

# EXPLORE

## Newsletter for the Association of Exploration Geochemists

NUMBER 73

OCTOBER 1991

### PRESIDENT'S MESSAGE

This issue of **EXPLORE** contains the Report of the Ad Hoc Committee on the Identity of the Association of Exploration Geochemists. The Committee was chaired by J. Alan Coope, and the Committee's report was presented to and accepted by the AEG Council at its meeting on June 26, 1991. I wish to thank Alan and his Committee for their efforts and diligence on behalf of the AEG.

In brief, the report reaffirms the central focus of the AEG on exploration geochemistry while encouraging closer communication with specialists in related fields to advance application of geochemical methods in interpretation, discovery, exploitation and reclamation. Most importantly, the report recognizes that past lack of emphasis on research into dispersion processes has been detrimental to both the application and perception of exploration geochemistry. The extent to which the AEG and the *Journal of Geochemical Exploration* should expand into environmental geochemistry has been vigorously debated by the membership. The report recommends: (i) involvement and joint meetings in areas where exploration and environmental geochemical interests overlap, and (ii) expansion of the *Journal of Geochemical Exploration* to include studies of an environmental nature that may contribute to the resolution of exploration problems.

To be effective, several of the Committee's recommendations require action. The AEG Council has therefore approved formation of:

- (i) an Educational Committee with a broad mandate to examine and recommend on the education of the exploration geochemist. Professor Art W. Rose (Penn State University, 332 Deike Building, University Park, PA 16802, USA) has agreed to chair this committee;
- (ii) a Professional Registration Committee, to examine the rapidly changing requirements for registration of geoscientists and make recommendations as to the response of the AEG. This Committee will be chaired by Dr. Ivor L. Elliott (Cominco Ltd., 700-409 Granville Street, Vancouver, BC, V6C 1T2, Canada);
- (iii) a Seminar Committee to introduce leading-edge seminars aimed at stimulating debate and raising the professional image of exploration geochemistry. Dr. Gwendy E.M. Hall (Geological Survey of Canada, 601 Booth Street, Ottawa, ON, K1A 0E8, Canada) has agreed to chair this Committee.

In parallel developments Dr. E. M. Cameron, Editor-in-Chief of the *Journal of Geochemical Exploration*, is developing new guidelines for the scope of the *Journal*. These are intended to encourage submission of a greater range of subject matter, including environmental geochemical topics, related to mineral resource exploration and development.

Graham F. Taylor (CSIRO Division of Exploration Geoscience, PO Box 136, North Ryde, NSW 2113, Australia), as the new Second Vice President (and a former Regional Councillor for Australia) now assumes responsibility for liaising with the Regional Councillors and promoting the interests of the membership outside North



*Continued on Page 2*

### AEG IDENTITY

MEMO TO: AEG Council  
FROM: The Ad Hoc Committee on the Identity of The Association of Exploration Geochemists

#### EXECUTIVE SUMMARY

The ad hoc Committee has completed its consideration of the future identity of the Association. The message underlying the following recommendations is that exploration geochemistry must advance beyond the empirical into the more creative and intellectual in order to guarantee the future of both the profession and the Association. The achievements of our pioneers and mentors and the foundations they established were profound, appropriate and timely, but in order to be effective, the Association must continually adapt to the challenges of the changing world.

The Committee presents the following recommendations for Council's attention and consideration:

1. The Association should reaffirm that there will always be a demand for natural resources. The need for basic geoscientific understanding, the challenges of discovery and the increasing regulation governing exploration, exploitation and reclamation will guarantee the necessity for geochemical research and development well into the foreseeable future.  
The AEG can foster all of these needs and meet the aspirations of a broadly based membership in a variety of affiliations by fully exercising its present mandate.
2. The AEG should maintain its central focus on exploration geochemistry but should expand its traditional horizons to cover those aspects of other geochemical disciplines that are relevant to mineral exploration.
3. The Association has to address the loss of credibility of exploration geochemistry as a specialized discipline in both academia and industry through the communication and

*Continued on Page 3*

### CONTENTS

President's Message .....	1	Field Trip Report .....	16
AEG Identity .....	1	Pearl Harbor File .....	17
Notes from the Editor .....	2	Journal of Geochemical Exploration .....	17
Letters .....	8	Recent Papers .....	19
News of Members .....	10	Denver Area Geochemical Exploration Discussion Group ..	21
Technical Notes		Association of Exploration Geochemists Special	
Hanby Colorimetric Test .....	11	Book Offer .....	22
Student Paper Prize .....	12	New Members .....	23
Call For Papers		Association of Exploration Geochemists Application	
SME Regional Symposium (with AEG Participation) .....	14	For Admission .....	24
Prospectors and Developers Association of Canada .....	14	Calendar of Events .....	25
Special Notes		Books Available .....	26
PROBPLOT .....	15	List of Advertisers .....	28
Journal of Geochemical Exploration Special Offer .....	15		
Soils of the World .....	16		

## Information for Contributors to EXPLORE

**Scope** This Newsletter endeavors to become a forum for recent advances in exploration geochemistry and a key informational source. In addition to contributions on exploration geochemistry, we encourage material on multidisciplinary applications, environmental geochemistry, and analytical technology. Of particular interest are extended abstracts on new concepts for guides to ore, model improvements, exploration tools, unconventional case histories, and descriptions of recently discovered or developed deposits.

**Format** Manuscripts should be double-spaced and include camera-ready illustrations where possible. Meeting reports may have photographs, for example. Text is preferred on paper and 5/4- or 3 1/2-inch IBM-compatible computer diskettes with ASCII (DOS) format that can go directly to typesetting. Please use the metric system in technical material.

**Length** Extended abstracts may be up to approximately 1000 words or two newsletter pages including figures and tables.

**Quality** Submittals are copy-edited as necessary without re-examination by authors, who are asked to assure smooth writing style and accuracy of statement by thorough peer review. Contributions may be edited for clarity or space.

All contributions should be submitted to:

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## EXPLORE

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OCTOBER 1991

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## NOTES FROM THE EDITOR

This issue of EXPLORE features the final report of the Ad Hoc Committee on the Identity of the Association of Exploration Geochemists. The committee has given full and careful considerations to the changing conditions that exploration geochemists work under and have recommended a course for the future of the AEG. The Editor strongly recommends that each member who has not already read this report do so now to determine how the Association of Exploration Geochemists can continue to benefit them in the future. Now that the report is final, the EXPLORE staff expect to reference this document when considering acceptance criteria for submission to EXPLORE as well as the general flavor and slant of the newsletter. Although the committee's deliberations are completed, we hope and expect to see comments and opinion on the report in the pages of future editions.

Also in this issue Shea Clark Smith reminds us of our past in a description of a field portable colorimetric technique.

The next issue of EXPLORE (No. 74, January 1992) will be devoted to Australian issues and papers. Anyone interested in contributing should contact Dr. Graham Taylor, CSIRO Division of Exploration Geoscience, PO Box 136, North Ryde, NSW 2113, Australia.

Owen P. Lavin  
Editor, EXPLORE

## President's Message

*Continued from Page 1*

America. As the first non-North American Vice President, it is particularly timely and appropriate that Graham should assume this role.

All these individuals have agreed to assume important tasks and to invest their time in the future of the AEG. I urge everyone to give them all the support and assistance possible. In particular, please contact them directly to make your own views known.

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## AEG Identity

Continued from page 1

- demonstration of current, innovative research and the need for more intensive investigations of geochemical dispersion processes. Lack of emphasis on process research in the past has been detrimental to the exploration geochemistry discipline.
4. The Association, the Journal of Geochemical Exploration and EXPLORE should continue to be prominent in the advancement of exploration geochemistry as contemplated by the aims and objectives of the Association. In the pursuit of these aims, the Association should expand existing programs and develop new initiatives as follows:
    - (i) introduce leading-edge seminars (of Penrose quality) that will stimulate debate and also create a more intellectual impact and raise the scientific/professional image of the exploration geochemist.
    - (ii) influence the development of curricula and promote and support formal education in exploration geochemistry in colleges and universities, stimulate research into the scientific aspects of geochemical processes and sponsor some aspects of graduate research.
    - (iii) strengthen both the profession and also the role of the AEG by continuously upgrading the quality of the Association's service to the membership and encourage and promote high professional standards through the establishment of guidelines for exploration geochemical practice.
    - (iv) foster, more directly, the interests of the non-North American membership (and potential membership) through maintaining and nourishing the AEG Distinguished Lecturers program and, as exploration geochemistry activity develops in more and more countries, give the non-North American membership increased responsibilities and stronger representation on Council.
    - (v) cultivate a more effective and polished image and develop programs and policies that will make the Voting Members of the Association more visible and influential.
  5. The Association of Exploration Geochemists should not unreservedly embrace environmental geochemistry, but maintain its present identity, restrict objectives to the dispersion (both natural and anthropogenic) of naturally occurring geochemical species and exchange ideas and encourage joint meetings and projects in areas where exploration and environmental geochemical interests overlap.
  6. The Association should not launch another journal devoted primarily to environmental geochemistry. The Journal of Geochemical Exploration should be encouraged to publish papers that address processes and procedures likely to increase efficiency in exploration, and help understand environmental challenges. The JGE should accept manuscripts of an environmental nature which may contribute to the resolution of exploration problems.
  7. The Association should establish closer communication with specialists in related fields. Joint meetings, collaborative projects, special volumes, review volumes, productive integration and the creation of communication networks are all recommended with a variety of disciplines including hydrology, geomorphology, plant physiology, geophysics, economic geology, pedology/soil science, analytical chemistry and petroleum geochemistry.
  8. While establishing closer scientific and technical relationships with other disciplines, it is essential that the Association vigorously cultivate these advances to improve, indirectly and directly, the understanding of the geochemical environment of mineral deposits, allowing, encouraging and fostering the development of improved methodology for application interpretation, discovery, exploitation and reclamation.
  9. Upon acceptance of the Committee's report, Council is strongly

urged to establish a procedure and a time-table for the implementation of the Committee's recommendations.

### INTRODUCTION

This ad hoc Committee was formed in June 1990 following Council's decision that a review of the future identity of the Association would be appropriate and timely.

