EXPLORE

Newsletter for the Association of Exploration Geochemists

NUMBER 75 APRIL 1992

PAST-PRESIDENT'S MESSAGE

The past year, starting with the very successful 15th International Geochemical Exploration Symposium in Reno, has been very active for your Association. It has also been a year in which our membership increased by approximately one hundred.

During the year, the Ad Hoc Committee, chaired by J. Alan Coope, on the Identity of the Association of Exploration Geochemists, made its report to the Association. The report reaffirms the central focus on the AEG on exploration geochemistry while encouraging closer communication with specialists in related fields. To be effective, several of the Committee's recommendations required action. The AEG Council therefore approved formation of an Educational Committee, a Professional Registration Committee, and a Seminar Committee. In parallel developments, Dr. E. Cameron, Editor-in-Chief of the Journal of Geochemical Exploration, developed new guidelines to encourage submission of a greater range of subject matter.

Also during the year, the hard work of the Ad Hoc committee on Awards and Medals, chaired by Bob Garrett, came to fruition with the striking of two medals: The Gold Medal to be awarded for outstanding scientific achievement in exploration geochemistry, and The Past President's Medal (silver) to be awarded to a member of the Association of Exploration Geochemists for dedicated service to the Association. The medals were on view for the first time at the recent Annual General Meeting in Phoenix where they were much admired. Nominations for recipients of the medals will be solicited in the near future.

The international character of the Association was strengthened in 1991 when Graham F. Taylor (CSIRO Division of Exploration Geoscience, Australia) became the first non-North American Vice President. Also, a special issue of **EXPLORE**, dedicated to exploration geochemistry in Australia, was published.

As I hand over the reins to our new President, Jeff Jaacks, I wish to thank The Executive, Council, Committee members and all those who, by devoting their time and effort to many tasks, ensured the success and growth of your Association during the past year. Especially, I wish to thank Sherman Marsh, as Secretary, for his guidance and help throughout my term in office.

W.K. Fletcher
Department of Geological Sciences
University of British Columbia
Vancouver, BC, V6T 1Z4
CANADA

PRESIDENT'S MESSAGE

The Association recently co-sponsored a successful short course and a geochemical exploration session held jointly with the Society of Mining, Metallurgy, and Exploration in Phoenix. The session on Geochemical Exploration in the Arid Regions of the Western U.S. was chaired by Owen Lavin and Carl Nelson. The short course on Biogeochemical Exploration was conducted by Colin Dunn, Gwendy Hall, Jim Erdman, and Clark Smith. I received many favorable comments from the attendees of both events and wish to take this opportunity to thank the organizers for their efforts.

The new Council and Executive of the Association assumed office at the Annual General Meeting held in Phoenix. A special thanks go to our outgoing president, K. Fletcher, and the members of Council, who have initiated and guided several of the programs which will ensure a healthy Association as we proceed into the future.

You might be wondering what programs the Association will conduct during the upcoming year. The Association, through its various committees, will: 1) finish the revision of the By-Laws to be voted upon at the next Annual General Meeting, 2) sponsor three sessions at the Mining, Exploration and the Environment '92 meeting to be held at Bellevue, Washington in April, 3) sponsor a session at the Third Goldschmidt Conference at Reston, Virginia in May, 4) publish the 1992 Directory, three volumes of

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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* 5¼- or 3½-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:

EXPLORE
c/o USGS
Box 25046, MS973, Denver Federal Center
Denver, CO 80225
USA

Information for Advertisers

EXPLORE is the newsletter of the Association of Exploration Geochemists (AEG). Distribution is quarterly to the membership consisting of 1100 geologists, geophysicists, and geochemists. Additionally, 100 copies are sent to geoscience libraries, 1500 are mailed to selected addresses from the rosters of other geoscience organizations, and 1000 are distributed at key geoscience symposia. Approximately 20% of each issue is sent overseas to every continent.

EXPLORE is the most widely read newsletter in the world pertaining to exploration geochemistry. Geochemical laboratories, drilling, survey and sample collection, specialty geochemical services, consultants, environmental, field supply, and computer and geoscience data services are just a few of the areas available for advertisers. International as well as North American vendors will find markets through **EXPLORE**.

The **EXPLORE** newsletter is produced on a volunteer basis by the AEG membership and is a non-profit newsletter. The advertising rates are the lowest feasible with a break-even objective. Color is charged on a cost plus 10% basis. A discount of 20% is given to advertisers for an annual commitment (four issues). All advertising must be camera-ready PMT or negative. Business card advertising is available for consultants only*. Color separation and typesetting services are available through our publisher, Network Graphics, Inc.

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EXPLORE

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President's Message

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the Journal of Geochemical Exploration, and four issues of the Newsletter (**EXPLORE**), 5) sponsor a Distinguished Lecturer, 6) conduct the 1993 Student Paper Competition, 7) establish additional contacts with other societies with geochemical interests, and 8) conduct a host of other activities to improve communication, simplify the membership application procedure, manage membership information, and expand the Association's membership outside of North America.

These efforts are conducted by volunteers. In a future newsletter we will list the various committees, with their corresponding functions, their goals for 1992, and the chairperson to contact should you desire to volunteer your assistance. I encourage you to volunteer your time to the Association and get involved.

I would also like to take this opportunity to encourage affiliate members to upgrade their membership status to voting member. This gives you the opportunity to vote on matters concerning the Association and have a say in the direction of the Association. Applications may be obtained through the Association offices in Vancouver.

If you have any questions, comments, or suggestions for the Association, feel free to contact myself or any council member and let us know what is on your mind. We are in office to serve you.

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ERRATUM

In EXPLORE Number 74 (January 1992), the editors omitted the authors name from the article entitled *The Status of Vapour Geochemistry in Australia*. The correct credits are:

Bill Ryall
Furgo Douglas Pty Ltd.
Sydney, Australia

Our apologies to Bill.

NOTES FROM THE EDITOR

Based on the comments we have received, the last issue of **EXPLORE**, which was devoted to Australian issues, was a success. The editor must apologize, however, for omitting Bill Ryall's name from his fine article "The Status of Vapour Geochemistry in Australia."

This issue of **EXPLORE** comes on the heels of the AEG annual general meeting held in Phoenix, Arizona and the installation of new officers and council members. See the minutes of the annual general meeting (this issue) for details.

Also in this issue of **EXPLORE**, the newly established medals of the Association of Exploration Geochemists are being introduced. These medals will be presented to individuals who have made special contributions to the Association and the science of exploration geochemistry. Bob Garrett provides an excellent description of the medals and their history in this issue while Alan Coope and Sherman Marsh describe the guidelines for awarding the medals.

Owen Lavin
Editor, **EXPLORE**

LETTERS

March 2, 1992

Dear Editor:

Bill Griffin's recent contribution on use of the Nickel Thermometer as a tool for diamond exploration (**EXPLORE** Number 74, pp 13-15) describes what all of us in that business hope will be another very useful tool for discovery. He has documented several instances where the nickel thermometer has been an effective indicator for the presence of diamonds in kimberlites and lamproites. He should, however, have included reference to his own extended abstract for the 1991 Kimberlite Conference in Brazil in which he notes that the nickel thermometer data for the Siberian diamond-bearing kimberlites "is not consistent with their high diamond grades; the favored alternate interpretation is that the geotherm at the time of emplacement of kimberlite was lower beneath Siberia than beneath the Kaapvaal craton" (Griffin et al. 1991).

This exception to the utility of his data should be viewed by him and all of us in the exploration business as another example of the fact that successful exploration integrates a number of geological, geophysical and geochemical criteria. It is seldom that one criterion alone (e.g. the Ni-thermometer or G10 garnets or diamond-inclusion chrome spinel in diamond exploration) will propel discovery.

Reference

Griffin, W.L., Gurney, J.J., Sobolev, N.V., and Ryan, C.G., 1991. Comparative geochemical evolution of cratonic lithosphere: South Africa and Siberia. *In* Extended Abstracts Fifth International Kimberlite Conference, Brazil, pp 119-121.

Yours Truly,

Hugo T. Dummett
Exploration Manager
North America, Mexico/Caribbean
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USA

March 26, 1992

To the editor

Hugo Dummett quotes from our extended abstract for the 5th International Kimberlite Conference to suggest that the Ni-thermometer doesn't work for Siberian kimberlites. This is misleading since not all the information could be included in even an extended abstract. In the paper actually presented at the IKC, we showed that:

(1) The Nickel thermometer as presented in our note for **EXPLORE** does correctly predict a high diamond grade for the Udachnaya pipe, where xenolith evidence is consistent with a typical cratonic 40 mW/m^2 geotherm; and

(2) Several independent lines of evidence are consistent with a lower geotherm beneath the more southerly pipes, such as Mir which are the cases referred to in the abstract. This evidence includes limited xenolith data, the low nickel temperatures (T_{Ni}) of garnet inclusions in diamonds from Mir (which require a lower-T intersection between the geotherm and the graphite-diamond equilibrium curve), and the unusual distribution of high-Cr garnets at low T (which is shown in the abstract).

Since that paper was presented, we have succeeded in quantitatively modelling (by use of published experimental work) the effects of P, T and composition on the Cr contents of mantle garnets, so that we now can extract geotherm parameters directly from Cr_2O_3-T_{Ni} data on garnet concentrations. This modelling also indicates the existence of a low geotherm beneath large parts of Siberia, which supports the other evidence listed above. Using this lower geotherm to interpret the T_{Ni} data, we derive high grade estimates (consistent with the available "data") for the producing Siberian kimberlites.

We also have developed a thermometer based on the Zn contents of chromites (Griffin, Gurney, Ryan and Sobolev, 5th IKC Extended Abstracts), which can be used analogously to the Nickel Thermometer for garnets. Cr_2O_3-T_{Zn} data on chromite concentrations also can be used to derive geotherm parameters, and the combination of garnet and chromite data is especially powerful. These developments make the Ni (-Zn) thermometry technique even more powerful, by freeing it from the need to know or assume a geotherm *a priori*.

Obviously, no single technique can answer all exploration questions. However, we believe that these new approaches offer a rapid, cost-effective tool for the evaluation of exploration targets, and should greatly benefit the industry by reducing the time and money spent on locating and testing uneconomic prospects.

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North Ryde, NSW 2113
Australia

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Letters

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March 13, 1992

The Editor,

The "Technical Notes" section of January, 1992, **EXPLORE** Magazine, entitled "The Status of Vapor [sic] Geochemistry in Australia," by Bill Ryall, offers some useful information to those interested in using vapor geochemistry in exploration. Perhaps the most instructive part was the introduction, which focuses attention on the need to carefully study the relationships among geologic and geochemical data, and accurately describes the relative paucity of such comprehensive studies in industry to date. His call for full integration of geochemical and geologic data in normal usage should be widely heeded.

Unfortunately, the author then proceeds to assess a variety of methods, mentioning both reported weaknesses and unreported ones, as well. Particularly unfortunate were the remarks regarding the PETREX Technique. The author claims no knowledge of any results, but is able to conclude nevertheless that the "Technique appears to offer no advantages over soil analyses." Ignorance of results should not constitute a basis for drawing conclusions, particularly when a great deal of information is available.

The PETREX Technique has been used only on a limited basis in Australia, but has seen service in over 750 resource exploration projects in 17 countries worldwide, using nearly 250,000 samplers over the past 9 years. Results of work have been published or presented numerous times by PETREX staff and others since 1983. The Technique has been used in deserts, swamps, rain forests, frozen ground, permafrost, and even in bedrock, in all seasons. The ability to operate in these areas and still trap hydrocarbons yields obvious advantages over taking variable soil samples in an area. The method has even enjoyed success in limited mineral exploration (Jaacks, 1991) and geothermal exploration (Viellenave, et al., 1987). A selected list of references is appended hereto.

