

New Era of Geochemical Surveys in the Kingdom of Saudi Arabia

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Geochemical surveys for mineral exploration in the Arabian Shield in the Kingdom of Saudi Arabia (KSA) have been carried out since the 1960s. At the end of 2021, a significant new initiative commenced with the geochemical Survey Arabian Shield (GSAS) Project. This is part of a Regional Geological Survey Program (RGP) that also includes airborne geophysical surveying and geological mapping to unlock the mineral potential of the Arabian Shield. The RGP is part of the Kingdom's 2030 Vision that aims to transform the mining sector into the third pillar of Saudi Arabian industry. The program led by the Saudi Geological Survey (SGS) focuses on surveying and mapping some 600,000 km² of the mineral rich Arabian Shield in western Saudi Arabia (Fig. 1) over the next six years. This program will provide a better understanding of the mineral resources of the area, estimated to be worth about \$1.3 Trillion (Saudi Press Agency, 2020). The work will provide an invaluable database of geological information to stimulate the mineral exploration sector in KSA.

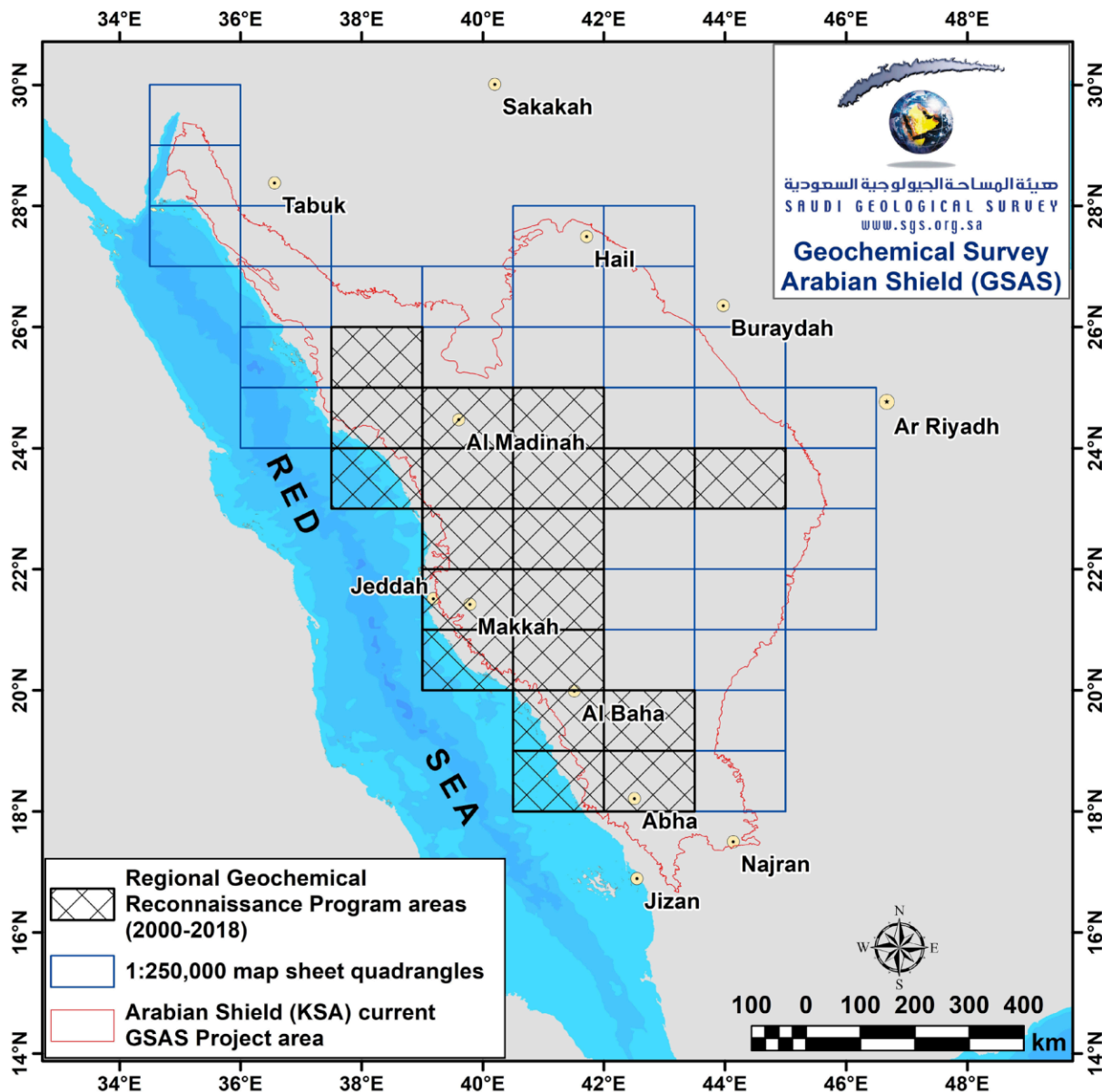


Figure 1. Map showing the SGS Regional Reconnaissance Geochemical Survey areas (2000-2018) and the current GSAS Project area covering the Arabian Shield, Kingdom of Saudi Arabia.