Initially a statement was prepared on "The Identity of the Association of Exploration Geochemists" (dated July 18th 1990) which was distributed to approximately 40 Voting Members including all Councillors. The twenty-eight responses (70%) were distributed to the Committee members along with a summary memorandum (dated December 6th 1990) identifying numerous points for comment and discussion. Committee responses were summarized and a series of preliminary recommendations identified in a March 18th 1991 memorandum which was returned to the Committee along with an additional contribution by the Chairman (dated March 19th 1991) entitled "Where are we and why?" Written contributions from Committee members not attending the 15th IGES were reviewed in a face-to-face meeting of the Committee held at the Symposium on April 29th 1991.

Eleven Voting Members constituted the Committee:

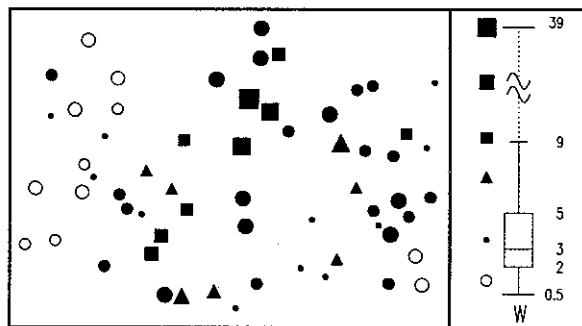
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Continued on Page 4

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## AEG Identity

Continued from Page 3

The Committee's deliberations were wide-ranging and perceptive. These took into account the history of the Association, the numerous developments in exploration geochemistry and other geochemical disciplines over the past four decades, the previously noted contributions from interested Voting Members and the useful discussions in both Council and in *EXPLORE* leading to the formulation of a series of recommendations which are presented for Council's attention and approval in this report.

An Executive Summary is provided but Council's attention is also directed to the sections on "Exploration Geochemistry, Historical Development, Current Perceptions and Some Solutions", "The Importance of a Clear Objective" and "Some Specific Questions" which follow.

Upon acceptance of the Committee's report, Council is strongly urged to establish a procedure and a time-table for the implementation of the Committee's recommendations.

An archive of all correspondence pertaining to the Committee's activities is being delivered to the Secretary of the Association for safe-keeping and for future reference.

### Exploration Geochemistry, Historical Development, Current Perceptions and Some Solutions

In the late 1940's and early 1950's when exploration geochemistry was gaining attention in the western world, the methods were vigorously promoted as being relatively simple, suitable for routine application and, once defined, could be confidently delegated to technical and, indeed, unskilled personnel. Not only did the combination of low costs, simple application and numerous well-publicized successes bring acclaim and attention, but it also served to convince the growing community of exploration geologists that

success with exploration geochemistry entailed nothing more than the almost unconscious repetition of the procedures set out in published case histories. Although there has been some general increase in geochemical awareness, this opinion has tended to harden over the years and today many exploration managers believe that exploration geochemistry is a skill to be developed by the exploration geologist rather than being the specialized discipline of the exploration geochemist.

The Association of Exploration Geochemists was formed in 1970 and has been successful in becoming internationally recognized as the society for exploration geochemists. The *Journal of Geochemical Exploration* is, indisputably, the leading publication of the exploration geochemistry discipline. Professional recognition of the exploration geochemist has been a prime consideration of the Association from the beginning. Standards of qualification for Voting Membership have been identified in the bylaws and articles defining the professional exploration geochemist have appeared in the newsletter on at least two occasions. Within industry, however, the typical geochemist is the exploration geologist who, despite only limited basic training in exploration geochemistry, is considered adequately geochemically literate and therefore a qualified practitioner. In addition, field work is quite often delegated to technical personnel with a minimum of supervision. Consequently, the quality of geochemical work in many exploration programs is often tainted with mediocrity.

Many draw a direct correlation between low levels of expertise in the average geochemical exploration survey and the early promotion of low costs, low skills and simplicity. If this is true then it is equally true that exploration geochemists have failed to convey to industry not only a basic appreciation of the complexities of the natural environment but also the potential of innovative geochemical science to address complex exploration problems.

It is not uncommon for qualified and experienced exploration geochemists to unwittingly perpetuate this myth of simplicity. We repeatedly read that sampling is a simple procedure and that analysis is cheap. Psychologically this conveys the impression that cheap analysis is not only desirable but adequate - in fact in several of our commonly used texts we are told that the need for a highly-skilled operator (and therefore well-paid) is a disadvantage of the ICP analytical technique. Similarly, the need for dedicated and well-trained samplers for some highly effective geochemical exploration procedures is often conveyed as being prejudicial to exploration economics.

Although not intended, short courses and workshops which advise on "how-to" conduct geochemical surveys tend to sustain the notion of a trade which can be learned very quickly and very cheaply and downgrades the geochemist from a professional scientist to a technician.

Because of this, many in academia look upon exploration geochemistry with some disdain and too many exploration managers cannot justify employing well-qualified exploration geochemists. *Leading-edge seminars (of Penrose quality) that will stimulate debate but also create a more intellectual impact and raise the scientific/professional image of the exploration geochemist are necessary to balance and eventually overshadow the more technical instruction that industry will continue to demand.* Subjects that should be considered include dispersion criteria, migration pathways, the form of elements in the secondary environment the application of stable isotope and fluid inclusion studies, and many other topics. *In addition, the Association should (i) influence the development of geochemistry curricula, (ii) promote and support formal education in exploration geochemistry in colleges and universities, (iii) stimulate research into the scientific aspects of geochemical processes and (iv) sponsor some aspects of graduate research.*

*In order to strengthen both the profession and also the role of the AEG the quality of the Association's service to the membership should be continuously upgraded and high professional standards*

Continued on Page 5

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## AEG Identity

Continued from Page 4

should be encouraged and promoted through the establishment of guidelines for exploration geochemical practice in the interests of orderly and responsible natural resource development and public safety.

Further, the Association should foster, more directly, the interests of the non-North American membership (and potential membership). In the near term, this can be done by maintaining and nourishing the AEG Distinguished Lecturer program. As exploration geochemistry activity develops in more and more countries, the Association should give the non-North American membership increased responsibilities and stronger representation on Council.

Programs and policies, should be developed that will make the Voting Members more visible and influential and downplay, (although not abandon), the financially oriented thrust of making it easy for geologists and technicians to join the Association as Associate Members.

Exploration geochemistry cannot be fostered and promoted in the same way that society markets cosmetics, shoes or automobiles. The Association must cultivate a more effective and polished image and encourage the more intellectual approach of research into geochemical processes and related topics. In this context, linkages with other disciplines are essential and the translation of research into innovative exploration methodology becomes even more challenging.

### The Importance of a Clear Objective

A clear objective for the Association is fundamental to any discussion of identity.

The Association membership consists of people from a wide variety of affiliations broadly classifiable into industry, independent contractors, academia and government. The philosophical approaches to exploration geochemistry within these estates can all be different.

For example, industry strives for discovery whereas academia and, possibly to some degree, government strive for understanding. Industry is absolutely dependent on the discovery of mines for its continued existence, whereas the independent contractor, the academic and the government employee can switch efforts away from mineral discovery into other fields — eg. environmental geochemistry — at short notice. These switches are caused by several factors — public opinion, availability of money and real or apparent declines in mineral exploration/development activity — which are usually complexly interrelated.

The present objectives and purposes of the Association of Exploration Geochemists are very clear. In order for the Association to continue to be a productive organization it must maintain a clear and objective purpose. The Association should not assume a fickle attitude that will be interpreted by many in terms of inconsistency and unreliability. Such would erode identity.

This understanding is implicit in a majority of submissions from

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the voting membership and, indeed, in the counsel of individual Committee members. *The Committee therefore recommends to Council that the Association reaffirms that there will always be a demand for natural resources. The need for basic geoscientific understanding, the challenges of discovery and the increasing regulation governing exploration, exploitation and reclamation will guarantee the necessity for geochemical research and development well into the foreseeable future. The AEG can foster all of these needs and meet the aspirations of a broadly based membership in a variety of affiliations by fully exercising its present mandate.*

### Some Specific Questions

During exchanges of correspondence, members of the Committee focused on several pertinent questions related to its mandate. Conclusions and recommendations summarized below are in harmony with proposals put forward earlier in this report.

#### Question 1. What is the preferred future direction of the AEG?

This was the central question included in the July 18th 1990 statement and was addressed by both the Committee and the responding voting membership. Responses were classified relative to the following positions:

- Those who feel the AEG should focus strongly on exploration geochemistry.
- Those who feel the AEG should maintain its central focus on exploration geochemistry, but should expand its traditional horizons to cover those aspects of other geochemical disciplines that are relevant to mineral exploration.
- Those who feel that the AEG is too exploration oriented and should expand into other applied geochemical fields and assume an even broader mandate.

Continued on Page 6

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## AEG Identity

Continued from Page 5

Generally it was noted that company employees tended to favor a position closer to (a) than (b); government employees and those from academia tended to group much closer to (b) than (a) and the more extreme opinions of some consultants tended towards a position between (b) and (c). There is no significant correlation between responses and geographic location although it is apparent that there is a stronger focus on the environmental aspects of applied geochemistry in Europe and that several consultants (worldwide) have entered into the environmental field.

The consensus of opinion among the voting members, which is supported and recommended by the Committee is that

*The AEG maintain its central focus on exploration geochemistry but should expand its traditional horizons to cover those aspects of other geochemical disciplines that are relevant to mineral exploration.*

### Question 2. *Is exploration geochemistry a sunset science?*

This question was raised by a voting member. A majority of Committee members emphatically rejected the notion that exploration geochemistry is a sunset profession or science. It was noted that exploration geochemistry has had a relatively short but successful history and the methods are still widely used in the search for mineral deposits. Although the number of students pursuing graduate studies in exploration geochemistry has declined compared with recent years, this number is probably comparable with the number of graduate students preparing to enter the profession approximately 30 years ago.

The Committee notes, however, that exploration geochemistry is losing some credibility as a professional discipline and interest and

support in government and academic institutions has decreased. This is all the more disappointing because the Committee is aware of some very innovative research investigations being carried out by certain groups around the world which could introduce a whole new dimension to geochemical understanding relating to element dispersion. These advances, stemming, for example, from electrogeochemical and gaseous dispersion studies are focusing attention on process in geochemical dispersion - an aspect of geochemical exploration that many claim has been ignored to the detriment of the discipline and the Association.