We would encourage future authors to fully investigate techniques prior to reporting on them and then to evaluate them in an objective manner.

Yours truly,

James H. Viellenave
Vice President
NORTHEAST RESEARCH INSTITUTE, INC
Lakewood, CO, USA

Selected References

Hayes, C., Thacker, M.M. and Viellenave, J.H., 1984, Exploration techniques aided by computer tiering; World Oil, December, 1984, pp 64-70.

Klusman, R.W., Voorhees, K.J. and Hickey, J.C., 1985, An integrative gas geochemistry technique for petroleum exploration; in Unconventional methods in exploration for petroleum and natural gas; Institute for The Study of Earth and Man, SMU, Dallas, TX, May, 1985.

Jaacks, J.A., 1991, Using pyrolysis mass spectrometry for mineral exploration; Geochemical Exploration Discussion Group, Colorado School of Mines, December 17, 1991. (Oral Presentation).

Schumacher, Dietmar, 1992, Surface exploration for oil and gas, advances for the eighties, applications for the nineties; Short course sponsored by Rocky Mountain Association of Geologists, January 27, 1992.

Viellenave, J.H. and Bloom, D.N., 1986, Soil gas geochemical exploration using the K-V fingerprint technique (PETREX) in dry gas regions: Selected case histories; AAPG Annual Meeting, Pacific Section, April, 1986.

Viellenave, J.H., Sakai, S., Suga, S., and Bisque, R., 1987, Use of the PETREX fingerprint soil gas geochemical technique in multiple scale geothermal exploration: A case history at Okuaizu geothermal field, Japan; Pacific Rim Congress, August, 1987.

Viellenave, J.H., and Wensley, J.R., 1986, Vertical migration demonstrated: Selected case histories; Canadian Society of Petroleum Geologist Convention, June, 1986.

MINUTES OF THE AGM

Annual General Meeting of the Association of Exploration Geochemists, Phoenix, Arizona, February 25, 1992

On February 25, 1992 The Association of Exploration Geochemists (AEG) held their Annual General Meeting (AGM) at the Phoenix Civic Plaza North in Phoenix, Arizona. The meeting was held in conjunction with the AEG exploration geochemistry session of the Society of Mining, Metallurgy and Exploration (SME) annual meeting.

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Minutes of the AGM

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1. Call to order
   The President called the meeting to order at 4:45 PM (MST) and established that a quorum was present.
2. Minutes of the 1991 AGM
   The President asked if there were any matters arising from the 1991 AGM minutes as published in **EXPLORE** number 72. There were no matters arising.
   It was moved (M. Chaffee) and seconded (G. Hall) that the 1991 minutes of the 1991 Annual General Meeting, as published in EXPLORE Number 72 and filed with the Secretary, be approved. The President asked for a vote on the motion. Passed unanimously.
3. Presidents Report
   The President thanked the organizers of the symposium and the exploration geochemistry session on behalf of the Council and Executive. The President enumerated the highlights from activities of the AEG during the last year.
   A. Approximately 500 people attended the 15th International Geochemical Exploration Symposium with the papers presented soon to appear in a special edition of the Journal of Geochemical Exploration.
   B. The membership of the AEG has increased during the last year to almost 1300 members.
   C. The first international issue of **EXPLORE**, focussing on Australia, was recently published. The President thanked O. Lavin and G. Taylor for their efforts in making this issue possible.
   D. The AEG has many volunteer committees and the President reported on the activities of some of the most active:
      (1) The Awards and Medals Committee (R. Garrett and A. Soregaroli, Chairmen) - Two medals have been made by the Association, each containing 2 ounces of solid silver: 1) a gold plated medal for "outstanding scientific achievement in the science of exploration geochemistry" and 2) a silver medal for "dedicated service to The Association of Exploration Geochemists." The mechanism for nomination of candidates to receive these medals is being finalized and will appear in an upcoming issue of **EXPLORE**. *Editor's Note: This issue p.8.*
      (2) The Identity Committee (A. Coope, Chairman) - This committee reported on the future course of the Association and its identity. The main points of their report were: 1) "reaffirmation of the central focus of the Association on Exploration Geochemistry while encouraging closer communication with specialists in related fields to vigorously advance application of geochemical methods in interpretation, discovery, exploitation, and reclamation" and 2) "past lack of emphasis on dispersion processes has been detrimental to both the application and successes of exploration geochemistry." The report made several recommendations: a) that there should be joint meetings in areas where exploration and environmental geochemistry interests overlap and b) there should be publications of environmental studies that contribute to resolution of exploration problems. This report was published in full in **EXPLORE** Number 73. In order to be effective, several of the committees recommendations require the establishment of more committees: a) Education Committee to examine and recommend on the education of exploration geochemists; b) Professional Registration Committee to examine the rapidly changing requirements for registration of geoscientists and make recommendations as to the response of The Association of Exploration Geochemistry; c) Seminar Committee to introduce leading edge seminars aimed at stimulating debate on raising the professional image of exploration geochemistry. In response to the recommendations of the Identity Committee Dr. E. Cameron, Editor-in-Chief of the Journal of Geochemical Exploration, has put out new guidelines on the scope of the Journal to allow the publication of environmentally oriented papers related to exploration geochemistry.
      (3) The By-laws Committee (D. Runnells, Chairman) - The 6th draft of the revised By-laws has been prepared and is being reviewed by Council and Executive. The final revision should be ready soon. The President thanked D. Runnells for his dedicated effort in revising the By-laws.

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Minutes of the AGM

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E. The AEG is participating in several upcoming meetings: (1) The regional meeting of the Society for Mining, Metallurgy, and Exploration in Bellevue, WA on April 6- 10, 1992, 2) the Goldschmidt Conference in Reston, VA on May 8-10, 1992, 3) the joint meeting with the Society of Economic Geology and the Society of Exploration Geophysists in Denver, CO in April of 1993, 4) the 16th International Geochemical Exploration Symposium (IGES) in Beijing, China in September of 1993, and 5) the 17th IGES in Townsville, Australia in 1995.

4. Secretary's Report
The Secretary noted the increase in membership in the Association and reminded members that Affiliates should upgrade their memberships to Voting whenever possible. The Secretary noted that the Association had distributed over 16,000 copies of **EXPLORE** throughout the world during the last year. This gives the Association a great deal of "visibility" and exposes a great number of people to exploration geochemistry. **EXPLORE** will continue to be published on a quarterly basis with the next two issues already planned. The secretary encouraged anyone with appropriate articles to submit them to **EXPLORE. EXPLORE** provides a medium for rapid publication of articles, usually within a few months. **EXPLORE** publishes articles on methodology, case histories, and techniques in exploration. In the next year a color issue of **EXPLORE** is planned with 4 pages to be in full color. The Secretary said that he would continue to keep members informed on important events and decisions of Council in his column in **EXPLORE**.
5. Treasurer's Report
In the absence of the Treasurer, S.P. Marsh gave the Treasurer's Report, which was forwarded by Dave Jenkins. He announced that an audited copy of the Treasurer's Report would not be available at this time but would be published in **EXPLORE** when it became available. He then gave an unaudited Treasurer's Report. The assets of the AEG in 1991 were $160,644.88 (down $36,118 from 1990) and liabilities were $25,794 (down $10,823 from 1990). The Association had revenues of $89,257 and expenses of $108,269 in 1991 resulting in a deficit of $19,012 for the year.
6. Introduction of the 1992 Executive
The President announced that the incoming President for 1992 would be Jeffrey A. Jaacks, the First Vice President would be Graham F. Taylor, the Second Vice President would be Gwendy E.M. Hall, the Secretary would remain Sherman P. Marsh, the Treasurer would remain David M. Jenkins, and the Business Manager would be Stanley J. Hoffman.
7. Announcement of the 1992-1994 Ordinary Councilors
The Secretary announced that, as a result of a general election, J. Stevens Zuker, Arthur J. Sinclair, and W. B. Coker had been elected as new Ordinary Councilors. Peter J. Rodgers and Paul Taufen were re-elected to a second term and W. K. Fletcher will serve as Ordinary Councilor in his ex officio status. There were four outgoing members of Council, Harold F. Bonham, Ray E. Lett, S. Clark Smith, and Arthur E. Soregaroli. These Council members were thanked for their efforts in helping to run the affairs of the Association and were invited to remain active participants.
8. Motion to Destroy Ballots
It was moved (E. Weiland) and seconded (B. Smee) that the accountants, Nemoth Thody and Associates, be instructed to destroy the 1992-1994 Ordinary Councillor ballots. The President asked for a vote on the motion. The motion passed unanimously.
9. Appointment of Auditors
It was moved (S. Marsh) and seconded (A. Coope) that the Treasurer be given permission to reappoint the existing accounting firm of Nemoth Thody and Associates as auditors for The Association of Exploration Geochemists for the year 1992. The President asked for a vote on the motion. The motion passed unanimously.
10. Transfer of Meeting
Before transferring the meeting, the out-going President thanked all the members of Council and Executive for helping him during his presidency. He gave special thanks to all the Committee Chairman for their hard work for the Association. The out-going President then transferred the meeting to the in-coming President, Jeffrey A. Jaacks. The in-coming President, Jeffrey A. Jaacks, introduced the Past President, W. K. Fletcher to give his Presidential Address (the full text of this address will be published in a forthcoming issue of the Journal of Geochemical Exploration).
11. Other Business
The President announced that the 1990 Student Paper Prize had been awarded to Steven J. Day for his paper entitled

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"Effects of valley and local channel morphology on the distribution of gold in stream sediments from Harris Creek, British Columbia, Canada," published in the JGE Vol. 32(1/3):1-16.

12. Adjournment

It was moved (J. A. Coope) and seconded (S.C. Smith) that the Annual General Meeting of The Association of Exploration Geochemists be adjourned. The President asked for a vote on the motion. The motion passed unanimously. The 1992 Annual General Meeting of The Association of Exploration Geochemists was adjourned at 6:10 PM MST.

Sherman P. Marsh
Secretary of The Association of Exploration Geochemists
U.S. Geological Survey
MS 973 Denver Federal Center
Denver, Colorado 80225
USA

NOTES FROM THE BUSINESS MANAGER

1. ***DIRECTORY:*** Publication of the 1992 AEG membership listing and directory of geochemical services is scheduled for April 1992. The service section of the DIRECTORY contains over 4,000 listings, emphasizing mineral exploration offices and geochemical/environmental laboratories. Geology departments of major universities, particularly in Canada, USA, and Australia are well represented, as are geophysical consultants, contractors and airborne survey firms. Many geochemical and geological consultants are listed, but probably not as many of our membership as should be, considering there is no cost for a listing. If you want to be included, send the necessary information by mail or FAX. The service portion of the DIRECTORY is continuously being updated and it is never to late to be listed.

   Receipt of the DIRECTORY is a benefit of AEG membership and a copy will be sent by surface mail to all members in good as of 1992. Several members have already sent in funds to purchase a copy. It is assumed that these members only require one copy of the DIRECTORY and a refund credit will be issued to them and mailed with the DIRECTORY. The credit can be used towards future dues or publication purchases.
2. ***Membership Data Base***: The AEG does not have sufficient information in its data base on many of it members. When renewing your membership, please include the following:
   (a) Mailing address (specify if this is also a business address).
   (b) Business address, if different from (a). Please indicate your affiliation (i.e. employer or institution).
   (c) Include you business card with your letter.
   Inclusion of your business address and affiliation will help keep AEG costs down by our avoiding sending promotional flyers and complimentary copies of **EXPLORE** to offices who already received this information on a regular basis.
3. ***Elsevier:*** I have confirmed that the recent letter sent to individual members by Jenny Henzen regarding institutional subscription rates was an unfortunate error. Elsevier intended to inform only institutional members of their 1992 price for the Journal of Geochemical Exploration (JGE). Incidently, the same information is routinely published on the back cover of the JGE. Members of the AEG will note that in the 1992 membership year there will be one extra volume of JGE (four instead of three), included at no additional cost. Current plans are to return to three volumes in 1993 unless the supply of papers dictates otherwise.

