



Special thanks to the contributing professors and AAG councilors who assisted with this focus issue of EXPLORE, a summary of those Universities around the world teaching courses in Exploration, Environmental, or Applied Geochemistry.

If there are Universities which we missed in this issue, please send all the information to the editor [Chris.Benn@bhpbilliton.com](mailto:Chris.Benn@bhpbilliton.com) for inclusion in a later issue of EXPLORE.

## “Who will deliver the last classical exploration geochemistry course?”

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## The General Picture for Science Education in Australia

Over the last 15 years the number of students entering Australian universities (including UNSW) has jumped by over 50 %. These gains have mainly favoured non-scientific fields, apart from medical science. The physical sciences

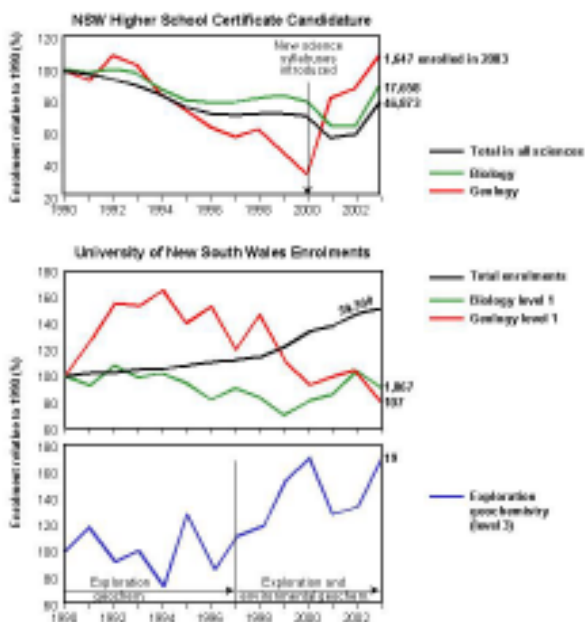


Figure 1 - Comparison of enrollments in science and selected disciplines in the NSW Higher School Certificate and at UNSW for the period 1990-2003, relative to 1990 enrollments. Actual enrollments for 2003 are also indicated.

continued on page 2



David Kelley

## AAG Presidential Address

Greetings fellow members of the Association of Applied Geochimists. By now you have probably heard that fellows voted overwhelmingly in favor of the name change from AEG to AAG. There are many changes that carry on from this and Council and Committee chairpersons will be active in implementing these changes. Please help spread the word that our name has changed to your colleagues.

In response to the name change, Council passed three motions of importance. These are: 1) the logo will remain the same except for the name of the Association around the perimeter, 2) the next conference in Perth in 2005 will be marketed as the 22<sup>nd</sup> International Geochemical Exploration Symposium AND the 1<sup>st</sup> International Applied Geochemistry Symposium, and 3) a new website, [www.appliedgeochemists.org](http://www.appliedgeochemists.org) has been registered to host the website. Keeping the same logo will help link our past to the future and the recognition that the AEG has established over the past 34 years.

I for one am glad to have this decision behind us. This issue has carried on for too long, and now we can focus on issues related to geochemistry and growing our Association. Exploration geochemistry will always be a core interest in our Association, but now it will be easier for us to interact with a broader range of specialists in geochemistry. This will only make us better geochemists as we face today's challenges. For those of us still involved in mineral exploration, this couldn't have come at a better time as the search for world-class mineral resources goes under cover. Understanding the processes involved in secondary dispersion through post-mineral overburden is currently the



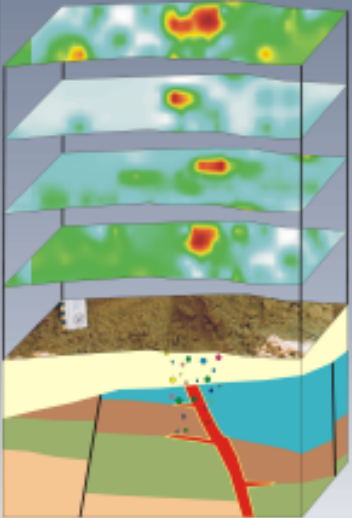
Figure 1 - Members from the IGGE and WMC attending the AAG presentation. Front row: Dr. Sun, Professor Xie, Mrs. Li, AAG President David Kelley and WMC Senior Geoscientist Zhanlin Gao.

continued on page 7



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## Focus on: Academic Institutions... *continued from page 1*



have experienced declining or static student enrolments in the face of, or maybe as a result of, a continued reduction in real funding provided to teach those disciplines. Many attribute declining enrolments to reduced numbers of students undertaking science in the latter years of high school. Whereas this is evident in the NSW Higher School Certificate (HSC) candidature over the period 1990–1999, there have been encouraging gains following the introduction of a new syllabus in science (Figure 1). However, to attract the weaker or numerically challenged students, new syllabuses have reduced the quantitative aspects of science and moved away from the study *of science* to the study *about science*, by exchanging social context for scientific content. NSW is possibly an anomaly in having had geology as a senior high school subject. The new HSC course on Earth and Environmental Science (E&ES), that replaced the moribund Geology course, has been well received by teachers and students and 1,700 were enrolled in 2003. Yet, for every student studying E&ES there are 10 students studying Biology. This proportion is likely to get worse for the geosciences\* as few graduates with relevant geoscience background are re-entering the school system as teachers (even during the latest mineral industry recession). I suspect this is a common story in many countries.

At tertiary level, the geosciences face both a lack of general student demand for courses and continuing per capita funding reduction for teaching. The peaks in first

*Continued on Page 17*


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## Generations of Applied Geochemists

### INTRODUCTION

Our fearless but now retiring Editor of **EXPLORE**, Mary Doherty, suggested that one of us (Gerry Govett) should write a few anecdotal comments about the history of geochemistry from the early Professor John Webb days to now. Many of us are either second, third or perhaps fourth generation geochemists as a result of that initial group at the Royal School of Mines (RSM) at Imperial College (IC), London. She suggested that this would be an opportune time as the Association takes “a bend in the road” with its name change and broadened activity.

GG quickly realised that the project was too big for one person – and in any case, doubted the veracity of his memory. Consequently, he solicited help from a few geochemists of various generations whose names appear at the end of this article; in addition to these, special thanks are due to Dr Robert Garrett of the Geological Survey of Canada (GSC) for help in documenting some of the history. Many more (perhaps hundreds!) could have been contacted; the time frame, however was short – about three weeks. Moreover, this is intended to be just a snapshot of a particular strand of the applied geochemical story (i.e., the exploration academic strand) and not a definitive history. Nevertheless, Gerry Govett, as compiler, takes responsibility for errors of omission and commission.

### SOME HISTORY

The precursor of the Applied Geochemistry Research Group (AGRG), was known as the Geochemical Prospecting Research Centre (GPRC), and commenced in the latter half of 1952. John S. Webb, then a mining geology lecturer at RSM, made a tour of North America with Herb Hawkes of the USGS (who had started work on exploration geochemistry after World War II) and others. While this was in progress, the Professor of Mining Geology, David Williams, recruited John S. Tooms, a chemistry and Honours geology graduate, as the first geochemical research student.

Applied geochemistry at RSM then commenced in one third of a small room shared with two mining geology postgraduate students, Jeff Kenyon and Tony Barringer. The latter became better known as a geophysicist and founder of Barringer Research in Canada and USA; interestingly, a great deal of Barringer’s consulting and research was in exploration geochemistry. A total of one hundred pounds sterling was allocated from departmental funds to set up a geochemical laboratory (in the same one third of a room!). Fortunately, this was in the days when dithizone was used for the determination of Cu, and Zn, and *B* nitroso *a* naphthol was used for Co.

The first research was funded by Rhodesian Selection Trust (RST) on the Copperbelt of what is now Zambia. Herb Hawkes expressed some concern about the project as the USGS had failed to obtain soil anomalies over mineralization beneath much thinner laterite profiles in Nigeria. The research, in fact, proved hugely successful in establishing soil and reconnaissance drainage exploration techniques that were rapidly adopted by the major mining companies (RST and Anglo American) in Central Africa and beyond. The difference between the failure in Nigeria and success in Zambia was analytical methodology.

From this relatively modest beginning, but with backing from various organizations including, in particular, the Natural Environment Research Council, the Department of Scientific and Industrial Research and numerous mining companies, the GPRC rapidly expanded into the AGRG (in 1961-62) occupying half of a new floor of the RSM.

### THE PRESENT CONTEXT

It has been argued in support of the change of name of our Association that geochemistry is important in land use, groundwater, human and animal health related to bedrock and the regolith, and the broad field of environmental geochemistry, and that we should attract geochemists working in these fields to our Association. It is sobering to look at the titles of papers given at the meeting held in London more than 20 years ago (in 1983) to honour John Webb (*Iain Thornton and Richard J Howarth, Eds, 1986; Applied Geochemistry in the 1980s. Graham and Trotman, 347p*).

In addition to the expected exploration-oriented papers, there are titles like *Geochemistry and Animal Health*, *Geochemistry and Human Health in the 1980s*, and *The Interaction Between Geochemical and Pollutant Metal Sources in the Environment: Implications for the Community*. It is also worth remembering that low density regional geochemical surveys and geochemical atlases (the original research surveys were by well known geochemists Keith Viewing, Lloyd James, and Robert Garrett, under the supervision of John Tooms and Ian Nichol), and environmental geochemistry in its broadest sense were pioneered by John Webb’s group.

So, upon reflection, it is likely that John Webb would regard the change of name to *Association of Applied Geochemists* coming full circle rather than “a bend in the road”. The change of name from *Geochemical Prospecting Research Centre* in the 1960s to the *Applied Geochemistry*

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## TABLE OF CONTENTS

|  |    |
|--|----|
| Focus On: Academic Institutions .....    | 1  |
| The General Picture for Science          |    |
| Education in Australia .....             | 1  |
| Universities .....                       | 19 |
| Message from the President .....         | 1  |
| Generations of Applied Geochemists ..... | 3  |
| Obituary: Dr. Henry Clifford James.....  | 8  |
| Calendar of Events .....                 | 9  |
| Recent Papers .....                      | 10 |
| New Membership Committee Report .....    | 11 |
| Student Paper Prize .....                | 20 |
| New Members .....                        | 31 |
| Coming Soon in EXPLORE .....             | 31 |
| Attention! E-mail recipients.....        | 31 |

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## Generations of Applied Geochemists

continued from Page 3

Research Group was to better reflect its broadened activities (parallel thinking to our change of name for AEG to AAG!).

The influence of John Webb, and his students and staff, upon the development of applied geochemistry and its spread around the world has been remarkable. The success of the AGRG should be judged not only on the quality of the research which resulted in its recognition as the premier applied geochemical research centre in the world, but also on the success of the human output. Of particular interest to the Association, of course, is that the late Alan Coope was one of the very early graduates of GPRC (1958). The numbers of ex-students of AGRG who head, or have reached senior positions in, mining and other organizations is impressive (and we apologise for not having space to list them all here). For this, their research supervisors may claim, possibly, some credit!

### THE SUCCESSION

Apart from the huge number of students that were trained in applied geochemistry with John Webb (the first 100 post-graduates were celebrated at the IGES at Vancouver in 1974), a few of these went on to become academics in various corners of the world and themselves trained geochemists who are now training more geochemists.

In the following paragraphs there is a very truncated history of second generation academic geochemists (in approximate chronological order of their time at IC) and *their* academic geochemical offspring. If we have omitted anyone, we apologise.

#### John Tooms

The first of the second generation is John Tooms, who stayed at RSM as Senior Research Fellow after his graduation and was later Reader. He was supervisor and mentor to many of the early geochemists (and hence an invaluable source of data for this article). John, however, was also *de facto* second-in-command to John Webb until he left to join the UN in 1973. He supervised more than 20 students (including Gerry Govett) with projects on four continents and in three oceans. In the mid-1960s he started the applied geochemical oceanographic and marine research (phosphates, tin, manganese nodules, metalliferous brines). Although the latter activity is not part of the exploration geochemistry story, two of John's students must be mentioned here – *Colin Summerhayes* who took over the marine side of John's job when he left IC, and *Dave Cronan* who joined the University of Ottawa and is now a professor in the Department of Earth Science and Engineering at IC. In the minds of those who followed him, John Tooms is regarded as first generation (perhaps 1.5?)

#### Dr Clifford James (*dec*)

(Information kindly supplied by Dr Nigel Radford, Consulting Geochemist Newmont Australia, and one of Cliff James' graduates; additional information was given by Dr Charlie Moon, see below).

Cliff was the third of the second generation and he

joined RST immediately following his graduation in 1957. In 1961 he returned to the IC Geochemistry Group as a DSIR Fellow where he taught and supervised students on exploration projects in Australia, the Far East and Ireland. While there he developed and patented a widely used mercury vapour meter. In 1965 he was appointed Lecturer in Economic Geology at Leicester University to help develop a new MSc course in Mining Geology and Mineral Exploration. He was Head of the Department of Geology from 1973 to 1976.

In 1982 he was appointed Head of the Department of Mining Geology in the Western Australia School of Mines in Kalgoorlie where he remained until his retirement in 1994. He was an enthusiast for applied geochemistry and trained many students from many countries. One of his most notable graduates was *Jane Plant*, CBE. Jane has had an influential career in the British Geological Survey where her most recent position is Chief Scientist. She has now also been appointed Professor of Applied Geochemistry at IC and is no doubt planning on continuing the geochemical legend of IC with her own particular flavour!

#### Gerry Govett, Emeritus Professor

The fourth of the second generation was Gerry Govett who joined the GPRC in 1955 and went to the Copperbelt (naturally!) to investigate factors controlling the dispersion of copper in soils and stream sediments that lead to a trial reconnaissance level drainage survey. He regards himself as an accidental academic as he never planned nor intended to be an academic. Nine years after his PhD he was working in the Philippines for the UN. His project manager, the late Ernie Hale on leave from the University of New Brunswick (UNB), suggested he go to UNB as a Visiting Professor for a year. As the UN were trying to persuade him to go to the Solomon Islands (which did not greatly enthuse him), he decided to give it a go in 1966.

He went back to the UN in 1967 and, while in Cyprus, he was offered a permanent position as Associate Professor at UNB. In 1968, when the UN was again offering him the Solomon Islands, which continued to be unattractive to him, he accepted the position at UNB. The rest, as they say, is history. While at UNB he supervised 23 MSc and PhD students from 13 countries with projects in seven of them. Two of these graduates became full-time academics (*Bob Whitehead* and *Sam Chork*, see below) while a third, *Wayne Goodfellow* of the GSC, is an Adjunct Professor at the University of Ottawa.