The Committee therefore recommends:

*The Association has to address the loss of credibility of exploration geochemistry as a specialized discipline in both academia and industry through the communication and demonstration of current innovative research and the need for more intensive investigations of geochemical dispersion processes. Lack of emphasis on process research in the past has been detrimental to the exploration geochemistry discipline.*

### Question 3. *To what extent should the AEG promote and foster exploration geochemistry?*

*It is recommended that the Association and the Journal of Geochemical Exploration and EXPLORE should continue to be prominent in the advancement of exploration geochemistry as contemplated by the aims and objectives of the Association. In the pursuit of these aims the Association should expand existing programs and develop new initiatives*

(in concert with the recommendations set out under the heading "Exploration Geochemistry, Historical Development, Current Perceptions and Some Solutions.")

### Question 4. *To what extent should the AEG embrace environmental geochemistry?*

Information obtained by the Committee indicates that a significant number of geochemists presently practicing in the environmental field would not join the AEG if the Association expanded its mandate to include the broad discipline of environmental geochemistry. This is because their interests are covered by existing organizations.

Committee members note that there is a danger that dilution of the current membership with peripheral interest groups could cause serious identity problems for the Association and unreservedly opening the Association to environmental membership will not serve the needs of the majority of the current AEG membership who are exploration geologists practicing exploration geochemistry.

On the other hand, Committee members are aware that many practitioners in the environmental geochemistry field are chemists and engineers without an expert appreciation of geological aspects of the natural environment, and also acknowledge that exploration

Continued on Page 7

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## AEG Identity

Continued from Page 6

geochemists have developed skills of application needed in environmental investigations and often work with environmentally significant data in pursuit of the mineral discovery objective. In recognition of these close interrelationships, the majority opinion on the Committee is that:

*The Association should not unreservedly embrace the broad discipline of environmental geochemistry, but maintain its present identity, restrict its objectives to the dispersion (both natural and anthropogenic) of naturally occurring geochemical species and exchange ideas and encourage joint meetings and projects in areas where exploration geochemical and environmental geochemical interests overlap.*

### Question 5. Should the AEG consider another journal?

All members of the Committee are against the launching of another journal. Reasons vary, however, with more than one Committee member citing the additional costs to the Association and the predictable strain on other resources. Others note that two journals, with one primarily devoted to environmental geochemical papers, would tend to divide the Association and lead to a decline in the *Journal of Geochemical Exploration*.

While some Committee members state that the JGE should accept environmental geochemical papers, others make recommendations compatible with the majority opinion in answer to Question 4.

The recommendation of the Committee is:

*The Association should not launch another journal devoted primarily to environmental geochemistry. The Journal of Geochemical Exploration should be encouraged to publish papers that address processes and procedures likely to increase efficiency in exploration and help understand environmental challenges and also accept manuscripts of an environmental nature which may contribute to the resolution of exploration problems.*

- Question 6 (i) *Are you in favor of closer scientific and technical relationships with scientists in related fields?*  
 (ii) *Should we court the petroleum industry more strongly?*

The Committee members' response to part (i) of this question is unanimous:

*The Association should establish closer communication with specialists in related fields. Joint meetings, collaborative projects, special volumes, review volumes, productive integration and the creation of communication networks are all recommended with a variety of disciplines including hydrology, geomorphology, plant physiology, geophysics, economic geology, pedology/soil science, analytical chemistry and petroleum geochemistry.*

There are cautionary comments. While allowing for this kind of activity, a few express concern about potential loss of objective. There is a danger, as we have seen with other prominent publications that many of us consult regularly, for themes of interest to "wander" too far from the society's prime purpose or the needs of the society's membership. ***In broadening scientific and technical relationships with other disciplines, it is essential that the AEG vigorously cultivate these advances to improve directly and indirectly the understanding of the geochemical environment of mineral deposits allowing, encouraging and fostering the development of improved methodology for application, interpretation, discovery, exploitation and reclamation.***

The Association, particularly through the efforts of the JGE editorial board have made several overtures to petroleum geochemists to contribute to the Journal and participate in other AEG activity. These overtures have not been wholly successful. The work of petroleum geochemists has uncovered considerable data pertinent to process and dispersion in geochemistry relevant to metals, other elements and hydrocarbons. As a result, a few Committee members consider communication with petroleum geochemists to be important.

### Question 7. Other matters?

The Committee addressed several, additional, general questions relating to geochemical methods and applications and future directions of the Association. Responses are covered in previous discussion and recommendations.

**J. Alan Coope**  
 Committee Chairman  
 Newmont Mining  
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## LETTERS

### To AEG members:

For almost two years I have sat on a committee titled "Committee for the Professional Registration of Geoscientists in Ontario" which is working with the Association of Professional Engineers of Ontario to effect registration of geoscientists.

Ontario has certainly not led the way in professional registration. As many of you may already know, Alberta, the Northwest

Territories, Newfoundland and most recently British Columbia have effected legislation which requires geologists to be registered with a provincial professional body to conduct business. At a recent meeting, the representative from Newfoundland submitted the following statement "We are taking the position that registration is mandatory, although operationally we have not started to conduct 'witch hunts', at least not until the grandfather period is over."

Saskatchewan hopes to have legislation in place by 1992 and the Ontario Committee is probably looking at 1993. The real concern is that the revised Engineering Profession Acts will be comparable and thus facilitate interprovincial reciprocity not to mention international recognition.

The working definition of professional geoscience that has been accepted by our committee is:

Practise of professional geoscience means reporting, advising, processing, evaluating, interpreting, surveying, sampling or examining related to any activity that:

- is directed towards the discovery or development of oil, natural gas, coal, metallic or non-metallic minerals, precious stones, other natural resources or water or the investigation of surface or subsurface geological conditions including identification of geological hazards, and
- is directed toward the protection, enhancement and management of the natural environment, and
- requires the professional application of the principles of geology, geophysics, geochemistry and environmental geoscience.

I have been asked to submit to the committee a definition of a geochemist primarily to justify to the Engineering Association the inclusion of geochemists as professionals. I would appreciate the input of any members who may have worked on such a definition in other contexts.

As the review process continues, I expect that issues concerning university curricula will arise and I hope to have some input to ensure that geologists who wish to take chemistry or environmental science courses can be encouraged to do so without jeopardizing their membership in a professional organization.

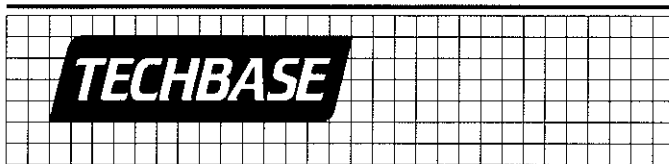
**Lynda Bloom**  
 Manager - Exploration  
 Citadel Gold Mines Inc  
 150 Signet Dr.  
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 Canada

### Dear Editor:

Most of us knew the late Dr. Hubert Lakin of the USGS who made and distributed six geochemical samples for round-robin testing, initiating with his effort a self-testing program for mineral laboratories. Unfortunately, most participants in this program determined total element content by any method they pleased to apply, whereas partial dissolution techniques were ignored. As a result, the rock standards arsenal was increased by 6 new members, and the original idea for geochemistry was lost. In "Technical Notes" (EXPLORE Number 70, January 1991, page 1), an excellent article expressing the needs of quality control in analytical geochemistry, by R.W. Leinz of the USGS, summarizes principles and tools employed in certification programs. I agree that such a program is badly needed for geochemistry, but there are application problems.

*Existing conditions:* Few commercial laboratories, have or employ personnel experienced in geochemistry. A quality improvement program in geochemistry as suggested by Mr. Leinz, could be a major undertaking. We have to bear in mind, that government or university laboratories have the time and resources to investigate, develop, innovate, optimize and correct procedures. Discounting a few commercial laboratories which make good profits, most need to survive on sales, pay leases and debts, and return dividends to the investors. As a result, commercial laboratories rarely investigate or develop methods. At the most, a chemist with a shortcut attitude may

*Continued on Page 10*



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## Letters

Continued from Page 8

change or introduce a few analytical operations without checking to see if the modifications have altered the original method. In all probability, the modification is not equivalent to the original version. It is here where quality assurance is mandatory.

With the complexities that exist in geochemistry, commercial laboratories cannot be held liable if they err in applying proper methods for matrices which are not obvious to them. Therefore, it is an obligation of the explorationist to suggest or require specific methods for particular series of samples. Hence, the laboratories need a compendium of geochemical analytical methods as a guide for outlining a quality assurance document.

**Certification:** As an initial step in certification, the AEG could discuss and propose quality assurance guidelines adaptable to geochemical testing. A good certification program could then be established by checking laboratories for their capabilities, organization, application of quality assurance documentation and by having labs pass tests in the analysis of proficiency evaluation samples. For discovering poor performers, plain metallic solution mixtures have proven sufficient. Sophisticated proficiency testing with rock samples could be reserved for specialized testing after a compendium of methods is made available by the AEG.

We have to remember that most laboratories are tired of analyzing proficiency evaluation or round-robin samples. This is because many laboratories subscribe to redundant certification programs, such as those from the various federal programs, various states, and some private certification organizations. It would be possible to compare our requirements with other programs. In principle, requirements established for hazardous materials testing laboratories are adaptable to geochemical testing. The AEG could require proof

of actual certification in that area of testing. With this precedent and additional compliance with a few remaining requirements of the AEG, including some tests of unknown rock samples, a laboratory could enter into the category of geochemical testing laboratory (e.g. "certified by the AEG").

**Geochemical methods:** For satisfying the special requirements of our profession, the AEG could standardize sampling and sample preparation methods for various types of matrices. This is the most critical element necessary for quality assurance. In addition, appropriate instruments for the expected range of concentration could be recommended.

Necessary committee efforts to reach a fruitful stage in the establishment of preparative and analytical methods may involve two to ten meetings and about the same number of mail inquiries and phone calls for each method.

Steps to follow for setting up standardization committees would be: 1) secure travel funds, 2) nominate a leading committee composed of a chairman, an editor and the chairmen of subcommittees, and 3) nominate a panel of experts in each area of expertise. Subcommittee chairmen and panel experts would be assigned to represent a professional society or agency (e.g. AEG, USGS, ACS, ASTM, GS, GSC, laboratory representatives, etc.).

