



President's Message



Rob Bowell

A new year always seems to bring some changes. For the AAG this is no different and following nominations and voting I am pleased to announce that we have four new councillors who will represent the association of the next two years. Firstly I would like to thank the outgoing members of council, Robert Eppinger, David Seneshen, Phil Baker and Alan Kelly for all their support and service over the last two years. Also I would like to thank Bob Clark and Tom Molyneux who were unsuccessful in their nominations for council. Without the enthusiastic support of members like these we would not be so active; so many thanks for your offer of service.

Finally I would like to welcome as new (and in some cases, returning) members of council; Olle Selinus, Jorge Loredó, Elizabeth Bailey, Stephen Cook and Chris Oates. I look forward to working with them and all of council to develop and lead the association forward.

As we look towards the New Year the association will be active in several areas, firstly plans for the 23rd International Applied Geochemistry Symposium are well developed and a call for abstracts has been issued. The meeting will be held in Oviedo, Spain from the 14th to 19th June.

The thematic sessions for Oviedo include:

- Exploration and environmental geochemistry of classic mining districts
- Geochemistry in the government sector
- Exploration case studies: A symposium in honour of Dr. Eion Cameron
- Ore-forming systems: A geochemistry perspective
- Analytical geochemistry
- Data interpretation
- Geochemical mapping
- New technologies in applied geochemistry

Please send abstracts to Jorge Loredó via the web link - <http://www.uniovi.es/IAGS2007>.

We are still keen to sign up sponsors and exhibitors for the meeting and again further information can be gained from the web site or directly from Jorge at School of Mining, University of Oviedo, Spain. Email: jloredo@correo.uniovi.es

Accommodation and early bird registration can also be made at the web site above. Several interesting field trips have been arranged and details are on the web site.

Finally in connection with Oviedo, Dave Kelley is still interested in obtaining nominations for the association's medals. This is your chance to acknowledge someone who has made significant contributions to the association and the science of applied geochemistry. Details can also be found on the AAG website (www.appliedgeochemists.org).

The association is also involved in Exploration'07 organized by the Canadian mineral exploration community to review the major advances in exploration technology.

The meeting is from the 9th to the 12th September and a call for posters has been issued. As part of the meeting AAG members in Canada have been involved in preparing two programs in exploration approach to different ore deposits. Further details can be found at AAG home page or by contacting Betty in the MAC office.

By now hopefully many of you have renewed your subscription through the web site. This is an easy system to use and hopefully will reduce delays in members renewing. If you have not yet, please do renew soon. Without your loyal support we would be continue to offer the same level of service as we do now.

So happy prospecting to all of you in 2007.

Rob Bowell
President AAG



Recent Advances in Base Metal Indicator Mineralogy: An Update from Overburden Drilling Management Limited

Introduction

Most heavy mineral geochemistry laboratories process samples primarily for kimberlite indicator minerals (KIMs). Some KIM species have distinctive features and are readily identified by mineral technicians but others are more obscure. The laboratory of Overburden Drilling Management Limited (ODM) in Nepean (Ottawa), Ontario, Canada differs from other heavy mineral laboratories in that all indicator mineral logging is performed by experienced exploration geologists rather than mineral technicians. Geological logging not only ensures improved identification of difficult KIM species but also permits recognition of all other heavy minerals in the sample including indicator minerals other than KIMs and background mineral assemblages that fingerprint the potential source regions of the indicator minerals.

Indicator minerals in general are heavy (concentratable), coarse grained (readily identifiable) and chemically stable in weathered surficial sediments. The stability requirement excludes most sulphide minerals except chalcopyrite and sphalerite which are somewhat resistant to degradation. For example, a major sphalerite anomaly in till detected recently for the Alberta Geological Survey suggests the presence of previously

unrecognized Mississippi Valley-type Pb-Zn mineralization in the northwestern part of the province (Plouffe *et al.*, 2006). However, ODM has identified several other suites of magmatic/metamorphosed massive sulphide indicator minerals (MMSIMs®) that are much more resistant than sulphides and are diagnostic of specific types of sulphide deposits (Averill, 2001). At present, the company's principal focus is on porphyry Cu indicator minerals (PCIMs®) and Ni-Cu-PGE indicators. For example, it is assisting the Canadian Mining Industry Research Organization (CAMIRO) with a major study of indicator minerals in both bedrock and overlying glacial and nonglacial sediments at five Ni-Cu-PGE deposits in

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Recent Advances in Base Metal Indicator Mineralogy... *continued from page 2*

Canada, Australia, Russia and China. To facilitate such studies, an electric pulse disaggregator is being installed. This device crushes rocks primarily around their constituent mineral grains rather than through the grains as in conventional milling.

Ni-Cu-PGE Indicator Minerals

The types of indicator minerals potentially present in the vicinity of a Ni-Cu-PGE deposit are inexorably linked to the conditions of formation of the deposit because these conditions involve chemical factors that influence mineral compositions. The two principal conditions of deposit formation have been elucidated most recently by

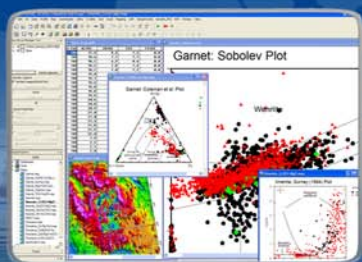
Mungall (2005). The first condition is that the parental melt must be enriched in Ni-Cu-PGE; *i.e.* partial melting of the source rocks, normally garnet peridotite in the upper mantle, must progress to a sufficient degree to produce a fertile melt. Such high-degree melts are also enriched in Mg and Cr and therefore tend to crystallize Mg- and Cr-bearing indicator minerals including olivine (especially forsterite), orthopyroxene (especially enstatite), Cr-diopside and chromite. Very high concentrations of these indicator minerals can further signify proximity to a restricted conduit where the separation of cumulus and sulphide minerals was concentrated during fractional crystallization of the melt after its ascent to the crust. Chromite is of particular interest because it is a significant collector of PGMs in the

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Figure 1. Binocular microscope photographs of representative populations of transported chromite grains derived from specific bedrock lithologies. All grains are of 0.5 to 1.0 mm size. (a) sharp to ragged crystals derived from peridotite; (b) resorbed crystals derived from kimberlite; (c) crystals corroded by lateritic weathering, masking their primary form and paragenesis.

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Recent Advances in Base Metal Indicator Mineralogy... *continued from page 3*

form of minute inclusions.

The above-mentioned Ni-Cu-PGE indicator minerals include species that are also used as KIMs because garnet peridotite horizons similar to those that produce Ni-Cu-PGE-fertile melts are sampled by kimberlitic melts during their ascent through the upper mantle. However the two suites differ in detail both chemically and in their physical characteristics. For example, Cr-diopside derived from a Ni-fertile intrusion typically contains less Cr₂O₃ and therefore is of a less vivid green colour than kimberlitic Cr-diopside. Chromite crystals from such intrusions are sharp, ragged or pitted (Fig. 1a) rather than rounded by resorption (Fig. 1b) as in kimberlite although in a lateritic environment these physical differences may be masked by corrosive weathering (Fig. 1c).

