



THE ASSOCIATION OF EXPLORATION GEOCHEMISTS NEWSLETTER

P.O. Box 523 (Metropolitan Toronto)
Rexdale, Ontario, M9W 5L4

No. 59

March 1987

President's Message - Glenn Allcott

Recently, I reread a review paper by G.J.S. Govett on the achievement and potential of geochemistry in mineral exploration. The paper contains, among other things, some statistics from the Australian Geoscience Council which concerns human resources in the geosciences in Australia. Some results of the survey indicate (1) that only about two per cent of the industry workforce are geochemists and (2) that, even within the Australian membership of our association, the main interest of more than 50 per cent of the members is not geochemistry. These statistics suggest that, in industry, the mineral exploration personnel recognize geochemistry as a useful tool but prefer to apply it themselves, perhaps with the advice and consultation of a small number of experts - the professional geochemists.

These statistics have significance for policy on membership and future direction of the Association. We limit the membership of our Association of Exploration Geochemists because we do not encourage those who are not "geochemists", but who use geochemistry, to join. Do we need an Association of Exploration Geochemistry with a larger number of interested members?

This will be the last newsletter prior to our Annual General Meeting in Orleans, France, at which time new officers will assume leadership of the Association. They will be faced with difficulties; however, they will meet them successfully because they have a strong dedication to the Association and its membership.

I would like to take this opportunity

to acknowledge the efforts of the current Executive, Councillors, committee chairpersons, committee members, and Association members who worked so hard for your Association this past year. Thank you all!

1987-88 Executive

At a Council Meeting of the Association of Exploration Geochemists held on March 19th, 1987, members of the new Executive were elected for the year 1987-88.

President:

S.J. Hoffman,
BP Selco Ltd.

First Vice-President:

M.A. Chafee,
United States Geological Survey

Second Vice-President:

A.E. Soregaroli
Westmin Exploration Ltd.

Interim Secretary:

R.E. Lett,
Barringer Magenta Ltd.

Treasurer (re-elected):

L.B. Bloom,
Ontario Geological Survey.

Personal Column

Information on Association members is received from around the world. To keep your fellow members informed of your latest moves, send a brief summary to the Rexdale office and please indicate that this information is intended for the Newsletter.

Bernard J. Maurette informs the members that his company, Maurette Resources & Services Limited offering XRF Analytical Services, is now associated with Loring Laboratories

Limited, 629 Beaverdam Road N.E.,
Calgary, Alberta, Canada T2K 4W7.

Bernard J. Maurette may be reached at
(403) 274-2777.

Employment Wanted

Bilingual Exploration Geochemist with more than 10 years experience seeks employment. Please write to 4005 Don Mills Road, Suite 150, Willowdale, Ontario, Canada M2N 3J9

Computer Software Pool

Computer programmes that are currently available through the AEG are listed below. This list is updated and replaces the list that occurred in Newsletter #56 which had several errors in it (our apologies.) In the future, the program lists will be provided once a year and any new additions will be listed as they are made available.

The programmes that were originally supplied as hardcopy paper format (Newsletter #50) have been discontinued in favour of programmes that have been written for the IBM-PC (DOS) microcomputers. Below is a description of the routines that are currently available from the Ontario Geological Survey through the Association of Exploration Geochemists. These routines have recently been adapted for the IBM-PC microcomputers and are available on one 5.25" double sided double density (DSDD 360 Kb) diskette. The cost for the disk plus postage is \$15.00 Cdn. (\$12.00 U.S.). The cost can be reduced to \$5.00 Cdn. (\$4.00 U.S.) if you send us your disk.

Only the source code is provided. Any routines required for plotting must be supplied by the user. The plotting routines used in the programmes are the Industry Standard Plotting Package (ISPP) routines as such as those used by Calcomp. These programmes have been developed using the IBM Professional Fortran compiler Version 1.18 and make use of Fortran 77 features.