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March newsletter: January 15
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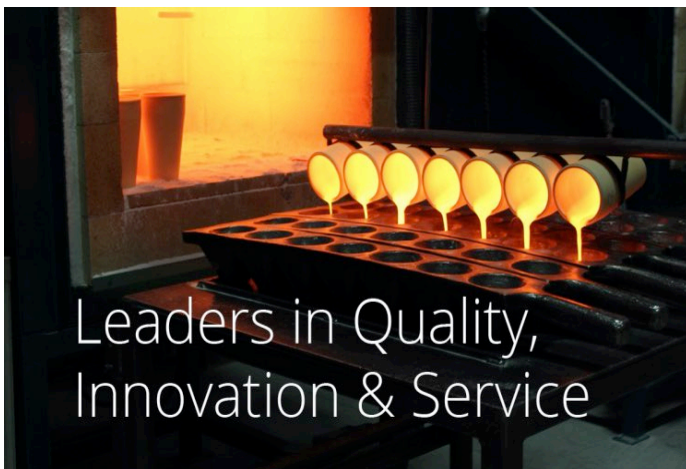
President's Report

For my final President's message of 2022, I am pleased to write that, finally, we held a successful 29th IAGS (International Applied Geochemistry Symposium) in the "Garden City" of Viña del Mar, Chile, during October 23 – 28, 2022. The 29th IAGS was originally scheduled November 8–13, 2020, but because of the COVID-19 pandemic it was postponed for 2 years! With its theme "Facing the Challenges of Today Using Applied Geochemistry", the 29th IAGS convened 9 different sessions, each one addressed either a broad or narrow spectrum of particular challenges in which geochemistry can be applied. Many of these challenges are not new but require new paradigms or new approaches, and these were demonstrated in three keynote lectures, 77 oral presentations and 23 poster presentations. That is significant considering that, perhaps during the last 2 years of the COVID-19 pandemic many of us were unable to complete our respective researches on time. But what is also significant is that the 29th IAGS attracted at least 200 participants, including those who participated in workshops and field trips, from 20 different countries. Also during the 29th IAGS, we awarded three medals of the Association to three esteemed colleagues – the 2019 AAG Gold Medal to Benedetto De Vivo, the 2020 AAG Gold Medal to Qiuming Cheng, and the 2020 Cameron–Hall Copper Medal to David Cooke - at our gala dinner at the Hotel Marina del Rey. Therefore, I thank again, on behalf of the Association, the Local Organizing Committee of 29th IAGS, led by Brian Townley, for their patience and resilience to see to it that this event happened and succeeded. We should give them a big hand! Planning for the next IAGS to be held in Adelaide, Australia, in 2024, is well underway in the good hands of David Cohen.

To sustain the role of our Association in the dissemination of knowledge and expertise in the field of applied geochemistry that are relevant to enhancing societal wealth through the minerals industry as well as protecting environmental health, I encourage Members/Fellows of our Association who gave presentations at the 29th IAGS to develop their presentations into full papers and submit them for publication either in our journal GEEA or in our newsletter **EXPLORE**. There is a saying, and I do not know who said it, that 'if it's not written, it didn't happen'. As you may or may not know yet, GEEA's 2021 impact factor is 2.266, which is a significant increase from its 2020 impact factor of 1.437. So, please consider publishing your research output in GEEA, or in **EXPLORE**, either those that you presented at the 29th IAGS or the ones in the future. Our GEEA Editor, Scott Wood, and our **EXPLORE** Newsletter editor, Beth McClenaghan, would be pleased to assist and receive your submissions.

Finally, I am pleased to announce that GEEA will have a new cover starting in 2023, our Association is on a solid financial footing despite the turbulent financial times globally, our website is again well maintained, and the incoming 2023–2024 Councilors of our Association have been determined. I thank our Council, coordinators, committee chairs/members, and indeed all of the members of the Association for their unyielding support of their time and energies during this and previous years.

John Carranza
President



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New Era of Geochemical Surveys ... continued from page 1

Prior to the formation of SGS in 2000, geochemical surveys in the Arabian Shield were conducted by the United States Geological Survey (USGS) and the Bureau de Recherches Géologiques et Minières (BRGM). These surveys targeted a variety of mineralization types present in the Arabian Shield and provided orientation information regarding the optimal sample media and fraction sizes for analyses. The results of this geochemical exploration work were generally published as internal confidential reports, many of which are stored in the SGS library in Jeddah. These reports indicate contamination of sediment samples by wind-blown detritus is a dominating concern for geochemical sampling in such arid environments.

According to Nehlig (1999), mineral exploration by various organizations and companies operating in the Kingdom of Saudi Arabia for 35 years has led to the discovery of more than 5,300 mineral occurrences. The main mineralization types of the Arabian Shield as listed by them include:

1. Base and precious metal deposits related to submarine volcanism (VMS type);
2. Cr-Ti-Fe-Ni-Cu (PGE) mineralization related to mafic-ultramafic rocks;
3. Sn-W mineralization related to peraluminous post-collisional granites;
4. REE-Th-U mineralization related to granites enriched in high-field-strength-elements and syeno-granites;
5. Porphyry-type Cu-Mo, Cu-Au and W-Mo mineralization;
6. Epithermal gold and base-metal sulfide mineralization;
7. Mesothermal gold veins relating to faulting;
8. Sedimentary Pb, Zn, Cu, or Ni-Mo mineralization; and
9. Ti-Au-W residual placers.

Agar (1992) summarizes the metallogeny associated with the Arabian Shield to include:

1. Cu-Ni and Cr mineralization associated with Proterozoic oceanic crust/ophiolite;
2. Base and precious metal deposits associated with formerly active plate margins (arc-type volcanogenic);
3. Shear-zone hosted mesothermal gold mineralisation related to accretionary and strike-slip tectonics; and
4. Sn-W-Ta-Mo-REE mineralisation associated with post-cratonization alkali granite magmatism of Late Proterozoic to Early Phanerozoic age.