The second condition for successful formation of a Ni-Cu-PGE deposit is that the fertile silicate melt becomes sulphide saturated while passing through the conduit and crystallizing, causing the separation of a sulphide liquid. Sulphide liquid is a major collector of Ni-Cu-PGE. As well, being heavy, it will settle to the bottom of the conduit (or concentrate in particular layer in the case of a stratiform complex) to form a significant deposit provided a sufficient volume of fertile magma passes through the conduit. Sulphide solubility is inherently high in Fe and Mg-rich melts under mantle conditions and

increases with decreasing pressure (ascending magma). It decreases with decreasing temperature but sulphide saturation can be reached most efficiently through removal of Fe and Mg from the melt by concentrated crystallization of olivine and pyroxene or through addition of SiO₂ and Al₂O₃ to the melt by assimilation of felsic crustal rocks. Sulphide saturation would, of course, be greatly accelerated if the assimilated rocks also contained sulphides but this increases the risk of sulphide oversaturation, resulting in a very low-grade deposit.

Assimilation of felsic rocks by mafic magmas produces hybrid Fe-Al, Mg-Al and Cr-Al alteration minerals such as black hercynitic spinel, green Cr-garnet (Cr-grossular, Cr-andradite or uvarovite) and ruby (Cr-bearing) corundum. The sulphide mineralization itself, other than the chalcopyrite component if present, is not a potential source of indicator minerals, nor are most PGE-bearing minerals (PGMs). In many deposits, Pt and Pd are held mainly in unstable sulphides such as braggite ((Pt,Pd,Ni)S) or tellurides such as merenskyite ((Pd,Pt)(Te,Bi)₂) rather than in stable native minerals or arsenides such as sperrylite. The susceptibility to weathering of Pt and Pd sulphides and tellurides in sediments is further increased by their tendency to occur as minute, silt-sized (<0.063 mm) grains rather than in the medium to coarse sand sizes (0.25 to 2.0 mm) like the other indicator minerals.

Porphyry Cu Indicator Minerals

In 2001 ODM developed the PCIM method, initially targeting porphyry Cu deposits in arid regions such as the Atacama desert where the climate has stabilized primary Cu-sulphide mineralization by converting it into chemically resistant (to ongoing arid weathering) supergene minerals such as atacamite. The original test samples were primarily of chusca developed on alluvium and were typically collected at a depth of 0.2 to 0.3 m, taking care to avoid surface sediment potentially containing wind-blown mineral contamination from mining or drilling activity. More humid regions have also been tested with appropriate changes to the sampling medium and indicator mineral suite. In addition, PCIM

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technology has been used to explore for epithermal Au deposits peripheral to porphyry Cu deposits.

PCIMs are as large as KIMs and Ni-Cu-PGE indicator minerals (0.25 to 2.0 mm) and produce even stronger anomalies in surficial sediments due to the extreme size of mineralized porphyry systems. Consequently only 1 kg samples, rather than 10 to 20 kg, are required facilitating sample collection and shipping, and just one sample/km² is sufficient to identify and outline significant porphyry Cu and epithermal Au systems. However, processing costs are similar to KIM projects because PCIMs have a wider specific gravity range, requiring the extraction and examination of both a mid-density and heavy mineral concentrate.

PCIMs that have been used successfully to date include six hypogene alteration species – diaspore, tourmaline (dravite), FeCaMn-garnet (andradite, grossular and spessartine; common metamorphic almandine is conveniently absent from Atacama samples), primary alunite, red rutile and barite – plus two supergene alteration minerals – jarosite and secondary alunite – and two “oxide” Cu minerals, turquoise and atacamite. Together these minerals fingerprint the overall porphyry Cu system; some also define individual alteration and mineralization zones within the system. For example, the presence of diaspore, tourmaline or primary alunite indicates advanced argillic alteration, FeCaMn-garnet indicates propylitic alteration and barite indicates a transition from porphyry Cu to epithermal Au mineralization. Other minerals being investigated include apatite, anatase, rose zircon and blond titanite. As in exploring for kimberlite with KIMs, it is not the presence of a single PCIM but rather a systematic suite of PCIMs in surficial sediments in a restricted area that indicates proximity to a porphyry Cu alteration system. Blind surveys in sloped areas with relatively thin (<20 m) cover have clearly distinguished between and accurately outlined the individual alteration zones whereas samples collected on thicker alluvial plains tend to give a blended PCIM response reflecting the overall porphyry system. Processing of alluvium from deep reverse circulation holes drilled to test bedrock has proved effective in extending the exploration coverage of the holes at minimal added cost.

In summary, PCIMs can be as useful as KIMs because: 1) there are more useable PCIM species than KIM species; 2) porphyry Cu alteration systems are much larger than kimberlite pipes and therefore supply far more indicators; and 3) the different alteration zones associated with porphyry deposits supply different and distinct suites of indicators. Together these features make PCIM exploration just as effective as KIM exploration, and even more discriminatory. Having recognized the broader indicator mineral associations, several questions concerning mineral chemistry are now apparent. Which, if any, of the three garnet species associated with propylitic alteration zones is the best indicator of Cu fertility? Is red colouration in rutile due to Cu or Cr? What imparts the distinctive rose colour to some zircons in otherwise colourless populations? Does blondness in titanite have any chemical significance? Can we discriminate chemically between primary and secondary alunite grains? To what extent are weak Cu anomalies in selective extraction soil geochemical surveys due to traces of Cu-bearing mineral grains in the sediment versus some mechanism of aqueous, gaseous or electrochemical migration of Cu from bedrock to surface? Recent record Cu prices suggest that the answers to such questions are of more than academic interest.

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BOOK REVIEW

WIKINOMICS: How Mass Collaboration Changes Everything
by Don Tapscott and
Anthony D. Williams. Penguin,
New York, 2006, 324 pages.

Each year the final issue of Time Magazine shows an image of the "Person of the Year" on its cover. In 2006 this was replaced by a reflective Mylar panel in which the reader could see her face. The person chosen for 2006 was "you" and the message was that traditional hierarchies that supply news, information and entertainment are being displaced by ordinary people. Their emancipation comes from computers, camera phones and video recorders that communicate through the Internet. This era of online sharing and collaboration has been dubbed "Web 2.0". Tapscott and Williams provide a comprehensive overview of the influence of the new web, with emphasis on business and science.

