

President's Message

The 24th IAGS is now less than 12 months away and I urge members and other potential attendees, especially graduate students, to start putting pen to paper (well, finger to keyboard) on their abstracts. With the ongoing mineral exploration boom, AAG hopes to have a large contingent from industry attending the conference in New Brunswick, Canada next June. The Symposium technical program will provide a range of broad themes, from those in "classical" exploration geochemistry to environmental and other areas of applied geochemistry. The pre- and post-symposium field excursions should also attract new faces to the IAGS. Dave Lenz and the Local Organizing Committee have worked to keep costs as low as possible to encourage student participation, though delegates can opt for up-market accommodation options if they want. Further details about the Symposium are provided in this edition of EXPLORE and the AAG website. With the Symposium in mind, I would like to draw member's attention to the new set of practical guidelines for the preparation and delivery of oral and poster papers by Ian Robertson (see *AAG News* on the AAG web site).

Apart from being inundated with general geochemical consulting work, word from a few of the AAG members who are general geochemical consultants is that there is almost as much demand for training courses for company personnel. This is training in the basics – from geochemical processes in surface environments to sampling, analysis, QC and simple data analysis. A couple of short courses that I have recently run with Neil Rutherford in Beijing at CUG attracted a total of 120 students and staff.

The AAG already has a significant commitment to the educational side of the discipline. These include support

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Newsletter for the Association of Applied Geochemists

of the AAG Distinguished Lecturer (currently Kurt Kyser), the IAGS with its accompanying workshops, AAG-sponsored short courses and workshops, some lectures and the like posted on the AAG website, support for students attending symposia and the donation of journal and book collections to universities in developing countries. There are many of our more senior members who may be losing some enthusiasm for spending long periods in the field battling black flies, black snakes and black rhinos, but who are both enthusiastic and well-prepared to transfer their knowledge and experience to the next generation within industry or those universities where applied geochemistry is lacking. There is certainly scope for the AAG to expand its educational role and to act as a contact point for companies and even universities seeking the services of AAG members in delivering customized educational programs. AAG could list members on the website with the training modules that they can offer (subjects, duration, etc) and develop a repository of teaching materials that could be drawn upon.

I would like to acknowledge the ongoing work of Eion Cameron handling the AAG investments (a major source of operating funds for the Association) during this period of financial market instability and stock market upheavals. We also note Gwendy Hall's retirement from official duties with the Geological Survey of Canada but look forward to her continuing activities in the geochemical sphere. I also need to make one correction to my last letter – the Distinguished Applied Geochemist Fund will be chaired by our immediate past-president Rob Bowell.

Dave Cohen, President



The geochemistry of acid-saline waters and drainage sediments in the Avon Catchment, Western Australian Wheatbelt

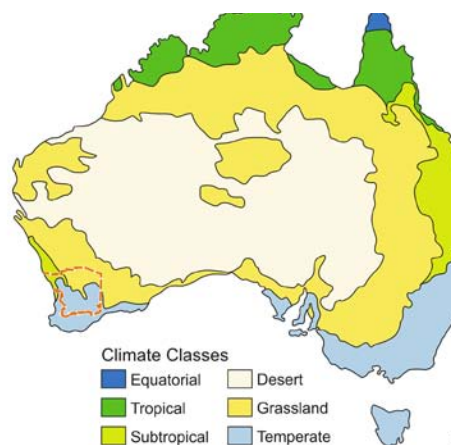


Figure 1: Location of Australian Wheatbelt east of Perth in Western Australia.

many parts of the West Australian (WA) Wheatbelt (Fig. 1). Engineering options to counter rising saline groundwaters are increasingly being adopted in the WA Wheatbelt (Clarke et al. 2002; Hatton et al. 2003).

Introduction

The relationship between native vegetation clearance and increasing groundwater and surface water salinities is well established in the semi-arid regions of Australia (Allison et al. 1990). The primary cause of dryland salinity in many parts of Australia is due to increased groundwater recharge following native vegetation clearance for annual crops and pastures. This has caused mobilisation of salt stored in the shallow regolith and/or increased groundwater discharge.

Salinisation due to rising water tables is a significant management issue in

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The geochemistry of acid-saline waters and drainage... *continued from page 1*

The adoption of engineered drainage solutions to control groundwater levels can be an effective management tool in landscapes affected by dryland salinity. However, hydrological efficiency is highly dependant on near surface regolith properties. Recently, there has been extensive state government agency and landholder interest in using deep (2-3 m) drainage systems as an option to control water table rise (Ali et al. 2004a) (Fig. 2). Over 10,000 kilometres of drains have already been constructed to protect both low-lying land from salinisation and rehabilitate marginally saline lands, and plans are already being assessed for further expansion of drainages on individual properties, and to establish regional integrated drainage systems.

Concerns have been raised by landholders, local government authorities, land management agencies and the general community (Dogramaci & Degens 2003) regarding the potential for drainage systems to discharge acidic, trace element rich waters that may impact on receiving environments. Initial investigations of some major drainage schemes found that these can discharge waters of pH 2-3 with total dissolved solids (TDS) of 30000 to 50000 mg l⁻¹ (TDS of seawater is 34600 mg l⁻¹) at 5-10 ML per day (Ali et al. 2004b).

In order to address these concerns, and provide a robust scientific basis upon which to plan drainage schemes and assess geochemical risks of acid discharge, the Engineering



Figure 2. Typical deep acidic saline drain with in the WA Wheatbelt.

Evaluation Initiative (EEI) and the Wheatbelt Drainage Evaluation Project have been commissioned as part of the WA National Action Plan for Salinity and Water Quality (NAPSWQ). Although salinity was originally assumed to be the main potential water quality problem, the realisation

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Notes from the Editor

The September issue of **EXPLORE** (No. 140) includes two articles. Paul Shand, Brad Degens, and Steve Rogers describe acid-saline waters in the Western Australian Wheatbelt. Dave Lentz provides an overview of the United Nations International Year of Planet Earth (2008). Scientific and technical editing assistance for this issue was provided by Matt Leybourne, GNS Science and Wendy Spirito, Geological Survey of Canada. Thanks to all authors and editors for their contributions. This issue also includes

detailed information about the upcoming 24th International Applied Geochemistry Symposium (IAGS 2009) that will be held in Fredericton, New Brunswick (Canada) from June 1st to June 4th, 2009. I am looking forward to getting together with AAG members and others at this meeting next year.

Future articles in upcoming issues of **EXPLORE** will include overviews of the Trinational (Canada-USA-Mexico) soil survey, transport and deposition of colloidal gold, and hydrogeochemical methods for exploration in Western Australia. AAG welcomes Thermo Scientific-Niton as a new Corporate Sponsor of **EXPLORE**. Our **advertisers** are important to **EXPLORE**; please mention seeing their special efforts on our behalf when you talk or correspond with them. For those interested in additional copies of **EXPLORE**, all past issues of **EXPLORE** are available in PDF format on the AAG website. Contributions to **EXPLORE** are welcome anytime, and guidelines for contributors are listed on the inside back page of each issue.

Recently, **EXPLORE** had an enquiry from an AAG member about the cost of mailing **EXPLORE** flat versus folded in half. Folding **EXPLORE** in half would allow it to be mailed in a smaller envelope. The cost savings in postage of the smaller envelope is considerably lessened by the cost that would be incurred to have the newsletter folded. The net savings to **EXPLORE** would only be \$63 per issue by mailing it in a smaller envelope. For now, we will continue to mail out unfolded copies. We appreciate and encourage members to continue to submit ideas or questions to **EXPLORE**.

Beth McClenaghan



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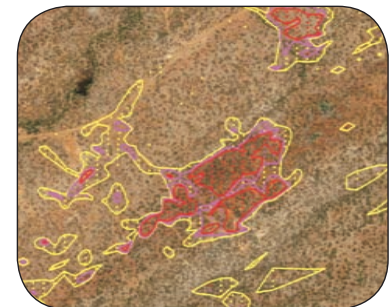
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that acidic groundwaters are common throughout the Wheatbelt (Rogers & George 2005; Shand & Degens 2007) has highlighted that acidity and mobilisation of elements, which may be toxic at high concentrations poses a significant risk. A number of projects are being managed by the Cooperative Research Centre for Landscape Environments and Mineral Exploration (CRC LEME) in collaboration with the WA State Government Department of Water, Department of Agriculture and Food and CSIRO Land and Water. The primary aim of these initiatives is to assess the geochemical risks and impacts on receiving environments of deep drainage, and to identify management options for the disposal of acidic waters. This paper outlines the main conclusions of recent investigations (Shand & Degens 2007) including an evaluation of geochemical risks in receiving environments of the Avon catchment into which deep drains discharge.

