamorphic sedimentary rocks, including the world-class Broken Hill Pb-Zn-Ag deposit in New South Wales (O'Brien et al. 2015; Tott et al. 2019). The MNA for the HM tool was configured to search for the network of minerals containing Zn in the HMMA dataset (Fig. 3). Gahnite (ZnAl_2O_4) is one of the most commonly observed Zn minerals, found in 837 of the 1315 samples (64%). Ecandrewsite was found in only 38 samples (3%), with many of these occurrences in the vicinity of Broken Hill (Fig. 4), the type locality for ecandrewsite (Birch et al. 1988). Similar co-relationships are observed for gahnite-zincochromite (ZnCr_2O_4), gahnite-zincostaurolite [$\text{Zn}_2\text{Al}_9\text{Si}_4\text{O}_{23}(\text{OH})$] and gahnite-tongxinite (Cu_2Zn) pairs in the Broken Hill area. In regard to the Delamerian Orogen, observations of elevated gahnite concentrations in drainages near Victor Harbour may have some affinity to the mineralization styles at Pb-Zn-Ag deposits (e.g. Wheal Ellen, Angas, Strathalbyn, and St. Ives) in the metamorphosed siliciclastic sediments of the Kanmantoo Group (Tott et al. 2019).

An unexpected finding was the occurrence in ~14% of the samples of grains of a copper-zinc alloy. These grains are typically very fine (<100 μm), elongate, and liberated, but are also seen to co-occur with cuprite (Cu_2O) in ~3% of samples. Concern was initially raised that the alloy phase may have been introduced as a contaminant during the sampling or sample processing stages in the form of brass, however, no brass tools or fittings were used at any stage during sample collection. Given the presence of both stainless steel and brass sieves within the processing lab, pure silica sand was used to test the sieving process as a source of brass/zinc-copper alloy contamination.



Fig. 3. Visualization of Heavy Mineral Map of Australia Zn-bearing mineral relationships within the GA-Curtin mineral network analysis (MNA) app. Colours pertain to mineral type: carbonate (blue); oxide (yellow); halide (red); sulphide (green); alloy (pink).

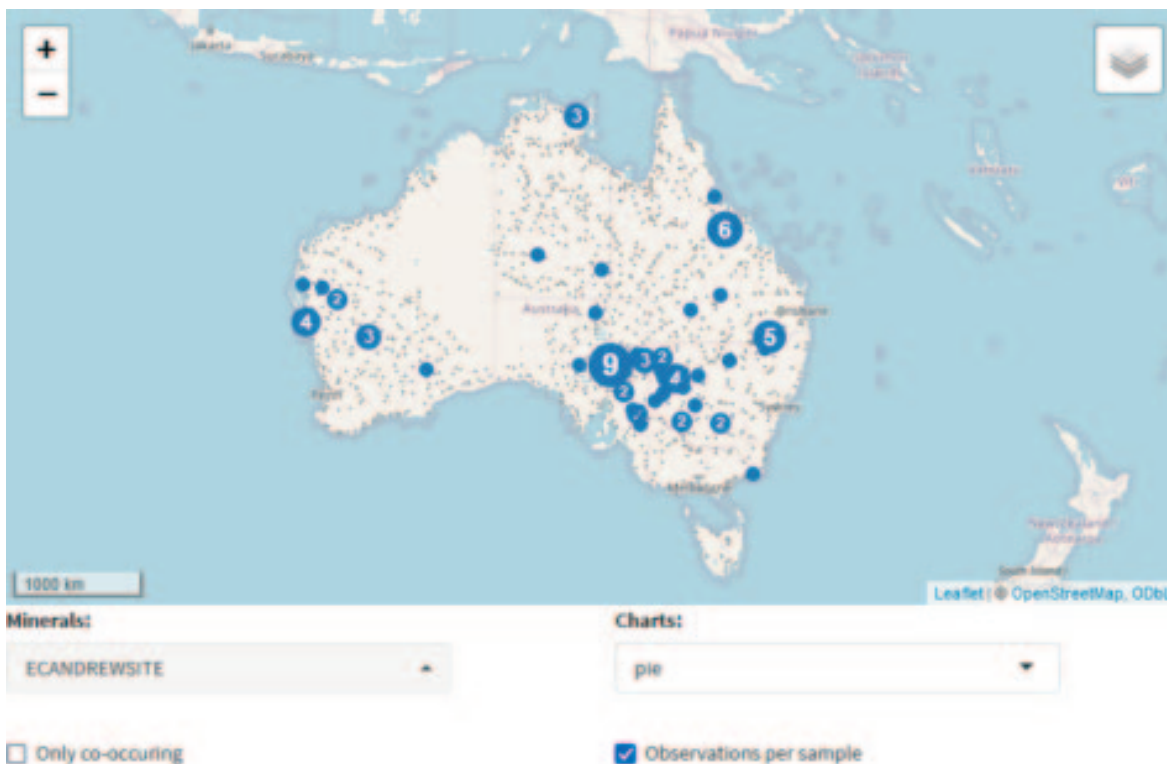


Fig. 4. Distribution of ecandrewsite ($(\text{Zn},\text{Fe}^{2+},\text{Mn}^{2+})\text{TiO}_3$) occurrences within the Heavy Mineral Map of Australia dataset across Australia. Image from the GA-Curtin mineral network analysis (MNA) app.

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Aliquots of silica sand were sieved through brass sieve stacks for multiple sieving cycles with HMCs produced for TIMA analysis. No alloy particles were observed within the silica sand mounts, and brass is not found elsewhere within the HMMA workflow.

The closest naturally occurring mineral to these alloy grains in terms of composition is tongxinite (Cu_2Zn) or so-called zinciferous copper (Sun et al. 2003; Mindat.org 2022). Tongxinite is not formally recognized by the International Mineralogical Association, but minerals with comparable compositions have been reported in several localities worldwide, including within an Australian mineral deposit, since the 1990s (e.g. Jambor and Roberts 2000; Zhang et al. 2002; Yuling et al. 2006; Tuisku 2010; Wulser et al. 2011; Xiong et al. 2018; Kostin 2021). From an exploration vectoring perspective, the presence of tongxinite in Australian drainages is significant due to its high implied density (8.29 g/cm^3 ; Webmineral 2022) and possible association with a range of mineral deposit types (e.g. Luo and Wang 1999; Tuisku 2010; Kostin 2021).

CONCLUSIONS

No country, let alone a continent, has pre-competitive datasets that provide internally consistent data about the baseline distribution of heavy minerals at a regional scale. The generated results include presence/absence of HMs, absolute HM abundances (observations), and HM abundance relative to the mass of bulk sediment analyzed (wt %). HM abundances can be displayed as maps using the Geoscience Australia portal or downloaded for detailed analysis and visualization using custom techniques.

The HMMA dataset, now complete after three years of work, constitutes mineralogical “big data”. The development of novel visualization methods to aid exploration of the HMMA data has demonstrated the utility of applying mineral network analysis (MNA) to the investigation of mineral co-occurrences, and how equilibrium mineral assemblages in metamorphosed base metal ores (e.g. gahnite-ecandrewsite-zincostaurolite) are reflected in adjacent catchments. The MNA for HM tool is freely available to the research community as an online resource.

