



# THE ASSOCIATION OF EXPLORATION GEOCHEMISTS NEWSLETTER

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

No. 60

July 1987

## President's Message - Stan Hoffman

Exploration geochemistry is at a crossroads. Geochemical technology is widely and routinely used in today's exploration programs. Standard methods developed in the 1960's and 1970's comprise the well-travelled path followed by an overwhelming majority of users in the 1980's. Maverick trailblazers, such as the researchers and the geochemical specialists, travel at tangents to the main trail, but commonly they are not able to divert the masses from the well-established route even when they recognize and publicize major pitfalls. In recent years, both Coker and Thomson have sounded a general alarm that the main road may be leading the average explorationist "up a veritable garden path", but few have taken heed of their arguments. Their general thrust has been that geochemistry is not as simple as many would like to think, and that it would be prudent to keep an open mind when considering applications for geochemical surveys.

We are at a crossroad -- where to go from here? Should we continue to follow that well-travelled path or should we consider what we have been doing? The AEG has been trying to crystallize our current understandings of geochemistry through special publi-

cations, such as Special Volume 3 of Reviews in Economic Geology on soils, for those who believe there is scope for learning new ideas. The well-travelled path will always be there, but should it be followed? I predict that those who continue to practice standard geochemistry without question will do so at a significantly lower efficiency than those who are prepared to pose questions. Competitive advantages will pass to the latter group.

For example, in recent years, multielement analysis on sample pulps partially digested in aqua regia has become widely available. What can we do with all these results? Questions have been raised by many on "how good are the determinations of many of these elements, such as Ca or Al?". Spirited discussions might ensue on this subject, but in my opinion the data can be used, for example, having leachable Al determinations for stream sediments or rock chips can prove invaluable in identifying false anomalies or alteration effects, respectively. Computer processing is mandatory to fully appreciate the power of multielement analysis. To those who still rely on mean plus two standard deviations for anomaly thresholds for three or four

elements, beware, for you are positioning yourself to compete in a very disadvantageous fashion. My advice is to review the recent literature and keep tuned to this newsletter for information.

Dr. Ray Lett, a longtime personal friend and colleague and secretary of the AEG, has resigned his position after five sterling years of service. On behalf of the Association, we extend our gratitude and thanks for a job well done. We welcome Sherman Marsh onboard as our new secretary and wish him all the best.

The exceptional effort required from the secretary on behalf of the AEG, has necessitated a separation of editorship of the newsletter from the secretary office. Chet Nichol, Clark Smith, and Hal Bonham have volunteered to prepare our newsletter out of Reno, beginning in September. With this change of venue, many new ideas have been forwarded to enhance the value of the newsletter to our membership. I urge you to support Chet with suggestions and contributions. At this time of transition, changes are easily accommodated and now is the time to make your opinions known. I wish Chet and his group success and thank them for their efforts.

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# Secretary's Notes

## - Sherman Marsh

By unanimous vote of the Council on May 21st, 1987, I was elected to be your new Secretary. I hope to provide the same outstanding service that Ray Lett has provided over the years. These are mighty big shoes to fill, but I'll do my best.

Our organization is undergoing some fairly extensive operational changes, the election of a new Secretary being only one. Starting this fall, the Newsletter will be published in Reno, Nevada by C. Nichols. We hope these

changes will increase our ability to respond to and communicate with the membership.

It was decided by Council that student yearly membership fees be established at \$20.00, regardless of the regular membership fees. The Council has also decided to increase the regional representation for the Australia to two, based on their large membership.

It has been noted that the publication of GeoExpo 86 has been

delayed due to the fact that some authors haven't returned corrected manuscripts. We would encourage all authors to complete and return corrections as soon as possible to avoid further delays.

Anyone wishing to contact me concerning Secretarial matters can reach me at:

U.S. Geological Survey  
MS 973 Denver Federal Center  
Denver, Colorado 80225  
(303) 236-5521

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# Membership Update

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## Personal

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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.