Occurrence and generation of acid waters in the Wheatbelt

Acid saline groundwaters are present over large areas of the Wheatbelt, but are more common in the east where up to 70% of groundwaters sampled have acidic pH (pH 3 – 4.5 (Fig. 3). Such groundwaters were known to occur

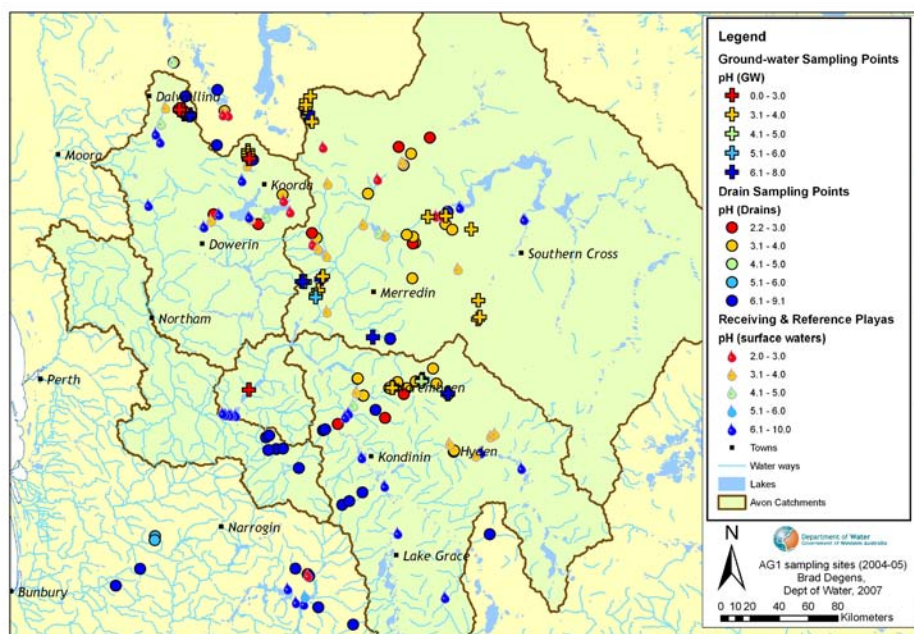


Figure 3. Locations of drain, lake and ground-water sampling sites (classified by sample pH) in the Avon catchment (from Shand & Degens 2007).

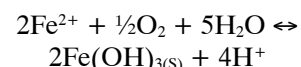
prior to the installation of drains showing that drainage is not the main cause of acidification. Acid hypersaline lakes (Fig. 4) are also a relatively common feature of the Wheatbelt, where the lakes represent strongly evaporated groundwater discharge. Acid hypersaline lakes typically occur in low-lying closed basins and in valley bottoms where they form discontinuous chains (Commander *et al.* 2002). Many of the deep drains installed in the Avon catchment of the Wheatbelt to control groundwater levels are acidic,



Figure 4. Acid hypersaline lake in the Wheatbelt near Koorda.

displaying a similar distribution to acid groundwaters (Fig. 3). The significance of increasing discharge of acidic waters for trace metal mobilisation, and the risk that this poses to aquatic ecosystems, should increasing drainage occur, has only recently been investigated (Shand & Degens 2007).

The origin of acidity in the groundwaters is not known in detail, although it is commonly believed that the oxidation of dissolved iron (Fe) plays an important role in generating acidity (Mann 1983; McArthur *et al.* 1991). This reaction may be more important at the margins of Playa Lakes and drains where reduced iron (Fe²⁺), present in Fe-rich groundwater, is oxidised to Fe³⁺, generating acidity (H⁺) in the process:



This model by itself is unlikely to explain the occurrence and preponderance of acid groundwater in many parts of the Wheatbelt, since Fe-rich waters are common in many other non-acidic areas. In addition, acidity is required (consumed) in order to dissolve iron initially by reductive dissolution of oxidised Fe, hence it is difficult to attain the low pH values of

groundwaters without an additional strong source of acidity (e.g. sulfide oxidation as found in acid mine drainage). New models are currently being developed based on fractionating alkalinity, e.g. removing alkalinity by the precipitation of calcite from stored acidity, the latter being stored and transported in the water. Such models may explain e.g. the correlation between calcrete/calcareous soils and gypsum with areas of low pH groundwater.

Geochemistry of the acid waters

Samples were collected from groundwater boreholes, drains and lakes (receiving environments) in the Avon

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The geochemistry of acid-saline waters and drainage... *continued from page 4*

catchment to assess the potential risks that the drains may impose on receiving environments. All samples were filtered in the field through 0.45 μm membrane filters and either acidified with ultrapure HNO_3 or retained unacidified and stored at 5° C, depending on the analysis performed. On-site measurements of pH, specific electrical conductance (SEC), temperature and Eh were taken at many sites (when possible). Drain/creek flow was also estimated whenever possible. The concentrations of major and minor cations and sulfate were determined by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES), and trace elements by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Anion analyses were completed using ion chromatography and colorimetry (APHA 1998).

Drain flow was highly variable (from 30 l s⁻¹ to less than 0.1 l s⁻¹) over the study area, and generally decreased with increasing age of the drain. In some cases, drains ceased to flow once the water table fell below the base of the drains. However, the impact often extended to distances greater than 200 m (Ali et al. 2004a) depending on the local geology and hydrogeology. During periods of low flow, the salinity of drain water increased and pH generally decreased.

The pH data for surface waters and groundwater

displays a bimodal distribution (Fig. 5). The pH was generally lower in the eastern Wheatbelt than in the western and central Wheatbelt, and most drains were typically saline (Fig. 5). Major element concentrations and TDS display large variations, typically over several orders of magnitude. High TDS surface waters are present in both acidic and alkaline surface waters and groundwaters (Fig. 6), although the former have much higher TDS, largely due to evaporation. Sodium displays a strong positive correlation with Cl ($r^2=0.99$) but the other major elements correlate poorly with Cl indicating gains or losses relative to seawater (Fig. 7). The surface waters in particular have low ratios of Ca, Mg and SO₄ to Cl relative to seawater consistent with removal processes such as mineral precipitation (e.g. calcite, gypsum, halite) and/or removal through redox processes (e.g., reduction of sulfate to sulfide).

Most minor and trace elements vary over several orders of magnitude. Nearly 50% of the samples have F concentrations exceeding the WHO guideline value of 1.5 mg l⁻¹ (Fig. 8). Nutrients and total organic carbon were measured only in surface waters but reached high concentrations: PO₄-P, NO₃-N, NH₄-N and TOC had maxima of 1.4, 11, 45