Gerry Govett left UNB at the end of 1977 to take the Chair of Geology in Mineral Exploration at the University of New South Wales (UNSW) where, after a few years *Sam Chork (retired)*, joined him on staff. While at UNSW he supervised eight MSc and PhD (and numerous Honours) students before being diverted into administration. One of his notable PhD graduates was *David Cohen* who is also an MSc graduate of Ian Nichol! Another IC applied geochemistry PhD graduate (*Alistair Dunlop*) was on staff at UNSW during Gerry Govett's time there (see separate entry, below).

continued on page 5

## Generations of Applied Geochemists

continued from Page 4

### R (Bob) E Whitehead, Emeritus Professor.

Bob says that he became a geochemist because while an undergraduate he asked a visiting lecturer a question. The visitor in question was Gerry Govett who replied “I do not know the answer, but if you will sell me your soul for three years, you can find the answer yourself.” In due course Bob sold his soul and graduated from UNB with a PhD in 1973. As neither Gerry nor Bob can remember the question, no one knows if Bob found the answer. He served as research assistant to Gerry until January 1974 when he took up a position as exploration geochemist at Laurentian University. Bob supervised 19 graduate students at the M.Sc. level, most of whom found work in the mineral exploration industry, and spent 5 years, along with J.F. Davies and H. Gibson, setting up and editing the CIM Journal of Exploration and Mining Geology

*David Cohen* completed graduate research degrees under both Ian Nichol at Queen’s and Gerry Govett at UNSW (it is debated whether this provided him with the least or the most genetic diversity of any exploration geochemist). He continued on at UNSW in coal and then groundwater research before joining the academic staff (replacing Sam Chork) at UNSW in 1992, to teach alongside Gerry Govett and Al Dunlop, and completed a sabbatical at CSM with Graham Closs. He is now Presiding Member of the Faculty of Science as well as (hopefully) masterminding the resurgence of applied geochemistry. His first PhD student *Samad Alipour* has been the head of the Geology Department at Urmia University in Iran, and he has a number of other graduate students from various corners of the planet.

### Ian Nichol, Emeritus Professor

After finishing his PhD research at Durham University with Sir Kingsley Dunham in 1961, Ian served his apprenticeship with John Webb assisting in the supervision of some ten students working in Sierra Leone, Zambia, Ireland, and Northern Ireland. Of particular current interest is Ian’s involvement with the Northern Ireland Geochemical Atlas, and the geochemical maps of Derbyshire, Denbighshire and Devon that drew attention to features of environmental concern as well as their exploration interest. In 1969 Ian returned to Queen’s University (where he had completed his M.A. in 1958) to commence research activity in exploration geochemistry in the context of the need for expansion in university research training opportunities.

Although most of the research was sited in Canada, research was also carried out in Australia, Thailand and China. In a two-year leave of absence from Queen’s (1986-88) Ian was Technical Manager of the U.N. Revolving Fund for Natural Resources Exploration. Over the years Ian supervised some thirty five Masters and PhD students at Queens, a significant number of whom have attained senior positions in the exploration industry, government agencies and universities. One of his most notable graduates is

### Graham Closs, Associate Professor.

After graduating from Queen’s University in 1973, Graham joined the Ontario Division of Mines (now Ontario Geological Survey) in Toronto as a geologist/geochemist. In 1978 he was appointed to the Department of Geology and Geological Engineering, Colorado School of Mines (CSM) following the retirement of the late Harold Bloom. He has supervised more than 25 graduate students in exploration geochemistry and economic geology, and still counting. One of those students is *Germano Melo*, now a Professor at the Federal University, Natal, Brazil. (and the only recorded fourth generation academic, so far!)

As an aside, it is of interest that Hal Bloom was a member of 1954 New Brunswick team of Herb Hawkes, John Webb, and John Riddell that conducted the English-speaking world’s first regional scale stream sediment survey. Both Hal and Herb left positions with the USGS to take up the opportunities associated with the New Brunswick activity. Hal then joined CSM in 1955 and Herb was associated with MIT and Cal Tech before becoming a private consultant. Another historical footnote is that in 1976 Gerry Govett had Herb Hawkes and John Riddell re-enact their stream sediment sampling in New Brunswick as part of the Exploration Geochemistry in the Appalachians Regional AEG meeting.

### Keith Viewing, sometime Professor

Keith had his first contact with geochemistry as an employee of RST watching a demonstration by John Webb in the Copperbelt in 1952. After a number of contacts in southern Africa with John Tooms and Cliff James, he joined the RSM group in London in 1960 where he did a PhD on regional drainage mapping in Sierra Leone. He returned to RST in 1963. In 1969 he joined the new Institute of Mining Research at the forerunner to the University of Zimbabwe where he was awarded a personal chair in 1975. In leading and developing the Institute for 20 years, he also supervised postgraduate applied geochemistry students. He also taught an intensive applied geochemistry course to mature age students in an MSc mineral exploration course at Rhodes University in South Africa in 1981–1989. In 1989 Keith left the University to join Anglo American to re-build their local exploration team where he remained until his retirement in 1993. Keith is an Honorary Fellow of the IMM (now the IMMM).

### K Fletcher, Emeritus Professor

Following his graduation from IC, K (we always wonder what K stands for!) went to the University of British Columbia in 1968 as a Postdoctoral Fellow with Professor Harry Warren. Two years later he became an Assistant Professor and started his own graduate student programme that eventually graduated twenty-two Masters and Doctoral students. Apart from teaching at UBC, K has given short courses in exploration geochemistry in more than a dozen countries – most recently, Tunisia and Mexico under the auspices of the Keevil Chair in Mineral Exploration that he held until his recent retirement. During time away from UBC, K spent three years in Zambia (where he was able to

continued on page 6

## Generations of Applied Geochemists

continued from Page 5

repeat history by using dithizone on the Copperbelt) and two years with the UN at the Southeast Asia Tin Research and Development Centre in Malaysia (where he now plans to reside for part of each year).

Among his graduate students in the 1970s were *Moses Olade*, who returned to academia in Nigeria (but is now believed to be in Arizona), and *Stan Hoffman* who contributed to the education of many geologists/geochemists through short courses and case histories based on articles in *Explore*. Several of K's other graduates have distinguished themselves by winning the **AEG Student Paper Prize** and most have gone on to careers in either mineral exploration or environmental geochemistry related to mining activities.

### Charles Butt

Charles sneaks in as a representative of those who are not strictly academics but are occasional supervisors and course presenters. Charles escaped the purist tendencies of most British geology departments (who believed that it was unworthy to study anything that might be either useful or tainted by trade) after reading John Webb's papers on exploration geochemistry and the links between geochemistry and agriculture and health. He studied at the AGRG from 1967-1971, commencing the regional geochemical survey of Northern Ireland, with Ian Nichol and later Iain Thornton as PhD supervisors, following up both exploration and agricultural issues.

Charles subsequently joined CSIRO in Perth, Western Australia, and has concentrated on developing exploration procedures for deeply weathered terrains ever since. Charles has delivered courses at undergraduate (at Curtin University) and graduate levels in Australia and several other countries. One of his PhD graduates, **Louisa Lawrance**, is a part-time lecturer at the University of Western Australia where she, in turn, has supervised several Honours and PhD students.

### Alistair Dunlop (retired 2003)

Alistair completed his PhD under the supervision of Tim Meyer from the AGRG at IC in 1973. He taught ore deposit geology, mineral exploration and exploration geochemistry at the University of New South Wales initially as a tutor and then as Senior Lecturer. He was a colleague of Gerry Govett and Sam Cork, and more recently David Cohen. Alistair supervised more than a dozen Masters and PhD students and many Honours students. One of his PhD students, *Surapon Arrykul* (graduated in 1985) returned to Thailand to continue the IC legacy at the Prince Sonkla University.

### Martin Hale, Professor

After learning geochemical surveying as an exploration geologist for Anglo American in Zambia, Martin embarked on his PhD research in exploration geochemistry at AGRG from 1972 to 1975. Another accidental academic, he stayed at IC as a lecturer, then senior lecturer and assistant director of the Department of Geology while supervising more than

15 PhD students in exploration geochemistry. In 1990 he moved to the Netherlands to become Professor of Mineral Exploration at the International Institute for Geoinformation Science and Earth Observation (ITC) and, until recently, was concurrently Professor of Geochemistry at Delft University of Technology. Now Head of Research at ITC, he has maintained strong links with exploration geochemistry by supervising mineral exploration PhD students and by editing two volumes (one with Jane Plant) of the Handbook of Exploration Geochemistry. After Gerry Govett passed the Series editorship to Martin in 2001, he widened its scope as the Handbook of Exploration and Environmental Geochemistry.

*Charlie Moon* was a research assistant to Martin Hale at IC and obtained a PhD in exploration geochemistry in 1983. He has been at the University of Leicester since then and is now Senior Lecturer in Mineral Exploration. *Flavio Tavora* and *Claudio Porto* were both research students of Martin's at IC in the late 1980 and went on to become academics at different universities in Brazil.

## THE FUTURE

We do not know whether applied geochemistry has become an entirely respectable academic pursuit, but it is probably now much more acceptable in the halls of learning than in the early days. Gerry Govett still vividly recalls John Webb's outrage at an encounter with another academic. He had tried to explain his discipline, to which the other academic responded with "Oh! You are just a technician, then". Gerry confesses to encountering similar attitudes in his early days – the problem being the word "applied". His response to doubters and critics then (and now) is that "applied geochemistry" is the same as "pure geochemistry" but more so – we do the same basic research but carry it a stage further by designing a practical use for our results.

Today the obvious question is: where are the fourth generation academic geochemists? More important than this is the question: is applied geochemistry being taught in enough universities to ensure a supply of trained geochemists to support the needs of the minerals industry, agriculture, environment and human health? The perception in Australian Universities is that available courses are more and more dictated by student demand (and hence funding). Whereas specialist geochemists can be trained through postgraduate degrees by supervisors who can get research funds and sponsors in relatively few institutions (and are there enough of these?), the increasingly broad scope of applied geochemistry does require that applied geochemistry be taught at the undergraduate level in a substantial number of universities.

We think that it is the task of all members of the newly-named **Association of Applied Geochemists** to make all the users of applied geochemistry – such as the mining industry, agricultural organisations, environmental agencies at local and national levels – aware of the need for universities to produce appropriately trained graduates for their needs. The users should also be lobbied to provide support, both in kind and cash, to assist universities meet the demand.

continued on Page 7



## Generations of Applied Geochemists

continued from Page 6

### POSTSCRIPT

This brief article is dominated by the interest of the contributors — exploration geochemistry. There is a parallel story to be told about the rest of applied geochemistry that is generally referred to as environmental geochemistry. The history of this (as has been alluded to above) may also fairly be said to have started with John Webb's group, and was developed under John Webb's successor at Imperial College,

Professor Iain Thornton. A final note of interest is to remind everyone that *Mary Doherty* – who suggested this brief historical adventure – is herself a third generation applied geochemist with an MSc from Queen's University supervised by Ian Nichol.

**Charles Butt, Graham Closs, David Cohen, Alistair Dunlop, Gerry Govett, Martin Hale, K Fletcher, Charlie Moon, Ian Nichol, John Tooms, Robert Whitehead and Keith Viewing**



## Presidential Address...

continued from Page 1

focus of research in many organizations. We are starting to see the collaborative involvement of organic geochemists, soil scientists, microbiologists and hydrologists to solve these complex problems. The AAG will be well positioned to bring these professions and others together for a greater degree of interaction.

It's official, the mining industry is coming back strong. I have not seen final numbers yet, but organizers of the PDAC convention just held in Toronto stated attendance of around 12,000 people. The junior mining sector is raising money hand over fist and exploration spending is up about 20%. A large percentage of this spending will go to geochemistry, which should bode well for all of us.

I was very fortunate recently to visit the Institute of Geophysical and Geochemical Exploration (IGGE) in Langfang, China. We were graciously hosted by Dr. Sun Hongyan, Dr. Wang Xueqiu and Professor Xie Xuejing. I was incredibly impressed by the state of geochemistry in China. There are over 1000 geochemists in China working on various aspects of applied geochemistry. At their own conference held on behalf of the China Geochemical Society in 2003, more than 200 of these geochemists convened to share their experiences and present their work. We met several students working on projects funded by the IGGE. It was refreshing to see geochemistry flourishing. This is certainly a tribute to the hard work of Professor Xie and his colleagues over the past 50 years.

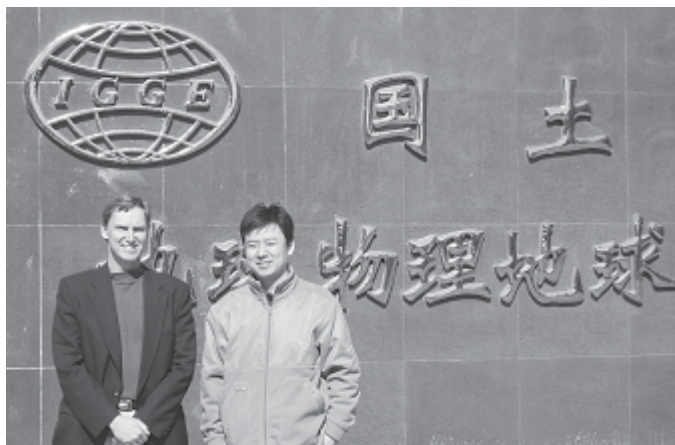


Figure 2 - AAG President David Kelley and IGGE Chief Geochemist Dr. Wang.

For those of you who have not met Professor Xie, he is considered the Father of Geochemistry in China. He is retired now but he uses Eion Cameron's definition of retirement, which means he is as active now as he was when he was "employed." Part of his success undoubtedly can be attributed to his wife Li Meisheng who is an analyst (every geochemist should be so lucky as to have their wife be an analyst). Mrs. Li was developing field portable colorimetric methods in the 1950's at the same time as Dr. Harold Bloom, but because of the strict control on scientific communication at the time, she was unable to publish her work.

I took the opportunity to meet with 16 of our members at the IGGE (Figure 1, page 1) to give them an update on the Association and a high-level overview of several talks presented at the IGES in Dublin. We had a very lively discussion afterwards about the Association and our direction. Professor Xie mentioned that the biggest obstacle preventing more Chinese geochemists from joining AAG is the language barrier. Of the 1000 geochemists in China, it is estimated that only about 100 read English. Cost of membership is less of an issue now because the standard of living has increased in China and membership in professional societies is usually supported by the government.

In addition to his full-time job as Chief Geochemist for the IGGE, Dr. Wang serves the AAG as our Regional Councilor for China (Figure 2). He is active in promoting the AAG to geochemists in China and encouraging the various libraries to subscribe to GEEA. Hopefully we can add about 80 new members and several new library subscriptions in the near future. Dr. Wang also mentioned that we may be able to assist the IGGE in providing training to geochemists from several African nations in the fall of this year. This would be great exposure for the AAG to an international audience of practicing applied geochemists.

The tide is finally changing for the Association and the minerals industry. Please stay active and offer your help. The dedicated professionals that are working hard for the Association welcome your input and assistance.

### David Kelley

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## Obituary

### Dr Clifford Henry James

**B.Sc., D.I.C., Ph.D., F.I.M.M., C.Eng.**

"MAK" 4/8/03

Dr Clifford James, Head of the Department of Geology of Leicester University from 1973-76, died on June 8<sup>th</sup> 2003 aged 72. He had suffered from kidney failure. In 1965, Cliff was appointed Lecturer in Economic Geology in the Department to plan and develop with Tony Evans and Aftab Khan a new M.Sc. course in Mining Geology and Mineral Exploration. He was responsible for the M.Sc. and B.Sc. courses in Geochemical Prospecting, Mineral Exploration, Photogeology and Remote Sensing, and Mineral Economics, but also contributed to courses in Surveying, Mine Surveying, Mining, Mineral Dressing, and Ore Geology. He led an annual imaginative integrated exploration field course to some part of the U.K. The MSc course soon built up an international reputation and attracted students from all over the world. A consequence of the demand was the emergence of separate MSc courses in Mineral Exploration and in Mining Geology and a BSc in Mining Geology. Cliff was promoted to Senior Lecturer in 1970. In 1973 he was made Head of Department, one of the first non-professorial members of staff to be so appointed in the University. He left the University in 1982 to take up an appointment as Head of the Department of Mining Geology in the Western Australia School of Mines (WASM) in Kalgoorlie, which is now part of the Curtin University of Technology.

