



THE ASSOCIATION OF EXPLORATION GEOCHEMISTS

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

President:

L.G. Closs
Geology Department
Colorado School of Mines
Golden, Colorado 80401
U.S.A.

NEWSLETTER NO. 43

MARCH 1983

Vice Presidents:

R.G. Garrett
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A 0E8
Canada

I. Thomson
Placer Development Ltd.
P.O. Box 49330, Bentall Stn.
Vancouver, British Columbia V7X 1P1
Canada

Secretary:

R.E. Lett
Association of Exploration Geochemists
P.O. Box 523
Rexdale, Ontario M9W 5L4
Canada

Treasurer:

R.G. Jackson
359 Broadway Avenue
Toronto, Ontario M4P 1X1
Canada

Councillors:

1983-84
G.H. Allcott
W.D. Goodfellow
S.J. Hoffman
S.E. Kesler
N.G. Lavery
K.A. Lovstrom

1983-85
W.B. Coker
B. Hitchon
A.A. Levinson
J.H. McCarthy Jr.
D.D. Runnells
A.E. Soregaroli

Australian Regional Councillor:
R.H. Mazzucchelli

European Regional Councillor:
B. Bolviken

Southern Africa Regional Councillor:
G.L. Coetzee

Brazilian Regional Councillor:
R.W. Lewis Jr.

A MESSAGE FROM THE PRESIDENT - L.G. Closs

The Exploration Geochemistry session at the AIME meeting held in Atlanta, Georgia, and the presentation (attached) of Dr. W.B. Coker to the Prospector and Developers meeting in Toronto, Ontario this past month were well received. AEG and AEG members will be contributing to further dissemination of information on exploration geochemistry at our regional meeting in Perth, Australia, in May and at the 10th International Geochemical Exploration Symposium in Helsinki, Finland, in August. At this time of reduced mineral exploration activity, I am pleased to report that the Association and its members are taking an active and positive role in effecting efficiencies in the exploration industry and thereby contributing to its revitalization.

In the upcoming year Council will be addressing issues related to publication policy, by-law changes, Symposia, distinguished lectureships and financial matters, in addition to normal business. A list of committee chairmen will be published in the June Newsletter. I encourage each of you to take an active role in the affairs of your Association. Convey your experience or opinions on AEG matters to the appropriate Committee Chairman, to me, or, through the open forum of the Newsletter - to the membership at large. We welcome your input.

I look forward to serving as your President over the next year and extend an invitation to you to fully participate in the affairs of your Association.

ADMISSIONS COMMITTEE REPORT

Names of the following candidates have been recommended to membership by the Admissions Committee and have been approved by Council. According to the Associations by-laws the names of the candidates are to be published for consideration by the membership. If you wish to comment on any candidate, please do so in writing to the secretary within 60 days.

VOTING MEMBERS

Beane, R.E.	Geochemist with Amax Exploration, Inc. Tucson, Arizona, U.S.A.
Beckel, J.	Exploration Geologist at Petromisa, Rio de Janeiro, Brasil.
Burstow, W.D.	Geological consultant, Conifer, Colorado, U.S.A.
Dada, S.S.	Exploration Geologist, Nigerian Mining Corp., Jos, Nigeria.
Danchin, P.D.	Exploration Manager, Union Carbide Exploration, Cape Town, South Africa.
Della Valle, R.S.	Research Geologist, Terradex Corp., Walnut Creek, California, U.S.A.
De Vivo, B. (Transfer)	Researcher at CNR (National Research Council of Italy) Naples, Italy.
Drez, P.E.	Research Geochemist, Exxon Minerals Co., Houston, Texas, U.S.A.
Easdon, M.M.	District Geologist/Manager, Lacana Mining, Reno, Nevada, U.S.A.
Eisenman, M.D.	Geochemist, Cominco American Inc., Spokane, Washington, U.S.A.
Grimes, D.J.	Research Geochemist, U.S. Geological Survey, Denver, Colorado, U.S.A.
Imeokparia, E.G.	Lecturer, University of Ibadan, Ibadan, Nigeria.
Karlson, R.C. (Transfer)	Chief Mine Geologist, Cotter Corp., Arvada, Colorado, U.S.A.
Karofi, A.Y.	Exploration Geochemist, Nigerian Mining Corp., Jos, Nigeria.
Lavin, O.P. (Transfer)	Geochemist/Consultant, O.P. Lavin and Associates, Kingston, Ontario, Canada.
Markov, R.A.	Geologist, Newmont Exploration, Timmins, Ontario, Canada.
Miller, J.K. (Transfer)	Project Geochemist, Anaconda Minerals Co., Denver, Colorado, U.S.A.