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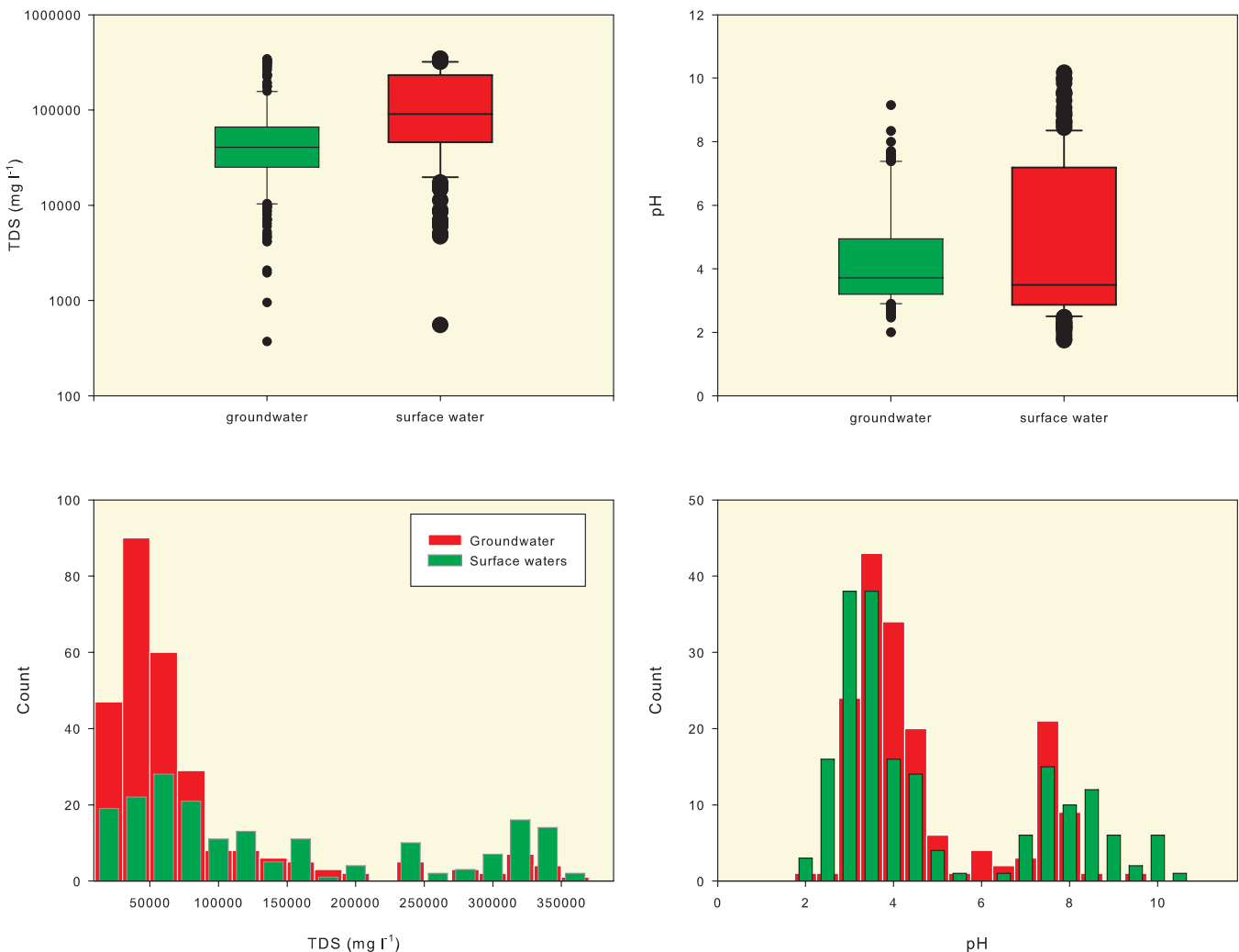


Figure 5. Boxplots (displaying median, interquartile ranges and outliers) and histograms for TDS (left) and pH (right) in surface waters and groundwaters sampled in the Avon catchment.

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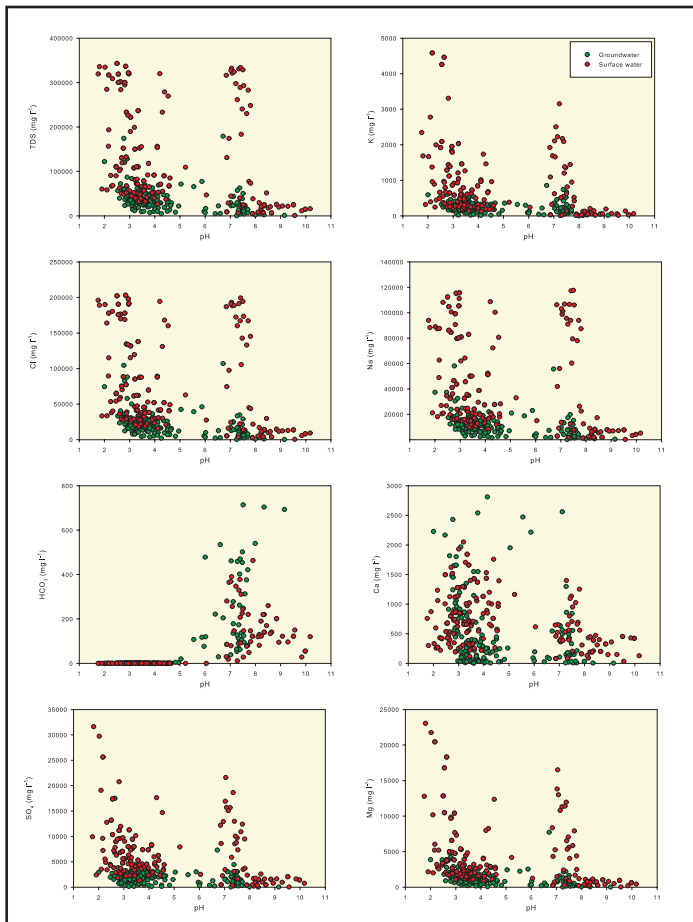


Figure 6. Relationship of TDS and major element concentrations to pH in surface waters and groundwaters of the Avon catchment.

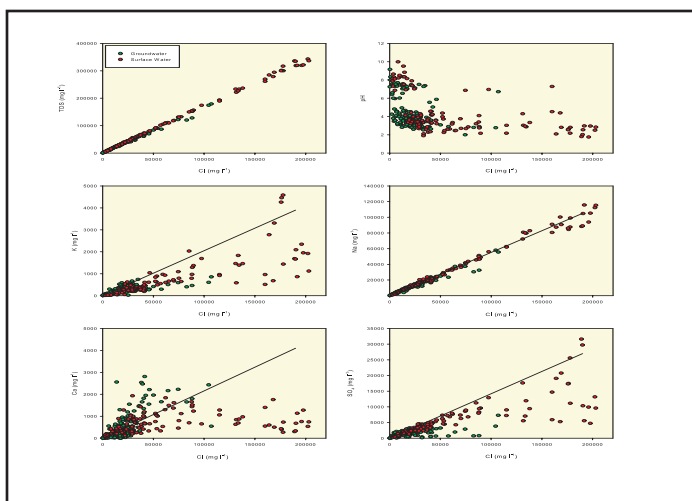


Figure 7. Relationship of TDS, pH and major element concentrations to Cl in surface waters and groundwaters of the Avon catchment. Solid line is seawater dilution line.

and 255 mg l⁻¹, respectively. The redox-sensitive elements Fe and Mn are present at high concentration in the waters, in general being higher at lower pH. Aluminium concentrations also display a wide range, reaching maximum concentrations greater than 1000 mg l⁻¹ at low

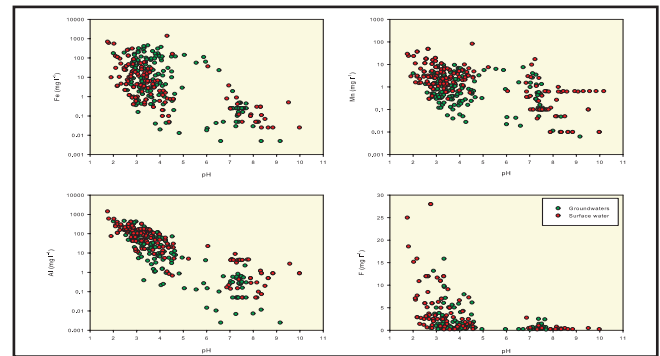


Figure 8. Concentrations of minor and trace elements in waters of the Avon catchment plotted against pH. Note log scales for Fe, Mn and Al.

pH. Many metals, including Fe and Mn are more soluble and mobile under acidic conditions (Stumm & Morgan 1996). The acid nature of both surface waters and groundwaters has allowed a number of trace elements to reach mg l⁻¹ concentrations including Co, Cr, Cu, Ni, Pb, U, Y and the rare earth elements (REE), many above national drinking water guideline values (Fig. 8). A number of elements which are rarely present in waters such as Th, Pd and Tl have elevated concentrations above typical baseline values. The concentrations of many trace elements are more typical of highly polluted waters, and much higher than those expected in non-industrial or mining areas (Nordstrom 2007; Shand & Edmunds 2008).

Geochemical processes occurring in drains

The discharge of acid groundwater to artificial drains, and subsequent reactions, has led to a complex and dynamic geochemical environment. The oxidation of reduced soluble Fe²⁺ in drains to insoluble Fe³⁺ oxy-hydroxides is commonly strikingly visible (Fig. 9) and often lead to a



Figure 9. Iron oxy-hydroxide minerals covering the base of a stream, note also the abundance of salt efflorescences adjacent to the stream caused by evaporation of capillary water. The efflorescences are generally present during summer months but are washed into the stream during rainfall periods, producing a pulse of increased salinity.

