

Newsletter

number 30: December 1997

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Highlights of 1996/97

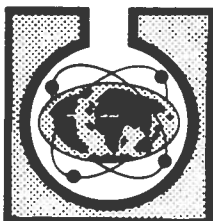
- Council Meeting at GSA in Salt Lake City
 - Four conferences supported
 - Financial strength of IAGC improved
 - Vietnam and Slovakia are new National Members
 - Working Group activities are scrutinized
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SPECIAL OFFER FOR IAGC MEMBERS

The IAGC is beginning a membership drive for 1998 and you can both help and benefit.

SIGN UP ONE COLLEAGUE OR FRIEND FOR NEW MEMBERSHIP OF IAGC IN 1998* AND YOU WILL GET A FULL REFUND (\$US CHEQUE) OF YOUR 1998 MEMBERSHIP DUES. PLEASE USE THE SPECIALLY MARKED APPLICATION FORM ENCLOSED IN THIS NEWSLETTER.

* the new member must not have been an IAGC member in 1997 and must pay their dues for 1998, in full, by July 31, 1998 for you to receive a refund. Limited to one refund per member.



IAGC Business Activities

Council Meeting (October 19, 1997)

The 1997 Council Meeting was held in the Marriott Hotel, Salt Lake City, Utah, USA on Sunday 19 October in conjunction with the 1997 Annual Meeting of the Geological Society of America. Seven Council Members (Faure, Fuge, Gascoyne, Harmon, Hoefs, Long and Sobolev) were in attendance (quorum requirement is five) and so all motions could be voted on. Highlights of the meeting include:

- a description by the President, Gunter Faure, on efforts of the Executive to support the IAGC Working Groups.
- a description by the Treasurer, David Long, of how the financial strength of the IAGC has been improved over the last year,
- the Executive Editor of IAGC's journal, Applied Geochemistry, was voted in as a member of Council,
- discussions on the problems experienced during the year with Elsevier Science regarding the IAGC's journal, Applied Geochemistry,
- a summary of how the difficulties of producing a Vernadsky Medal have been resolved by the creation of certificates of Honourary Membership and Appreciation.

Message from the President (G. Faure)

The International Association of Geochemistry and Cosmochemistry (IAGC) is making its presence felt in the world by the activities of its Working Groups and by the continuing growth of our journal APPLIED GEOCHEMISTRY (AG). Thanks to the excellent leadership of Ron Fuge, the Executive Editor of our journal, the page budget for 1998 has been raised to 1000 pages, permitting the publication of eight issues for the first time in its history. In addition, the scope of the journal has been modified to emphasize environmental geochemistry in the broadest sense of that term, including both natural and anthropogenic phenomena. However, all applications of chemical and isotopic techniques to mineralogical, aqueous, and atmospheric phenomena, continue to be included in the scope of our journal.

The success of AG has strengthened the financial stature of IAGC because Elsevier Science Ltd. is now paying us an annual royalty based on the sale of AG to institutional libraries around the world. As a result, we will continue to be able to support the activities of our Working Groups. The international meetings they organize provide opportunities for the advancement of geochemistry and

cosmochemistry. For this reason, I call upon the chairpersons of our Working Groups to keep in touch with the Officers of the Association to permit them to allocate our financial resources in a timely manner.

In order to stimulate research in the subject area of environmental geochemistry, the IAGC sponsored two technical sessions at the recently held annual meeting of the Geological Society of America in Salt Lake City. These sessions (organized by Don Runnells and by David Long and myself) attracted excellent presentations in front of large audiences. The latter session honoured Dr. Ernest Angino for his pioneering research in environmental geochemistry and his service to IAGC as its long-time Treasurer. This session also featured an award for the best student paper in order to recognize excellence in the content and manner of presentation. We plan to sponsor another technical session at the GSA Meeting in Toronto in 1998, including a best student-paper award. The theme of our session will be: Trace Elements in the Environment: Sources, Transport, Fate, and Toxicology. Please join us for this occasion.

The future strength of the IAGC depends not only on the quality of our journal and on the activities of our Working Groups, but also on the participation of a large and international membership. For this reason, I now call on every member of the IAGC to recruit at least one new member for 1998. Please use the application form that is included in your copy of the Newsletter for this purpose. Membership in the IAGC costs only \$10.00 (US) per year and permits us to offer you a subscription to AG for only \$44.00 (US). Student members pay only \$33.00 (US). Although members are not required to subscribe to our journal, I hope that many of the new members will elect to do so.

Let's go out and organize the geochemists of the world!
The first step is to double the membership of the IAGC in 1998.



Treasurer's Report (D. Long)

The financial statement for the IAGC for 1996 is as follows:

◇ Statement of Income and Expenses January 1, 1996 to December 31, 1996

Beginning Balance, January 1, 1996		\$58,511.82
Income:		
Member Dues	\$ 6,255.00	
National Dues	3,155.00	
Other	825.00	
Interest	571.77	10,806.77
		\$69,318.59
Expenses:		
Newsletter	\$ 1,310.90	
Council Travel	1,000.00	
General Office Expenses	398.00	
Membership Fee - IUPAC	50.00	
4th Environmental Geochemistry Conference	2,000.00	
GES IV: Ilkley	2,000.00	
WRI - 9	3,000.00	
Bank Fees	12.00	9,770.90
Cash Balance, December 30, 1996		\$59,547.90
Total Excess Income Over Expenditures 1996	\$ 1,035.87	
Chequing Account #047031 Douglas Co.	\$27,182.25	
Chequing Account #566064 Citizens Bank	32,365.44	\$59,547.69

