



GeoVIEW.WA — an interactive geological resource

INTRODUCTION

Mineral exploration is an important and challenging activity in the state of Western Australia (Fig. 1). The State is in excess of 2.5 million square kilometres in area (one-third of Australia), and had a 2012-13 mineral production of greater than \$AU 101 billion. Effective mineral exploration increasingly relies on the need to integrate large and diverse datasets, and this has led to the development of software applications that can rapidly display and interrogate data. Although a variety of software packages are currently available, to some explorers, either the cost (including the initial purchase price and the cost of ongoing maintenance or upgrades), or type of operating platform restricts their use. Recognising this limitation, the Geological Survey of Western Australia (GSWA) developed the web-based application GeoVIEW.WA, which can be used to view and interrogate a wide range of data in both a textual and spatial context. GeoVIEW.WA can be accessed through the Online Systems tab from the Department of Mines & Petroleum's website at www.dmp.wa.gov.au.

GSWA is the principal supplier of geoscience information to the mineral exploration industry in Western Australia. Exploration companies active in the State range from multinationals, through mid-tier and junior companies, to individual prospectors, and all make use of the geoscience data made available by GSWA. GeoVIEW.WA offers all explorers the capability to integrate, view, interrogate and download large and diverse datasets using a web browser.

Table 1. Operational Layers in GeoVIEW.WA (see Figure 2).

Layer	Description
Minerals	Compilation of mines and mineral deposits (MINEDEX ⁺), mineral exploration reports (WAMEX ⁺), specialized projects (e.g., inventory of abandoned mine sites)
Drillholes	Mineral exploration drillholes (MDHDB*); drillholes with spectral mineral data (HYLOGGER); drillholes held by GSWA
Tenements	Mineral exploration tenements (historical, live, pending)
Native title	Native title claim and determined areas, indigenous land use agreement areas
Special category lands	E.g., geoheritage sites, heritage areas, conservation estates
Geochronology	Age determination information and metadata, GSWA and Geoscience Australia data
Geochemistry	Private sector and GSWA geochemistry (includes data from WACHEM[†] and WAROX[†])
Geophysics	Company and government airborne surveys and ground surveys, and surveys in progress
Petroleum	E.g., petroleum and geothermal titles and releases, petroleum wells, 3D seismic lines, magnetic surveys
Indexes	Mapsheet indexes at various scales
Administrative boundaries	E.g. local government authorities, mineral fields
Topography and cultural	E.g., Location of towns, road and rail networks
Geology	Lithology and structure at various scales, tectonic units, basin depths
Topographic imagery	1:250 000 topographic map mosaics
Geology imagery	1:250 000 and 1:100 000 map mosaics
Relief imagery	Shuttle radar topography mission (SRTM) imagery
Geophysics imagery	Magnetics, gravity and radiometrics imagery
ASTER imagery	Advanced Spaceborne Thermal Emission and Reflection Radiometer content and composition images

*MDHDB – discussed here

[†] corporate database



Figure 1. Location of Western Australia.

GEOCHEMISTRY IN GEOVIEW.WA

GeoVIEW.WA integrates 18 fundamental categories of information (listed as Operational Layers in Figure 2 and Table 1), and a total of 110 individual layers sourced not only from within GSWA, but from other parts of the parent organisation (Department of Mines and Petroleum, DMP), other State and Federal government agencies, and, when provided to GSWA, the private sector. An example of the comprehensive coverage is provided by geochemical data. Of the seven datasets available through GeoVIEW.WA

(Fig. 2), five are from the private sector. The datasets include stream sediment chemistry from two regional surveys (1) Pickands-Mather (n = 32 700) and (2) BHP-Billiton (n = 19 600), (3) a soil geochemistry survey (WMC Yamarna area (n = 15 200)), (4) granite-greenstone bedrock chemistry from the Yilgarn Craton (Hallberg; n =

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EXPLORE NEWSLETTER WISHES TO THANK OUR CORPORATE SPONSORS FOR THEIR SUPPORT



President's Message



Wishing everyone an enjoyable holiday season and all the best for the New Year. Hopefully, 2015 will bring positive changes in the mineral exploration industry; certainly the Association of Applied Geochemists (AAG) will be doing our part in 2015 to generate interest in exploration and environmental geochemistry through our biannual conference, showcasing the latest in our combined research efforts in exploration geochemistry, the geochemistry of the environment associated with mineral extraction, and advances in analytical methodologies.

The AAG emphasises and encourages student participation in the 27th International Applied Geochemistry Symposium (IAGS) in Tucson in April 2015. A total of 104 students attended the 26th IAGS in Rotorua, NZ in 2013 (of which 16 international students were supported financially by the AAG/IAGS to attend). The 27th IAGS organizers are again offering financial assistance for students to present their research at the next symposium; student applications close on January 1, 2015. Students should see the information in this issue of **EXPLORE** or posted on the AAG website about student financial assistance applications for the symposium. Students planning on attending should also take note of the free workshop on getting your research published in the peer-reviewed literature, and the AAG's Student Paper Prize, which is awarded every two years for the best student first-authored paper published in the AAG's journal *Geochemistry: Exploration, Environment, Analysis* (GEEA).

The AAG has now officially entered the modern social media world, thanks to the efforts of Romy Matthies, Sarah Rice and Bruno Lemiere. The AAG has

a blog on its website, a Twitter account (@[AAGeochemists](#)), and is on LinkedIn with the group "Association of Applied Geochemists". At the time of this writing in late October, the group already has 80 members.

As noted previously, our journal GEEA is searching for a new Chief Editor. A new editor will be announced in the near future. I am hoping that a large number of papers will come out of the 27th IAGS conference in April 2015 to keep the new Editor (and associates) very busy throughout 2015. Once again, I would like to express my thanks and admiration for the job Gwendy Hall has done over the last 14 years as Editor of the journal.

In the last issue of **EXPLORE**, Gwendy Hall wrote a moving obituary for our friend and colleague, Eion Cameron. On a personal note, Eion was a great mentor to me and I really miss his guidance and zest for science. Keiko Hattori at the University of Ottawa is leading an effort for a special issue of GEEA in honour of Eion. Although Eion passed away before the volume could be completed (hopefully to appear in 2015), he was shown the list of authors and papers. This will be an excellent issue that highlights many of the areas in exploration geochemistry in which Eion was influential.

Finally, I would like to take this opportunity, on behalf of the executive and all AAG members to thank all of the volunteers that have contributed time and energy to the AAG in 2014. The AAG also thanks the five corporate sponsors for their generous support of the **EXPLORE** newsletter in 2014: Actlabs, ALS Minerals, SGS, AGAT Laboratories, and REFLEX Geochemistry.

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Matt Leybourne

President



Notes from the Editor

The December 2014 issue of **EXPLORE** features one technical article by Paul Morris, Joel D'Antoine, and Ann Fitton that describes the Geological Survey of Western Australia's (GSWA) web-based application GeoVIEW.WA for viewing geological data. **EXPLORE** thanks all contributors and reviewers for this fourth issue of 2014 including: Steve Amor, Joel D'Antoine, Al Arseneault, Patrice de Caritat, Ann Fitton, Matt Leybourne, Iftikhar Malik, Tom Molyneux, Paul Morris, and Wendy Spirito.

EXPLORE gratefully acknowledges the financial support of our five corporate sponsors in 2014, Actlabs, ALS Minerals, SGS, AGAT Laboratories, and REFLEX Geochemistry, as well as our **EXPLORE** advertizers. Pim van Geffen (**EXPLORE** Business Manager) and I wish all AAG members a successful 2015.

Beth McClenaghan

Editor



GeoVIEW.WA — an interactive geological resource ... *continued from page 1*

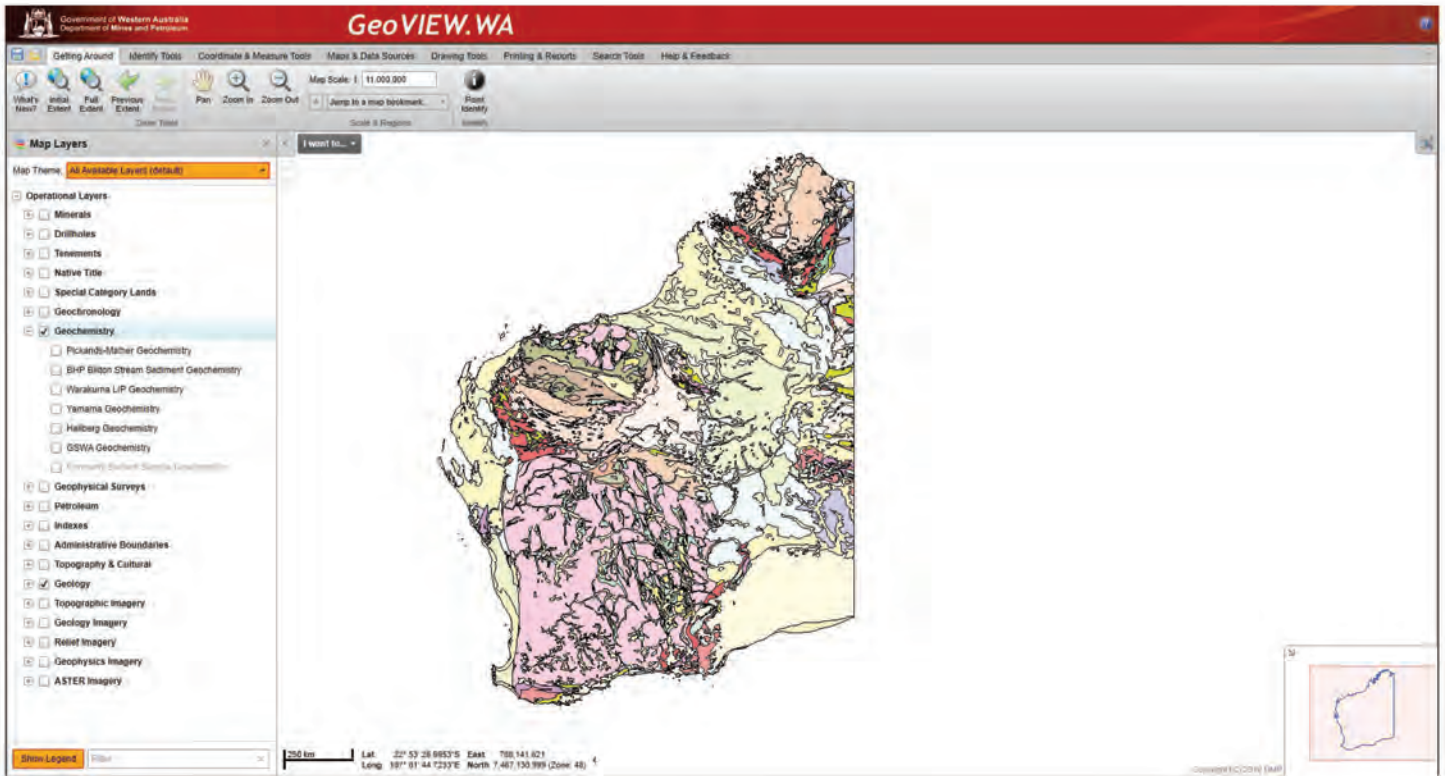
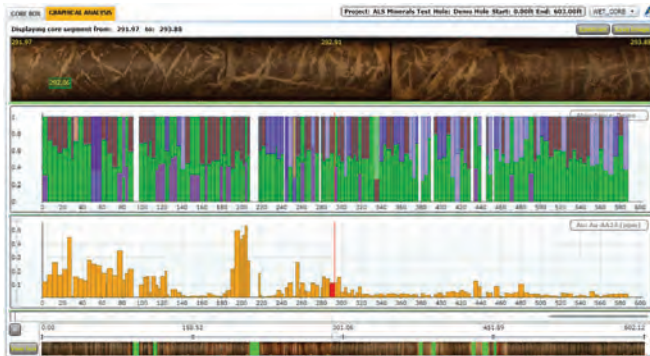