The leading committee would agree on the goals and the subcommittees carry out the work. The pace of the work could be set at different speeds, depending on the aspirations of the leading committee, of the expected completeness and of the available resources. After finishing each work assignment, methods would be approved by the leading committee for publication in a specialized journal or returned for review. A compendium of approved methods would be published at a later date.

Maybe now is the time we could come together and fix this problem.

**Evaldo L. Kothny**  
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## NEWS OF MEMBERS

**Dr. Jane Plant** has been appointed to the post of Assistant Director, Minerals and Geochemical Survey Division at the British Geological Survey, Nottingham, England. Effective immediately.

**Dr. Stan Hoffman**, Business Manager of the Association of Exploration Geochemists, has relocated his office. Effective immediately, the new address is 1531 West Pender Street, Vancouver, BC, V6G 2T1, Canada. The telephone and fax numbers remain unchanged.

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## TECHNICAL NOTES

### Hanby Colorimetric Test

#### Introduction

Several of us recall, and some of us still use, the various cold extractable field tests developed by Professor Harold Bloom. The "Bloom Tests" use chelating agents that when bound to certain metals form colored complexes. Remember the pink-purple to blue colors you would get using diphenylthiocarbazone (you know, DITHIZONE) when the soils, sediments, or water you were testing had ppm levels of Cu, Zn and Pb. Thanks to Professor Bloom, there was a sensitive, inexpensive, on-site test that moderately trained geologists and geochemists could use to help them find ore.

It is amusing and curious how history repeats itself. Now, environmental geochemists are scrambling for sensitive, inexpensive, on-site tests they can use to determine the extent of contamination. John Hanby has just that. In application, his test is very similar to the Bloom Test, but the Hanby test identifies soils, sediments, and water contaminated by various aromatic compounds. It is based on a Friedel-Crafts aromatic alkylation which produces colored products proportional to the concentration of the reactants.

The colors depend on the aromatic composition. If 5 to 10 ppm benzene is present, the reaction will produce a rich yellow color. Toluene produces orange. The colors also depend on the concentration:

- Benzene: yellow (1 ppm) to orange (10 ppm);
- Toluene, ethylbenzene and xylenes: orange-yellow (1 ppm) to burnt orange (10 ppm);
- Gasoline: beige (5 ppm) to rust, red-brown (20 ppm);
- Diesel: beige (5 ppm) to green (20 ppm);
- PCBs: light pink (0.05 ppm) to coral (0.2 ppm); and
- Naphthalene: light violet (0.2 ppm) to violet (2 ppm).

#### Methodology

Somewhat unlike the Bloom Tests, the Hanby test requires more and larger glassware. It would also be handy to have a table for the setup. To perform the test, a 500 ml water sample is taken in a separatory funnel, and 5 ml of a proprietary alkyl halide reagent is added. The sample is agitated vigorously for two minutes during which time organics are extracted into the reagent phase. (DOES THIS SOUND FAMILIAR !!) The sample then sits for 5 minutes until the reagent phase has settled to the bottom. Then the reagent phase is drained into a test tube containing a catalyst (Lewis base) and the reaction between the aromatics and the alkyl halide immediately proceeds. Vigorous shaking during the reaction (2 minutes) ensures even dispersal of the catalyst and uniform color of the products. A color chart created from known concentrations of the contaminant is used for comparison. Since the contaminant could be a complex mixture of various aromatics, knowledge about the composition of the contaminant is desirable. The colors must be read quickly because of the photochemical degradation of the products in sunlight.

There are two ways to test soils. The easiest is direct extraction, which is more effective for older gasoline, diesel and other fuel oil contamination where the components are fairly insoluble. The more time consuming method is washing; this method is more effective for fresh gasoline.

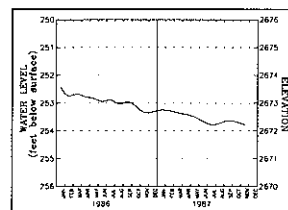
The direct extraction method uses 5 g of soil and 10 ml of extraction reagent. The mixture is agitated vigorously for 5 minutes to effectively disaggregate the soil and extract the aromatic compounds. The reagent is then transferred to a test tube and mixed with the catalyst.

The washing method requires 100 g of soil in a 500 ml mixture of flocculent salt and distilled water. The soil floc is shaken for 15-20 minutes and then transferred to a 1 liter Imhoff cone. Clarification takes about 30 minutes. The wash water is then tested like the water test described above.

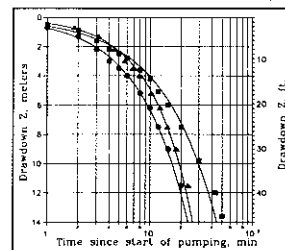
All of these tests are based on a 4.2 ml aliquot of the extraction phase. Since partitioning of the phase is somewhat variable, the volume of the extraction phase prior to the alkylation reaction must be measured. Failure to calibrate to the 4.2 ml standard may result in overstating the concentration by as much as 16 percent. Tests comparing Hanby's test to other methods (purge and trap GC, and UV/VIS spectrophotometric reflectance) show colorimetry variation ( $\pm 20\%$ ) is mostly due to the amount of catalyst.

One charming attribute of the test is that it can be performed backwards: that is, alkyl halides like trichloroethylene, freon, chloroform, methyl chloroform, chloropropane and others can be tested using an aromatic extractant. It yields the same color results, but tends to have a number of negative interferences that limit its applicability.

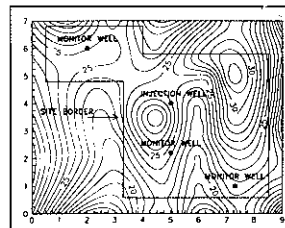
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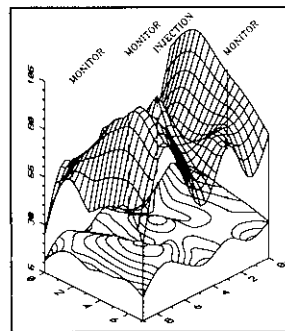
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Continued on Page 12

## Technical Notes

Continued from page 11

### Case History

The Hanby test was used to monitor river water that had been contaminated by the collapse of an oil tank near Pittsburgh, PA on January 2, 1988. Approximately one million gallons of oil spilled into the Monongahela River, a tributary of the Ohio River. Part of the remedial investigation involved a run up the Ohio River from Wheeling to identify the front of the spill. However, the first sample at Wheeling showed the front had already passed. Further testing upstream showed the Hanby test tracked well with on-site readings from a fluorometer provided by the EPA (Table 1).

The Hanby test has been used on most of the more recent major oil spills. In addition to the Ashland Chemical Company tank collapse (above), it was used for the Galveston Bay spill near San Leon, Texas (July, 1990) where it revealed concentrations of dissolved oil 10 to 20 times the toxic level for fish even in waters that looked relatively pristine. The Hanby test was also used at the Exxon Valdez spill in Alaska's Prince William Sound where it helped monitor the impact on nearby fish hatcheries.

### Conclusion

The Bloom Test solves a number of problems facing exploration geochemists including cost, sensitivity, and a need for immediate information. These same needs now face those operating in environmental science. The cost of one Hanby test is about \$27 compared to \$175 from a off-site laboratory. The test's sensitivity is highly suitable for confirming contamination, quantifying the contamination level, determining the limits for soil excavation and measuring the progress of groundwater remediation. It is moderately suitable for tracing the source of contamination and determining the

placement of monitor wells. It may even find its way into exploration for oil deposits.

The Hanby test has become a recognized method by the EPA and is reported by the Agency's Office of Underground Storage Tanks in **Field Measurements: Dependable Data When You Need It** (June, 1990). It describes Hanby's test and several other alternatives to fixed-facility laboratories, including interviews with users of the various techniques discussed.

Materials for this report were provided by John Hanby, Hanby Analytical Laboratories, Inc., 4400 South Wayside, Suite 107, Houston, Texas 77087, USA.