Cliff attended a number of primary schools as his father was a bank manager with Lloyds and moved often. He went to Worthing High School for boys and then obtained a choral scholarship to Lancing College where he took his A levels in Physics, Chemistry and Mathematics. He did two years of National Service training as a Telecommunication Mechanic with REME and emerged with the rank of Craftsman of the highest class attainable by a National Serviceman. To pursue his long-standing interest in geology he went to Imperial College to read Mining Geology, and graduated in 1954, winning the Cullis best student award in the process.

He stayed on at Imperial to achieve a PhD in Applied Geochemistry, a subject in which he was a real enthusiast and in which he built up a high international reputation. In 1957 he joined the Rhodesian Selection Trust as a geologist-geochemist for three years with his first wife Cynthia as an assistant. He set up laboratories for the new exploration section of the company at its bases in Salisbury and Francistown as well as field laboratories near their field operations. He was involved in gold exploration, and masterminded their geochemical exploration programmes for copper and other base metals. He did research on the geochemical dispersion of arsenic and antimony in relation to gold exploration and on prospecting for chromite in the Great Dyke. He returned in 1961 to the flourishing Imperial College Geochemistry group as a DSIR Fellow and also taught and supervised graduates on exploration projects in Australia, the Far East, and Ireland. He did pioneering work

on the application of gaseous dispersion in prospecting, and patented a widely used mercury vapour meter able to detect  $10^{-10}$  gm per litre of air.

At Leicester he extended his research into the methodology and the interpretation of geochemical data in the exploration for base metals in Greece, Turkey, many parts of the U.K., and for bauxites in Guyana. He developed special interests in the errors inherent in geochemical data from a variety of environments and in applying new statistical methods like Cluster Analysis to aid their interpretation. His memory was phenomenal and his wide knowledge of mineral deposits world-wide was a great asset in teaching and in discussions at scientific meetings. He was invited to do the Annual Review of Exploration for the Mining Journal which he did with Aftab Khan throughout his time at Leicester. He served for many years on the Editorial Boards of the Journal of Applied Geochemistry and the Applied Earth Science Section of the Institution of Mining and Metallurgy. His exploration expertise was highly respected in the mining industry and his advice was sought by many international mining companies and organisations including the World Bank.

Cliff developed a strong interest in the mineral deposits of Western Australia which began in 1963 when he paid the first of his many visits to Kalgoorlie on sabbatical leave to do special projects with the Western Mining Corporation with his friend, Roy Woodall, the Exploration Manager, who later became a Director of the Corporation. It was a part of the world he liked and where he became well-known. He was therefore delighted to receive the offer to go there in 1982. He went with his second wife Carmel, at a time of major change in education for the minerals industry. He used his extensive experience at Leicester to develop a four-year Bachelor of Engineering in Mining Geology to complement the existing BSc degree. There he also set up an exploration geochemistry laboratory for teaching and research. Near the end of his career he was heavily involved with a major Australian Government project to provide assistance to the Hanoi University of Mining and Geology in Vietnam where he developed close personal relationships with his fellow Vietnamese academics, and the people in general. He retired in 1994 and returned with Carmel to reside in the Isle of Wight.

Cliff's sense of fun was greatly missed when he left Leicester. His classes were usually enlivened by amusing stories of his experiences. He loved playing games and organising social events. He was the driving force behind the annual Bennett Balls and Christmas parties, usually with a Jazz Band and a cabaret in which he had a leading role. His performance singing falsetto, and in costume the role of Zerlina, in the seduction scene from Mozart's Don Giovanni, is unforgettable. He had a versatile singing voice and was often heard leading his students singing rugby songs in pubs and organising staff-student darts and cricket matches after field trips. The team spirit he generated between the various staff and the students contributed in no small way to the success and happy atmosphere of the department. Cliff is survived by his wife Carmel, and his children Howard and Kate by his first wife Cynthia.







## CALENDAR OF EVENTS

International, national, and regional meetings of interest to colleagues working in exploration, environmental and other areas of applied geochemistry.

■ April 18-21, 2004, **Clean technologies for the mining industry**, Concepcion, Chile: INFORMATION: Mario Sanchez, msanchez@udec.cl, www.udec.cl/ctmi

■ April 21-23, 2004, **5th Biennial Interstate Technical Group on Abandoned Underground Mines Workshop**, Viscount Suite Hotel, 4855 East Broadway, Tuscon, Arizona, USA, by the Arizona Department of Transportation and Federal highway Administration. (Nick Priznar, 1221 North 21st Avenue, 068R, Phone: 602-712-8089 FAX: 602-712-8415 EMail: npriznar@dot.state.az.us

Web: <http://www.fhwa.dot.gov/mine/minework.htm>)

■ May 2-7, 2004, **40th Forum on the Geology of Industrial Minerals**, Indiana Memorial Union Building, Indiana University, Bloomington, IN, USA, by the Indiana Geological Survey and Department of Geological Sciences Indiana University. (Nelson R. Shaffer, 611 N. Walnut Grove, Bloomington, IN 47405, Phone: 812/855-2687 FAX: 812/855-2862 EMail: shaffern@indiana.edu Web: <http://igs.indiana.edu/imforum>)

■ May 3-5, 2004, **GSA Rocky Mountain/Cordilleran**, Boise, Idaho. INFORMATION: C.J. Northrup, Chair, (208) 426-1581, cjnorth@boisestate.edu

■ May 9- 12, 2004, **EDMONTON 2004**, Canadian Institute of Mining and Metallurgy - Annual General Meeting (CIM-AGM), Mining Industry Conference and Exhibition. More information: [www.cim.org](http://www.cim.org)

■ May 17-20, 2004, **National Monitoring Conference: Building and Sustaining Successful Monitoring Programs**, Chattanooga Convention Center, Chattanooga, TN, by the National Water Quality Monitoring Council (NWQMC). (National Monitoring Conference Coordinator), 10045 Red Run Blvd., Ste. 110, Owings Mills, MD 21117, Phone: 410-356-8993 FAX: 410-356-9005 EMail: nwqmc2004@tetrattech-ffx.com Web: <http://www.nwqmc.org>)

■ June 5-11, 2004, **2004 Goldschmidt Conference**, Copenhagen, Denmark. INFORMATION: Susan L.S. Stipp, Assoc. Prof., NanoGeoScience, Geological Institute, University of Copenhagen, Øster Voldgade 10, DK-1350 Copenhagen, Denmark; Bjørn Jamtveit, Co-director, Physics of Geological Processes, University of Oslo, P.O. Box 1047, Blindern, N-0316 Oslo, Norway. <http://www.goldschmidt2004.dk/>

■ June 19-24, 2004, **Clay Minerals Society annual meeting**, Richland, WA, USA, by the Clay Minerals Society and Pacific Northwest National Laboratory. (Jim Amonette, Phone: 509-376-5565 FAX: 509-376-7972 EMail: jim.amonette@pnl.gov Web: <http://www.pnl.gov/cms/>)

■ June 27-July 2, 2004, **11th International Symposium on Water-Rock Interaction**, Saratoga Springs, New York, USA (Dr. Susan Brantley, Secretary General, Dept. of Geosciences, The Pennsylvania State University, 239 Deike Building, University Park PA USA 16802, Phone: 814-863-

1739 FAX: 814-863-8724 Web: <http://www.outreach.psu.edu/C&I/WRI/>)

■ August 20-28, 2004, **32nd Session of the International Geological Congress**, Florence, Italy (Chiara Manetti, Dipartimento di Scienze della Terra, Via La Pira, 4 - 50121 Firenze -ITALY, EMail: casaitalia@geo.unifi.it Web: <http://www.32igc.org>)

■ Aug 21-28, 2004 **Global and Continental-Scale Mineral Resource Assessments, 32nd International Geological Congress**, Florence, Italy, by the Bureau de Recherches Géologiques et Minières; International Union of Geological Sciences; and U.S. Geological Survey. (Joe Briskey, U.S. Geological Survey; 12201 Sunrise Valley Drive, MS-954; Reston, VA 20192, Phone: 703-648-6112 EMail: jbriskey@usgs.gov Web: <http://www.32igc.org/home.htm>)

■ September 19-22, 2004, **8th International Congress on Applied Mineralogy (ICAM 2004)**, Aguas de Lindoia, Aguas de Lindoia, Sao Paulo, Brazil, by the International Council for Applied Mineralogy (ICAM); International Mineralogical Association - Commission on Applied Mineralogy (IMA-CAM). (Dogan Paktunc, 555 Booth Street, Phone: 613-947-7061 FAX: 613-996-9673 EMail: dpaktunc@nrcan.gc.ca Web: <http://www.icam2004.org>)

■ Sep 27-Oct 01, 2004, **SEG 2004: Predictive Mineral Discovery Under Cover**, University of Western Australia, Perth, WA, Australia, by the Society of Economic Geologists (SEG), Geoconferences WA, and Society for Geology Applied to Mineral Deposits (SGA). (Susan Ho, P.O. Box 80, Bullcreek WA 6149, Australia, Phone: (61 8) 9332 7350 FAX: (61 8) 9310 6694 EMail: susanho@geol.uwa.edu.au Web: <http://www.cgm.uwa.edu.au/geoconferences/index.asp>)

■ October 10-15, 2004, **SEG International Exposition & 74th Annual Meeting**, Denver, Colorado, US, by the SEG. (Debbi Hyer, 8801 S. Yale, Tulsa OK 74137, Phone: (918) 497-5500 Email: dhyer@seg.org Web: <http://meeting.seg.org>)

■ November 7-10, 2004, **Annual Meeting of the Geological Society of America**, Seattle, Washington. INFORMATION: TEL 1-800-472-1988, meetings@geosociety.org.

■ November 25-27, 2004, **International Karakorum Conference**, Islamabad, Pakistan. Information: Prof. Dr. F. A. Shams, Lahore, Pakistan. pags@yahoo.com or telefax: 092-42-9230236.

■ February 28-March 2, 2005, **2005 SME Annual Meeting and Exhibit**, Denver, CO. INFORMATION: Meetings Department at 800-763-3132 or 303-973-9550. [http://www.smenet.org/meetings/calendar/event\\_calendar.cfm](http://www.smenet.org/meetings/calendar/event_calendar.cfm)

■ May 15-18, 2005, **Geological Society of Nevada Symposium 2005** Sparks, Nevada USA, INFORMATION: Geological Society of Nevada (gsnsymp@unr.edu)

Please check this calendar before scheduling a meeting to avoid overlap problems. Let this column know of your events.

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## RECENT PAPERS

This list comprises titles that have appeared in major publications since the compilation in **Explore** Number 121. 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) 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**.

Albarede, F., 2003. *Geochemistry: An Introduction*. Cambridge Univ. Press. 248 p.

Ashley, P.M., Lottermoser, B.G., and Chubb, A.J., 2003. Environmental geochemistry of the Mt. Perry copper mines area, SW Queensland, Australia. *Geochemistry: Exploration, Environment, Analysis* 3(4): 345-357.

Bissig, T., Clark, A.H., Lee, J.K.W., and van Quadt, A., 2003. Petrogenetic and metallogenetic responses to Miocene slab flattening: new constraints from the El Indio – Pascua Au-Ag-Cu belt, Chile/Argentina. *Min. Deposita* 38(7): 844-862.

Boni, M., 2003. Non-Sulfide Zinc Deposits: a new (old) type of economic mineralization. *SGA News* 15: 1, 6-11.

Borba, R.P., Figueiredo, B.R., Rawlins, B., and Matschullat, J., 2003. Geochemical distribution of arsenic in waters, sediments, and weathered gold mineralized rocks from Iron Quadrangle, Brazil. *Environ. Geol.* 44(1): 39-

Braungardt, C.B., Achterberg, E.P., Elbaz-Poulichet, F., and Morley, N.H., 2003. Metal geochemistry in a mine-polluted estuarine system in Spain. *Applied Geochem.* 18(11): 1757-1772.

Breward, N., 2003. Heavy-metal contaminated soils associated with drained fenland in Lancashire, England, UK, revealed by BGS Soil Geochemical Survey. *Applied Geochem.* 18(11): 1663-1670.

Cameron, E.M. and Hattori, K.H., 2003. Mobility of palladium in the surface environment: data from a regional lake sediment survey in northwestern Ontario. *Geochemistry: Exploration, Environment, Analysis* 3(4): 299-311.

Carapezza, M.L. and Granieri, D., 2004. CO<sub>2</sub> soil flux at Vulcano (Italy): comparison between active and passive methods. *Applied Geochem.* 19(1): 73-88.

Costa, J.F., 2003. Reducing the impact of outliers in ore reserve estimation. *Math. Geol.* 35(3): 323-

Craw, D., Falconer, D., and Youngson, J.H., 2003. Environmental arsenopyrite stability and dissolution: theory, experiment, and field observations. *Chem. Geol.* 199(1/2): 71-82.

Daniel, S.E., 2003. Environmental due diligence for exploration managers. *CIM Bull.* 96(1074): 87-89.

Daniels, W.L., Schroeder, P., Nagle, S., Zelazny, L., and Alley, M., 2003. Reclamation of prime farmland following mineral sands mining in Virginia. *Min. Eng.* 55(12): 42-48.

Djingova, R., Heidenreich, H., Kovacheva, P., and Markert, B., 2003. On the determination of platinum group elements in environmental materials by inductively coupled plasma mass spectrometry and microwave digestion. *Analytica Chimica Acta.* 489(2): 245-

Donahue, R. and Hendry, M.J., 2003. Geochemistry of arsenic in uranium mine mill tailings, Saskatchewan, Canada. *Applied Geochem.* 18(11): 1733-1750.

Dow, J.A.S., 2002. Exploration Geology – Business and Leadership Challenges for the Future. *SEG Newsletter* No. 50: 17-21.

Emsbo, P., Hofstra, A.H., Lauha, E.A., Griffin, G.L., and Hutchinson, R.W., 2003. Origin of High-Grade Ore, Source of Ore Fluid Components, and Genesis of the Meikle and Neighboring Carlin-Type Deposits, Northern Carlin Trend, Nevada. *EG* 98(6): 1069-

Farias, S.S., Casa, V.A., Vazquez, C., Ferpozzi, L., Pucci, G.N., and Cohen, I.M., 2003. Natural contamination with arsenic and other trace elements in groundwaters of Argentine Pampean Plain. *Science of the Total Environment* 309(1-3): 187-

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## RECENT PAPERS

continued from Page 10

Fernandez-Nieto, C., Torres-Ruiz, J., Subias-Perez, I., Fanlo-Gonzalez, I., and Gonzalez-Lopez, J.M., 2003. Genesis of Mg-Fe carbonates from the Sierra Menera Magnesite-Siderite Deposits, Northeast Spain: Evidence from Fluid Inclusions, Trace Elements, Rare Earth Elements, and Stable Isotope Data. *EG* 98(7): 1413-1426.

Fortuna, J., Kesler, S.E. and Stenger, D.P., 2003. Sources of Iron for Sulfidation and Gold Deposition, Twin Creeks Carlin-Type Deposits, Nevada. *EG* 98(6): 1213-1224.