Figure 2. Computer screen snapshot of GeoVIEW.WA interface showing the available Operational Layers. The seven datasets available for geochemistry are shown. Map coverage shown is interpreted bedrock geology at 1:2 500 000. *continued on page 4*



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1 860), and (5) exploration company surface geochemistry captured as part of a Mineral Drillhole and Surface Geochemistry Database (MDHDB) generated by GSWA (n > 4 500 000 assays). Data from within GSWA (GSWA geochemistry in Figure 2) comprise regolith and rock geochemistry carried out on samples collected by GSWA staff as part of either regional mapping and mineralization programs, or resulting from regional regolith geochemical surveys. The data are stored in the corporate WACHEM database, with associated metadata in the field observations database, WAROX. WACHEM currently holds in excess of 35 000 analyses. GSWA data can be searched using two approaches, textual or spatial. Textual searching allows interrogation according to element and element concentration range, and using metadata from the WAROX database, such as lithology, sample number, or analytical batch. The output can be downloaded in .csv format, from which individual batch details can be also downloaded using a hyperlink to the sample. The batch information contains quality control information (e.g., analyses of sample duplicates, reference materials, blanks), as well as the analytical laboratory (and laboratory-specific acronyms for sample preparation and analysis), and information on how the sample was prepared (e.g. crushing, screening, milling). Spatial searching encompasses selecting analyses according to 1:500 000 scale tectonic units, exploration tenement, a user-defined rectangle, a 1:250 000 or 1:100 000 map sheet, or a user-defined set of coordinates. Similar to textual

interrogation, extracted data are made available as .csv files, with related batch information.

The largest collection of geochemical data available through GeoVIEW.WA is that linked to the Mineral Drillhole and Surface Geochemistry Database (MDHDB). Both drilling and surface geochemical data have been extracted from public company reports, submitted to DMP on an annual basis as a part of a regulatory requirement of holding a mineral exploration licence. These data are released when the exploration licence is relinquished. Drillhole coordinates and associated metadata (e.g., drilling methodology, trend and plunge of drillhole) are available through GeoVIEW.WA, whereas other data (including drill hole geology and survey information, and drillhole assays data) are available as either text files or in .pdf format. Currently, the MDHDB holds in excess of 1 260 000 drill hole collar coordinates and related metadata. Surface geochemistry comprises the locations of individual samples and a link to a text file of results and metadata (n > 4 500 000 assays).

EXAMPLES OF GEOVIEW.WA USAGE

Point identification

The Point Identify tool can be used to show the attributes of point data. For GSWA geochemical coverage (Fig. 3), selection of a point using this tool produces a fly-out, showing the metadata and the sample composition (Fig. 3). The Results panel on the left of screen provides

continued on page 6

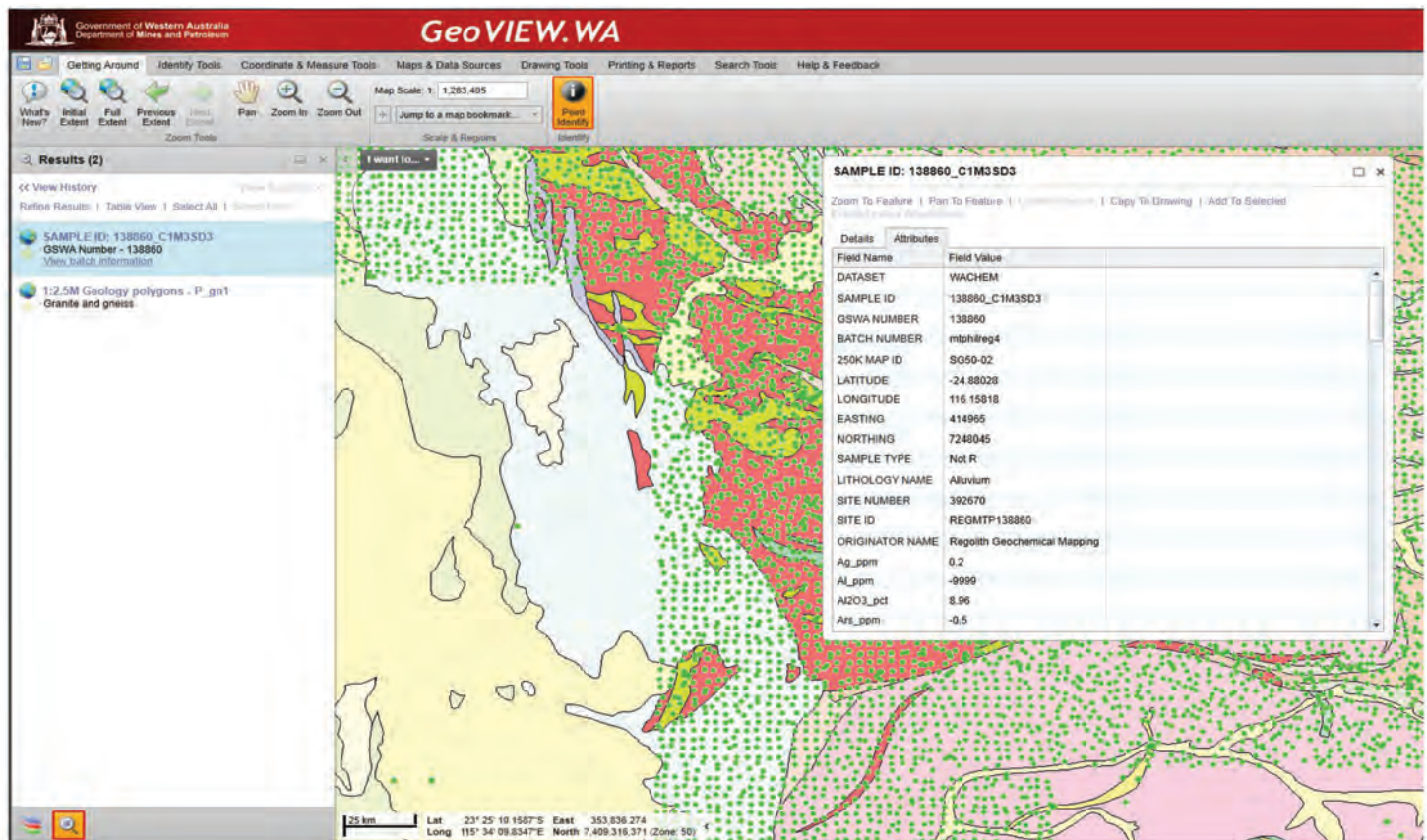


Figure 3. Samples from the GSWA WACHEM database for the Gascoyne area of Western Australia, shown against 1: 2 500 000 scale interpreted bedrock geology. The fly-out table is the result of using the Point Identify tool to examine an individual sample.



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the option to view the selected data in the Table View, enabling downloading of data as a csv file. This panel also shows other attributes, in this case, the lithology at the sample site (granite and gneiss), derived from the background bedrock geology coverage. There is also the option to view the analytical batch details for the selected sample, which contains information on the laboratory and the analytical methodology.

Filtering

The Advanced Filter Builder allows user-defined searching. The GSWA geochemistry coverage for part of the State (Fig. 4a) is shown against 1:2 500 000 scale geology. Using a combination of Field Names, Operators and Values (shown in the Advanced Filter Builder panel), the selected data can be filtered. In the example shown, the selected data shown in Figure 4a have been filtered according to Au concentration > 0.001 ppm and Pt <> 1 ppb (Fig. 4b). Using the 'I want to' drop down menu, the selected data can be exported as an ArcGIS shapefile.