Their first example will be familiar to readers of **EXPLORE**. In 2000, Rob McEwen, the CEO of Goldcorp, owner of a gold mine in northern Ontario, became impatient at the pace at which new reserves were being found. He asked his staff to assemble all data for the mine, 400 MB, and place this on the company website. He issued a challenge to all comers: use the data to develop ideas to find new reserves, with the winners sharing a prize of \$575,000. Some 1,400 people from 50 countries downloaded the file. Of the 110 submissions that were viewed as semi-finalists, 50% of the targets were new to Goldcorp and they had an 80% success rate. "We found the 6 million ounces we were looking for" said McEwen. The capitalization of the company in 2001 was \$0.5 billion. Using the rich reserves of the mine as currency, the company has grown and merged with other companies until in 2007 it is worth \$23B, comparable to Newmont (\$24B) and Barrick (\$30B).

The initiative showed the value of tapping a far larger pool of talent than could be assembled in any one company. This also works for a much larger organization. Proctor and Gamble is a major consumer products manufacturer. They employ 9000 researchers but their knowledge is not enough to answer all the questions that arise during product development. The company now lists many of these challenges on the InnoCentive network, which is supported by 35 Fortune 500 companies, including P&G, Boeing and Eli Lilly. One recent listing was to find a method to exfoliate sheets of mica. The solution was worth \$40,000. There are 90,000 "solvers" registered with InnoCentive. Some of these have given up their previous employment. This mimics the effect of eBay where one million have given up their day jobs to trade full time.

The most familiar examples of Internet-based cooperation are Linux, the Human Genome project and Wikipedia. Linux has developed by the work of thousands of programmers around the globe, both in corporations

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and as individuals. It is displacing proprietary operating systems. IBM was formerly the largest developer of proprietary software. The company saw that its objectives could be better met by cooperating in the development of Linux and other open source software, rather than building its own. Today, it is saving close to \$1 billion a year through this approach. Seventy percent of websites are now powered by free open source software and Linux is found in products as varied as mobile phones and BMW cars. Many of the largest biotech and drug firms are participating in the Human Genome project. Like IBM with Linux, they saw that cooperation leads to faster and more economical development and they can focus their own R&D on spin-off applications. Started in 2001, the English language version of Wikipedia is now ten times the size of the Encyclopedia Britannica. There are five staff members, one million registered users, of which 100,000 have contributed more than ten entries. Five thousand volunteers keep the site humming.

Science publishing was established in the 17th century. Much of the cost is incurred in printing, distributing and marketing hard copy. Is this still necessary? For the books that we read for entertainment, the computer screen has not replaced the printed page. We relax in a chair, start on page one, and progress to the end. After the book returns to the shelf, it is rarely consulted. Journals are different. Few of us read these cover to cover. Their main value comes later when we search back for information. With the complete contents of many journals now housed on the servers of publishers or Google Scholar, it is easier to search online, then drill down to the article or page. Printing places constraints, other than cost. As PowerPoint presentations show, scientists prefer to illustrate in colour. This is particularly important for geoscience maps. Yet costs of printing deter colour illustration. Printing adds time to the publication cycle. Recognizing this, some publishers, such as Springer, are publishing papers online when the corrected proofs are received, rather than waiting until there are sufficient papers to send a complete issue to the printer. But this begs the question, "what do I see on the printed page in March that I did not read online in January?" Seeking to further speed the flow of information, arXiv was established in 1991 as a public server for scientists in physics and mathematics to deposit manuscripts they plan to submit to journals. Today, 4500

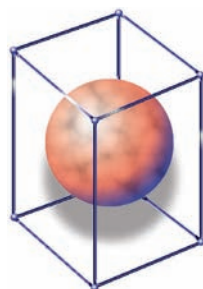
manuscripts arrive each month. RSS feeds are sent to inform readers of newly deposited manuscripts in their field. Authors receive comments and criticism from others who are interested in the topic. The informal exchange made possible by arXiv is more likely to lead to cooperative work between the author and respondents than with journal referees.

How will Web 2.0 affect applied geochemists? Most other fields of geochemistry are staffed by academics. Publish or perish is part of the job description, thus most knowledge in the field reaches the public domain. The majority of applied geochemists work directly or indirectly for companies. Time to prepare papers is limited and may be discouraged. Thus much knowledge is not widely available. There is also a difference in the nature of the knowledge compared to some other areas of science. A drug manufacturer may develop and test a product, then distribute it around the world knowing that all humans are essentially the same. In applied geochemistry there is an infinite variation in geology, geomorphology, soils and climate to which techniques must be adapted. Applied geochemistry is particularly suited to blogs and wikis that retrieve this dispersed knowledge. Take a topic of current interest: "selective leaches". A traditional means of communicating information would be for a half dozen specialists to write a book. This has two disadvantages. First, from the time that the book is printed until a new one comes along, the contained information is static. Second, it misses out on the knowledge of a hundred or more geologists and geochemists who have applied selective leaches around the world. The "wiki" approach removes these disadvantages by an ongoing cooperative interaction between the specialists and those who apply the methods.

Eion Cameron



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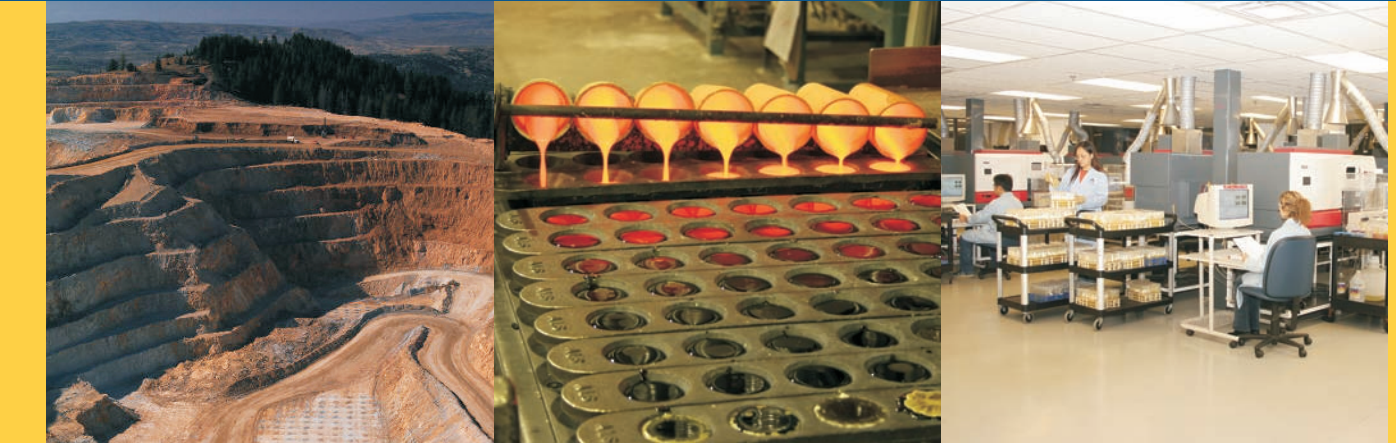
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New AAG Councillors Elected for 2007-2008