The first systematic regional survey program in the Arabian Shield area of KSA commenced in 2000 with the Regional Geochemical Reconnaissance Program based on the collection of stream sediment at a density of one sample per 25 km². The stream sediments, collected from low-order wadis (stream channels), were dry sieved in the field to yield a <2 mm fraction and further sieved in the SGS laboratory to recover a <2 >0.177 mm (-10+80 mesh) fraction. This fraction was chosen in order to provide optimal contrast for defining anomalous mineral element concentrations (Al-Thekair, 1984; Al-Thekair *et al.*, 2005). The samples were pulverized and analyzed for 60 elements using ICP-OES and AAS following a four-acid digestion. By 2020, SGS had completed the sampling of nineteen 1:250,000 map sheet (1.5° of longitude and 1° of latitude) areas (Fig. 1). For eleven of these map sheet areas, geochemical atlases have been published (e.g., Abdalla *et al.*, 2015).

The new geochemical survey activity in KSA commenced with the award in 2021 to the China Geological Survey (CGS) of a contract to carry out a geochemical survey of the Arabian Shield, under the guidance of Eng Abdullah M. Shamrani, Chief Executive Officer, Saudi Geological Survey and Dr. Wadee A. Kashghari, Owner and Director of the Regional Geological Program (RGP). The Project is directed by the SGS aided by Technical Partners, experienced geochemists from IGS (International Geoscience Services) Ltd. and the Geological Survey of Finland (GTK). The Geological Survey Arabian Shield (GSAS) Project will cover the 600,000 km² with predominately stream sediment samples collected at a density of one site per 6.25 km² (Fig. 2). The project will have a duration of six years with the sampling, the collection of approximately 100,000 sediment samples, to be completed in the first three years. The sampling will be carried out at the 1:50,000 topographic map scale, reporting results and map plotting will be at the 1:250,000 map quadrangle scale (Fig. 1).

The CGS will substantially upgrade the geochemical survey capability of the SGS, introducing new techniques and modern technologies to all the phases associated with this challenging project. Field data is being collected using a digital recording system and handheld devices combining GPS, data recording, smart phone and camera. The CGS Geochem Master software runs on an Android system and will be used to pre-plot sample sites, guide samplers to locations in the field, and be used to record field site and sample information. The information can be rapidly uploaded to a field database giving rapid access to the project managers concerning the progress of the project. The CGS has substantial staff resources and experience from their work in similar arid terrains in the Peoples' Republic of China (PRC) to conduct the sampling within the framework of a demanding schedule.

New Era of Geochemical Surveys ... *continued from page 5*



Figure 2. CGS geochemists in the field collecting stream sediments for the GSAS Project. Photographs from China Geological Survey.

Delayed by the COVID pandemic, the sampling commenced in March 2022, and by the end of the first phase of sampling in June 2022, some 30,000 (representing 35% of the total) stream sediment samples have been collected. The sampling was preceded by a phase of orientation and planning which resulted in the preparation of three procedure manuals to ensure the sampling, sample preparation and chemical analyses are carried out to strictly adhere to protocols (China Geological Survey, In Prep. a, b, c).

It is estimated that stream sediments will be collected from 85-95% of the area using low-order drainage channels established at a time when the climate was less arid. A common systematic sampling procedure has been established across the Arabian Shield area that considers a variety of landscape types. These include mountainous, flat plain, sabkha, relatively unweathered recent harrat (basaltic lavas) and Nafud (sand dune areas). In the field, stream sediment collected from stream drainage channels is sieved to <2 mm (-10 mesh). During sample preparation, samples are sieved further to remove the <0.25 mm (-60 mesh) fraction as a measure to mitigate the effects of contamination by windblown material. The sediment samples will be analysed in the laboratories of CGS for 76 elements using a variety of analytical techniques (China Geological Survey, In Prep. c).

The creation of a geochemical database of the field and analytical data in the KSA National Geoscience Database (NGD) is a key project deliverable. This database will be used to generate 1:250,000 scale map quadrangle reports and maps culminating at the end of the project with a geochemical atlas of the Arabian Shield within the KSA.

Acknowledgement

The authors thank R.G. Garrett for his review of the manuscript.



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Notes from the Editor

Welcome to the fourth **EXPLORE** issue of 2022. This issue features an article describing new geochemical surveys in the Kingdom of Saudi Arabia and was written by Mazen Balkheyour, Ibrahim Osman Abdella, and Christopher Johnson.

EXPLORE thanks all those who contributed to the writing and/or editing of this issue and the other three issues of **EXPLORE** in 2022, listed in alphabetical order: Elizabeth Ambrose, Steve Amor, Dennis Arne, Al Arsenault, Steve Barnes, John Carranza, Zhaoshan Chang, David Cohen, Silas Sunday Dada, Theo Davies, Hugh de Souza, Mary Doherty, Bob Garrett, Michel Houlé, Richard Howarth, Nicholas Jansen, Dan Layton-Matthews, David Leng, Matthew Leybourne, Marty McCurdy, Jeanne Percival, Collette Pilsworth, Jessey Rice, Alexander Seyfarth, Dave Smith, Monica Sorondo, Cliff Stanley, Stephanie Sykora, Brian Townley, McLean Trott, Nicholas Turner, Yulia Uvarova, and John Woods.

EXPLORE gratefully acknowledges our advertizers and thanks them for their financial support in 2022. Below is the team that has provided readers with four excellent issues this year. We wish all AAG members and other readers a successful year in 2023.