Exploration company surface geochemistry – spatial search

These data are shown in GeoVIEW.WA as a series of sample sites (Fig. 5a). Each sample has associated metadata which can be examined in GeoVIEW.WA. Geochemical data are held in the WAMEX database as a series of text files. Individual samples shown in GeoVIEW.WA are linked to the geochemical data via a unique company exploration report number. An example of the Company Surface Sample Geochemistry coverage (Fig. 5a) shows the high density of samples in some areas. Using the Geochemistry Search option, an area of samples can be selected using a variety of tools, including user-specified coordinates or a polygon tool (Fig. 5b). The results of this search (Fig. 5c) are presented in a table which lists Sample Id and related metadata, including the report number (A-number) – i.e., the link to the geochemical data held in

continued on page 7

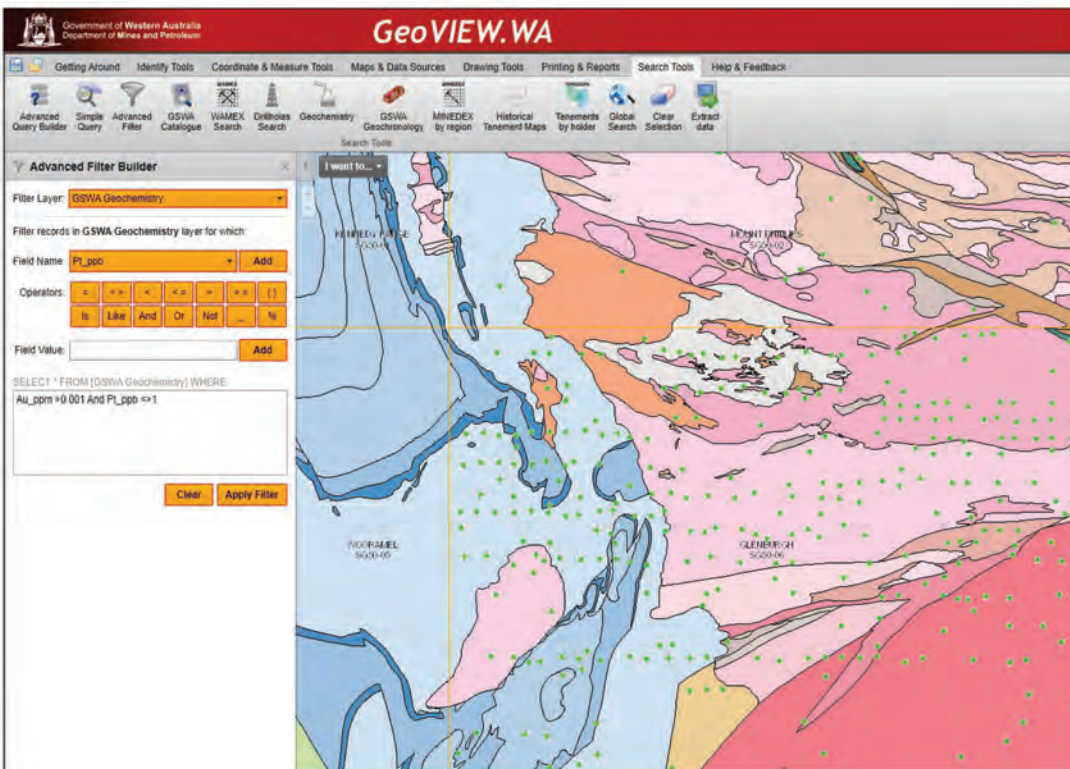
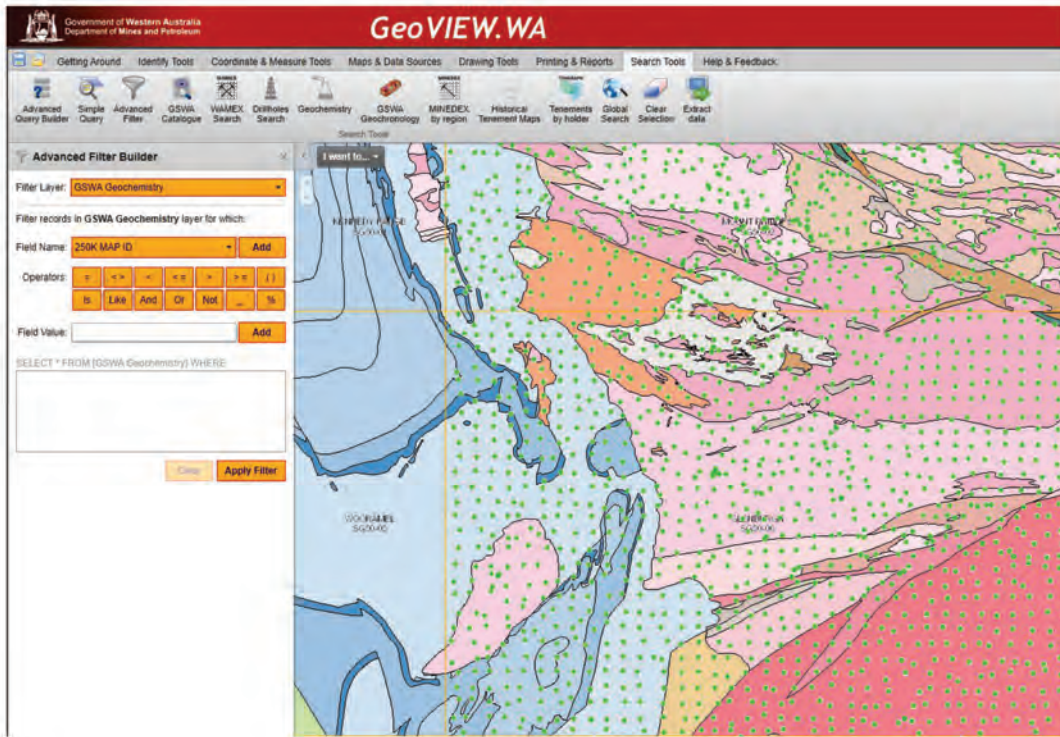


Figure 4a) GSWA samples with geochemistry from the Gascoyne area of Western Australia; b) Coverage in Figure 4a filtered according to user-defined Au and Pt concentrations using GeoVIEW.WA's Advanced Filter Builder.

GeoVIEW.WA — an interactive geological resource ... *continued from page 6*

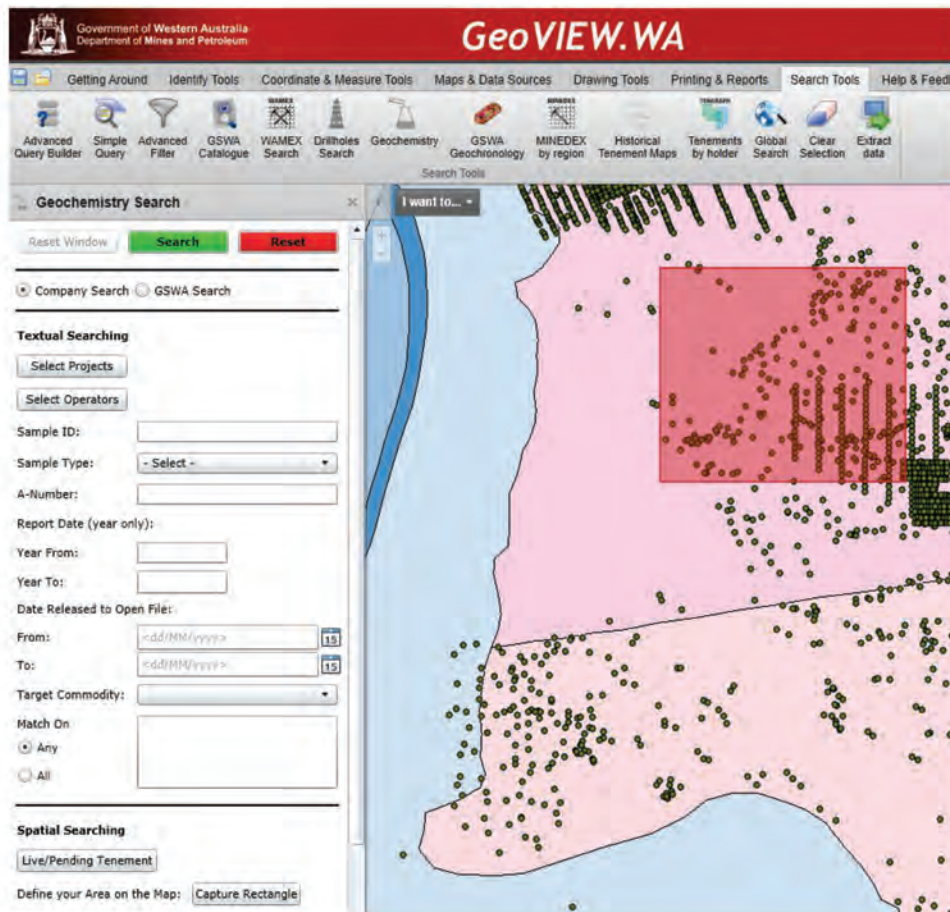
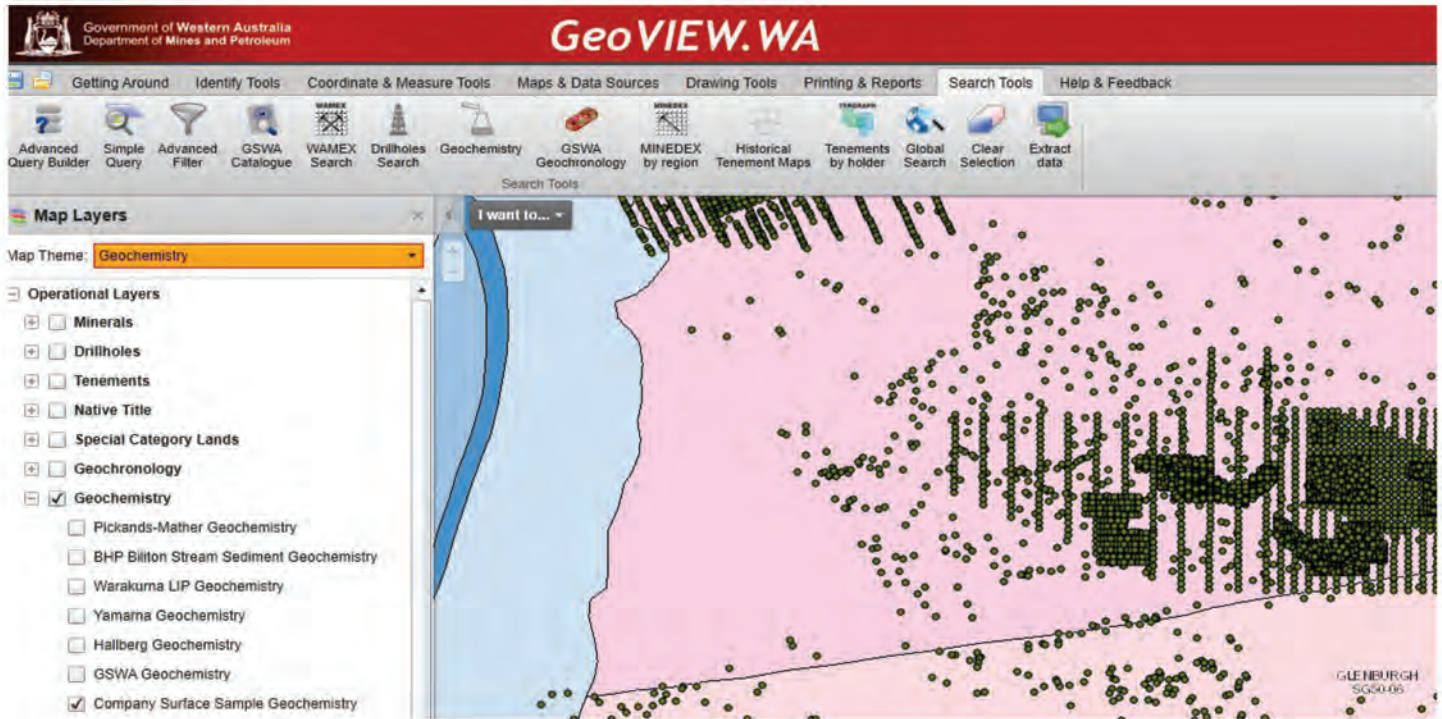