TABLE 1

### DIESEL FUEL IN OHIO RIVER WATER January 7, 1988

OHIO RIVER MILE POINT	FLUOROMETER READING	HANBY TEST (PPM)
89.0	4	0.10
85.5	8	0.15
85.5	9	0.15
85.5	6	0.20
85.0	8	0.20
85.0	11	0.20
84.5	6	0.20
84.5	10-15	0.50
84.5	10	0.20
82.0	20	1.00
81.0	25	1.00
80.0	30	1.50
79.0	33	2.50
77.0	57	10.00
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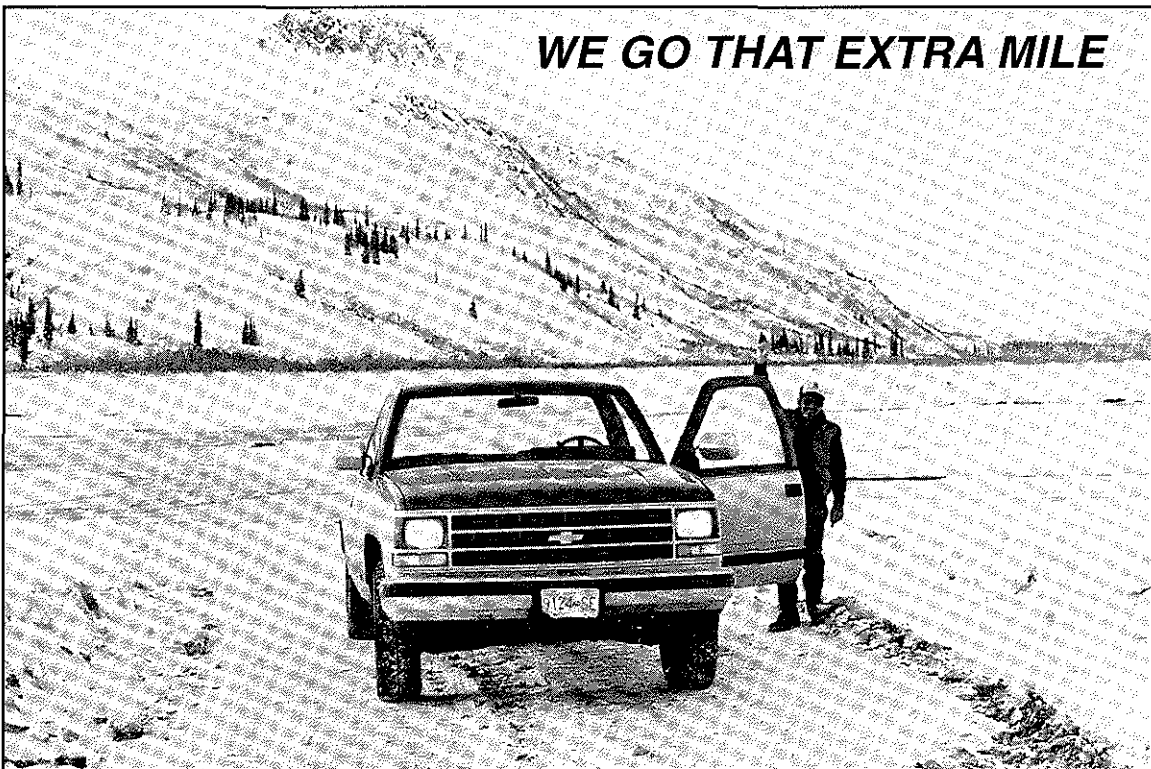
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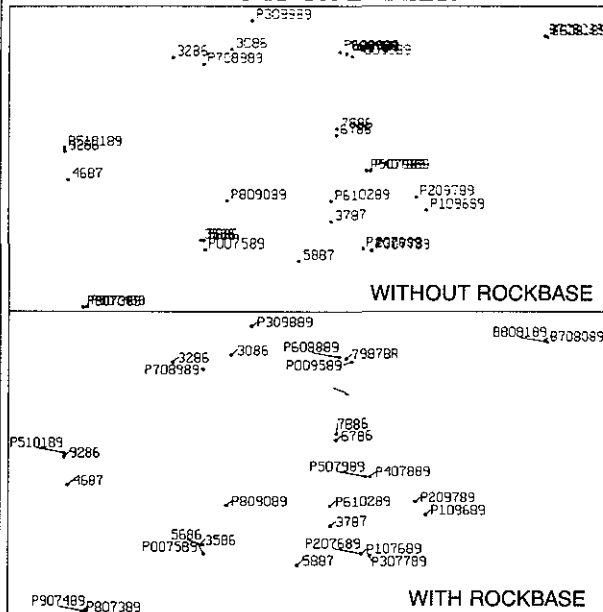
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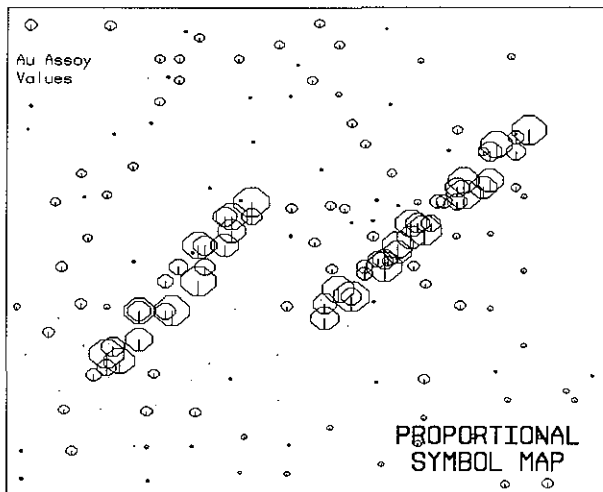
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The North Pacific section of the Society for Mining, Metallurgy and Exploration, Inc. (SME) is sponsoring a three day regional symposium April 8 - 10, 1992 in Bellevue, Washington, assisted by the Association of Exploration Geochemists (AEG). The symposium will include open sessions for presentation of papers of topical exploration interest in geology, geochemistry, and geophysics. The AEG will participate in three half day sessions, focusing on the practicality of modern methods of multielement analysis, recent developments in drainage geochemistry, and the relationship between exploration and environmental geochemistry. The economic geology sessions will emphasize recent exploration case histories.

A general call for papers is issued, with abstracts of up to 500 words to be submitted to each program chairman. For more information authors should contact the appropriate chairman.

**Session:** Modern methods of multielement analysis

Dr. Gwendy E.M. Hall  
Head, Analytical Methods Development  
Geological Survey of Canada  
Room 702, 601 Booth Street  
Ottawa, ON, K1A 0E8  
Canada  
TEL: (613) 995-4521  
FAX: (613) 996-9990

**Session:** Recent developments in drainage geochemistry

Dr. W.K. Fletcher  
Department of Geological Sciences  
University of British Columbia  
Vancouver, BC, V6T 2B4  
Canada  
TEL: (604) 228-2392  
FAX: (604) 228-6088

**Session:** The relationship between exploration and the environment

Dr. Donald D. Runnells  
Department of Geological Sciences  
University of Colorado  
Boulder, CO 80309-0250  
USA  
TEL: (303) 492-8141  
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The symposium will be accompanied by short courses prior to the convention and field trips after the convention. For more information on the many more sessions to be held at this symposium, please contact:

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*Continued on Page 15*

## Call For Papers

*Continued from Page 14*

words on any aspect of mineral exploration and/or development should be submitted for consideration by November 1, 1991.

Authors whose abstracts are accepted by the committee will be required to submit an extended six-page abstract for publication by January 17, 1992. The authors will also be asked to make a 20 minute presentation at a session to be held on Tuesday, March 31, 1992. This session is designed to provide an opportunity for individuals in the mineral industry to report on technical matters and will run parallel to the main convention technical session. Papers should be submitted in triplicate to:

Dr. W.E. Urquhart  
Chairman, Convention 92 Technical Program  
Prospectors and Developers Association of Canada  
74 Victoria Street  
Suite 1002  
Toronto, ON, M5C 2A5  
Canada

## Symposium on International Geochemical Mapping and Integrated Methods in Exploration & Discovery

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### Journal of Geochemical Exploration Special Offer

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10	1-3	1978		
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12	1-3	1980	Nos.2 & 3 Conceptual Models in Exploration Geochemistry - Australia	
13	1-3	1980	Nos.2 & 3 Geochemical Exploration for Uranium	
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15	1-3	1981	Out of Print	
16	1-3	1982		
17	1-3	1982		
18	1-3	1983		
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21	1-3	1984	Nos.1-3 Geochemical Exploration 1983, 10th IGES, Espoo, Finland	
22	1-3	1984	Nos.1-3 Geochemical Exploration in Arid and Deeply Weathered Terrains	
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28	1-3	1987	Nos.1-3 Geochemical Exploration 1985 (part 1) 11th IGES, Toronto, Canada	
29	1-3	1987	Nos.1-3 Geochemical Exploration 1985 (part 2) 11th IGES, Toronto, Canada	
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31	1-3	1989		
32	1-3	1989	Nos.1-3 Geochemical Exploration 1987, 12th IGES, Orleans, France	
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## Special Notes

Continued from page 15

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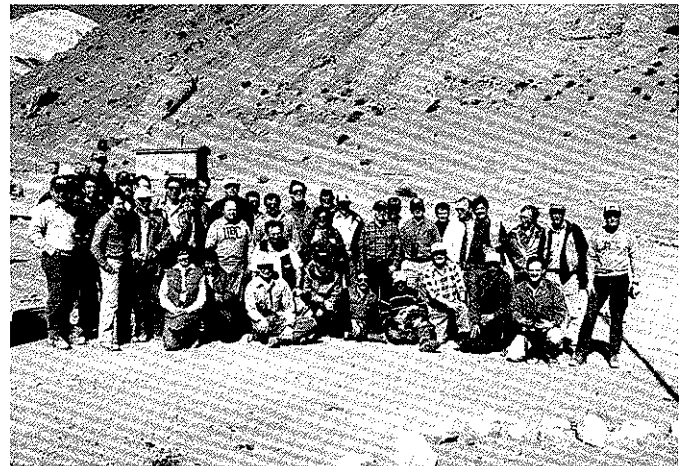
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## FIELD TRIP REPORT

### Gold/Silver Deposits of Chile - An AEG/SEG Field Conference

The Association of Exploration Geochemists and the Society of Economic Geologists jointly sponsored a field conference on the gold/silver deposits of Chile from April 13-24, 1991. The field trip was led by Richard Sillitoe, consultant, London, England and Francisco Camus, exploration manager for CODELCO, Santiago, Chile assisted by Nicolas Saric, exploration manager, Society Minera Pudahel Ltda., Toms Vila, exploration manager, Minera Anglo American Chile Ltda., Harold F. Bonham Jr. Nevada Bureau of Mines and Geology, and Larry J. Garside, Nevada Bureau of Mines and Geology. The trip commenced on the evening of April 12 at the Miami International Airport for an overnight flight to Santiago, Chile. The field conference was fully subscribed at 35 participants and 5 trip leaders. The participants were truly an international group with representation from Australia, Canada, France,



AEG/SEG Chile Field Trip participants at Santa Cecilia field camp of Minera Anglo American Chile.

Ireland, South Africa, Italy, Great Britain, and the United States. The group assembled on Sunday evening at the offices of the Chilean Geological Survey for a talk on the Geological Evolution of Chile by Dr. Constantino Mpodozis, chief regional geologist.

On Monday, April 15 the group visited the El Bronce mine of Compania Minera El Bronce, a major producer of gold and silver, in the foothills of the Andes north of Santiago. El Bronce is a low-sulfidation, epithermal vein system of Cretaceous age, related to a deeply eroded ash-flow tuff caldera. After an underground tour of the main veins, the group proceeded to La Serena.

On Tuesday, April 16, a visit was made to the Andacollo district, where gold-bearing mantos in Cretaceous volcanic rocks occur marginal to, and genetically related to, a porphyry Cu-Mo-Au stock. The gold deposits are currently being developed by Dayton Developments Corp. In the evening, a talk on the El Indio gold deposit was given by Raymond Jannas, chief of exploration at El Indio. April 17 was devoted to travelling from La Serena to El Salvador. April 18 was devoted to an examination of the El Hueso gold mine operated by Homestake. El Hueso is a high-sulfidation gold deposit which is located marginal to the Potrerillos porphyry copper deposit at elevations above 4,000 meters. A brief visit to the old glory hole of the Potrerillos porphyry copper deposit was made in the late afternoon. The participants were impressed with the spatial and probable genetic links between the porphyry and the El Hueso deposit.