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Geochemical Exploration Field Program at Colorado School of Mines

Mary Doherty, Zhaoshan Chang

Colorado School of Mines, Golden Colorado, USA


The annual course 'Exploration Geochemistry' was held on campus from September 26 to October 7, 2022, with 19 graduate students, including full time and on-the-job Professional Master's degree students. Highlights of the course include visiting speakers who lend their expertise in geochemistry, time spent in the CSM LA-ICP-MS/MS lab, and two days in the field learning about field sampling, geomorphology and exploration geochemistry. This year we appreciated teaching contributions from Kiel Arndt (Kobold Metals), Beth McClenaghan (Geological Survey of Canada), Steve Smith and Garth Graham (U.S. Geological Survey), and Devin Castendyk (WSP). Many thanks to these contributors who gave time and experience to the students!

The field training is another highlight, allowing students to observe mineralization, alteration, and practice geochemical sampling around porphyry molybdenum, orogenic gold, and intermediate epithermal vein-type base-metal deposits. During the field program, students sample a larger river, a smaller third order creek, and consider dry sediment drainage sampling. Fine sediment samples



Figure 1: The Clear Creek just outside the Colorado School of Mines campus has a catchment basin that includes the Henderson Molybdenum Mine, the historic gold districts of Black Hawk & Central City, and Uranium occurrences. Mary Doherty is leading the discussion about the stream sediment sampling conditions and details at this site.

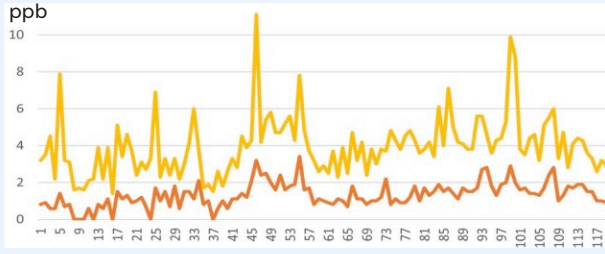
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are compared to heavy mineral concentrates, BLEG and indicator mineral samples. A clean water collection and filtration procedure is taught and supervised by the USGS specialists. The importance of geomorphology mapping to soil sampling is amply demonstrated in a glaciated valley also containing fans of alluvial and colluvial material. Students collect a soil sample, measure soil field pH, and collect pine tree needles and tree cores. Finally, students are able to spend some time on the historic mine dumps where they practice using a portable spectral mineralogy ASD instrument, and a portable XRF.

We are currently recruiting for our August 2023 start for the next round of students within the Mineral Exploration Professional Master's Degree program. This is a non-thesis, 1-year Master's degree program featuring applied exploration and economic geology courses including this 'Geochemical Exploration' course. We welcome students from all countries, and the program is amenable to students who may be working full time and wish to take one or more 2-week course(s) per semester. Email: MineralExploration@mines.edu

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Geochemical Exploration Field Program at Colorado School of Mines... *continued from page 10*

Figure 2: Kiel Arndt demonstrates stream sediment sampling, sieve size fractions, stream geomorphology, composite sampling and field data collection. Different stream sediments samples are collected so that students understand the difference between collection of a composite stream sediment, a fine fraction stream sediment, BLEG, indicator mineral samples and panned heavy mineral concentrates. The students had previously used ioGAS to interpret the U.S.G.S. regional stream sediment data covering the Clear Creek catchment area.



Figure 3: Steve Smith teaches the students how to pan for gold and/or heavy mineral concentrate samples. In this site close to the Henderson Mine area, students found only garnet and magnetite in the heavy fraction, though it seems a nugget of gold turned up in one pan (!). Farther down drainage, one might have expected fluorite and huebnerite in the panned concentrate.



Figure 4: Garth Graham demonstrates clean procedures for water sample collection, water pH and alkalinity measurements, sample filtering and acidification.

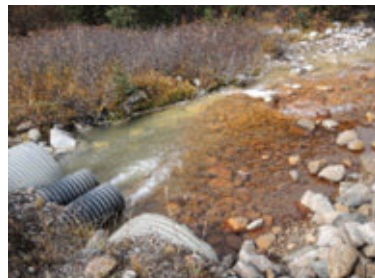


Figure 5: Neutral water from Deer Creek mixes with acidic water in the Snake River to precipitate Fe- and Al-oxides. The Al oxide boulder coatings can be observed for 10 Km down drainage to Dillon Reservoir, a water source for the City of Denver. This chemical formation of Fe-, Mn- and Al-oxides is a dramatic demonstration of the formation of these oxides formed in oxidizing conditions and with change in pH, observed in many environments either in surface waters or in soil/regolith.

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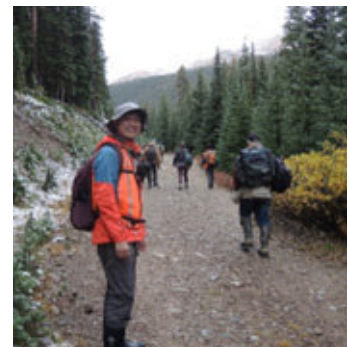
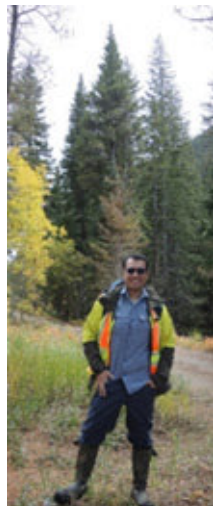
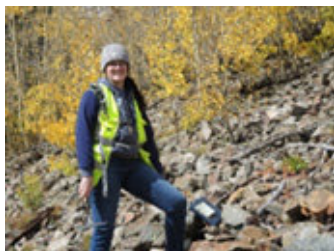
Figure 6: The hundreds of historic gold mines of Black Hawk & Central City Districts were serviced by a deep tunnel ~300m below the ore, which both transported ore to a central mill (circa ~1880-1940), and simultaneously allowed for mine dewatering. This tunnel water is now treated in the grey building shown in the rear, before the water enters Clear Creek.