**Dr. Keith Nicholson** has left the University of Papua New Guinea to take up a Lectureship in Geochemistry at the Geothermal Institute, University of Auckland, Private Bag, Auckland, New Zealand.

**Peter M. Fozzard** wishes to inform the members that he is now working as an independent consultant in international minerals exploration and development. He may be contacted at: 5207 Calabria Court, Alexandria, VA 22310, (703) 971-0269 or 136 Brompton Park Crescent, London SW6 1SP, England.

**J. Alan Coope** wishes to advise that he has transferred to Newmont Services Ltd., Tucson, Arizona. He may be contacted at Newmont Services Ltd., 200 West Desert Sky Road, Tucson, Arizona, U.S.A. 85704, (602) 297-7281.

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## Requests for Employments

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### **Gold Exploration Geologist - Geochemist**

Fifteen years US experience. Discovered 5 million tons of 0.08 oz/t Au in Nevada. Extensive experience in exploration geochemistry, generating prospects, and developing heap leach

orebodies. Seeks short or long term assignments in southwest U.S.A.

Contact: Peter D. Tillman, Exploration Geologist, 6521 N. Calle Padre Felipe, Tucson, Arizona 85718 U.S.A.  
(602) 742-2396

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## Employment Opportunities

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*Employment opportunities in the CSIRO Laterite Geochemistry research group in Perth, WA, Australia.*

### **Numerical Geologist/Geochemist** *Aust \$28107-\$41339*

To access, develop and apply numerical methods in interpretation of multielement geochemical data. Applicants should possess a PhD or equivalent with experience in interpretation of geochemical data. A sound geological background is essential.

Indefinite position (i.e. ongoing)

### **Research Fellow/Senior Research Fellow**

*Aust \$28107-\$41339*

Planning and execution of geochemical dispersion studies about gold and polymetallic mineral deposits.

Research also on bonding of elements of interest in lateritic sample materials. PhD or equivalent required in geology/geochemistry.

Three year term appointment.

### **Experimental Scientist in Geology/Geochemistry**

*Aust \$20615-\$31166*

Duties include geochemical orientations studies in lateritic terrain, up to 30% field work; and detailed mineralogical, textural and geochemical studies.

Three year term appointment.

Duties and selection criteria are available from the Project Leader, Dr. R.E. Smith, CSIRO Division of Minerals and Geochemistry, PO, Wembley, WA, 6014, Australia.

**Future Meetings**

## Exploration '87

The Third Decennial International Conference of Geophysical and Geochemical Exploration for Minerals and Groundwater will be held from September 27 to October 1, 1987 in Toronto, Canada.

The program includes seventy invited oral papers, one hundred poster papers, field schools, a trade show and an opportunity to visit earth science

organizations in the Toronto area.

The volume to be published after Exploration '87 is expected to exceed 900 pages of valuable exploration information.

To learn more, write to Exploration '87, c/o 222 Snidercroft Road, Concord, Ontario, Canada L4K 1B5 or Telex 06-964570 Toronto.

## Second International Conference on Prospecting in Arid Terrain

*Perth, Western Australia  
April 26-29, 1988*

A first circular for this conference sponsored by the Australian Institute of Mining and Metallurgy, the Institute of Mining and Metallurgy and the Association of Exploration Geochemists was enclosed with Newsletter #59. If you did not receive the Circular or would

like additional information, contact:  
Arid Terrain Conference Secretariat  
The Australasian Institute of Mining and Metallurgy  
PO Box 122  
Parkville Victoria Australia 3052  
Telephone +613 347 3166  
Facsimile +613 347 8525  
Telex: AUSIM AA33552

**Future Meetings**

## V.M. Goldschmidt Conference

**A conference to mark the Centennial year of V.M. Goldschmidt's birth.**

*Baltimore, Maryland, U.S.A.  
May 11-13th, 1988*

The V.M. Goldschmidt Conference will be held from Wednesday, May 11 to Friday, May 13, 1988. It will focus on the chemical aspects of the earth and planetary sciences. It is sponsored by The Geochemical Society, The European

Association of Geochemistry, The International Association of Geochemistry and Cosmochemistry, The Mineralogical Society of America, and The Association of Exploration Geochemists. The Society of Environmental Geochemistry and Health is a participating society.