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further decrease in pH. The elements Fe and Al are pH sensitive and act as stores of acidity in solution, releasing H^+ during the precipitation of oxyhydroxide minerals by hydrolysis reactions. These minerals commonly form gels in the environment, which are efficient scavengers of trace metals (e.g., As, Cr, Sn, Th, V, Cd, Cu, Mo), but the fine colloidal nature of these materials places them at risk of being suspended and flushed from the drains even at low flow velocities. The association of the metals with the precipitates and gels is not well documented in the drains of the study area, but it is probable that these materials could act as transporting media for metals from the drains if not well managed.

A wide range of minerals actively form in the drain environment (Fitzpatrick et al. 2007). Iron sulfide minerals (pyrite and monosulfides) are commonly encountered immediately beneath the oxidised sediment surface where conditions are reducing, causing sulfate to be reduced to sulfide. The key requirements for high rates of sulfate reduction and sulfide accumulation are: (i) high concentrations of sulfate in surface water or groundwater, (ii) saturated, reducing iron-rich soils and sediments, and (iii) the availability of labile carbon to fuel microbial activity (Berner 1984). Disturbance of these sulfide-rich sediments, in particular if they form monosulfidic black oozes, in drains can lead to severe deoxygenation and acidification. (Sullivan et al. 2002).

A remarkable range of other mineral precipitates and gels were found in the drains (Table 1), indicative of the

Mineral Name	Chemical Formula
akaganéite	$Fe^{3+}O(OH, Cl)$
bassanite	$2(Ca)_2(SO_4) \cdot (H_2O)$
barite	$BaSO_4$
bischofite	$MgCl_2 \cdot 6H_2O$
bloedite	$Na_2Mg(SO_4)_2 \cdot 4H_2O$
boehmite	$AlO(OH)$
carnallite	$KMgCl_3 \cdot 6(H_2O)$
eugsterite	$Na_4Ca(SO_4)_3 \cdot 2(H_2O)$
glauberite	$Na_2Ca(SO_4)_2$
gypsum	$CaSO_4 \cdot 2(H_2O)$
halite	$NaCl$
jarosite	$KFe^{3+}(SO_4)_2(OH)_6$
lepidocrocite	$FeO(OH)$
mirabilite	$Na_2SO_4 \cdot 10(H_2O)$
natrojarosite	$Na Fe^{3+}(SO_4)_2(OH)_6$
pentahydrate	$MgSO_4 \cdot 5(H_2O)$
rozenite	$Fe^{2+}SO_4 \cdot 4(H_2O)$
schwertmannite	$Fe^{3+}_{16}O_{16}(OH)_{12}(SO_4)_2$
starkeyite	$MgSO_4 \cdot 4(H_2O)$
thenardite	$NaSO_4$

Table 1 Chemical compositions of minerals found in the drains of the Australian Wheatbelt.

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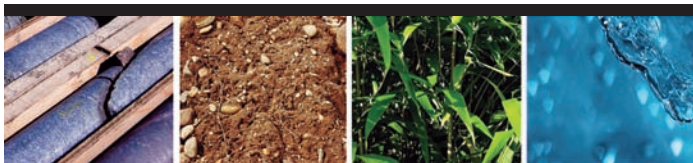
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range of geochemical conditions occurring. Bright yellow natrojarosite mottles in some of the clay-rich sulfuric horizons are indicative of acid conditions in the pH range 3.5-4. Similarly, the occurrence of orange-coloured mottles, gels and crusts are indicative of schwertmannite and akaganéite, which form from the oxidation of ferrous iron under acidic conditions in the pH range 4-5. Saline and subaqueous soils with sulfuric material may also occur in receiving lakes. Other precipitates include evaporite minerals, those being found to date in the drains and lakes include pentahydrate, starkeyite, bischofite, bassanite, carnallite, rozenite, barite, halite and gypsum in sandy sulfuric horizons with pH <3.0; natrojarosite and jarosite in clay-rich sulfuric horizons with pH 3.5-4; and eugsterite, bloedite, thenardite, glauberite, gypsum, thenardite, mirabilite, schwertmannite, lepidocrocite, akaganéite and colloidal poorly crystalline, pseudoboehmite-like (white) precipitates in sulfidic materials with pH >4-5.

The processes that give rise to the variable mineral assemblages play a major role in influencing transport of acidity and trace metals from the drains and vary with season and drain age. Furthermore, identifying the processes has enabled development of practical management options to mitigate the risks that drain discharge poses to receiving environments. In order to facilitate the transfer of information on drain and water geochemistry, an interactive web-based database has been constructed (Baker & Fitzpatrick 2005). This website incorporates a visual



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Receiving environments

Many acid drains discharge to saline sites, principally playas in the floodways of the main palaeodrainage systems (Dogramaci & Degens 2003; de Broekert & Coles 2004; Ali et al. 2004b). Acid drainage discharge to playa lakes can result in acidification of surface waters and the sediments and soils surrounding the playa lakes. However, in some cases lake waters and sediments may have been acidic prior to discharge, in which case the impacts are dependent on the magnitude of drain discharge compared with regional ground-water discharge. Concentrations of Al, Fe and trace metals including Pb, Ni, Co and U are often higher in the surface waters of sites receiving acidic drainage. This acidification and associated increased in trace metal solubility may result in impacts on aquatic ecosystems, including loss of habitat and reduced ecosystem functioning during playa lake filling events, and should form an integral part of future research in the region.

The discharge of acid drain water into alkaline waters in receiving environments allows the possibility for neutralisation of acidity. Geochemical modelling using the PHREEQC geochemical code was undertaken. This modelling indicates that the neutralisation of acidity in the drain waters in receiving environments is unlikely to occur until the volumes of alkaline waters are in the order of more than 25-99 times that of the incoming acid drainage waters. It will therefore be necessary to implement further remediation strategies in the absence of such volumes of alkaline waters being continuously available.

Management implications of acid drain water

The widespread occurrence of acid groundwaters and surface waters in the Wheatbelt containing high concentrations of potentially toxic elements requires care to be taken in managing and linking deep drains installed for salinity reduction. Drains also need to be designed and managed to minimise turbulent flow to minimise the flushing of precipitates and gels (frequently containing trace metals) and disturbance of sulfidic sediments (being a store of acidity and trace metals). In particular, entry of surface waters from catchments to the drains should be avoided without measures to contain flow velocities. Drains should also be designed to maximise hydrological residence times as the formation of precipitates will contribute to maximising retention of trace metals within the systems.

Management of trace metal mobility and acid release will need to be considered when maintenance cleaning of sediments from drains is carried out. This might include mixing with sediments from alkaline drain spoils, placement within depressions on drain spoils (allowing drying and containment but including contact with alkaline spoils) or collection and containment in a site with low risk of off-site impacts (i.e. outside of a surface water flow path).

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It is vital for all landholders, community groups, drainage contractors and local governments to be aware of the many impacts that could result from the occurrence of sulfuric materials and disturbance of sulfidic materials, as these have important consequences for environmental, engineering, economic, and quality of life perspectives. Disturbance and oxidation of sulfidic material can have negative impacts including: destruction of wetlands, acidification and deoxygenation of waterways and increased incidence of fish kills and disease, contamination of valuable groundwater resources, mobilisation and accumulation of heavy metals, corrosion and destabilisation of roads, concrete and steel infrastructure, stimulation of blooms of blue-green algae, decrease in the agricultural productivity of land, increased odour problems and increased mosquito and arbovirus incidence.

Future work

The work completed in the Avon catchment is now being extended to other parts of the Wheatbelt. Following a review of potential acid neutralisation techniques for acid drains in the Wheatbelt (Douglas & Degens 2006), pilot treatment sites have recently been established to investigate low-cost, practical treatment options for acidic drainage waters. Future research will focus on the geochemical processes and efficiency of the treatment sites. The trials will focus on simple engineering structures using either carbonate neutralisation (being the most widely available, low cost

material currently available in the Wheatbelt) or sulfate reduction systems using locally available carbon sources.

Acknowledgements

We are grateful to the following team members of the project for their scientific contributions: Andrew Baker, Grant Douglas, Rob Fitzpatrick, Richard George, David Gray, Warren Hicks, Adam Lillicap, Mark Raven and Margaret Smith.