Figure 7: Dr. Zhaoshan Chang discussed rock sampling, and SWIR analysis of alteration minerals with the ASD FieldSpec 4 High Resolution NG during the rock sampling portion of the field trip.



Figure 8: Soil, tree, and rock chip sampling training near the historic Pennsylvania Pb-Ag mine. The valley is U-shaped by a mountain glacier, with lateral moraine terraces evident across the valley. Coluvial / alluvial fans are also evident. A geomorphology map would be important here for the interpretation of detailed soil and biogeochemistry sampling if one were conducting mineral exploration.



29th International Applied Geochemistry Symposium and 1st International Geosciences, Viticulture, and Wine Symposium

The Association of Applied Geochemists and the Sociedad Geológica de Chile (SGCh) convened the 29th International Applied Geochemistry Symposium and 1st International Geosciences, Viticulture, and Wine Symposium in Viña del Mar, Chile from 23-28 October, 2022. The symposium was dedicated to the memory of Dr. Peter Winterburn, who was part of the local organizing committee, but passed away on 21 June, 2019. Approximately 200 delegates from 20 countries registered for the conference - an enthusiastic meeting of geoscientists from around the world that gathered in person after the long COVID-19 pandemic shut down that cancelled or converted many symposia around the world to online events over the past two years.

The symposium was preceded by four workshops:

1. Influences of geology, mineralogy, and geochemistry on the cultivation of vine (R&D Wine Consortium of Chile / CORFO), presented by Brian Townley, Pamela Castillo, Ignacio Serra, Paulina Flores and David Morales. Topics covered the geological, mineral and geochemical influences on the cultivation of vine in the frame of global climate change and the implications on Terroirs.
2. Data Science in Ore Deposit Geochemistry: Processes to Predictions, presented by Cliff Stanley, McLean Trott and Simon Griffith. Topics covered concepts of mass transfer in hydrothermal systems, application of those concepts on a large scale, and machine-learned prediction of the geological phenomena in question.
3. Stable and Radiogenic Isotopes in Mining Exploration, presented by Ryan Mathur online via Zoom. Topics covered how stable metal, transition metal and radiogenic isotopes can be used in mineral exploration to solve problems associated with ore genesis, among them how copper isotope values can be used in waters and minerals to vector to mineralization, how tin, zinc, and silver isotopes in ores reveal important aspects of metallogenesis, and how radiogenic isotope systems can be used to define timing of mineralization and how integrated chronologies can be used in exploration and metallogenic studies.
4. Exploration Geochemistry: Applying the Fundamentals, presented by David Cohen, Beth McClenaghan, James Kidder and Cliff Stanley. Topics covered included litho-geochemistry, deeply weathered environments, covered terrains, analytical QA-QC, till sampling in glaciated terrain, hydrogeochemistry, and geochemical mapping.

The symposium itself consisted of four days of oral and poster presentations in the nine sessions listed below. The posters were presented between 4 and 6 pm each day (along with refreshments and wine) and linked to the speaker session topics featured.

1. Exploration geochemistry: present and future challenges
2. New field portable technologies
3. Big Data: Squeezing multi-element geochemical data by means of science and self-learning techniques
4. Geochemistry applied to mineral characterization for geological, geometallurgical and resource modeling
5. Environmental geochemistry for sustainable mining and development
6. Water and hydrogeochemistry - challenges in exploration, mining, and sustainable development
7. New uses of isotopic geochemistry in applied geochemistry
8. Linking geology and geochemistry to viticulture and wine, the 1st International Geosciences, Viticulture and Wine Symposium
9. Analytical geochemistry technologies and quality assurance / quality control

Three invited keynote speakers presented thoughtful overviews of important topics to exploration geochemists exploring globally. AAG Gold medalist Qiuming Cheng, from Sun Yat-Sen University, China, spoke about the fundamental laws of geochemical elements and methods for anomaly recognition for mineral exploration. Bernhard Dold, of SUMIRCO, Germany, presented an overview of the role of geochemistry in sourcing deposits of critical elements and industrial minerals from mine waste/ore deposits. Britt Bluemel of GoldSpot Discoveries, Canada presented an overview of the use of data science to transform geochemical understanding into discovery.

There were eight student oral presentations and 12 student posters spanning a wide range of topics. The SGS Prize for the best student oral presentation was awarded to Bianca Phillips (University of British Columbia) with commendations for McLean Trott (Queen's University) and Collette Pilsworth (Queen's University). The student poster prize was awarded jointly to Pablo Becerra (Universidad Austral de Chile) and Magali Antileo (Universidad de Chile) and with a commendation to Andres Canales (Universidad del Desarrollo).

A day off in middle of the symposium provided delegates with time to catch up with colleagues, sight see in the region and enjoy the impressive sandy beach of Viña del Mar, tour a winery, or hold meetings with work colleagues.