The Association of Exploration Geochemists will sponsor a technical session on the Geochemistry of platinum group methods.

Papers are invited and Abstracts should be sent to the Technical Program committee by November 20th, 1987.

Further information can be obtained from:

**Mr. William Curley,**  
Goldschmidt Conference Coordinator  
410 Keller building  
The Pennsylvania State University  
University Park  
Pennsylvania, U.S.A. 16802  
(814) 865-9173

# New Publications - Ray Lett

In Newsletter #59 (March 1987), I remarked that several new publications on Exploration Geochemistry were in the final stages of preparation. I am happy to announce that the three publications are now available and can be ordered either directly through the Association or from the publishers. The publications are:

## **PRACTICAL PROBLEMS IN EXPLORATION GEOCHEMISTRY**

by A.A. Levinson, P.M.D. Brandshaw and I. Thomson

This publication comprises a collection of questions and answers stressing the practical geochemical aspects of 40 exploration projects for many elements. It represents a marathon effort by Dr. Levinson and his co-authors over several years. Any explorationist who seeks to improve his ability to interpret geochemical data will find this publication essential. A notice of special offer is included with this Newsletter.

## **EXPLORATION GEOCHEMISTRY: DESIGN AND INTERPRETATION OF SOIL SURVEYS**

*Society of Economic Geologists*

*Reviews in Economic Geology, Vol. 3.*

*Reviews in Economic Geology* is a publication of the Society of Economic Geologists (SEG) designed to accompany the Society's Short Course series. Like the short courses, each volume will provide intensive updates on various applied and academic topics for practicing economic geologists and geochemists in exploration, development, research, or teaching. A volume first serves as a textbook for its associated short course, and subsequently is available to SEG members and others at a modest cost. The first volume in the series was published in 1984. Volume 3, entitled *Exploration Geochemistry: Design and Interpretation*

of *Soil Surveys*, will be available in June, 1987.

Soil surveys are used routinely in geochemical prospecting. Unfortunately, the effectiveness of such surveys is often compromised when failure to appreciate the characteristics of the geochemical environment leads to poor sampling selection of unsuitable methods of sample preparation and analysis, and over reliance on inappropriate numeric methods. In suggesting alternate approaches, this volume uses case histories and questions and answers to lead the explorationist through a logical sequence in the use of soil surveys. Major sections deal with survey design, sampling and recording of

field data, sample preparation and analysis, statistical procedures and the use of geochemical models and interpretational flow sheets. Case histories are drawn from North America, Europe, and Africa; deposit types include epithermal gold, volcanogenic massive sulfides, unconformity uranium, and disseminate Cu-Mo.

Volume 3 should assist all explorationists involved in soil surveys to review and evaluate their own programs. The volume is also suitable as a supplementary text and source of problem sets for advanced courses in mineral exploration.

An order form is included with this 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**

- |                     |   |
|---------------------|---|
| <b>B.E. Maclean</b> | Geologist<br>4337 West 12th Avenue<br>Vancouver, B.C.<br>Canada V6R 2P9             |
| <b>I.D. Pirie</b>   | Senior Exploration Geologist<br>Falconbridge Copper Corp.<br>Vancouver, B.C. Canada |

### **Student Members**

- |                    |  |
|--------------------|--|
| <b>C.L. Foulk</b>  | Colorado School of Mines<br>Golden, Co, U.S.A.           |
| <b>W. Zhang</b>    | University of British Columbia<br>Vancouver, B.C. Canada |
| <b>R.D. Sibley</b> | Exeter University<br>Exeter, Devon, England              |

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# Committees of the AEG

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The president of the AEG, through consultations with the Council of the Association and others, appoints members of the AEG to chair committees. These committees develop policies and make recommendations to the AEG council to advance a cause(s) pertinent to applied geochemistry. Individuals who chair or work on these committees do so without compensation, generously donating their time and oftentimes subsidizing the Association through secretarial services or telephone calls paid for by their employers. We appreciate their support.