   Elsevier will also be offering AEG members a special book offer. Look in the July issue of **EXPLORE** for details.
4. ***AEG Publications:*** The cost of GEOEXPO/86 proceedings of a symposium held in Vancouver, B.C. in 1986, has been reduced to US $25.00.
5. ***AEG Special Book Offers:*** Two special offers are now available: Practical Problems in Exploration Geochemistry by A.A. Levinson, P.M.D., Bradshaw and I. Thomson (US $35.00) and Geochemistry in Mineral Exploration by A.W. Rose, H.E. Hawkes and J.S. Webb (US $39.95). Both can be acquired from the AEG for Vancouver Office (delivery by surface mail).

Stan Hoffman
Business Manager of the AEG
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CANADA

NEW AEG MEDALS

The Gold Medal and the Past Presidents' Medal of the Association of Exploration Geochemists

History

When the Association was founded in 1970, routine exploration geochemistry in most of Europe, Africa, the Americas and Australasia was barely 20 years old. The notable exceptions were in Russia and Scandinavia where geochemical prospecting had developed in the 1930s. Our pioneers were still active with many years of work and research before them. Presenting awards did not have a high priority in a rapidly expanding arena of mineral industry surveys, and government and university research.

On April 26, 1977, the Association was formally incorporated as a legal entity in Canada; prior to that time our legal status was unclear. Immediately upon incorporation on the 26th, the Association honoured three members who had made vitally important contributions to the development, growth and acceptance of exploration geochemistry with the election by Council of H.E. Hawkes, H.W. Lakin and J.S. Webb to Honorary Membership. Later that year a motion was passed by Council (October 17th) to limit Honorary Membership to 1% of the voting membership. This was felt necessary in order to preserve the nature of the exceptional recognition that the Association bestowed on an Honorary Member.

Side One of the Gold Medal

Side One of the Past President's (Silver) Medal

Side Two of both medals

As the Association grew it was able to recognize Professor H.V. Warren's unique contributions since the 1940s through his election by Council to Honorary Membership on April 12, 1980. With the stabilization of the voting membership of the Association at around 450 it was not possible for Council to elect additional Honorary Members. In May 1989, following the death of Bert Lakin, the President at that time, Maurice Chaffee, asked Alan Coope to form an ad hoc committee to review and recommend to Council persons worthy of election to Honorary Membership in the Association.

The committee, consisting of 5 past-Presidents and Councillors, took on the difficult task of identifying an individual to be nominated for Honorary Membership. Following the committee's report, R.W. Boyle was elected an Honorary Member of the Association by Council on August 30, 1989.

As a member of this committee I know how difficult it was to arrive at a unanimous recommendation to Council. It became apparent during the deliberations that the Association needed additional ways in which to honour those who had made outstanding contributions to both the life of the Association and the discipline of exploration geochemistry. Previously a number of ad hoc actions had been taken. In 1980 and 1982 calligraphic

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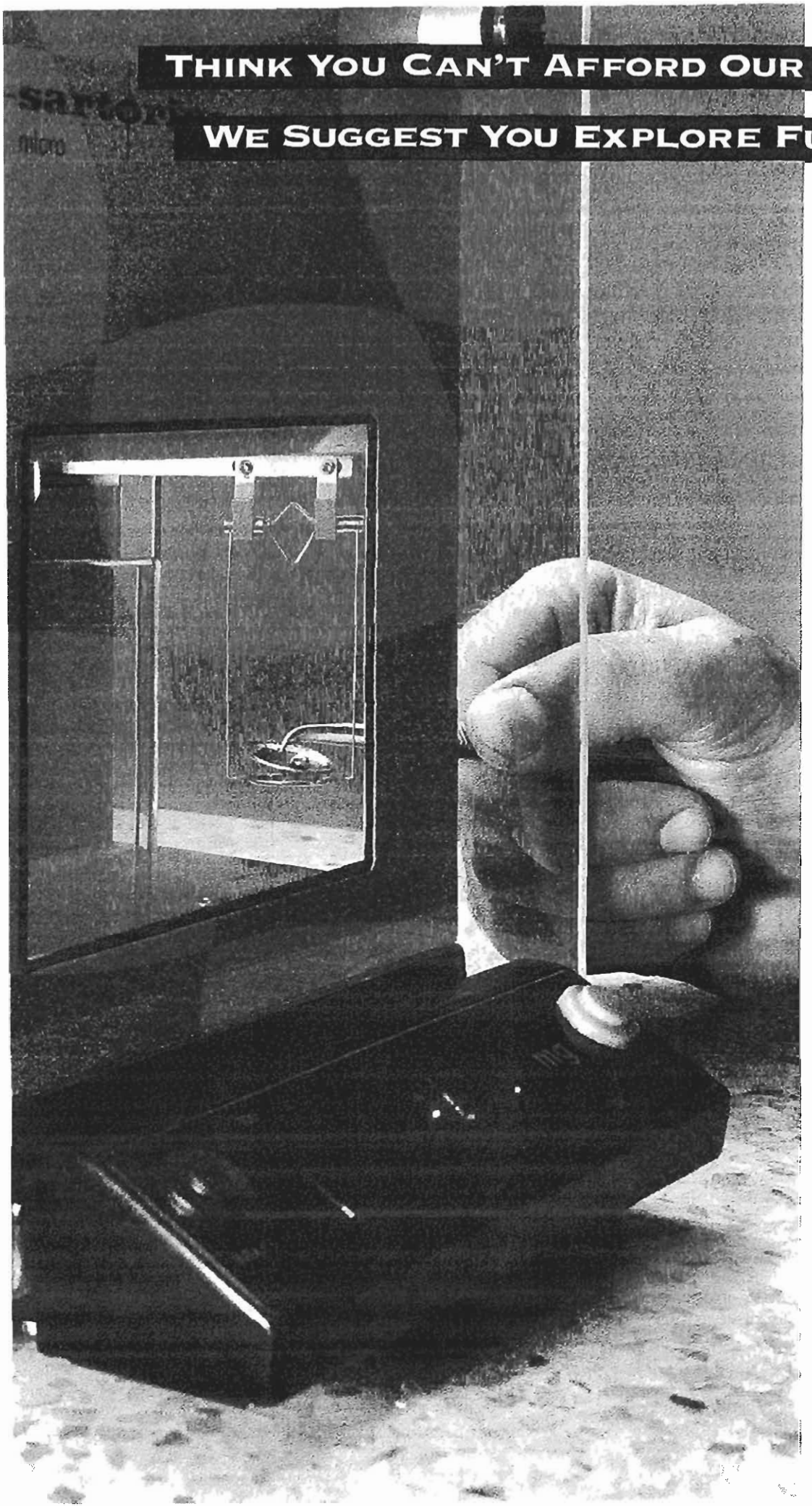

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New AEG Medals

Continued from Page 8

scrolls had been presented to members as a mark of appreciation for their very considerable efforts on behalf of the Association. These were to Alan Coope on the 10th Anniversary of the Association, and to Eion Cameron and John Hansuld on the 10th Anniversary of the Journal of Geochemical Exploration. In 1985 there was an attempt to find some way of honouring Nils Brundin, one of the fathers of Scandinavian exploration geochemistry, at the 10th International Geochemical Exploration Symposium in Espoo, Finland. But Brundin's untimely death brought those plans to an end.

To address the need for more formal awards, the Association's President, Art Soregaroli, established an ad hoc Awards and Medals Committee in January 1990 to review how the Association could honour deserving geochemists. The committee was to recommend to Council appropriate awards practices and the procedures for their establishment and implementation. Three past-Presidents, Maurice Chaffee, Robert Garrett and Ian Thomson were named to this committee.

In June 1990 a report was submitted to Council in which the awards and honours given by eight other geoscience associations (CIMM, IMM London, GAC, MAC, GSA, MSA, SEG, and Society of Exploration Geophysicists) were reviewed. Initial recommendations were made, based on the committee's perception of the Association's needs and the procedures of the other bodies reviewed concerning the form, names and frequency of possible awards, and the selection of award recipients. This report was discussed by Council, who on November 14, 1990, unanimously passed the following motion:

> ". . .that the Association of Exploration Geochemists institute two (2) medals; one restricted to members of the Association of Exploration Geochemists, to recognize outstanding service to the Association, and a second, open to any scientist in the field of exploration geochemistry, to recognize outstanding achievement in the science of exploration geochemistry."

The committee was instructed to investigate the costs of producing the two medals. Alan Coope had had previous experience in preparing the Duncan Derry Medal for the Geological Association of Canada, and as a result Glenn Trenchard and Associates of Scarborough, Ontario, was contacted. From then on the committee worked closely with Glenn Trenchard, who helped by suggesting options and supplying cost estimates.

A further report, submitted to President Don Runnells on February 14, 1991, recommended that the two medals be named: 1) the Past Presidents' Medal (silver), for dedicated service to the Association, and 2) the Gold Medal of the Association of Exploration Geochemists, for outstanding scientific achievement. This report also provided an initial cost estimate. Council decided on March 13, 1991, to proceed with the project to strike thirty of each medal.

The committee continued its work, and a final written report was submitted to Council on April 24th with several possible designs and an estimate of Can $8404 (US $7227). Council discussed this on September 4, 1991, and the estimate was accepted together with the wording for the silver medal, "Awarded to (*name*) for Dedicated Service to the Association (*year*)." The wording for the gold medal was more difficult to reach consensus over, everybody feeling that it was very important to "get it right." This was resolved between the committee, the President, Kay Fletcher, the Past-President, Don Runnells, and the Secretary, Sherm Marsh, in the next few weeks as, "For Outstanding Scientific Achievement in Exploration Geochemistry (*name*) (*year*)."

On September 19, 1991, Glenn Trenchard was sent the selected designs and the order for sixty medals. On the 24th the committee had the opportunity to review the final artwork and approve preparation of the dies. The medals, 50mm in diameter and 3 mm thick, were each struck from 2 troy ounces of silver bullion by the Sherritt Gordon Mint. The thirty Gold Medals were then double gold plated on the silver core. The finished medals were delivered to the Association in late November, each in a black velvet presentation box. As I am sure that those of you who examined the metals at the AGM in Phoenix will agree, Glenn Trenchard and the Sherritt Gordon Mint provided us with two beautiful medals. Black and white photos of the metals at a scale of 1:1 are shown on page 8.

On October 30, 1991, Council unanimously approved the motion:

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New AEG Medals

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" . . . that an Awards Committee be formed and that it be composed of five (5) members, consisting of two Past-Presidents, a Regional Councillor, an Active Councillor and another voting member to be selected by the Chair-person."
The first task of this committee will be to continue the work of the ad hoc committee and institute the guidelines for the selection of award winners for approval by Council.

Finally, I wish to thank my committee co-members, Maurice Chaffee and Ian Thomson, for their help in this project; we jointly thank the members of Council who have provided guidance, advice and comment on our various proposals. The Association also sincerely thanks Glenn Trenchard for helping us to produce two superb medals.