The presence of detrital tongxinite is noted for the first time in Australia, although the significance of this observation in mineral exploration requires further study. It is hoped that the HMMA’s quantitative HM mineralogy will be a useful input to exploration geoscience, and lead to more efficient mineral discovery in Australia.

ACKNOWLEDGEMENTS

Geoscience Australia’s Exploring for the Future program provides pre-competitive information to inform decision-making by government, community, and industry on the sustainable development of Australia’s mineral, energy, and groundwater resources. The Exploring for the Future program, which commenced in 2016, is an eight-year, \$225 m investment by the Australian Government. PdC and EB publish with permission from the Chief Executive Officer, Geoscience Australia.

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REFERENCES

- Averill, S.A. 2001. The application of heavy indicator mineralogy in mineral exploration with emphasis on base metal indicators in glaciated metamorphic and plutonic terrains. *In: McClenaghan, M.B., Bobrowsky, P.T., Hall, G.E.M. and Cook, S. (eds), Drift Exploration in Glaciated Terrain. Geological Society of London, Special Volume 185, 69–81.*
- Birch, W.D., Burke, E.A.J., Wall, V.J., and Etheridge, M.A. 1988. Ecandrewsite, the zinc analogue of ilmenite, from Little Broken Hill, New South Wales, Australia, and the San Valentin mine, Sierra de Cartagena, Spain. *Mineralogical Magazine*, 52, 237–240.
- Caritat, P. de 2022. The National Geochemical Survey of Australia: review and impact. *Geochemistry: Exploration, Environment, Analysis*, 22(4). <https://doi.org/10.1144/geochem2022-032>
- Caritat, P. de, McInnes, B.I., Walker, A.T., Bastrakov, E., Rowins, S.M., and Prent, A.M. 2022. The Heavy Mineral Map of Australia: Vision and Pilot Project. *Minerals*, 12(8), 961. <https://doi.org/10.3390/min12080961>
- Caritat, P. de, Walker, A.T., Bastrakov, E., Main, P., and McInnes, B.I.A. 2023. The Heavy Mineral Map of Australia Project, Final Data Release. National Dataset and Atlas. *Geoscience Australia Record*, 2023/42, 847 p. <https://dx.doi.org/10.26186/148916>
- Jambor, J.L. and Roberts, A.C. 2000. New mineral names: Tongxinite. *American Mineralogist*, 85, 263–266.
- Kostin, A.V. 2021. Mineralization in the Kildyam mafic volcanic rocks – a magmatic contribution to ore-forming fluids (Central Yakutia, Russia). *Природные ресурсы Арктики и Субарктики*, 26(2), 49–71.
- Lech, M., Caritat, P. de, and McPherson A. 2007. National Geochemical Survey of Australia: Field Manual. *Geoscience Australia Record* 2007/008. <https://pid.geoscience.gov.au/dataset/ga/65234>
- Luo, M. and Wang, Y. 1999. The discovery of copper-zinc (Cu₂Zn) ores of Baxi gold deposit in Ruergai and its geologic significant. *Acta Mineralogica Sinica*, 19(1), 20–22.
- Mao, M., Rukhlov, A.S., Rowins, S.M., Hickin, A.S., Ferbey, T., Bustard, A., Spence, J., and Coogan, L.A. 2017. A novel approach using detrital apatite and till geochemistry to identify covered mineralization in the TREK area of the Nechako Plateau, British Columbia. *In: Ferbey, T., Plouffe, A., and Hickin, A.S. (eds), Indicator Minerals in Till and Stream Sediments of the Canadian Cordillera. Mineralogical Association of Canada, Topics in Mineral Sciences*, 47, 191–243.
- McClenaghan, M.B., Parkhill, M.A., Seaman, A.A., Pronk, A.G., McCurdy, M., and Kontak, D.J. 2014. Overview of tungsten indicator minerals scheelite and wolframite with examples from the Sisson W-Mo deposit, Canada. *In: McClenaghan, M.B., Plouffe, A., and Layton-Matthews, D. (eds), Application of Indicator Mineral Methods to Mineral Exploration. Geological Survey of Canada, Open File 7553, 59–67.*
- McClenaghan, M.B., Plouffe, A., Paulen, R.C., Houlé, M.G., Jackson, S.E., and Peter, J.M. 2016. Overview of indicator mineral research at the Geological Survey of Canada – an update. *EXPLORE*, 170, 1–15.
- Morrison, S.M., Liu, C., Eleish, A., Prabhu, A., Li, C., Ralph, J., Downs, R.T., Golden, J.J., Fox, P., Hummer, D.R., and Meyer, M.B. 2017. Network analysis of mineralogical systems. *American Mineralogist*, 102(8), 1588–1596.
- Mindat.org 2022. Tongxinite. <https://www.mindat.org/min-7340.html>
- Nowicki, T.E., Moore, R.O., Gurney, J.J., and Baumgartner, M.C. 2007. Chapter 46 Diamonds and associated heavy minerals in kimberlite: a review of key concepts and applications. *Developments in Sedimentology*, 58, 1235–1267. [http://dx.doi.org/10.1016/S0070-4571\(07\)58046-5](http://dx.doi.org/10.1016/S0070-4571(07)58046-5)
- O'Brien, J.J., Spry, P.G., Teale, G.S., Jackson, S., and Rogers, D. 2015. Major and trace element chemistry of gahnite as an exploration guide to Broken Hill-type Pb–Zn–Ag mineralization in the Broken Hill Domain, New South Wales, Australia. *Economic Geology*, 110, 1027–1057.
- Pain, C.F., Pillans, B.J., Roach, I.C., Worrall, L., and Wilford, J.R. 2012. Old, flat and red-Australia's distinctive landscape. Chapter 5 *In: Blewett, R. (ed), Shaping a Nation-A Geology of Australia. Geoscience Australia and ANU E Press, Canberra*, 227–275. <http://doi.org/10.22459/SN.08.2012>. <http://press-files.anu.edu.au/downloads/press/p194981/pdf/chapter-5.pdf>
- Pillans, B. 2007. Pre-Quaternary landscape inheritance in Australia. *Journal of Quaternary Science*, 22, 439–447.
- Salama, W., Anand, R.R., and Verrall, M. 2016. Mineral exploration and basement mapping in areas of deep transported cover using indicator heavy minerals and paleoredox fronts, Yilgarn Craton, Western Australia. *Ore Geology Reviews*, 72, 485–509.
- Sun, Y., Xiao, Y., and Wang, J. 2003. The discovery features of the native zinc-copper intermetallic compound in China. *Journal of Mineral Petrology (in Chinese with English abstract)*, 23(2), 11–14.