It follows from the President's Message that, if AEG is to encourage contributions from its membership, additional volunteers are most welcome, particularly if new ideas can be brought forward which have escaped attention thus far. Our current method of operation searches for workers amongst those individuals known to Council members or friends of Council members and suffers from inadvertently omitting existing committees, their chairmen, and their addresses are given below, along with vacancies still to be filled in the structure. Please write to the appropriate committee chairman if you are interested in volunteering your services, with a copy of your letter sent to the president of AEG.

## 1. Newsletter editor-in-chief:

*Chet Nichols, assisted by Clark Smith and Hal Bonham.*

C.E. Nichols  
680 Greenbrae Drive #290  
Sparks, Nevada 89431 U.S.A.  
(702) 331-4423

Correspondants are needed from:

- A - (1) Scandinavia, (2) Europe, (3) Africa, (4) Australia, (5) South America, (6) Canada, (7) Asia  
B - laboratories; and  
C - computer service industries.

Assistance will be required from individuals willing to encourage advertising submittals.

motivated volunteers from our general membership. In order to encourage new blood to become involved in the AEG,

## 2. Symposium Committee:

*Colin Dunn, chairman*

C.E. Dunn  
Geological Survey of Canada  
601 Booth Street  
Ottawa, Ontario  
K1A 0E8  
(613) 996-2373

## 3. Publicity Committee:

*John Gravel, chairman, assisted by Stephen Day*

John Gravel  
c/o B.C. Department of Mines  
756 Fort Street  
Victoria, B.C.  
V8V 1X4  
(604) 387-3233

Volunteers are needed for:

- A Creating a university library circulation list.
- B Creating a geology department circulation list.
- C Identifying book stores willing to market our special publications.
- D1- Creating a list of individuals willing to act as local contact to promote the AEG.
- D2- Encouraging volunteers to represent the AEG within local exploration communities.
- E Identifying individuals who are members of societies in associated fields (i.e. analysts, environmentalists, soil scientists, etc.) who are willing to assist the AEG to penetrate beyond the exploration geochemistry market.

## 4. Calendar of Events:

*Fred Siegal, chairman*

F.R. Siegel  
George Washington University  
Department of Geology  
Washington, D.C. 20052  
U.S.A.

Volunteers are needed to submit news of upcoming geological, geochemical, exploration, and related meetings as soon as these become known. Persons involved in planning symposia should keep Dr. Siegel informed in order to avoid symposia conflicts and perhaps organize joint symposia.

## 5. Membership Committee:

*J.P. Saheurs, chairman*

J.P.G. Saheurs  
6154 Voyageur Drive  
Orleans, Ontario, Canada  
K1C 2W3

A comprehensive report is currently being discussed by the AEG council. More information on this subject in the next newsletter.

## 6. Student Prize Committee:

*Steve Kesler, chairman*

S.E. Kesler  
Department of Geology & Mineralogy  
University of Michigan  
Ann Arbor, MI 48109  
U.S.A.

If you are familiar with a paper of interest to the association published by a student in the last two years, please bring it to our attention if it represents an outstanding work for consideration for the student prize.

## 7. Publications Committee:

*position currently vacant*

Wanted: an individual with experience in methods and costs of publication to advise the AEG council on our options prior to publication decisions. Planned publications in the near future include a bibliography update, a membership list, our newsletter, possibly a laboratory - suppliers - contractors - consultants guide, etc.

More on other committees in the next newsletter.

*Stan Hoffman, President.*

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## A Report

# The International South European Symposium

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### The International South European Symposium

*(Joint Meeting of AEG and the Institute of Geology and Mineral Exploration)  
Athens, Greece  
November 9-11, 1986*

### A Report

The symposium drew more than 150 members of the profession, largely from Greece, western and eastern Europe, and Africa, plus a few from the Western Hemisphere. The Institute (I.G.M.E.) is the national geological survey and mineral authority of Greece. Under Director and Meeting Chairman C. Papavassiliou and deputy Chairman S. Kalogeropoulos, I.G.M.E. also organized four associated field trips, and presented a number of papers on current investigations.