In closing, the committee hopes that the two medals will become an important part of the Association's life. Council has accepted our recommendation that they should only be awarded when recipients of sufficient merit are identified. Simply to award medals every year would result in their devaluation as a special sign of recognition by the Association. The stature of the medals will be largely established by their first few recipients, thus considerable thought and care must go into the selection of award winners. When nominations are solicited by the Awards Committee the old ad hoc committee, which is now disbanding, would ask you to remember that for an award to have stature, the recipient must also have stature. If not, the Association's medals will not reflect the excellence that we would all wish them to recognize and honour.

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Geological Survey of Canada
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CANADA

Guidelines for Medals

1.0 *THE MEDALS AND THEIR PRESENTATION*

1.1 The Association of Exploration Geochemists has inaugurated two (2) medals to be awarded to worthy and deserving persons in accordance with the guidelines set out below.

1.2 The medals, each minted from two troy ounces of silver bullion of a design approved by the Council of the Association, are referred to as the *"GOLD MEDAL"* and the *"PAST PRESIDENTS' MEDAL."*

1.3 The *Gold Medal*, to be awarded to a person for outstanding scientific achievement in exploration geochemistry, will be engraved with the name of the recipient and the year of the award.

1.4 The *Past Presidents' Medal*, to be awarded to a member of the Association of Exploration Geochemists for dedicated service to the Association, will be engraved with the name of the recipient and the year of the award.

1.5 The Gold Medal will be presented by the President of the Association and the Past Presidents' Medal by the Chairman of the Awards Committee at Annual General Meetings of the Association.

1.6 The award citation for the Gold Medal shall be prepared by the President from information provided by the Awards Committee and the award citation for the Past Presidents' Medal shall be prepared by the Chairman of the Awards Committee.

1.7 The award citations for each medal and the acceptance speeches of the recipients will be included in full in the first issue of the Association newsletter, **EXPLORE**, published following the Annual General Meeting at which the awards are presented.

1.8 The Secretary of the Association will issue a press release at the time of the awards naming the recipients and a description of the services and/or scientific achievements for which they are honored. The press release will be prepared by the Chairman of the Awards Committee, and will be mailed or delivered to appropriate newspapers, journals, and societies around the world.

2.0 *THE AWARDS COMMITTEE*

2.1 The immediate Past President of the Association will be the Chairman of the Awards Committee. The Chairman of the Committee will select four (4) other Voting Members to include one (1) previous Past President, two (2) members of Council including one (1) Regional Councillor and one (1) other active Voting Member.

2.2 The Chairman of the Awards Committee for each year will assume his responsibilities immediately following the Annual General Meeting which concludes his term as President of the Association and he will serve until the next Annual General Meeting.

2.3 The Awards Committee will be responsible for soliciting nominations for both the Gold Medal and the Past Presidents' Medal through notices in the first issue of **EXPLORE** following the Annual General Meeting, other newsletters, and other appropriate procedures.

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New AEG Medals

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3.0 *NOMINATIONS*

3.1 To be eligible for consideration for either award to be presented at the next Annual General Meeting, nominations must be received by the Chairman of the Awards Committee ***on or before December 1st***. Nominations accepted by the Awards Committee will be eligible for the consideration for the medal award named in the nomination through and until the third Annual General Meeting following the receipt of the nomination. Nominees may be renominated through the submission of an updated but complete nomination to the Chairman of the Awards Committee.

3.2 Acceptable nominations shall be signed by a minimum of four (4) Voting Members of the Association in good standing and shall include the following:

(a) A letter of nomination (to be signed by a minimum of four (4) Voting Members;
(b) A resume or curriculum vitae of the nominee;
(c) An itemized list of the outstanding scientific achievements (Gold Medal) or the dedicated service to the Association (Past Presidents' Medal) of the nominee.
(d) Other pertinent documentation relevant to these achievements and/or qualifications of the nominee may include endorsements from other individuals whether or not Voting Members of the Association.

Since members of the Awards Committee may not have personal knowledge of the nominee, the completeness and quality of the nomination will be critical in evaluation and selection.

3.3 The Awards Committee will review all nominations and the Chairman of the Awards Committee will report the Committee's selection for each award to Council at a Council Meeting called at least six weeks prior to the Annual General Meeting at which the medals will be presented. The Committee, in it's judgement, may elect not to select any of the nominees entered for consideration and not more than one Gold Medal and one Past Presidents' Medal will be awarded in any one year. Council will confirm the Committee's selections by majority vote.

Editor's Note: In the new bylaws of the AEG "Fellow" will become the equivalent of "Voting Member."

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TECHNICAL NOTES

Cat Mountain - comparison of aqua regia-ICP multielement analysis and Au + 35 instrumental neutron activation analysis (INAA)

It was noted in the Pearl Harbor file of **EXPLORE** Number 71 that Activation Laboratories had offered to analyze the Cat Mountain soil samples reported in **EXPLORE** Number 69, on page 8, using a non-destructive, instrumental neutron activation method of analysis (INAA). The analysis has been completed and the study was extended to include bedrock trench channel samples and diamond drill split core to determine if aqua regia (AR) extraction parameters accompanying the initial analysis (Acme Analytical) varied with degree of weathering of the sample media.

The following report on comparative results initially follows the element order described in **EXPLORE** Number 69, with additional findings characteristic of INAA results described subsequently. Au was determined following an AR-MIBK-graphite furnace AA procedure for all samples taken from Cat Mountain. Hall et al. (1989) found that Au contents were typically lower from the AR partial extraction as compared to a total determination like INAA. Figures 1A, 3, and 5 do not show this to be the case on this property as Au levels and patterns are almost identical. Evidently AR extraction can approach 100%. In theory, the 30 gm subsample analyzed for Au by INAA should minimize heterogeneity compared to using a 10 gram AR split. Larger splits to 50 gm are possible for an AR digestion, but costs approach or exceed an INAA analysis and the main advantage of the AR method-cost is lost. Coope and Lavin, at a special session of the AEG Reno-91 symposium, indicated that the efficiency of AR extraction can be very different for different laboratories, with most being lower than INAA data. Notwithstanding, AR-Au analysis is undertaken at many commercial laboratories as a routine Au determination method, and studies such as this one indicate results can be of high quality. Accuracy of Au analysis should be checked using at least two analytical procedures at the beginning of a project prior to selection of a routine method of analysis.

Figure 5 of **EXPLORE** Number 69 suggested ICP-Cu, Ag, As, Mo, W, Fe, and Co patterns were important to continued exploration for alkalic Au-Cu porphyry deposits (note the term ICP-Cu means AR-ICP-Cu, etc.). In reviewing ICP versus INAA data for these elements, INAA-Ag values correspond to ICP-Ag above 5 ppm. Average As, Co, and Fe abundances determined by INAA are higher, but patterns are more or less identical. Mo patterns are identical. W values are higher by INAA, but the location of major W anomalies in soils are the same. INAA-W has indicated additional targets amongst soil survey data to the east of Figure 1B. This is the type of finding Calow (Pearl Harbor file, **EXPLORE** Number 71) indicated might occur if total W data were not available: significant anomalies might be missed as a consequence of the partial extraction nature of AR. Missing are comparisons for Cu and Pb which cannot be analyzed by INAA. A relatively high detection limit for Zn (50 ppm) means only the highest Zn contents (exceeding 150 ppm) can be expected to be comparable, reliable background variations seen only amongst ICP-Zn data. Elements of the INAA package which appear to correlate with Au-Cu (and which cannot be determined by ICP analysis) include positive relationships with La, Sc, Br, Tb, Rb, Ta, Hf, Ce, Sm, Yb, Lu and Cs and negative

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Technical Notes

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relationships with Na and Ba. Cu and Au grades in drill core and comparisons between ICP-As, W, Na, and INAA-As, W, Na are shown on Figure 5.

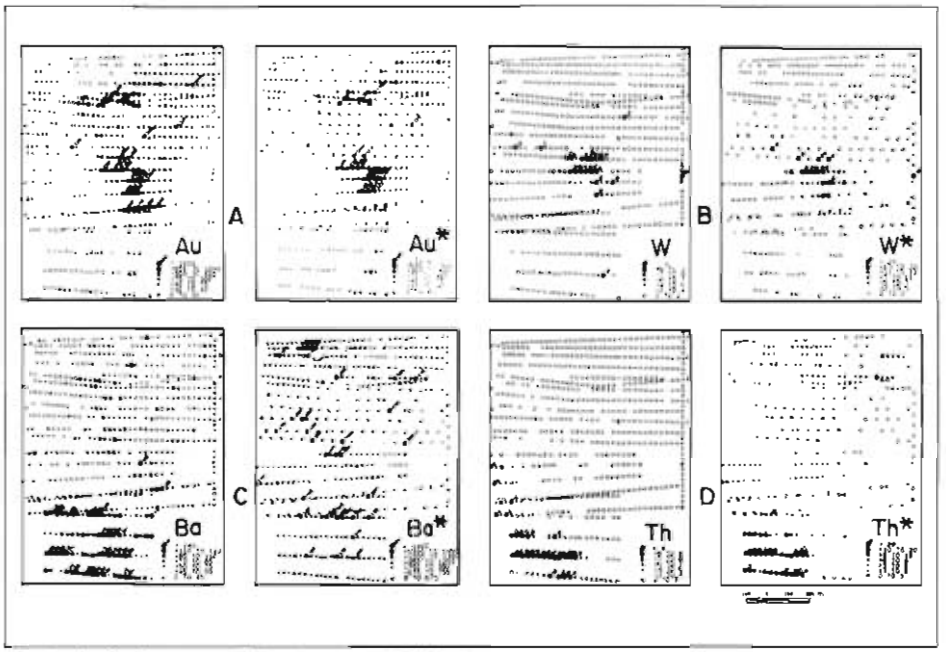

Fig. 1 A. Soil survey: AR-Au versus INAA-Au (note INAA analysis are indicated by an asterisk); B. ICP-W versus INAA-W; C. ICP-Ba versus INAA-Ba; D. ICP-Th versus INAA-Th.

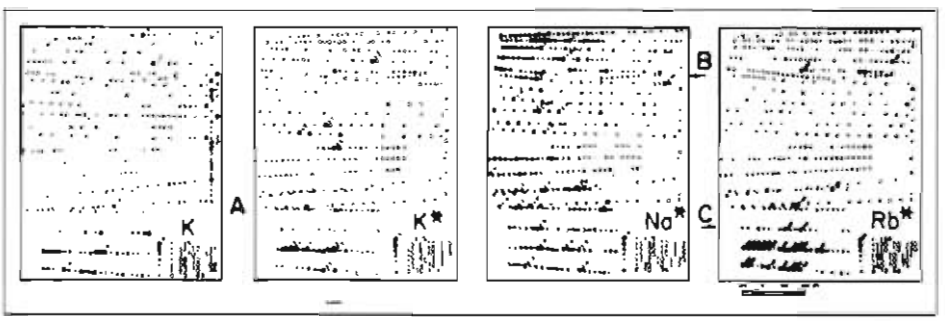

Fig. 2 Soil survey: A. ICP-K versus INAA-K; B. INAA-Na; C. INAA-Rb.