The previous five years of income and expenses of IAGC operations have been summarized for comparison to 1996. These are shown below:

	1991	1992	1993	1994	1995	1996
INCOME						
National Members	5,167	2,584	4,283	2,360	3,180	3,155
Individual Members	5,214	5,760	7,187	4,280	7,540	6,255
Interest		2070	1684	1614	673	372
IUGS						
IUNESCO		2,000				
Other	4,688		1,586			825
	15,069	12,414	14,740	8,255	11,393	10,807
EXPENSES						
Symposia, newsletter, etc.	7,385	9,004	7,995	13,425	5,415	9,361
General office	567	523	856	602	490	398
Journal		6,000	67			
Bank		75	101	118		12
	7,952	15,602	9,009	14,145	5,905	9,771
Excess Income over Expenses	7,117	-3,188	5,731	-5,890	5,488	1,036
Cash balance	56,369	53,182	58,914	53,024	58,512	59,548

After the discussions and recommendations made at the 1996 General Assembly in Beijing to improve the financial strength of the Association, the following has been accomplished this year:

- IAGC funds in the checking account in Kansas and Michigan were consolidated into one account in East Lansing, Michigan.

- All funds in the checking account were transferred to an interest bearing account. The checking accounts will earn at approximately 1%.
- \$10,000 of IAGC funds were invested in a 60-month Certificate of Deposit (CD) with an interest rate of 5.79% and APY of 5.95%. Annual interest yield from this CD will be approximately \$600 and will be used to support the Ingerson Lectures.
- \$20,000 of IAGC funds were invested in a 16-month CD with an interest rate of 5.85% and APY of 6.01%. This CD will yield \$1,618 at maturity.
- \$10,000 of IAGC funds were invested in a 25-month CD with an interest rate of 5.65% and APY of 5.8%. This CD will yield \$1,246 at maturity.

Conferences Supported

Several international meetings have been planned through the IAGC Working Groups and have received financial support for their activities, where requested. These include:

- the 5th International Symposium on Hydrothermal Reactions, July 20-24, 1997, at Gatlinburg, USA.
- the 2nd International Symposium on Applied Isotope Geochemistry, Sept. 30-Oct. 4, 1997, at Lake Louise, Alberta, Canada.
- the 4th International Symposium on Environmental Geochemistry, Oct. 5-10, 1997, Vail, Colorado, USA.
- the first IAGC Symposium: Trace Metals in the Environment: Sources, Transport and Fate - A Tribute to Ernest E. Angino, at the Geological Society of America Annual Meeting, Oct. 20-23, 1997, Salt Lake City, Utah, USA.

Although it appears that all these meetings are convened in North America, most of them actually alternate between European or other countries and North America on an annual basis. Upcoming IAGC-sponsored meetings are more internationally distributed and include the 9th International Symposium on Water-Rock Interaction, March 30-April 3, 1998, in Taupo, New Zealand, the 7th International Kimberlite Conference, April 13-17, 1998, in Cape Town, South Africa, and the 17th International Mineralogical Association Meeting, August 9-16, 1998, in Toronto, Canada (for a fuller description and names and addresses of the organizers, see pages 8 and 9).

Ingerson Lecturer

The Ingerson Distinguished Lecturer Award consists of an award made to a distinguished geochemist approximately every two years in the form of a Certificate of Appreciation and an honorarium plus expenses, for presenting the Lecture at an appropriate international meeting. The funding for this award was made possible by a bequest from Earl Ingerson and is now controlled through a separate account (see Treasurer's Report).

The next Ingerson Lecture will be given by Denis Shaw at the IMA Meeting in Toronto, Canada, August 9-16, 1998.

The Geochemical Society (USA) also convenes Ingerson Lectures in response to a similar bequest but these are largely confined to the USA. The IAGC is presently exploring the possibility of renaming the series as the International Ingerson Lectures to distinguish between the two events.

Membership

Membership in the IAGC has fallen dramatically in 1997 to only 501 and, in part, is likely due to an administrative error by Elsevier Science who failed to include a request for IAGC dues in their invoicing for subscriptions to Applied Geochemistry, early in the year. To try and recoup these losses, this Newsletter will be circulated to all 1996 members (as well as new 1997 members) with a request for them to rejoin the Association. In addition, we are offering a refund on member's 1998 dues if they can sign up a new member who pays his/her dues in full by July 31, 1998 (see details on front cover).

The Executive has considered handling the dues collection itself but the resulting confusion to members (caused by two separate invoices instead of one) and the high financial cost of administering the process make it an unattractive option at present. However, if further problems arise in dues collection or if members are not satisfied with Elsevier's performance, the option will be reconsidered.

One other method of increasing membership has been tested this year and is showing some success. It is the inclusion of a combined information sheet and membership application form in the registration packages received by delegates at IAGC-sponsored meetings. For instance, the recent Symposium on Environmental Geochemistry at Vail, Colorado (October 1997) has so far yielded nine new-member applications.

National Membership

Applications for National Membership have been received from Vietnam and Slovakia and were approved at the Council Meeting in Salt Lake City.

Vietnam is represented by the Research Institute of Geology and Mineral Resources in Hanoi (Dr. Ho Vuong Binh, delegate). Dr. Binh has indicated that 82 geochemists in Vietnam are represented and these are drawn principally from RIGMR, the Hanoi Natural Science University, Hanoi Mining and Geological University, the Petroleum and Gas Institute, Hochiminh University and the Marine Institute. Dr. Binh looks forward to strengthening the application of geochemical science for exploration of mineral resources and environmental protection in Vietnam by establishing cooperative agreements with scientists of other nations. He may be contacted at RIGMR, Thanhxuan, Hanoi, Vietnam, FAX: 844 8542125.

