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EXPLORE

Newsletter for the Association of Exploration Geochemists

NUMBER 99 MAY 1998

PRESIDENT'S MESSAGE

Peter Simpson

One of the great advantages of membership in specialised and well focussed and professionally managed societies such as the Association of Exploration Geochemists is the frequent opportunities for stimulating contact with fellow members on matters of common concern and interest. Council Members also benefit greatly from the Council Meetings organised by our Secretary Sherman Marsh through tele-conference calls which are invaluable for discussing issues and problems that are better resolved in *conference than by correspondence.*

Four interrelated issues of crucial importance to the AEG Membership have been at the top of the AEG Officers' and Council's agenda over the last few months:

1) The flow of papers for publication in Journal of Geochemical Exploration (JGE) and EXPLORE,
2) Negotiations and outcome of a new publication agreement for the Journal of Geochemical Exploration (JGE) in 2000 and beyond ,
3) A name change for our journal, combined with an extended range of topics with strong emphasis on geochemical exploration, and
4) Finalising of details for the 19th International Geochemical Exploration Symposium (IGES), Vancouver in 1999.

The first item concerns, most importantly, the need to increase the scope and the flow of good quality papers for the JGE and for our newsletter EXPLORE. These publications are the public expression of our group identity and point of view in the world and much time and effort is therefore put in by teams of dedicated volunteers, including co-editors, reviewers and office staff to help make them as interesting, informative and readable as possible. This effort is rewarded by the attainment of a very respectable JGE Institute of Scientific Information (ISI) Citation Index of 1.85 for the period 1991-1995, which is a good measure of the value and use to which our publications are put by the user community.

The Journal, under Eion Cameron's editorship, has typically relied in the past on the publication of a series of top quality Special Issues, edited by experts in the chosen field of interest, interspersed with volumes containing peer-reviewed general papers on a wide range of topics.

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ANALYST'S COUCH

Determining palladium: are you recovering all Pd when dissolving a Ag prill?

By GWENDY E.M. HALL and J.C. PELCHAT

Together with Au and Pt, Pd is usually determined in geological materials by Pb fire assay combined with a wet chemical technique such as ICP-AES or ICP-MS (Hall and Bonham-Carter, 1988; Hall, 1992). Separation and preconcentration of the analytes is the role of the fire assay procedure which produces a Ag prill ready for dissolution in a combination of the acids, HNO_3 and HCl. The authors previously demonstrated the capability of this method, using ICP-MS as the analytical technique, with data obtained during the certification of the GSC/Canmet PGE control reference materials (CRM) TDB-1, WGB-1, WPR-1, WMG-1, WMS-1 (Hall and Pelchat, 1994). In this paper, it was pointed out that Pd results could be low if the conditions recommended for dissolution of the Ag prill were not adhered to. The procedure is as follows:

- To the Ag prill (ca 3 mg) in a graduated test-tube, add 0.5 ml of 3.2 M HNO_3 and place in a water-bath at 90°C for 30 min;
- Add 0.5 ml of 2.4 M HCl to precipitate excess Ag as AgCl and carry on heating for 15-20 min (otherwise loss of Pd was found to occur);
- Make up to 5.0 ml with water, mix, centrifuge off solution, decant into another test-tube, make up to the mark and analyse.

This method produced a detection limit of 0.5 ppb Pd for a 10-g sample and a precision of 3-10% relative standard deviation in the range 20-1300 ppb Pd. It was indicated that full coagulation of the AgCl precipitate was desired for complete recovery of Pd. Recently, changes

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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 5- or 3-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 J.T. Nash, 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 1200 geologists, geophysicists, and geochemists. Additionally, 100 copies are sent to geoscience libraries. Complimentary copies are often mailed to selected addresses from the rosters of other geoscience organizations, and additional copies are distributed at key geoscience symposia. Approximately 20% of each issue is sent overseas.

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 15% 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, Vivian Heggie, Heggie Enterprises.

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EXPLORE

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Past-President's Message

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EXPLORE on the other hand is continually seeking informative, newsy and topical items of interest to the membership generally. The message from both the Journal and **EXPLORE** should therefore be interpreted by all members (and others) as an open invitation to put in that extra effort and polish up that manuscript or topical news item and submit it to the editors for review and publication.

Gwendy Hall, our new Editor in Chief who takes over on Eion's retirement this year, has reorganised the JGE's Ottawa Office on Anne Brown's retirement. We are all very grateful to Anne for the many years of dedicated service to the JGE. We are very pleased to welcome Marcia Scrimgeour who will run this office in future under Gwendy's direction and she is now readily contactable at email: JGE@compmore.net. Authors will be guaranteed a fast turnround of reviewed manuscripts which should help to speed the written word into print.

The negotiations for a new agreement for JGE with Elsevier, to commence in 2000 are now at an end. The AEG negotiating team initially prepared an outline of essential requirements for a new agreement which are based on AEG's experience and difficulties with the present agreement. These have been discussed in great detail in **EXPLORE No 97**. The aspect of greatest concern to your Council was the alarming and sudden drop in Institutional Subscriptions (libraries), which resulted directly from the 52% subscription increase in US dollar terms imposed by the publishers between 1995 and 1997.

It soon became clear that AEG representatives, negotiating in good faith, were never going to achieve either of the principal objectives established in the re-evaluation of the current agreement with Elsevier. These consisted of an urgent need to make a significant reduction of institutional subscription prices to levels comparable with those charged by similar journals. In view of the previous history of problems over institutional subscrip-

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President's Message

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tions and intimations of large price rises in the pipeline for members also, it appeared that a share in the Copyright would necessary to ensure that the AEG had adequate control in the future management of the Journal. For example, all of the efforts by the Editorial team to increase and restore cancelled institutional subscriptions by improving and extending the Journal, would be at risk if AEG did not have control over the pricing mechanisms for both institutions and members.