Elizabeth Bailey

Elizabeth Bailey received her B.Sc. degree from the Pennsylvania State University in 1980 and completed graduate coursework at the University of Alaska Anchorage. She joined the U.S. Geological Survey (USGS) in 1982 as an analytical chemist. After more than a decade of analyzing geochemical samples, she moved out of the laboratory and began participation in field geochemistry as part of multidisciplinary teams conducting mineral resource assessments in Alaska. Elizabeth is currently a research chemist with the USGS with her primary research interests including regional-scale stream sediment geochemistry and biogeochemical cycling of mercury near areas of known mineralization. In addition to her contribution to the mineral resource assessment of several areas in Alaska, she has been part of a team that developed an on-line digital database for USGS geochemical data from Alaska, and has conducted research on the microbial transformations of Hg near abandoned Hg mines in Alaska. Elizabeth has been a member of AAG since 1993 and a fellow since 2001. She has served as an assistant editor for *Explore* and currently serves on the editorial review board of *GEEA*.

Stephen Cook

Stephen Cook is chief geochemist for Teck Cominco, and is based in Vancouver. He received his B.Sc. degree in geology from Carleton University in Ottawa (1984), after which he worked with the Geological Survey of Canada (1985-1988) in the regional geochemical surveys group. In 1991, he completed his M.Sc. in exploration geochemistry at the University of British Columbia, with Dr. W. K. Fletcher, on the geochemistry of platinum in soils of the Tulameen Ultramafic complex, southern B.C. During the period 1991-2000 he worked as a geochemist with the British Columbia Geological Survey in Victoria, where one of his main interests involved the use of lake sediment geochemistry in mineral exploration. In 2000, he joined Anglo American Exploration (Canada) Ltd. in Vancouver as senior geochemist - North America and Europe, where he was involved in numerous geochemical exploration programs and research studies throughout Canada, Mexico, the U.S. and northern Europe. He left Anglo American in 2004 to start his own geochemical consultancy, Cook Geochemical Consulting, where he worked for 2 years prior to joining Teck Cominco in June 2006. Stephen is registered as a professional geoscientist in British Columbia (APEGBC - P.Geo., geochemistry), and was a member of the organizing committee for the 19th International Geochemical Exploration Symposium held in Vancouver in 1999.

Jorge Loredó

Jorge Loredó graduated in mining engineering from the University of Oviedo (Spain) in 1976 and received his PhD from the University of Oviedo (Spain) in 1981. He

specialized in mining geology at the Paris School of Mines in 1981-1982 and has been actively involved in mining and environmental geochemistry from the 1980's. From 1985, he has been Senior Lecturer of mining and environmental geochemical exploration at the Oviedo School of Mines, University of Oviedo (Spain). Jorge has been visiting researcher on geochemical exploration in the Department of Geology and Geophysics of the University of California at Berkeley in 1987/88; Visiting Professor in mining and environmental geochemical exploration in La Rioja and San Juan Universities (Argentina) in 1997 and 1999, in the University of Piura (Peru) in 1998 and 1999, in the Academy of Mines and Metallurgy of Cracow in 1992, and in the University of Sofia (Bulgaria) in 1993. He has been coordinator of national and international research projects such as ERMITE, PIRAMID, TRANSCAT, ERBLASEN, CENIT-CO₂, GEOCIMA, He has many years of experience of consulting with the Spanish mining and environmental industries and institutions and is currently Head of the Department of Mining and Exploration at Oviedo University (Spain) and Chairman of the 2007 International Geochemical Exploration Symposium, which will be held in Oviedo, Spain. Jorge has been chairman of the 9th International Mine Water Congress (IMWA05) celebrated in Oviedo (Spain) in 2005 and has been a voting member of AAG since 1984.

Chris Oates

Chris Oates began his career as an exploration geochemist with WMC, January 1981 based in Kalgoorlie, Western Australia. During his time with WMC in Kalgoorlie (1981-1989), he was Exploration Geochemist and subsequently Senior Exploration Geochemist for exploration programs throughout Western Australia for Ni and Co Laterites, Ni sulphides, Archaean VMS deposits, Archaean Au deposits, PGE's and Proterozoic Cu-Zn and Au deposits. Numerous orientation surveys including hydro-geochemical surveys were carried out during this time as well as the development of exploration geochemical techniques with other WMC geochemists and geologists such as "Deflation Lag" sampling 1981-82 and low level detection limit (1 ppb) aqua regia Au, in 1982 for soils and deflation lags. The application low level Au technique leading to the discovery of the Redeemer, Thiel well and Mt. Dimmer Au deposits. January 1990 to June

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Shea Clark Smith

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SheaClarkSmith@aol.com

New Councillors... *continued from page 9*

1999 was spent with Western Mining Corporation based in Santiago, Chile as Senior Exploration Geochemist and subsequently Research Geochemist involved in exploration programs for PCD's, CRD Zn and Epithermal Au deposits in Chile, Argentina, and Nicaragua. Application of -63um regional stream sediments in Chile led to the discovery of the Turbio PCD system and the Furioso epithermal Au deposit, in southern Chile. Exploration geochemical techniques refined during this time were "Base of Slope Talus" in both desert and high altitude Andean environments, "Grid Soils" on Andean 38° slopes, evaluation of Partial Leaches for Nth Chile PCD's and isotope studies to establish the origin of the Nth Chile gypsiferous soils. In July 1998, Chris joined Anglo American plc as Vice President - Geochemistry and over the last 8 years has been involved in the establishment of an Anglo American global exploration geochemical team, and establishing sampling and analytical policies and protocols, mine sampling & mine laboratory "Best Practice" & audits, analytical round robins and the development of internal and external exploration and environmental geochemical research programs.

Olle Selinus

Olle Selinus is a Ph.D. geologist working with the Geological Survey of Sweden (SGU). During the 1960s and 1970s, he worked in mineral exploration with a mining company and at the SGU, mainly lithochemical exploration. Since the beginning of the 1980s, Olle's research work has been focused on environmental geochemistry and geostatistical methods, including research on medical geology. He has served as the organizer of several international conferences in this field, as a member of numerous scientific committees, and has published over 80 manuscripts in scientific journals and several books. He has also acted as scientific expert for the European Union. Olle is currently the Deputy Head of the Geochemical Division at SGU, and in charge of external research and development at the geological survey. He served as Editor-in-Chief for the book on "Essentials of Medical Geology" which has received several prestigious international awards. He was appointed Geologist of the year 2005-2006 in Sweden and was awarded the Outstanding Achievement Reward of the Commission on Geoscience for Environmental Management (GEM) in 2006. He is chairman of IUGS Special Initiative on Medical Geology, president of the International Medical Geology Association, chairman of "Earth and Health" of the IUGS-UN-UNESCO initiative of Planet Earth (IYPE), and chairman of the health sector of the 4 GeoUnions Initiative as well as Senior Advisor of IYPE. He is associate editor of *Applied Geochemistry*.