Figure 5a) Distribution of surface geochemistry samples from the Mineral Drillhole and Surface Geochemistry Database in the Gascoyne area of Western Australia; b) Polygon search area (red box) for data shown in Figure 5a; c) Results of polygon search. Table lists the report number (A-number) which links the sample metadata shown in the table to the text files of geochemical data held in the WAMEX database.

GeoVIEW.WA — an interactive geological resource ... *continued from page 7*

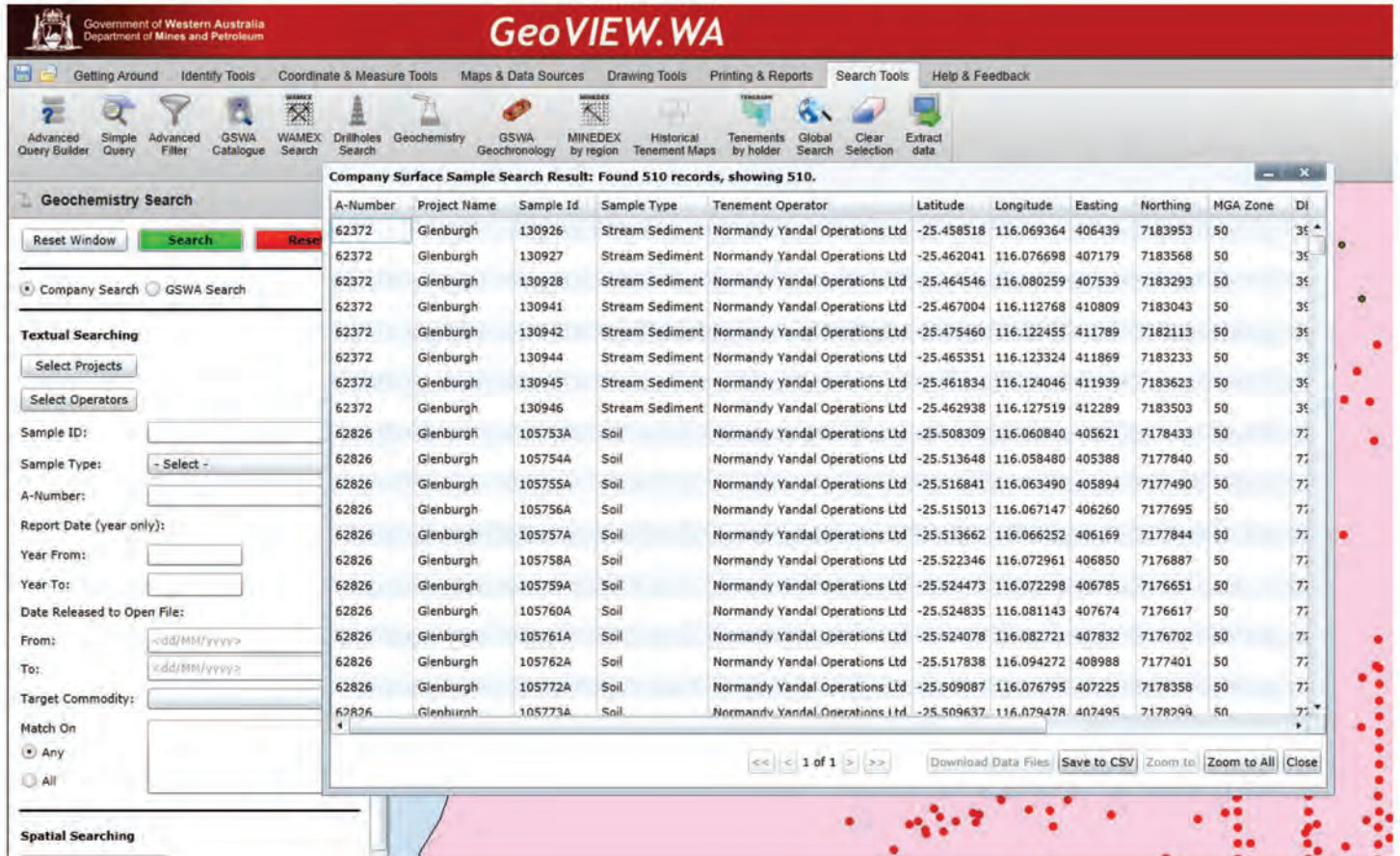


Figure 5c.