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The United Nations International Year of Planet Earth (2008)



The United Nations International Year of Planet Earth (2008) global launch was held at UNESCO Headquarters (Paris, France) on February 12 and 13, 2008 (Fig. 1). The



Figure 1. UNESCO flag waving beside the UN headquarters "World Dome" with the Eiffel Tower in the background.

International Year of Planet Earth (IYPE) is designed to foster scientific research activities and outreach, by raising global political and public awareness of the immense, under-utilized potential of Earth sciences for improving the quality of life and safeguarding the planet. International Union of Geological Sciences (IUGS) and UNESCO are the sponsoring partners of IYPE, with all 191 UN member countries supporting the UN Resolution proclaiming the IYPE for 2008. The resolution states "The International Year of Planet Earth aims to capture people's imagination with the exciting knowledge we possess about our planet, and to see that knowledge used to make the Earth a safer, healthier and wealthier place for our children and grandchildren International Year of Planet Earth 2007-2009."

The founding patrons of IYPE are the President of Namibia, Sam Nujoma; the former President of Tanzania,



Benjamin Mkapa; the Chairman of the Board of Anglo American, Sir Mark Moody-Stuart; the former Prime Minister of the Netherlands, Ruud Lubbers; and King Carl XVI Gustaf of Sweden. By the official launch, there were approximately 70 member nations, including Canada. The ceremonies were dominantly a series of incredible speeches and theme lectures (Fig. 2), and amazing poems from young people around the world. These presentations were eclipsed by a speech by Sir Arthur C. Clarke that was definitely the highlight of the IYPE launch ceremonies. Clarke stated: "The aim of the Year is to persuade public and governments worldwide to make better use of Earth science when framing planning decisions, and by using Earth science to inform the



Figure 2. USGS Director Mark Myers presenting a talk (with a discussion panel) about the "evolution of humans" with the backdrop of a NASA composite photographic image of Earth's night sky (lit up), by far achieved by fossil fuel consumption and not considered sustainable.

public about the sustainable use of Earth resources, to make the world a healthier, wealthier and safer place in which to live."

Almost 70 countries are members of IYPE. The two main activities of IYPE are its Science and Outreach programs. Funding for projects in these 2 areas is to come from industry, foundations and governments around the world, although implementing them has mainly been at the grassroots level by volunteers. With greater than 400,000 earth scientists worldwide, the UN is hoping we have a broad-based impact. The Science Programs fall into 10 broad, societal relevant and multidisciplinary themes:

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The United Nations International Year of Planet Earth... *continued from page 12*

health, climate, groundwater, ocean, soils, deep Earth, megacities, hazards, resources, and life. Efforts also include an IYPE book on-line that has lots of "gift ideas". <http://yearofplanetearth.org>

In January 2008, I asked the AAG executive for input before I traveled as the AAG representative to the IYPE launch (Fig. 3) Here is a summary of some of the feedback I received. AAG members are actively engaged in outreach in schools, as are many other active geoscience organizations. Because AAG is an international organization, however, the impacts of the various Science components of IYPE were of most interest to us as our expertise falls in over half of the Science theme areas. Our AAG members plan on



Figure 3. Dave Lentz, the AAG representative at the United Nations International Year of Planet Earth (2008) global launch at UNESCO Headquarters (Paris, France) on February 12 and 13, 2008.

being engaged in them all from grassroots efforts through to lobbying industry and governments, particularly on issues pertaining to world health and poverty. These efforts can be achieved by encouraging the broad-based application of environmental and exploration geochemistry. As major proponents of detailed regional geochemical mapping, all AAG members know we can help to identify areas where potentially toxic elements can negatively impact health, where one can see the effect of industrial or natural pollution and perhaps link it to health problems, particularly cancers and malnutrition; however, this occurs only where geochemical data are available for epidemiological studies. Numerous cases exist where surveys have led to awareness of health problems related to a wide variety of heavy metals. The FOREGS Geochemical Baseline Mapping Program for sediment, water, and soil recognized and addresses these issues by doing the research, building the protocols, and then building the databases covering much of Europe. IUGS-IAGC's Working Group on Global Geochemical Baselines is also contributing to this important effort; there are numerous websites that detail these baseline studies and method development, and that determine protocols for sampling through to analysis. In 2006, the North American Soil Geochemical Landscapes Project was initiated and represents a comprehensive tri-national soil sampling effort involving multiple agencies; they have a special session at the

IAGS 2009.

As we know, these same regional geochemical databases and maps catalyze mineral exploration and, in rare cases, may result in mine development, which can have a major impact on poverty. Recently published statistics from northern Ontario (Canada) quantify the huge economic impact mining has had in generating wealth. Having just spent a few weeks in Mali at a gold mine, I saw that this impact was overtly evident; this year alone yielded profits to the government of approximately 80 million dollars. Mali is considered to be one of the five poorest countries in the world, with >60% of its population earning less than \$1 USD per day. Much of the Mali's government funds are spent on health and clean water development.

Dr. Olle Selinus (Geological Survey of Sweden) has long been working on issues related to world health and poverty, in Sweden and around the Third World. For some time, Ollie's group has been focused on medical geology in developing nations. The International Medical Geology Association (IMGA) is focused on these issues; many AAG members are actively engaged in this field too, where the lines between disciplines fade to white. Presently, the IMGA is developing a web-based education package for general use.

Public awareness will lead to government attention, which is what is needed. In Canada for example, the Canadian International Development Agency (CIDA) does not generally support these types of programs, even though the long term impacts are known to be high. CIDA's focus in Mali is on clean drinking water and health too, but to many they do not see the commonality of these strategies.

AAG has a very engaged membership. There is a lot of volunteer work ahead of us to make the level of impact that only we can bring to the world. A major grassroots effort focused on public understanding through to motivating government leadership and participation is needed, as we have seen with the British Geological Survey and Swedish Geological Survey. We really can change the world, if we really want to.

More information about the United Nations International Year of Planet Earth (2008) is available on the following website: <http://yearoftheplanetearth.org>.

David Lentz

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24TH INTERNATIONAL APPLIED GEOCHEMISTRY SYMPOSIUM (IAGS 2009)

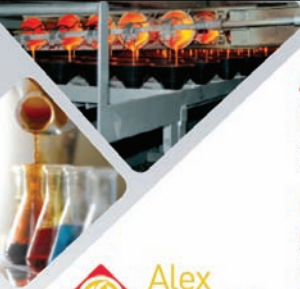
WELCOME

The 24th International Applied Geochemistry Symposium (**IAGS 2009**) is the Association of Applied Geochemists (AAG) biennial meeting, which will be held in Fredericton (New Brunswick, Canada) on the campus of the University of New Brunswick **Monday June 1st to Thursday June 4th, 2009**. This biennial AAG meeting is co-sponsored by the *International Association of GeoChemistry (IAGC)* and the *International Association of GeoAnalysts (IAG)* and includes the *North Atlantic Minerals Symposium (NAMS)*. The symposium will be preceded by 5 professional development workshops on Sunday, May 31st. There will be 3 pre-meeting field trips (Wednesday May 27 to Saturday May 30th) and 3 post-meeting field trips (Friday June 5th to Monday June 8th) throughout Atlantic Canada. The trips will leave from and return to Fredericton. The symposium is jointly organized by geoscientists from the *University of New Brunswick (UNB)*, *New Brunswick Department of Natural Resources*, *New Brunswick Research and Productivity Council*, *New Brunswick Department of the Environment*, and professionals drawn from the consulting engineering and mineral exploration industry in New Brunswick, in conjunction with a professional conference organizer (PCO).

TECHNICAL PROGRAM

The technical program of the symposium will run 4 days and will include 2 separate morning ½ day Plenary Sessions (1 Mineral Exploration oriented and the 2nd Environmentally oriented) that will feature a keynote speaker and will not overlap with other sessions. The remaining days will have ½ day sessions with 15-minute presentations. Tuesday afternoon will feature 5-minute oral presentations (4 slide) for the poster presenters.

An extended abstract volume will be produced with a format for each paper of 2-4 pages, a 200 word short abstract, figures, tables, acknowledgements, and references in a Microsoft Word document. An example of the submission format will be available on the IAGS 2009 website soon.