VOTING MEMBERS (con't)

- Moore, A.C. Senior Geologist, BHP Co., Ltd., Sydney, NSW, Australia.
- O'Hara, P.F. Self-employed Geologist, Prescott, Arizona, U.S.A.
- Pincus, W.J. (Transfer) Project Geologist, FMC Corporation, Denver, Colorado, U.S.A.
- Radford, N.W. Senior Geochemist, Geopeko, Winnellie, Australia.
- Ridgeway, J. Principal Scientific Officer, Institute of Geological Sciences, Nottingham, U.K.
- Rogers, P.J. Geochemist, Nova Scotia Dept. of Mines and Energy, Halifax, Nova Scotia, Canada.
- Sheppard, N.W. (Transfer) Geochemist, CRA Exploration Pty., Broken Hill, NSW, Australia.
- de Smeth, J.B. Exploration Geochemist, University of Utrecht, Amsterdam, The Netherlands.
- Smith, S.C. (Transfer) Senior Geochemist, Phillips Petroleum, Denver, Colorado, U.S.A.
- Sondag, F.P.J. Assistant, Laboratoire de Geochimie, Universite Catholique de Louvain, Laouvain-la-Neuve, Belgium.
- Turner, Exploration Geochemist, Energy Fuels Nuclear, Inc. Flagstaff, Arizona, U.S.A.

AFFILIATE MEMBERS

- Burke, K.E. Geochemist, Trenton, Michigan, U.S.A.
- Crosby, R.M. (Transfer) Project Geologist, Miramichi Lumber Co., Ltd., Fredericton, N.B., Canada.
- Doler, R.E. Exploration Geologist, Hecla Mining Co., Wallace, Idaho, U.S.A.
- Fedikow, M.A.F. (Transfer) Mineral Deposit Geologist, Manitoba Dept. of Energy & Mines, Winnipeg, Manitoba, Canada.
- Graves, R.M. Exploration Geologist with Kidd Creek Mines Ltd., Windsor, Nova Scotia, Canada.
- Hauntz, C.E. (Transfer) Exploration/Project Geologist, AMSELCO, Ely, Nevada, U.S.A.
- Hoag, R.B.Jr. (Transfer) Hydrogeologist/Geochemist and Principal of Exploration BCI Geonetics, Inc., Laconia, N.H., U.S.A.
- Lassen, R. Senior Field Technician with Amselco Exploration, Spokane, Wa. U.S.A.

AFFILIATE MEMBERS (con't)

- Leaman, P.W. Geochemist, BHP, Perth, Australia.
- Melo, O. de O. Professor at UFC, Institute de Geociencias,
Fortaleza, Ceara, Brasil.
- Morley, R.L. (Transfer) District Geologist, Utah International Inc.
Golden, Colorado, U.S.A.
- Mulela, D. Senior Project Geologist, Zimco Ltd.,
Lusaka, Zambia.
- McGauley, T. Chemist, Union Carbide Corp., Grand Junction,
Colorado, U.S.A.
- McKay, G.J. Exploration Geologist, PNC Exploration Pty.Ltd.,
Sydney, Australia.
- Odigi, M.I. Exploration Geologist/Lecturer, University of
Port Harcourt, Port Harcourt, Nigeria.
- O'Reilly, D.G. A Resources Management Planner, Ontario Ministry
of Natural Resources, Cochrane, Ontario, Canada.
- Ossi, E.J. Exploration Geologist, Utah International Inc.,
Knoxville, Tennessee, U.S.A.
- Ozlu, N. Professor of Geochemistry and Ore Deposits,
Algiers University, Algiers, Algeria.
- Rombouts, L.P. UNDP Expert, Antwerp, Belgium.
- Sektheera, S. (Transfer) Senior Geologist, Department of Mineral Resources
for Thailand, Bangkok, Thailand.
- Snelling, A.A. Project Geologist, Denison Australia Pty. Ltd.,
Casuarina, N.T., Australia.
- Snyder, K.D. (Transfer) Senior Geologist, Mineral Exploration with
NL Petroleum Services, London, England.
- Way, B.C. Geologist, self employed, Vancouver, B.C., Canada.

STUDENT MEMBERS

- Besse, L. A graduate student of Eastern Washington
University, Cheney, Washington, U.S.A.
- Cheff, R.L. A graduate student of the University of Idaho,
Moscow, Idaho, U.S.A.
- Germann, O.A. A graduate student at the Technical University
of Aachen, Aachen, Federal Republic of Germany.
- Herzig, P.M. A graduate student at the Technical University
of Aachen, Aachen, Federal Republic of Germany.