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Toronto, Ontario, Canada, September 8-13, 2007

Exploration 07 is the fifth in a series of once-a-decade meetings organized by the Canadian mineral exploration community to review the major advances in exploration technology made over the previous 10 years. Designed with the global exploration community in mind, earlier meetings were attended by up to 1,000 delegates from as many as 60 countries. In addition to a worldclass set of presentations and supporting workshops, a full documentation of the proceedings is one of the established traditions of these decennial reviews. As with previous meetings, Exploration 07 will present the state of the art in exploration technology, with the focus on geophysics, geochemistry, remote sensing, data processing and integration and the application of these disciplines to ore discovery. The organizing committee of Exploration 07 invites its colleagues from around the world to convene in Toronto in September 2007 to network with their international colleagues, build on their exploration expertise and to celebrate another 10 years of advancement of the exploration geosciences. Exploration 07 will review the current state of the art in geophysics, geochemistry, remote sensing, data processing and integration. Given the industry-wide

emphasis of better integration of scientific capabilities and business imperatives, the meeting will seek to highlight the strategic linkage between the technological and commercial sides of the exploration industry from primary ore discovery to risk management through the entire mining cycle.

Who Should Attend

The activities of Exploration 07 will be of interest and value to a wide spectrum of stake holders in mineral exploration, including geologists, geochemists, geophysicists as well as managers, academics and government scientists involved with mineral exploration and mining-related environmental programs.

Information and Registration

To receive the information that you will need to participate as a delegate or exhibitor to Exploration 07, you should fill in the form on the information booklet and fax it back to the organizing committee at 1-905-474-1968, or email your contact details and items of interest to: interest@exploration07.com

Workshop 1: Exploration Geochemistry— Basic Principles and Concepts Saturday, September 8th, 2007

Topics to be covered include:

- Sample Analyses, Preparation Methodologies, Analytical Techniques
- Quality Control in Geochemical Analyses
- Geochemical Data Evaluation and Interpretation
- Regolith Mapping / Landform evolution / geochemistry applications
- Glaciated Terrain - till geochemistry and indicator minerals
- Soil Geochemistry / Selective Extraction / Soil Gases
- Drainage Sampling – streams, lakes – sediments, waters, HMCs
- Biogeochemistry
- Groundwater Geochemistry

Workshop 2: Indicator Mineral Methods in Mineral Exploration Sunday, September 9th, 2007

Topics to be covered include:

- Survey design
- Sample processing methods
- Mineral chemistry
- QA/QC in sample processing and analysis
- Indicator mineral methods in precious metal exploration
- Indicator mineral methods in diamond exploration
- Indicator mineral methods in base metal exploration
- Laboratory case study: sample integrity
- Exploration case study: indicator mineral survey in India
- Public sector case study: Indicator mineral survey of Minnesota

For more information about these workshops see the Exploration 07 website: <http://www.exploration07.com/>

EXPLORATION



07

www.exploration07.com



Call for Poster Papers

Toronto, Canada September 9-12, 2007

Exploration07 is the fifth decennial conference providing a global review of the previous decade's advances in the state of the art in exploration geophysics, geochemistry, remote sensing data processing and integration. The organizing committee of Exploration 07 invites submissions for poster papers that are consistent with the conference themes described below.

Emphasis will be placed on recent advances in methodology applied to contemporary mineral exploration, important case histories, and developments in the assessment and monitoring of exploration and mining related environmental issues.

The poster papers are intended to complement the already established themes of conference oral sessions:

- The Leading Edge
- Sharpening the Sword: Honing Technology to Drive Discovery
- Advances in Regional-scale Geochemical Methods
- Advances in Prospect-scale Geochemical Methods
- Frontiers in Geochemistry
- Advances in Airborne Geophysics
- Advances in Ground and Borehole Geophysics
- Advances in Geophysical Inversion and Modeling
- Advances in Regional Exploration
- Advances in Mine Site Exploration and Ore Delineation
- Advances in 3-D Visualization and Data Integration
- Ore Deposits and Exploration Technology: Linking Deposit Models and the Technologies to Explore for them



Acceptance of a poster paper requires submission of a Short Paper which will be published in the conference proceedings. The Short Papers must be in English, and be approximately 4 pages in length.

These will be peer reviewed. A style guide and template will be available from [www. exploration07. com](http://www.exploration07.com) in December 2006. In addition, authors will be encouraged to submit their poster in PDF format for posting on the Exploration 07 website following the conference.

Posters are deemed a vital part of the Exploration 07 technical program and will be housed in a dedicated room adjacent to the trade exhibit hall. In addition, the posters and their authors will be showcased during two sessions to enable authors to personally present their posters to interested delegates. The committee encourages any geoscience student to consider submitting a poster.

While the normal poster presentation medium will be a 1mx 2 m poster board, the committee will consider accommodating a limited number of PC-based presentations. If this is the preferred form of presentation, this must be indicated at the time of submission.

Submission Deadline

The deadline for submission of Short Papers is **April 02, 2007**. Notification of acceptance will be provided by **April 16**. Space is limited and submissions tendered after the deadline will not be accepted.

Please visit [www. exploration07. com](http://www.exploration07.com) for more information or e-mail [posters@exploration07. com](mailto:posters@exploration07.com) if you have any questions or wish to make a poster submission. A Guide for Authors will be available for download from the website in December 2006.



CONGRESS LOCATION AND VENUE

OVIEDO is the capital of Asturias, (NW Spain) where coal mining has been very important from the 18th century. Hg, Cu, Pb-Zn, As, Fe Mn, and other substances have been also exploited. Currently, coal, gold and fluorspar mining are still active. The Congress will be hosted in the 'Principe de Asturias' Conference Hall, located in Oviedo city centre. During the Congress, a selection of field trips to key mining areas in Northern Spain will be offered.

PROGRAMME

Technical sessions will take place in the Conference Hall. The official language of the conference will be English.

		Thursday 14th	Friday 15th	Saturday/Sunday 16th/17th	Monday 18th	Tuesday 19th
Morning	9.00-10.40	Registration (8.00-9.00)	Technical Session 4	WORKSHOPS*/ TOURIST EXCURSIONS**	Technical Session 8	Technical Session 12
	11.00-11.45	Opening ceremony (9.00-10.00)	Keynote Speaker		Keynote Speaker	Keynote Speaker
	Coffee		Coffee			
	11.45-13.05	Technical Session 1	Technical Session 5		Technical Session 9	Technical Session 13
Lunch						
Afternoon	14.45-16.35	Technical Session 2	Technical Session 6		Technical Session 10	Technical Session 14
	Coffee		Coffee			
	17.00-18.30	Technical Session 3	Technical Session 7		Technical Session 11	Closing Ceremony and AAG Meeting
Evening		Welcome Reception	Typical Dinner		Symposium Official Dinner	

*If you are an AAG Member, you should include your membership number.