Following lengthy discussion on this topic at two Council Meetings, a unanimous decision was reached to advise Elsevier, that with the deepest regret, and in spite of the long and generally mutually beneficial relationship, *"the Association of Exploration Geochemists does not wish to enter into a new agreement at the end of the current agreement. The Association of Exploration Geochemists will continue to honour all existing commitments under the current agreement, which remains in force until 31 December 1999."*

Because Elsevier will retain the copyright to the current JGE title, new arrangements will have to be made by your Council to meet the AEG's requirements for publication of the Association's new journal starting in 2000 and beyond. A change of name will be necessary and the AEG will take that opportunity to develop and extend the scope for the new journal. Several new titles have been suggested already. In addition there is an opportunity to review the future and increasingly diverse opportunities which are becoming available for publication of both hard and electronic copy. A minimum of two years will be required to recover the AEG's very respectable existing ISI ratings and rebuild a portfolio of library subscriptions, during this period the support and loyalty of AEG members and others to the new journal will be very important for its success.

The range of topics for papers in the new journal could include some or all of the following:-

1) Exploration (including geochemistry with geology and geophysics, especially integrations of all three topics) for economic mineral deposits, including precious metals, base metals, energy minerals, bulk minerals;
2) Envirogeochemistry, integrated with geology and geophysics, where relevant, and including planning for mine closure;
3) Lithogeochemistry;
4) Hydrogeochemistry;
5) Biogeochemistry;
6) Gas geochemistry, especially for detection of deeply buried or blind orebodies;
7) Fluid inclusion studies for mineral exploration – for example large hydrothermal ore deposits are generally associated with host rocks containing abundant fluid inclusions whereas barren host rocks are generally devoid of such inclusions;
8) Mineral Deposit Modelling - This topic is usually classified in terms of typological parameters only and needs to be re-evaluated and redefined for exploration purposes in relation to measurable and detectable geoscientific signatures which can be identified in regional geological, geochemical and geophysical databases;
9) Regional and Global Geochemistry – Especially Global Geochemical Baselines, with particular reference to exploration, environment and legislative developments;
10) New technological and analytical developments, partial extraction techniques and current laboratory research relevant to exploration and the environment;
11) Special Topics - Adaptation of geochemical methods to local environments, such as those characterised by deeply weathered and old continental platforms and others including northern / subarctic and permafrost environments;
12) Case Studies – from company reports, government and university sponsored research;
13) Results of current university theses and research contracts;
14) Geochemical exploration and environmental technology transfer to developing countries;
15) Legal aspects, and quality assurance with implications for exploration and the environment from both national and global perspectives.

Perhaps of most immediate interest to the members, arrangements for the 19th International Geochemical Exploration Symposium in Vancouver 11-16 April 1999, have been agreed by the Organising Committee. The second circular will shortly be circulated, so put this in your diary straight away and start making your plans to come to this meeting. Strong links to important local meetings have also been organised through the personal initiative of members, such as the Geological Society of Nevada (GSN) Symposium entitled: Geology & Ore Deposits 2000 – The Great Basin and Beyond to be held May 14-19, 2000 in Reno, Nevada (Phone:702-323-3500, email:gsnsymp@nbmg.unr.edu). Shea Clark Smith writes 'More than any other co-sponsor, the AEG could draw the largest international audience to the meeting.' There must be other meetings where our local network of Regional Councillors could help develop similar linkages with AEG

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President's Message

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and our publications? Looking further into the future, plans are underway, led by Dr John Farmer of Edinburgh University (email:jgfarmer@ed.ac.uk), to hold the 6th International Symposium on Environmental Geochemistry in Edinburgh in 2003. Hopefully for maximum attraction, this will be strategically organised in relation to the Festival.

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EXPLORE NEEDS YOU!!!!!!

- Your articles
- Your science
- Your thoughts
- Your ideas
- Your help

Send your short articles to one of the editors and it will probably be published in the very next issue. And, don't forget to think *COLOR*. We would like to have color-oriented articles for upcoming color issues.

Analyst's Couch

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were introduced to simplify the dissolution procedure. Rather than requiring two test-tubes in the process outlined above, only one was used by eliminating the decantation step after centrifuging off the AgCl preciptate. Secondly, the strength of HCl was increased, from 2.4 to 4M (a concentration used in other lab procedures). These changes resulted in low recoveries for Pd in the CRMs inserted to monitor quality. Thus, a small project was carried out to identify the critical parameters.

Fifteen 10-g samples of the well characterised and homogenous CRM, TDB-1 (a diabase) were sent to Acme Laboratories (Vancouver, Canada) for fire assay preparation to the Ag prill stage. Prills representing blank flux reagents were also prepared. Dissolution and ICP-MS analysis was then carried out at the GSC under various experimental conditions. The first part of the process was not changed: a 0.5-ml aliquot of 3.2M HNO_3 was added to each prill in a Fisher-brand polypropylene calibrated 15-ml test-tube, and the mixture heated at 90°C in a water bath for 30 min. Then a 0.5-ml aliquot of HCl of different strengths was added to the test-tube which had been cooled to about 30-40°C on the bench top. The test-tube was returned to the water bath for ca 20 min to ensure complete coagulation of the AgCl. The variations on the procedure are as follows:

Method 1 Strength of HCl, 4M. After cooling, the solution is made to 10 ml with water, centrifuged after mixing and analysed without decanting (i.e. precipitate still present).
Method 2 Strength of HCl, 4M. After cooling, the solution is made to 5 ml with water, centrifuged after mixing and transferred to new polypropylene test-tube. It is made up to 10.0 ml with water and analysed.
Method 3 As Method 2 but 4.5M HCl was used.
Method 4 As Method 2 but 6M HCl was used.
Method 5 As Method 2 but 2.4M HCl was used.
Method 6 As Method 2 but 2M HCl was used.
Method 7 As Method 5 but the solution is not cooled between acid additions.

ICP-MS conditions have been described previously (Hall and Pelchat, 1994).