STUDENT MEMBERS (con't)

- Jombwe, N.F. A graduate student at the School of Applied Geology, Kensington, N.S.W. Australia.
- Keyssner, S.W. A graduate student at the Technical Univeristy of Aachen, Aachen, Federal Republic of Germany.
- Novajas, R.A. A graduate student at the Technical University of Aachen, Aachen, Federal Republic of Germany.
- Pivonka, L.J. A graduate student at the Colorado School of Mines, Golden, Colorado, U.S.A.
- Smith, S. M. A graduate student at the Colorado School of Mines, Golden, Colorado, U.S.A.
- Tombale, A.R. A graduate student at the University of British Columbia, Vancouver, B.C. Canada.

FUTURE MEETINGSSECOND GEOLOGICAL CONGRESS ON THE MIDDLE EASTOctober 22-24, 1983, Bagdad, Iraq

The second Geological Congress on the Middle East organized by the Arab Geologist Association and the Iraq National Oil Company will be held in Baghdad between October 22-24, 1983. A first circular had been circulated and a second circular is planned for April 1983. Deadline for abstracts and registrations is August 1, 1983.

For Further details please write to:

Dr. Wissam S. AL-Hashimi,
Secretary General
Second Geological Association
P.O.Box 1247 Central Post Office,
Baghdad, Iraq

UPDATE

JOINT 10TH INTERNATIONAL GEOCHEMICAL EXPLORATION SYMPOSIUM AND
3RD SYMPOSIUM ON METHODS OF GEOCHEMICAL PROSPECTING -August 29 - September 7, 1983 - Espoo/Helsinki, Finland

The second circular was mailed in January 1983. Some 400 persons have so far returned the preliminary registration forms and some 120 accompanying members have been pre-registered.

Dead line for abstracts was March 15, 1983. The program includes six invited state of the art reports, four keynote lectures, 36 contributed papers, 18 presentations of last minute results and some 30 poster presentations. Dead line for abstracts on last minute results is August 28, 1983 at registration.

Panel discussions will be arranged on geochemistry in aid programs and on the status of geochemistry in exploration.

On August 27 and 28 the following work shops will be arranged:

1. Till geochemistry; 2. Biogeochemistry; 3. Hydrogeochemistry; 4. Bulk standard samples for geochemistry and; 5. Thresholds and anomaly interpretation. All work shops run parallel. Those who take part in the pre-symposium field trips will be able to attend the work shops.

Ten field trips are planned; six on ore deposits in Fennoscandia, one on till-geochemical cases in central Finland, one on uranium occurrences and alkaline rocks in Greenland one on geology of Soviet Karelia and one to Scientific institutes of Leningrad.

The Third Circular with detailed information and final registration forms will be mailed by the end of April only to those who have responded on the 1st of 2nd circulars.

Address for correspondence;

Dr. Alf Bjorklund,
Geological Survey of Finland
SF-02150 Espoo 15, Finland

Telephone (90) 4693375

Telex 123185 geolo sf

UPDATE

AUSTRALIAN REGIONAL MEETING, PERTH, WESTERN AUSTRALIA, May 23-26, 1983THEME: Geochemical Exploration in Arid and Deeply Weathered Environments

Further details of this Meeting are given in a second circular which includes an outline of the technical program and field excursions. The technical program will cover topics related to the major meeting theme including Geomorphology in Relation to Geochemical Exploration, Weathered Bedrock Geochemistry, Iron stone Geochemistry, Groundwater Geochemistry, Vapour Geochemistry, Supergene Oxidation and Gossan Geochemistry. The joint session on "Geochemistry and Genesis of Ore Deposits Associated with weathering held with the Geological Society

of Australia will include pages on the Telfer Gold Deposits, the Argyle Alluvial Diamond Deposits, Supergene Iron Ore Deposits of the Hamersleys, Bauxite and Laterite Co-Ni Deposits and the Lake Way Calcrete Uranium Deposits.

Field Excursions are planned to Golden Grove Cu-Zn deposit and the Eastern Gold fields. A brief AEG Business Meeting will be held on May 24, 1983.

Completed registration forms, remittances and all enquiries should be addressed to

Mr. R.A. Young
Secretary, Organizing Committee
AEG Regional Meeting
P.O.Box 91
Belmont, W.A. 6104 Australia

FROM THE SECRETARIES OFFICE - Ray Lett

During March two meetings were held of particular interest to Geochemists and to others involved in mineral exploration. At the AIME, 112th Annual Meeting in Atlanta Georgia a joint AEG-AIME session entitled "Geochemistry Applied to to-day's Exploration" was attended by about 100 individuals. A brief report by Bob Garrett on this session and the Association's Annual General Meeting is included in this Newsletter. The Prospectors and Developers Annual Convention held in Toronto in early March with the theme of "Exploration at the Crossroads" attracted over 2000 delegates. Continued interest in precious metals created a strong note of optimism at the Convention. In keeping with the theme one technical session critically examined the key element of exploration and the role of the Geochemist very ably presented by Bill Coker. The full text of his talk is published in this Newsletter and I would be interested in comments and suggestions from members on the Association's role in providing education and instruction on applied geochemistry.