**Proof of your studentship is required when you submit your registration form. Without this copy, the registration will not be valid.

Proposed topics for Technical Sessions:

- Classic mining districts: Exploration and environmental geochemistry in the shadow of headframes.
- Geochemistry in the government sector: exploration and environmental applications.
- Geochemistry in the industry sector: exploration and environmental applications
- Exploration case studies symposium in honour of Dr. Eion Cameron
- Exploration, Classic European mining districts & New technologies
- Hydro-bio geochemistry
- Commercial session
- Ore Deposit-Forming Systems: A Geochemical Perspective
- Analytical Geochemistry
- Litho-geochemistry
- Data interpretation
- Geochemical mapping
- Geochemistry and health
- New technologies and miscellaneous papers

SHORT COURSES

Courses will take place on Saturday 16th June. A minimum number of attendants will be necessary to run the courses, so the Organising Committee encourage delegates to participate. Bookings can be made on the registration form.

Short course 1:

Litho-geochemistry in Mineral Exploration: Principles and Practice of Molar Element Ratio Analysis
Instructor: Dr. Clifford R. Stanley. Associate Professor. Department of Geology, Acadia University. Nova Scotia, Canada.
Cost: 250€

Short course 2:

Mine water geochemistry
Instructor: Dr. Paul Younger. Newcastle University. United Kingdom.
Cost: 250€

Short course 3:

Urban Geochemistry (This course will be taught in Spanish).
Instructor: Dr. Eduardo de Miguel. Madrid Polytechnic University.
Cost: 150€

continued on page 15

23rd IAGS... *continued from page 14*

FIELD TRIPS

There are four field trips available for the attendees to the Symposium, visiting the most important and interesting mining districts of Spain. These trips will be also combined with visits to places of cultural and touristic interest close to the mines. A group ranging from 20 to 25 people are required for each trip; otherwise it will be cancelled. To make the booking, please mark with a cross the corresponding cabin in the Symposium Inscription Form. Once the trip is confirmed, make the payment and return the receipt by mail to the Symposium Secretariat. The secretariat will send you a message confirming your reserve thereafter.

PRE-CONGRESS FIELD TRIPS:

The pre-congress field trips departure will take place from the Geological Survey (C/Río Rosas, 23. Madrid) at 9.00 a.m.

Excursion 1: Riotinto (Cu), Las Cruces (Cu), Agua Blanca (Ni-Cu), Las Médulas (Au)

Departure: 10th June from Madrid.

Arrival: 13th June to Oviedo

Itinerary: Madrid –Sevilla – Cáceres –León –Oviedo:

10th June: visit to “Las Cruces and Rio Tinto Mines”. Lunch in Rio Tinto. Departure to Seville where dinner and accommodation will take place.

11th June: visit to Agua Blanca Mines and lunch in the surroundings. Accommodation and dinner in Cáceres. There will be free time to visit the old part of the town.

12th June: Departure to Salamanca to visit the city. Lunch and accommodation in Salamanca.

13th June: Visit to “Las Médulas” (roman gold mines) and lunch in a close typical restaurant. Departure to Oviedo.

Cost: 750 €

Excursion 2: Almadén (Hg), Rodalquilar (Au), La Unión (Pb).

Departure: 10th June from Madrid

Arrival: 13th June to Oviedo.

Itinerary: Madrid- Granada- Cartagena- Toledo - Oviedo.

10th June: visit to “Almadén Mine” and lunch in Almadén town. Departure to Granada where The Alhambra will be visited in the afternoon. Dinner and accommodation in Granada.

11th June: visit to “Rodalquilar Mine” and lunch in the surroundings. Dinner and accommodation in Cartagena.

12th June: visit to the “Unión Mine”, lunch and departure to Toledo.

13th June: Dinner and accommodation in Toledo. Free time to visit the city and departure to Oviedo.

Cost: 750€

POST-CONGRESS FIELD TRIPS:

Excursion 3: Begega (Au), As Pontes (coal), Las Médulas (Au)

Departure: 20th June from Oviedo

Arrival: 22nd June to Madrid.

Itinerary: Oviedo- Santiago de Compostela- Ponferrada- Madrid.

20th June: visit to Rio Narcea Gold Mines. Lunch will have on the way to Santiago de Compostela. In the

afternoon, the As Pontes mine will be visited. Dinner and accommodation in Santiago de Compostela. Free time to visit the city.

21st June: Visit to “Las Médulas” (roman gold mine) and lunch in a near typical restaurant. Dinner and accommodation in Astorga.

22nd June: Departure to Madrid. Stop for lunch in El Escorial (close to Madrid). The arrival is due to 17.00 h approximately.

Cost: 500€

Excursion 4: Reocín (Zn – Pb), Bilbao (Fe)

Departure: 20th June from Oviedo

Arrival: 22nd June to Madrid

Itinerary: Oviedo – Santillana del Mar – Bilbao- Madrid

20th June: visit to Reocin Mines. Lunch at the touristic town of Comillas. In the afternoon the Altamira caves and museum will be visited. Dinner and accommodation in Santillana del Mar.

21st June: Visit to the iron mines of Bilbao. After lunch, visit to the Guggenheim museum. Dinner and accommodation in Bilbao.

22nd June: Departure to Madrid. Stop in Vitoria for the following cultural visits:

10.30h: visit to the “Lucía-Village” wine museum, where there will be a traditional tasting.

12.00h: Lunch in “Lucía-Village”.

17.00h: Visit to Laguardia Village.

18.00h: Departure to Madrid. The arrival is due to 22.30 h approximately.

Cost: 600€

NOTES:

- * Prices include accommodation in 3-4 stars Hotels, all meals, transport and tickets for the corresponding visits, as well as taxes.
- * Prices have been calculated for groups of 25 people, but if the number of people is increased, the final price would be less.
- * Accommodation for the night before the pre-congress trips and the night after the post-congress trips is not included.
- * Possible changes will be advertised in advance in the web site.

REGISTRATION FEES PER DELEGATE (before 30th April 2007)

AAG Members*: 450€

Non-members: 500€ (550€ including one year membership)

Students***: 200€

TRAVEL AND ACCOMMODATION

Asturias airport: Ranón. Santiago del Monte, 33459 Castrillón. Asturias (13 km from Avilés)
Information: Tel: +34 985 127500 / +34 985 127600. There is a regular bus (ALSA) from the Airport to Oviedo bus station, which takes about 45 minutes (tickets can be paid directly to the bus driver in the Airport).