29th International Applied Geochemistry Symposium... *continued from page 13*

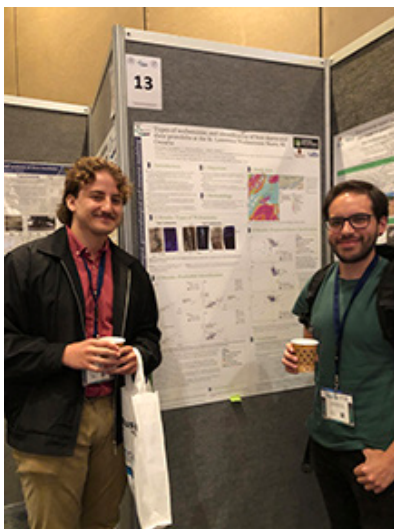
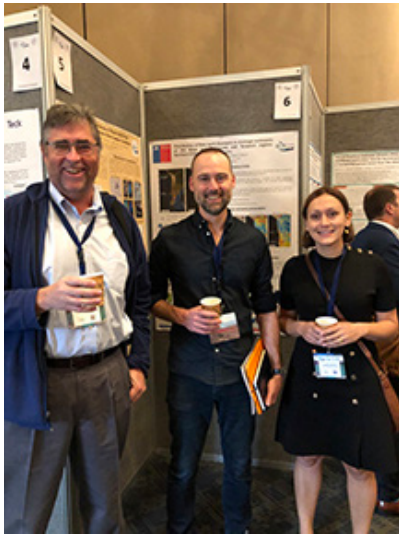
Held on the Thursday evening, the gala banquet lived up to the name “gala” with a delicious feast of food, pisco sours, wine from Chile, and live entertainment while dining. AAG awarded three medals at the banquet, the 2019 AAG Gold Medal to Benedetto De Vivo, the 2020 AAG Gold Medal to Qiuming Cheng, and the 2020 Cameron–Hall Copper Medal to David Cooke. After the awards, the dancing to lively DJ music commenced until 2 am. Some geochemists continued on afterwards at local bars, followed by snack time at McDonald’s at 4:30 am. Geochemists are a very tough breed.

A four-day field trip, ‘Mineral Deposits and Geology of Northern Chile’ was carried out post conference, from October 30 through November 2, 2022. It was led by Dr. Constantino Mpodozis with the participation of 25 geologists from Argentina, Canada, Chile, Australia, Peru, Ecuador, Japan and Brazil.

We thank Brian Townley, the Local Organizing Committee, and PCO for their tireless efforts in organizing a very successful symposium. It was originally scheduled to be held in the Fall of 2020 but was postponed due the global COVID-19 pandemic until it could be held in person. We all very much appreciated to be able to gather in person to meet up with friends and make new ones.

See future issues of **EXPLORE** and the AAG website (<https://www.appliedgeochemists.org/>) for information about the 30th IAGS meeting to be held in Australia and scheduled for late 2024.

Beth McClenaghan, David Cohen, Brian Townley and Monica Sorondo



Opening Ceremony

continued on page 15

29th International Applied Geochemistry Symposium... *continued from page 14*



Brian Townley



All smiles from Banquet attendees!



Dr. Carranza and Dr. Cheng



29th International Applied Geochemistry Symposium... *continued from page 15*



David Cohen with Wine and Snacks



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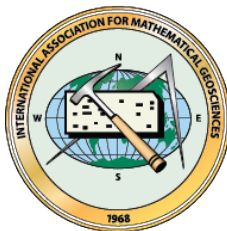
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Letter to the Editor

Hi All,

I would like to take this opportunity to praise the local organizing committee of the 29th IAGS 2022 in Vina del Mar, Chile for the fine job they did in organizing and executing the conference. It had been four years since we got together as a group, and it was wonderful to attend interesting talks, to find out what others have been doing in the geochemical realm, to meet new geochemists, and to see and interact with, in person, friends we all have made at previous IAGS conferences over the years.

On a personal level, while I was able to participate in the pre-conference short courses, and the first day of talks, I unfortunately came down with COVID on the second day of the conference and was unable to participate further, missing the opportunity to present several papers. For that, please accept my apologies, and be assured that I will present these research results sometime in the future, in oral or written form.

More importantly, I would like to express my thanks to the large number of geochemists who contacted me while I was isolating myself from others due to my illness, and who conveyed very sincere concern to me, as well as offers of assistance, should my condition have gotten serious. Fortunately, I had the 5-day version of COVID, with only three days of a really sore throat that made talking quite painful. However, it was very comforting to know of the concern and willingness to help that many had for me, as it speaks very well to the community our association had engendered over the years. I understand that there were two other attendees of the conference who likewise came down with COVID, and I hope they are well and received the same support as I did.

Very Sincerely,
Cliff Stanley



Welcome New AAG Members

Regular Members

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.

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Member no. 4496

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Project Geologist
Minera Hamptonperu
Jr. desamparados 219
Cajamarca
PERU
Member no. 4499

Matheus Rodrigues
Specialist Geologist
Anglogold Ashanti
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Nova Lima, MG
BRAZIL 34000495
Member no. 4500

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Master's Student
Colorado State University
1113 Skyline Dr.
Fort Collins, CO
UNITED STATES 80521
Membership # 4497

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



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EXPLORE articles now listed on AAG website

The AAG website now includes a master listing of all **EXPLORE** science articles published since 1987, the first issue of our Associations newsletter. A new link has been added to the **EXPLORE** home page to download a spreadsheet listing all the scientific articles published in the **EXPLORE**. You will find this list here

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

Elizabeth Ambrose
AAG Website Manager

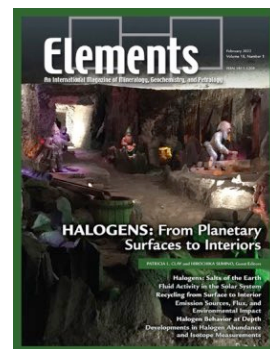


Recently Published in Elements

February 2022, volume 18, no. 1, Halogens: From Planetary Surfaces to Interiors

The articles in this issue survey the role that the halogens play in shaping diverse planetary systems, from the surface of planets to their interiors. This issue also reviews the methods that are appropriate for the determination of halogen elements and of isotopes of Cl and Br in terrestrial and extraterrestrial materials.