Gammons, C.H., Wood, S.A., Jones, J.P., and Madison, J.P., 2003. Geochemistry of the rare-earth elements and uranium in the acidic Berkeley Pit Lake, Butte, Montana. *Chem. Geol.* 198(3/4): 269-

Garcia-Sanchez, A. and Alvarez-Ayuso, E., 2003. Arsenic in soils and waters and its relation to geology and mining activities (Salamanca Province, Spain). *J. Geochem. Explor.* 80(1): 69-80.

Gemici, U., Tarcan, G., Colak, M., and Helvacı, C., 2004. Hydrogeochemical and hydrogeological investigations of thermal waters in the Emet area (Kutahya, Turkey). *Applied Geochem.* 19(1): 119-135.

Goncalves, M.A., Nogueira, J.M.F., Figueiras, J., Putnis, C.V., and Almeida, C., 2004. Base-metals and organic content in stream sediments in the vicinity of a landfill. *Applied Geochem.* 19(1): 137-151.

Gray, D.J., 2003. Naturally occurring Cr 6+ in shallow groundwater of the Yilgarn Craton, Western Australia. *Geochemistry: Exploration, Environment, Analysis* 3(4): 359-368.

Gueguen, C., Gilbin, R., Pardos, M., and Dominik, J., 2004. Water toxicity and metal contamination assessment of a polluted river: the Upper Vistula River (Poland). *Applied Geochem.* 19(1): 153-162.

Guo, H. and Wang, Y., 2004. Hydrogeochemical processes in shallow Quaternary aquifers from the Northern part of the Datong Basin, China. *Applied Geochem.* 19(1): 19-27.

Hammarstrom, J.M., Sibrell, P.L., and Balkin, H.E., 2003. Characterization of limestone reacted with acid-mine drainage in a pulsed limestone bed treatment system at the Friendship Hill National Historical Site, Pennsylvania, USA. *Applied Geochem* 18(11): 1705-1722.

Heitt, D.G., Dunbar, W.W., Thompson, T.B., and Jackson, R.G., 2003. Geology and Geochemistry of the Deep Star Gold Deposit, Carlin Trend, Nevada. *EG* 98(6): 1107-1135.

continued on Page 27

## New Membership Committee Report and Recommendations

Submitted July 2003 prior to name change to AAG

### Executive Summary

The Association of Exploration Geochemists has experienced a significant decline in its membership over the last several years. To help plan how to reverse this trend, the New Membership Committee carried out a series of brainstorming activities to identify: 1) the issues relating to the decline in AEG membership numbers over the last 7 years, 2) the opportunities that exist for obtaining new members, and 3) the activities the AEG needs to engage in to add to its membership.

The patterns of increase and decrease in AEG membership over the years suggest that the recent decline is related to a downturn in the mining industry. All regions have been similarly affected as have all areas of subject interest (exploration, environmental, analytical, etc). The major interest of the majority of members remains exploration geochemistry. There has not been a recent growth in members specifically interested in environmental geochemistry but it is recognized that this is unlikely to take place until a more inclusive name has been selected for the Association that reflects its change in focus.

The major reasons for seeking membership in the AEG are perceived to be: 1) the Association's journal, GEEA, 2) the organization of technical meetings in applied

continued on page 12

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## New Membership Committee ...

*continued from page 11*

geochemistry, 3) networking opportunities provided by a pool of geoscientists with similar interests, and 4) the opportunities to remain current in applied geochemistry through the Newsletter and the Web site. It is imperative therefore that the AEG seek to strengthen each of these assets to the benefit of its existing members and to attract new members.

Potential sources of significant numbers of new members exist in Australia, Canada, Europe, and the U.S.A. These areas suffered the greatest decline in membership during the downturn in the industry but still contain the largest pool of geoscientists interested or engaged in applied geochemistry relating to the mineral resource sector. Geoscientists active in environmental geochemistry are a specific group that can be targeted. Student populations are a third group.

The Committee recommends the following measures to stabilize the current membership level and increase membership numbers as the economic status of the minerals industry improves: 1) continue to improve the benefits of membership, 2) advertise the change in name and focus of the Association, and 3) initiate a membership drive in the major regions (Australia, Canada, Europe, U.S.A.) with particular focus on targeting environmental geochemists and student populations. Specific action items are identified. These measures are predicated on the adoption of an appropriate name change that reflects an organization inclusive of all geoscientists interested in applied geochemistry as it relates to exploration, mining, and reclamation activities.

### Introduction

The Association of Exploration Geochemists has experienced a significant decline in its membership over the last several years. In response to this trend, the AEG is in the process of changing its name and by-laws to create an organization that is more inclusive of geoscientists interested in applied geochemistry as it relates to exploration, mining, and reclamation activities. The New Membership Committee set as its goal to identify the various reasons for the decline in its membership, the opportunities to attract new members, and the activities the Association needs to engage in to add to its membership.

Committee members were solicited from various regions where the AEG has an active membership. Individuals were selected who represented interests in environmental geochemistry as well as exploration geochemistry. Through a series of brain-storming sessions, various issues were explored. The contents of this report represent a summary of all ideas advanced with respect to issues affecting the level of AEG membership and actions that can be taken to increase membership. An attempt was made to avoid judging the relative merit of specific ideas. Merit must be determined by Council.

The following individuals took the time to consider the

issues and contribute the ideas and comments contained within this report:

Robert Jackson, Chairman  
 Mark Elliott  
 David Garnett  
 Clemens Reimann  
 Eduardo Silva  
 Clark Smith  
 Cliff Stanley

### Issues relevant to AEG membership levels

At the outset, the Committee tried to identify the various issues that relate to the level of our membership. The following issues were addressed:

- 1) Why is the membership declining?
  - Why do geoscientists join AEG?
  - What is the history of new membership growth and decline?
  - Who competes with the AEG for professional membership?
- 2) How to retain existing members?
  - How can AEG be more relevant to geoscientists?
  - Is the current level of membership fees a factor in the loss of members?
  - How can the AEG increase the benefits of membership?
- 3) What AEG marketing is working, what is not?
  - What currently is the AEG's marketing strategy?
- 4) How to attract new members?
  - What are the likely sources of new members?
  - How can new members be attracted from student populations?
  - How can new members be attracted from the 'Regions'?
  - How can lapsed members be encouraged to rejoin – is the effort worth it?
  - What should be the AEG's strategy for increasing membership?

### Factors affecting declining membership

The membership database was used to identify some long term trends in the growth and decline of AEG membership. Historical data was available for the primary stated interest of each member, the general interest in various subjects regardless of primacy, and membership numbers for the major regions of the world. Unfortunately, sufficient information did not exist with respect to employment type (government, company, university, etc) to draw any conclusions.

It should be noted that many members do not fill in the information requested. For example, in 1995, only 70% of membership renewals included information on interests, etc. Consequently, the trends defined represent a subset of the overall membership. The major interest groupings are

*continued on page 13*

# New Membership Committee ...

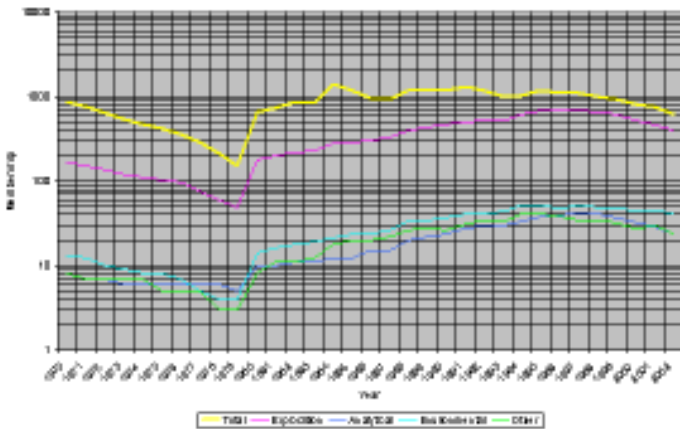
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exploration, analytical, and environmental. The 'Other' category includes computer, agricultural, terrain (Quaternary), petroleum, and groundwater interests. With the exception of agricultural which is poorly represented, the other interest groups have similar numbers in each category.

The following are some observations based on the data:

1) The membership has been in decline since 1996 falling from 1160 to 660 between 1995 and 2002 (Figure 1).

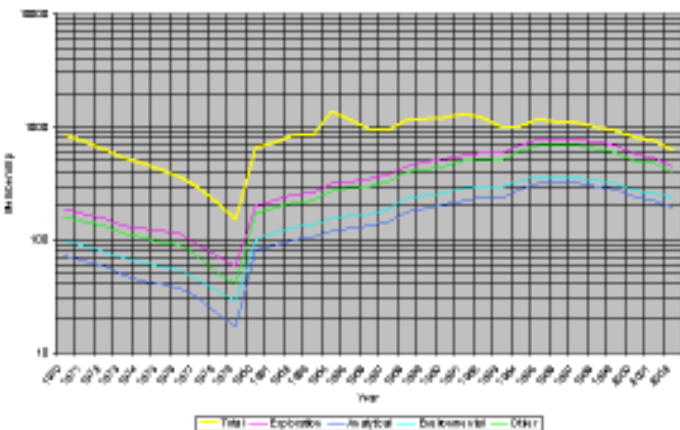
Figure 1: Membership Trends by Major Interest



2) The major interest of the majority of members remains exploration despite this decline; at least 59% of members stated exploration was their number 1 interest in 1995 – 63% in 2002.

3) All areas of subject interest (ie. exploration, analytical, environmental, etc) have experienced a similar pattern of growth and decline; this is true whether these subjects are of primary interest or general interest (Figure 1 and 2).

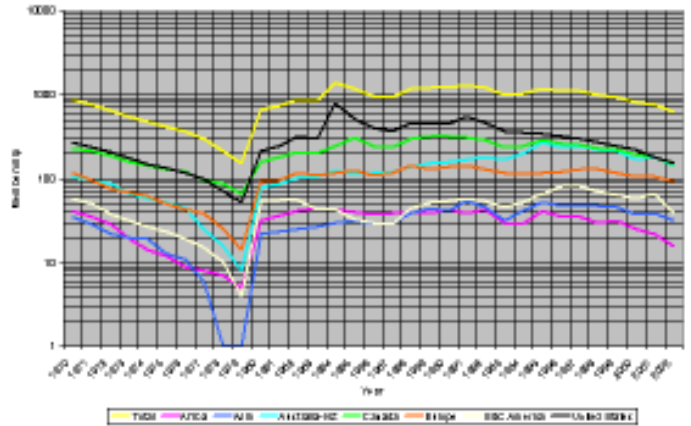
Figure 2: Membership Trends by Interest



4) All regions of the world have experienced a similar decline in membership (Figure 3); however, because Australia, Canada, and the United States account for the largest group of members (77% in 1995), it is in these countries where there have been the greatest decline in membership numbers (446 lost members between 1995 and 2002); these countries account for 68% of the membership in 2002.

The Committee concludes that the decline in membership is primarily related to the economic slowdown. For example, in Australia, overall exploration expenditure decreased 49% from 1997 to 2001. The decline was 70% in the junior mining sector. As a consequence, the numbers of

Figure 3: Membership Trends by Region



employed geologists and geochemists has decreased significantly through layoffs and merger synergies. If the AEG can stay relevant, membership should start to increase again in the next exploration surge.

Given the strain imposed by the economic state of the minerals industry, the Committee attempted to identify specific factors that influence a geoscientist in choosing to join AEG and similarly, those factors that affect the decision to let a membership lapse. These are summarized as follows:

### Reasons for joining AEG:

- The Journal
  - overwhelmingly considered the key reason for membership
- Organization of technical meetings
  - also important although membership is not a prerequisite for attendance
- Networking
  - access to a pool of geoscientists with similar interests
- Remaining current
  - AEG as a source of information
  - the Newsletter and Web site are assets in this regard

While the AEG has endeavoured to provide other services to its members like the Distinguished Lecturer Series, it is not clear if these help to attract new members.

*continued on page 14*



## Robert G. Jackson

Consulting Geochemist

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## New Membership Committee ...

continued from page 13

### Reasons for letting memberships lapse:

- Cost of membership
  - cost may have exceeded some critical threshold (ie \$50 US)
  - strength of the US\$ relative to other currencies
- Changing careers
  - many geoscientists have left the industry either temporarily or permanently
- Changing focus of the Journal
  - fewer papers of interest to explorationists
  - the reduction in high quality papers on exploration geochemistry suitable for publication is due in part to the decline in academia research and the rise in industry-funded consortiums that impose 2-3 year confidentiality restrictions; papers with an environmental focus have been needed to sustain GEEA
  - the current mix of exploration and environmental papers does not appear to reflect the interests of the Association judging by the stated interest of members (interestingly, the increase in environmental content has not contributed to a rise in the number of members specifically interested in environmental geochemistry)

- Competition for fees from other geoscientific organizations or journal subscriptions
- Competition from regional organizations
  - local organizations are more focused in their scientific content
  - examples cited include the Association of Environmental Geoscientists in Germany and the local chapters of SEG
- Infrequent contact from AEG
  - 3 journal issues, 4 newsletters, bi-annual symposia, Web site may not be sufficient
- Greater reliance on the Web as a source of information
  - questionable whether the AEG Web site is dynamic enough to attract frequent visits by members and so help fulfill this new way of staying current

### Competition for Professional Membership

It is the opinion of the Committee that current membership fees are reasonable and in line with that of other organizations. Unfortunately, the level of these fees continues to be an impediment to obtaining new members in Third World countries. No easy solutions were identified to address this problem.

However, geoscientists have been faced with difficult financial decisions during the downturn in the industry. Both journal subscriptions and professional membership fees have been increasing at a time when employers have been cutting back. In contrast, the list of competing journals/associations has been growing. Consequently, many geoscientists have chosen to join only one organization or subscribe to one publication, the ones most relevant to their interests and providing the greatest benefits relative to cost. A partial list of competitors follows:

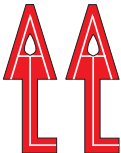
- Economic Geology (Society of Economic Geologists)
- Exploration and Mining Geology (The Geological Society – CIM)
- Journal of Applied Geochemistry (International Association of Geochemistry and Cosmochemistry)
- Geochimica et Cosmochimica Acta (Geochemical Society)
- Journal of Geochemical Exploration
- Environmental Pollution
- Environmental Geology
- The Science of the Total Environment
- Environmental Science and Technology
- (Society of Environmental Geochemistry and Health)

Another source of competition is the wealth of information available on the Web. To meet this challenge it is critical that the AEG Web site be developed to better advantage both to advertise the benefits of membership and to serve as a portal to other sites with relevant information as a service to members.

Competition affects not only the ability of the AEG to attract new members but also its ability to retain existing


continued on page 15

**ASSAYS AND GEOCHEMICAL ANALYSES**



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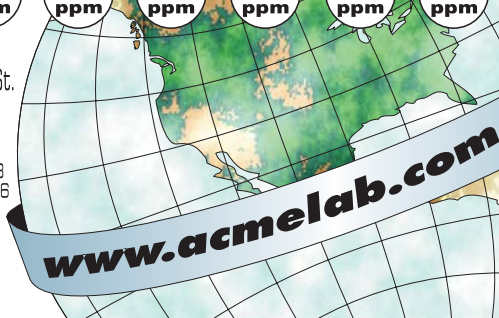
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## New Membership Committee ...