Oviedo Taxi: Tel.: 985 250000 / 985 252500.

23rd IAGS... *continued from page 15*

HOTELS

Oviedo offers a wide range of accommodation; we have booked a limited number of rooms in various centric hotels. All of them have special rates for the congress participants. Accommodation is based on a first come first serve basis. Please book your accommodation as soon as possible, as the organizing committee cannot guarantee the reserve rates after May 31st, 2007. The rates indicated in the following table include breakfast and local taxes.

HOTEL (web page links)	RESERVED ROOMS	SPECIAL RATES (including breakfast and taxes)	
Hotel de la Reconquista***** Gil de Jaz, 16 33004 Oviedo	No confirmed	Double room: 135.07€	Single room: 106.17€
Hotel AC Forum Oviedo***** Plza. Ferroviarios, 133003 Oviedo	25	Double room: 100.50€	Single room: 80.80€
Hotel Ramiro I**** Calvo Sotelo, 1333007 Oviedo	25 (Reserved for Scientific Committee)	Double room: 106.90€	Single room: 69.50€
Gran Hotel Regente**** Jovellanos, 3133003 Oviedo	40	Double room: 98.70€	Single room: 74.80€
Hotel Libretto**** Marqués de Santa Cruz, 1233007 Oviedo	15	Double room: 99.30€	Single room: 93.20€
Hotel Fruela*** Fruela, 333007 Oviedo	15	Double room: 81.80€	Single room: 66.60€
Hotel Campoamor*** Argüelles, 2333003 Oviedo	10	Double room: 86.30€	Single room: 75.40€
Hotel NH Principado*** San Francisco, 633003 Oviedo	30	Double room: 120.20€	Single room: 101.60€
Hotel Carreño** Monte Gamonal, 4a33012 Oviedo	10	Double room: 61.70€	Single room: 51.20€
Hotel Santa Clara** Santa Clara, 133003 Oviedo		Double room: 68.66€	Single room: 49.00€

To book a room in the selected hotels, please fill and send by fax or e-mail the form you can download to:

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Tel.: +34 985213465

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E-mail: congresosuniovi@viajesecuador.net

NOTE: For registrations received after 30th April 2007 there will be a surcharge of 50 € applied to these registration fees.

Fees include the abstract volume, coffee breaks and lunches during the Technical Sessions days, welcome reception dinner on Thursday 14th and typical Asturian dinner on Friday 15, 2007.

Registration fees do not include the Symposium Official dinner (80€).

Accompanying person's fee: 100 €, including admission to the welcome reception and Oviedo guided city tour.

For cancellations received before 30th April, no fee will be charged; however, no refunds will be issued after this date, though it is possible to send a substitute delegate.

REGISTRATION

Please fill the form you can download on the IAGS website and send it by e-mail to:

iags2007@innova.uniovi.es

For more information about the 23rd IAGS Symposium, contact:

Dep. Explotación y Prospección de Minas (Escuela Técnica Superior de Ingenieros de Minas
c/o Independencia, 13; 33004 Oviedo, Asturias,
SPAIN

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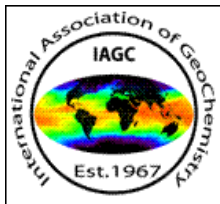
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Tel: (03) 6226 2472 Fax: (03) 6226 7662

Email: Katrina.Keep@utas.edu.au





International Association of Geochemistry

A. A. Levinson Tribute Symposium

Professor Alfred A. Levinson, a long-standing IAGC member passed away in December 2005 after a long and distinguished career in geochemistry. Al worked for many years in exploration geochemistry, first in private industry and later in academia. During this time, he proposed a system of mineral nomenclature for rare-earth elements that was accepted by the International Mineralogical Association. From 1967 to 1970, Prof. Levinson served as executive editor of *Geochimica et Cosmochimica Acta* and also edited the Proceedings of the Apollo 11 and Apollo 12 Lunar Science Conferences. During the 1970s and 1980s, he published two textbooks on exploration geochemistry. In 2002, the mineral species levinsonite-(Y), a hydrated REE aluminosulfate formed during supergene weathering of pyritiferous phyllite was named in his honor. Late in his career, Prof. Levinson directed his research toward diamonds and gemstones, becoming an acknowledged expert on the occurrence, exploration, recovery, and economics of diamonds.

Al is recognized for fundamental and applied research in two fields - exploration geochemistry and gem mineralogy - which form the basis for a special tribute symposium "Applied Geochemistry - From Brines to Diamonds: Memorial Symposium for A. A. Levinson" to be held during the 17th Goldschmidt International Conference, which will take place in Cologne, Germany from 19-24 August 2007. This day-long symposium will consist of two parts: Part I: 'Exploration Geochemistry', consisting of presentations in the broad area of exploration geochemistry, including both theoretical and field studies; and Part II: 'Gem Mineralogy, Diamonds and Gemstones', which will be directed toward the origin, mineralogy, and geochemistry of diamonds and other gemstones.

It is hoped that former students and colleagues will contribute to this symposium in recognition of Prof. Levinson's achievements in geochemistry and mineralogy over a most productive professional career. Papers given at the symposium will be published in a special issue of the IAGC journal *Applied Geochemistry* (guest editor, Brian Hitchon).

Abstracts for Goldschmidt 2007 are now being accepted, with the abstract submission deadline being April 19, 2007. Full instructions for submitting abstracts can be found at the conference web site: "<http://www.goldschmidt2007.org/abstracts.php>".

Please bring this announcement to the attention of your colleagues with a potential interest in the subject areas. Individuals intending to participate in the symposium should e-mail their name, contact information, and abstract title to Brian Hitchon (geosci@telusplanet.net).



Geological Association of Canada Short Course

Application of Till and Stream Sediment Heavy Mineral and Geochemical Methods to Mineral Exploration in Western and Northern Canada

Organizers: Roger Paulen (Alberta Geological Survey) and Isabelle McMartin (Geological Survey of Canada)

Length: 1 day (May 22, 2007) Yellowknife, NWT, Canada

(GAC-MAC Full Member: \$235 (GAC-MAC Student Member: \$100 (GAC-MAC Non-member: \$300

Mineral exploration in western and northern Canada requires an appreciation and understanding of glacial processes, surficial sediments, and glacial history. This course will focus on the application of indicator mineral and geochemical methods to mineral exploration in western and northern Canada. An overview of glacial processes and sampling techniques will be presented followed by reviews of indicator mineral methods used for diamond and gold exploration. Several case studies, both by leading Canadian researchers and the exploration industry will also be presented. A published volume is anticipated to result from this short course. Sponsored by Shear Minerals, Ltd. and Overburden Drilling Management Limited

For more information about the meeting and short course:

website: <http://www.nwtgeoscience.ca/yellowknife2007/>

Topics to be covered:

Introduction

- R. Paulen and I. McMartin: Mineral exploration in the glaciated terrain of western and northern Canada.