Keynote speaker Jerry Govett (Australian) compared major-element rock classification schemes and their degree of utility in massive sulfide and "porphyry" exploration. Presentations on exploration methods covered diverse topics: stream sediments and panned concentrates in southern Europe, Scotland and the Middle East; lanthanides, uranium and base metals in various environments; laterite prospecting; and minor elements in epithermal gold deposits. A paper by Anna Rassios (Greece) noted systematic changes in silicate and oxide phases in the vicinity of chromite bodies in the Vourinos ophiolite complex.

A second keynote lecture by Steve Scott (Canada) included spectacular videotapes of sea-floor hydrothermal deposition observed from a manned vessel. Walter Pluger (F.R. Germany) described the difficulty of discovering additional systems in remote ocean regions, using towed unmanned underwater sensing devices. Chris Herzig (F.R. Germany) discussed Cyprus Crustal Study Project coreholes through the Agrokippia "B" massive sulfide system. Observed mineralogy and

temperatures require replacement processes at substantial depths below the sea floor, an anathema to volcanogenicists of a few years ago.

Several papers by Central European authors discussed statistics and sampling density. Clemens Reimann and H. Kurzl (Australia) found -80 mesh soil sampling and non-parametric statistics (boxplots) to be the most effective regional gold exploration technique in contaminated alpine terrain. Other statistically-oriented discussions centered on data standardization and national metallogenic or geochemical atlases.

A final group of presentations described advances or specific installations of instrumentation. A few papers on environmental geochemistry and selective extraction methods completed the session.

To me, a high point was a field trip

to massive sulfide, gold-rich porphyry copper and other ore occurrences in Macedonia. A post-meeting trip to the island of Santorini showed the catastrophic effect of a major ash flow eruption and caldera collapse, plus the extent of magmatic and geothermal systems still active some 3500 years thereafter. Interchange of ideas between multinational, multilingual geochemists was facilitated by an unexpected wave of cold weather.

Dedicated efforts of I.G.M.E. geoscientists made the conference and trips possible. The illustrated guidebooks should prove useful to future visitors. An evening banquet and the hospitality of the local people were especially memorable.

*Laurence P. James  
Golden, Colorado*

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### A future AEG Special Publication

## Stream Sediment Geochemistry

Paul Matysek, geochemist with the British Columbia Ministry of Mines has agreed to coordinate the publication of a future AEG 'special publication summarizing the state of the art regarding stream sediment sampling. Stream sediment geochemistry has been an interest of Paul's since his M.Sc thesis work, an extract of which was published by the AEG in the Saskatoon symposium volume. That paper was given the student prize award in 1985. Paul is responsible for managing regional surveys for the government of British Columbia at a density of 1 sample per 13 km<sup>2</sup>.

Paul is currently compiling a table of contents for this volume. Those interested in assisting in the compilation, which has as its primary objectives to upgrade the quality and standardize, as much as possible, the methodology of stream sediment survey,

are invited to write to Paul at the address below. A copy of the table of contents and other notes will be forwarded to interested parties for comment before the bulk of the writing begins. A similar procedure will be employed subsequently to achieve a consensus of opinion on the hows, whys, whens, whats, and wheres of stream sediment sampling based on the 30 or so years of cumulative experience available in industry and elsewhere. If you want to participate in the process, let Paul know at:

**Paul Matysek**  
c/o B.C. Department of Mines  
756 Fort Street  
Victoria, B.C. Canada  
V8V 1X4  
(604) 387-3234

*Stan Hoffman, President*

# PROBPLOT

## PROBPLOT

*An Interactive Computer Program to Fit Mixtures of Normal (or Log-Normal) Distributions with Maximum Likelihood Optimization Procedures*  
by Clifford R. Stanley  
AEG Special Volume #14

The PROBPLOT program is an interactive computer program written for the IBM-PC and compatible computers which allows the analysis and modeling of cumulative frequency data on probability plots. Optimal mixtures of normal (or log-normal) distributions can be fit to any cumulative frequency data for the purpose of the selection of thresholds to partition data into groups.