The programmes that are available are:

1: BOUNDARY.FOR: a programme which calculates the following:

a: $\text{Na}_2\text{O} + \text{K}_2\text{O} - \text{FeO} (\text{Total}) - \text{MgO}$ values for the AFM ternary diagram.

b: $\text{Al} - \text{Fe} + \text{Ti} - \text{Mg}$ cation values for the Hensen classification scheme.

c: $\text{Al}_2\text{O}_3 - \text{MgO} - \text{CaO}$ values for the ACM ternary diagram.

d: SiO_2 & $\text{Na}_2\text{O} + \text{K}_2\text{O}$ values for the silica-alkalies diagram.

The programme uses the following subroutines which can be adapted for other purposes.

AFMBND: subroutine that draws AFM calc-alkaline - tholeiite boundary curve. This curve is defined by Irvine & Baragar (1971).

JENBND: subroutine that draws Jensen boundary curves as defined by Jensen (1976).

ALKBND: subroutine that draws SiO_2 vs. $\text{Na}_2\text{O} + \text{K}_2\text{O}$ boundary as shown by Irvine & Baragar (1971).

TRIANG: subroutine that draws the ternary diagram outline. Uses ISPP standard plotting routines.

TRI: subroutine that converts ternary values into x-y cartesian coordinates for plotting purposes.

CHEM: subroutine that calculates and adjusts various chemical components (SiO_2 , Al_2O_3 , Fe_2O_3 , FeO , MgO , CaO , Na_2O , K_2O , TiO_2 , P_2O_5 , CO_2 , S , H_2O^+ , H_2O^-) as read in from the main programme.

BARTH: subroutine that calculates the BARTH-NIGGLI normative mineral calculation necessary for the Irvine & Baragar rock classification scheme.

IRVBAR: subroutine that calculates volcanic rock names according to Irvine & Baragar (1971).

JENSEN: subroutine that calculates rock names according to the classification of Jensen (1976).

2: JENSEN.BAS: A BASIC programme that calculates volcanic rock names based on the major element chemistry (the same as SUBROUTINE JENSEN above).

3: EQUAL.FOR: A FORTRAN 77 programme that plots linear and planar data on an equal-area projection using ISPP plotting procedures.

These programmes were developed primarily for plotting lithochemical data, however they can be adapted to be used with other chemical components or solely for volcanic rock classification purposes.

References

Irvine, T.N.; Baragar, W.R.A.
1971: A Guide to the chemical classification of the Common Volcanic Rocks Can. Jour. Earth Sc. vol. 8, p. 523-546.

Jensen, L.S.
1976: A new cation plot for classify Subalkalic Volcanic Rocks, Ontario Div. Mines, Misc. Pap. 66, 22p.

The Association of Exploration Geochemists or anyone else affiliated with the authorship or distribution of the computer programmes assumes no responsibility for any problems or errors that arise from the use of any of the programmes. All users assume use of the programmes entirely at their own risk.

Please note that all orders for software must be accompanied by a cheque or money order payable to:
The Association of Exploration Geochemists
P.O. Box 523
Rexdale, Ontario
Canada, M9W 5L4

For further information, requests, or submissions, contact:
Eric Grunsky
Ontario Geological Survey
911-77 Grenville St.
Toronto, Ontario
Canada M7A 1W4
(416) 965-7046

Future Meetings

Short Course

Geochemical Exploration for Precious Metals
Colorado School of Mines
Denver, Colorado, U.S.A.
May 11th - 13th, 1987

The Geochemical Exploration for Precious Metals Short Course, now in its 27th year, is an introductory course on the fundamentals of modern geochemical exploration techniques for precious metals. The instructor is Dr. L.G. Closs, Colorado School of Mines. Further information may be obtained from:

Dr. L.G. Closs
Geology Department
Colorado School of Mines
Golden, Colorado, 80401, U.S.A.
Telephone (303) 273-3856

or
Special Education and Continuing Education (SPACE) Office
Colorado School of Mines
Golden, Colorado, 80401, U.S.A.
Telephone (303) 273-3321

**EXPLORATION '87,
Third Decennial International
Conference on Geophysical and
Geochemical Exploration for
Minerals and Groundwater,
Toronto, Ontario, Canada
September 27th to October 1st,
1987**

Principal Circular

The theme of EXPLORATION '87 is centered on geophysical and geochemical methods and their roles in modern exploration for mineral, groundwater and geothermal resources; recent advances in methodology, instrumentation, field procedures, data processing and interpretation as well as on trends for the future. Emphasis will be placed on the presentation of case histories and on the application of these sciences in developing countries.