On April 19 the field party departed El Salvador en route to the La Coipa silver-gold mine. La Coipa is a high-sulfidation silver-gold deposit hosted by Triassic sedimentary rocks and Miocene dacitic volcanic rocks. It occurs in an extensive belt of argillic and advanced argillic alteration. The mine is operated by Minera Mantos de Oro. The ore bodies occur at elevations ranging from 3800 to 4000 meters.

On April 20 the group departed for visits to the Marte and Lobo porphyry gold deposits in the Maricunga belt. The Marte deposit is late Miocene in age and occurs in the core of a dissected stratovolcano. The mine is operated by Minera Tres Cruces, a consortium representing Anglo-American, Cominco Resources and Chemical Bank. The Marte open pit is located at 4100 to 4200 meters above sea level. The composite diorite porphyry stock, exposed in the open pit, is cut by a multidirectional quartz stockwork which contains the bulk of the gold mineralization. Alteration presently exposed in the pit is intermediate argillic in character and is immediately overlain by a zone of advanced argillic alteration developed in the andesite wall rocks of the deposit. In the late afternoon the group proceeded to the Lobo porphyry gold property, where they examined representative diamond drill core from the

Continued on Page 17

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## Field Trip Report

Continued from Page 16

deposit. Alteration and mineralization at Lobo are similar to Marte, but Lobo is somewhat more deeply eroded than Marte. The field group then proceeded to Anglo American's field camp at Santa Cecilia.

On April 21 the group departed for the Alderbaran prospect. The final climb up exploration roads to an elevation of 5000 meters above sea level proved to be too much for one of the vans so it was necessary to ferry part of the group to the ridge crest. From there, most of the group enjoyed a bracing hike in a stiff breeze to the top of the Aldebaran system, at an elevation of 5100 meters. Aldebaran provides an excellent opportunity for an overview of a nearly intact system, from near the original paleosurface of the stratovolcano, with sulfur and mercury mineralization associated with acid leaching, downward through an epithermal high-sulfidation vein system into a copper-gold porphyry deposit, all in a vertical distance of 1000 meters.

It is certain that our Chilean hosts, in particular Francisco Camus, Nicolas Saric, and Toms Vila made our field trip a most enjoyable and rewarding experience through their long hours of hard work in preparation for the trip and in the superb hospitality afforded the participants all along the way. A special vote of thanks is also owed to Dick Sillitoe, who was the initial catalyst for the idea of a Chilean field conference and who spent much time and effort working with his Chilean colleagues in planning the trip and making it a reality. Thanks are also owed to all of the Chilean mine geologists, too numerous to mention here, who gave of their time and imparted their knowledge of the deposits to us at the various properties.

**Harold E. Bonham Jr.**  
Research Geologist  
Nevada Bureau of Mines and Geology  
University of Nevada, Reno  
Reno, NV 89557-0088  
USA

## PEARL HARBOR FILE

In EXPLORE Number 72, a portion of a soil survey for Zn was presented, along with the location of the massive sulphide lens discovered as a consequence of followup. How was or could the bedrock source(s) of mineralization be predicted without additional sampling?

Firstly, reference could be made to field notes collected at time of sampling which would have indicated overburden genesis to be alluvium beside a creek channelway. Note the creek valley is not substantial and the government 1:50,000 scale topographic map does not show the creek or the valley. You had to be in the field to recognize drainage conditions. No field notes? Historical drilling/trenching describes what happens in the absence of field notes!

A second approach (not tried here) should prove successful; that of employing a terrain analysis (EXPLORE Number 65, pp. 14-16). A terrain analysis could be conducted using air photographs, which would allow recognition of drainage features and alluvial deposits not apparent on government 1:50,000 scale maps. Creeks, bogs, alluvium, and other overburden types would be immediately apparent and could be factored into the geochemical interpretation. With this information at hand, geochemical interpretation would point to a bedrock metal source near the western end of the anomaly.

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## JOURNAL OF GEOCHEMICAL EXPLORATION

During the past year there have been discussions about broadening the scope of both the AEG (see report this issue of the Ad Hoc Committee) and the *Journal of Geochemical Exploration*. In the case of the latter, this has involved the AEG Council, the Editorial Board, and Elsevier. The results of these deliberations are summarized in an editorial for an upcoming issue of the JGE and which is reproduced below.

### (JGE) Editorial

This issue marks a change in the Scope of the *Journal of Geochemical Exploration*, which is carried on the back cover of each issue. This has been revised as follows:

*The Journal of Geochemical Exploration covers all aspects of the application of geochemistry to the exploration and study of mineral resources, and related fields, including the geochemistry of the environment. Topics include: the description and evaluation of new or improved methods of geochemical exploration; sampling and analytical techniques and methods of interpretation; geochemical distributions in and around mineralized environments; and processes of geochemical dispersion in rocks, soils, vegetation, water and the atmosphere. Papers that seek to integrate geochemical, geological, and geophysical methods of exploration are particularly welcome. Given the many links between exploration and environmental geochemistry, the journal encourages the exchange of concepts and data; in particular, to develop mineral resources while protecting the environment.*

There are two important changes. The first is the inclusion of environmental geochemistry as a major topic. Environmental geochemistry is in rapid growth, in response to public demand for the protection of the Earth. For many environmental studies, methods of sampling, analysis and interpretation are essentially similar to that used by exploration geochemists. Investigations of nuclear waste disposal are a variation on the broad geochemical problem of the dispersion of elements out from a point source. An increasing proportion of exploration geochemists are now working wholly or in part on environmental problems. One of the most obvious links between environmental and exploration geochemistry is that they share the same methods of analysis. More attention will be given to geochemical analysis within our pages, starting with a special issue planned for 1992.

The second change is that the journal will be giving greater emphasis to the integration of geochemical, geological and geophysical

Continued on Page 18



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## Journal of Geochemical Exploration

Continued from page 17

methods in the search for minerals. As exploration becomes more demanding, the need for a holistic approach becomes more necessary, as does the exchange of ideas between the different specialists. In part, this change reflects the very favorable reception of readers to a past special issue which compared the geological, geochemical and geophysical characteristics of gold deposits around the Pacific.

This broadening in scope of the journal will require the strengthening of the editorial board to include expertise in these new areas. A technical change is that we are now requesting authors to provide the final copy of their manuscript on floppy disc. This will, hopefully, speed publication of papers, and reduce the errors that inevitably occur during typesetting.

### Eion Cameron

Editor-in-Chief, JGE  
Geological Survey of Canada  
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Following is the list of titles contained in the next two issues of the *Journal of Geochemical Exploration* to be published.

### Volume 41, No. 3

Transport of magnetite and gold in Harris Creek, British Columbia, and implications for exploration. *W.K. Fletcher and J. Wolcott*  
Biogeochemical prospecting for gold-bearing quartz veins of the Piedmont, Great Falls, Maryland. *F.R. Siegel, J.A.N. Barrows, and E.M. Barrows*

Comparison of analytical results for gold in vegetation with and without high-temperature ashing. *G.E.M. Hall, A.M. Rencz and A.I. MacLaurin*

Gold-bearing iron duricrust in Central Brazil. *S.M.B. de Oliveira and E.G. Campos*

An assessment of least median of squares regression in exploration geochemistry. *C.Y. Chork*

The analysis of termite hills to locate uranium mineralization in the Karoo Basin of South Africa. *J.P. Le Roux and B.B. Hambleton-Jones*

An analytical method for hydrogeochemical surveys: inductively coupled plasma-atomic emission spectrometry after using enrichment coprecipitation with cobalt and ammonium pyrrolidine dithiocarbamate. *D.M. Hopkins*

Geochemistry and exploration criteria for epithermal cinnabar and stibnite vein deposits in the Kuskokwim River region, southwestern Alaska. *J.E. Gray, R.J. Goldfarb, D.E. Detra, and K.E. Slaughter*

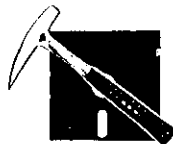
### Book reviews

Geochemical Methods of Prospecting for Non-Metallic Minerals, by *I.L. Komov, A.M. Lukashov, and A.V. Koplus* - *A.W. Rose*

Exploration Geochemical Data Analysis with the IBM PC, by *G.S. Koch Jr.* - *J.A. Sturdevant*

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### Special Issue on Fluid Inclusion Gas Analyses in Mineral Exploration

Introduction *Stephen E. Kesler*

Fluid Inclusion Volatiles as an Exploration Guide to Black Shale Hosted Gold Deposits, Dolgellau Gold Belt, North Wales, U.K. *T.J. Shepherd, S.H. Bottrell and M.F. Miller*

Fluid Inclusion Gas Geochemistry as a Potential Minerals Exploration Tool: Case Studies from Creede, CO, Jerritt Canyon, NV, Coeur d'Alene district, ID and MT, Alaska Juneau Gold Belt, AK and mid-continent MVT's. *G.P. Landis and A.H. Hofstra*

Geology and Geochemical Analysis of Mineralizing Fluids at the St. Cloud and U.S. Treasury Mines, Chloride Mining District, New Mexico. *D.I. Norman, R.W. Harrison, and C. Behr Andres*

Application of Gas Analysis of Jasperoid Inclusion Fluids to Exploration for Micron Gold Deposits. *J.R. Graney, S.E. Kesler, and H.D. Jones*

Fluid Inclusion Gas Composition of Some Mineral Deposits and a Geothermal Area. *Sukune Takenouchi*

Use of Fluid Inclusion Gas Surveys for the Assessment of Lode Deposits (With Reference to Gold and Tungsten Deposits). *F.A. Letnikov and A.V. Narseev*

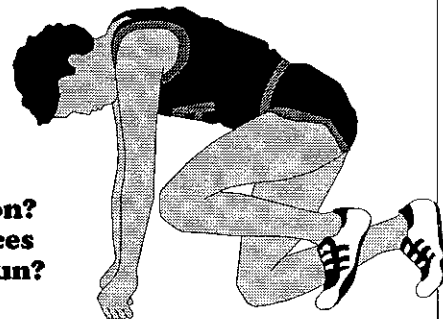
Decrepitation in Gold Exploration. A Case History from the Cotan Prospect, N.T., Australia. *K. Burlinson*

Multichannel Micro-raman Spectroscopy of Fluid Inclusion Gases in Mineral Exploration. *R.W.T. Wilkins*

Fluid Inclusion Volatile Analysis by Heated Crushing, On-line Gas Chromatography: Applications to Archean Fluids. *C.J. Bray, E.T.C. Spooner, and A.V. Thomas*

Fluid Inclusion Gas Analysis of Hydrothermal Vein Molybdenum Deposits Associated with the Drammen Granite in the Permian Oslo Rift, Norway. *I.F. Walder, D.I. Norman and T.V. Segalstad*  
Application of fluid inclusions in Mineral exploration. *Kun Jo Moon*

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## RECENT PAPERS

This list comprises titles that have appeared in major publications since the compilation in **EXPLORE** Number 72. 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 (GCS Paper) and Open File Report (GCS 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, Colorado 80401, Chairman AEG Bibliography Committee. Please send new references to Dr. Closs, not to **EXPLORE**.