Results for Pd, Pt and Au in TDB-1 are presented in Table 1, together with data for spiked solutions of reagents where the equivalent of 10 ppb of analyte had been added at the beginning of the dissolution procedure. For the spiked solutions, 3 mg of Ag were added (as $AgNO_3$ solution) to the 0.5 ml of 3.2M HNO_3 in the test-tube to simulate a Ag prill. Recoveries of Pd in TDB-1 by Method 1 are extremely low, at 11-21% of the certified value (22.4±1.4 ppb). Values for Pt and Au are acceptable, as are those for the 10 ppb duplicate spiked solutions. Slightly higher results for Pd in TDB-1 are achieved by separating

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Analyst's Couch

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Table 1

Results for Pd, Pt and Au in TDB-1 and spiked solutions using different methods to dissolve the Ag prill; analysis by ICP-MS.

	TDB-1			Spike at 10 ppb		
Dissolution method	Pd	Pt	Au	Pd	Pt	Au
(1) 0.5 ml 3M HNO_3 \ 0.5 ml 4M HCl, up to 10 ml, centrifuge, no decanting	2.4, 4.7	4.5, 4.0	6.5, 5.5	10.0, 10.0	9.9, 10.0	9.9, 10.0
(2) 0.5 ml 3M HNO_3 \ 0.5 ml 4M HCl, up to 5 ml, centrifuge, transfer, to 10 ml	8.6, 7.1, 5.3	4.1, 4.7, 4.7	5.0, 6.3, 6.5	10.0, 10.0	10.0, 10.0	10.0, 10.0
(3) 0.5 ml 3M HNO_3 \ 0.5 ml 4.5M HCl, up to 5 ml, centrifuge, transfer, to 10 ml	13.3, 5.5	3.6, 4.4	5.8, 6.1	9.7, 9.5	9.5, 9.5	9.7, 9.7
(4) 0.5 ml 3M HNO_3 \ 0.5 ml 6M HCl, up to 5 ml, centrifuge, transfer, to 10 ml	10.6, 10.5	4.1, 4.1	5.6, 6.1	9.4, 9.3	9.0, 9.1	9.5, 9.6
(5) 0.5 ml 3M HNO_3 \ 0.5 ml 2.4M HCl, up to 5 ml, centrifuge, transfer, to 10 ml	23.0, 23.3	5.1, 5.1	6.3, 5.8	10.2, 10.2	10.3, 10.4	10.0, 10.1
(6) 0.5 ml 3M HNO_3 \ 0.5 ml 2M HCl, up to 5 ml, centrifuge, transfer, to 10 ml	23.9, 23.3	4.8, 5.5	7.1, 6.2	10.1, 10.0	10.0, 10.1	9.5, 9.6
(7) as (5) but don't allow sample to cool between acid additions between acid additions	23.4, 23.7	5.2, 4.9	7.0, 6.6			
Certified values	22.4±1.4	5.8±1.1	6.3±1.0			

the AgCl residue from the analyte solution but recoveries are only 32-38%. Increase in HCl strength, from 4 to 4.5 and 6M (Methods 3 and 4), increases Pd values, though they remain unacceptable. High HCl concentration appears to reduce slightly the recovery of Pt in TDB-1 and in the spiked solutions. Reduction of HCl concentration in the 0.5 ml aliquot, to 2.4 and 2M (Methods 5 and 6) achieves full recovery of Pd in TDB-1, in the 23-24 ppb range. Results for Pt and Au are also excellent. Whether the solution is cooled prior to HCl addition doesn't appear to have any effect: results by Methods 5-7 agree well. It is the HCl concentration that is critical for Pd.

The good recoveries of the synthetic spiked solutions are somewhat puzzling. However, previously when the changes had just been introduced, it was the low recoveries of Pd in the spiked solutions which first alerted us to this problem. Under those conditions, the solutions had been allowed to sit in contact with the AgCl precipitate for 3-6 hours. It is thought that low recovery for Pd would also have been encountered here if the mixture in Method 1 (Table 1) had been left longer prior to analysis. Perhaps it is the excess NO_3^- (from the $AgNO_3$ solution added) in solution which causes Pd in the spike solutions to be more stable than that in the TDB-1 digested prill solutions.

The 'lost' Pd in the TDB-1 solutions was thought to be in the AgCl precipitates, and not on the walls of the test-tubes. This was verified by dissolving the AgCl residues remaining in the three test-tubes used in Method 2. About 0.1 ml of concentrated NH_4OH solution was added to each precipitate to dissolve it (instantaneous on swirling), followed by 0.5 ml of 2.4M HCl to again form

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Analyst's Couch

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the precipitate. The solution was made up to 10 ml in 1% HNO_3, centrifuged, decanted and made up to the 10.0 mark for analysis. Acid (1% HNO_3), rather than deionised water, was used to counter the alkalinity of the NH_4OH. Table 2 shows the results for Pd, Pt and Au in these solutions. Clearly the 'lost' Pd was residing in the AgCl precipitate. Total Pd for each sample - the sum of that found first in solution and then in the precipitate - agrees well with the certified value of 22.4 ppb. A small amount of Pt (0.3 ppb) was also found in the precipitate but Au was not detectable.

Table 2
Results for Pd, Pt and Au in three samples of TDB-1 where each Ag prill was dissolved ('in soln') by Method 2 (Table 1) and the AgCl precipitate redissolved for analysis ('in ppt')

	Pd, ppb		Pt, ppb		Au, ppb	
	In soln	In ppt	In soln	In ppt	In soln	In ppt
TDB-1	8.6	14.0	4.1	0.25	5.0	<0.1
TDB-1	7.1	17.4	4.7	0.35	6.3	<0.1
TDB-1	5.3	18.6	4.7	0.31	6.5	<0.1

Blank flux reagents processed through the fire assay and dissolution Methods 2 and 5 also showed different values for Pd. Those where prills were dissolved using 4M HCl (Method 2) gave values of 1.1±0.1 ppb (n=3), whereas those where the recommended method (2.4M HCl) was employed produced an average of 2.4±0.1 ppb Pd (n=3). No differences were evident in the blank flux results for Au (2.5±0.9 ppb, n=6) or Pt (0.42±0.04 ppb).