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Heavy mineral exploration on the continental scale continued from page 12

- Tott, K.A., Spry, P.G., Pollock, M.V., Koenig, A., Both, R.A., and Ogierman, J. 2019. Ferromagnesian silicates and oxides as vectors to metamorphosed sediment hosted Pb-Zn-Ag-(Cu-Au) deposits in the Cambrian Kanmantoo Group, South Australia. *Journal of Geochemical Exploration*, 200, 112–138.
- Tuisku, P. 2010. Heavy minerals from gold sluicings in Lapland Gold Rush areas, and their bearing on the origin of gold bearing tills. *In: Tuisku, P. and Nemliher, J. (eds), Proceedings of the 5th Annual Meeting of Nordic Mineralogical Network, Ser. A, No. 31, University of Oulu, Tallinn, 33–37.*
- Walker, A.T., McInnes, B.I.A., Caritat, P. de., and Bastrakov, E. in prep. The Heavy Mineral Map of Australia Project: A novel, rapid, automated, quantitative mineralogy workflow.
- Webmineral.com 2022. Tongxinite. <http://www.webmineral.com/data/Tongxinite.shtml#.Y4iVuOxByX0>
- Wulser, P.A., Brugger, J., Foden, J., and Pfiefer, H.R. 2011. The sandstone-hosted Beverley Uranium deposit, Lake Frome Basin, South Australia: Mineralogy, geochemistry, and a time-constrained model for its genesis. *Economic Geology*, 106, 835–867.
- Xiong, F., Yang, J., Xu, X., Kapsiotis, A., Hao, X., and Liu, Z. 2018. Compositional and isotopic heterogeneities in the Neo-Tethyan upper mantle recorded by coexisting Al-rich and Cr-rich chromitites in the Purang peridotite massif, SW Tibet (China). *Journal of Asian Earth Sciences*, 159, 109–129.
- Yuling, X., Zengqian, H., Jiugua, X., Zhongxin, Y., Ge, B., and Xiaoyu, L. 2006. Discovery of Cu-Zn, Cu-Sn intermetallic minerals and its significance for genesis of the Mianning-Dechang REE Metallogenic Belt, Sichuan Province, China. *Science in China Series D*, 49, 597–603.
- Zhang, D., Wang, Y., and Feng, C. 2002. Geological and geochemistry of Tuolugou exhalative-sedimentary Co-Au deposit, Qinghai Province. *Mineral Deposits [Kuangchuan Dizhi]*, 21(3), 213–222.



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Articles in Past Issues of EXPLORE

1 year ago EXPLORE 198 (March 2023)

Old soils, new targets: Reassessing historic soil surveys with Ultrafine+® in a machine-learned landscape context

5 years ago EXPLORE 182 (March 2019)

Application of Fourier transform infra-red spectroscopy (FTIR) for mineral quantification

10 years ago EXPLORE 162 (March 2014)

Optimised detection limits for multi-element geochemical analysis

20 years ago EXPLORE 123 (April 2004)

Who will deliver the last classical exploration geochemistry course?

30 years ago EXPLORE 82 (March 1994)

Hydrogeochemical surveys in Newfoundland - Geological mapping with REEs in lake waters and

Ideal CHIM with the newly-developed, NEOCHIM electrode

<https://www.appliedgeochemists.org/explore-newsletter/explore-issues>



New Applied Geochemists at the Geological Survey of Canada

James Kidder

Dr. James Kidder joined the Applied Geochemistry Section of the Geological Survey of Canada as a research scientist in 2021. He completed his Ph.D. in 2020 at Queen's University, which focused on assessing the potential of metal stable isotope systems (Cu, Mo) in hydrogeochemical mineral exploration. Before joining the GSC, James spent more than a decade working in the mineral exploration and mining industry. This included experience in Africa, Australasia, Europe, and South America on world-class precious and base metal projects as well as grassroots exploration.

At the GSC, James' research covers a broad range of deposit types and commodities and focuses on the development of geochemical tools to aid mineral exploration. He currently leads research projects investigating the surficial geochemical footprints of mineral deposits, the dispersion mechanisms of elements, and the application of new technologies in the innovation of sampling techniques. This work involves the application of novel techniques such as non-traditional stable isotopes, hydrogeochemistry, and metagenomics.



Alex Voinot

After completing his Ph.D. in Geochemistry/Environmental Geochemistry at University of Strasbourg in 2012, investigating B isotope as proxies of mineral weathering reactions in soils, Dr. Alexandre Voinot moved to Canada to work with Prof. Kurt Kyser at Queen's University as a Postdoctoral Fellow (William E. White fellowship). His work during that period initially involved the study of fractionation of U, Mo, and thallium (Tl) with varying redox conditions during the formation and alteration of uranium ore deposits from various deposit-types all around the globe. He then progressed into a laboratory manager position with the Queen's Facility for Isotope Research, in charge of the ICPMS, laser ablation and clean lab facilities. His research progressed to the study of various types of ore deposits, such as orogenic gold, VMS, HEBS or SEDEX, using in situ trace element concentrations (LA-ICPMS) or non-traditional stable isotopes (Cu, Li, Fe...) to identify key mechanisms of ore formation and remobilization in deep and surficial environments.

Alexandre joined the Applied Geochemistry Section of the Geological Survey of Canada in 2023, where he is now leading several research projects, including the study of conventional (LCT-pegmatites) and unconventional (brines, Li-rich lake sediments...) Li deposits all across Canada using innovative methods such as Li isotopes and metagenomics, as well as machine-learning techniques applied to large-scale lake sediment surveys (Bear-Slave corridor, NWT/NU) to generate maps for mineral prospectivity and environmental monitoring purposes.

Aleksandra Mloszewski

Dr. Aleksandra Mloszewski is a geomicrobiologist with a multidisciplinary background in geochemistry, Precambrian geology, invertebrate paleontology, and microbiology. She received a Ph.D. from the University of Alberta and was a Postdoctoral Fellow at the University of Tuebingen (Germany), the University of Toronto, and at the Health Sciences North Research Institute (Sudbury). Aleksandra integrates field-based studies with experimental work in geochemistry, microbiology and genomics to investigate 1) how microbes affect their environment and vice versa; 2) how these interactions evolved through geologic time; and 3) what evidence of these interactions are preserved in the rock record. Her current research focuses on microbe-metal-mineral interactions to better understand the potential of using microbes and their biosignatures as indicators of mineralization; as an unconventional method to extract critical minerals; and their role in mine-site remediation. Alexandre joined the Applied Geochemistry Section of the Geological Survey of Canada in January 2024.



2023 Association of Applied Geochemists Medal Winners

Renguang Zuo, Gold Medal Winner

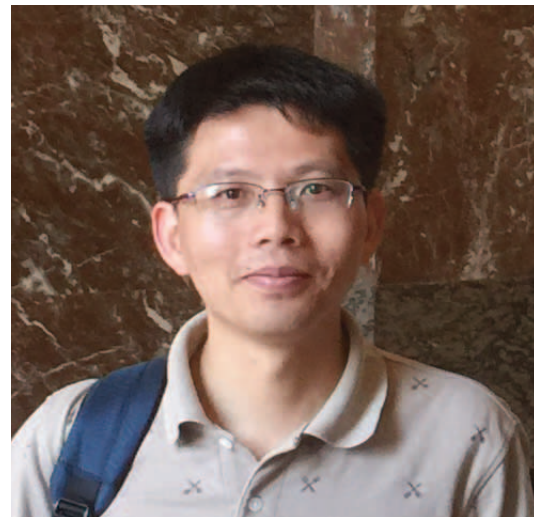
Professor Renguang Zuo has been awarded the Association of Applied Geochemists' (AAG) Gold Medal for 2023 for his exceptional contributions to the scientific field of applied geochemistry, and exemplary service in promoting the exchange of ideas and the dissemination of information in this field through a distinguished career in university teaching, research and publishing.