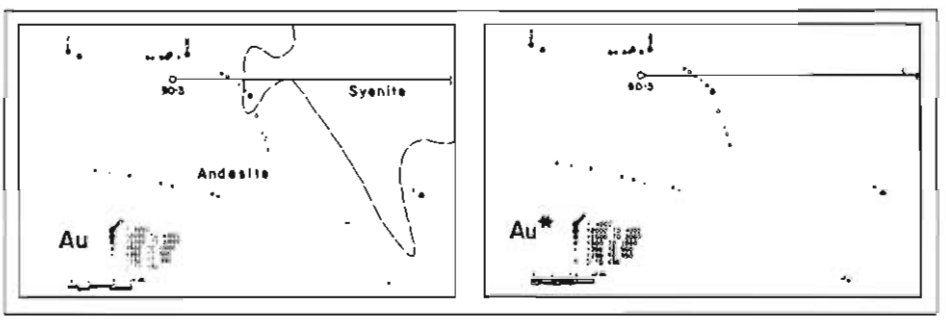

Fig. 3 Rock chip (trench) lithogeochemistry. AR-Au versus INAA-Au. Note the location of hole 90-3 of Figure 5 is indicated.

Figure 6 of **EXPLORE** Number 69 depicted ICP-Mn, Ca, Sr, and Al distributions, all elements potentially important to assessing the quality of a soil survey (Hoffman, 1986) Mn and Al cannot be determined by INAA without additional cost, an INAA-Sr detection limit of 500 ppm is too high to provide useful data on the occurrence of zones of seepage where base metals may be accumulating, and an INAA-Ca detection limit of 1% defines substantially different patterns compared to ICP-Ca. ICP-Ca contents exceeding

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1%, when heterogeneously distributed, commonly reflect organic contaminants which have a high scavenging capability, whereas INAA-Ca primarily reflects geology of overburden materials (in this case predominantly locally-derived). ICP-Ca can map carbonate or Ca-rich bedrock, but patterns are typically homogeneous in such cases. Low INAA-Fe and Sc and high Br can indicate organic-rich samples and may provide a guide to organic contamination using INAA data.

Figure 7 of **EXPLORE** Number 69 displayed Mg, Ba, and Th patterns. Mg cannot be determined by INAA without additional cost. The Ba distributions (Fig. 1C) are markedly different. An INAA-Ba low correlates with the major Au-Cu anomaly whereas ICP-Ba exhibits a positive anomaly in the same region. Th patterns are similar for high values (Fig. 1D) and an area of enhanced values in the southwest reflects a monzonite intrusion (Fig. 4). AR-Th suggested weak enhancement underlying (i.e. to the west at a lower elevation) the main Au-Cu anomaly, but elevated values were so close to the analytical detection limit of 2 ppm to mandate that this observation be considered a speculation. The INAA-Th pattern gives credence to the speculation, suggesting an intrusion probably continues in a north-northeasterly direction across the grid beneath a thin cover of volcanic rocks. The INAA-K, Ba values indicate a zone of potassic alteration underlying the soils. The AR-K, Ba results appear to be downslope from the main Cu-Au anomaly. Could this reflect movement of fines downslope? The fines will contain a higher abundance of alteration minerals which will be more amenable to AR digestion.

Some of the useful elements of the ICP suite cannot be matched by INAA analysis, either because of detection limit (DL) or analytical considerations: Bi, Cd, Ni (DL 50 pp), V, Ti, P, and B. Cr patterns are comparable, but levels are higher by INAA, as expected. La distributions by both methods point to the monzonite intrusion reflected by Th, but INAA-La also defines a "V-shaped" anomaly in the north (the same "V-shape" seen on the Au and Cu maps). ICP-U (DL = 5) is not detected in aqua regia leachates, but INAA-U (DL 0.5 ppm) follows La but also correlates with Cu. Other elements of the INAA suite showing variations which reflect underlying geology on this property (and have not been mentioned previously) include Ce, Ta, Hf, Lu, Sm, and Yb. When the INAA data is chondrite normalized a positive Eu anomaly will occur over the ore zone, a factor which will indicate a change in the oxidizing nature of the ore-bearing fluids. There is also a change in the ratio of the light to the heavy rare earths which can define the zone of influence of the ore-bearing solutions.

Three elements delivered by INAA, total K (Fig. 2A), Ba, and total Na (Fig. 2B) can be fundamentally important to searching for alkalic Au-Cu targets (note that a 9.35 hour half life for radioactive K means K is not generally offered as part of the commercial INAA multielement package but could be included on request). Potassic alteration is a key geological parameter, and at Cat Mountain INAA-K, in addition to correlating with the monzonite intrusion in the southwest, defines (1) an anomaly northwest of the highest contrast Au soil anomaly and (2) an anomaly following Au in the northeast. ICP-K (Fig. 2A) also delineates the monzonite intrusion, but otherwise its

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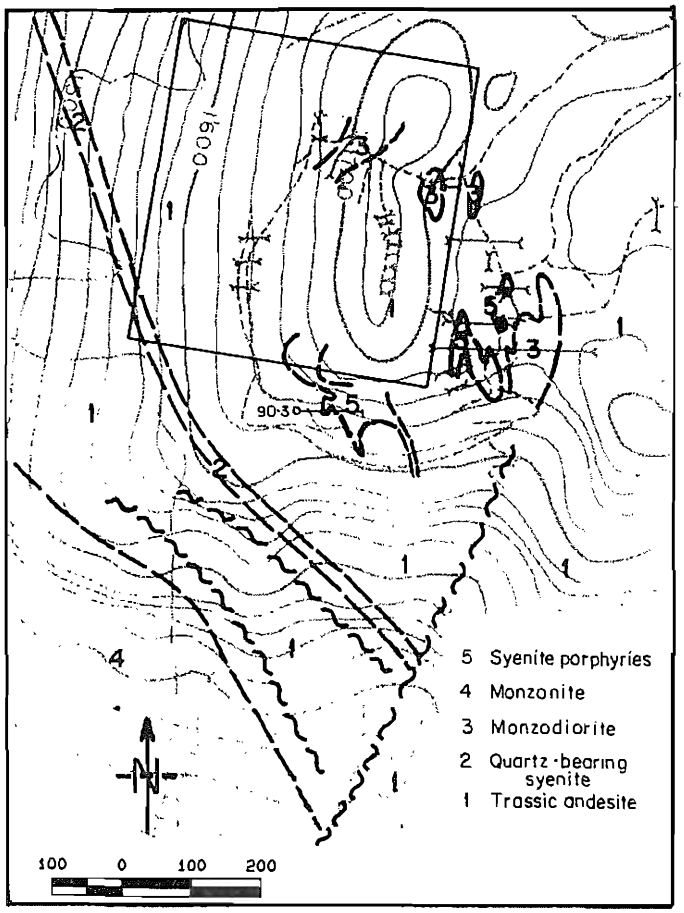

Fig. 4 Soil survey area geology, as mapped to the end of 1990. Note the location of hole 90-3 of Figure 5 is indicated.

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distribution is antipathetic to INAA-K, Ba. This probably reflects the insolubility of potash feldspar in AR as opposed to greater solubility of sericite-clay. More work is needed to relate geochemical results to bedrock mineralogy, but ICP-K anomalies may reflect a peripheral zoning around a potash feldspar core indicated by INAA-K anomalies. Use of a total count scintillometer is suggested for in-field trials to prospect for potasically-altered zones. Airborne geophysical surveys should include radiometrics (K channel).

INAA-Na (Fig. 2B) exhibits depletion (<0.95%) in a "V-shaped" zone, following INAA-Ba and K and corresponding to the "V-shaped" Au-Cu anomaly. Elevated values exceeding 1.55% Na lie on the west and south sides of Cat Mountain, flanking known mineralized zones. Could Na-depleted zones in soils have application to the search for alkalic Au-Cu deposits? This Na depletion is not apparant in the ICP-Na soil data where all Na values are at detection limits. Study of drill core suggests lower INAA-Na values are accompanied by relatively greater ICP-Na levels. INAA-Rb (Fig. 2C) in soils resembles the Th, La (and other REE), Ta, Hf, and Cs patterns which appear due to underlying geology. Continued research into the relationships between ICP and INAA distributions of the same elements may facilitate recognition of anomalies of exploration significance.

General discussion

The above documentation, plus maps not presented in this text, raises the question -which analytical procedure should be recommended for routine application? Optimally, having both sets of data at hand during interpretation would be desirable, but failing that, what method would be selected? Firstly, it is important to recognize that both analytical procedures (including AR-Au determination to compliment the ICP multielement analysis) cost about the same amount as the INAA complimented by AA-Cu. A decision is therefore not cost-controlled but based on element suite, detection limits and turnaround time.

Speed of turnaround favours the AR-ICP method (and the AR or FA method for Au). This must be balanced by the fact that INAA analyzes 3X the sample weight in providing a more representative Au determination. The AR digestion may yield variable Au recoveries, particularly if different laboratories are being compared, and FA results may be adversely affected by matrix and erratic FA reagent blanks. Despite these possible deficiencies, laboratories can provide rush turnaround (perhaps at additional cost) for Au (AR or FA), a feat which cannot be matched by INAA where at least seven days are needed to allow ultra sensitive Na to decay.

ICP or AA analysis is needed to routinely determine Cu, Pb, Zn, Ag, and Mo and leachable Ca, Sr, Mn, and Al data if the quality of a soil or drainage survey needs to be assessed. Elements such as Mg useful in identifying mafic rocks or Mg alteration, or Ni to characterize rock type, and several other elements not readily analyzed by INAA would not be available without ICP analysis.

INAA offers alternative opportunities. Ultramafic and mafic rocks can be indicated by elevated INAA-Cr, Co, Ni, and Sc values and decreased REE values. Rock composition and genetic history can also be determined from distributions of U, Th, REE, and other incompatible elements such as Sc, Hf, Ta, and Cs which are not determined by ICP. Alteration zones can be mapped by identifying INAA-Na depletion and INAA-K and Ba enrichment halos. Faults at Cat Mountain appear well reflected by INAA-W anomalies and INAA-K, Na and Th maps suggest exploration targets which ICP data could not identify. Rb may be indicating sericitized bedrock. Similarly the eastern W anomaly is only weakly apparent amongst ICP data but is strongly evident amongst INAA data. The close relationship between INAA-W, Au, and structure is particularly evident in hole 90-3 (Fig. 5). INAA delivers lower detection limits for As and Sb, and although not needed here for As, for Sb positive correlation is seen with the Cu and Au (at the 1.5 to 3.0 ppm level), which is not seen for ICP-Sb (DL 2 ppm). Distributions of elements not available following an ICP analysis (i.e. Br, Rb, Hf, Ta, Sc, Cs, REE) may have value here, or on other properties.

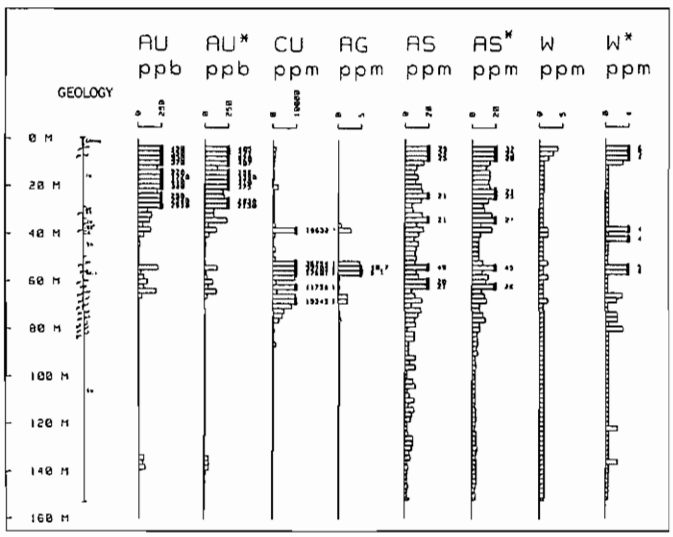

Fig. 5 Drill core lithogeochemistry. Asterisk indicates INAA data. Geological code: 1, 1a Andesite, 5b equigranular syenomonzonite, 6 hybrid intrusive-volcanic. Faults are indicated.