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These extended abstracts will be printed in a volume and reproduced on CD-ROM; student registrants will only receive the CD-ROM. Both the book and CD-ROM will be included in the normal registration package. The co-chairs will be involved with the scientific and technical editing of these extended abstracts, with the help of the Technical Program Chairs, Drs. Kay Thorne (NB DNR-Minerals) and David Keighley (UNB).

Abstracts will be accepted starting January 15th, 2009. Submission will be by email to: dlentz@unb.ca. **The final deadline for extended abstracts is February 15th, 2009**

PLENARY SESSION IN HONOUR OF PROFESSOR GERRY GOVETT

Deep Search Geochemical Exploration Methods

Chair: *Wayne Goodfellow (Geological Survey of Canada)*

Dr. Gerry Govett is one of the pioneers in the development and testing of new and improved methods of detecting ore deposits buried at depth in the Earth's crust. As leader of the Exploration Geochemistry Group at the University of New Brunswick (UNB), Professor Govett led a team of researchers and graduate students focused on primary halos associated with massive sulphide deposits, the electrochemical dispersion of elements in soils overlying buried deposits, and the mathematical processing of geochemical data to discern trends related to mineralized sources.

With the return of the 24th International Applied Geochemical Symposium (IAGS) to Canada in 2009, a plenary one-day session has been planned to recognize Dr. Govett's early contributions to the development of deep search geochemical methods. The focus on deeply penetrating methods recognizes the increasing need to replenish the declining base metal reserves of major mining camps in Canada and indeed elsewhere in the world, and the need for more effective geochemical methods of detecting deposits concealed beneath thick glacial sediment or at depth within rock sequences. The session will consist of talks and posters on a range of topics related to deep exploration. These include primary mineralogical and geochemical vectors to ore such as hydrothermal alteration and dispersion of elements and isotopes from vents in the case of seafloor hydrothermal deposits; secondary vectors related to mineral and element dispersion by a number of processes such as glaciation, ground and surface water transport and deposition of metals and tracer isotopes; the upward migration of elements into soils by advective or electrochemical mechanisms; novel methods employing breakthroughs in analytical technology; and 3D GIS visualization and interpretation of prospective ore horizons and related primary vectors. The objective of this session is to present recent advancements in deep search methods. The oral program will consist of both invited speakers to cover the major themes and unsolicited presenters on the major topics. Each talk will consist of 20 minutes except for invited talks where 30 minutes will be allocated. The poster session will compliment the oral program and offers a venue for innovative research on this subject to be presented and discussed.

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24th International Applied Geochemistry Symposium... *continued from page 14*

SPECIAL SESSIONS

New Frontiers for Exploration in Glaciated Terrain

CoChairs: *Beth McClenaghan (Geological Survey of Canada), Roger Paulen (Alberta Geological Survey), Bill Coker and Chris Benn (BHP Billiton)*

Since the discovery of economic diamond deposits in northern Canada in the 1990s, the application of indicator mineral methods has been expanding to include a broader spectrum of commodities including base metals and uranium. The application of till geochemistry continues to be an important part of the drift exploration methodology. The session will highlight recent developments in indicator mineral and till geochemistry methods as well as recent case histories for diamonds, base metals, gold, PGE and uranium.

Applied Geochemistry of Geological Storage of CO₂

Cochairs: *William D. Gunter & Ernie H. Perkins (Honorary Cochair: Brian Hitchon)*

The United States, the European Union, Australia and Canada are all pursuing Carbon Capture and Storage (CCS) demonstration projects as a option for reducing GHG emissions from usage of fossil fuel at large Final Emitters (LFEs). Currently in Canada, CCS is being considered by Alberta, Saskatchewan and Nova Scotia. A critical part of CCS is the geological storage of the CO₂. This involves finding a secure geological site in depleted oil and gas reservoirs or deep saline aquifers. An unusual facet of geological storage is that the containment of the CO₂ in

the storage reservoir becomes more secure with time due to geochemical reactions where the CO₂ may potentially dissolve in the formation water and react with the formation minerals neutralizing the carbonic acid and precipitating carbonate minerals. There are two time scales involved, (i) the short operational time scale (10s of years) when CO₂ is being actively injected into the reservoir and (ii) the long geochemical time scale, post closure after injection has ceased, when water – rock reactions are most active (100s to 1000s of years). Verification of geochemical trapping of CO₂ is difficult given the long time scales involved. This session will be devoted to addressing this issue through experimental, natural analogues, industrial analogues and numerical simulation.

Applied Geomicrobiology: New Frontiers in Exploration and Environmental Geomicrobiology

Cochairs: *Christopher Weisener (U. Windsor), David A. Fowle (U. Kansas)*

This forum will address aspects of applied geomicrobiology, specifically the role of microbes on elemental cycling in near-surface environments. The focus of the session will include topics related to: microbial transformations in mine settings, metal sequestration and mobilization associated with ore deposits, bioremediation and augmentation, isotopic, molecular and new methods in applied geomicrobiology.

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24th International Applied Geochemistry Symposium... *continued from page 14*

Mine Waste Characterization: State of the Practice, Problems, and Future Directions

Cochairs: *David Bird (Colorado Division of Reclamation, Mining & Safety, DNR), James Ranville, (Colorado School of Mines), Ronald Schmiernund (Economic & Environmental Geochemistry Inc.)*

Predicting long-term environmental impacts from mining wastes at hard rock metal mining sites is an increasingly necessary component of the permitting and financing processes. In addition, there are escalating demands for minimal long-term water treatment, environmentally-acceptable pit lakes and chemically stable waste dumps and tailings storage facilities. The current boom is putting intense pressure on the industry to meet these challenges and the consequences of failure are becoming increasingly high-profile with attendant global corporate liabilities. Unfortunately, accurate predictions of waste behavior have generally been difficult to obtain, and ideal "walk-away" closures in most cases remain elusive.

The understanding of acid rock drainage and associated processes must be considered relatively sophisticated, albeit incomplete. However, understanding appears to be disproportionately great relative to success in prediction and prevention. In part, this under-achievement stems from a failure to thoroughly integrate, in a timely fashion, waste characterization programs with economic geology, environmental baselines, mine planning and development in addition to the prevailing regulatory requirements. In part, the shortcomings of the available predictive tools and techniques are contributors to the problem.

This session will explore the state of the practice of mine waste characterization and its place in the overall creation of a modern mine. Lessons learned from the past will be considered, and how those lessons can be applied to improving methodologies, and the interpretation of the data derived from the existing methodologies. Papers will be sought in the following areas: Evaluations of overall success/failure of previous efforts, Corporate programs and perspectives for integrating waste characterization, Multi-national case studies of projects with lessons learned, State-of-the art analytical, simulation and modeling tools.

NORTH ATLANTIC MINERALS SYMPOSIUM (6th)

Cochairs: *Andrew Kerr (Geological Survey of Newfoundland and Labrador), Gerry Stanley (Geological Survey of Ireland), Lawrence Winter (Altius Minerals Corporation)*

The NAMS concept is intended to bring together representatives of industry, government geoscience, and university research who share a common interest in the geology and mineral potential of the North Atlantic region. This focus is defined loosely to include eastern North America and western Europe, adjacent northern lands, and Atlantic islands. NAMS seeks reviews and ideas connected to the regional and district metallogeny of these regions, exploration and research case studies of all types, and also wider conceptual contributions related to metallogeny that are applicable in the region. In the wider context of this conference, contributions related to the use of applied

geochemical techniques in the North Atlantic exploration environment are also welcome. The North Atlantic Minerals Symposium (NAMS) is a joint initiative of the Geological Survey of Ireland and the Geological Survey of Newfoundland and Labrador (Canada).

GENERAL SESSIONS

- Classic mining districts: exploration and environmental geochemistry in the shadow of headframes
- Mapping Geochemical Data
- Geochemistry in the industry sector: exploration and environmental applications.
- Recent & Classic Exploration Case Studies
- Ore Deposit-Forming Systems: A Geochemical Perspective
- Biogeochemistry
- Data management, Statistical Analysis, and Interpretation
- Lithogeochemical Applications
- Analytical Geochemistry: rocks, regolith, soils, organics, water, and air
- Geochemistry in the Government Sector: exploration and environmental applications
- Geochemistry and Health
- Geochemical Aspects of Mine Waste
- Applied Mineral-Chemical Interactions
- New technologies in Geochemical Exploration to Waste Management
- Remote Sensing and Petrophysics

POSTERS

The Local Organizing Committee will supply a poster boards (dimensions to follow shortly). Velcro will be provided to attach posters. The authors should also prepare some 11" by 17" or 8.5" by 14" copies of their poster to hand out to interested delegates. On Tuesday afternoon, authors will have the opportunity to present (4 slide ppt) for 5 minutes on their topic.