Anderson, G.M. 1991. Organic Maturation and ore precipitation in southeast Missouri. *EG 86* (5): 909-926.

Anon. 1991. Nuclear Techniques in the Exploration and Exploitation of Energy and Mineral Resources. IAEA. Proc. V. UNIPUB. 627 p.

Anon. 1991. A guide for reporting exploration information, resources and reserves. *Min. Eng.* 43(4): 379-384.

Ansdell, K.M. and Kyser, T.K. 1991. The geochemistry and fluid history of the Proterozoic Laurel Lake Au-Ag deposit, Flin Flon greenstone belt. *Can. J. Earth Sci.* 28 (2): 155-171.

Barsukov, V.L., Baranov, E.N., Volosov, A.G. and Grinenko, V.A. 1991. Means of developing and improving the principles of the geochemical methods of predicting concealed mineralization. *Geochem. Intern.* 28(5): 1-10.

Bird, D.K., Brooks, C.K., Gannicott, R.A. and Turner, P.A. 1991. A gold-bearing horizon in the Skaergaard Intrusion, East Greenland. *EG 86*(5): 1083-1092.

Boyle, R.W. et al. (Eds.) 1990. Sediment-Hosted Stratiformed Copper Deposits. *Geol. Assoc. Can. Spec. V.* 36. 710 p.

Bushnell, S.E. 1991. Polymetallic epithermal fissure vein mineralization, Topia, Durango, Mexico: Part II. Silver mineral chemistry and high-resolution patterns of chemical zoning in veins - A discussion. *EG 86*(4): 900-902.

Campbell, J.D. 1990. Hidden Gold: The Central Norseman Story: An Account of Structural Geology Studies and Ore-Search at Norsemen, Western Australia. Australasian IMM Monograph series, No. 16, Proc. 16. 2 V. 67 p.

Chyi, L.L. and Chous, C.L. 1990. Recent Advances in Coal Geochemistry. *Geol. Soc. Am. Sp. Paper* 248. 99 p.

Closs, L.G. 1991. Geochemistry - 1990 Annual Review, *Min. Eng.* 43(5): 492-493.

Commeau, J. and Valentine, P.C. 1991. A method for the concentration of fine-grained rutile (TiO<sub>2</sub>) from sediment and sedimentary rock by chemical leaching. *EG 86*(4): 878-882.

*Continued on Page 20*

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## Environmental Geochemistry in Northern Europe

**Environmental Geochemistry in Northern Europe, Rovaniemi, Finland, October 17 - 19, 1989**

Proceedings of the First Symposium on Environmental Geochemistry in Northern Europe have been published as Geological Survey of Finland, Special Paper 9, ed. by Eelis Pulkkinen, 321 pages, 269 figures and 48 tables, 1991.

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## Recent Papers

*Continued from Page 19*

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*Continued on Page 21*

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## Recent Papers

*Continued from Page 20*

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## DENVER AREA GEOCHEMICAL EXPLORATION DISCUSSION GROUP

### Denver Area Geochemical Exploration Discussion Group

The 1991-92 program for the Denver area geochemical discussion group has been established and is provided below. All interested parties are encouraged to attend.

**October 15, 1991**

**AL HOFSTRA**, U.S. Geological Survey

Genetic Models for the Sediment-Hosted Gold Deposits in the Jerritt Canyon District

**November 19, 1991**

**WILLIS ALDERMAN**, A.P.G.E.

Stress Sage Anomaly over the Patrick Draw Field — Is it there?

**December 17, 1991**

**JEFF JAACKS**, Westmont Gold Inc.

Using Pyrolysis Mass Spectrometry for Mineral Exploration

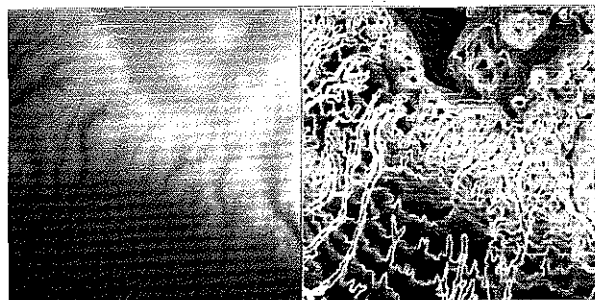
**January 21, 1992**

**STEVE SMITH AND DAVE DETRA**, U.S. Geological Survey

Update on Element Dispersion in Alluvium Covering Gold Deposits on the Getchell Trend

*Continued on Page 28*

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## NEW MEMBERS

### To All Voting Members:

Pursuant to Article Two of the Association's By-Law No.1, 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 Sherman P. Marsh, Secretary AEG, U.S. Geological Survey, Mail Stop 973, Box 25046, Federal Center, Denver, CO 80225, USA.

**Editors note:** Council has decided that all new applicants will receive the journal and newsletter upon application for membership. The process of application to either the Toronto office or Vancouver office, recommendation by the Admissions Committee, review by the council, and publication of applicant's names in the newsletter remains unchanged.

### AFFILIATE MEMBERS

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Belgian Geological Survey  
Brussels, Belgium

**Elliot, John D.**  
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**Gardiner, Christopher**  
*Contract Geologist*  
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**Harper, Glen H.**  
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**Stadler, Carl**  
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Sacramento, CA, USA

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Barringer Laboratories  
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Hobart, Tasmania, Australia

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New Mexico Tech.  
Socorro, NM, USA

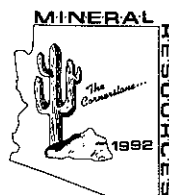
**Abdi, M. Said**  
Technical University  
Berlin, Germany

## SME SHORT COURSE

### Biogeochemical Exploration - Simplified February 22-23, 1992 Sheraton Hotel Phoenix, Arizona, USA

This course is designed for explorationists as an introduction to the concepts of biogeochemical methods applied to exploration programs for minerals and precious metals. Emphasis is placed on practical application of techniques. Course content includes: element requirements and tolerances of common plants; environmental controls on metal uptake; sampling methods, sample preparation, analytical methods, analytical controls, and data evaluation. Case histories from: arid, temperate, and boreal environments are presented, and a half day field trip is taken to demonstrate methods.

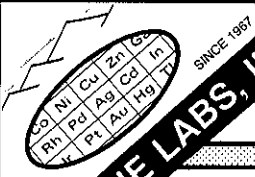
**INSTRUCTORS:** *Colin E. Dunn*, Biogeochemist, Geological Survey of Canada; *Gwendy E.M. Hall*, Analytical chemist, Geological Survey of Canada; *James A. Erdman*, Botanist, US Geological Survey; and *S. Clark Smith*, Geochemist, Minerals Exploration and Environmental Geochemistry.



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**CONTACT:** SME, Meetings Dept., PO Box 625002, Littleton, CO 80162 USA, TEL:(303)973-9550 FAX:(303)979-3461.

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## CALENDAR OF EVENTS

### *International, National and Regional Meetings of Interest to Colleagues Working in Exploration and Other Areas of Applied Geochemistry*

■ Oct. 15-17, '91 Industrial minerals in the European market, mtg., Hannover, Germany (A. Muller, Bundesanstalt fur Geowissenschaft und Rohstoffe, Postfach 51 01 53, D-3000 Hannover 51, Germany; TEL: 05 11 6 43-22 98/ 22 99; FAX: 643 23 04)

■ Oct. 21-24, '91 Geological Society of America, ann. mtg., San Diego, CA (Vanessa George, GSA, Box 9140, Boulder, CO 80301, USA; TEL: (303) 447-2020)

■ Nov. 4-8, '91 Alaska Miners Association, ann. mtg., Anchorage, AK (AMA, Suite 203, 501 W. Northern Lights Blvd., Anchorage, AK 99503, USA; TEL: (907) 276-0347; FAX: (907) 278-7997)

■ Nov. 11-13, '91 Alluvial mining, intl. mtg., London (Institution of Mining and Metallurgy, 44 Portland Place, London, W1N 4BR)

■ Nov. 11-14, '91 Circum-Pacific Council for Energy and Mineral Resources, mtg., Bangkok, Thailand (Mary Stewart, Circum Pacific Council, Suite 500, 5100 Westheimer, Houston, TX 77056, USA; TEL: (713) 622-1130; FAX: (713) 622-5360)

■ Nov. 11-15, '91 GIS for Mineral Potential Mapping, Shortcourse (GIS Shortcourse Dept. of Geology, University of Ottawa, 770 King Edward, Ottawa, ON, K1N 6N5, Canada; TEL: (613) 564-3480, FAX: (613) 564-9916)

■ Nov. 11-28, '91 5th International Circum-Pacific Terrane Conference, Santiago, Chile (D.G. Howell, U.S. Geological Survey, MS 902, 345 Middlefield Road, Menlo Park, CA 94025, USA; TEL: (415) 329-5430)

■ Nov. 18-19, '91 Ore Deposits and Exploration Potential of the Soviet Union, Golden, Colorado. Presented by the Colorado School of Mines Student Chapter of the Society of Economic Geologists: (Paul Emsbo, Dept. of Geology, Colorado School of Mines, Golden, CO 80401, USA; TEL: (303) 273-3859)

■ Nov. 19-21, '91 International Symposium on Applied Geochemistry, Hyderabad, India (Prof. K. S. P. Rao, Applied Geochemistry, Osmania University, Hyderabad 500007 (AP) India)

■ Dec. 4-7, '91 Mining in Indonesia, mtg., Jakarta (Ellen Lavine, Information Services, Suite 735, Bethesda, MD. 20814, USA; TEL: 301-656-3179)

■ Dec. 4-6, '91 Northwest Mining Association Convention, Spokane, WA (Northwest Mining Association, 414 Payton Bldg., Spokane, WA 99201-0772, USA)

■ Jan. 6-7, '92 Mineral deposits, study group, field trip, and mtg., Aberdeen, Scotland (C.M. Rice, Dept. of Geology and Petroleum Geology, Meston Building, King's College, University of Aberdeen, AB9 2UE, UK)

■ Feb. 4-6, '92 Minerals, metals and the environment, mtg., Manchester, England (Institution of Mining and Metallurgy, 44 Portland Place, London, W1N 4BR, UK)



### Symposium on International Geochemical Mapping

Third Goldschmidt Conference  
Reston, Virginia  
May 8-10, 1992

Co-sponsored by  
The Association of Exploration Geochemists  
and IGCP Project 259

As part of the Goldschmidt Conference, a one-day symposium will present the results of regional and continental scale geochemical mapping in North America and Greenland, and demonstrate its application to geological and environmental fields.