Areas in which Professor Zuo has made significant scientific contributions include the application of big data analytics and deep learning algorithms to applied geochemistry, developing several geoinformatics models for recognising geochemical anomalies, quantification of uncertainties in processing geochemical survey data, and the development of computer software for the processing of geochemical survey data.

Professor Zuo's extensive scientific and career achievements include the following:

- Publication of over 160 papers in peer-reviewed, international publications, with over 7,000 citations
- Serving on the AAG council 3 times, as well as a Councillor for the Association for Mathematical Geosciences
- Being appointed a Fellow of the AAG, Society of Economic Geology and the Geological Society of London
- Appointed Professor of the State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Wuhan, China and Founding Director of Research Center for Solid Earth Big Data, China University of Geosciences, where he has supervised more than 40 Ph.D. and M.Sc. students
- Serving as Associate Editor of the Journal of Geochemical Exploration, Natural Resources Research, Computers & Geosciences, Journal of Earth Science, and Ore Geology Reviews
- Awarded the Kharaka Award by the International Association for GeoChemistry (IAGC) in 2015
- Organised 8 special volumes for several different international journals

By any measure, Professor Zuo's publication and scientific record has been both prodigious and highly regarded.



Ryan Nobel, Silver Medal Winner

Dr. Ryan Noble is the recipient of the Association of Applied Geochemists (AAG) Silver Medal for 2023. This award is made in recognition of dedicated service in advancing the affairs of the AAG over an extended period.

His contributions to the AAG have extended over 20 years and are in addition to his significant scientific contributions. They include the following:

- Serving as a Councillor of the AAG almost continuously since 2010, including serving as Vice President (2014–15), then President (2016–17), then Chair of the Awards and Medals Committee (2018–19)
- Chairing the Strategy Committee to determine the course of the AAG for the next decade
- Representing the AAG on the Australian Geoscience Council (AGC) since 2019
- Representing the AAG on the Executive Committee for Elements magazine since 2017
- Membership of the Editorial Committee for Geochemistry: Exploration, Environment, Analysis (GEEA) for over a decade
- Contributing articles to EXPLORE magazine and reviewing submissions to both EXPLORE and GEEA

Dr. Noble's contributions to the AAG are an outstanding example of an active and productive scientific researcher volunteering their time to promote their chosen field of research through a professional body. The AAG would not exist were it not for such people.



30th International Applied Geochemistry Symposium (IAGS)

The Local Organising Committee (LOC), the Association of Applied Geochemists (AAG) welcome you to the 30th International Applied Geochemistry Symposium, IAGS 2024, Adelaide/Tartanya, Australia. This conference has the theme “Geochemistry for a Sustainable Future”. Join us and contribute to sharing advances in approaches and technologies for exploration, processing and the environment for social benefit. Scientific sessions will include an emphasis on critical minerals. The IAGS LOC is pleased to announce that the [International Association for Mathematical Geosciences \(IAMG\)](#) are partnering with IAGS and AAG to host sessions on ‘Big Data Analytics and Machine Learning Algorithms in Geochemistry’.



Aim of the IAGS 2024

The 30th IAGS will celebrate the central role of applied geochemistry in providing a sustainable future, as per the conference theme. At this conference the key sub themes will highlight the critical need for applying geochemical solutions across environmental, exploration and mining, and social solutions. These key sub themes are Exploration, Environment, Processing, Technology, Research, and Society.

Why Adelaide?

A visit to Adelaide and the state of South Australia offers delegates easy access to the best of what Australia has to offer: beautiful beaches, unique Australian wildlife, world-renowned wine regions, premium culinary experiences, access to the outback, and a chance to learn about and engage with Australian Aboriginal culture.

South Australia has a strong geo-scientific community, including the Geological Survey of South Australia within the Department for Energy and Mining, resources exploration industry base, universities and research organisations including CSIRO. Currently, significant work is taking place to gain UNESCO World Heritage status for South Australia’s Flinders Ranges due to its extraordinary Ediacaran fossils and geological landscape.

Dates to remember

IAGS2024 will formally commence on Monday 14th October and run through Friday, 18th October for the Scientific Program at the Adelaide Convention Centre. Wednesday 16th October will not have scheduled Scientific Program events to make room for tours and workshops.

Wednesday March 27, 2024 **Abstracts Close**

Monday April 8, 2024

Program Announced Including Workshops & Field Trips

Friday August 2, 2024

Early Bird Registrations Close / Full Price Opens

Monday October 14, 2024

Symposium Begins

Proposed list of scientific sessions (TBC)

The final sub-themes of the scientific sessions of the conference, including the special sessions and the Chairpersons, will be announced with the second circular later in 2023 and also on the [website](#).

Workshops

The IAGS 2024 LOC see conference workshops as a key part of the IAGS 2024 offering and experience. Workshops will likely be held pre-conference. Workshop pricing will be at standardized day-rates with discounts for students and members of some professional organisations.

The LOC is seeking expressions of interest from the geoscience community to run workshops at the IAGS 2024. If you are interested in this, please contact [Ned Howard](#) and [Anna Petts](#) by 23rd December 2023.

As part of your submission, please provide information regarding the following:

- Names of individuals who are leading/involved and the organisation/s they represent,
- General topic and outline of workshop content,
- Brief outline of how the proposed workshop aligns with the targeted workshop themes listed below,
- Duration,
- Any requirements for the workshop venue (other than standard AV equipment),
- Representatives of commercial providers will need to demonstrate inclusion of general content non-specific to technologies or services they are promoting.

Suggested workshop topics:

- Geochemical data collection, analysis and interpretation applied to exploration, ore deposit characterization and/or remediation
- Geochemical characteristics of ore deposits, hydrothermal alteration and mineralization processes
- Isotope geochemistry and geochronology
- Environmental geochemistry and hydro-geochemistry

IAGS 2024 ... *continued from page 16*

- Geology and geochemistry of the regolith/critical zone and transported cover
- Sample theory, sampling practices and QA/QC
- Training in commonly used geochemical and geological software
- Novel or commonly used geochemical and mineralogical technologies and their application, e.g., portable analysers, micro-analytical techniques, scanning and imaging technologies
- Pre-competitive geochemical datasets and their application to exploration
- Geometallurgy, ore deposit knowledge and characterisation
- Soil geochemistry and viticulture
- Other topics relating to applied geochemistry where justified in the EOI submission

Already confirmed workshops include “Applied geochemistry for exploration, geology and geochemistry of the critical zone/regolith and geology” and “Geochemistry of iron oxide-copper-gold deposits”.

Field trips

It is not mandatory to participate in IAGS2024 to register for a Field Trip. Field Trips will be held with a minimum number of registered participants. There will be a number of field trips planned, including pre, mid and post conference.

Sponsors

The Organising Committee is seeking organisations interested in sponsoring the IAGS 2024, and invites potential Sponsors/Exhibitors to follow the link below, or to contact the committee for a prospectus. Participating as a Sponsor or Exhibitor provides your organisation with the opportunity to demonstrate your level of support and commitment to the industry and connects your organisation with your target audience.

Conference fees

The IAGS and AAG will provide membership registration for IAMG members. Students and participants from some developing countries will be able to apply for a bursary to support travel to IAGS2024. Please check the conference website regularly for application details.