This theme will be elaborated through lectures, seminars an exhibition, poster sessions and in field schools. Post conference visits to instrument manufacturers, geoscience laboratories and service companies will be provided

for those interested.

If you have not received a Principal Circular, please contact:
EXPLORATION '87
c/o 222 Snidercroft Road
Concord, Ontario
Canada L4K 1B5
Telephone: (416) 669-2280
Telex: 06-964570
Fax: (416) 669-5132

**Canadian Institute of Mining and Metallurgy Annual Meeting,
Toronto, Canada
May 3-7th, 1987**

This meeting will feature a technical session on Quaternary Geology and Geochemistry in Mineral Exploration.

For further information contact
CIM
400-1130 Sherbrooke St. West,
Montreal, Quebec H3A 2M8

**V.M. Goldschmidt Conference
for Geochemistry
Baltimore, Maryland
May 11th - 13th, 1988**

Preliminary Announcement and Call for Papers

The V.M. Goldschmidt Conference for Geochemistry to be held in Baltimore will celebrate the centennial year of Goldschmidt's birth. The conference themes are therefore on the chemical aspects of the Earth and Planetary Sciences. The V.M. Goldschmidt Conference is sponsored by The Geochemical Society and co-sponsored by the European Association of Geochemists, the International Association of Geochemistry and Cosmochemistry and the Mineralogical

Society of America. Participating societies include the Association of Exploration Geochemists and the Society of Environmental Geochemistry and Health.

Technical sessions will consist of both volunteered and invited papers. Abstract forms can be obtained from:

Goldschmidt Conference Coordinator
The Pennsylvania State University
410 Keller Building
University Park, PA, 16802

1986 Student Prize Award

The Association is pleased to announce that the 1986 Student Prize has been awarded to S.I. Kalogeropoulos for his paper, co-authored by S.D. Scott, entitled "Mineralogy and Geochemistry of Tuffaceous Exhalites (Tetusekiei) at the Fukazawa Mine, Hokuroko District, Japan". The paper was published in Economic Geology (1983), Monograph Number 5, pages 412-432. Dr. Kalogeropoulos obtained his Ph.D. degree in 1982 from the University of Toronto and is now Scientific Adviser to the Director, Institute of Geology and Mineral Exploration, Athens, Greece. The Student Prize is a one-year free membership in the Association.

Secretary's Notes

You may have noticed that the previous Newsletter contained no information about New Members. The absence of this information reflects the small number of individuals presently applying for membership in the Association. Membership decline and the difficulties of attracting new members are major concerns and possible solutions to the problem are being energetically considered by the Membership Committee led by J.P.G. Saheurs.

It is possible that potential members are discouraged by the length of time involved in completing an application for voting member status. One solution to this problem is for a candidate to apply to join the Association as an Affiliate Member (which requires no sponsors) and, at a later date, transfer to the voting member category. You will find a notice included with this Newsletter offering the GeoExpo/86 Proceedings at a special pre-publication price, reduced prices on selected Special Publications and an option to join the

Association as an affiliate member. If you have colleagues who may be interested in joining the Association, please show them this form (or a copy) and encourage them to complete the affiliate member application.

In the next Newsletter there will be information on two new publications of interest to geochemists. These are the Handbook of the AEG-SEG Short Course recently held in Denver, Colorado and a book on Exploration Geochemistry Problems compiled by A. Levinson. In June, members will receive the Proceedings of the 11th International Geochemical Exploration Symposium as Journal of Geochemical Exploration Volume 27 (Nos. 1-3).

Finally, for those of you who will be present at the 12IGES in Orleans, I hope you will try to attend the Annual Meeting and support your Association.