*continued from page 14*

members. For this reason, the overall marketing strategy incorporates a number of recommendations for improving the benefits of membership and ensuring that the AEG is relevant to the interests of geoscientists.

### Sources of new members

It was previously noted that the greatest loss in numbers of members has occurred in Australia, Canada, and the U.S.A. These regions along with Europe contain the largest pool of geoscientists interested or engaged in applied geochemistry relating to the mineral resource sector. As the health of the mineral sector improves, these regions are a potential source of significant new members or re-joining past members. Other regions such as South America, Africa, and Asia are also sources of new members. However it is perceived that Regional Councilors or other regional champions need to become more active in promoting the AEG and soliciting new memberships for the AEG to attract many new members in these areas.

Geoscientists active in environmental geochemistry are a group that can be specifically targeted. Many of these are employed by government research agencies or are carrying out post-graduate research. However, a significant effort needs to be made to attract members from this group. The benefits of membership need to be relevant to them. The AEG has to advertise its new persona actively both at symposia and through print media and the Web.

A third source of new members is the student population of universities. While few geology departments offer courses in exploration geochemistry, many that have an environmental geology stream will include courses in groundwater geochemistry and the like. Undergraduate students interested in applied geochemistry might be attracted to the AEG.

### Recommended marketing strategy

The Committee was unclear as to whether there was any organized marketing strategy for the AEG to promote itself and attract new members. It appears that the Publicity Committee listed on the Web site does not exist and has not existed for the last 3 years. The following is what the Committee believes the AEG marketing strategy to be:

- Organize international symposia to disseminate technical information and attract individuals with similar interests as new members
- Provide and staff an information booth at such symposia and occasionally other meetings, usually those co-sponsored by the AEG or providing geochemical short courses put on by AEG members
- Post application forms in Explore
- Provide information about the AEG on its Web site

Of these, symposia appear to have been the major source of new members over the years. The Committee does not believe that the Web site is designed in such a way as to elicit interest in prospective new members. The Home Page content only makes sense to existing members. There is little to capture the interest of non-members visiting the site for the first time.

The Committee recommends the following steps toward stabilizing the current membership level and increasing membership numbers as the economic status of the minerals industry improves. These steps are not sequential but rather need to be carried out concurrently. They are predicated on the adoption of an appropriate name change that reflects an organization inclusive of all geoscientists interested in applied geochemistry as it relates to exploration, mining, and reclamation activities.

### **1) Improve benefits of membership**

- Improve the content of GEEA; the following were some suggestions for doing this:
  - Commission papers
  - Provide financial incentives to graduate students
  - Actively solicit papers from AEG members
  - Actively solicit papers from universities and government organizations by 'champions' in the various regions or organizations
  - Actively pursue research consortiums to encourage publication of results upon completion of research (forego post-project confidentiality periods)
- Improve the Web site; the following were some suggestions for doing this:
  - Post particularly relevant articles from back issues of Explore (ie case histories)
  - Post abstracts of GEEA papers
  - Post 'news bulletins' on the Home Page; brief summaries of technical content or activities of current interest to members and non-members even if drawn from other journals
  - Make sure every area of the Web site is current with respect to information provided
- Keep the Newsletter focused on helping members stay current
  - Actively pursue ads from consultants, suppliers, and

*continued on Page 16*

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## New Membership Committee ...

*continued from page 15*

labs for a special issue on resources available to companies

- Continue the strategy of special issues focusing on topical subjects

- Develop an effective employment section in the member's only area on the Web site
  - Provide free postings of jobs
  - Need to advertise that the AEG membership is a source of employees to the environmental sector
  - Monitor other job sites and post links whenever a relevant position is advertised
  - make the AEG Web site a one stop compilation of job openings in applied geochemistry

With regard to the viability of GEEA, it is essential that high quality papers on exploration geochemistry continue to appear in the journal at regular intervals. Industry-funded research consortiums (Cooperative Research Centres in Australia; CAMIRO in North America) are a reality as a means of funding research in exploration geochemistry. Unfortunately, the results of this research may never get published due to confidentiality restrictions of 2-3 years.

Do companies really believe they gain competitive advantage from this research and therefore that is the reason they fund it? The Committee finds this doubtful. The reason they fund the research is because that is the only way research in areas of specific interest to a company will get done and the cost can be spread amongst many participants. Publishing the results could work to their advantage by spawning additional research on the same subject by other groups. That's how geochemical methods evolve and improve over time.

The Committee recommends that the AEG actively lobby both the companies and the consortiums to encourage the publication of research results at the end of the project to help ensure timely and relevant papers for GEEA to the benefit of AEG members.

### 2) Advertise the change in name and focus of the Association

- Put an ad on the Home Page promoting membership in the AEG



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  - Pay for the insertion of application forms in economic geology and environmental journals/newsletters

- Make every effort to hold existing members
  - A persuasive promo letter from the President should go out to each member along with the renewal notice drawing attention to the benefits of renewal
  - Keep it short, sweet, and personal
  - Could list up-coming papers to appear in GEEA
  - Draw attention to focus issues in Explore, new members-only features on the Web site, bibliography up-dates, etc

- Take out booth space at meetings other than sanctioned AEG events (particularly environmental meetings)

### 3) Focus membership drive on Australia, Canada, Europe, and U.S.A.

- Identify a co-ordinator for a membership drive
  - Need someone with the time and professional contacts to organize a pool of AEG members to assist in the effort, perhaps a retired AEG member

- Contact members who have lapsed over the last 2-3 years and try to persuade them to rejoin
  - Obtain one or more volunteers from each region to initiate contact by phone, mail, or e-mail

- Actively solicit new members at universities
  - Compile a list of universities offering exploration or environmental geochemistry as a core part of their undergraduate or post-graduate program (particularly those with mining-related post-graduate research)
  - Try to identify a speaker who can present a relevant talk while at the same time promote the AEG and sign up new members
  - Provide complementary issues of Explore to Geology departments
  - Provide a free membership for the first year to any student who publishes an article in Explore or GEEA
  - Promote the creation of student chapters of the AEG spear-headed by a member with faculty contacts

- Build membership fees into symposia registration fees
  - This needs to be a standard operating procedure.



**ADVERTISE!**

## Focus on: Academic Institutions...

*continued from page 2*



year geoscience enrolments in Australia of ~1,800 a year over the period 1994-1998 were only sufficient to generate ~400 third year and ~200 honours geoscience enrolments across the 27 Australian universities with geoscience programs. Honours enrolments over the last five years declined by 50%. In 2003, first year enrolments in biology at UNSW alone were equal to the total enrolment in *all* first year geoscience across *all* universities in Australia (Foden, 2003). Postgraduate enrolments leapt from 400 to nearly 600 between 1991 and 1994, but have since shown a slow decline (Foden, 2003). Academic staff numbers have also declined – quite rapidly in some Universities. A move towards more part-time and contract staff hides the real extent of staff losses. The decline in membership numbers and rise in the median age is also being felt in professional association and learned societies such as the AAG and Geological Society of Australia. For many geoscience schools the question arises as to whether a serious geoscience degree program (or major) will be deliverable with the resources available in the near future.

University administrators are well aware of the high cost of laboratories, support staff and fieldwork demanded by most of the sciences when planning undergraduate numbers. An honours student in biology or geoscience is usually a financial liability to the school (though an academic benefit) unless they continue on to a higher degree. Geoscience is not viewed as an essential science, and does not receive the partial protection afforded to the “enabling” sciences of physics and chemistry, mathematics as well as biology. A major science faculty without a physics or a chemistry school (or department) would be considered a joke – a science faculty without a geoscience may become the norm. Three universities in Australia have disestablished their geoscience schools – others have merged geosciences with other disciplines, such as geography or even biology. Enrolment trends suggest this contraction is not forcing geoscience students into a more limited number of universities – it is diverting them towards other sciences or out of science altogether. Allocating more research funds to virtual *centres of excellence* owned by a small number of universities may provide some protection for the geosciences, but actual concentration of geoscientists into a few institutions (research ghettos) will accelerate the demise of these disciplines.

Education is being shifted from a position at the centre of social and cultural development in Australia to just another sector of industry. If university enrolments in the geosciences drop then this is viewed as just a product of market forces. How can such a trend exist in a country that obtains over 50% of its export income from mining and for whom major environmental and economic challenges are water supply, groundwater pollution and soil salinity? Industry is acutely aware of the problem but incapable of effective action to preserve the extent of geoscience within the tertiary sector. Universities have been forced by government to become as ruthless in their economic

*continued on page 18*

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## Focus on: Academic

### Institutions... *continued from page 17*



rationality as the mining industry has been during the latest recession – they don't mine low-grade deposits and we don't teach small classes.

UNSW has one of the larger science faculties in Australia (350 academics, 300 support staff and nearly 5,000 students). Though comprising only 15% of UNSW academics, the Science Faculty generates over 30% of the annual UNSW research income and publications. Yet the physical sciences face severe staff cutbacks due to lack of undergraduate student numbers. With changing funding models within UNSW, undergraduate classes with less than 30 students or postgraduate classes with less than 25 face close scrutiny (i.e. the chop). This is not a problem for our biologists (more accurately the *molecular biologists*, according to my botany and zoology colleagues) who had nearly 300 students enrolled in a second year genetics course in 2003. No undergraduate geoscience course in Australian universities attracts such numbers, as far as I know. Exploration geochemistry has never exceeded 22 students at undergraduate level in its 25-year history at UNSW.

Science still excites people in the 21<sup>st</sup> century – TV has at least three channels devoted to it. Dinosaurs, big bangs, earthquakes, Mars exploration and human genome mapping stories all rate front page in newspapers. Students who undertake science generally enjoy the experience and science staff at UNSW receive a disproportionate number of teaching awards. Over 95% of UNSW geology graduates have found immediate employment or obtained postgraduate scholarship, even during the recent recession. What is the problem? The problem is possibly threefold:

- (i) the kudos once attached to being a scientist in the developed world has largely vanished,
- (ii) the job prospects in science are generally viewed as poor (in the long term) compared with medicos, lawyers or screen jockeys at the stock exchange,
- (iii) the quantity and quality of dedicated science teachers in high schools have dropped alarmingly.

### Exploration and Environmental Geochemistry

If things are difficult for the geosciences, what of our cherished sub-discipline? *Exploration Geochemistry*, as loosely defined by the contents of Rose, Hawkes and Webb

(1984) or Levinson (1980) is becoming scarce in the university system – both in research and, therefore, in teaching. A Google search using the key words [*Exploration Geochemistry + University + Course + .edu ± .ac*] scored 300 hits, from which I could count 22 universities that offered (metals) geochemical exploration courses at undergraduate or postgraduate level. I should confess that this list no longer includes UNSW. The same search with [*Environmental Geochemistry + etc*] scored 3,400 hits and included >120 universities offering various environmental geochemistry courses. The answer to the longevity of our sub-discipline already lies in the name change from AEG to AAG – broaden our perspective to attract students to university courses, members to the association, delegates to conferences and experts from other disciplines into our orbit. Does the AAG have a strategic plan to entice students into its ranks?

At UNSW, enrollments in *Geochemical Exploration* hovered around 10 students until 1996 when the course changed to *Exploration and Environmental Geochemistry* after which enrolments increased to an average of 14. From 2004, this course will be entirely replaced by *Environmental and Contaminant Geochemistry*. Quell horreur! The reason for this change partly comes from the new alignment of Geology with Biology and Physical Geography into a new unified school (no departments) and the desire to provide better integration of these disciplines in both research and teaching. We must now address the needs and interests of a more disparate group of students and I have been reflecting on the statement of Einaudi (1994):

*“Generalists with a high degree of competence have a longer half-life than specialists in today's unpredictable world (the half-life of an isotope geochemist is about 10 years). Enrolments can increase if you persuade students of the general applicability of studies in economic geology”*

In line with this general philosophical approach, the number of courses offered to students at UNSW, across most faculties, has been significantly reduced under the principle of “teach less *better*”. There have also been moves to reduce the level of prescription in programs, hence course pre-requisites (computer control) are being gradually replaced by assumed knowledge (student responsibility). The educational philosophy is swinging towards providing a broad framework of content for each major discipline or cross-discipline, but developing more general *graduate attributes* that include a greater capacity for critical thinking and the ability to acquire knowledge and skills for oneself. In other words, teach key geochemical principals and skills well and let the content sort itself out (to some extent). As such, classical exploration geochemistry and many of the contaminant geochemistry courses that carry an “environmental geochemistry” label, should be viewed as mere extensions of the underlying broader discipline of **applied (low-T) geochemistry** (the purpose of our newly defined association).

The question we have had to consider is “what constitutes the core of applied geochemistry from which specific applications in the exploration or environmental games may be drawn?” This is worthy of much AAG debate

*continued on page 19*



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## Focus on: Academic Institutions...

*continued from page 18*



(hint to webmaster) as part of the process of converting a name change to a true broadening of the association's scope and commitment to the various inhabitants of the applied geochemical world. Some of what I perceive "the core" to be is already well covered in most current exploration geochemistry courses, including low-T aqueous chemistry, sampling media selection and methodologies, analytical techniques, quality control. Where these courses are commonly limited is in the areas of organics (natural and anthropogenic) and the role of biota in geochemical processes (of interest to those working at the plant-soil-water interface). With suitable breadth of content, applied geochemistry will take its place at the centre of programs for students of the natural sciences (at both undergraduate and postgraduate levels), rather than the isolated regions inhabited by just economic geologists, and ensure a steady flow of new AAG members into the future.

I therefore pose the following question to all AAG members: "You have a new course titled 'Applied Geochemistry', 56 hours of class and lab contact time, a TA and three days for fieldwork – what will you cover?"

Einaudi, M.T., 1994. *Future of Economic Geology in Academia*. Meyer Symposium on Compatibility of Mining and the Environment, GSA, Seattle, October, 1994.

Foden, J., 2003. A survey of the changing enrolment and staffing levels in the geosciences at Australian Universities since 1990. *The Australian Geologist*, 127:21-24.

\*Attempts have been made to separate courses and programs with high geology content (geoscience) from courses that are principally physical geography, although the two commonly overlap.



**Institution: Colorado School of Mines**

**Location: Colorado USA**

Contributing Professor: Dr. Graham Closs

Course of Study: Exploration Geochemistry, Applied Geochemistry

Web Site: <http://www.mines.edu/academic/geology>

Colorado School of Mines (CSM) is a small, premier technical university located just west of Denver, Colorado at the edge of the Rocky Mountains. It has a focus on engineering and science disciplines related to resource development: exploration, production and environmentally responsible operation. A number of mining, petroleum and environmental firms are based in the area, as are several other universities and the United States Geological Survey. This setting provides access for field-based programs, supported by outstanding laboratory facilities, and an active geosciences community.

Research and courses in Exploration Geochemistry were initiated in 1955 by Professor Harold Bloom. He developed the colorimetric Cold Extractable Heavy Metals Test (CXHM), referred to as the "Bloom Test", for immediate, onsite analysis, thus contributing significantly to exploration effectiveness. These types of tests were the precursors to the current revised interest in selective extraction research.

Currently Graham Closs [lcloss@mines.edu](mailto:lcloss@mines.edu), has responsibilities for exploration geochemistry at CSM. He came to CSM after completing the program in Exploration Geochemistry at Queen's, followed by 5½ years experience as geologist/geochemist with the Ontario Government. His work in Ontario focused on problems of applying exploration geochemistry to the glaciated terrain of Northern Ontario. His interests include design and planning of surveys, applications of exploration/applied geochemistry to baseline studies and resource assessment problems, and geological data analysis. Specific topics are selected to meet industry's needs as their target commodities and exploration environments change over time.