TICKET TYPE	EARLY BIRD		STANDARD	
	Member	Non-Member	Member	Non-Member
All inclusive	980	1190	1190	1380
Sponsor / Exhibitor	650	650	650	650
Symposium	850	1050	1050	1250
Student	350	350	450	450
Gala Dinner	150	150	150	150

N.B. Price is in AUD and includes GST

All Inclusive registration:

Includes 4-day conference and gala dinner

Sponsor/Exhibitor registration:

4-day conference only for Sponsors/Exhibitors

Symposium registration:

4-day conference only

Student registration:

4-day conference

Gala Dinner registration:

Dinner only

Visa information

If you are planning on attending IAGS 2024 from overseas, please consider the various options before going through the registration phase. Australia has some tough immigration laws, so we don't want you to get stuck if you are considering a visit to Australia to attend the conference.

The visa that you will have to apply for depends on your passport. We have provided the following link, but please make sure you read the information thoroughly before starting the process of your visa application.

<https://immi.homeaffairs.gov.au/visas/getting-a-visa/visa-finder>

Good luck with this process, and make sure you are aware of the visa processing time, to make sure it's finalized before the conference.

Latest Updates

If you would like regular information, and all the latest updates for IAGS2024, please sign up to our mailing list by clicking the following link.

<https://docs.google.com/forms/d/e/1FAIpQLSeNtXrQExR8Wnn8uPc2-rGshr3pUel-jOem6yiuxYrmdaFe8w/viewform>

More information is available on the website at <https://iags2024.com.au>

or

email iags2024@bie.com.au



CALL FOR AAG MEDAL NOMINATIONS

Significant contributions to applied geochemistry or service to AAG are recognised by award of either the AAG Gold or Past Presidents' (Silver) medals respectively. The history of how the medals came about and the formulation of guidelines for their award are discussed in the April 1992 issue of EXPLORE, issue 75, which can be found on the AAG website.

Guidelines for nominating individuals for either medal are posted in 'The Association' section of the AAG website (www.appliedgeochemists.org) under the 'Awards' area. Past discussions of the guidelines indicated that the process for nominating individuals for either medal was a little cumbersome, to the extent that some nominations were not being made, and others took an unnecessarily long time to resolve. With this in mind, the 2012–2013 Awards & Medals Committee (Chair: Paul Morris. Committee members Eion Cameron, Pertti Sarala, and Chris Benn) revisited the guidelines to make the nomination process a little friendlier, with a more concise time frame for resolution. The revised guidelines for nominations are presented below.

3.0 NOMINATIONS

- 3.1 To be eligible for consideration for either award, nominations must be received by the Chairman of the Awards and Medals Committee on or before December 1st of any year.
- 3.2 For acceptance by the Awards and Medals Committee, nominations must be signed by a minimum of four (4) Fellows (voting members) of the Association in good standing. Nominations should include the following:
 - (a) A one-page recommendation from each of the four nominators;
 - (b) A resume or curriculum vitae of the nominee;
 - (c) An itemized list of the outstanding scientific achievements (Gold Medal) or the dedicated service to the Association (Silver Medal) of the nominee (maximum two pages).

Since members of the Awards Committee may not have personal knowledge of the nominee, the completeness and quality of the nomination will be critical in terms of evaluation and selection.

Nominations for either medal can be made any time to ejncarranza@gmail.com and will be considered in the year of the nomination provided they are received prior to December 1.

John Carranza
Past President
Chair, Awards and Medals Committee



Geochemistry: Exploration, Environment, Analysis

VOLUME 24, ISSUE 1, FEBRUARY 2024

Research Articles

Weathering as a control on the triple oxygen isotopes of groundwater-associated ferromanganese deposits: lessons from the Grimlock Ni–Co–Mn prospect, Northern Territory, Australia

D.R. Knaack, M.I. Leybourne, D. Layton-Matthews, J. Drummond, A. Dobosz, and P. Pufahl

<https://doi.org/10.1144/geochem2023-066>

Identification of multi-mineral-species geochemical anomalies using Bayesian maximum entropy and the spectrum separable module-constrained convolutional autoencoder

B. Zhao, D. Deng, D. Zhang, K. Tang, P. Tang, and L. An

<https://doi.org/10.1144/geochem2024-002>

Geogas prospecting for igneous ore deposits covered by regolith: the Zijinshan high-sulfidation epithermal Cu–Au deposit in the Cathaysia Block

Q. Li, R. Ye, H. Duan, K. Xu, S. Shen, and Y. Tian

<https://doi.org/10.1144/geochem2023-061>

Source analysis and contamination evaluation of potentially toxic elements in soil in typical high geological background areas at the county scale in northeastern Yunnan, China

Y. Zhou, Z. Guo, M. Peng, C. Wang, and H. Cheng

<https://doi.org/10.1144/geochem2023-044>

Behaviour of redox-sensitive elements (Ti, As, V and Fe) in clay pit samples with and without Al normalization

J. Jurković, M. Tvica, E. Babajić, L. Čengić, and J. Sulejmanović

<https://doi.org/10.1144/geochem2023-047>

Multi-element geochemical analyses on ultrafine soils in Western Australia – towards establishing abundance ranges in mineral exploration settings

A. Henne, R.R.P. Noble, and M. Williams

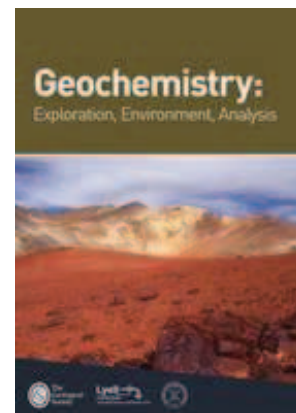
<https://doi.org/10.1144/geochem2023-043>

Thematic collection: Geochemical processes related to mined, milled, or natural metal deposits

Geology, geochemistry, mineralization and fluid inclusion characteristics of the SW of Hormuz Island banded iron formations, southern Iran

A. Fakhri-Doodoiu and M. Alipour-Asli

<https://doi.org/10.1144/geochem2023-002>

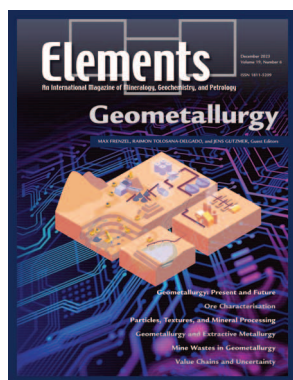
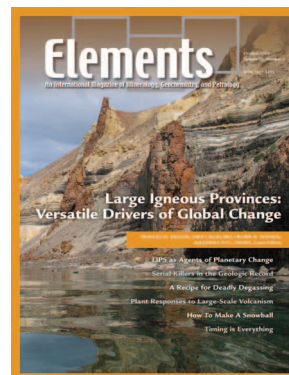


Recently Published in Elements

October 2023, v. 19, no. 5, Large Igneous Provinces: Versatile Drivers of Global Change

This issue of Elements explores the various impacts of large igneous provinces (LIPs), from their links to mass extinctions in aquatic and terrestrial environments to climate warming and global icehouse events. This issue also features the current knowledge of subsurface architectures of LIPs, processes and products of interaction between LIP magma and surrounding crustal rocks, and understanding of the timing of intrusive events.