Conclusions

Both analytical methods provide valuable information needed to explore Cat Mountain. The decision as to which approach is used for routine purposes on this or other projects will probably be dictated by management, time considerations and what degree of geological information is required. Turnaround considerations favour the AR-leach , ICP analysis, and AR-Au or FA-Au (note - not all labs are equal). AR-ICP data are also well suited to identifying seepage or remobilized metal in the secondary environment, a need made more important by a failure of the industry to recognize the need to employ samplers trained in the art of soil sampling. The maximum of geologically-related geochemical information and a larger subsample Au value (without the worry of recovery) favours INAA. From a technical viewpoint, one method cannot replace but can only supplement the other.

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Influence of Subsample Size on Pt Recovery: Analytical Pitfalls in Geochemical Exploration for Chromite-Associated Pt Deposits

In the determination of gold, analysis of the largest practical subsample (usually about 30 g for fire assay) is generally considered superior insofar as this provides a more representative sample and hence a more reliable result than a smaller subsample (Harris, 1982). Here we present data on the effects of subsample size in the determination of Pt in chromite-rich materials. The study formed part of the analytical quality control programme of an investigation of the exploration geochemistry of Pt in surficial media associated with the Tulameen ultramafic complex in southern British Columbia (Cook, 1991; Cook and Fletcher, in press).

Seven 10 g and seven 30 g splits of two Pt standards (RK-05 and PT-5) were randomized and inserted as drift monitors in batches of samples submitted to a commercial laboratory for determination of Pt by lead fire assay/ICP-AES. Seven additional subsamples of PT-5 weighing 10 g and seven weighing between 10 and 20 g were included in a second batch. RK-05 was prepared from a pyroxenite by the Geological Survey of Canada (B. Ballantyne, personal communication, 1988). PT-5 was prepared by one of us (WKF) from dunite from the Tulameen ultramafic complex in which Pt occurs mainly as Pt-Fe-Ni-Cu alloys associated with chromite (St. Louis et al., 1986; Nixon et al. 1990; Cook, 1991).

Analytical results are summarized in Table 1 and Figure 1. For RK-05, with a Pt content of about 30 ppb, the difference in Pt content between the two subsample sizes is negligible; however, for PT-5 the median Pt content of 30 g subsamples (325 ppb) is only 73% of that of 10 g samples (median 448 ppb). A t-test confirms that the mean Pt concentrations of the 10 g and 30 g subsamples are significantly different at $P_{0.05}$. Furthermore, analytical reproducibility decreases with increasing sample size. Comparing batch 2 to batch 1 there is a between batch increase in the median Pt values of both the 10 g and 10 to 20 g subsamples; however, Pt values are again significantly lower ($P_{0.05}$) with the larger subsample size.

We attribute the low recovery and poorer reproducibility obtained with larger subsamples of PT-5 to an excessively high sample to flux ratio resulting in incomplete dissolution of refractory chromite grains during the fire assay fusion. A similar problem has previously been described for PGE that remain as inclusions within undissolved chromite rather than entering the

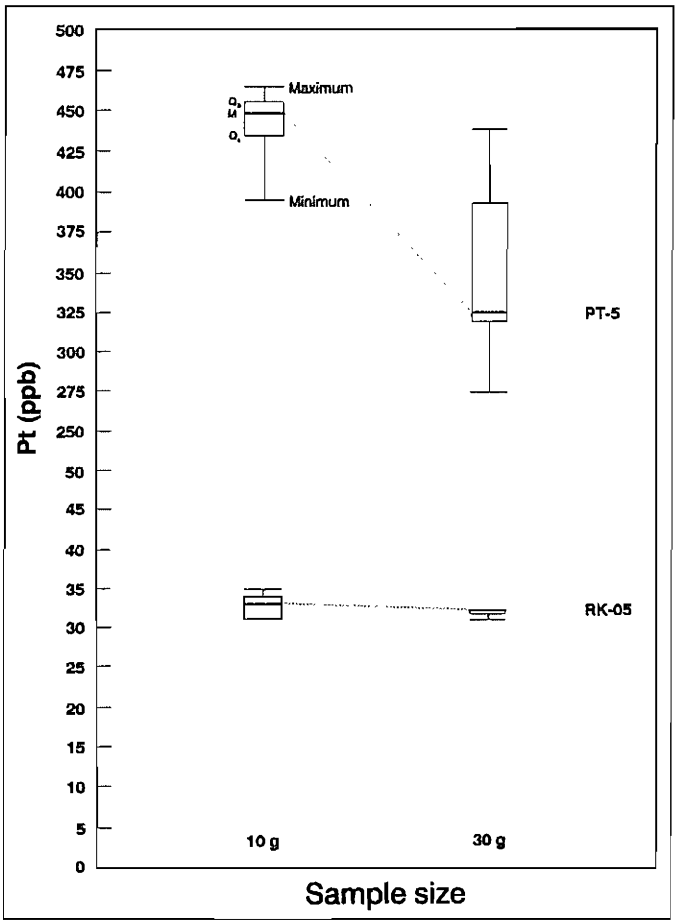

Fig. 1. Boxplots showing variation in Pt concentrations (ppb) of control reference standards RK-05 and PT-5 with increasing size of the analytical subsample. N=7 for each group. Boxplots show median (M), minimum and maximum concentrations for each grouping; fifty percent of the data for each grouping lies within the box between the first quartile (Q1) and the third quartile (Q3).

Table 1. Subsample size: mean + 1s, median and range of Pt (ppb) concentrations of 10 g, 10-20 g, and 30 g subsamples of control reference standards RK-05 and PT-5. N=7 for each group.

Standard	Batch	10 g	10-20 g	30 g
RK-05	1	32.7 ± 1.7[1] 33[2] (31 - 35)[3]		31.7 + 0.5 32 (31 - 32)
PT-5	1	442.1 + 23.4 448 (396 - 465)		352.3 + 58.1 325 (274 - 438)
PT-5	2	511.9 + 29.4 501 (488 - 567)	450.6 + 42.8 447 (385 - 522)	

1. Mean + 1s
2. Median
3. Range (Minimum to maximum)

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flux (Borthwick and Naldrett, 1984; Asif and Parry, 1991). It is apparent that for chromitiferous samples increasing subsample size can actually decrease recovery and analytical reliability for Pt determinations unless precautions are taken to ensure complete decomposition. Various pretreatment methods have been recommended for this purpose (Grimaldi and Schnepfe, 1969; Moloughney, 1986; Hall and Bonham-Carter, 1988; Asif and Parry, 1991) but may not always be feasible in routine geochemical surveys. Exploration geochemical programmes for chromite-associated Pt deposits should therefore always establish the reliability of sample decomposition before starting routine analysis.

The study was supported by funding from the Science Council of British Columbia, the British Columbia Ministry of Energy, Mines and Petroleum Resources, the Geological Survey of Canada, and Placer Dome Inc.. Newmont Exploration of Canada provided geological information on Grasshopper Mountain.

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Geochemical Trends in Weathering Profiles Above Melanocratic Amphibolite, Ibodi Area, Southwestern Nigeria

Abstract

Lateritic profiles above the Ibodi amphibolite are characterized by minerals such as talc, vermiculite, kaolinite, goethite, jarosite, hematite pseudorutile, anatase, rhodochrosite and chromiferous chlorite. They are notably depleted in SiO_2, MgO, but enriched in Al_2O_3, Fe_2O_3 and MnO, with Ni being particularly depleted relative to the rock.

Compositional variations suggest that the lower saprolite zone holds good promise for Ni accumulation with Co, Cr, Mn and Fe rich phases more favorable in the laterite horizon above.

Introduction

The Ibodi melanocratic amphibolite belongs to the mafic-ultramafic complex of southwestern Nigeria (Elueze, 1982). Samples are typically dark coloured, relatively medium grained and composed dominantly of hornblende. Segregations with relict igneous texture are sometimes encountered.

A humid tropical climate is prevalent, and promotes intense weathering in the area. The overlying residual soils show ample structural contiguity with the amphibolite; hence, other than possible creep, the profiles are largely residual.

Compositional Characteristics

Representative samples of the parent rock, laterite, and soil layers were analyzed by a fusion technique using an X-ray fluorescence spectrometer, at the Geology Department, Hamburg University. The mean chemical results are presented in Table 1, while X-ray diffractograms of the rock, laterite and soil depict their mineralogical compositions (Fig. 1).

The X-ray diffractogram for the rock (Fig. 1) portrays prominent peaks of hornblende, chrome-chlorite, antigorite, lizardite and nepowite. The presence of the serpentine minerals suggests that the primary ferromagnesians have undergone some degree of alteration. Diffraction patterns for the laterite and soil depict the minerals kaolinite, vermiculite, talc, goethite and jarosite, which are essentially weathering derivatives.

No bauxite constituent was identified, whereas Fe oxyhydroxides plus ilmenite and clay minerals are distributed throughout the profiles. Mn phases and pseudorutile seemingly occur more prominently towards the base.

An examination of Table 1, shows that relative to the rock, there are depletions of SiO_2, MgO, CaO, Na_2O, K_2O and P_2O_5 in the weathered overburdens which exhibit enrichments in Fe_2O_3, TiO_2 and MnO (cf. Schellmann, 1989). Al_2O_3 is however reduced in the laterite, compared to the rock. This depletion is

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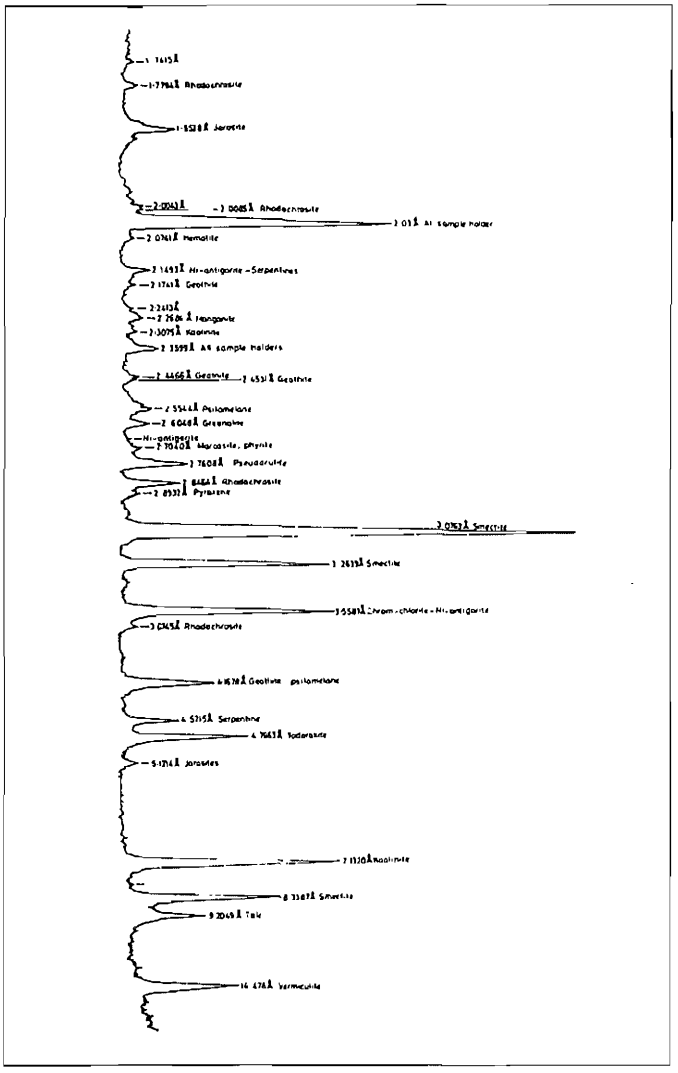

Fig. 1. X-ray trace for typical laterite sample.

apparently reflected by the lower peaks of kaolinite in the X-ray diagram for the laterite, in comparison to the rock and soil. Congruent dissolution of kaolinite may have occurred in the laterite, producing enhancement in Fe_2O_3 with respect to Al_2O_3. The overall dispersion of major elements illustrates an expected pattern, whereby highly immobile components like Fe_2O_3, Al_2O_3, MnO and TiO_2 register maximum values in the upper layer, while MgO and SiO_2 portray minimum contents.