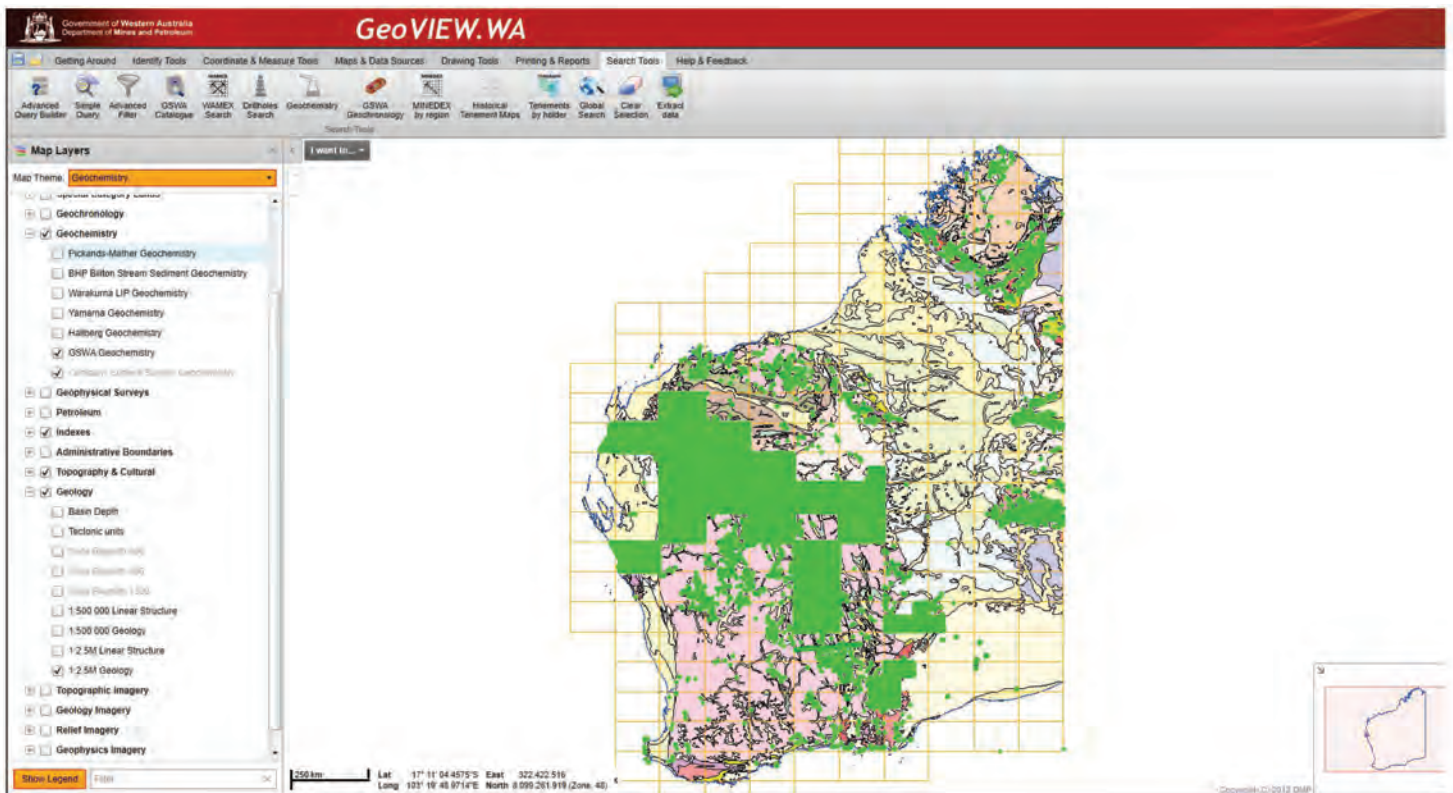


Figure 6a

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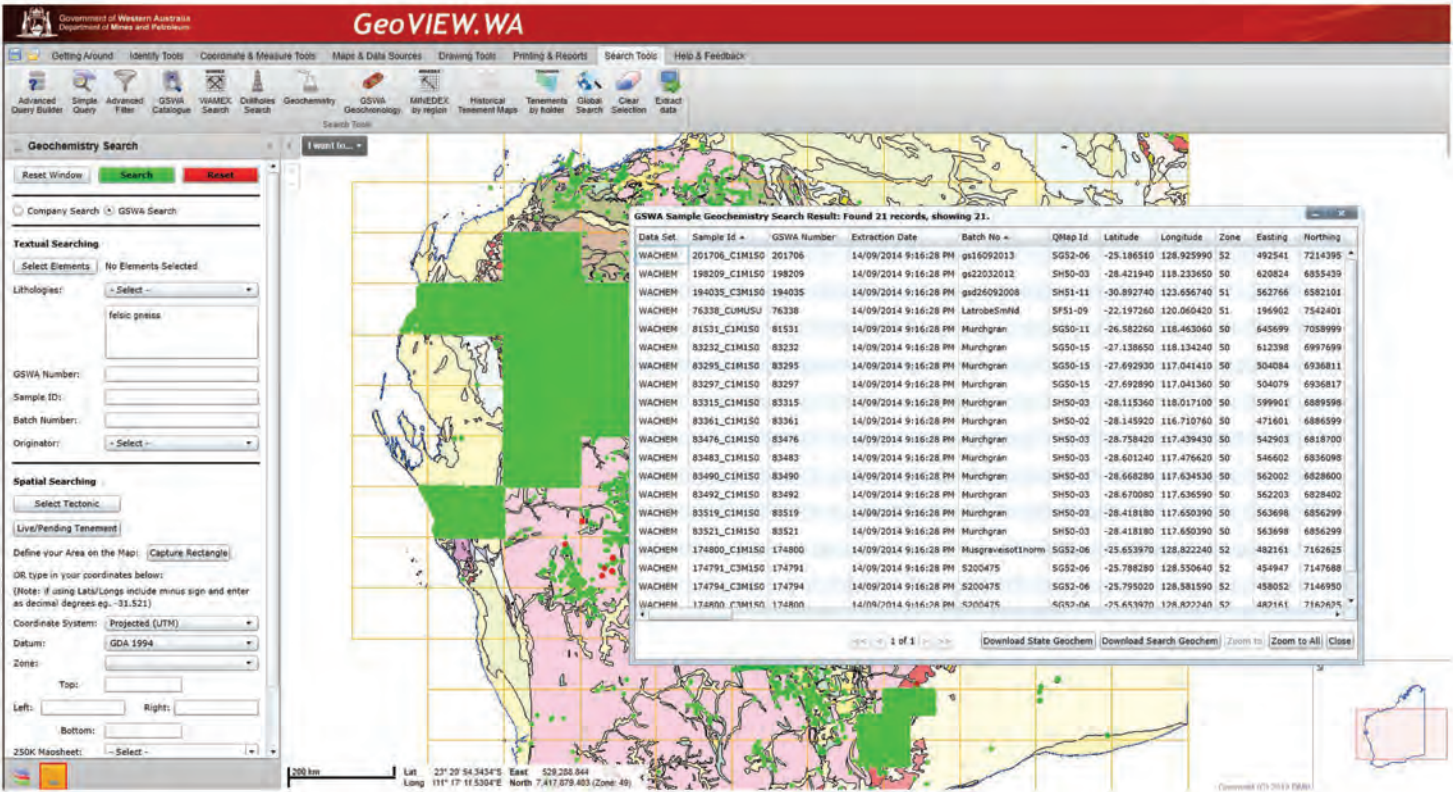


Figure 6a) State-wide coverage of geochemical data from GSWA’s WACHEM database (page 8); b) Result of a textual search of WACHEM data (Fig 6a) according to lithology (felsic gneiss), resulting in 21 samples. These data can be downloaded as a .csv file.

the WAMEX database. The sample search results can be downloaded as a csv file.

Geochemistry according to lithology – textual searching

GeoVIEW.WA also allows textual searching of geochemical data, such as samples collected over certain bedrock lithologies. The state-wide coverage of GSWA geochemistry (Fig. 6a) can be refined according to lithology using a textual search (Fig. 6b). Here, the textual search option has been used to identify samples located in areas of felsic gneiss. Similar to other searches of GSWA geochemistry, the results of the search (21 records shown in Figure 6b) can be downloaded as digital data files.

The textual search option also allows further refinements (e.g. searching according to Sample ID, sample collector (Originator) etc.).

CONCLUSION

GeoVIEW.WA is a free, web-based software application that provides access to multiple data layers using a variety of textual and spatial search options, most of which are user-defined. Data can be downloaded as a series of reports, digital data files and maps. All datasets available through GeoVIEW.WA are dynamic, and refreshed daily.

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Chief Geochemist
- Joel D’Antoine**
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- Ann Fitton**
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27th International Applied Geochemistry Symposium Short Courses

Saturday (April 18, 2015)

Short Course #1: Acid Rock Drainage, Geochemical Processes, Modeling and Natural Systems (Bill Deutsch).

The natural geochemical system adjusts to the impact of acid rock drainage (ARD) through water/rock interactions that tend to neutralize the acidic pH and immobilize a portion of the metal contaminant mass within the solid phase. In this short course, a discussion will be provided to the geochemical processes (neutralization, mineral dissolution/precipitation, oxidation/reduction, and adsorption/desorption) that affect acidic waters and dissolved metal contaminants as the acidic water migrates from its source and interacts with the natural environment. The process of developing conceptual geochemical models for a site will be explained and examples of computer simulations of natural attenuation and applied remedial action of ARD will be provided. Use of comprehensive computer geochemical models for estimating the long-term stability of remediation methods will be discussed.

Short Course #2: Application of Indicator Mineral Methods to Exploration (Beth McClenaghan & Dan Layton-Matthews).

Mineral chemistry: modern techniques and applications to exploration

Dan Layton-Matthews, Queen's University

Micro-analytical Innovation for Indicator Mineral Exploration

Paul Agnew, Rio Tinto

Overview of titanite as an indicator mineral
Bob Linnen, University of Western Ontario



Trace element compositions of silicates and oxides as exploration guides to metamorphosed massive sulfide deposits

Paul Spry, Iowa State University

Tourmaline: the universal indicator?

John Chapman, Geological Survey of Canada

Indicator minerals in exploration/targeting of specialty metal (REE, Ta, Nb) deposits

George Simandl, British Columbia Geological Survey

Overview of porphyry Cu indicator minerals

Karen Kelley, United States Geological Survey

The Blackwater gold-spessartine-pyrolusite dispersal train, British Columbia, Canada: Influence of sampling depth on indicator mineralogy and geochemistry

Stu Averill, Overburden Drilling Management Ltd.

A review of scheelite chemistry and its use as a discriminator in ore-deposit settings, use as an indicator mineral and monitor of ore-forming processes
Dan Kontak, Laurentian University

Indicator mineral signatures of the Mount Pleasant Sn-W-Mo-Bi-In Deposit, New Brunswick, Canada
Beth McClenaghan, Geological Survey of Canada

27th International Applied Geochemistry Symposium Short Courses ...

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Short Course #3: Metal Mobility in Hydrothermal and Supergene Environments (Bill Chavez & Erich Peterson).

This workshop presents practical applications of metals geochemistry characterizing hydrothermal and supergene environments, including the use of activity and Eh-pH diagrams to interpret metal occurrence and distribution. Examples from hydrothermal ore deposits provide reinforcement of the general principles presented, and examples from supergene ores emphasize the importance of weathering-related metals mobility (or lack thereof) and geochemical processes associated with their weathering. In-class examples shall provide for group discussions and question-answer sessions.

Sunday (April 19, 2015)

Short Course #4: Adding Value in Exploration and Remediation with Isotope Geochemistry (Kurt Kyser & Matt Leybourne).

Elemental geochemistry has proven invaluable in exploring for undercover ore deposits using a multitude of surface media. The challenge in exploration geochemistry is in finding those particular elements that reflect the ore deposits at depth, but also to understand the processes involved in mobilizing and fixing these elements at the surface. Similarly, the challenge in remediation is in understanding element cycles in the near surface environment and how these can be exploited to our benefit.

Most elements of interest have more than one isotope whose ratios can provide the most sensitive and precise way to fingerprint the source of an element and record the influence of buried and altered ores alternation and processes by which elements migrate. This information can be used to guide both exploration and remediation at regional and local scales. The purpose of this workshop is to examine how isotopes can add value to understanding the processes by which elements migrate in the near surface environment and provide new avenues to enhance learning for both effective exploration and formulating remediation strategies.

Short Course #5: Regolith and Terrain Mapping (Simon Bolster).

Near-surface exploration geochemistry in regolith-dominated environments will be introduced and examined. This workshop provides an overview of the importance of understanding the regolith and includes practical examples in mapping regolith terrain, field logging, interpreting geochemical datasets, and data validation systems. Case studies will cover exploration programs that have succeeded through regolith analysis and others that have failed due to lack of attention to the regolith. Australia and Africa, as well as other continents, will be considered.

Short Course #6: Application of Field Portable X-Ray Fluorescence in Exploration and Mining (Gwendy Hall).

The previous pXRF workshop at the 26th IAGS in Rotorua was highly successful and, given the large number of enthusiastic attendees, we are offering an updated version in Tucson. As the user of the now widely adopted technique is most often not an analyst, it is important to understand the strengths and weaknesses of this field analytical methodology. Presenters are from industry, government surveys, and academia.

Presentations will cover:

- theory and merits of pXRF, including interferences;
- best practices in pXRF;
- needs (or not) of sample preparation for various media;
- lithological characterization in exploration for different rock/ore types;
- applications to the analysis of cores;
- soil and sediment analysis;
- use of pXRF in environmental geochemistry; and,
- recent advances in the software and hardware associated with these instruments.