The program supports all aspects of probability plot analysis described by Dr. A.J. Sinclair in Special Volume #4, *Application of Probability Graphs in Mineral Exploration*, including data censoring, data truncation correction, logarithmic and arithmetic analysis, polymodal distributions, and threshold selection. Multi-modal population distribution modeling and threshold selection can both be done visually by the operator and using mathematical optimization procedures to produce unbiased estimates.

Data in a wide variety of formats can be input into the program. Output consists of histograms, probability plots, summary statistics, thresholds, and distribution model parameters. Data sets as large as 3500 cases and 45 variables can be accommodated.

Computer system requirements are 256 kilobytes of memory, a disk drive, and a dot-matrix printer. PROBPLOT will support the CGA, EGA, and Hercules graphics cards, as well as the 8087 numerical co-processor chip.

This special volume #14 is distributed on a double-sided double-density 360 kilobyte 5.25 inch floppy disk. This contains an instruction manual file which can be dumped to the printer, the object code files required to run the program, and a sample data set which can be used for instruction. Program source code can be made available to those who wish to modify the code to work on other computer systems.

A combination package of Special Volume #4 (which discusses the theory of probability plot analysis) and #14 (the program to perform the analysis) is available at a \$5.00 U.S. discount of the combined price of each special volume. Users unfamiliar with the use and theory of probability are encouraged to purchase both special volumes because the material in the instruction manual of Special Volume #14 is designed to complement Special Volume #4 and does not reiterate the material presented there.

The Association of Exploration Geochemists and anyone else affiliated with the authorship or distribution of the PROBPLOT program assumes no responsibility for any problems or errors that arise from the use of the

PROBPLOT program. All users assume use of the PROBPLOT program entirely at their own risk.

Cost\*:

Special Volume #14 ONLY  
Members - \$25.00 U.S.  
Non-Members - \$50.00 U.S.

Special Volumes #4 and 14  
Members - \$30.00  
Non-Members \$55.00 U.S.

Note: Please specify which graphics card is installed in your computer and whether or not you have an 8087 numerical co-processor chip when ordering so you will receive the correct version of the program.

Also, please note that all orders 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, please contact:

**Clifford R. Stanley**  
Dept. of Geological Sciences  
University of British Columbia  
6339 Stores RD.  
Vancouver, British Columbia  
CANADA V6T 2B4

To order, please copy this coupon and return, with your payment to:  
The Association of Exploration Geochemists, P.O. Box 523, Rexdale,  
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# Computer Software Pool

Computer programs that are currently available through the AEG are listed below. This list will be updated as changes or new programs are announced. Please refer to Newsletter No. 59 (March 1987) for the most recent description of the programs.

The following routines have been adapted for 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 US). The cost can be reduced to \$5.00 CDN (\$4.00 US) if you send us your disk.

The programs 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. Only the source code is provided. Any routines required for plotting must be supplied by the user. The plotting routines used in the programs are the Industry Standard Plotting Package (ISPP) routines such as those used by Calcomp.

Programs currently available are:

**1. BOUNDARY.FOR:** a program which calculates and draws ternary values for the AFM, Al-Fe+Ti-Mg (Jensen),  $Al_2O_3$ -MgO-CaO ternary diagrams, and the TAS (Total Alkalies vs.  $SiO_2$ ) binary diagram. These calculations are based on weight per cent oxides from analyses determined for volcanic rocks.

In addition, the program contains a number of subroutines that draw the boundary lines between various fields that distinguish various volcanic suites and rock types.

**2. JENSEN.BAS:** A BASIC program that calculates volcanic rock names based on the major element chemistry.

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

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

Please note that all orders for software should be made to  
The Association of Exploration  
Geochemists  
P.O. Box 523  
Rexdale, Ontario, Canada  
M9W 5L4

For further information, requests, submissions, contact:

**Eric Grunsky**  
Ontario Geological Survey  
911-77 Grenville Street  
Toronto, Ontario, Canada  
M5S 1B3  
416-965-7046

## Executive

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