This trend has been observed with other samples, and other dissolution approaches have resulted in poor recoveries for Pd. For example, the use of concentrated HNO_3 (0.5 ml) to dissolve Ag, followed by heating with aqua regia (1 ml) produced results for Pd in two samples, P and M, of 8.8 and 203 ppb, respectively. When another set of Ag prills was processed according to Method 2, values for Pd in P and M rose to 65 and 350 ppb, results which are probably still low (see Table 1). In both methods, the solution was made up to 5 ml (with water) before centrifuging and to 10 ml after separation from the AgCl precipitate.

It is well known that Pd (II) is present in an HCl medium as $PdCl_4^{2-}$ but there is evidence for the existence of all species from $PdCl^+$ to $PdCl_6^{4-}$. From Volume 3 of the Comprehensive Inorganic Chemistry Handbook (Pergamon Press, Oxford, 1973, p. 1285), "The absorption spectrum of an aqueous solution of $PdCl_4^{2-}$ changes with time due to hydrolysis and the formation of aqueous species". The properties of these anionic complexes have been used to separate Pd by adsorption onto resins (Rocklin, 1984). Thus, the low recoveries observed in this work probably reflect adsorption of Pd onto the AgCl precipitate from a medium of HCl where the complex is unstable.

This instability occurs after the period of heating with HCl, when the solution is diluted with water to 5 or 10 ml.

There has been discussion on the Internet on this subject of low recoveries for Pd in geoanalysis, at the Plasma Chemists' site

http://www.geo.cornell.edu/geology/white/icp-ms/icp-ms.html

A suggestion was made that polypropylene test-tubes were responsible for adsorbing Pd from solution and that glass should be used instead. The work reported here indicates that there is no problem with polypropylene, as the spiked solutions demonstrated good recovery and the 'lost' Pd was identified and quantified in the AgCl precipitate.

Thus, the recovery of Pd during the dissolution procedure will depend upon: the concentration of HCl employed; the amount of water used to dilute the HNO_3/HCl solution; the length of time the solution is in contact with the AgCl precipitate prior to analysis; and the concentration of Pd. Many laboratories have their own version of a method such as that outlined in the beginning of this paper. It is highly recommended that they assess the validity of their method and define the acceptable degree of flexibility in the conditions used.

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19th International Geochemical Exploration Symposium

April 11 - 16, 1999
Hotel Vancouver
Vancouver, BC CANADA

This symposium will be the last major Geochemical Exploration meeting of this Century. In keeping with the theme, *Exploration Geochemistry into the 21st Century,* the conference will aim to stimulate and disseminate new ideas and innovations.

If you would like to receive more information, please complete the Reply Form and mail or fax the IGES Secretariat Office.

TECHNICAL SESSIONS

Technical Sessions will be held on April 12-13, 15-16. April 14th will be a mid symposium break to give delegates and guests the opportunity of enjoying the many attractions offered by Vancouver and the surrounding area.

Topics include:

- Integrated exploration case histories - discoveries and disappointments
- Search for concealed deposits (including diamonds)
- New sampling methodologies at all scales
- Data presentation & interpretation
- Analytical methods (including quality control)
- Lithogeochemistry
- Envirogeochemistry related to the minerals industry

Anyone interested in submitting a paper for the 19th IGES should complete the Reply Form for more information.

Deadline for Abstracts is October 1, 1998

SHORT COURSES

Short Courses will take place April 10 - 11th before the symposium.

FIELD TRIPS

Field trips will take place after the meeting, starting April 17th. The field trips are intended to complement short course and technical session themes by providing applied demonstration of methods and interpretation.

Reply Form

19th International Geochemical Exploration Symposium
Vancouver, BC Canada
April 11 - 16, 1999

Please send more information on the 19th IGES to:

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CALENDAR OF EVENTS

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

■ May 18-20, 1998, **Geological Association Canada/ Mineralogical Association Canada,** Quebec, Canada. INFORMATION: A Morin, Dept. Geologie et de genie geololoque, Universite Laval, Pavillon Adrein-Pouliot Sanite-Fay, Quebec, G1K 7P4 Canada. TEL. 418-656-2193. FAX 418-565-7339. Includes a 2.5 day pre-meeting MAC short course entitled **Mineralized Porphyry-Skarn Systems,** INFORMATION (for the short course only) Dave Lentz, TEL: (506) 547-2070; FAX:(506) 547-7694.

■ May 22-27, 1998, **Geochemistry of Crustal Fluids: Characterization of Reactive Transport in Natural Systems,** Aghia Pelaghia, Crete. INFORMATION: J. Hendekovic, European Science Foundation, 1 Quai Lezay-Marnesia, 67080 Strasbourg Cedex, France, e-mail: euresco@esf.org.

■ May 25-26, 1998, **Rocky Mountain Section, Geological Society of America,** Flagstaff, Arizona. INFORMATION: Michael Ort, Dept. of Geology, Northern Arizona University, Flagstaff, AZ 86011.

■ May 26-29, 1998, **American Geophysical Union,** Spring meeting, Boston, Mass. INFORMATION: AGU meetings dept., 2000 Florida Ave., NW, Washington, DC 20009. TEL. 800-966-2481, FAX: 202-328-0566, e-mail: meetinginfo@kos-mos.agu.org.

■ June 1-4, 1998, **Pan American Current Research on Fluid Inclusions (PACROFI) VII,** Las Vegas, Nevada. INFORMATION: Jean Cline, Dept. of Geosciences, University of Nevada, Las Vegas, Nevada 89154-4010, FAX: 702-895-4064.

■ June 6-11, 1998, **Clay Mineral Society 35th Annual Meeting,** Cleveland, Ohio. INFORMATION: Samuel M. Salvin, Dept. of Geological Sciences, Case Western Reserve Univ., Cleveland, OH 44106, 216-368-4413. FAX: 216-368-3832.

■ July 4-11, 1998, **Geological Society of America Penrose Conference on "Processes of Crustal Differentiation: Crust-Mantle Interactions",** Verbania, Italy. INFORMATION: T. Rushmer, Dept. of Geology, University of Vermont, Burlington, VT 05405, 802-656-8136, FAX: 802-656-0045.