In addition, Professor Sam Romberger [sromberg@mines.edu](mailto:sromberg@mines.edu) is active in the field of hydrothermal geochemistry and acid rock drainage, and Professor Ron Klusman, [rklusman@mines.edu](mailto:rklusman@mines.edu) focuses on gas geochemistry applications and has conducted baseline geochemical studies. Exploration Geochemistry has been a part of the economic geology program at the Colorado School of Mines for almost a half century.

*continued on page 21*

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## Student Paper Prize



Paul A. Polito

The Association of Exploration Geochemists and SGS take pleasure in announcing the winner of the 2002 Student Paper Competition Award. This is for the best paper in a refereed scientific journal by a student, on work performed as a student, published within five years of graduation which addresses an aspect of exploration geochemistry. The student must be the principal author and nominations may be made by anyone familiar with the student's work.

Entries closed at the end of 2002 for the Association's fourteenth biennial Student Paper Competition. We received a total of four entries from three entrants from Australia and Spain. They were all of a high standard and the choice was difficult. The winner is Paul A. Polito, now a Post-Doctoral Research Fellow at Queens University, Kingston, Canada. His winning paper is based on research for his Ph.D in Australia.

Paul obtained his B.Sc. degree at the University of Adelaide, in South Australia in 1992. He then proceeded straight to his Honours degree in 1993 and wrote a thesis entitled 'The geology and geochemistry of the Moorowie copper mine, Northern Flinders Ranges, South Australia'.

From 1994-1995 he worked as a Geologist for the South Australian Department of Primary Industries, where he was involved in soil, rock and gas geochemistry around Mississippi Valley deposits, mapping in the Flinders Ranges and geochemistry and exploration in the Gawler region. From July 1995 to May 1999 he was back at the University of Adelaide for his Ph.D studies, under the guidance of Prof

Yvonne Bone. He completed a thesis entitled 'Exploration implications predicted by the distribution of carbon – oxygen – hydrogen gases above and within the Junction gold deposit, Kambalda, Western Australia.'

Paul's passion as an exploration geochemist is to develop novel exploration tools for industry, using an holistic, multidisciplinary approach rather than a specialist approach, investigating background situations as thoroughly as those near mineralization. See [http://geol.queensu.ca/isotope\\_lab/people.html](http://geol.queensu.ca/isotope_lab/people.html) for information on his current pursuits. He is a member of the Geological Society of Australia, the Association of Exploration Geochemists and the Society for Geochemistry Applied to Mineral Deposits.

He received a \$500 cash prize from SGS, a two-year membership of the Association of Exploration Geochemists, together with our journal, *Geochemistry, Exploration, Environment Analysis* and our newsletter, *Explore*, a certificate of recognition and \$500 towards expenses to attend the 21st IGES in Dublin, where the award was presented.

His award-winning paper is entitled 'A light hydrocarbon soil-gas anomaly above the Junction orogenic gold deposit: an alternative exploration technique' which was published in 2000 in our very own *Geochemistry, Exploration, Environment Analysis* Vol. 2 (4) and was co-authored with J.D.A. Clarke, Y. Bone and J. Viellenave. The abstract of the paper follows:

"A soil-gas survey conducted above the Junction orogenic lode-gold deposit near Kambalda in Western Australia detected strong, broadly coincident, CO<sub>2</sub>-O<sub>2</sub>-light hydrocarbon anomalies through cover sediments above known mineralization. Alternatively, only CO<sub>2</sub>-O<sub>2</sub> aberrations (without light hydrocarbons) were detected above areas where non-gold related carbonate and sulphide mineralization exists. Oxidation of the alteration assemblage associated with mineralization and the release of the gases in the fluid inclusions they contain are proposed as the source for these CO<sub>2</sub>-O<sub>2</sub>-light hydrocarbon anomalies. We believe that soil-gas exploration for orogenic gold deposits has widespread potential as an exploration method in Western Australia where regolith cover can make detection of mineralized shear zones by traditional exploration methods for gold problematic to impossible."

The Association of Exploration Geochemists would like to thank SGS (previously XRAL) for, once again, supporting this worthy cause, which encourages young geochemists to publish their research in a timely manner.

### I.D.M. Robertson

Chairman, Student Paper Competition Committee



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## Focus on: Academic Institutions... *continued from page 19*



Recent and current exploration-related research topics include: laterite geochemistry in support of gold exploration in Venezuela, geochemical and fluid inclusion zoning in epithermal deposit systems, soil gas geochemistry related to volcanogenic massive sulfide and porphyry copper exploration, assessment of field portable X-ray Fluorescence instruments for exploration and environmental surveys, and geological data analysis techniques applied to data management, presentation and interpretation.

Exploration geochemistry is but one component of an interdisciplinary graduate Geochemistry Program that emphasizes the energy, minerals, and materials fields and their complex interaction with the environment. Faculty are drawn from the Geology and Geological Engineering and the Chemistry and Geochemistry Departments, and the Division of Environmental Sciences and Engineering. Specialties include both fundamental and applied research areas of geochemistry. Masters and PhD degrees, and non-thesis Masters degrees are offered. Project support has been provided by mining companies, government agencies and the individuals.

**Contact: Dr. L. Graham Closs**

*Department of Geological Engineering  
Colorado School of Mines, Golden, Colorado 80401  
E-Mail: [lcloss@mines.edu](mailto:lcloss@mines.edu)*

### Institution: Federal University of Rio de Janeiro

#### Location: Rio de Janeiro, Brazil



Contributing Professor: Dr. Claudio Gerheim Porto  
Course of Study: Mineral and Petroleum Exploration, Environmental studies.  
Web Site: <http://www.geologia.ufrj.br>

The teaching activities of the Geology Department of the Federal University of Rio de Janeiro are related to applied geochemistry and aim to provide knowledge to students at undergraduate and graduate levels that can be used in the areas of Mineral and Petroleum Exploration, and Environmental Studies. The following disciplines are offered:

1. Undergraduate level (BSc): Geochemistry, Organic Geochemistry, Geochemical Prospecting, Introduction to GIS.
2. Graduate levels (MSc and PhD): Regolith Geology in Tropical Terrains, Advanced Geochemistry, Petroleum Geochemistry, Introduction to Hydrogeochemistry, Isotope Geology, GIS Applied to Geological Resources

Research in the Geology Department has recently been granted US\$150,000 for a two-year project aiming to develop geochemical exploration strategies adapted to the regolith environments of the Amazon region. The grant has been

issued by the Mineral Fund from the Ministry of Mines & Energy and originates from mining taxes.

Partners include the Federal University of Pará (UFPA), State University of São Paulo (USP), State University of Campinas (Unicamp), the Geological Survey (CPRM), as well as a number of mining and exploration companies, including CVRD and Wheaton River.

**Contacts:**

Dr. Claudio Gerheim Porto, Email: [porto@geologia.ufrj.br](mailto:porto@geologia.ufrj.br)  
Dr. José Carlos Sícoli Seoane,  
Email: [cainho@geologia.ufrj.br](mailto:cainho@geologia.ufrj.br)

### Institution: International Institute for Geo-information and Earth Observation



#### Location: Enschede in the Netherlands

Contributing Professor: Dr. Boudewijn de Smeth  
Course of Study: Mineral Resource Exploration, Applied Geochemistry  
Web Site: <http://www.itc.nl/education>

ITC, the International Institute for Geo-information and Earth Observation in Enschede in the Netherlands provides regular training courses, ranging from short courses to 18 month MSc. courses in a wide number of disciplines, to several hundreds of mid-career professionals every year. The students are mainly from developing countries. Entry requirements are at least a BSc. relevant for the opted course. ITC, which started in 1952, has over 15,000 alumni spread all over the world. Besides education, the Institute is involved in research (currently 50 PhD candidates) and consulting activities world wide.

All ITC courses are organized in modules of three weeks. These consist of core modules on GIS and RS, programme modules, specialization modules, and elective modules. Most course participants come for the 18 months MSc programme or the 12 months professional masters programme but also for a short course of a few modules or just a single module. Full information on courses, course content, timing, costs etc. can be found on the ITC web site: <http://www.itc.nl/education>

The six educational programmes cover a wide range of topics in which applications of GIS and Remote Sensing methods form the common factor. Within two educational programmes, Applied Geochemistry is a topic in the Water Resources and Environmental Monitoring programme (WREM) and in the Earth Resources and Environmental Geoscience programme (EREG). Each programme has several specialisation courses. The objective of teaching applied geochemistry in these courses is to create understanding of how to use it appropriately and correctly when solving problems in hydro-geochemistry, exploration geochemistry and environmental geochemistry. Specialisation courses which have most components of applied geochemistry are the Mineral Resource Exploration (EREG) course and the WREM specialisation courses.

## Focus on: Academic

### Institutions... *continued from page 21*



Teaching geochemical topics in class is combined with several weeks of practical training in the field in Spain, Portugal, Kenya or elsewhere and chemical or physical analysis at the ITC Geochemical, Water and Soil Laboratory. Field training involves sampling methods at various scales, determination of major water quality parameters in the field or field-lab., mineral determination with portable infrared equipment, gamma-ray spectrometry, digital field data capture, ground checking multi- and hyper-spectral remote sensed data as well as excursions to organisations, mines and industry. The ITC laboratory is adequately equipped with sample preparation equipment and spectrometers (AAS and ICP-AES) for the purpose of training and research support but not for massive data production. Quality control is an important aspect in the student training. During the elective module periods, students from all different programmes can choose from a wide array of topics among which there is one module specifically in Applied Geochemistry and one on Hydro Geochemistry.

**Contact:** Dr. Boudewijn de Smeth  
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### Institution: Queen's University Location: Ontario, Canada



Contributing Professor: Dr. Graham Closs, Kurt Kyser  
Course of Study: Mineral Exploration, Applied Geochemistry  
Web Site: <http://www.queensu.ca>

Exploration Geochemistry was initiated at Queen's University in 1969 by Professor Ian Nichol following recognition that research and trained geochemists familiar with problems associated specifically with Canadian conditions were needed. Nichol had previously been associated with Professor John Webb's program at Imperial College, London. Thirty-five post-graduate research programs were completed under his direction between 1969 and 1998. Support was provided by individual mining companies, consortia of companies, commercial laboratories and government agencies. Topics addressed were initially focused on Canadian problems: glacial geology/drift prospecting, lake sediment geochemistry, litho-geochemistry applied to volcanogenic massive sulfide exploration, uranium exploration geochemistry, gold exploration geochemistry and associated sampling issues, selective extraction, and data analysis and interpretation. As the Canadian mining industry adopted more global focus, so too did the topics addressed by this group. Projects were completed in Australia, Thailand, the USA, Chile and China. Graduates have gone on to senior positions in industry, government, private practice, and universities.

Exploration Geochemistry has been an integral component of the non-thesis QMINEX Masters mineral exploration program since its inception in 1975. To date, over 120 students have completed this program.

Professor Kurt Kyser [kyser@geol.queensu.ca](mailto:kyser@geol.queensu.ca) joined the

Queen's faculty in 1995 and is carrying on responsibilities for exploration geochemistry. Kyser was previously associated with the USGS and the University of Saskatchewan. In 1997 he established the Stable Isotope and ICP-MS Laboratory at Queen's. It has continually evolved as a state-of-the-art research facility housing some of the most technologically advanced equipment in Canada, including the recently acquired High Resolution ICP-MS. From this base he has been involved in a broad range of problems spanning the earth, biological and environmental sciences.

In the natural resources area, his collaborative and multidisciplinary research interests range from property scale evaluation to issues of regional area selection. Examples of recent exploration research projects include: (1) development of continuous leach (CL)-ICP-MS analysis to identify specific sites and mineral phases from which elements are being released, and hence anomaly screening, (2) evaluation of N and S isotopes in soils as a guide for regional exploration in northern Chile, (3) determination of metal content and stable isotopes in tree rings for both exploration and environmental application, and (4) use of Pb-isotope ratios in sandstones near areas of unconformity-related uranium deposits in Australia as guides for exploration. He and his team are demonstrating the value of these *recently* available and powerful isotope geochemistry tools to the future of mineral exploration.

In addition, two other faculty members have interests in applied geochemistry. Professor Heather Jamieson's [jamieson@geol.queensu.ca](mailto:jamieson@geol.queensu.ca) research is in the area of environmental geochemistry, focusing on the impact of mining on the environment. Professor Victoria Remenda's [remenda@geol.queensu.ca](mailto:remenda@geol.queensu.ca) research in hydrogeology employ groundwater tracers including stable isotopes of water and major, minor and trace gases.

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### Institution: Seoul National University Location: Seoul, Korea

Contributing Professor: Prof. Hyo T. Chon, Professor of Applied Geochemistry  
Course of Study: Exploration and Environmental Geochemistry.  
Web Site: <http://gong.snu.ac.kr/~envilab>

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*continued on page 23*

## Focus on: Academic Institutions...

*continued from page 22*



### Institution: Technische Universität Bergakademie Freiberg



**Location: Freiberg, Germany**  
 Contributing Professor: Dr. Jörg Matschullat, Director Interdisciplinary Environmental Research Centre (IÖZ)  
 Course of Study: Applied and Environmental Geochemistry  
 Web Site: <http://www.ioez.tu-freiberg.de>

Freiberg is still one of the strongest universities of Germany in the Earth Sciences. Geochemistry is offered for students of all directions in the Earth sciences. We currently have three professors (chair plus 2 associate) for Applied and Environmental Geochemistry, Analytical Geochemistry and Isotope Geochemistry. Our labs feature the whole range of facilities except for detailed organic analysis. Respective techniques are taught in collaboration with the chemical department. Our research is also strongly focused on applied and environmental geochemistry, well reflected by our publications.

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 E-Mail: [joerg.matschullat@ioez.tu-freiberg.de](mailto:joerg.matschullat@ioez.tu-freiberg.de)

### Institution: University of Barcelona



**Location: Barcelona, Spain**  
 Contributing Professor: Dr. Manuel Viladevall  
 Course of Study: Exploration and Environmental Geochemistry  
 Web Site: <http://www.itc.nl/education>

**Contact:** Dr. Manuel Viladevall, Geological Engineer ENSG Department of Geochemistry, Petrology and Geological Prospecting  
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 Phone: 34 934021397, Fax: 34 934021397, Mobile: 619540764  
 E-mail: [mviladevall@ub.edu](mailto:mviladevall@ub.edu)

### Institution: University of Michigan



**Location: Michigan, USA**  
 Contributing Professor: Dr. Stephen Kesler  
 Course of Study: Exploration and Environmental Geochemistry  
 Web Site: <http://www.geo.lsa.umich.edu/>

The Department of Geological Sciences at the University of Michigan has an active program in all aspects of geochemistry. Ongoing research relevant to exploration

and environmental geochemistry includes work on:

- 1) fractionation of heavy stable isotopes, especially mercury, in ore deposits, sedimentary rocks, and biological materials,
- 2) the oxidation state of magmas related to porphyry copper mineralization and their role as a guide to fertile intrusions,
- 3) the setting of gold in arsenian pyrite and its role in formation of epithermal deposits,
- 4) base and precious metal geochemistry of igneous minerals as an indicator of concentration processes during magmatic differentiation, and
- 5) geochronologic constraints on unroofing of base and precious metal deposits in convergent margin terranes.