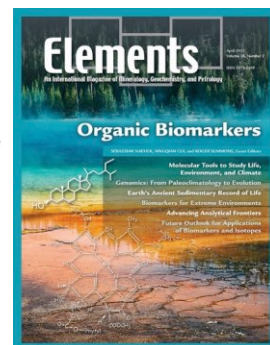
There are two AAG news items in this issue. The first is a citation for W.K. Fletcher – AAG Gold Medal Award for 2021. The second is a citation for Paul Morris – AAG Silver Medal Award for 2021. Both news items were contributed by Stephen Cook (AAG Past President and Past Chair, Awards & Medals Committee).



April 2022, volume 18, no. 2, Organic Biomarkers

The articles in this issue present biomarkers and their compound-specific stable isotope compositions to study fundamental biogeochemical processes and their application as proxies for environmental and climate reconstructions.

There are three AAG news items in this issue. The first is a citation for David Cooke – AAG Cameron–Hall Medal Award for 2020, contributed by Stephen Cook (AAG Past President and Past Chair, Awards & Medals Committee). The second is an abstract is for an article that appeared in issue 190 (March 2021) of the **EXPLORE** newsletter, namely “Minor Elements – the Middle Child between Petrochemistry and Geochemistry” by Robert G. Garrett. The third is an abstract is for an article that appeared in issue 191 (June 2021) of the **EXPLORE** newsletter, namely “Integration of Geochemical and Mineralogical Data: An Example from the Central Victorian Goldfields, Australia” by Dennis Arne.



June 2022, volume 18, no. 3, Organic Biomarkers

The articles in this issue present the different environments and processes where water is of fundamental importance, as well as its past and present distribution within the Solar System and how this peculiar molecule affects astrophysical and geological processes.

There are three AAG news items in this issue. The first is a Message from the President, John Carranza. The second is an abstract is for an article that appeared in issue 192 (September 2021) of the **EXPLORE** Newsletter, namely “Geochemistry of LCT Pegmatites in Part of Northeastern Nasarawa State, North Central Nigeria” by A. Chukwu, S.C. Obiora, and T.C. Davies. The third is an advertisement for the Writing of Geochemical Reports.



Reminder: AAG members can access past issues of Elements at <http://elementsmagazine.org/member-login/> using their e-mail address and AAG member ID.

John Carranza



Geochemistry: Exploration, Environment, Analysis

Volume 22, Issue 4, November 2022

Elemental inheritance evaluation for geochemical elements in soil of the Daliangshan area, China

Zhen-Jie Zhang, Hong Liu and Yuan Ouyang

<https://doi.org/10.1144/geochem2022-010>

Investigation of geochemical characteristics and hydrothermal alteration zone mapping supported by remote sensing of a porphyry copper prospect, southeastern Iran: integrated applications to exploration

Fereshteh Khammar, Shahab Alborzian Joonaghani, Leila Jan Abadi, Mohammad Boomeri and David R. Lentz

<https://doi.org/10.1144/geochem2022-014>

Improvement of geochemical prospectivity mapping using power spectrum–area fractal modelling of the multi-element mineralization factor (SAF-MF)

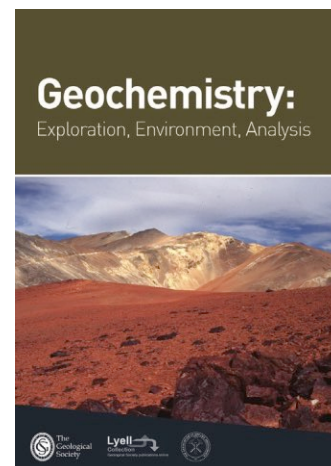
Hossein Mahdianfar and Mirmahdi Seyedrahimi-Niaraq

<https://doi.org/10.1144/geochem2022-015>

Geochemical and mineralogical soil survey of the conterminous USA: a project retrospective

David B. Smith

<https://doi.org/10.1144/geochem2022-031>



Writing Geochemical Reports, 3rd Edition

Edited by Lynda Bloom and Owen Lavin

Writing Geochemical Reports: Guidelines for surficial geochemical surveys was first conceived and written by Dr. Stan Hoffman and was published in 1986 by the Association of Exploration Geochemists as Special Volume No. 12. Stan was an energetic and passionate geochemist working for a large mining and exploration company based in British Columbia, Canada. In his job, he saw a lot of reports about surficial geochemical surveys and he recognized the need for rigour and standardization in this relatively young field of exploration geochemistry. During this time, geochemical reports were confined to hardcopy black-and-white documents.

Fifteen years later, advances in the science of exploration geochemistry necessitated a modernization of the original guidelines. Lynda Bloom, together with several co-contributors, produced the second edition in 2001. Twenty years hence, advances in technology have again made some of the earlier recommendations obsolete. Importantly, electronic publication of reports has become the norm, enhanced by the ability to bundle text, tables, figures, images, and oversized maps into one electronic file.

This third edition expands the original mandate of surficial geochemical reports 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/writing-geochemical-reports-3rd-edition>



Association of Applied Geochemists

Writing Geochemical Reports 3rd Edition



Lynda Bloom and Owen P. Lavin
Editors





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 on November 11th 2022, but further changes are likely, and users of the listing are strongly advised to carry out their own research as to the validity of an announcement.