■ July 7-10, 1999, **Geocongress '98,** Unversity of Pretoria, South Africa. INFORMATION: P.O. Box 798, Pretoria, 0001 South Africa, fax: 012-841-1221, e-mail: eaucamp@geoscience.org.za.

■ August 9-14, 1998, **General meeting of the International Mineralogical Association,** Toronto, Canada, INFORMATION: E. Schandl, Dept. of Geology, University of Toronto, Toronto, Canada M5S 3B1. TEL 416-978-7084, FAX 416-978-3938.

■ August 23-27, 1998, **American Chemical Society National Meeting,** Boston, Mass. INFORMATION: Sally Pecor, ACS News Service, 1155 16th St., NW, Washington, D.C. 20036, phone 202-872-4451, fax 202-872-4370, e-mail: s_pecor@acs.org.

■ August 30-Sept. 4, 1998, **Clay mineralogy and petrology,** Brno, Czech Republic, International Geological Correlation Programme Project No. 405. INFORMATION: Petr Sulovsky, Dept. of Mineralogy, Petrology, and Geochemistry, Masaryk University, Kotlarska 2, CZ 611 37 Brno, Czech Republic, FAX: 420-541211214, email: clays@sci.muni.cz.

■ September 22-25, 1998. **International Meeting of Gold Exploration and Mining in Nw Spain,** Oviedo, Spain. INFORMATION: Daniel Arias Prieto, Facultad de Geología. Universidad de Oviedo C/Arias de Velasco s/n, 33005 Oviedo, Spain. FAX (34)8-5103087. Email: arias@asturias.geol.uniovi.es.

Continued on Page 9

Calendar of Events *Continued from Page 8*

■ October 26-29, 1998, **Annual meeting of the Geological Society of America**, Toronto, Ontario, Canada. INFORMATION: Pierre Robin, Dept. of Geology, 22 Russell St., Toronto, ON M5S 3B1, Canada, TEL 416-978-3022, FAX 416-978-3938.

■ November 9 - 12, 1998, **Fifth Annual African Mining Investment Symposium, and Arab Mining Investment Symposium,** Marrakech, Morocco. Field excursions before and after. Sponsored by MIGA (World Bank). INFORMATION: Ms. L. Gorman at MIGA, Washington D.C., fax 1-202-522-2650, e-mail: lgorman@worldbank.org.

■ April 11-16, 1999, **19th International Geochemical Exploration Symposium,** Vancouver, Canada. INFORMATION: Venue West Conference Services Ltd., #645-375 Water Street, Vancouver, BC, Canada V6B5C6, TEL. 604-681-5226, FAX 604-681-2503.

■ May 26-28, 1999, **Geological Association of Canada-Mineralogical Association of Canada Joint Annual Meeting,** Sudbury, Ontario, Canada. INFORMATION: Dr. P. Copper, Dept. of Earth Sciences, Laurentian University, Sudbury, Ontario P3E 2C6, TEL. 705-675-1151 (ext. 2267), FAX: 705-675-4898, e-mail: gacmac99@nickel.laurentian,ca.

■ October, 25-28, 1999, **Annual Meeting of the Geological Society of America,** Denver, Colo. INFORMATION: TEL 1-800-472-1988, meetings@geosociety.org.

■ April 24-28, 2000, **5th International Symposium on Environmental Geochemistry,** Cape Town, South Africa. INFORMATION: 5ISEG, Department of Geological Sciences, University of Cape Town, Private Bag, Rondebosch, 7701, South Africa, FAX 27-21-650-3783. Email: 5iseg@geoglogy.uct.ac.za.

■ May 15-18, 2000, **Geology and ore deposits 2000: The Great Basin and beyond,** Reno/Sparks, Nevada, USA. INFORMATION: Geological Society of Nevada. 702-323-3500, ax 702-323-3599, e-mail: gsnsymp@nbmg.unr.edu.

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

Virginia T. McLemore
New Mexico Bureau of Mines and Mineral Resources
801 Leroy Place
Socorro, NM 87801 USA
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FAX: 505-835-6333
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NEW MEMBERS

To All Voting Members:

Pursuant to Article Two of the Association's By-Law No.1, names of the following candidates, who have been recommended for membership by the Admissions Committee, are submitted for your consideration. If you have any comments, favorable or unfavorable, on any candidate, you should send them in writing to the Secretary within 60 days of this notice. If no objections are received by that date, these candidates will be declared elected to membership. Please address comments to Sherman P. Marsh, Secretary AEG, U.S. Geological Survey, Mail Stop 973, Box 25046, Federal Center, Denver, Colorado 80225, U.S.A.

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 Nepean 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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Robertson, F. Bruce
Geologist
Geographe Resources
Northbridge, WA, AUSTRALIA

Yavuz, Fuat
Assistant Professor
Istanbul Technical University
Istanbul, TURKEY

RECENT PAPERS

This list comprises titles that have appeared in major publications since the compilation in **EXPLORE** Number 98. Journals routinely covered and abbreviations used are as follows: Economic Geology (EG); Geochimica et Cosmochimica Acta (GCA); the USGS Circular (USGS Cir); and Open Field Report (USGS OFR); Bulletin of the Canadian Institute of Mining and Metallurgy (CIM Bull.); Transactions of Institute of Mining and Metallurgy, Section B: Applied Earth Sciences (Trans IMM). Publications less frequently cited are identified in full. Compiled by **L. Graham Closs**, Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO 80401-1887, Chairman AEG Bibliography Committee.

Please send new references to Dr. Closs, not to **EXPLORE.**

Amor, S., Bloom, L., and Ward, P., 1998. Practical Application of Exploration Geochemistry. Short Course Notes, PDAC. Toronto.

Barnes, H.L., 1997. Geochemistry of Hydrothermal Ore Deposits. 3rd Ed. Wiley. 972 p.

Belyaev, A.A., 1997. Thermal model of metasomatic ore rhythms. Geochem. Intern. 35(8): 741.

Blackburn, W.H. and Dennen, W.H., 1997. Encyclopedia of Mineral Names. Min. Soc. Canada. Spec. Pub. 1. 360 p.