Slovakia is represented by the Geochemical and Mineralogical Section (GMS) of the Slovak Geological Society (SGS, current President is Dr. Peter Reichwalder). Dr. Martin Chovan of Comenius University is President of the GMS and all geochemical-related correspondence and events are dealt with by Dr. Thomas Lanczos. His address is Dept. of Geochemistry, Comenius University, Mlynska dolina G-224, 842 15 Bratislava, Slovak Republic (FAX: 421-7-728-867, e-mail: lanczos@fns.uniba.sk). The GMS has approximately 60 members specializing in most areas of geochemistry and are drawn from the Faculty of Natural Sciences, Comenius University, the Slovak Academy of Sciences and the Geological Survey of the Slovak Republic. The Dept. of Geochemistry at the Comenius University has an active graduate program with seven postgraduates currently enrolled.

Beginning with this Newsletter, each National Member country will receive five copies of the Newsletter instead of one. This will allow National Member delegates to distribute information on IAGC events more efficiently than before to their member organizations.

Activities of Working Groups

The Activities of IAGC's Working Groups have come under scrutiny this year. One group, on Natural Waters, Protection from Pollution (A.M. Nikanarov, Chairman) was formally disbanded in 1996 owing to inactivity for several

preceding years. The current status of other Working Groups is summarized below.

Members wanting further information on the activities of a specific Working Group or who wish to participate are encouraged to contact the Chairman at the address given on page 11, or the IAGC Secretary, Noel Gascoyne.

1. Extraterrestrial Geochemistry
(H. Palme, Germany)

No report has been received. However, this Working Group is undergoing a resurgence of activity by attempting to forge a collaboration with the Meteoritical Society through convening one or more sessions at the Society's annual meeting.

2. Applied Isotope Geochemistry
(A. Raheim, Norway)

No report has been received. A second meeting sponsored by this Working Group (AIG-2, held in Lake Louise, Alberta, Canada in September/October 1997) was successful. The third AIG symposium is to be held in Orleans, France in 1999, and will be organized by Dr. Jean-Pierre Girard.

3. Geochemical Training in Developing Countries
(U. Aswathanarayana, Mozambique)

No report has been received. However, the Chairman has indicated he would like to hold a workshop on methods of improving and orienting geochemical training in developing countries. Council, while supporting the need to improve geochemical training and promoting research techniques, does not wish to attempt to influence the curricula used in geochemical training as this is a responsibility of a country's educational policy. A requirement for improving the level of geochemical training in all countries (not just developing countries) was voiced by Council at the 1997 Council Meeting and Councillors R.S. Harmon and D.T. Long have been actioned to prepare and submit a proposal to Council on methods of improving IAGC's role and effectiveness in geochemical education and how to better promote research techniques. **IAGC members are asked to provide suggestions to either David Long or Russell Harmon (addresses on page 10) on these topics.**

4. Health and Disease
(I. Thornton, U.K.)

No report has been received. This Working Group is inactive and will likely be disbanded or reformed into a Working Group on Environmental Geochemistry. IAGC Council is seeking expressions of interest in organizing this Working Group from the membership at large.

5. Thermodynamics of Natural Processes
(G. Kolonin, Russia)

This Working Group is very active and recently supported the Fifth International Symposium on Hydrothermal Reactions at Gatlinburg, Tennessee, USA, July 1997. The Chairman reports that over 120 scientists and engineers attended from 13 countries and half of the attendees came from outside North America. Discussions on specific aspects of Thermodynamics of Natural Processes took place between members from Russia, China, Switzerland, USA and the Ukraine. Four decisions and recommendations were made:

- the next meeting of the Working Group would be in Dubna, Russia in 1998;
- the next Symposium, TNP-3, was proposed for Germany, the date and location to be decided;
- A. Kalinichev and V. Tauson were proposed as additional officers of the Working Group; and,
- Working Group members are contributing to the fourth volume of *Advanced Mineralogy. Processes of Mineral Formation: Frontiers in Experimental Research and Evolution in Geological History.*

6. Geochemistry of the Earth's Surface
(R. Berner, USA)

No report has been received. This Working Group appears to be relatively inactive and somewhat dissociated from the IAGC. Action is being taken to resolve this situation.

7. Global Geochemical Mapping
(A. Darnley, Canada)

This Working Group continues to be active and centres on a joint project with the IUGS on global geochemical baselines. The Chairman reports that three business meetings have been held in 1997, and individual committee members have spoken about the project in symposia and/or

workshops elsewhere, e.g. Canada, Brazil, Israel, Russia, USA. These meetings were:

- ten European countries plus Canada were represented at a meeting in Aveiro, Portugal (January 21-24), mainly concerned with planning arrangements for the next item below, but also to discuss future analytical requirements and sources of funding;
- a field course was held in Limbach, Slovakia (June 16-19). This was attended by representatives of 18 European countries to test expanded field sampling instructions and ascertain if any amendments were required. The finalized instructions will be published by the Geological Survey of Finland as the FOREGS Field Manual early in 1998. (FOREGS = Forum of European Geological Surveys; it includes ED and some former East Bloc countries.); and,
- meeting in Vail, Colorado (October 5 and 8), in conjunction with the 6th Symposium on Environmental Geochemistry and Health.