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### Institution: University of Nevada, Reno



**Location: Nevada, USA**  
 Contributing Professor: Dr. Greg B. Arehart, Department of Geological Sciences  
 Course of Study: Geochemistry  
 Web Site: [www.mines.unr.edu/geology/](http://www.mines.unr.edu/geology/)

The Geochemistry program at the University of Nevada, Reno at present has four full-time faculty plus a number of research, affiliated and adjunct faculty with offices in the Mackay School of Earth Sciences and Engineering. Our course offerings range from theoretical (e.g., Isotope Geochemistry; Geochemical Modeling) to applied (e.g., Environmental Geochemistry, Hydrothermal Geochemistry). Ongoing research includes application of a wide variety of techniques to the understanding of earth and ocean processes. We have active research projects in environments ranging from high-temperature geochemistry (e.g., volcanic and hydrothermal processes) to low-temperature and environmental geochemistry (e.g., contaminant fate and transport). The Nevada Bureau of Mines and Geology and the US Geological Survey Reno Field Office are housed within the same building complex and there is significant interaction among the groups. The Desert Research Institute (a research branch of the University and Community College System of Nevada) is located just north of main campus and provides additional opportunities for interdisciplinary geochemical research.

Examples of some recent and ongoing research projects include:

- ❖ Stable isotope geochemistry of hazardous organic contaminants: sources and behavior in ground water
- ❖ Geothermal system geochemistry & hydrology
- ❖ Carbonate vein geochemistry in and around Carlin-type hydrothermal systems



## Focus on: Academic Institutions...

*continued from page 23*



- ❖ Trace metals in geothermal systems as a discriminator between magmatic and extensional systems
- ❖ Fluxes of trace gases (mercury and volatile organics) in the environment and global mercury cycles
- ❖ Surface chemistry and dissolution rates of minerals
- ❖ Elemental and isotope geochemistry of hydrothermal carbonates and implications for fluid flow in the crust
- ❖ Oxidation rates of arsenic sulfides
- ❖ Paleoclimate on a long-term timescale using stable isotopes of geothermal and fossil geothermal systems
- ❖ Tephrochronology of Tertiary Great Basin rocks
- ❖ Thermochemical profiling of fossil hydrothermal systems using low-temperature geochronology and stable isotope geochemistry
- ❖ Crustal architecture of the Great Basin elucidated from stable isotope geochemistry of plutons
- ❖ Experimental studies of gold bisulfide reaction with activated carbon
- ❖ Aqueous geochemistry of pit lakes forming at active and abandoned mine sites
- ❖ Sediment diagenesis, marine and lake sediment geochemistry and paleoceanography

**Contact:** Dr. Greg B. Arehart, Department of Geological Sciences MS-172, University of Nevada, Reno; Reno, NV 89557-0138 USA  
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### **Institution: University of New South Wales** **Location: New South Wales, Australia**

Contributing Professor: Dr. David Cohen  
 Course of Study: Applied Geochemistry  
 Web Site: <http://www.unsw.edu.au>



**Contact:** Dr. David Cohen  
 School of Biological, Earth and Environmental Sciences  
 Faculty of Science, The University of New South Wales, Australia  
 Email: [d.cohen@unsw.edu.au](mailto:d.cohen@unsw.edu.au)

### **Institution: University of Pretoria** **Location: South Africa**

Contributing Professor:  
 Prof. H. F. J. Theart, Department of Geology  
 Course of Study: Environmental Geochemistry  
 Web Site:  
<http://www.up.ac.za/academic/geol/Welcome.html>



Applied geochemistry is alive and well at the University of Pretoria, South Africa.

We teach a course in Environmental Geochemistry, as a module required for the degree BSc Environmental and Engineering Geology, in addition to the standard chemistry

courses these students need to do. The general objective of this four-week module is to create an understanding of the interactions between the pollutants produced by Man and the geological environment, especially groundwater. The course comprises formal lectures to give the students a sound background of low temperature geochemistry, solute transport in groundwater, sampling methods, experimental techniques and statistical analysis of gathered data. In addition, the students are given individual assignments emphasizing the dynamic student-centered and co-operative learning approach of this module — creating creative thinking, communication, and interpersonal skills as well as group dynamics.

At the end of this module the students should have

- Knowledge and understanding of different pollutants, their origin, characteristics and properties,
- The ability to describe the interaction amongst pollutants, the subsurface and groundwater,
- Knowledge and understanding of different site investigation techniques,
- The ability to design and implement a monitoring programme for a contaminated site,
- The ability to evaluate possible remediation options and to select the best option.

During the fourth year training programme for BSc Hons Geology, Exploration Geophysics, and Environmental and Engineering Geology students, Exploration geochemistry is taught as an important component of a module on exploration techniques. Here the students are introduced to the fundamental principles governing geochemical dispersion in the primary and secondary environments as applied to litho-, stream-, and soil-geochemical surveys. Quality control, data processing and anomaly detection are also addressed. In addition, the students are given individual assignments to develop their ability to apply the concepts taught.

Mineral and rock chemistry, including major and trace elements as well as isotope geochemistry, as applied in igneous and metamorphic petrology and mineral beneficiation for the mining industry, is taught in various courses throughout the BSc Geology programme and in courses designed for metallurgical and mining engineering students. Advanced training in this regard is provided in the course work for the MSc Applied Mineralogy.

Current research in the department on related topics includes a study on the geochemical detection of base-metal sulphide deposits covered by calcrete and sand in arid environments. A main area of focus within the Centre for Research on Magmatic Ore Deposits (CERMOD) is the research on the geochemical behaviour of the PGE's related to base metal sulphides and their host rocks. Also, the use of mineral and whole rock chemistry to detect areas associated with low PGM flotation recovery within the UG2 chromitite layer of the Bushveld Complex is being investigated. The Department of Geology maintains well-equipped laboratories for graduate teaching and, in combination with this, it also runs more sophisticated research equipment. It hosts XRF, XRD (including a

*continued on page 25*

## Focus on: Academic Institutions... *continued from page 24*



precession single crystal camera) and EMP equipment, a modern heat flow calorimeter for cement development studies, and a high temperature experimental laboratory for sulphide research. These facilities are augmented by local collaboration with sister departments in the University of Pretoria, the Council for Scientific and Industrial Research's Water Research Unit, the Nuclear Energy Cooperation of South Africa, and the South African Police's forensic laboratory. In this way researchers and students have access to a wide range of equipment including micro-Raman spectroscopy; scanning, emission and transmission electron microscopy; single crystal XRD; atomic absorption spectroscopy; atomic force microscopy; and image analyses microscopy.

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E-mail: htheart@postino.up.ac.za.

## Institution: University of the Western Cape Location: Bellville, South Africa



Contributing Professor: Professor Charles Okujeni  
Course of Study: Applied Geochemistry  
Web Site: www.uwc.ac.za

The applied geochemistry programme in the Department of Earth Sciences, University of the Western Cape was initiated in 1997 and funded through the Anglo American Chairman's funds, Anglogold and the Mineral Education Trust Funds (METF). The programme is being coordinated by Prof. Charles Okujeni.

Introductory courses to geochemistry and exploration geochemistry are taught at 2<sup>nd</sup> and 3<sup>rd</sup> year respectively and cover basic principles including litho-geochemistry, hydro-geochemistry, surficial equilibria and isotope geochemistry etc. Further post graduate lectures on geochemical concepts and exploration geochemistry cover various aspects of methodology, application of geochemical techniques as well as case studies.

Research has mainly focussed on regolith and litho-geochemistry. The main project area is the Kraaipan Greenstone Belt in the Northern Province of South Africa. There are currently 2 Ph.D, 4 M.Sc and 2 Honors student currently enrolled in the programme; other Ph.D and M.Sc students are also being co-supervised with the chemistry department on various environmental geochemistry projects.

Research activities have been constrained by limited infrastructure of research. A marked change is anticipated when our XRF and a GFAAS will be commissioned in 2004.

**Contact:** Charles Okujeni  
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## Institution: Acadia University Location: Wolfville, Canada



Contributing Professor: Professor Cliff Stanley  
Course of Study: Applied Geochemistry  
Web Site: www.acadiau.ca

Acadia University, located in Wolfville, Nova Scotia, Canada, offers both B.Sc. and M.Sc. programs in Geology and Environmental Geoscience. The university has approximately 4000 students, is regarded as one of the top liberal arts universities in Canada, and possesses a very strong geology program. The Dept. of Geology consists of 6 professors and graduates, 12-15 undergrads, and 2-4 graduate students per year. Amongst the courses offered are a range of applied geochemistry, economic geology, and related courses:

### Undergraduate Courses

Introduction to Geochemistry  
Exploration and  
Environmental Geochemistry  
Mineral Deposits  
Mineral Exploration  
Exploration Geophysics

### Graduate Courses

Geochemical Material Transfer  
Advanced Economic Geology  
Advanced Exploration and  
Environmental Geochemistry

Applied geochemistry research at Acadia is undertaken through B.Sc. Honours and M.Sc. thesis projects. These are largely under the direction of Dr. Cliff Stanley, although Dr. Ian Spooner (glacial geology) and Dr. Sandra Barr (igneous petrology) have collaborated in supervising applied geochemistry thesis projects.

Dr. Stanley's research interests include litho-geochemistry, numerical applications in geochemistry, till geochemistry and biogeochemistry. Recent, ongoing and future research projects involving geology honours and masters students at Acadia University include:

Heavy metal uptake in *Salix* as a potential phyto-remediation agent (*B.Sc. honours environmental science student Sandi MacPherson*)

Speciation of Zn in stream sediments of the Antigonish Highlands, Nova Scotia (*B.Sc. honours geology student Charlie Moore*)

Au uptake in *Eucalyptus salmophloia* (*B.Sc. honours environmental science student Rebecca Schaefer*)

Au precipitation mechanisms at the Callie Gold Mine, Northern Territory, Australia (*B.Sc. honours geology student Jeffery Bigelow*)

Litho-geochemistry of the Fimiston Lode, Kalgoorlie, Western Australia (*M.Sc. geology student Tansy O'Conner-Parsons*)

Glacial dispersion of Li from a spodumene pegmatite, Yarmouth Country, Nova Scotia (*M.Sc. geology student Andrea Locke*)

Igneous petrology and litho-geochemistry of the Mechanic Settlement layered intrusion, Sussex, New Brunswick (*M.Sc. geology student Russel Heibert*)

## Focus on: Academic Institutions...

*continued from page 25*



### Institution: Jilin University

#### Location: China

The Department of Geochemistry of Jilin University was established in 1995, based on the original Geochemical Staff Room founded in 1961 and Geochemical Expecting Staff Room founded in 1964. At present, the Department includes Geochemical Research and Teaching Center, Resource and Environment Research and Teaching Center and attached laboratory. The Department has 1 undergraduate program offering BSc degree, 2 MSc graduate programs and 1 PhD graduate program. They are listed as follows.

*Undergraduate program:* Exploration and Engineering: Applied Geochemistry

*MSc program:* Geo-Exploration and its Information Technology: Applied Geochemistry

*Nuclear Technology and Application*

*PhD program:* Geo-Exploration and its Information Technology: Applied Geochemistry

Currently there are 17 academic staff members in the Department, among which 6 are professors, 4 are associate professors, and 2 laboratory assistants in the Department. Professor Hao Libo is the department head.

At present the research works we are carrying out include regional geochemistry and environmental geochemistry funded by the Ministry of Land and Resources and Ministry of Science and Technology. Tel: 86-0431-8502441 Fax: 86-0431-8524544

#### Major and Main Courses

##### *Undergraduate*

Introduction to Exploration and Engineering: Applied Geochemistry. The characteristic of the major is that the students who study Exploration and Engineering: Applied Geochemistry not only master the theories of applied

geochemistry and environmental science, but also have the power to solve the problems with the geochemical theory. **Main Courses:** Introduction to Earth Science • Introduction to Environmental Science • Theory of Geochemistry • Theory of Geophysics • Applied Geochemistry • Environmental Geochemistry • Instrument Analysis Technology • Processing and Explanation of Geochemical Data • Applied Geophysics • Multivariate Statistical Analysis • Analytical Chemistry Experiment.

*MSc Graduate:* Geo-Exploration and its Information Technology: Applied Geochemistry

**Main Courses:** Applied Geochemistry • Special Subject of Applied Geochemistry • Trace Element and Isotope Geochemistry • Geochemical Data Processing • Modern Geochemical Sample Analysis

*Nuclear Technology and Application*

**Main Courses:** Isotope Geochemistry

*PhD Graduate:* Major Geo-Exploration and its Information Technology: Applied Geochemistry

**Main Courses:** Existing Status Theory of Element • Theory and Methods of Survey Geochemistry • Special Subject of Applied Geochemistry • Regional Geochemical Survey and Evaluation.

Professor Hao Libo

Survey Geochemistry/Environmental Geochemistry

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Professor Ji Hongjin, Survey Geochemistry

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Professor Zhou Yongchang, Survey Geochemistry

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Professor Zhong Chongxue, Survey Geochemistry