Trace elements, for example Co, Cu, and V are comparatively enriched in the profiles (Table 1). Chrome has essentially retained its rock content in the laterite, and has been slightly enriched in the soil. In terms of interelement relations, the pairs Co-Mn and Co-Fe display intimate association as noted by Topp et al. (1984). These suggest that Co and Mn are related to goethite or jarosite. Although, there is no notable decrease of Cr in the laterite, an enrichment of about 38% is observed in the soil. X-ray curves reveal that the Cr-bearing constitutents are mainly chrome-chlorite and spinels. However, Cr may also be associated with goethite and jarosite, as possibly indicated by the correlation of Cr and Fe.

Relative to the rock, the lateritic profiles are strongly depleted in Ni which is expected to be retained in the serpentines (cf. Zeissink, 1969). The depletion is seemingly due to leaching from the upper layers with possible concentration under favourable pH conditions in the lower saprolite zone that could not be penetrated by pitting. Golighly (1981) has shown that the precipitation or substitution of Ni for Mg requires the migration of Ni-bearing solution from a low to a high pH environment typical of saprolites.

Table 1 Mean Chemical Compositions
Mean Concentrations (%)

	Rock n = 20	Laterite n = 20	Soil n = 20
SiO_2	45.87	43.91	37.60
Al_2O_3	7.79	4.31	11.43
Fe_2O_3g	13.47	25.39	25.26
MnO	0.22	0.45	0.46
MgO	20.82	18.91	8.57
CaO	5.78	1.00	0.99
Na_2O	0.35	0.17	0.23
K_2O	0.20	0.1	0.20
TiO_2	0.91	1.54	2.39
P_2O_5	0.07	0.03	0.10
P	8.2	6.5	6.3
Mean Concentrations (ppm)			
Ba	32.60	47.2	285.2
Co	90.40	100.80	167.60
Cr	2462.60	2295.40	3387.40
Cu	9.20	50.80	267.00
Nb	25.60	35.80	29.00
Ni	956.40	567.80	630.60
Rb	6.80	8.00	26.20
Sr	12.00	0.00	15.40
V	182.20	362.60	375.40
Zn	172.80	266.80	235.60
Zr	113.00	33.00	238.60

Conclusions

Mineralogical data reveal that the Ibodi amphibolite is transformed due to weathering, into lateritic bodies mainly characterized by various hydrated silicates and oxides. Chemical variations are commonly related to mineralogical attributes of the weathered horizons, and indicate essentially the effects of vertical dispersion of elements. In particular, Fe, Cr, Co and Cu show enrichments in the upper, whereas the envisaged lower saprolite horizon has good potential for Ni concentration. Consequently, follow-up study would have these zones as targets for base metals mineralization.

Acknowledgements

The contributions of colleagues and friends at Ibadan and Hamburg, are duly acknowledged with immense thanks.

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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:

- the extent of coverage by systematic geochemical mapping
- airborne gamma-ray spectrometry
- sample media, sampling methods and designs; *establishing relevant geochemical baselines*
- 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 additional information, please contact:

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DATA AVAILABLE

Till Sampling Survey, Fort Frances Area, Ontario.

Geological and geochemical data from the Ontario Geological Survey, Fort Frances Area Till Sampling Survey have been published in *Till Sampling Survey, Fort Frances Area: Results and Interpretation, Ontario Geological Survey Study 56*. The database is now available in either Lotus 1-2-3 (V 2.2) or ASCII-DOS text file formats on 5.25" PC(/MS)-DOS compatible floppy diskettes. The data include descriptive logs from sonic drilling, penetration logs, sampling coordinates, sampling intervals for borehole samples, fine fraction and heavy mineral fraction geochemical data, quality control geochemical data, heavy mineral weight data, gold grain data, heavy mineral identification data, pebble count, grain size and carbonate data. Documentation on each diskette describes individual file contents and formats in an ASCII file (read.me). Data on the diskettes is in the form of a self-extracting LHarc file [©Yoshi, 1989]. One megabyte of disk space is required to use the data files. Requests for data must be accompanied by a self-addressed envelope able to hold a 5.25" diskette. There will be no charge for the diskette.

For more information or to order these data contact:

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Phone (705) 675-4441
CANADA

LOST MEMBERS

The members listed below have recently moved and mail is being returned to the AEG offices. If you have moved recently or if you know the current address of the "lost" individuals, please send an update of address change to:

The Association of Exploration Geochemists
Post Office Box 48270
Bentall Centre
Vancouver, BC V7X 1A1
Canada

Mail has been returned from the following members as of March 5, 1992:

T.J. Cammarata, Seattle, WA, USA
Johannes Hill, Ottawa, ON, Canada
C. Keller, Saskatoon, SK, Canada
M.W. Lewis, Calgary, AB, Canada
Jan Magnusson, Stockholm, Sweden
Peter Megaw, Tuscon, AZ, USA
J.D. Reeve, Whitehorse, YT, Canada
D.E. Robertson, Reno, NV, USA
G.J. Walton, North Vancouver, BC, Canada
S. Weekes, Halifax, NS, Canada

UPCOMING MEETING

U. S. Geological Survey Conference on the Mineral Resources of Puerto Rico, June 22-26, 1992

The United States Geological Survey (USGS), the Puerto Rico Department of Natural Resources (DNR) and the University of Puerto Rico at Mayaguez are pleased to sponsor a public meeting detailing the results of a Mineral Resource Assessment of Puerto Rico at the Condado Beach Hotel, San Juan, Puerto Rico. Topics will include base and precious metals, offshore sand and gravel deposits, other industrial minerals, and coal. The meeting is open to all interested parties, especially those interested in the economic geology and mineral resources of the Caribbean.

MEETING SCHEDULE

June 22, 1992:
Check-in and an informal evening get-together (cash bar)
June 23-24, 1992:
Oral and poster presentations
June 25, 1992:
Field trip

ACCOMMODATIONS

A block of rooms has been reserved for meeting participants at the Condado Beach Hotel. For further information on costs and reservations contact S. Marsh (address below). There will be no fee for the meeting sessions or the field trip.

FIELD TRIP

A one-day field trip on June 25, 1992 will visit several localities of geological interest, many of which will have been discussed in the talks and posters during the prior two days. The trip will depart from the Condado Beach Hotel at 8:00 AM and will return at approximately 7:00 PM. Buses will transport participants south to Ponce and then west to Mayaguez returning through the heart of the karst topography to San Juan. There will be no fee for the field trip, but a nominal charge will be collected on-site for lunches. Most stops will be along roads. Cameras, hat, sunscreen, and suitable footwear are recommended. Sample bags and a few rock hammers will be available. *Attendance will be limited to the first 90 registrants.*

For further information or to obtain registration forms please contact:

Mr. Sherman P. Marsh
U.S. Geological Survey, MS 973
Denver Federal Center
Denver, CO 80225
USA
TEL: (303) 236-5521
FAX: (303) 236-3200

1993 SEG Conference

Integrated Methods in Exploration and Discovery

Announcement of Short Courses, Workshops, and Field Trips

The 1993 Conference **INTEGRATED METHODS IN EXPLORATION AND DISCOVERY**, sponsored by the Society of Economic Geologists and co-sponsors the Association of Exploration Geochemists, the Society of Exploration Geophysicists, and the U.S. Geological Survey, will be held in Denver, Colorado, on April 17-20, 1993. The conference will highlight advances in effective integration of technology with experience in mineral exploration and development. Short courses, workshops, and field trips will be offered both before and after the conference in addition to the four days of oral and poster presentations, forums, and exhibits. The entire program will focus on the geology, geochemistry, and geophysics of mineral deposits and their use in exploration and development, with an emphasis on the integration of technology and field operations.

The short courses, workshops, and field trips will provide unique hands-on training opportunities for professionals in industry, academia, and government. Among the topics to be presented at the conference are:

1) The Environmental Geochemistry of Mineral Deposits. Conveners are Geoffrey Plumlee (USGS), Mark Logsdon (Adrian Brown Consultants), and Lorraine Filipek (Denver Knight Piesold).

2) Applications of Geographic Information Systems in Mineral Deposit Modelling and Resource Assessment. Conveners are Charles Trautwein (USGS-EROS Data Center), Robert Bruce (Colorado School of Mines), and James Elliott (USGS).

3) Ore Reserve Estimates in the Real World. Instructors are John Stone (Consulting Geologist) and Peter Dunn (Consulting Geologist).

4) Geophysical Map Interpretation on the PC. Instructors are Tien Grauch, Donald Hoover, James Pitkin, K. Eric Livo, and Anne McCafferty (all USGS).

5) Henderson and Leadville Mine Tours. The SEG Guidebook Volume 2 on the Leadville district as well as information about Henderson will be given to participants.

6) Underground Mine Mapping. Leaders for this workshop are William Atkinson (University of Colorado), James Paschis (Advanced Sciences, Inc.), and Martin Nelson (Consulting Geologist).

7) Geochemical Exploration for Base and Precious Metals. Instructors are L. Graham Closs (Colorado School of Mines), R.K. Glanzman (CH2M Hill), and J.A. Jaacks (Westmont Gold Inc).

8) Practical Geophysical Methods for Geologists in Mineral Exploration. Instructors are Jack Corbett (Consulting Geophysicist) and Kenneth Zonge (Zonge Engineering and Research).

9) Epithermal Geochemistry of Volcanic-Hosted Precious Metal Deposits. Instructors are Arthur Panze (Cruson & Panze, Geologists) and Miles Silberman (USGS).

10) Becoming an Independent Contractor or Consultant. Convener is Douglas Silver (Balfour Holdings).

All of these sessions are offered in order to promote interdisciplinary exchange of technology and information, provide training opportunities, and to attack the problem of future mineral supply. Look for additional information on registration and fees for the 1993 SEG Conference in the Fall issue of **EXPLORE**.

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The following special volumes are available from the AEG on a post-paid basis (surface mail) to all. Both member and non-member prices are listed.