Reports describing current work relating to baseline geochemical mapping were presented by participants representing Europe, Russia, China, India, Indonesia, Korea, Australia, Colombia, Brazil, USA, Canada and Southern Africa. Twenty five people from 16 countries attended. The Field Manual prepared by the Forum of European Geological Surveys task force was adopted as the current standard for geochemical sampling of temperate regions. This field manual will be expanded in the future to include methods for sampling in non-temperate climates and arrangements for the co-ordination of this process were agreed. The Analytical Manual was discussed, with the aim of completion prior to the geochemical sampling commencing in Europe and parts of Russia in 1998. Within Europe it is planned to sample about 900 sites in about 180 cells of the Global Reference Network (see 1995 UNESCO report for more information).

Some project management changes took place. After 10 years as project leader and subsequently a co-leader Arthur Darnley of the Geological Survey of Canada has been succeeded by Dr. David Smith of the US Geological Survey. Arrangements are being made to hold a meeting in Italy in Spring 1998. This will include a field demonstration of sampling methods prior to the main phase of sampling in FOREGS countries. All countries are welcome to send representatives.

Information has been received that the UN Committee on Natural Resources, which in May 1996 passed a resolution proposing the establishment of a global land monitoring programme based on the project's principal publication (UNESCO 1995), is meeting again in early 1998 to receive responses from FAO, WHO and UNEP concerning implementation of the project. The project's original supporters, IAEA and UNESCO have also been invited to participate in discussion of the proposal in the context of sustainable development. The proposal has been put forward in order to fill a large gap in the existing Global Environmental Monitoring Programme. Without comprehensive and standardized data to describe the current situation, the recognition of change and assessment of possible consequences is guesswork.

8. Water-Rock Interaction **(W.M. Edmunds, UK)**

This Working Group continues to be active. The Chairman reports that the Ninth International Symposium on Water-Rock Interaction (WRI-9) is to be held from March 30 to April 3, 1998 at Taupo, New Zealand. The Secretary General for this meeting is Brian Robinson supported by an able committee of geochemists. Taupo is an excellent venue being on the shores of Lake Taupo, a 60 km² caldera lake with views to the sacred Maori volcanic peaks of the Tongariro Massif.

It is anticipated that the symposium will welcome some 300 delegates plus 50 accompanying members. The planned sessions will include:

Surficial systems.
Processes involving organic matter,
Groundwater,
Basins: Diagenesis, fluid evolution and hydrocarbons,
Metamorphism,
Weathering,
Magma-water interaction,
Ore deposits,
Geothermal: Fluids, gases, rocks and exploitation,
Ocean floor processes,
Fluids and tectonics,
Experimental,
Modelling,
Minerals, surfaces,
Waste storage and disposal.

The symposium contains something for everyone and follows in the successful formula for WRI meetings where specialists in one field can have their horizons enlarged by feeding on WRI themes from many other disciplines. A

number of New Zealand specialists are on hand to start many of the sessions and to bring some insight into the fascinating systems in New Zealand which are not well-known to the majority of participants.

Strong emphasis is being placed on poster sessions. Not least, the peer reviewed, short abstracts for WRI-9 have already been passed on to the Editor, Greg Arehart. The final 850 page volume will provide a veritable state of the art on Water Rock Interaction.

IAGC MEMBERS

Is your country registered as a National Member of the IAGC? Currently only the following are fully paid-up, voting National Members: Australia, Canada, China, Czech Republic, Finland, Germany, Hungary, Italy, Japan, Norway, Russia, Switzerland, United Kingdom. However, our ordinary members are derived from as many as 45 different countries!

A National Member is an organization such as a committee, society or academy of a country that is designated by the IAGC as the official representative of geochemists in that country. Annual dues to be paid by that organization depend on the number of geochemists represented but start at \$60 per year.

Fully paid-up National Members have the final authority and decision-making power of the IAGC and vote on all business activities at the General Assembly held every four years.

If you would like your country to have international representation in geochemistry by becoming a National Member of the IAGC, contact the Secretary, Mel Gascoyne (e-mail: gascoynem@aecl.ca or see address on P. 10) for further details.

Applied Geochemistry

Subscriptions

The subscription rate for Applied Geochemistry in 1998 will be \$44. Students are eligible for a 25% discount. This rate is only available to paid-up members of the IAGC. The rate was reduced from Elsevier Science's initial request (of \$46) by negotiations with the President, Gunter Faure. A new contract must be negotiated with Elsevier in 1998, for ensuing years. Note that the subscription rate for non-IAGC members is \$430 !

Options for renewal are therefore:

1. Membership (\$10.00) plus AG (\$44.00) = \$54.00,
2. Membership plus student subscription (\$33.00) = \$43.00; and,
3. Membership without the journal = \$10.00.

Any questions about renewals of subscriptions to *Applied Geochemistry* should be directed to Elsevier through Joan Caccante in New York (ph +1-212-633-3753).

Editor's Report

During the 12 months October 1st, 1996 to September 30th, 1997, a total of 133 manuscripts were received. This was about the same number as in the previous 12 months. In view of the continuing high flow of manuscripts the journal is set to increase in size for volume 13 (1998) with 8 issues being published with an annual page budget of 1000 pages.

In the Denver meeting of the Editorial Board of *Applied Geochemistry* it was agreed that in view of the increasing importance of the topic of environmental geochemistry within the general subject of applied geochemistry, there was a need for the journal to encourage submission of papers on this topic. To this end it was decided to revise the aims and scope of the journal. A copy of this revision is included below.