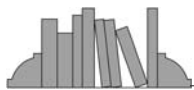
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| University  | Country      | Professor              | Field of Study                                     | Web Site  |
|---|--------------|------------------------|--|---|
| <a href="#">University of New South Wales</a>                                     | Australia    | Dr. D. Cohen           | Applied Geochemistry                               | <a href="http://www.unsw.edu.au">http://www.unsw.edu.au</a>   |
| <a href="#">Federal University of Rio de Janeiro</a>                              | Brasil       | Dr. Claudio Porto      | studies  | <a href="http://www.geologia.ufrj.br">http://www.geologia.ufrj.br</a>                                       |
| <a href="#">Acadia University</a>   | Canada       | Dr. C. Stanley         | Geology  | <a href="http://www.acadiau.ca">http://www.acadiau.ca</a>   |
| <a href="#">Queen's University</a>  | Canada       | Dr. Kyser              | QMINEX mineral exploration, Applied Geochemistry   | <a href="http://www.queensu.ca">http://www.queensu.ca</a>   |
| <a href="#">Jilin University</a>  | China        | Dr. Xueqiu Wang        | Exploration Geochemistry                           |   |
| <a href="#">Freiberg</a>  | Germany      | Dr. Jörg Matschullat   | Applied and Environmental Geochemistry             | <a href="http://www.ioez.tu-freiberg.de">http://www.ioez.tu-freiberg.de</a>                                 |
| <a href="#">Seoul National University</a>   | Korea        | Prof. Hyo T. Chon      | Exploration and Environmental Geochemistry         | <a href="http://gong.snu.ac.kr/~envilab">http://gong.snu.ac.kr/~envilab</a>                                 |
| <a href="#">International Institute for Geo-information and Earth Observation</a> | Netherlands  | Dr. Boudewijn de Smeth | Mineral Resource Exploration, Applied Geochemistry | <a href="http://www.itc.nl/education">http://www.itc.nl/education</a>                                       |
| <a href="#">University of Pretoria</a>  | South Africa | Prof. H. F. J. Theart  | Exploration and Environmental Geochemistry         | <a href="http://www.up.ac.za/academic/geol/Welcome.html">http://www.up.ac.za/academic/geol/Welcome.html</a> |
| <a href="#">University of the Western Cape</a>                                    | South Africa | Pro. C. Okujeni        | Applied Geochemistry                               | <a href="http://www.uwc.ac.za">http://www.uwc.ac.za</a>   |
| <a href="#">University of Barcelona</a>   | Spain        | Dr. M. Viladevall      | Exploration and Environmental Geochemistry         | <a href="http://www.ub.edu/gpp/">http://www.ub.edu/gpp/</a>   |
| <a href="#">Aberystwyth University</a>  | UK           | Dr. R. Fuge            | Applied and Environmental Geochemistry             |   |
| <a href="#">Bristol University</a>  | UK           | Prof. Wood             | Organic and Experimental Geochemistry              |   |
| <a href="#">Cardiff University</a>  | UK           | Prof. D. Rickards      | Applied and Environmental Geochemistry             |   |
| <a href="#">Imperial College</a>  | UK           | Prof. I. Thornton      | Applied and Environmental Geochemistry             |   |
| <a href="#">Leeds University</a>  | UK           | Prof. R. Raiswell      | Applied and Environmental Geochemistry             |   |
| <a href="#">Leicester University</a>  | UK           | Dr. C. Moon            | Environmental and Exploration Geochemistry         |   |
| <a href="#">Manchester University</a>   | UK           | Prof. C. Curtis        | Pure and Applied Geochemistry                      |   |
| <a href="#">Newcastle University</a>  | UK           |                        | Organic Geochemistry                               |   |
| <a href="#">Reading University</a>  | UK           | Dr. A. Parker          | Environmental Geochemistry                         |   |
| <a href="#">Royal Holloway College</a>  | UK           | Prof. Mather           | Environmental Geochemistry                         |   |
| <a href="#">Sheffield University</a>  | UK           | Dr. S. Banwart         | Environmental Geochemistry                         |   |
| <a href="#">Southampton University</a>  | UK           | Dr. I. Croudace        | Marine Geochemistry                                |   |
| <a href="#">Colorado School of Mines</a>  | USA          | Dr. G. Closs           | Exploration Geochemistry                           | <a href="http://www.mines.edu/academic/geology">http://www.mines.edu/academic/geology</a>                   |
| <a href="#">University of Michigan</a>  | USA          | Dr. S. Kesler          | Exploration and Environmental Geochemistry         | <a href="http://www.geo.lsa.umich.edu/">http://www.geo.lsa.umich.edu/</a>                                   |
| <a href="#">University of Nevada, Reno</a>  | USA          | Dr. Greg B. Arehart    | Geochemistry                                       | <a href="http://www.mines.unr.edu/geology/">http://www.mines.unr.edu/geology/</a>                           |



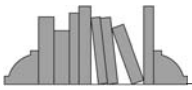


## RECENT PAPERS

*continued from Page 11*

- Higuera, P., Oyarzun, R., Biester, H., Lillo, J., and Lorenzo, S., 2003. A first insight into mercury distribution and speciation in soils from the Almaden mining district, Spain. *J. Geochem. Explor.* **80**(1): 95-104.
- Holk, G.J., Kyser, K., Chipley, D., Hiatt, E.E., and Marlatt, J., 2003. Mobile Pb-isotopes in Proterozoic sedimentary basin as guides for exploration of uranium deposits. *J. Geochem. Explor.* **80**(2/3): 297-
- Ishihara, S., 2002. Chemical characteristics of the mineralized granitoids I. Mo and W provinces of the Inner zone of southwest Japan, and II. Polymetallic province of the west-central Hyogo Prefecture, Japan. *Bull. Geol. Surv. Japan* **53**(9/10): 657-672 and 673-
- Jambour, J.L., Blowes, D.W., and Ritchie, A.I.M. (eds.), 2003. *Environmental Aspects of Mine Wastes*. Min. Assoc. Can. Short Course Series, V. 31, 430 p.
- Jones, B.G., Chenhall, B.E., Debretson, F., and Hutton, A.C., 2003. Geochemical comparisons between estuaries with non-industrialized and industrialized catchments: the Huon and Derwent River estuaries, Tasmania. *Aust. J. Earth Sci* **50**: 653-667.
- Kesler, S.E., Fortuna, J., Ye, Z., Alt, J.C., Core, D.P., Zohar, P., Borhauer, J., and Chryssoulis, S.L., 2003. Evaluation of the Role of Sulfidation in Deposition of Gold, Screamer Section of the Betze-Post Carlin-Type Deposit, Nevada. *EG* **98**(6): 1137-1157.
- Klusman, R.W., 2003. Rate measurements and detection of gas microseepage to the atmosphere from the enhanced oil recovery/sequestration project, Rangeley, Colorado USA. *Applied Geochem.* **18**(12): 1825-1838.
- Klusman, R.W., 2003. Computer modeling of methanotropic oxidation of hydrocarbons in the unsaturated zone from an enhanced oil recovery/sequestration project, Rangeley, Colorado USA. *Applied Geochem.* **18**(12): 1839-1852.
- Korobushkina, E.D., Pampura, V.D., and Mamitko, V.R., 2003. Geochemical role of microorganism in gold dispersion and concentration in the Zhirov gold-base metal deposits (Southern Kamchatka). *Doklady Earth Sci.* **389**(3): 380-383.
- Kwong, Y.T.J., Swerhone, G.W., and Lawrence, J.R., 2003. Galvanic sulphide oxidation as a metal-leaching mechanism and its environmental implications. *Geochemistry: Exploration, Environment, Analysis* **3**(4): 337-343.
- Kyser, K. and Hiatt, E.E., 2003. Fluids in sedimentary basins: An introduction. *J. Geochem. Explor.* **80**(2/3): 139-150.
- Lavric, J.V. and Spangenberg, J.E., 2003. Stable isotope (C, O, S) systematics of the mercury mineralization at Idrija, Slovenia: constraints on fluid source and alteration processes. *Min. Deposita* **38**(9): 886-899.
- Lima, A., DiVivo, B., Cicchella, D., Cortini, M., and Albanese, S., 2003. Multifractal IDW interpolation and fractal filtering method in environmental studies: an application on regional stream-sediments (Italy), Campania region. *Applied Geochem.* **18**(2): 1853-1965.
- Maier, W.D., Barnes, S.-J., Gartz, V., and Andrews, G., 2003. Pt-Pd reefs in magnetites of the Stella layered intrusion, South Africa: A world of new exploration opportunities for platinum group elements. *Geology* **31**(10): 885-888.
- Marchbank, A.R., Kirby, E., and Roberto, E.E., 2003. The application of biologically-mediated leaching methods – A comprehensive review. *Bull. CIM* **96**(1072): 143-
- Marsh, E.E., Goldfarb, R.J., Hart, C.J.R., and Johnson, G.A., 2003. Geology and geochemistry of the Clear Creek intrusion-related gold occurrences, Tintina gold province, Yukon, Canada. *Can. J. Earth Sci.* **40**(5): 681-
- McPherson, R., 2003. *Modern Prospecting*. Gem Guide Book Co. 303 p.
- Meza-Figaeroa, D., Valencia-Moreno, M., Valencia, V.A., Ochoa-Landin, L., Perez-Segura, E., and Diaz-Salgado, C., 2003. Major trace element geochemistry and <sup>40</sup>Ar/<sup>39</sup>Ar geochronology of Laramide plutonic rocks associated with gold-bearing Fe skarn deposits in Guerrero State, Southern Mexico. *J. South Amer. Earth Sci.* **16**(4): 205-218.
- Mulja, T., Collins, M., Wong, H.H., Rizal, R., Brown, T., and Zainuddin, M., 2003. An integrated mineral exploration program in the Takengon tenement, Aceh magmatic arc, North Sumatra. *Geochemistry: Exploration, Environment, Analysis* **3**(4): 321-335.
- Nolan, A.L., Baltpurvins, K., Hamilton, I.C., and Lawrence, G.A., 2003. Chemostat-controlled selective leaches of model soil phases – the hydrous manganese and iron oxides, Part 2: re-adsorption studies. *Geochemistry: Exploration, Environment, Analysis* **3**(4): 313-320.
- Nutt, C.J. and Hofstra, A.H., 2003. Alligator Ridge District, East-Central Nevada: Carlin-Type Gold Mineralization at Shallow Depths. *EG* **98**(6): 1225-1241.
- Pereira, H.G., Renca, S. and Saraiva, J., 2003. A case study on geochemical anomaly identification through principal components analysis supplementary projection. *Applied Geochem.* **18**(11): 37-44.

*continued on page 28*



## RECENT PAPERS

*continued from Page 27*

- Pestana, M.H.D. and Formoso, M.L.L., 2003. Mercury contamination in Lavras do Sul, south Brazil: A Legacy from past and recent gold mining. *Science of the Total Environment* **307**(1-3): 125-
- Peters, S.C. and Blum, J.D., 2003. The source and transport of arsenic in a bedrock aquifer, New Hampshire, USA. *Applied Geochem.* **18**(11): 1773-1788.
- Railsback, L.B., 2003. An earth scientist's periodic table of the elements and their ions. *Geology* **31**(9): 737-740.
- Reich, M., Parada, M.A., Palacios, C., Dietrich, A., Schultz, F. and Lehmann, B., 2003. Adakite-like signature of Late Miocene intrusions at the Los Pelambres giant porphyry copper deposits in the Andes of central Chile: metallogenic implications. *Min. Deposita.* **38**(7): 876-885.
- Richmond, A., 2003. Financially efficient ore selections incorporating grade uncertainty. *Math. Geol.* **35**(2): 195-
- Ripley, E.M., Lightfoot, P.C., Li, C. and Elswick, E.R., 2003. Sulfur isotope studies of continental flood basalts in the Noril'sk region: Implications for the association between lavas and ore-bearing intrusions. *GCA* **67**(15): 2805-
- Salmon, S.U. and Malmstrom, M.E., 2004. Geochemical processes in mill tailings deposits: modeling of groundwater composition. *Applied Geochem.* **19**(1): 1-17.
- Samusikov, V.P., 2003. Trace elements in native gold as criteria for the identification of the formation type and erosion level of gold ore deposits. *Doklady Earth Sci.* **391**(5): 742-746.
- Schwartz, M.O. and Melcher, F., 2003. The Perkoa Zinc Deposit, Burkina Faso. *EG* **98**(7): 1463-1485.
- Severson, M.J., 2002. NRRI/RI – 2002/20. Required Metallic Exploration, Mining, Processing Permits in Minnesota – The Who, What, Where, and When to Non-Ferrous Metallic Mine Permitting. CD-ROM.
- Sherlock, R.L., Barrett, T.J., and Lewis, P.D., 2003. Geological setting of the Rapu Rapu gold-rich volcanogenic massive sulfide deposits, Alby Province, Philippines. *Min. Deposita* **38**(7): 813-830.
- Sillitoe, R.H., 2003. Iron oxide-copper-gold deposits: an Andian View. *Min. Deposita* **38**(7): 787-812.
- Song, X.Y., Zhou, M.F., Cao, Z.M., Sun, M., and Wang, Y.L., 2003. Ni-Cu-(PGE) magmatic sulfide deposits in the Yangliuping area, Permian Emeishan igneous province, SW China. *Min. Deposita* **38**(7): 831-843.
- Spandler, C., Hermann, J., Arculus, R., and Mavrogenes, J., 2003. Redistribution of trace elements during prograde metamorphism from lawsonite blueschist to eclogite facies, implications for deep subduction-zone processes. *Contrib. Mineral Petrol.* **146**: 205-222.
- Stone, W.E. and Crocket, J.H., 2003. Platinum-group element contents of chromites from mafic-ultramafic layered flows, Abitibi greenstone belt, Ontario: Implications for geochemical fractionation and mineral exploration. *Min. and Petrol.* **75**(1/2): 139-
- Thorleifson, H., 2003. Presidential Preamble – Geological Map of the Future. *Geol. Assoc. Can. Geology* **32**(3): 4.
- Tonkin, J.W., Balistrievi, L.S., and Murray, J.W., 2004. Modeling sorption of divalent metal cations on hydrous manganese oxide using the diffuse double layer model. *Applied Geochem.* **19**(1): 29-53.
- Tonkins, A.G. and Mavrogenes, J.A., 2003. Generation of metal-rich felsic magmas during crustal anatexis. *Geology* **31**(9): 765-772.
- Tsikos, H., Beukes, N.J., Moore, J.M., and Harris, C., 2003. Deposition, Diagenesis, and Secondary Enrichment of Metals in the Paleoproterozoic Hotazel Iron Formation, Kalahari Manganese Field, South Africa. *EG* **98**(7): 1449-1462.
- Turner, W.A., Laamrani, A., and Rivard, B., 2003. Laboratory reflectance spectra of hydrothermally altered carbonate facies, Pine Point mining camp, NWT, Canada. *Geochemistry: Exploration, Environment, Analysis* **3**(4): 369-379.
- Veeresch, H., Tripathy, S., Chaudhuri, D., Hart, B.R., and Powell, M.A., 2003. Sorption and distribution of adsorbed metals in three soils of India. *Applied Geochem.* **18**(11): 1723-1732.
- Weaver, A.J., 2003. The Science of Climate Change. *Geosciences Canada* **30**(3): 91-114.
- Webb, A.D., Dickens, G.R., and Oliver, N.H.S., 2003. From banded iron-formation to iron ore: geochemical and mineralogical constraints across the Hamersley Province, Western Australia. *Chem. Geol.* **197**(1-4): 215.
- Wilde, A., 2003. The Golden Triangle of Southeast China: Another Carlin Trend? *SEG Newsletter No. 55*: 1, 9-12.
- Yilmaz, H., 2003. Geochemical exploration for gold in western Turkey: Success and failure. *J. Geochem. Explor.* **80**(1): 117-



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## Election Results

The recent paper ballot in January 2004 resulted in the passing of the following:

- 1) The proposed change in the name of the Association to Association of Applied Geochemists.
- 2) The proposed change to the By Laws, and
- 3) The proposed change allowing the President to serve up to two years and abolishing the position of Second Vice President.

### Coming soon in the AAG EXPLORE newsletter:

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124 Laboratory Update

Chris Benn — [Chris.Benn@BHPBilliton.com](mailto:Chris.Benn@BHPBilliton.com)

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Pursuant to Article Two of the Association's ByLaw No.1, the names of the following candidates, who have been recommended for membership by the Admissions Committee, are submitted for your consideration. If you have any comments, favorable or unfavorable, on any candidate, you should send them in writing to the Secretary within 60 days of this notice. If no objections are received by that date, these candidates will be declared elected to membership. Please address comments to David B. Smith, Secretary AAG, USGS, Box 25046, MS 973, Denver, CO 80225, USA.

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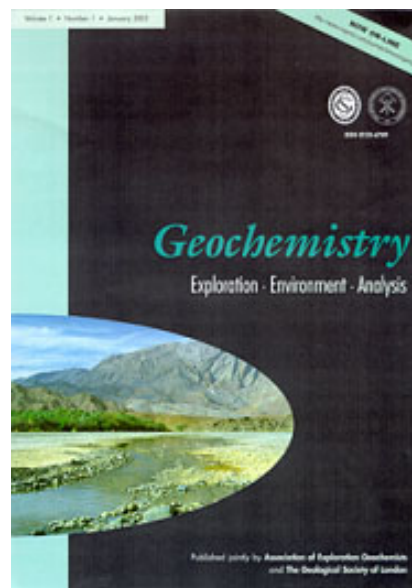
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