#### Topics will include:

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- airborne gamma-ray spectrometry
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- analytical techniques; *element suites, instrumental methods, element speciation, standardization*
- data compilation and presentation
- applied/integrated case histories; *mineral exploration, geological correlation, health, agriculture, forestry...*

#### For abstract forms and additional information, please contact:

Dr. Peter H. Davenport Geological Survey Nfld. Dept. of Mines & Energy PO. Box 8700 St. John's, Nfld. A1B 4J6 Canada Tel: 709-729-2171 Fax: 709-729-3493	Dr. James M. McNeal U.S. Geological Survey Mail Stop 913 Reston Virginia 22092 USA Tel: 703-648-5459 Fax: 703-648-6057
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**Abstract deadline: December 1, 1991**

## Calendar of Events

*Continued from Page 25*

- Feb. 18-20, '92 McKelvey Forum on **Energy Resources**, mtg., Houston, TX (Christine Turner, USGS, Box 25046, MS 939, Federal Center, Denver, CO 80225, USA; TEL: (303) 236-1561)
- Feb. 22-23, '92 **Biogeochemistry** Short Course pre-Society for Mining, Metallurgy and Exploration Inc., Phoenix, AZ - see below (Tara Davis, SME, P.O. Box 625002, Littleton, CO 80162, USA)
- Feb. 24-27, '92 **Mineral resources**, ann. mtg., Phoenix, AZ (Society for Mining, Metallurgy and Exploration Inc., Meetings Department, Box 625002, Littleton, CO 80162, USA; TEL: (303) 973-9550; FAX: (303) 979-3461)
- March 3-30, '92 Computer-simulated **mineral exploration** workshop, Fontainebleau, France (L. Zanone, Ecole des Mines de Paris, Centre de Geologie General et Miniere and Informatique Gitologique et Miniere, 35, Rue Saint Honore, 77305 Fontainebleau Cedex, France; TEL: 33-1-64-69-49-30; FAX: 33-1-64-69-47-01; deadline for grant requests: Jan. 15, 1992)
- March 9-12, '92 Circum-Pacific Council for **Energy and Minerals Resources**, mtg., Bangkok, Thailand (Mat Stewart, Circum-Pacific Council, Suite 500, 5100 Westheimer, Houston, TX 77056, USA; TEL: (713) 622-1130; FAX: (713) 622-5360)
- March 28, '92 **Came 92 'CAD**, From Mapping to Mining, Royal York Hotel, Toronto, ON, Canada.
- March 29 - April 1, '92 **Prospectors and Developers Association** of Canada 1992 Annual Convention, Royal York Hotel, Toronto, Ontario (Dr. W.E. Urquhart, 74 Victoria Street., Suite 1002, Toronto, ON M5C 2A5, Canada)
- Apr. 8-10, '92 Society for Mining, Metallurgy and Exploration Inc. Regional (Northwest Section) Symposium on Topical **Exploration Interest in Geology, Geochemistry and Geophysics**, Bellevue, Washington (Grant Newport, c/o Weyerhaeuser Co., PC2-31, Tacoma, WA 98477, USA; TEL: (206) 924-2754, FAX: (206) 924-3862).
- May 8-10, '92 **Goldschmidt Conference**, Reston, VA, by the Geochemical Society, the AEG, and other societies (Bruce R. Doe, USGS, 923 National Center, Reston, VA 22092, USA; TEL: (703) 648-6205; FAX: (703) 648-6191). Includes Symposium in **International Geochemical Mapping** (P. H. Davenport, Geological Survey, Newfoundland Department of Mines and Energy, P.O. Box 8700, St. John's, Newfoundland A1B 4J6, Canada; TEL: (709) 729-2171; FAX: (709) 729-3493, abstract deadline, Dec. 1, 1991).
- May 25-27, '92 GAC-MAC, ann. mtg., Wolfville, Nova Scotia (Aubrey Fricker, Atlantic Geoscience Centre, Bedford Institute of Oceanography, Box 1006, Dartmouth, NS, B2Y 4A2, Canada; TEL: (902) 426-6759)
- Aug., '92 13th Caribbean Geological Conference, Pinar del Rio, Cuba (Sociedad Cubana de Geologia, Apartado 370, CH-10100, Habana, Cuba)
- Aug. 23-28 '92 Symposium on **The Environmental Geochemistry of Sulfide Oxidation**, (American Chemical Society Meeting), Washington, D.C. (Charles N. Alpers, Dept. of Geological Sciences, McGill University, 3450 University St., Montreal, Quebec, H3A 2A7, Canada, TEL: (514) 398-3589; or David Blowes, Waterloo Center for Groundwater Research, University of Waterloo, Waterloo, ON, N2L 3G1, Canada; TEL: (519) 885-1211, ext. 6997)
- Aug. 24-Sept. 3, '92 29th **International Geological Congress**, Kyoto, Japan (Secretary General, IGC-92 Office, P.O. Box 65, Tsukuba, Ibaraki 305, Japan, TEL: 81-298-54-3627; FAX: 81-298-54-3629)
- Oct. 26-29, '92 Geological Society of America, ann. Mtg., Cincinnati (Vanessa George, GSA, Box 9140, Boulder, CO 80301, USA; TEL: (303) 447-2020)
- Apr. 17-20, '93 **Integrated Methods in Exploration & Discovery**, Society of Economic Geologists Conference, Denver, CO (Richard L. Nielsen, SEG, Box 571, Golden, CO 80402, USA; TEL/FAX (303) 279-3118)
- May 17-19, '93 GAC-MAC, ann. mtg., Edmonton, Alberta (J. W. Kramers, Alberta Geological Survey, Box 8330, Station F, Edmonton, AB, T6H 5X2, Canada; TEL: (403) 438-7644; FAX: (403) 438-3364)
- Sept., '93 **16th International Geochemical Exploration Symposium**, and **5th Chinese Exploration Geochemistry Symposium**, Beijing, China (Dr. Xie Xuejing, Honorary Director, Institute of Geophysical & Geochemical Exploration, Langfang, Hebei 102849, China; TELEX: 22531 MGMRC CN; FAX: 86-1-4210628; and, Dr. Lin Cunshan, Deputy Director, Institute of Geophysical and Geochemical Exploration, Langfang, Hebei 102849, China; TELEX: 26296 LFPBL CN; FAX: 86-0316-212868)
- Oct. 25-28, '93 Geological Society of America, ann. mtg., Boston, MA (Vanessa George, GSA, Box 9140, Boulder, CO 80301, USA; TEL: (303) 447-2020)

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

### Fred Siegel

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*Washington, D.C. 20052*

*USA*

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## BOOKS AVAILABLE

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A very limited number of hard-covered copies of *Geochemical Exploration 1980* — Hannover symposium have recently become available. These are being offered for sale to AEG members for \$35, including shipment by surface methods. Non-members can purchase the volume for \$50. Please send your orders to the AEG Vancouver address. If airmail shipment is required, please add \$10 per copy.

### Exploration Geochemistry 1990 - Prague

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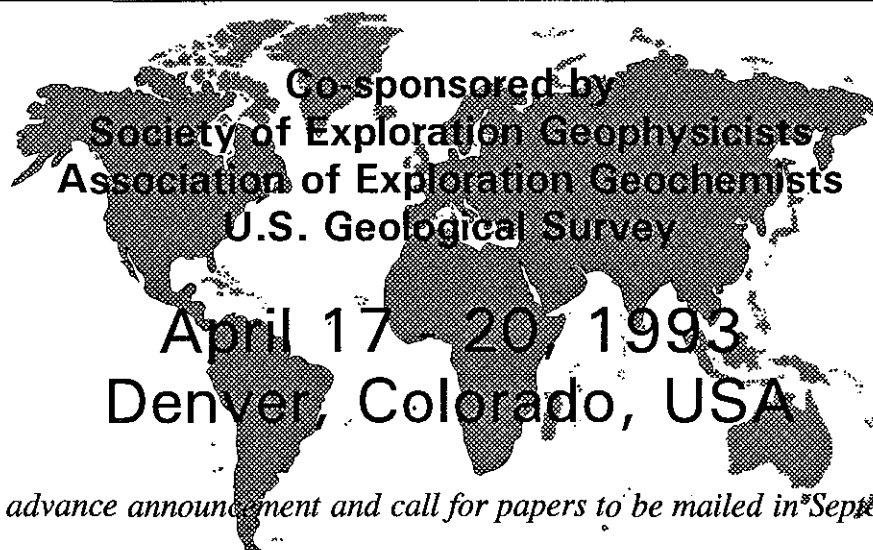
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Continued from Page 21

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Golden Software, Inc. ....	11
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Scandinavia .....	19
SME 1992 Short Course .....	23
SEG Conference Announcement .....	27
Skyline Labs, Inc. ....	23
Tardis Systems .....	21

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