Applied Geochemistry is an international journal devoted to publication of original research papers, rapid research communications and selected review papers in geochemistry and cosmochemistry which have some practical application to an aspect of human endeavour, such as the preservation of the environment, environmental monitoring, agriculture, health, waste

disposal and the search for resources. Papers on applications of inorganic, organic and isotope geochemistry are therefore welcome provided they meet the main criterion. Topics covered include: (1) environmental geochemistry (including natural and anthropogenic aspects, and protection and remediation strategies); (2) hydrogeochemistry, surface and groundwater; (3) medical geochemistry; (4) agricultural geochemistry; (5) the search for energy resources (oil, gas, coal, uranium and geothermal energy); (6) the search for mineral deposits (metalliferous and non metalliferous); (7) upgrading of energy and mineral resources where there is a direct geochemical application; (8) waste disposal including the specific topic of nuclear waste disposal.

Despite this change in the aims and scope of the journal it must be stressed that *Applied Geochemistry* will continue to be true to its title and will continue to publish papers on ALL aspects of applied geochemistry.

With regard to production of *Applied Geochemistry* there are some continuing problems caused by Elsevier's frequent changes in their production staff. This has increased the workload of the editor considerably over the last few years. Nevertheless, recent discussions with Elsevier suggest that these problems should soon be resolved.

IAGC Symposium

The first IAGC-convened symposium was held at the Annual Meeting of the Geological Society of America in Salt Lake City, Utah, on October 21, 1997. The topic was 'Trace Metals in the Environment: Sources, Transport and Fate - A Tribute to Ernest E. Angino'. The symposium was very successful with 15 papers presented over the 4-hour period. The abstracts are included in a loose-leaf insert for the interest of IAGC members.

A new policy approved at the Council Meeting and initiated at this Symposium was to award a cash prize (\$100), plus IAGC membership for one year, to the presenting author of the best student paper. This award would be made at the IAGC-convened symposium at each annual GSA Meeting and a similar award would be made available in a suitable international meeting.

For the 1997 GSA Meeting, two presentations were judged to be equally the best (those by Icopini and by Ellis, see abstracts) and so each was awarded the full prize.

The next IAGC Symposium will be at the GSA Annual Meeting, to be held in Toronto, Canada, October 26-29, 1998. The theme will again be 'Sources, Transport, Fate and Toxicology of Trace Elements in the Environment'. An award is planned for the best student presentation. Further information can be obtained from Gunter Faure or David Long (see addresses on page 10).

A similar award is planned for the best student presentation at WRI-9 in New Zealand, in March, 1998. Further details can be obtained from the Secretary, Mel Gascoyne.

Other News

The Proceedings of the 6th International Kimberlite Conference (eds. N.V. Sobolev and R.H. Mitchell) have been published (Allerton Press Inc., 150 5th Avenue, New York, NY 10011, price \$95.00). This work is from papers presented at 6IKC held in Novosibirsk, Russia on July 30-August 18, 1995. The Proceedings consists of two volumes containing about 50 papers on all aspects of kimberlites, related rocks and the characterization, genesis and exploration of diamonds. Further information can be obtained from N.V. Sobolev (see address on page 11).

Upcoming IAGC-Sponsored Meetings

◇ *WRI-9, 9th Int. Symp. on Water-Rock Interactions*
1998, March 30-April 3
Taupo, New Zealand
Contact: B. Robinson
Wairakei Research Centre
PB 2000 Taupo, New Zealand
FAX: 64-7-374-8199
e-mail: wri-9@gns.cri.nz

◇ *7IKC, 7th International Kimberlite Conference*
1998, April 13-17
Cape Town, South Africa
Contact: J.J. Gurney
Dept. of Geological Sciences
University of Cape Town
Private Bag
Rondebosch 7700, South Africa
FAX: 27-21-650-3783
e-mail: 7ikc@geology.uct.ac.za

IAGC-Sponsored Symposium, GSA Annual Meeting, Salt Lake City

SESSION 65, 8:00 AM

Tuesday, October 21, 1997

T05. International Association of Geochemistry and Cosmochemistry: Trace Metals in the Environment: Sources, Transport, and Fate--A Tribute to Ernest E. Angino

SPCC 151 A-G

8:15 AM Lyons, W. Berry

THE GEOCHEMISTRY AND CHEMICAL EVOLUTION OF LAKES BONNEY AND FRYXELL, ANTARCTICA: THE ANGINO LEGACY

LYONS, W. Berry, WELCH, K.A., and GRAHAM, E.Y., Dept. of Geology, The University of Alabama, Box 870338, Tuscaloosa, AL 35487, blyons@wgs.geo.ua.edu; PRISCU, J.C., Montana State Univ., Bozeman, MT 59717; BIRDSON, L.V., USGS-WRD, Boulder, CO 80303; BULLEN, T.D., USGS-WRD, Menlo Park, CA 94025; GREEN, W.J., Miami Univ., Oxford, OH 45056.

In the early 1960s, E.E. Angino and his colleagues published the first geochemical studies of Lakes Bonney and Fryxell, Taylor Valley, Antarctica. These are perennially ice-covered, stratified lakes with brackish to hypersaline monimolimnia and fresh surface waters. Angino speculated that the lakes' chemical evolution was very complex and no single origin of solutes could explain their geochemical differences. In addition, he claimed that climate variations must have played a major role in the development of the present chemical composition. We have used a variety of geochemical and isotopic parameters including transition metals, rare earth elements (REE), $^{87}\text{Sr}/^{86}\text{Sr}$, $\delta^{18}\text{O}$ and ^{36}Cl and the nutrients, phosphate and nitrate to characterize the sources of solutes to these lakes. The $\delta^{18}\text{O}$ values of the lake water indicate that the deep water in Lake Bonney has undergone extensive evapo-concentration, while in Lake Fryxell it has not. The REE, ^{36}Cl and $^{87}\text{Sr}/^{86}\text{Sr}$ data demonstrate that at least three sources of solutes have existed. The sources include marine aerosol, weathering products from the stream channels and floodplains, and ancient marine salt. The trace metal profiles reflect the importance of redox processes within the lakes, while nutrient profiles have been greatly influenced by the previous evapo-concentration episodes. These nutrient profiles determine the current primary production rates within the lakes. Our data confirm many of the initial conclusions drawn by Angino and others thirty-five years ago. These include the importance of changing climatic regimes on the physical and chemical development of these unusual lakes.