Continued on Page 11

Recent Papers *Continued from Page 10*

Closs, L.G., 1998. Exploration Geochemistry - Mineral. (1997 Review). Geotimes 43(2): 28-29.

Fletcher, W.K. and Loh, C.H., 1997. Transport and deposition of cassiterite by a Malaysian stream. J. Sed. Res. 67(5): 763.

Fyfe, W.S., 1997. Deep fluids and volatile recycling: Crust to mantle. Techtonophysics 275(1-3): 243.

Gibbs, B.L., 1997. Exploring with modern technology. EMJ 198(12): 32J-32L.

Giblin, A. and Massuchelli, R., 1997. Groundwater geochemistry in exploration: an investigation in the Black Flag district, Western Australia. Aust. J. Earth Sci. 44(4): 433-444.

Kerrich, R. and Wyman, D.A., 1997. Review of developments in trace-element fingerprinting of geodynamic settings and their implications for mineral exploration. Aust. J. Earth Sci. 44(4): 465.

McIntosh, J.M. and Groat, L.A., (Eds.), 1997. Biological-Mineralogical Interactions. Min. Assoc. Canada. Short Course V. 25. 239 p.

Murakami, T., Ohnuki, T., Isobe, H., and Sato, T., 1997. Mobility of uranium during weathering. Am. Min. 82(9/10): 888-899.

Nakano, T., Murakami, H., Miyake, K., and Nakayama, K., 1997. Chemical composition of ^{18}O-depleted limestone in the Kamioka Zn-Pb mine as a potential tool for the exploration of skarn deposits. Resource Geol. 47(3): 109-120.

Navrotsky, A., 1995. Physics and Chemistry of Earth Materials. Cambridge U. Press. 417 p.

Razvozzhaeva, E.A., Makrygina, V.A., and Martikhaeva, D.K., 1997. Geochemistry of the ore-forming elements in the carbonaceous matter of metasediments from the Baikal-Putom highland. Geochem. Intern. 35(8): 733-740.

Rendu, J.M., 1998. Practical geostatistics at Newmont Gold: a story of adaptation. Min. Eng. 50(2): 40-45.

Routh, J. And Ikramuddin, M., 1996. Trace-element geochemistry of Onion Creek near Van Stone lead-zinc mine (Washington, USA) - Chemical analysis and geochemical modeling. Chem. Geol. 133 211-224.

Runnells, D.D., Dupon, D.P., Jones, R.L., and Cline, D.J., 1998. Determination of natural background concentrations of dissolved components in water at mining, milling, smelting sites. Min. Eng. 50(2): 65-71.

Ryan, B., 1997. The Mesoproterozoic Nain Plutonic Suite in Eastern Canada and the Setting of the Voisey's Bay Ni-Cu-Co Sulphide Deposit. Geoscience Canada 24(4): 173-188.

Shinozuka, M. and Mariko, T., 1997. Host rock geochemistry and tectonic setting of the El Roble volcanogenic massive sulfide deposit, Republic of Columbia. Resource Geol. 47(3): 131-144.

Stein, H.J., Morgan, J.W., Markey, R.J., and Hannah, J.L., 1998. An introduction to Re-Os- what's in it for the mineral industry? SEG Newsletter 32: 1, 8-15.

Thompson, G.A., 1998. Deep mantle plumes and geoscience vision. GSA Today (April): 17-25.

Yaroshevsky, A.A., 1997. Average chemical composition of the main groups of magmatic associations in the earth crust. Geochem. Intern. 35(8): 689-694.

Zaw, K, Large, R.R., and Huston, D.L., 1997. Petrological and geochemical significance of a Devonian replacement zone in the Cambrian Rosebury massive sulfide deposit, western Tasmania. Can. Min. 35: 1325-1349. Notes provided to attendees at the AEG-sponsored workshop

WORKSHOP NOTES AVAILABLE

Quality Control Methods in Mineral Exploration are now available from Barry Smee, who presented the workshop in January, 1998, at the Society of Economic Geologists Annual Meeting. This collection of informally reproduced papers contains the practical "how-to" methods required to design a Quality Control program, a description of the Quality Control methods used in a commercial laboratory, a summary of the fire assay method for gold, and case histories of Quality Control results from precious and base metal exploration programs. Price is US $40.00 plus shipping; a portion of this fee goes to the AEG.

Please order by contacting:

Barry Smee
Smee and Associates Consulting Ltd.
1011 Seaside Dr.
Sooke, B.C. V0S 1N0
Canada
Fax: (250) 646-2398 or E-mail: bwsmee@islandnet.com

GSN CALL FOR PAPERS

Geology and ore deposits 2000 —the great basin and beyond

The Geological Society of Nevada (GSN) is pleased to announce the organization of a symposium to be held in Reno-Sparks, Nevada, during May 15-18, 2000. Theme sessions will include: *Geology of Nevada in the Context of the Great Basin and the Cordillera; Ore Deposit Models for Frontier Exploration; Environmental Geology–From Exploration to Remediation; World Class Gold Systems–Ultimate Origins; Exploration Technology for the 21st Century; Tectonics and Ore Deposits; Ore Deposits in Volcanic Terranes; Tons and Grade–Descriptive Geology of New Discoveries.*

The Program Committee invites original papers, oral or poster, bearing on the above sessions. Field trip and short course proposals are also invited and should include a brief description, length (number of days), estimated fees, and suggestions for potential leaders and instructors. GSN will publish a *Program with Abstracts*, hardbound volumes and CDs of the *Symposium Proceedings* and *Field Trip Guidebooks.*

The Symposium will examine the geologic and tectonic setting of ore deposits worldwide, with particular emphasis on the geology of world class mineral districts within and outside of the Great Basin of the western United States. Descriptive papers on recently discovered ore deposits are especially encouraged, as are papers on general geology, geochemistry, geophysics, and tectonics of the Great Basin. Original papers on geology and ore deposits outside the Great Basin are expressly invited. There will be Keynote and Luncheon presentations by eminent geoscientists currently involved in research relating to the session topics.

Awards will be given for the Best Student Papers.