Short Course #7: The interpretation of geochemical Survey data (Eric Grunsky)

This half-day workshop outline is tentatively, but may include the following:

- Compositional Data Analysis
- Discussion on mineral stoichiometry and its effect on compositional data
- Censored Data & Replacement Values
- Leveling Geochemical Datasets
- Spatial Sampling Schemes
- Characterizing Geochemical Data - visual and numerical descriptions
- Multivariate Statistics - discovery and validation
- Classification and Predictive Geochemical Mapping
- Mineral Resource Prediction

Case Studies from Canada, Australia, United States, Mexico, Indonesia

Special Student Workshop: Student publishing workshop-free to all students

This two hour workshop will be provided free to students. It is a 2 hour evening presentation that will be held on Saturday April 18, 2015 from 6 pm to 8 pm. Pizza and drinks will be served. This informal workshop will focus on the philosophy and mechanics of publishing your research efforts in the peer-reviewed literature in general, and GEEA (Geochemistry: Exploration, Environment, Analysis) specifically. Topics to be covered include: how to start the writing process, how to construct a good paper, what makes a piece of research publishable, how to write a submission letter, how to deal with reviewer and editor comments and write a rebuttal letter, and how best to celebrate publication of your first paper.



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Annual Earth Science Conference 2014, Pakistan

The annual conference on Earth Sciences Pakistan 2014 was held from 29-31 August in the cold lofty thick forested Nathia Gali, a place in the Lower Himalayan belt of Pakistan. It was organized by the Centre of Excellence in Geology, University of Peshawar, Peshawar. By changing from pure geology to earth science, the conference now attracts a variety of professionals ranging from geology, tectonics, hydrology and applied professions such as environmental hazards, flood forecasts and their economic impact, climate change and glaciations in the western part of Himalaya, Karakoram and Hindu Kush. A special feature was the entry of GIS and Geomatics disciplines in understanding various current issues of the subject. In addition, there were presentations of papers in geo-engineering, resource estimates and shale gas fracturing technology in the country.

There were only five papers on geochemistry in the overall 142 presentations. One current study reported on arsenic and fluoride concentration in water and soil at Nagar Parker, an area extreme south-east of Pakistan and close to the border of India. Values of arsenic range from 350 to 683 $\mu\text{g/L}$ in the surface water and fluoride from 20.1 to 31.7 mg/L. While these values range from 110 to 266 and 90 to 518 mg/kg in the soil concluding that population consuming local vegetables and drinking water is at the high risk of chronic toxicity.

Gold hunting using heavy mineral techniques is still popular in Pakistan. In a recent study on 124 stream sediment samples, Professor Tahir Shah along with his colleagues collected samples from Charsada and Nowshera Districts, both belonging to Khyber Pakhtunkhwa Province. Samples have a maximum concentration of Au (45ppm), Ag (20ppm), Cu (130ppm), Pb (203ppm), Zn (55ppm), Ni (699), Cr (541ppm), Co (36ppm) and Cd (6ppm). They have also noticed physical features of gold grains which are sub-rounded to well rounded, are flat, have pits and grooves on surface showing flaky and porous appearance. They conclude that gold particles are possibly derived from the distal source indicating some economic interest.

In another study of pollution load for toxic elements in the industrial estate, Gadoon Amazai, the authors report mean concentrations (mg/kg) of toxic metals: Cr (301.6), Cd (8.8), Pb (152.3), Ni (58.8), Cu (144.7), Zn (359.4) and Co (32.5) with their background values as 93.6, 6.1, 35.5, 55.9, 59.1, 116.6 and 24.1 respectively. Comparing it also with major elements, it has been concluded that toxic metals have high influence on the environment as compared to major elements.

Organizing such conferences in the political turmoil of Pakistan is a miracle. The diversified papers more on applied side is indicative that interest for traditional or pure geology is rapidly declining among young professionals. Also, there appears to be directionless research in the academies which a country like Pakistan in fact cannot afford.

The author is thankful to Dr. Muhammad Hanif for providing the photograph.

Iftikhar A. Malik



Participants in the Annual Earth Science Conference, Pakistan held at Nathia Gali, District Abbotabad.



New AAG Members

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USA 61820
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Update on Elements

Elements October 2014 issue

Cosmogenic Nuclides, the October issue of *Elements* illustrates a frontier area that is fast moving thanks to improvements in analytical instrumentation. It is interesting to see that theoretical developments in particle physics have found applications in our effort to understand today's landscapes. Guest editors Friedhelm von Blanckenburg and Jane Willenbring, together with the cast of authors they assembled, chose to illustrate how cosmogenic nuclides can help us understand Earth-surface processes. And the Toolkit article shows off the technological prowess needed to measure these rare nuclides—one atom in a million billion.

Elements August 2014 issue

Unconventional hydrocarbons, such as gas and oil shale, oil sands, and heavy oil, can now be exploited more effectively and economically. This has stimulated exploration and exploitation on a global scale and has led to a new economic and environmental landscape in energy matters. Exploiting unconventional hydrocarbons requires additional technology, energy, and capital compared to the industry standard. In this thematic issue, Guest editors David Cole and Michael Arthur address the geologic and geochemical nature of these resources and their impact on global socioeconomics and the environment.

Electronic access to *Elements*

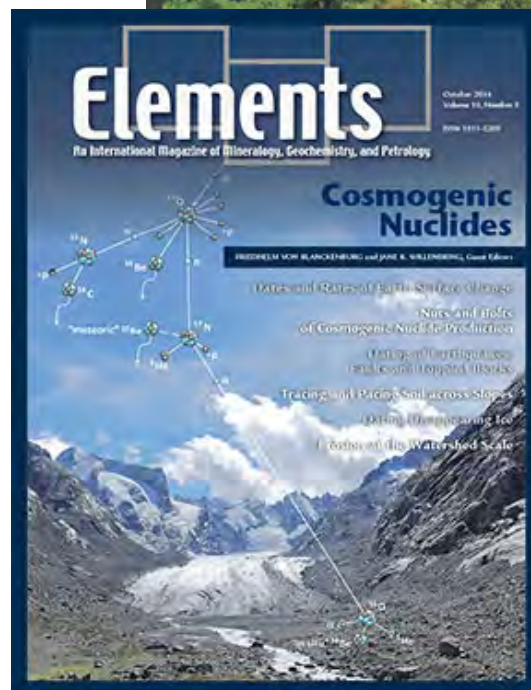
A reminder that AAG members have access to all *Elements* electronic files at <http://www.elementsmagazine.org/archives/index.html>. A new member joining the AAG will have access to all back issues of *Elements* since publication of Volume 1, Number 1. This is a real benefit of AAG membership!

When you click on a file, you will be asked for a user ID and a password:

User ID = your e-mail address

Password = your AAG membership number

Patrice de Caritat



Geochemistry Software is Free for Students

Aqueous Solutions LLC, maker of The Geochemist's Workbench® software package is distributing its sophisticated geochemistry software to university students around the world at no charge.

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The Geochemist's Workbench, the industry standard

software for geochemical modeling, is licensed by more than 3000 locations in 64 countries around the world. Recognized for its easy-to-use interface and fully integrated graphics, as well as for its powerful and reliable computing engine, the GWB makes quick work of geochemistry tasks small and large.

The software has been adopted in fields beyond geochemistry, including engineering, chemistry, microbiology, and materials science. Aqueous Solutions LLC develops and maintains GWB Student and The Geochemist's Workbench. The company, located in Champaign, IL, is also developing a software object called ChemPlugin™ designed to turn flow models into reactive transport simulators.

Visit student.GWB.com to learn more about the free GWB Student Edition.





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.

26-29 January 2015. Mineral Exploration Roundup. Vancouver BC Canada. Website: www.amebc.ca/roundup/2015

26-27 January 2015. XIII International Conference on Environmental Pollution, Public Health and Impacts. Istanbul Turkey. Website: tinyurl.com/kf556ta

27-31 January 2015. International School: The Nature of Diamonds and their use in Earth's Study. Brixen-Bressanone Italy. Website: tinyurl.com/kvybuq3

31 January-7 February 2015. 11th International Eclogite Conference. Rio San Juan Dominican Republic. Website: tinyurl.com/kb5jpy9

22-26 February 2015. 2015 European Winter Conference on Plasma Spectrochemistry. Münster Germany. Website: www.ewcps2015.org/

16-20 February 2015. 4th International Conference of Young Scientists and Experts. St. Petersburg Russia. Website: tinyurl.com/k2zkz57

1-4 March 2015. Prospectors and Developers Association of Canada Annual Convention. Toronto ON Canada. Website: www.pdac.ca/convention

16-20 March 2015. 46th Lunar and Planetary Science Conference. Woodlands TX USA. Website: tinyurl.com/kclgykw

12-17 April 2015. European Geosciences Union General Assembly. Vienna, Austria. Website: www.egu2013.eu/

14-17 April 2015. 24th International Mining Congress and Exhibition of Turkey. Antalya Turkey. Website: imcet.org.tr/defaulten.asp

20-24 April 2015. 27th International Applied Geochemistry Symposium. Tucson AZ USA. Website: www.27iags.com

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continued from page 16

3-7 May 2015. 14th European Workshop on Modern Developments & Applications in Microbeam Analysis. Portoroz Slovenia. Website: tinyurl.com/nlrfno

3-7 May 2015. Joint GAC-MAC-CGU-AGU Meeting. Montréal QC Canada. Website: ja.agu.org/2015

9-13 May 2015. Canadian Institute of Mining, Metallurgy, and Petroleum 2015 Conference & Exhibition. Montreal QC Canada. Website: convention.cim.org/

31 May-3 June 2015. AAPG 2015 Annual Convention & Exhibition. Denver CO USA. Website: tinyurl.com/khwohmm

7-13 June 2015. Applied Mineralogy & Advanced Materials - International Conference. Castellaneta Marina, Italy. Website: www.amam2015.org

14-19 June 2015. 12th International Conference on Mercury as a Global Pollutant. Jeju Korea. Website: mercury2015.com