The are no AAG news items in this Elements issue.



December 2023, v. 19, no. 6, Geometallurgy

This issue of Elements explores the fundamental concepts relevant to the field geometallurgy. It reviews how current geometallurgical research is opening up prospects for geoscientists to develop improved economic and environmental outcomes for the global raw materials industry as part of a sustainable economy.

The are no AAG news items in this Elements issue.

February 2024, v. 20, no. 1, Extraterrestrial Organic Matter

This issue of Elements provides an overview of the concept of extraterrestrial organic matter as well as the latest scientific findings. The thematic articles in this issue are

- Extraterrestrial Organic Matter: An Introduction
- Formation and Evolution Mechanisms of Organic Matter in Space
- Delivery of Organic Matter to Early Earth
- Diversity of Complex Organic Matter in Carbonaceous Chondrites, IDPs, and UCAMMs
- Asteroidal Organics from the Sample Return Mission Hayabusa2 and their Implication for Understanding our Origins
- Analytical Techniques for Identification and Characterization of Extraterrestrial Organic Matter

The are no AAG news items in this Elements issue.



Reminder

AAG members can access past issues of Elements at

<http://elementsmagazine.org/member-login/>

using their e-mail address and AAG member ID



Writing Geochemical Reports, 3rd Edition

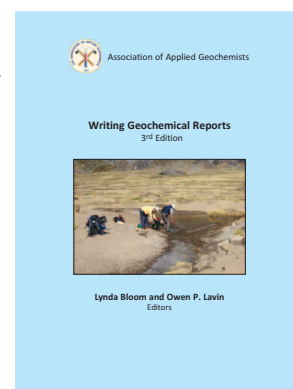
Guidelines for surficial geochemical surveys

Edited by Lynda Bloom and Owen Lavin

The Association of Applied Geochemists has developed international standards for writing geochemical reports that provide clear instructions for reporting geochemical results, together with the requisite supporting information to evaluate these results for accuracy, integrity and credibility. The target audience for these guidelines is anyone charged with reporting geochemical results, which includes, but is not limited to, company geoscientists, external consultants and contractors, government scientists, and university scientists and students. The guidelines focus on preparation of an electronic publication that provides a systematic and permanent record of the work performed and take into account the ability to bundle text, tables, figures, images, and oversized maps into one electronic file. The third edition of this guide was released in 2022 and expands the original mandate of Writing Geochemical Reports (1st and 2nd editions) to include multiple types of geochemical surveys with survey-specific recommendations.

The guide may be downloaded free of charge from the AAG website:

<https://www.appliedgeochemists.org/publications>



Welcome New AAG Members

REGULAR MEMBERS

Regular Members are non-voting members of the Association and are actively engaged in the field of applied geochemistry at the time of their application and for at least two years prior to the date of joining.

Mr. Jack Maughan

Senior Data Scientist,
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Dr. Jessey Rice

Research Scientist
Geological Survey of Canada
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CANADA K1A 0E9
Membership No. 4523

Mr. Hammed Rasheed

Postgraduate Student
University of Ibadan
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NIGERIA 200284
Membership No. 4524

Dr. Walid Salama

Principal Research Scientist
CSIRO
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Perth, WA
AUSTRALIA 6151
Membership No. 4525

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Senior Consultant
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FELLOWS

Fellows are voting members of the Association and are actively engaged in the field of applied geochemistry. They are Regular AAG Members who are nominated to be a Fellow by a Fellow of the Association by completing the Nominating Sponsor's Form. Consider becoming a Fellow of the AAG.

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STUDENT MEMBERS


The Association also has student memberships. These members are students that are enrolled in an approved course of instruction or training in a field of pure or applied science at a recognized institution. Student members pay minimal membership fees.



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AAG Councillors

Term: 2024–2025

Mark Arundell

Mark Arundell became a Fellow of AAG in 2007 after joining in 2002. He received a B.Sc. (Hons) in Geochemistry from the University of Melbourne in 1985 and a Master of Economic Geology from the University of Tasmania (CODES) in 1998. He worked as an exploration geologist and an underground and open-cut mine geologist with Renison Goldfields Consolidated (RGC) from 1986–1995; an exploration geologist at North Ltd. from 1995–2000, and Rio Tinto from 2000–2009. Since 2009, he has worked for IMEx Consulting as an exploration geologist/geochemist. Mark was an AAG Councillor from 2008 to 2011 and the course leader of the “Interpreting Geochemical Data” workshop at the 2005 IGES in Perth. Mark currently consults globally as an exploration geochemist and is passionate about training. He has conducted public and in-house workshops for a number of clients and professional organizations.



Patrice de Caritat

Patrice’s university training is in geology, mineralogy, and geochemistry, and his research interests include environmental, exploration and isotope geochemistry, hydrogeochemistry, and low-density geochemical mapping. He is Senior Principal Research Scientist at Geoscience Australia and is also a Visiting Fellow at the Research School of Earth Sciences, Australian National University (ANU), and Adjunct Professor at the University of Canberra. In 2017–2018, Patrice was subject-matter expert seconded to the Australian Federal Police assisting with developing their soil forensic capability. He is a Fellow of the Association of Applied Geochemists (AAG) since 2005, Associate Editor for their journal 'Geochemistry: Exploration, Environment, Analysis' (2017–23), and AAG Councillor (2011–12, 2013–14, and 2019–22) and Society News Editor for 'ELEMENTS' (2011–2015). Patrice holds a Lic. Sci. (B.Sc. Hons) degree from the University of Louvain (Belgium), and Ph.D. from the ANU. He has published over 180 scientific papers, reports, chapters, and books (Google Scholar h-index 45).



Behnam Sadeghi

Dr. Behnam Sadeghi is a Research Fellow at the Australian Resource Research Centre (ARRC) within CSIRO, Australia, and a Fulbright Research Scholar at the Earth and Planets Laboratory (EPL) of the Carnegie Institution for Science in Washington, D.C., USA. Specializing in mineral exploration, Behnam focuses on critical minerals and energy transition. His expertise encompasses urban and environmental geochemistry integrated with data science, mathematical geosciences, including fractal/multifractal modeling and compositional data analysis, geostatistics for simulation and uncertainty quantification, and advanced Geographic Information Systems (GIS) and geospatial data analytics. He is also involved in renewable and sustainable energy, particularly geothermal energy resource exploration. Behnam has been recognized as a Fellow of the Association of Applied Geochemists (FAAG), the Australian Institute of Geoscientists (FAIG), and the Australian Institute of Mining and Metallurgy (FAusIMM). He is a lifetime member of IAMG and a Registered Professional Geoscientist (RPGeo) in Information Geoscience with AIG.