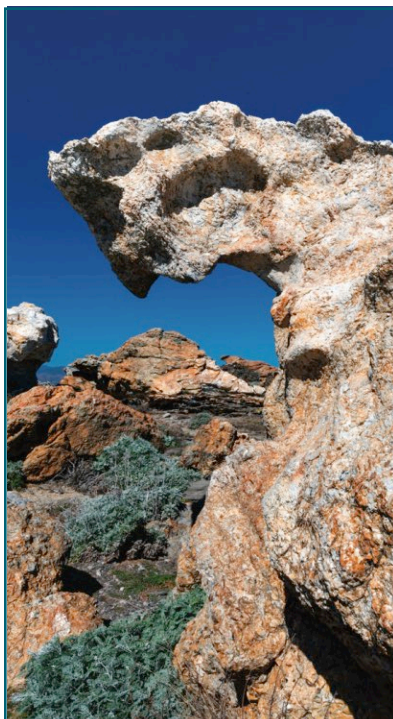
Please let us know of your events by sending details to:
Steve Amor, Email: steve.amor2007@gmail.com
or

Or Elizabeth Ambrose, Email: eambrose0048@rogers.com

2023

- 23-26 JANUARY. Mineral Exploration Roundup. Vancouver BC Canada. Website: roundup.amebc.ca
- 29 JANUARY-3 FEBRUARY. Winter Conference on Plasma Spectrochemistry. Ljubljana Slovenia. Website: ewcps2021.si
- 3-5 FEBRUARY. Atlantic Geoscience Society Colloquium 2023. Truro NS Canada. Website: tinyurl.com/mptdayyv
- 5-8 MARCH. Prospectors and Developers Association of Canada Annual Convention. Toronto ON Canada. Website: www.pdac.ca/convention
- 13-17 MARCH. 54th Lunar and Planetary Science Conference. The Woodlands TX USA. Website: www.hou.usra.edu/meetings/lpsc2023
- 13-18 MARCH. Australasian Exploration Geoscience Conference. Brisbane Qld Australia. Website: 2023.aegc.com.au
- 19-23 MARCH. Minerals, Metals & Materials Society Annual Meeting & Exhibition. San Diego CA USA. Website: www.tms.org/AnnualMeeting/TMS2023
- 10-14 APRIL. Geociencias 2023 - X Earth Science Convention. Havana Cuba. Website: www.cubacienciasdelatierra.com
- 13-15 APRIL. 6th International Conference on Geoinformatics and Data Analysis. Marseille France. Website: www.icgda.org
- 23-28 APRIL. EGU General Assembly 2023. Vienna Austria. Website: tinyurl.com/4b3cfvva
- 25-27 APRIL. International Conference on Geographical Information Systems Theory, Applications and Management. Prague Czech Republic. Website: www.gistam.org
- 30 APRIL – 3 MAY. CIM Convention. Montreal QC Canada. Website: convention.cim.org

continued on page 23



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	Dy	0.03
	Ho	0.01
	Nb	0.8
	Ta	0.04

*a selection of analytes reported by ME-MS89L™.
Boron can only be reported as an add-on to ME-MS89L™.



CALENDAR OF EVENTS... *continued from page 22*

- 24-27 MAY. GAC-MAC Joint Annual Meeting. Sudbury ON Canada.
Website: gac.ca/events/gac-mac-annual-meeting
- 18-23 JUNE. Catchment Science: Interactions of Hydrology, Biology and Geochemistry (Gordon Research Conference). Andover NH USA. Website: tinyurl.com/2p968pxe
- 19-22 JUNE. SIAM Conference on Mathematical & Computational Issues in the Geosciences. Bergen Norway.
Website: tinyurl.com/4eesycan
- 26-27 JUNE. International Workshop on the Characterisation and Quantification of Lithium. Paris France.
Website: cqlmns.sciencesconf.org
- 3-7 JULY. 2023 International Platinum Symposium. Cardiff UK. Website: tinyurl.com/2wcshfeh
- 9-14 JULY. Goldschmidt 2023. Lyon France. Website: tinyurl.com/32zcx7es
- 10-13 JULY. 10th Annual International Conference on Geology & Earth Science. Athens Greece.
Website: www.atiner.gr/geology
- 14-20 JULY. 21st INQUA Conference. Rome Italy. Website: inquaroma2023.org
- 16-21 JULY. Chemical Oceanography (Gordon Research Conference): Chemical Tracers in the Sea. Manchester NH USA. Website: tinyurl.com/mu7ybfz6
- 25-27 JULY. 6th International Archean Symposium. Perth WA Australia. Website: 6ias.org
- 28 JULY. Target 2023: Innovating now for our future. Perth WA Australia.
Website: www.aig.org.au/events/target-2023
- 18-22 AUGUST. Water-Rock Interaction WRI-17/ Applied Isotope Geochemistry AIG-14. Sendai Japan.
Website: www.wri17.com
- 26-29 AUGUST. SEG 2023 Conference: Resourcing the Green Transition. London, England.
Website: tinyurl.com/2p8b7mue
- 28 AUGUST – 1 SEPTEMBER. 17th Biennial Meeting of the Society for Geology Applied to Mineral Deposits. Zurich Switzerland.
Website: sga2023.ch
- 28 AUGUST-1 SEPTEMBER. 8th World Multidisciplinary Earth Science Symposium. Prague Czech Republic.
Website: www.mess-earth.org
- 11-15 SEPTEMBER. IWA World Water Congress & Exhibition 2023. Beijing China.
Website: www.worldwatercongress.com
- 15-18 OCTOBER. GSA Connects 2023. Pittsburgh PA USA. Website: community.geosociety.org/gsa2023
- 31 OCTOBER - 2-NOVEMBER. 14th Fennoscandian Exploration and Mining conference. Levi Finland.
Website: femconference.fi

2024

- 21-26 JULY. International Conference on Mercury as a Global Pollutant. Cape Town South Africa.
Website: tinyurl.com/mw37tdh4
- 25-31 AUGUST. 37th International Geological Congress. Busan, Republic of Korea. Website: www.igc2024korea.org





Happy Holidays

from the EXPLORE team

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