Ray Lett

1987-88 AEG

Distinguished Lecture Series

The 1987-88 AEG Distinguished Lecturer will be Dr. Howard McCarthy of the United States Geological Survey. During 1987-88, he will visit three schools in eastern Canada. Lecture and seminar topics will include "The Use of Gases as Geological Guides to Concealed Mineral Deposits", "A look at current U.S.G.S. Research on Mineral Resources" and "Methods and Techniques of Sampling, Analysis and Interpretation of Soil Gas Anomalies".

Our congratulations to Dr. McCarthy on his election as third Distinguished Lecturer and success on his tour.

The Analyst's Couch

Ray Lett has received several letters lately such as the one from Peter Tillman that was included in the last issue of the Newsletter. There appears to be an increasing awareness of the fallibility of commercial analytical procedures, likely induced by nearly everyone's personal experience with the lack or reproducibility of gold assays. The Association can provide a forum for analysts, to explain how the use of appropriate analytical techniques can improve the quality of geochemical surveys. In all fairness, it is important to remember that the quality of geochemical data can be vastly improved but it likely requires much higher analytical costs. The majority of exploration geochemists require inexpensive and quick analyses. In this particular industry it is necessary to maintain a dialogue between analytical chemists and geochemists in order to

develop techniques which serve the requirements of providing data of sufficient accuracy and precision, at an affordable price.

The following brief description of an analytical problem will perhaps serve as an example of the type of informal submissions to the Analyst's Couch which many members may find useful. Both questions and answers can be published, with the length of the article based on the availability of space.

Analysis of Barite-Rich Samples for Lead

Analysis of samples containing sulphate minerals, such as barite and gypsum, can produce erroneous results if strong acid attacks (i.e. using hydrofluoric acid) are

used. The sulphate minerals will dissociate to produce sulphate anions which recombine to produce insoluble lead sulphates. The lead (and possibly other metals to a lesser extent) will precipitate such that very low lead values are reported in solution. The results for specific samples subjected to both a hydrofluoric acid attack and a Specific Galena attack (developed for the Geological Survey of Canada by Gwen Hall) are listed below.

Sample	Pb (ppm)	Pb (ppm)	Ba(%)
HF	Specific	Galena	XRF
Digestion			Attack
1	800	1600	1.1
2	520	1050	2.0
3	11000	20550	2.7
4	1000	3275	17
5	1500	3425	19
6	800	2300	35

The Analyst's Couch continued

Results using the Specific Galena Attack (HCl subsequently followed by HNO₃ digestion) are significantly higher than the HF "total" digestion. The effect has also been seen to a lesser extent when comparing results from standard aqua regia and Specific Galena attacks.

This problem occurs for all sample types (soils, stream sediments and rocks). It is probably most significant in the search for Pb-Zn-Ag barite-hosted deposits. Ever wonder why so many Zn anomalies in your stream sediments didn't have coincident Pb anomalies?

I would also like to ask for help in determining the effect of "shielding" on gold analysis, in particular for heavy metal concentrates. I would appreciate hearing from anyone who has quantitative data for various sizes of gold grains.

Lynda Bloom
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Geophysics/Geochemistry
77 Grenville Street
Toronto, Ontario
Canada. M7A 1W4

Reply to a Letter to the Editor by Peter D. Tillman, published in the A.E.G. Newsletter, Jan. 87.
(Edited due to space limitations)

Problems encountered with commercial laboratories in regard to gold geochemical analysis can be extended to other trace elements, such as the Platinum Group Metals (PGM). Earlier in my activities, I found that not only commercial laboratories but myself as well could not turn out reliable trace values for these metals. Now, almost 20 years later, while commercial laboratories still do not do well, I have perfected my own analyses and discovered where others fail. With these methods I was able to do two major surveys and several smaller ones. With

Au and PGM I practiced methods on three claims with a partner and found that we had to guide one laboratory on how to do the assays. Our own values were consistent with that one, but two other commercial laboratories could not find anything detectable. What we learned from this experiment was that PGM anomalies can be related to gold anomalies in this magmatic emplacement, and gold is easier to analyze than any of the PGM. The recent publication revealing a close correlation between Au and Tl can only be applied to hydrothermal systems, not to this magmatic emplacement. Unpublished results of my own demonstrate a close correlation of Tl with Hg; the other one relating Au with Hg is well known. However, the question still remains: Is this a limitation of the methods used or a problem inherent with the commercialization of a laboratory? The situation for gold is analyzed below.