8:30 AM Nezat, Carmen A.

CHEMICAL WEATHERING IN STREAMS FROM TAYLOR VALLEY, ANTARCTICA

NEZAT, Carmen A., cnezat3@ua1vm.ua.edu, LYONS, W. Berry, GRAHAM, Elizabeth Y., and WELCH, Kathleen A., Dept. of Geology, Box 870338, Univ. of Alabama, Tuscaloosa, AL 35487; LECHLER, Paul J., Nevada Bureau of Mines and Geology, MS 178, University of Nevada, Reno, NV 89557; MCKNIGHT, Diane M., INSTAAR, 1560 30th St., Campus Box 450, University of Colorado, Boulder, CO 80309.

Taylor Valley (TV), Antarctica is one of the coldest and driest regions in the world. The surrounding hills are composed of granite, gneiss, schist, marble, dolomite, and basalt. The valley floor contains glacial till composed of these rock types, as well as old lake deposits. During the austral summer, streams flow from alpine glaciers through this till to closed-basin lakes. Previous studies have indicated that dissolution of salts of marine origin make the most significant contribution to stream chemistry, but that chemical weathering of silicate rocks also plays a role. The goal of this study is to determine how each of the silicate rock types influences the stream chemistry. In order to do so, the relationships between the rock type in monolithologic watersheds and the solutes in the streams that drain them are evaluated.

Ratios of alkali (K, Rb, Cs) and alkaline earth (Ca, Sr, Ba) elements were compared among weathered rock, unweathered rock, and streams. Ratios are used since the lighter cations within each family are abundant in common minerals and the heavier cations substitute for the more common ones. Stream and weathered rock samples from monolithologic watersheds in the United States and the polythologic TV were analyzed. Additional cation ratios of average continental crust, seawater and other monolithologic watersheds were collected from previous studies.

From the K/Rb and Sr/Ba data, weathered rocks have higher concentrations of heavy cations relative to light cations indicating release of the lighter cations and retention of the heavier ones. All stream samples are enriched in lighter cations relative to weathered and unweathered rock, and are depleted relative to seawater values. Also, TV streams are more enriched in lighter cations than the streams in monolithologic watersheds, suggesting both marine and silicate rock weathering influences. In addition, the Rb/Cs data indicate that TV streams include solutes from weathering of one or more of the following: sandstone, carbonate, and metamorphic rocks.

8:45 AM Angino, Ernest E.

LEACHABLE TRACE ELEMENTS IN NON-DAIRY COFFEE CREAMERS

ANGINO, Ernest E., Dept. of Geology, 120 Lindley Hall, Univ. of Kansas, Lawrence KS 66045; MACPHERSON, G. L., Dept. of Geology, Univ. of Kansas, Lawrence KS 66045

One of the commonest daily actions is that of drinking a cup of coffee (5-10 cups per day is not unusual). Non-dairy creamers are frequently added to the coffee. These powders contain disodium phosphate and sodium silicoaluminate (piroglossite feldspar). We selected 10 common creamers for determination of Li, Ca, Sr, Ti, V, Cr, Mn, Fe, Co, Ni, Zn, Ga, Se, Pb, Sr, Mn, Sn, Ba, Pb, Th, and U content. EPA drinking water standards are established for nine of these elements. The experimental method was designed to simulate the strong-acid environment of the stomach while preparing a solution easily analyzed by ICPMS. To accomplish this, the powdered material was dissolved in 2% nitric acid and heated gently on a hot plate in a clean environment. Samples were filtered through 0.45 micron membrane filters to remove all of the suspended and most of the colloidal material. Metals in the resulting solutions thus represent the leachable fraction of metals in the non-dairy creamers. Samples were analyzed for the metals by ICPMS and data were drift corrected using the results of multiple readings of the same solution throughout the analytical run. Standards were made from commercial multi-element solutions.

Of the elements analyzed, dissolved Ca and Ti would be present at concentrations averaging about 800 and 200 ppb, respectively, in coffee flavored with creamer. Cr, Mn, and Fe would be present at approximately 5% - 6% of the EPA MCL or SMCL. Other EPA-regulated elements analyzed would be present at concentrations much less than the EPA drinking water standards, with the exception of Pb, present at levels of about 0.6 ppb. Although the amount of Cr in creamer-flavored coffee is small, ingestion of 10 cups per day of coffee flavored with non-dairy creamer would supply about 30% of the daily recommended intake of Cr.