Ice flow and glacial dispersion

- R. Stea: Deciphering ore dispersal in complex glaciated terrain.
- I. McMartin and R. Paulen: Ice-flow indicators and the importance of ice-flow mapping.

Till sampling techniques

- R. Paulen and A. Plouffe: Sampling techniques in western Canada and the Cordillera.
- I. McMartin and J. Campbell: Sampling protocol in regions of discontinuous and continuous permafrost

Stream sediments

- R. Lett: Stream sediment sampling and geochemistry in the Cordillera.
- G. Prior, M. McCurdy, P. Friske: Stream sediment sampling in the Western Canada Sedimentary Basin.

Heavy Minerals

- S. Averill: Kimberlite and Ni-Cu-PGE indicators - similarities and differences.
- D. Hozian, G. Prior, R. Paulen and S. Averill: Quality control in indicator mineral sampling and processing.

Case Histories I - Diamonds

- I. McMartin and L. Dredge: Glacial dispersal research in Keewatin.

Application of Till and Stream...

continued from page 17

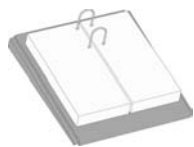
- P. Strand and J. Burgess: Tracing kimberlite indicator mineral dispersal trains: An example from the Churchill Diamond Project, Nunavut.
- T. McCandless: Glacial heavy mineral sampling and kimberlite discovery in the Northern Slave Province, Nunavut.

Case Histories II – Gold, Base Metals and Uranium

- R. Carpenter: Drift prospecting for gold in permafrost - Some examples and possible guidelines.
- T. Ferbey and V. Levson: The influence of ice-flow reversals on the vertical and horizontal distribution of trace element values in tills, Huckleberry Mine area, west-central British Columbia
- R. Paulen: Drift prospecting in northern Alberta – a unique glacial terrain for exploration.
- J. Campbell: Drift Prospecting for Uranium in the Athabasca Basin.

Summary

- H. Thorleifson: Overview of indicator mineral methods in mineral exploration, what lies ahead?



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

2007

- March 4-7, 2007. **Prospectors and Developers Association of Canada Annual Convention**, Toronto, Canada. Website: <http://www.pdac.ca>
- April 1-4, 2007. **10th International Symposium on Wetland Biogeochemistry: Frontiers in Biogeochemistry**, Annapolis, Maryland, USA Website: <http://www.serc.si.edu/conference/>
- April 29 to May 2, 2007. **2007 Canadian Institute of Mining and Metallurgy Annual Conference and Exhibition** Website: <http://www.cim.org>
- May 23-25, 2007. **Joint Annual Meeting Geological Association of Canada- Mineralogical Association of Canada**, Yellowknife, Northwest Territories, Canada. Website: www.nwtgeoscience.ca/yellowknife2007/
- May 27-31 2007. **IMWA Symposium: Water in mining environments**. Cagliari, Sardinia, Italy. University of Cagliari, Department of Earth Sciences, E-mail: Rosa Cidu @ cidur@unica.it

- June 14-19, 2007. **23rd International Applied Geochemistry Symposium**, Oveido, Spain. Contact: Jorge Laredo, University of Oveido, Spain Email: jlaredo@correo.
- July 5-19, 2007. 9th International Conference on the Biogeochemistry of Trace Elements ((9th ICOBTE). Beijing, China. Website: <http://www.conferencenet.org/conference/icobte.html>
- August 13-18, 2007. **WRI-12 International Symposium on Water-Rock Interaction**, Kunming, China. Website: <http://www.wri12.org>
- August 19-24, 2007. **Goldschmidt 2007 - "Atoms to Planets"** Cologne, Germany Website: <http://www.goldschmidt2007.org/>
- August 20- 24, 2007. **SGA Meeting - 9th Biennial** Dublin, Ireland. Website: <http://www.cpreregistrations.com/sga2007>
- September 9-12, 2007. **Exploration 07** Toronto, Canada. Website: <http://www.exploration07.com/>
- September 24-30, 2007. **AGS-2007 Symposium: Ores and Orogenesis-CircumPacific Tectonics, Geologic Evolution and Ore Deposits**. Tucson, Arizona, USA Website: <http://www.agssymposium.org>
- October 22-24, 2007. **World Gold 2007** Cairns, Australia. Website: <http://www.ausimm.com/gold2007>
- October 28-31, 2007. **GSA Annual Meeting, Earth Sciences for Society Beginning of the International Year of Planet Earth**, Denver, Colorado, USA website: <http://www.geosociety.org/meetings/2007/>
- November 27-29, 2007. **6th Fennoscandian Exploration & Mining FEM 2007** Lappia Hall, Rovaniemi, Finland. Website: www.lapinliitto.fi/fem2007/index.htm

2008

- July, 2008. **SEG-GSSA 2008 Resurgence of Economic Geology and the Minerals Industry in Africa**, Joint Conference of the Geological Society of South Africa and SEG Incorporating GEOFORUM 2008. Johannesburg, South Africa. Website: <http://www.seg-gssa2008.org/>
- July 13 - 18, 2008 **Goldschmidt 2008** Vancouver, BC, Canada. Web site: (forthcoming)
- August 5-14, 2008. **33rd International Geological Congress**, Oslo, Norway. Website: <http://www.33igc.org>.
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David Lawie, John Gravel



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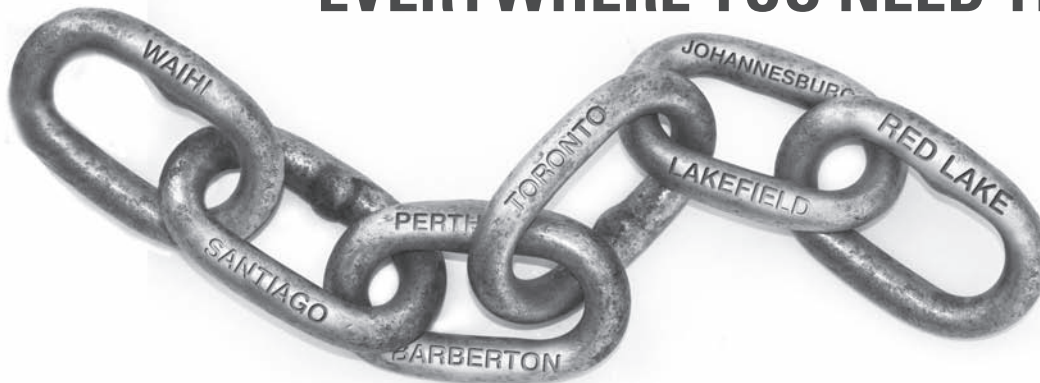
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