For the convenience of the delegates, posters may be printed by the Organization at a cost of \$125 Cdn. Those delegates interested should send to the Congress secretariat before May 1st, 2009 in a pdf (containing a page with the final dimensions, within the established limits) and it will be printed and placed on the Congress boards.

SUBMISSION OF EXTENDED ABSTRACTS AND PAPERS

Extended abstracts should be sent to dlentz@unb.ca as a single e-mail attachment, saved as a Microsoft Word document, using the extended abstract template, with figures and tables embedded in the document. Format guidelines for the abstracts are available at *Geochemistry: Exploration, Environment, Analysis* (GEEA) "Instructions to Authors", at the website listed below.

http://www.geolsoc.org.uk/template.cfm?name=journals_geea_home_page

Papers from the conference proceedings will be published in "*Geochemistry: Exploration, Environment, Analysis*" (GEEA), produced jointly by the Association of Applied

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24th International Applied Geochemistry Symposium... *continued from page 16*

Geochemists and the Geological Society of London. Manuscripts, indicating '24th IAGS', should be submitted by September 30, 2009 to: Marcia Scrimgeour, Editorial Office Manager, *Geochemistry: Exploration, Environment, Analysis*, P.O. Box 26099, 72 Robertson Road, Nepean, Ontario, K2H 9R0, CANADA. Email: geea@sympatico.ca

STUDENT BURSARIES FOR TRAVEL

A limited number of bursaries will be available to students to assist with travel to the conference. Information and application forms will be posted on the symposium website shortly.

IMPORTANT DATES

- **January 15, 2009:** Start of submission of Extended Abstracts
- **February 15, 2009:** Deadline for submission of Extended Abstracts
- **March 25, 2009:** Deadline for student bursary applications
- **April 10, 2009:** Deadline to inform the students if their applications to the Student Travel Bursary have been successful
- **April 2nd, 2009:** Deadline to inform authors of their acceptance (oral or poster)
- **April 30, 2009:** Deadline for Early-bird registration, a surcharge of 50\$ will be levied thereafter, and field trips will be decided. **All authors of extended abstracts must register by this date, or they will be removed from the program.**
- **September 30, 2009:** Deadline for submission of papers to *Geochemistry: Exploration, Environment, Analysis* for the Proceedings Special Issue

CONTACT US

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email: dlentz@unb.ca

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The Association of Applied Geochemists

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2008 AAG

Student
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SGS

The AAG is calling for nominations for the 17th biennial Student Paper Competition. The paper must address an aspect of exploration geochemistry or environmental geochemistry related to mineral exploration and represent research performed as a student. The student must be the principal author and the paper must have been published in *Geochemistry: Exploration, Environment, Analysis* no more than three years after completion of the degree. A nomination may be made by anyone familiar with the work of the student.

**Deadline for receipt of nominations is
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The winner will receive:

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Nominations and a digital copy of the paper should be sent to:

Dr David Cohen
Chair, Student Paper Competition
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The University of New South Wales
UNSW NSW 2052
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The results of the 2008 competition will be announced at the 24th IAGS in mid 2009.

Further details are available from the chair of the committee or the AAG Students' page at <http://www.appliedgeochemists.org/>



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

2008

- September 8-10, 2008, 9th International Congress for Applied Mineralogy, Brisbane, Australia. Website: <http://www/icom2008.com>
- September 14–18, 2008, 5th International Conference on Uranium Mining and Hydrogeology. Freiberg, Germany. Website: URL: <http://www.geo.tu-freiberg.de/umh>
- September 15-20, 2008. Association of Environmental and Engineering Geologists 51st Annual Meeting, New Orleans, Louisiana USA. Website: <http://www.aegweb.org/i4a/pages/index.cfm?pageid=3836>
- October 2-3, 2008. 2008 NGWA/U.S. EPA Remediation of Abandoned Mine Lands Conference. Denver, USA. Website: www.ngwa.org/DEVELOPMENT/conferences/details/08100025109.aspx
- October 5-8, 2008. Geological Society of America Annual Meeting, Houston, Texas, USA. Website: www.geosociety.org/meetings/index.htm
- October 27-29, 2008. Exploration on the Edge. ARC Centre of Excellence in Ore Deposits (CODES), Hobart, Tasmania. Website: <http://fcms.its.utas.edu.au/scieng/codes/index.asp>

- October 27-November 7, 2008. Ore Deposit Models and Exploration Strategies. ARC Centre of Excellence in Ore Deposits (CODES), Hobart, Tasmania. Website: <http://fcms.its.utas.edu.au/scieng/codes/cpage.asp?lCpageID=55>
- November 4–6 2008. 22nd Colloquium of African Geology and 13th Conference of the Geological Society of Africa. Hammamet, Tunisia. E-mail: afric2008@gmail.com
- November 14-20, 2008, Exploration & Mining Geochemistry International Workshop, Perth, Western Australia. Website www.ioglobal.net.
- December 3-12, 2008. Modular Course in Exploration Geochemistry. Sudbury, Ontario, Canada. Email: spiercey@laurentian.ca. Website: <http://earthsciences.laurentian.ca>.
- December 15-19, 2008. American Geophysical Union Fall Meeting. San Francisco, USA. Website: www.agu.org/meetings/fm08/

2009

- January 26-29, 2009 Mineral Exploration Roundup 2009. Vancouver, B.C. Canada. Website: <http://www.amebc.ca/roundupoverview.htm>
- March, 2009. Ore Deposits of South America. ARC Centre of Excellence in Ore Deposits (CODES), Hobart, Tasmania. Website: <http://www.fcms.its.utas.edu.au/scieng/codes/cpage.asp?lCpageID=55>

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CALENDAR OF EVENTS

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- March 1-4, 2009. Prospectors and Developers Association of Canada Annual Convention, Toronto, Canada. Website: <http://http://www.pdac.ca>
- May 24 - 27, 2009. Geological Association of Canada/ Mineralogical Association of Canada Annual Meeting Toronto, Canada. Website: <http://www.gac.ca/activities/index.php>
- June, 2009. Ore Deposit Geochemistry, Hydrology and Geochronology. ARC Centre of Excellence in Ore Deposits (CODES), Hobart, Tasmania. Website: <http://www.fcms.its.utas.edu.au/scieng/codes/cpage.asp?lCpageID=55>
- June 1 - 4, 2009. 24th International Applied Geochemistry Symposium, Fredericton, New Brunswick, Canada Website: <http://www.unb.ca/conferences/IAGS2009>
- June 22 - 26, 2009. Goldschmidt 2009. Davos, Switzerland. Website: <http://www.goldschmidt2009.org>
- August 17-20, 2009. Society for Geology Applied to Mineral Deposits 10th Biennial Meeting, Townsville, Australia. Email: SGA2009@jcu.edu.au
- September 7-11, 2009. Geoanalysis 2009. Drakensberg Region, South Africa. Website: <http://geoanalysis2009.org.za>
- September 21-26, 2009. Association of Environmental and Engineering Geologists 52nd ANNUAL MEETING, Lake Tahoe, USA. Website: <http://www.aegweb.org/i4a/pages/Index.cfm?pageID=3696>
- October 18-21, 2009. Geological Society of America Annual Meeting. Portland, Oregon, USA. Website: www.geosociety.org/meetings/index.htm

2010

- April, 2010. 27th Society for Environmental Geochemistry and Health, European Conference, Galway, Ireland. Website: <http://www.nuigalway.ie/segh2010/>
- May, 2010. Geological Association of Canada/ Mineralogical Association of Canada Annual Meeting Calgary, Canada. Website: <http://www.gac.ca/activities/index.php>
- July 14-18, 2010. Goldschmidt 2010. Knoxville, USA. Website: www.geochemsoc.org/news/conferencelinks/

- October 31-November 3, 2010. Geological Society of America Annual Meeting. Denver, Colorado, USA. Website: www.geosociety.org/meetings/index.htm

2012

- August 5–15, 2012. 34th International Geological Congress, Brisbane, Australia. Website: <http://www.ga.gov.au/igc2012>
- 2012. Geoanalysis 2012. Brazil

Please let this column know of your events by sending details to:

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613-992-7805



Mineral Exploration Roundup 2009 Short Course

January 26 to January 29, 2009
Vancouver, British Columbia, CANADA
Website: <http://www.amebc.ca/default.htm>

Sources and Sinks in Hydrothermal Systems

Presented by AME BC, Dick Tosdal, Stephen Cox, Mike Leshner, Kurt Kyser, Peter Hollings, Wayne Goodfellow
Date: January 24-25, 2009

Overview:

Ore deposits require a source of fluids, ligands, and metals as well as a transport system and sink for precipitation in economic concentration. These involve the interplay between magmatic activity, basin development, and tectonics. Understanding the scale of those systems and recognizing where within a paleohydrothermal system one might be can provide important vectors toward undiscovered resources.