9:00 AM Faure, Gunter

SOURCES OF THE NATURAL STRONTIUM ANOMALY IN THE RIVERS OF OHIO ESSENBURG, Cheryl L. and FAURE, Gunter, The Ohio State University, Dept. of Geological Sciences, 125 South Oval Mall, Columbus, OH 43210

The Sr/Ca ratios of rivers draining marine carbonate rocks of Paleozoic age in western Ohio are 25 times higher than the crustal average of about 5, when the concentrations of Sr are expressed in parts per billion and those of Ca in parts per million. The principal rivers in Ohio with elevated average Sr/Ca ratios greater than 20 are the Maumee River and its tributaries, the Sandusky River, the Scioto River, and the Great Miami River. The resulting strontium anomaly affects an area of about 20,000 km² in western Ohio and eastern Indiana. The Sr/Ca ratios of rivers in western Indiana, southern Michigan, West Virginia, and Kentucky are everywhere less than 10. The strontium enrichment of rivers in western Ohio has been attributed to the dissolution of celestite (SrSO₄) in the Silurian dolomites of that region.

The Hocking River and its tributaries in eastern Ohio that drain Carboniferous sandstone, shale, and some limestone, have normal Sr/Ca ratios close to the crustal average. Although the Little Miami River in southwestern Ohio drains marine carbonate rocks of Ordovician age, its average Sr/Ca ratio is also close to the crustal average, suggesting that these rocks contain less celestite than the Silurian carbonates.

Contrary to our expectation, the Sr/Ca ratios of the Maumee and Sandusky rivers in northwestern Ohio vary seasonally by up to a factor of 10, whereas the Sr/Ca ratio of the Muskingum River remains virtually constant throughout the seasons. An analysis of seasonal discharge records and chemical compositions of these rivers indicates that the seasonal variation of Sr/Ca ratios of the Maumee and Sandusky rivers is caused by increases in the abundance of Sr-rich bedrock water during periods of low flow. The Sr/Ca ratio of the Muskingum River remains constant because the bedrock water does not contain unusually high strontium concentrations.

These results demonstrate that the Sr/Ca ratios of the rivers of Ohio are controlled by the mineral composition of the bedrock underlying the drainage basins. The existence of this bedrock-related strontium anomaly of western Ohio may have beneficial medical implications for the human population by reducing its susceptibility to tooth decay and to osteoporosis.

9:15 AM Gascoyne, Mel

THE MOBILIZATION OF URANIUM IN A FRACTURE ZONE BY OXYGENATED GROUNDWATER

GASCOYNE, Mel, gascoym@secl.ca; FROST, Laurie H., STROES-GASCOYNE, Simcha, WILKS, Peter, and GRIFFAULT, Lisa Y., Atomic Energy of Canada Limited, Whiteshell Laboratories, Pinawa, Manitoba R0E 1L0, Canada.

Uranium present in alteration minerals lining a highly permeable fracture zone in the granitic rock at Canada's Underground Research Laboratory (URL) in southeastern Manitoba has been mobilized during a chemical tracer test by injecting oxygenated water into the fracture zone from a near-surface source. The test was performed by Atomic Energy of Canada Limited (AECL) in a portion of Fracture Zone 2 (FZ2) accessed from the URL at a depth of 250 m in the granitic Lac du Bonnet Batholith. In this test, oxygen- and bicarbonate-rich groundwater from the upper ventilation raise was injected continuously using injection/withdrawal tracer-testing methodology between two boreholes 17 m apart in FZ2 at a rate of 5 L/min. The first phase of the test involved injecting water that had been stripped of dissolved uranium (~0.1 mg/L) using AECL's EXPURIT uranium filter. Subsequent to the injection, the groundwater was injected at the same rate without prior removal of U. The Eh and concentrations of dissolved oxygen, U, major ions, micro-organisms, and iodide and coliforms (added tracers) were monitored in the withdrawal water.

Breakthrough of dissolved oxygen and increase in Eh occurred within the first 10 hours of the test. Uranium concentrations began to increase after 14 hours and $^{234}\text{U}/^{238}\text{U}$ activity ratios decreased. Uranium and dissolved oxygen concentrations, Eh and U isotope activity ratio reached stable values after ~150 hours. Both U concentrations and $^{234}\text{U}/^{238}\text{U}$ ratios increased when unfettered, U-rich water was injected in the second part of the test. Micro-organism content increased to the levels of the injected water and no filtration by the geologic media was observed. However, injected silica colloids (size 20 nm) showed slight retardation and lower recovery when compared with injected iodide tracer levels. Some losses of both tracers to the surrounding flow system were identified by sampling an adjacent borehole.

These tests demonstrate the ease of removal of U from the alteration minerals in this fracture zone at a depth of 250 m in granitic rock, when conditions change from reducing to oxidizing. The results indicate that U mobilization is kinetically controlled.

9:30 AM Icopini, G. A.

CHROMIUM SPECIATION IN SOILS: IMPLICATIONS FOR BIOSTABILIZATION

Icopini, G.A., Long, D.T., and Ellis, R.J., Dept. Geol. Sci., Mich. St. Univ., icopini@pilot.msu.edu; Fomey, L.J. Center for Microbial Ecology, Mich. St. Univ., E. Lansing, MI 48824.