14-19 June 2015. Catchment Science: Interactions of Hydrology, Biology & Geochemistry. Andover NH. Website: tinyurl.com/mc2y5qm

15-19 June 2015. 6th International Limnogeology Congress. Reno NV USA. Website: ilic6.org/

22 June-2 July 2015. 26th International Union of Geodesy and Geophysics General Assembly. Prague Czech Republic. Website: www.iugg2015prague.com/

21 June-26 June 2015. Isotopes 2015. Jerusalem Israel. Website: tinyurl.com/kmu8sxe

26-28 June 2015. ECROFI23 - The Sorby Conference on Fluid and Melt Inclusions. Leeds UK. Website: www.see.leeds.ac.uk/ecrofi

29 June-2 July 2015. Conference on Mathematical and Computational Issues in the Geosciences. Stanford CA USA. Website: www.siam.org/meetings/gs15/

12-16 July 2015. 13th International Conference on the Biogeochemistry of Trace Elements. Fukuoka Japan. Website: www.icobte2015.org

25-29 July 2015. Annual Meeting of the American Crystallographic Association. Philadelphia PA USA. Website: tinyurl.com/3dfn8lu

26-29 July 2015. Granulites & Granulites 2015. Windhoek Namibia. Website: tinyurl.com/qg3xrwz

26-31 July 2015. Gordon Research Conference — Chemical Oceanography 2015. Holderness NH USA. Website: tinyurl.com/os2gc35

27 July-2 August 2015. 19th INQUA Congress (Quaternary Perspectives on Climate Change, Natural Hazards and Civilization). Nagoya, Japan. Website: inquat2015.jp

8-14 August 2015. Geoanalysis 2015. Leoben, Austria. Website: geoanalysis.info

10-12 August 2015. 12th International Congress of Applied Mineralogy. Istanbul Turkey. Website: icam2015.org/

10-12 August 2015. Microscopy & Microanalysis 2015. Portland OR USA . Website: tinyurl.com/qewvuz3

10-12 August 2015. SGA 2015. Nancy France. Website: sga2015.blog.univ-lorraine.fr/

continued on page 18



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CALENDAR OF EVENTS

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16-21 August 2015. Goldschmidt 2015. Prague Czech Republic. Website: goldschmidt.info/2015/

17-20 August 2015. CANQUA 2015 Meeting. St. John's NL Canada. Website: www.canqua.com/meetings

23-28 August 2015. 29th Meeting of European Crystallographic Association. Rovinj, Croatia. Website: ecm29.ecanews.org/

13-18 September 2015. 27th International Meeting on Organic Geochemistry. Prague Czech Republic. Website: www.imog2015.org/

20-25 September 2015. 8th Hutton Symposium on Granites and Related Rocks. Florianopolis Brazil. Website: www.hutton8.com.br

21-25 September 2015. 11th meeting on Applied Isotope Geochemistry. Orléans France. Website: aig11.brgm.fr

27-30 September 2015. Society of Economic Geologists 2015 Conference: World-Class Ore Deposits: Discovery to Recovery. Hobart Australia. Website: www.seg2015.org/

1-5 November 2015. GSA 2014 Annual Meeting. Baltimore MD USA. Website: www.geosociety.org/meetings/2015

3-5 November 2015. 10th Fennoscandian Exploration and Mining. Levi Finland. Website: 10times.com/fem-levi

9-13 November 2015. Introduction to Secondary Ion Mass Spectrometry in the Earth Sciences. Potsdam Germany. Website: www.gfz-potsdam.de/SIMS/short-course

18-19 January 2016. 10th International Symposium on Environmental Geochemistry. Perth Australia. Website: www.iseg10.com/

27 August – 4 September 2016. 35th International Geological Congress. Cape Town South Africa. Website: www.35igc.org

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

Steve Amor

Geological Survey of Newfoundland and Labrador

P.O. Box 8700, St. John's NL Canada. A1B 4J6

Email: StephenAmor@gov.nl.ca

709-729-1161



FREE downloads from Geological Survey of Canada

The Geological Survey of Canada has recently published two Open Files that contain the extended abstracts from recently held workshops that may of interest to mineral explorationists. The Open Files can be downloaded for FREE from the GSC's GEOSCAN website.

1. **Application of indicator mineral methods to mineral exploration** Extended abstracts for Short Course 07 "Application of indicator mineral methods to mineral exploration" held at the 26th International Applied Geochemistry Symposium, Rotorua, NZ, November 17, 2013.

McClenaghan, M. B., Plouffe, A., and Layton-Matthews, D. (eds). 2014. Application of indicator mineral methods to mineral exploration. Geological Survey of Canada, Open File 7553, 74 p., doi:10.4095/293858.

<http://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/shorte.web&search1=R=293858>

2. **New frontiers for exploration in glaciated terrain** Extended abstracts for short course, "New frontiers for exploration in glaciated terrain" held at the Prospectors and Developers Association of Canada, Annual convention, Toronto, March 1, 2013.

Paulen, R. C. and McClenaghan, M. B. (eds). 2013. New frontiers for exploration in glaciated terrain. Geological Survey of Canada, Open File 7374, 85 p., doi:10.4095/292679.

<http://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/shorte.web&search1=R=292679>

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Meeting report

GeoMap 2014 Workshop on “Practical Aspects of Geochemical Exploration and Mapping with Logratio Techniques” held in Olomouc, Czech Republic, 16-20 June 2014

Thirty seven applied/analytical geochemists and mathematicians/statisticians from Europe, USA, and Australia met for the week-long GeoMap Workshop to present and discuss issues and recent developments relating to compositional data. On the Monday and Tuesday morning a Short Course on “Geometry and Statistics of Compositional Data”, organised by Raimon Tolosana-Delgado and attended by a dozen people, started off the proceedings. From the Tuesday afternoon to Friday, a series of themes structured around a keynote lecture each and two or three shorter presentations, followed by extensive round-table discussions, was planned. The half-day themes were: General issues (keynote lecturer: Clemens Reimann); Fractions, fractionation and multilayer data (Jennifer McKinley); Background versus anomaly detection (Antonella Buccianti); Absolute single-component mapping and uncertainty assessment (Karl Ellefsen); Identifying and mapping processes (Patrice de Caritat); and Analytical issues (Beata Walczak). Lively discussions demonstrated that there are still unresolved issues and problems specific to geochemical (compositional) data, e.g., related to data quality and logratio transformations, mapping single-component distributions, and back-transforming results to the original data space.

A balanced attendance by the geochemical and mathematical communities, ample time for both organised and informal discussions (all participants staying at the conference venue), the relatively small group allowing all to mingle and network, and the perfect organisation by

Karel Hron and his colleagues, ensured a very successful Workshop. At the end of the week, six topics requiring further consideration were identified and working groups put together to tackle these out of session and aim for future publication of their findings. Excellent and abundant catering, diverse evening activities including an organ demonstration at the St Moritz Church (whose baroque organ has no less than 8000 pipes) and a conference dinner near the 18th century Svaty Kopecek (Holy Hill) monastery overlooking Olomouc, ensured that everybody left happy in addition to intellectually stimulated.

Patrice de Caritat & Clemens Reimann



GeoMap participants in front of Svaty Kopecek monastery.

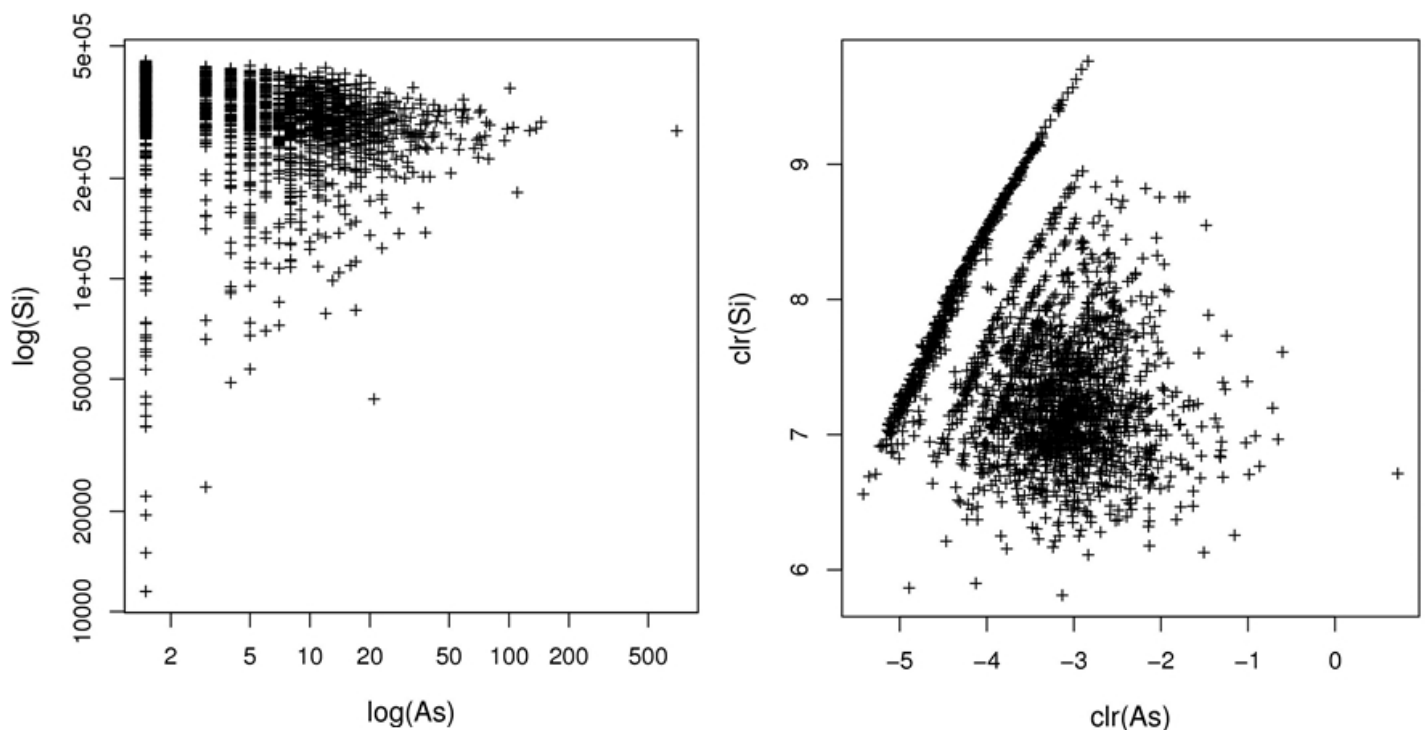


Figure 1. Scatter diagrams illustrating data quality and transformation/back-transformation issues.