Alexander Seyfarth

Alexander Seyfarth is an X-ray spectroscopist with over 20 years of experience with XRF and XRD. Alexander holds a Diploma in Mineralogy from University Giessen (1996). Starting as an Application Scientist in Germany with Siemens, he was transferred to the US where he is now a proud citizen, still living in the Midwest (Wisconsin). As the resident “Geoscientist”, he travelled within the Americas to mine sites, cement plants, and quarries and presented application and theory-based talks at trade shows and conferences for Bruker and Thermo Fisher Scientific in various functions. With a group of other XRF trainers, he continued the XRF course from University of Western Ontario and moved it to Hamilton College; expanding it also back to the roots in South Africa. He is an Associated Volunteer Researcher with Colorado School of Mines as of 2021 for direct XRF core scanning and hyperspectral imaging. Since 2017, Alexander is back full-time to the geochemistry world as Global Technical Manager for XRF with SGS Natural Resource Division and is active in both SGS internal technical formation as well as externally with a focus on the new and smaller devices, such as PXRF and Micro Libs. His professional interest lies in research, promoting, and expanding XRF (and LIBS on solids) within the community as well as modern gamma activation analysis for gold assaying. His focus for AAG volunteer work is the training and education of future geochemists as well as promoting and establishing best practices for new types of instrumentation leveraging his extensive contacts with various instrument vendors. His experience in social media and marketing can be applied to AAG’s LinkedIn outreach as well as promoting AAG on the web.



AAG Councillors *continued from page 21*

Term: 2024–2025 ...continued

Cliff Stanley

Cliff Stanley, P. Geo., is a Professor of Applied Geochemistry in the Department of Earth & Environmental Science, Acadia University, Nova Scotia, Canada. Cliff received his bachelor's degree in Earth Science from Dartmouth College (1980), worked for three years for Anaconda Minerals Company as a geochemist, and then returned to academia to complete his master's and doctorate at UBC (1984, 1988) under the supervision of Dr. Alastair Sinclair and statistician Dr. John Petkau. Prior to Acadia, Cliff worked for two years as a research associate at Queen's University with Dr. Ian Nichol in lithogeochemistry, and for seven years as an Adjunct Professor in the MDRU at UBC, leading research in alkalic porphyry Cu-Au deposits, lithogeochemistry, and Broken Hill-type mineral deposits. Cliff has been a member of the Association since 1981, a Fellow since 1988, and has previously served as Councilor for the Association for 14 years. In addition, Cliff has been a distinguished lecturer for AAG (2004) in lithogeochemistry, and for CIM (2008) and AusIMM (2009) in geochemical quality control. Cliff has published extensively in sampling and quality control, partial digestion pedogeochemistry, lithogeochemistry, and geochemical data analysis. In 2017, Cliff was awarded the Chayes Prize for contributions to research in numerical petrology by the IAMG.



Term: 2023–2024

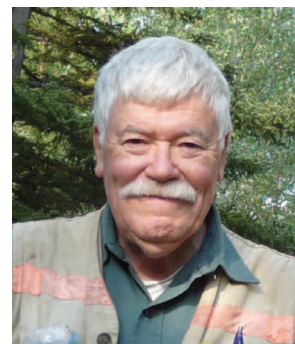
Aaron Baensch

Aaron is a diversified geoscientist and technologist with 25 years of international experience, spanning technology development and research, global business development and strategy, mining operations, and mineral exploration. He is currently employed at Eurasian Resources Group (ERG) as the Head of Smart Exploration Technologies, concentrating on new opportunities in Saudi Arabia. Prior to this, he spent 15 years focusing on a wide range of mining and exploration technologies, including the adaption of systems used by NASA on the Mars Curiosity Rover. He was also an embedded researcher and project manager at MinEx CRC and the Deep Exploration Technologies CRC. Aaron spent his first decade working in a variety of management, operational, and exploration roles across a range of gold, nickel, and copper projects. Professionally, Aaron is a graduate of the Western Australian School of Mines, Kalgoorlie (WASM), and holds a Bachelor of Science in Mineral Exploration and Mining Geology. He is a Registered Professional Geoscientist as well as a Fellow of the AusIMM, AIG, SEG, and AAG.



Ray Lett

Ray obtained a B.Sc. University of London, UK, in 1968, a M.Sc. University of Leicester, UK in 1970, and a Ph.D. from the University of British Columbia in 1979. He is a geochemical consultant and university sessional lecturer in geochemistry and economic geology at the University of Victoria, Canada. He was a laboratory supervisor and senior geochemist for the British Columbia Geological Survey between 1990–2010. Prior to that, he was a geochemist for Barringer Research/Magenta from 1980 to 1990 and an exploration geochemist/geologist for Amax Exploration/Fox Geological/BP Minerals in Vancouver, BC between 1970 and 1979. Ray served as AAG Secretary from 1980 to 1985; as a Councillor (1990–1992, 1999–2000, 2006–2009, 2015–2017); member of the AAG Education Committee (2010–2022) and the Strategy Committee (2016–2017). Ray retired from the BC Geological Survey after 20 years with Government as a geochemist. Ray now spends his time consulting, teaching (part-time) undergraduate university courses in geochemistry and economic geology and serving on various geoscience committees. As a geochemist for over 50 years, he has been fortunate to have had outstanding mentors, such as Clifford James and Kay Fletcher, and feels that it is vital for us all to encourage new generations of students to consider a career in geochemistry.



Paul Morris

Dr. Paul Morris was university-educated in New Zealand at Otago University and Victoria University (Wellington), followed by stints at the University of Sydney, and Shimane University in western Japan. In 2018, he retired from a 30 year career at the Geological Survey of Western Australia, where he was Chief Geochemist for 22 years. He joined AAG (then AEG) in 1999 and has been a Fellow since 2002. During his AAG membership, he has held various positions including Councillor, Symposium Coordinator, President, and Chair of the Awards and Medals Committee and the Education Committee, and is currently Chair of the New Membership Committee. He provides regular editorial assistance to the Association's newsletter, EXPLORE.



AAG Councillors *continued from page 22*

Term: 2023–2024 continued

Ryan Noble

Dr. Ryan Noble is a Senior Principal Research Scientist and the Group Leader of Predictive Mineral Systems Science with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Perth, Western Australia. He has been with CSIRO for 17 years working on geochemical research with application to the exploration industry. Ryan has a B.Sc. and M.Sc. in soil science from the University of Tennessee and a Ph.D. in applied geology from Curtin University. Ryan has worked on numerous regolith and groundwater geochemistry projects related to gold, base metal, Ni, and U mineral exploration. More recently he has been researching clay-sized fraction chemistry and spectral mineralogy using machine learning to put the results into landscape contexts. He is a Past President and a Fellow of the Association of Applied Geochemists. Currently, Ryan serves on the Editorial Board for GEEA and as a Board Member of the Australian Geoscience Council and the Elements journal. He is the current Chair of Australian Earth Science Education (AusEarthEd). Building on his earlier activities in the AAG, Ryan is keen to continue his involvement to strengthen the AAG for the benefit of its members.



Pim van Geffen

Dr. Pim van Geffen is Technical Director Geochemistry & Geometallurgy at CSA Global, an ERM Group Company. He is a professional geoscientist with 18 years of experience in mineral exploration and mining across the globe. He is a leader in the fields of geochemistry and geometallurgy and is passionate about innovation and improved business practices in the sector. From exploration to operations, closure, and remediation, he focuses on material characterization and process optimization throughout the mining value chain. He sees tremendous potential in underutilized geoscientific data for characterizing ore and waste, minimizing operational risk, and maximizing return. Pim has delivered many public and private short courses and conference contributions on geochemical data analysis and its geometallurgical applications. He is a Fellow of the Association of Applied Geochemists.