Sp. Vol. No.	Description	Member Price	Non-Member Price	
4	Application of Probability Plots in Mineral Exploration (A.J. Sinclair)	US $ 8.00	US $ 12.00	
7	Geochemical Exploration 1977 Proceedings of the Denver Geochemical Symposium (ed. J.R. Waterson and P.K. Theobold)	US $ 20.00	US $ 40.00	
10	Gold-81, Precious Metals in the Northern Cordillera (ed. A.A. Levinson)	US $ 7.50	US $ 18.00	
11	Exploration Geochemistry Bibliography to January 1981 (compiled by H.E. Hawkes)	US $ 10.00	US $ 20.00	
11.1	Exploration Geochemistry Bibliography Supplement 1 to Oct. 1984 (compiled by H.E. Hawkes)	US $ 10.00	US $ 17.00	
11.2	Exploration Geochemistry Bibliography Supplement 2 to Oct. 1987 (compiled by H.E. Hawkes)	US $ 10.00	US $ 17.00	
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14 *	PROBPLOT, An Interactive Computer Program to Fit Mixtures of Normal (or Log Normal) Distributions with Maximum Likelihood Optimization Procedures (C.R. Stanley) Graphic card type _____ ; e.g., CGA, EGA, Hercules) 8087 chip (Y/N) _____	US $ 30.00	US $ 55.00	
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4 + 14*	Combination offer	US $ 35.00	US $ 60.00	
PRICE REDUCED	GEOEXPO/86, Proceedings of an exploration symposium focussing on Cordilleran environments held in Vancouver May 12-14, 1986 (ed. I.L. Elliot and B.W. Smee)	US $ 25.00	US $ 25.00	
—	Reviews in Economic Geology Volume 3. Exploration Geochemistry; Design and Interpretation of Soil Surveys (ed. W.K. Fletcher) This volume was co-sponsored by the SEG.	(to USA) US $ 20.00 (Foreign) US $ 23.00	US $ 25.00 US $ 28.00	
—	1992 AEG Membership Listing and Directory of Exploration Geochemical and Environmental Services	US $ 10.00	US $ 20.00	
—	Journal of Geochemical Exploration for 1991 (Volumes 39-41) for 1990 (Volumes 36-38) for 1989 (Volumes 34-35)	US $ 50.00 US $ 50.00 US $ 50.00	N/A N/A N/A	
	AEG T-Shirt Size: ☐ S ☐ M ☐ L ☐ XLG Colour: ■ Royal blue - white print ■ Grey - ice green print ■ White - rich blue print	US $ 10.00	US $ 12.00	
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—	Epithermal Gold Mineralization of the Circum-Pacific; Geology, Geochemistry, Origin and Exploration, Volumes 1 and 2. Journal of Geochemical Exploration, Volumes 35 and 36: (Hard-Covered Edition)	US $ 160.00	US $ 246.25	
NEW ITEM	14th Prague IGES Abstracts Volume, 262 pp	US $ 25.00	US $ 50.00	
NEW ITEM	Geochemical Exploration 1990, Proceedings Volume, 14th Prague IGES, 425 pp	US $ 40.00	US $ 50.00	
NEW ITEM (for AEG)	Soils of the World. Colour wall chart. 95 cm x 135 cm in size. Published by Elsevier.	US $ 22.00	US $ 28.00	
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Upcoming Meetings

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16th International Geochemical Exploration Symposium

The Association of Exploration Geochemists, the Geological Society of China, and the China Association for Science and Technology invite you to attend the 5th Chinese Exploration Geochemistry Symposium (CEGS), from September 1-2, 1993, and the 16th International Geochemical Exploration Symposium (IGES) from September 3-5, 1993, in Beijing, China. The official language of the 16th IGES is English. For the 5th CEGS, texts and figures in all presentations will have Chinese and English titles. English versions of each oral presentation will be available for foreign participants. Synchronous translation is also available.

A call for papers is extended, with sessions and poster presentations planned for the following topics:

1. Geochemical exploration for gold and other precious metals.
2. Geochemical exploration methods in different geological and geographical environments.
3. Geochemical exploration for blind and buried ore deposits.
4. Geochemical exploration for oil gas, and geothermal fields.
5. Environmental and agricultural geochemistry.
6. Regional geochemistry and international geochemical mapping.
7. Analytical techniques.
8. Data processing and interpretation of geochemical data.
9. Integrated methods in exploration and discovery.

Extended Abstracts, upto 600, words should be sent to Prof. Zheng Kangle at the 16th IGES Office by February 1993.

Workshops are scheduled for the topics:

1. Progress in Environmental Geochemical Exploration, led by Dr. I. Thorton, Center for Environmental Technology, Imperial College (US$25).
2. International Geochemical Mapping, led by Dr. A.G. Darnley, Geological Survey of Canada (US$25).
3. Analytical Methods in Exploration Geochemistry, led by Dr. Gwendy E.M. Hall, Geological Survey of Canada (US$25).
4. Applied Biogeochemical Prospecting, led by Drs. C.E. Dunn, G.E.M. Hall, and R. Scagel, Geological Survey of Canada (US$25).

A short course on Geoanalysis in Environmental Geochemistry, Geochemical Mapping, and Mineral Exploration will be conducted by Professor Qian Desun, Central Laboratory of Anhui Provincial Bureau of Geology and Mineral Resources (US$150).

Five excursion routes will by arranged for the post-symposium period:

1. Beijing-Dunhuang-Urumqi-Fuyun-Beijing, a six-day trip (US$1100)
2. Beijing-Hohhot-Baotou-Bayan Obo-Beijing, a six-day trip (US$580).
3. Beijing-Jinan-Taian-Yantai-Shanghai, a seven-day trip (US$715).
4. Beijing-Xi'an-Guilin-Liuzhou-Dachang-Guilin, a seven-day trip (US$920).
5. Beijing-Chengdu-Lhasa-Yangbajin-Beijing, an eight-day trip (US$1540).

If paid before June 30, 1993, registration fees are:

AEG members: ..... US $160
Non AEG members: ..... US $210
Accompanying members: ..... US $48
Exhibitors: ..... US $48

Correspondence with the organizing committee can be directed to:

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Beijing 100037
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NOW AVAILABLE:

Notes for a short course on methods of biogeochemical and geobotanical prospecting - with emphasis on arid terrains:

BIOGEOCHEMICAL EXPLORATION - SIMPLIFIED

by C.E. Dunn, J.A. Erdman, G.E.M. Hall, and S.C. Smith

(Course sponsored by the Society for Mining, Metallurgy, and Exploration: Phoenix, Arizona, 22-23 February, 1992)

AEG members may now obtain from the Vancouver address these short course notes, comprising over 200 pages of text, tables, and figures. The section of geobotanical exploration includes 21 full color plates illustrating the plants and features of significance in arid terrains. The discussion of biogeochemical methods is a guide to the procedures and precautions that need to be employed in desert environments, and also includes information and examples from the forested regions of North America. A comprehensive resume of analytical methods in biogeochemical exploration is given. One case history from Nevada is described in detail, and abstracts to a number of others are included.

Order from: ***Association of Exploration Geochemists, Bentall Centre, PO Box 48270, B.C. V7X 1A1, Canada. Cost: US$50, Post paid (surface mail)***

CALENDAR OF EVENTS

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

■ Apr. 22-24, '92 Geology in Europe and beyond (**Mineral deposit modelling** in relation to crustal reservoirs of the ore-forming elements, Nottingham, England (The Conference Office, The Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, United Kingdom; TEL: (071) 580 3802; FAX: (071) 436 5388; abstracts deadline, Jan 10, '92)

■ May 3-8, '92, Forum on the geology of **industrial minerals**, ann. mtg., Martinsburg, W. Va. (Claudette Simard, West Virginia *Geological and Economic Survey, Box 879, Morgantown, WV,* 26507-0879 USA; TEL: (304) 594-2331; FAX: (304) 594-2575)

■ 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, 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, NF, A1B 4J6, Canada, TEL: (709) 729-2171; FAX: (709) 729-3493)

■ May 17-20, '92 Dredging and **placer mining**, mtg., Sparks, NV (Yung Sam Kim, Nevada Institute of Technology, Box 8894 Campus Station, Reno, NV 89507 USA; TEL: (702) 673-4466)

■ 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)

■ June 15-17, '92 First Thematic Conference on **Remote sensing for marine and coastal environments**:, New Orleans, Louisiana (Nancy Wallman, ERIM, Box 134001, Ann Arbor, MI 48113-4001 USA, TEL: (313) 994-1200 ext 3224, FAX: (313) 994-5123.

■ July 19-22, '92 Second International Symposium on **Mining in the Arctic** (Dr. Sukumar Bandopadhyay, Chairman, 108 Brooks Building, University of Alaska Fairbanks, Fairbanks, Alaska 99775. TEL: (905) 474-6876).

■ Aug. 10-14, '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, U.S. Geological Survey, 2800 Cottage Way, Room W-2235, Sacramento, CA 95825, TEL: (916) 978-4648; FAX: (916) 978-5529; or David Blowes, Waterloo Center for Groundwater Research, University of Waterloo, Waterloo, ON, N2L 3G1, Canada, TEL: (519) 885-1211, ext. 6997; abstract deadline is March 1, 1992, 200 words or less, on ACS forms)

■ 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)

■ Aug. 29-Sept. 1, '92, **GeoTech '92** Geocomputing Conference (GeoTech c/o ExpoMasters Contract Station 19, P.O. Box 207, Denver, CO 80231; TEL: (303) 752-4951, FAX (303) 752-4979).

■ Sept. 2-4, '92 **Arctic margins**, int'l mtg., Anchorage, Alaska, by Alaska Geological Society (David Steffy, U.S. Minerals Management Service, 949 E. 36th Ave., Anchorage, AK, 99508 USA; TEL: (907) 271-6553; FAX: (907) 271-6805; abstracts deadline, Feb. 1)

■ Sept. 13-18, '92 **Geostatistics**, mtg., Troia, Portugal (Amilcar Soares, Centro de Valorizacao de Recursos Minerais, IST Av. Rovisco Pais, 1096 Lisbon, Portugal, FAX: (351) 1-8486935)

Oct. 12-16, '92 Energy, environment and technological innovation, int'l mtg., Rome, by Universidad Central de Venezuela, and Universita di Roma (Secretaria CPA, Comision de Promocion Academica, Facultad de Ingenieria, Universidad Central de Venezuela, Edf. Decanato, Caracas, 1050, Venezuela; TEL: (58) 2-6627538; FAX: (58) 2-6627327)

■ Oct. 26-29, '92 Geological Society of America, ann. mtg., Cincinnati (Vanessa George, GSA, Box 9140, Boulder, CO 80301, TEL: (303) 447-2020)

■ Feb. 8-11, '93 Geologic **remote sensing**, mtg., Pasadena, CA (Nancy J. Wallman, ERIM, Box 134001, Ann Arbor, MI, 48113-4001 USA; TEL: (313) 994-1200, ext. 3234; FAX: (313) 994-5123)

■ Apr. 17-20, '93 **Integrated Methods in Exploration & Discovery**, Conference, by the Society of Economic Geologists, Society of Exploration Geophysics, and others, Denver, CO (J. Alan Coope, SEG Conference '93, Box 571, Golden, CO 80402 USA; TEL: (303) 837-5819; FAX: (303) 837-5851)

■ 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. 3-5, '93 **16th International Geochemical Exploration Symposium**, and Sept. 1-2, '93 **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)

■ Sept. 25 - Oct. 1, '93 International Association of Volcanology and **Chemistry of the Earth's Interior**, mtg., Canberra, Australia (IAVCEI ACTS, GPO Box 2200, Canberra ACT 2601, Australia, TEL: (61) 6-257-3299; FAX: (61) 6-257-3256)

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RECENT PAPERS

This list comprises titles that have appeared in major publications since the compilation in **EXPLORE** Number 74. Journals routinely covered and abbreviations used are as follows: Economic Geology (EG); Geochimica et Cosmochimica Acta (GCA); the USGS Circular (USGS Cir); and Open File Report (USGS OFR); Geological Survey of Canada Papers (GSC Paper) and Open File Report (GSC OFR); Bulletin of the Canadian Institute of Mining and Metallurgy (CIM Bull); Transactions of Institute of Mining and Metallurgy, Section B: Applied Earth Sciences (Trans IMM). Publications less frequently cited are identified in full. Compiled by **L. Graham Closs**, Department of Geology and Geological Engineering, Colorado School of Mines,

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Recent Papers

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Golden, CO 80401, Chairman AEG Bibliography Committee. Please send new references to Dr. Closs, not to **EXPLORE**.

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

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