AAG Social Media

Please join, like, or follow one or all of the following to keep up with the latest news from the AAG:

LinkedIn group

(<https://www.linkedin.com/groups/Association-Applied-Geochemists-6751309/about>)

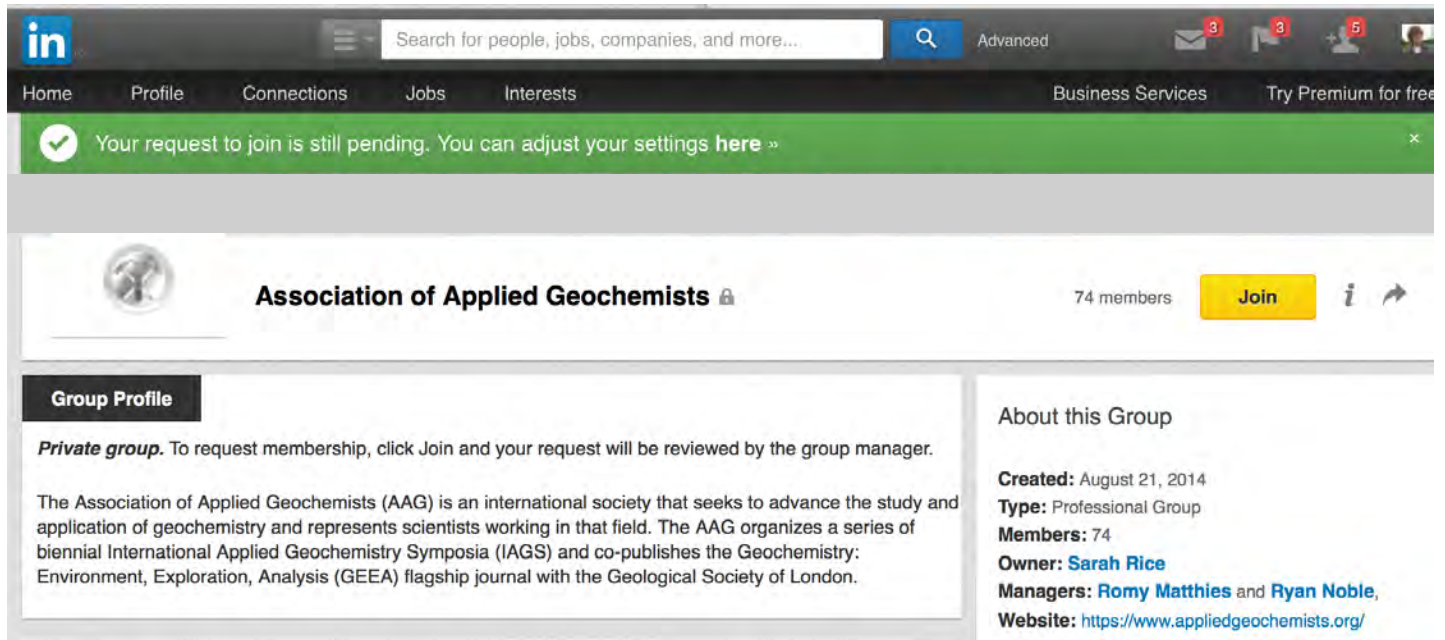
You will have to request membership, but we are quick to update and approve.

Facebook group

(<http://facebook.com/groups/932809636733324>)

Twitter feed

@aageochemists
(<https://twitter.com/AAGeochemists>)



The screenshot shows the LinkedIn profile for the "Association of Applied Geochemists" group. The profile is a private group with 74 members. A green banner at the top indicates that the user's request to join is still pending. The group description states that it is an international society that seeks to advance the study and application of geochemistry. It organizes biennial International Applied Geochemistry Symposia (IAGS) and co-publishes the Geochemistry: Environment, Exploration, Analysis (GEEA) journal. The group was created on August 21, 2014, and is managed by Sarah Rice, Romy Matthies, and Ryan Noble. The website listed is <https://www.appliedgeochemists.org/>.



From the Archives



Field trip at the Outokumpu Ni Mine, Finland after the 10th International Exploration Geochemistry Symposium in Helsinki in September 1983. Provided by Tom Molyneux.



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New Centre for Environmental Geochemistry opens in Nottingham, UK

The British Geological Survey (BGS) and the University of Nottingham have announced a new research facility, the Centre for Environmental Geochemistry. It will bring together existing facilities and groups within the two institutions to do research that can help address some of the most pressing environmental problems we face, as well as offering teaching and training. Initially the Centre will focus on applying geochemical expertise to applications within three main themes - reconstructing past environmental and climate change, the cycling of chemicals through soils and watercourses, and developing new tools to research the underground environment.

The first theme involves using geochemistry to understand and measure the environmental changes that have happened in the past over timescales from decades to millennia. This kind of science is essential to help us understand how the Earth system will respond to the unforeseen consequences of our activities - for example, how climate change will affect ecosystems or what changing land and river management practices will do to the availability of water.

Professor Melanie Leng, head of the BGS Stable Isotope Laboratory, will lead this theme, as well as becoming overall Director of the Centre and holding a chair at Nottingham. She expects to work with Dr Christopher Vane, head of the Organic Geochemistry Laboratory at BGS and a science leader within the Centre, on projects in areas from understanding ocean circulation to modelling the roles of lakes and wetlands in the carbon cycle under different climate conditions.

Research on biogeochemical cycling through the soil and waters is vital for food security and understanding changes in land use. For example, it has applications for urban farming and protecting food production systems from pollution, analysing soil mineral deficiencies that may be hampering agriculture in parts of the developing world, and applying soil-management techniques by taking into account soil conditions and other local factors. Dr Michael Watts, head of the Inorganic Geochemistry Laboratory at BGS, will lead this strand of research. The third theme, research on the subsurface environment, also has many practical applications - for instance, in finding and extracting energy in a way that's secure even over geological time spans. Research will look at improving resource estimates by simulating natural oil and gas generation in geological basins and quantifying the amount of gas that can be generated from different rocks.

The Centre has already funded PhD students and postdoctoral researchers. Leng hopes that it will eventually become a self-sustaining facility that researchers from all over the UK can turn to for geochemical expertise. As well as directing the new facility, she will continue in her previous position as Stable Isotope Laboratory manager

at BGS, which is part of the NERC Isotope Geosciences Facilities, run for the UK environmental science community.

Website: <http://www.environmentalgeochemistry.org/home.html>

Further information:
NERC media office
01793 411561
07917 557215
pressoffice@nerc.ac.uk



Special issue of Geochemistry: Exploration, Environment, Analysis

Volume 14, issue 3, August 2014 of *Geochemistry: Exploration, Environment, Analysis (GEEA)* is the second issue that is focused on the testing and application of pXRF to mineral exploration. This special issue of GEEA contains nine papers, the titles of which are listed below:

- Use and calibration of portable X-Ray fluorescence analysers: application to litho-geochemical exploration for komatiite-hosted nickel sulphide deposits
- Applicability of handheld X-Ray fluorescence spectrometry in the exploration and development of carbonatite-related niobium deposits: a case study of the Aley Carbonatite, British Columbia, Canada
- Application of portable X-ray fluorescence analysis to characterize dolerite dykes at the Plutonic Gold Mine, Western Australia
- The use of property-scale portable X-ray fluorescence data in gold exploration: advantages and limitations
- An assessment of field-portable X-ray fluorescence analysis for nickel and iron in laterite ore (New Caledonia)
- Portable XRF and wet materials: application to dredged contaminated sediments from waterways
- Spatial patterns of geochemical elements measured on rock surfaces by portable X-ray fluorescence: application to hand specimens and rock outcrops
- Vertical distribution of elements in regolith over mineral deposits and implications for mapping geochemical weak anomalies in covered areas
- Calibration of a portable X-ray fluorescence spectrometer in the analysis of archaeological samples using influence coefficients



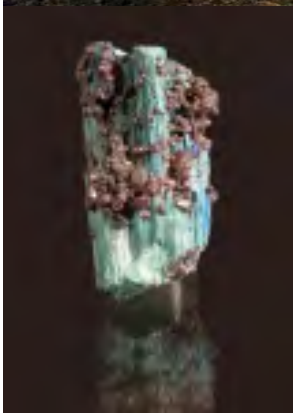


Association of Applied Geochemists 27th INTERNATIONAL APPLIED GEOCHEMISTRY SYMPOSIUM

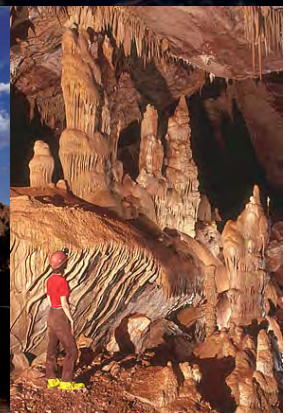


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EXPLORE

Newsletter No. 165

DECEMBER 2014

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Quarterly newsletters 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

Information for Contributors

Manuscripts should be double-spaced and submitted in digital format using Microsoft® WORD. Do NOT embed figures or tables in the text document. Each photo and/or figure (colour or black and white) should be submitted as separate high resolution tiff, jpeg or PDF (2400 resolution or better) file. Each table should be submitted as separate digital file in Microsoft® EXCEL format. All scientific/technical articles will be reviewed. All 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: http://www.geolsoc.org.uk/template.cfm?name=geea_instructions_for_authors

In addition to the technical article, authors are asked to submit a separate 250 word abstract 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**:

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