Additional information may be obtained from the GSN Symposium Editor. Full details will also be available soon on the Web from GSN's home page.

GSN Symposium Editor
P.O. Box 12021
Reno, NV 89510-2021, USA
Tel: (702) 323-3500 Fax: (702) 323-3599
e-mail: gsnsymp@nbmg.unr.edu
http://www.seismo.unr.edu/GSN

CALL FOR PAPERS / POSTERS

19TH INTERNATIONAL GEOCHEMICAL EXPLORATION SYMPOSIUM
VANCOUVER, APRIL 11-16, 1999

EXTENDED ABSTRACTS ARE REQUIRED BY OCTOBER 1, 1998.

The Technical Sessions will include the following topics but authors are encouraged to submit papers on all aspects of exploration geochemistry. Contributions from the mineral exploration industry and comparative studies of different methodologies are especially welcome.

- **Integrated exploration case histories — discoveries and disappointments**
- **Search for concealed deposits (including diamonds)**
- **New sampling methodologies at all scales**
- **Data presentation and interpretation**
- **Analytical methods (including quality control)**
- **Lithogechemistry**
- **Envirogeochemistry related to the minerals industry.**

Details of the abstract format will be posted at our web site *http://www.aeg.org*. Please submit your abstract by e-mail to *fletcher@unixg.ubc.ca*. If this is not possible send a paper or electronic copy on disk (in ASCII text format) to W.K. Fletcher, Geology Unit, Earth Ocean Sciences, 6339 Stores Road, University of British Columbia, Vancouver, B.C., Canada, V6T 1Z4. Tel: (604) 822-2392; Fax: (604) 822-6086. In addition, send a paper copy to 19th I.G.E.S., Secretariat, Venue West Conference Services, Ltd., 645-375 Water Street, Vancouver, B.C., Canada V6B 5C6. Tel: (604) 681-5226; Fax: (604) 681-2503. E-mail: *Congress@venuewest.com. Please indicate whether the abstract is intended for oral presentation or as a poster.*

NOTES FROM THE EDITORS

As you can see this issue is about a month late, as was the last issue. This delay is not entirely due to sloth on the part of your editors. The primary reason is that we are suffering from a lack of material to print. This situation has become endemic and has especially affected the last two issues. We have "tapped out" our friends and colleagues until they run when they see us coming. We have hit on our fellow Councilors in the AEG over and over and now we are faced with absolutely nothing for the July issue. Where are the technical contributions? Surely some of you Fellows and Members are doing research, interesting field work, exploration, bizarre extractions, weird chemistry, or just have some radical ideas that you would like to present. Send your short articles along to us and we'll get them into print within 3-6 months. We're pretty liberal and will accept most any credible effort. Bear in mind that we usually have one or more issues in COLOR during the year. That's FREE COLOR!!!! What other publication can offer you a deal like that???!! So, if you've got a little something tucked away that you would like to see in print or if you've been saving that special graphic that just has to have color, send it along. NOW'S THE TIME!!!!

On a more serious note, but following the same theme,

Continued on Page 17

For those that couldn't make it to the 4th International Symposium on Environmental Geochemistry in Vail, Colorado, the following are available:

Program with Abstracts	$15.00
ISEG hats (ISEG and Vail, CO on hat)	$ 6.00
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Deadlines for the Next Four Issues of EXPLORE

Contributors's deadlines for the next four issues of **EXPLORE** are as follows:

Issue	Publication date	Contributor's Deadline
100	July 1998	May 31, 1998
101	October 1998	August 31, 1998
102	January 1999	November 30, 1998
103	April 1998	February 28, 1999

AEG PUBLICATIONS

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	_____
14	★	PROBPLOT, An Interactive Computer Program to Fit Mixtures of Normal (or Log Normal) Distributions with Maximum Likelihood Optimization Procedures (C.R. Stanley). On 3.5" diskette; requires 1 mb hard disk space	US $30.00	US $55.00	_____
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7		Geochemical Exploration 1977 Proceedings of the Denver Geochemical Symposium (ed. J.R. Waterson and P.K. Theobald)	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 (complied by H.E. Hawkes)	US $10.00	US $20.00	_____
11.1		Exploration Geochemistry Bibliography Supplement 1 to October 1984 (complied by H.E. Hawkes)	US $10.00	US $17.00	_____
11.2		Exploration Geochemistry Bibliography Supplement 2 to October 1987 (complied by H.E. Hawkes)	US $10.00	US $17.00	_____
—		Digital bibliography - entire AEG bibliography through 1994. A *.dbf file on 3.5" diskette (requires 14 mb hard disk space)	US $10.00	US $20.00	_____
12		Writing Geochemical Reports (S.J. Hoffman)	US $ 5.00	US $ 7.00	_____
—		Geochemical Exploration 1980 - Hannover (ed. A.W. Rose and H. Gundlach). Hard cover edition		US $35.00	US $50.00
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—		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 Syrveys (ed. W.K. Fletcher). This volume was co-sponsored by the SEG.	US $20.00	US $25.00	_____
—		1992 AEG Membership Listing and Directory of Exploration Geochemical and Environmental Services	US $10.00	US $20.00	_____
—		Epithermal Gold Mineralization of the Circum-Pacific; Geology, Geochemistry, Origin and Exploration, Volumes 1 and 2.	US $160.00	US $246.00	_____
—		Soils of the World. Colour wall chart. 95 cm x 135 cm in size. Published by Elsevier.	US $22.00	US $28.00	_____
SPECIAL 1.		Practical Problems in Exploration Geochemistry, 1987. (A.A. Levinson, P.M.D. Bradshaw and I. Thomson) 269 pp.	US $35.00	US $80.00	_____
—		17th IGES Extended Abstracts from "Exploring the Tropics", 15-19 May, 1995, Townsville Australia (for airmail add $20)	US $50.00	US $65.00	_____
—		A Global Geochemical Database for Environmental and Resource Management, Recommendations for International Geochemical Mapping, Final Report of IGCP Project 259. (A.G. Darnley A. Bjorkland, B. Bolviken, N. Gustavsson, P.V. Koval, J.A. Plant, A. Steenfeld, M. Tauchid and Xie Xuejing; with contributions by R. Garrett, and G.E.M Hall).	US $20.00	US $20.00	_____
—		Geochemistry in Mineral Exploration (second edition, published 1979) (A.W. Rose, H.E. Hawkes, and J.S. Webb) - airmail US$10.00/International $20.00 additional	US $60.00	US $80.00	_____
—		Journal of Geochemical Exploration in Subscription Years 1994 and earlier, whole year or part	US $70.00	N/A	_____

NOTE: Members may order back issues or volumes for the usual membership fee. The member may elect to receive all issues of that subscription year or just the issue/volume desired (the price is the same). The 1995 subscription year will be "back issued" six months after completion (ca. Oct., 1995).