This 2-day course will examine the sources and sinks of hydrothermal deposits. The course is aimed at mineral exploration, government, academic and student geologists, and provides an opportunity to meet and exchange data and views with leading researchers in the field.



RECENT PAPERS

This list comprises titles that have appeared in major publications since the compilation in **EXPLORE** Number 139. Journals routinely covered and abbreviations used are as follows: Economic Geology (EG); *Geochimica et Cosmochimica Acta* (GCA); the USGS Circular (USGS Cir); and Open File Report (USGS OFR); Geological Survey of Canada papers (GSC paper) and Open File Report (GSC OFR); Bulletin of the Canadian Institute of Mining and Metallurgy (CIM Bull.); Transactions of Institute of Mining and Metallurgy, Section B: Applied Earth Sciences (Trans. IMM). Publications less frequently cited are identified in full. Compiled by L. Graham Closs, Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO 80401-1887, Chairman AEG Bibliography Committee. Please send new references to Dr. Closs, not to **EXPLORE**.

Albanese, S., 2008. Evaluation of the bioavailability of potentially harmful elements in urban soils through ammonium acetate-EDTA extraction: a case study in southern Italy. *in* *Geochemistry: Exploration, Environment, Analysis*: 8(1): 49-57.

Arcos, D., et al., 2008. Geochemical modeling of the weathering zone of the "Mina Fe" U deposit Spain: A natural analogue for unclear spent fuel alteration and stability processes in radwaste disposal. *Applied Geochem.* 23(4): 807-821.

Armienta, M.A., et al., 2008. Arsenic distribution in mesquite (*Prosopis laevigata*) and huizache (*Acarcia farnesiana*) in the Zimapan mining area, Mexico. *in* *Geochemistry: Exploration, Environment, Analysis* 8(2): 191-198.

Modular Course in Exploration Geochemistry

Date: December 3-12, 2008.

Location:

Laurentian University, Sudbury, Ontario, Canada.

Information: Dr. Steve Piercy,

Mineral Exploration Research Centre,

Department of Earth Sciences,

Laurentian University,

Willet Green Miller Centre,

933 Ramsey Lake Road,

Sudbury, ON, Canada, P3E 2C6;

tel. +1.705.675.1151 x4595; fax +1.705.675.4898;

e-mail: spiercy@laurentian.ca;

website: <http://earthsciences.laurentian.ca>

Astrom, M.E., et al., 2008. Niobium in boreal stream waters and brackish-water sediments. *in* (2): 139-148.

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I, _____, wish to apply for election as a ___Member / ___Student Member of the Association of Applied Geochemists. I have read the Code of Ethics of the Association and in the event of being elected a Member/ Student Member agree to honour and abide by them.

MEMBER: *State Employer and Employee title*

I am actively engaged in scientific or technological work related to applied geochemistry exploration and have been so for the past two years.

_____ as a _____
 (employer) (employment title)

STUDENT MEMBER: *Student status must be verified by a Professor of your institution or a Fellow of the AAG*

I certify that the applicant is a full-time student at _____ in pure or applied science.
 (institution)

 (Professor/ AAG Fellow Signature) (Printed Name and Title)

Witness my hand this _____ day of _____, 20_____.

 (Signature of applicant)

NAME AND ADDRESS: PLEASE PRINT (to be completed by applicant)

Name: _____ Telephone bus: _____
 Address: _____ fax: _____
 _____ home: _____
 _____ e-mail: _____

Annual Dues :

All applications must be accompanied by annual dues. All payments must be in US funds. Select one of the four listed below.

1	2008 member dues	US\$	100	_____
2	2008 student member dues		10	_____
	- If receipt required, include a self-addressed envelope and add		2	_____
	- If your check is not drawn from a U.S.A. or Canadian bank, add		15	_____
			TOTAL	_____

Payment by check, International Money Order, UNESCO Coupons, International Postal Orders, VISA, American Express and Master Card are acceptable. For credit cards users, minor variations in your billing may reflect currency exchange rate fluctuations at time of bank transaction.

Type: VISA ___ American Express ___ Master Card ___ Credit card account number: _____
 Exp. date: _____ Name: _____ Signature: _____

***Application for voting membership (Fellow) requires the sponsorship of three voting members. Request a voting member application from the Association office.**

Please note: Your application form will be acknowledged upon receipt. The Admissions Committee reviews all applications and submits recommendations to Council, who will review these recommendations at the next Council Meeting or by correspondence. If no objection is raised the names, addresses and positions of candidates will be listed in the next issue of the AAG Newsletter. If after a minimum of 60 days have elapsed following submission of candidate information to the membership no signed letters objecting to candidates admission are received by the Secretary of the Association from any Member, the Candidate shall be deemed elected, subject to the receipt by the Association of payment of required dues. Send completed application, together with annual dues to:

Association of Applied Geochemists
P.O. Box 26099, 72 Robertson Road, Ottawa, Ontario, CANADA K2H 9R0
 TEL: (613) 828-0199, FAX: (613) 828-9288, email: office@appliedgeochemists.org WEBSITE: http://www.appliedgeochemists.org

High Resolution Remote Sensing

The Annual General Meeting
of the
Geological Remote Sensing Group (GRSG)
10-11 December 2008
Burlington House, Piccadilly, London

Call for Papers

The theme of the GRSG Annual General Meeting is '*High Resolution Remote Sensing*' and will feature presentations on the geoscientific applications of high spatial and spectral remote sensing. Papers are being solicited on the following topics;

- New sensors and data (eg IKONOS, Quickbird, Worldview, GeoEye)
- Earth viewers (eg Google Earth, Microsoft Virtual Earth)
- Field spectrometers, core, downhole, and ore sorting
- Digital elevation model options and applications
- Hyperspectral surveys and scanners
- Mineral and petroleum Exploration
- Environmental and geohazards
- Possible fieldtrip/workshop

To present a talk on any of the topics listed above please submit a title and abstract of less than 300 words to the GRSG Chairman

Dan Taranik at dtaranik@angloamerican.co.uk



EXPLORE

Newsletter No. 140

SEPTEMBER 2008

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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

Manuscripts should be double-spaced and submitted in digital format using WORD. Photos and figures (colour or black and white) should be submitted as separate digital files and as high resolution jpeg or PDF files. Tables should be submitted as separate digital files in 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

Submissions should be sent to:

Beth McClenaghan, Geological Survey of Canada, 601 Booth Street, Ottawa, ON, CANADA K1A 0E8 Email: bmcclena@nrca.gc.ca

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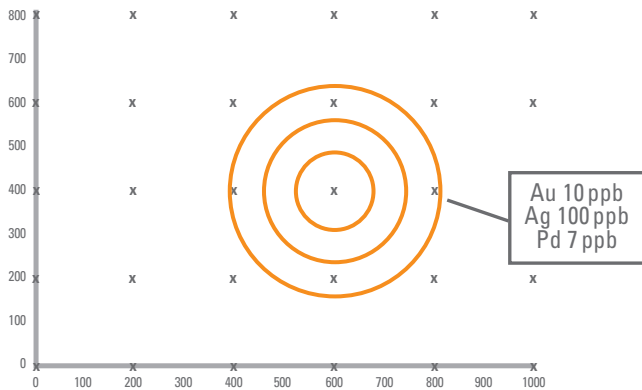
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