The accuracy of the analysis usually depends on the matrix and sample preparation. And sample preparation relates to the instrumental method applied to the sample. All methods using some sort of spectrum (a line spectrograph, flame AA, ICP, DCP, furnace AA) are more or less strongly interfered with by common matrix elements, especially Fe, Ca, Al, Ni. A common practice to clean off interferents from noble metal elements is to do a fire assay preconcentration with Pb as a collector for Au, Ag, Pt, Pd or with NiS for all the PGM. During this step losses always occur and they may be substantial, because fire assaying is an art and not a true foolproof routine analytical method. There is also the possibility of adding excess metal introduced by contamination from chemicals, dirty equipment used for sample regrinding and preparation, etc. Another routine commercial practice is to leach the sample with aqua regia or another oxidizing acidic mixture, even leaching with cyanide, thiourea, etc. Usually, a diluted leachate is filtered or directly aspirated into the instrument.

All the coextracted interferents introduced simultaneously will increase the readings of the noble metals. Such unreliable erratic results, which are common, are useless. If a solvent extraction follows a leaching (or a separation by ion exchange) before presentation of the analyte to the instrument, a great deal of the problem is eliminated.

Of importance are the substantial losses of noble elements during fire assay preconcentration mentioned above, i.e. from clays or metasediments. To up to ten reassays of the slag have been proposed to collect all the metals. This would not only increase the cost but also sensibly expose the analysis to sources of increasing contamination. Obviously, a preliminary test would be in order to decide what way to go.

In my own laboratory, I am using a tedious spectrophotometric method. Initially, an odd combination of Ga-Fe-Ca-Cl gave fake gold contents, but this was eliminated by replacing the hydrochloric acid with sulfuric acid. Mercury, the main interference, is eliminated with heat before leaching gold with sulfuric acid-bromine. Gold is chelated with iodide and sulfite, then extracted with triphenylmethane dyes into toluene and measured. The small amounts of Hg introduced with chemicals which never exceeds 0.03 ppm gold can be subtracted. The results with careful work are precise to 0.01 ppm, provided the sample is well homogenized. Only with such numbers can one do geochemical work with gold, especially when the range does not exceed 0.2 ppm. With a proper algorithm the plotted values coincided with, or established the vein system, sometimes through more than 30 feet of overburden.

*L. Kothny, Ph.D. (Charter Member, 1970)
20 Rheem Blvd.
Orinda, California, 94653*

Newsletter Advertising

A limited number of professional-card format adverts suitable for consultants and service organizations will be accepted for publication in the Newsletter. These adverts may be either 3" x 1" (\$50.00 Cdn. per insertion) or 3" x 2" (\$100.00 Cdn. per insertion) with

the stipulation that the adverts are accepted on a first-come, first-served basis, must be camera-ready, and must be prepaid. Announcements of employment opportunities and requests for employment will be published at no cost in the Newsletter.

New Members

Names of the following candidates have been recommended by the Admissions Committee and have been approved by Council. According to the Association's by-laws, the names of

candidates are to be published for consideration by the membership. If you wish to comment on any of the candidates, please do so in writing to the secretary within 60 days.

Voting Members

M.O. Desilets

Assistant Chemist, Nevada Bureau of Mines, 1050 Nevada St., Apt. 228, Reno, Nevada, U.S.A. 89503

R.J. Goldfarb

Research Geologist, U.S. Geological Survey, 5946 McIntyre St., Golden, Colorado, U.S.A. 80403

A. Kelepertsis

Assistant Professor of Geochemistry, Department of Geology, Athens University, Panepistimiopolis 15784 Athens, Greece

I.D.M. Robertson

Research Associate, Geology Dept., Australian National University, 21 Custance St., Farrer, Australia

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J.T. Sims

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