Notes for Short Courses on Biogeochemical Exploration. Each book comprises 200-250 pages of text, figures, tables, and photos. The content of each is similar, except different aspects are emphasized. All prices quoted are for surface mailing; if airmail is desired please add (US)$15.00

—	Biogeochemical Exploration, Simplified - with emphasis on arid terrains (C.E. Dunn, J.A. Erdman, G.E.M. Hall, and S.C. Smith) Note: this text includes geobotanical aspects in some detail	US $50.00	US $50.00	_____
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Note: This text is an expansion of the volume 'Applied Biogeochemical Prospecting in Forested Terrain' and includes several case histories from Australia. In Australia the volume can be obtained from Dr. David Cohen, Dept. Geology, Univ. New South Wales, Sydney, AUSTRALIA, for Aus$60.00.

Do you need a receipt? Include self-addressed envelope and US $ 2.00, otherwise your cancelled check or bank card statement is your receipt.	US $ 2.00	US $ 2.00	_____
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20TH INTERNATIONAL GEOCHEMICAL EXPLORATION SYMPOSIUM, 2001

The Association of Exploration Geochemists is looking for a venue for the 20th IGES. The Association will consider all proposals for hosting this event. Proposals must include the following:

- Location
- Date
- Sponsoring organization
- Meeting title or theme
- Contact person(s)
- Suggested outline for meeting
- Suggested field trips and short courses
- Facilities
- Brief description of the locality

Any interested organizations should submit their proposals to the AEG Business Office

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CANADA

GEOLOGY AND ORE DEPOSITS 2000: The Great Basin and Beyond

A Geological Society of Nevada Symposium

May 15-18, 2000, Reno/Sparks, Nevada, USA

Co-sponsored by:

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Notes from the Editors *Continued from Page 14*

geochemical exploration and related environmental papers have been in short supply in the last few years. This poses a serious threat to the AEG as our visibility to the scientific world rests with our publications. Submissions to the JGE have dropped off in the last few years and the AEG has had difficulty fulfilling our page requirements with Elsevier. We realize that many Fellows and Members are working overtime and have difficulty finding space on their schedules for writing and publishing, but communication of ideas and experiences is necessary for the growth of exploration geochemistry. Please attempt to publishing even a brief account of the results of your work and research. Also, encourage your colleagues, members or not, to do the same; others in AEG are ready to support them with helpful reviews and edits. As we move into the next century and launch a new AEG journal we must have an increased flow of good technical papers to rebuild our circulation and increase our visibility in the geologic community.

Sherm and Tom

ASSOCIATION OF EXPLORATION GEOCHEMISTS

SPECIAL BOOKS OFFER 1998

Author/Title	Non-Member Price	Member Price
Augustithis, S.S. Atlas of of Metamorphic-Meta-Somatic Textures and Processes	254.00	152.40
Bardossy, G. and Aleva, G.J.J. Lateritic Bauxites	242.00	145.20
Butt, C.R.M. and Zeegers H. Regolith Exploration Geochemistry in Tropical and Subtropical Terrains	267.00	160.20
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****Gulson, B.L.** Lead Isotopes in Mineral Exploration	out of print	
Hale, M. And Plant, J.A. Drainage Geochemistry	274.50	164.70
Hedenquist, J.W., White, N.C. and Siddely, G. Epithermal Gold Mineralization of the Circum-Pacific: Geology, Geochemistry, Origian and Exploration	393.00	235.80
Howarth, R.J. Statistics and Data Analysis in Geo-Chemical Prospecting	219.50	131.70
Kauranne, L.K., Salminen, R. And Eriksson, K. Regolith Exploration Geochemistry in Arctic and Temperate Terrains	208.00	124.80
Laznicka, P. Breccias and Coarse Fragmentites	288.50	173.10
Mysen, B.O. Structure and Properties of Silicate Melts	146.50	87.90
Naqvi, S.M. Precambrian Continental Crust and its Economic Resources	196.50	117.90

** this title will only be reprinted if there is a minimum number of requests

AEG APPLICATION FOR NON-VOTING MEMBERSHIP*

to the Association of Exploration Geochemists

Please complete the section relevant to the class of membership sought and supply your address on this form. Mail the completed application, together with annual dues, to the address below.

MEMBER

I _____ wish to apply for election as a Member of the Association of Exploration Geochemists. I am presently employed by:

_____ as a _____.
(employer) (employment title)

I am actively engaged in scientific or technological work related to geochemical exploration and have been so for the past two years. Upon receipt of the Code of Ethics of the Association I will read them and, in the event of being elected a Member, agree to honour and abide by them. Witness my hand this_____day of_____19_____. _____
(Signature of applicant)

STUDENT MEMBER

I _____ wish to apply for election as a Student Member of the Association of Exploration Geochemists. I am presently engaged as a full-time student at _____, where I am taking a course in pure or applied science. Upon receipt of the Code of Ethics of the Association and in the event of being elected a Student Member agree to honour and abide by them. Witness my hand this_____day of_____19_____.

_____
(Signature of applicant)

Student status must be verified by a Professor of your institution or a Fellow of the Association of Exploration Geochemists. I certify that the applicant is a full-time student at this institution.

_____ _____
(Signature) (Printed Name and Title)

NAME AND ADDRESS

(to be completed by all applicants)

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