Here we report preliminary data from studies to understand the fate and transport of Cr at a former leather tannery site. The studies are being done to assess the potential use of biogeochemical processes to limit Cr mobility (biostabilization). High Cr levels (up to 200,000 mg/kg) are found in surface soils at the site that range from sandy and oxic to peaty and anoxic. Despite the high concentrations of Cr in the soils, there appears to be little or no leaching of Cr to the shallow groundwater. Sequential chemical extractions (SCEs) were used to identify substrates that sequester Cr in six operationally defined phases of the soil. In both anoxic and oxic soils, Cr was primarily associated with an acidic, moderately-reducible (MR) phase and a basic, oxidizable (BOX) phase. In anoxic soils a significant amount of Cr was also associated with an acidic, easily-reducible phase (ER). A positive linear correlation was observed between the concentration of Cr in the BOX phase and total organic matter. These data suggest there are multiple sequestering mechanisms for Cr in these soils. In oxic soils, sequestering most likely occurs through sorption to Fe oxyhydroxides in the MR phase and organic matter in the BOX phase. Other than sorption to organic matter, the mechanisms of Cr immobilization in anoxic soils are unclear. Although one could postulate that Fe oxyhydroxides, and Mn oxides and labile Fe oxides (ER) sorb Cr in anoxic soils, the existence of oxide substrates under reducing conditions is debatable. An interesting observation is that Fe is similar to Cr, in that it also occurs in the ER and MR phases of anoxic soils. However, it is unknown whether Cr and Fe are sorbed to the same substrate and are therefore extracted simultaneously, or whether the co-extraction of these metals is simply fortuitous. The possibility that Cr is not sorbed to a substrate but rather exists as a precipitate (e.g., Cr(OH)₃) can not be excluded.

9:45 AM Ellis, Robert J.

HEAVY METAL PARTITIONING IN SOILS AT A FORMER LEATHER TANNERY

Ellis, Robert J., ellisr1@pilot.msu.edu; Icopini, Gary A.; and Long, David T., Department of Geological Sciences, Michigan State University, East Lansing, MI, 48824-1115; Fomey, Larry J.; Marsh, Terence L.; Merlin, Christophe, and Roberts, Michael S., Center for Microbial Ecology, Michigan State University, East Lansing, MI, 48824-1115.

At a former leather tannery, soils and sediments have metal concentrations ranging from background to elevated, affording the opportunity to study the biogeochemical fates of heavy metals under diverse sediment types and microbiological processes. Sediments vary in degree of saturation, oxidation, and organic matter content. It appears that over the 40 years since tannery operations ceased, metals have become immobilized and do not appear to be entering the ecosystem.

As part of the effort to investigate the biogeochemical processes immobilizing metals, the fate of selected metals (e.g., Cr, Cu, Zn) is being studied in this system using selective chemical extractions and porewater samplers to determine metal partitioning within sediments, and between solid and liquid phases. Graphical techniques, P- and O-mode factor analysis and GIS are used to evaluate biogeochemical patterns in partitioning.

Selected results are 1) methanogenesis and sulfate reduction appear to be important microbial processes in the saturated sediments; 2) easily reducible (ER; Fe/Mn oxides), moderately reducible (MR; Fe oxides), and basic oxidizable (BOX; organic matter) are the most important sequestering phases under all sediment conditions; 3) relative partitioning among phases varies among the metals studied (e.g., Cr is primarily associated with MR and BOX, Zn is primarily associated with ER and MR, and Cu is associated with BOX and ER for samples with high organic matter and associated with ER and MR for samples with low organic matter); and 4) partitioning among phases, especially for Zn, differs between unsaturated and saturated conditions. Our preliminary conclusion is that the nature of metal partitioning in the sediments with elevated concentrations is similar to that of uncontaminated sediments. However, substrates comprising the ER and MR phases in the anoxic samples are unclear because the existence of oxides under these conditions is debatable. Microbial processes may play a key role in determining the nature of substrates immobilizing the metals under anoxic conditions.

◇ **IMA '98, 17th Int. Mineralogical Assoc. Meeting**

1998, August 9-16
Toronto, Canada
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◇ **IAGC Symposium: Sources, Transport, Fate and Toxicology of Trace Elements in the Environment**

At the GSA Meeting, Toronto
1998, October 27, (provisionally)
Toronto, Canada
Contact: G. Faure
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Columbus, Ohio 43210-1398 U.S.A.
FAX: 1-614-292-7688

◇ **The Exploration of the Moon**

1998, October
Contact: E.M. Galimov
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e-mail: galimov@geokhi.msk.su

◇ **SEG-5, 5th Int. Symp. on Environmental Geochemistry**

2000, April
Contact: M. Fey
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University of Cape Town
Rondebosch 7701, South Africa
FAX: 27-21-650-3783

Other Meetings of Interest

◇ **Conf. on Hazardous Waste Research**

1998, May 19-21
Salt Lake City, Utah, U.S.A.
Contact: website www.engg.ksu.edu/HSRC/home.html
phone: 1-913-532-0780

◇ **35th Ann. Mtg. Clay Minerals Society**

1998, June 6-11
Cleveland, Ohio, U.S.A.
Contact: P.J. Eberl
CMS, P.O. Box 4416
Boulder, Colorado 80306, U.S.A.
FAX: 1-303-444-2260
e-mail: peberl@clays.org

◇ **Int. Symp. History of Mineralogy, Mineralogical Museums, Gemology, Crystal Chemistry and Classification of Minerals**

1998, June 23-27
St. Petersburg, Russia
Contact: G.G. Anastasenko
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◇ **4th Int. Symp. on Environmental Geotechnology and Global Sustainable Development**

1998, August 9-12
Boston, U.S.A.
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◇ **IEP'98, Issues in Environmental Pollution**

1998, August 23-26
Denver, Colorado, U.S.A.
Contact: L. Quirke
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Wantage, Oxon, OX12 0QS
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FAX: 44-1235-868420
e-mail: lynquirke@compuserve.com

◇ **8th Ann. V.M. Goldschmidt Conference**

1998, August 30-September 3
Toulouse, France
Contact: Conference Organizer
8th Ann. Goldschmidt Conf.
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31400 Toulouse
France
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e-mail: goldconf@lucid.ups-tlse.fr

◇ *8th Congr. of Int. Assoc. of Engineering Geology and the Environment*

1998, September 21-25
Vancouver, Canada
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