CALENDAR OF EVENTS

International, national, and regional meetings of interest to colleagues working in exploration, environmental and other areas of applied geochemistry. These events also appear on the AAG web page at: www.appliedgeochemists.org.

The status of the meetings was confirmed at the time of publication, but users of the listing are strongly advised to carry out their own research as to the validity of an announcement.

Please let us know of your events by sending details to:

Ray Lett, Email: Raylett@shaw.ca
or

Elizabeth Ambrose, Email: eambrose0048@rogers.com

2024

14–19 April	EGU General Assembly. Vienna Austria. Website: www.egu24.eu
19–21 April	International Conference on Geoinformatics and Data Analysis. Paris France. Website: www.icgda.org
2–4 May 2024	10 th International Conference on Geographical Information Systems Theory, Applications and Management. Angers France. Website: gistam.scitevents.org
7–8 May	International Mining Geology Conference 2024. Perth WA Australia. Website: tinyurl.com/4dp4mffx
12–15 May	ICIM Convention & EXPO. Vancouver BC Canada. Website: www.cim.org/featured-events/cim-convention
12–15 May	XIII South American Symposium on Isotope Geology. Buzios Brazil. Website: tinyurl.com/43he2ura
19–22 May	GAC-MAC Annual Meeting. Brandon MB Canada. Website: gac.ca/events/gac-mac-annual-meeting
21–23 May	11 th World Conference on Sampling and Blending. Muldersdrift South Africa. Website: tinyurl.com/ycx9psc8
5–6 June	Canadian Mining Expo 2024, Timmins ON Canada. Website: virtex.canadianminingexpo.com
10–12 June	SIAM Conference on Mathematics of Planet Earth (MPE24). Portland OR USA. Website: www.siam.org/conferences/cm/conference/mpe24
16–22 June	16 th International Conference on Gas Geochemistry. Tenerife Spain. Website: icgg16.involcan.org
17–19 June	GeoConvention 2024. Calgary AB Canada. Website: geoconvention.com
23–28 June	Geochemistry of Mineral Deposits for a Low Carbon society (Gordon Research Conference). Newry ME USA. Website: tinyurl.com/bddja374

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CALENDAR OF EVENTS

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2024 continued

- 29 June –8 July XXIV International Multidisciplinary Scientific GeoConference - Surveying, Geology and Mining, Ecology and Management (SGEM). Varna Bulgaria. Website: www.sgem.org/index.php
- 8–12 July 12th International Kimberlite Conference. Yellowknife NT Canada. Website: 12ikc.ca
- 15–18 July 11th Annual International Conference on Geology & Earth Science. Athens Greece. Website: www.atiner.gr/geology
- 21–26 July International Conference on Mercury as a Global Pollutant. Cape Town South Africa. Website: tinyurl.com/mw37tdh4
- 28 July – 1 August Microscopy & Microanalysis 2024, Cleveland OH USA. Website: tinyurl.com/mpwbhcw7
- 28 July – 2 August Contemporary Applications of Organic Geochemical Research (Gordon Research Conference). Holderness NH USA. Website: www.grc.org/organic-geochemistry-conference/2024
- 4–9 August Biomineralization (Gordon Research Conference). New London NH USA. Website: www.grc.org/biomineralization-conference/2024
- 6–8 August International Ni-Cu Symposium. Thunder Bay ON Canada. Website: ec.lakeheadu.ca/ni-cu
- 11–15 August IWA World Water Congress & Exhibition. Toronto ON Canada. Website: worldwatercongress.org
- 11–18 August ISEG: International Symposium on Environmental Geochemistry. Galway Ireland. Website: www.universityofgalway.ie/iseh-iceph
- 18–23 August 4th European Mineralogical Conference. Dublin Ireland. Website: emc-2024.org
- 18–25 August Goldschmidt 2024. Chicago IL USA. Website: tinyurl.com/5cr87s7e
- 24–30 August 35th International Geographical Congress. Dublin Ireland. Website: igc2024dublin.org
- 25–27 August 14th International Conference on Environmental Pollution and Remediation (2024). Barcelona Spain. Website: icepr.org
- 25–31 August 37th International Geological Congress. Busan, Republic of Korea. Website: www.igc2024korea.org
- 4–6 September Discoveries in the Tasmanides. Albury NSW Australia. Website: www.minesandwines.com.au
- 15–18 September Interfaces Against Pollution 2024. Torino Italy. Website: www.iap2024torino.it/iap-2024-torino
- 15–19 September Geoanalysis 2024. Wuhan China. Website: tinyurl.com/yeyj8nuh
- 22–25 September GSA Connects 2024. Anaheim CA USA. Website: community.geosociety.org/gsa2024/home
- 27–30 September SEG 2024 Conference in Namibia. Windhoek Namibia. Website: tinyurl.com/zsb3kkrf
- 2–4 October Mongolia Mining 2024. Ulanbataar Mongolia. Website: mongolia-mining.mn
- 6–9 October MS&T24: Materials Science & Technology. Pittsburgh PA USA. Website: www.matscitech.org/MST/MST24
- 14–18 October 30th International Applied Geochemistry Symposium (IAGS). Adelaide SA Australia. Website: iags2024.com.au
- 7–9 November International Conference on Geology and Earth Sciences. Bali Indonesia. Website: icges.org
- 22–24 November Seventh International Workshop on Environment and Geoscience (IWEG 2024). Shanghai China. Website: www.iweg-conf.org
- 25–28 November Mediterranean Geosciences Union Annual Meeting. Barcelona Spain. Website: 2024.medgu.org
- 1–6 December American Exploration & Mining Association (AEMA) Annual Meeting. Reno NV USA. Website: tinyurl.com/yuf7yk8m

2025

- 2–7 March European Winter Conference on Plasma Spectrochemistry. Berlin Germany. Website: ewcps2025.de
- 3–7 August 18th SGA Biennial Meeting. Golden CO USA. Website: sga2025.org
- 8–12 September Eurosoil 2025. Seville Spain. Website: soilscience.eu/eurosoil-2025



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EXPLORE Publication Schedule

Quarterly newsletters are published in March, June, September, December

• **Deadlines** for submission of articles or advertisements:

March newsletter: January 15

June newsletter: April 15

September newsletter: July 15

December newsletter: October 15

- **Manuscripts** should be double-spaced and submitted in digital format using Microsoft WORD®. Articles should be between 2000 and 3000 words. Do **not** embed figures or tables in the text file.
- **Figures and/or photos** (colour or black and white) should be submitted as separate high-resolution (2000 dpi or higher) tiff, jpeg or PDF files.
- **Tables** should be submitted as separate digital files in Microsoft® EXCEL format.
- All scientific/technical articles will be reviewed. Contributions may be edited for clarity or brevity.
- Formats for headings, abbreviations, scientific notations, references and figures must follow the Guide to Authors for *Geochemistry: Exploration, Environment, Analysis* (GEEA) that are posted on the GEEA website at: <https://www.geolsoc.org.uk/geea-authorinfo>
- An **abstract** of about 250 words must also be submitted that summarizes the content of their article. This abstract will be published in the journal ELEMENTS on the 'AAG News' page.

Submissions should be sent to the Editor of **EXPLORE**:

Beth McClenaghan

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