The Association's Executive would like to extend a warm welcome to A.A. Levinson, D.D. Runnells, W.B. Coker, A.E. Soregaroli, and B. Hitchon on their election as Ordinary Councillors at the Atlanta Annual General Meeting on March 10th. In addition those other individuals who were nominated but unsuccessful in the election are sincerely thanked for their interest in the Association.

Finally, I would urge those members who have still to send in their 1983 Membership Dues to please do so as soon as possible.

THE ATLANTA REGIONAL MEETING, March 10th, 1983 - Bob Garrett

This year, due to the upcoming 10th IGES and 3rd SMGP in Helsinki in August, the annual regional meeting used as a vehicle for the Annual General Meeting of the Association was a quiet affair. However, quiet does not mean boring. About 100 people attended the session entitled, "Geochemistry applied to todays exploration" which was organized by Erick Weiland as a joint venture between the Association and the

AIME as part of the AIME's 112th Annual Meeting in Atlanta, Georgia. The session was co-ordinated by Erick Weiland, and Graham Closs, a total of eight papers were presented. The topics covered included analytical method selection (Closs), partial dissolution techniques (Chao), analytical data reliability (Glanzman and Mason), graphical data presentation (Garrett), stream sediment geochemistry (Theobald) and vapour geochemistry (McCarthy). The papers were well received, aroused questions from the floor, and discussions continued on into the lunch hour. If any common theme developed it was that we must ensure that the knowledge and technology acquired by our profession to date be made understandable by the many persons now using exploration geochemical procedures, so that they may plan and execute appropriate and effective surveys. It is hoped that the papers will be published as a group in an appropriate journal. Unfortunately space is not available in the Journal of Geochemical Exploration due to the publication schedules of the 9th and 10th IGES meetings.

The Annual General Meeting of the Association was conducted after a luncheon which was attended by about a third of those present at the session. The results of the election of the Ordinary Councillors are published elsewhere in this Newsletter, and the Minutes and Annual Reports will be published as usual in the June Newsletter. Howie McCarthy, now our past-president, delivered his address on "Trends in Exploration" which, apart from some administrative meeting details, closed a stimulating morning and luncheon of exploration geochemistry on an optimistic and up-beat note.

GEORGE W. MANNARD MEMORIAL

The Canadian Geoscience Council and Kidd Creek Mines have instituted a Memorial Fellowship in Geological Science at McGill University in memory of George Mannard. They would welcome participation by the geoscience community.

The present proposal is for a two-year fellowship in the Mineral Exploration Program leading to an M.Sc. (Applied) Degree - the first year, in the amount of \$6,000, plus summer employment by Kidd Creek; and the second year for \$2,000. The recipient would be chosen on the recommendation of the Chairman of the Department.

Any funds raised in trust by the Geoscience community will augment those contributed by Kidd Creek Mines. A tax deductible trust fund is being set up for this purpose by the secretary-treasurer of CGC. Donations should be marked: 'Mannard Memorial Trust (CGC)' and forwarded to:

Dr. W.G. MacLeod, Secretary-Treasurer, CGC
c/o Petro-Canada,
P.O.Box 2844,
Calgary, Alberta, T2P 3E3
Canada

TRANSLATION OF RUSSIAN EXPLORATION LITERATURE - Are you interested ?

I would like to draw attention to AEG members that there is quite a large volume of Russian literature, in particular works relating to geochemistry, geophysics and economic geology of both metallic and hydrocarbon deposits which could be of value to the exploration community.

I was recently shown a list of some 60 relevant (1974-1982) publications including symposia which apparently have not been translated in North America. It has been suggested by a colleague who is a professional translator of Russian Geological literature that these articles could be translated and distributed at some basic cost which would be determined by the level of interest. Obviously the greater the commitment to purchase translations, the lower the cost.

Do you think the level of interest within our membership would be sufficient to justify publication of the titles in our Newsletter to determine what positive response this would generate. If we do receive positive response from interested people than I feel sure that the translator in question would be prepared to rapidly translate the pages of greatest interest.

Launie Curtis, Curtis and Associates, Toronto

*** **

NOTICE OF AN AEG EXTRAORDINARY GENERAL MEETING

To Be Held

At

17:10 Hours

On Thursday September the 1st

at the Dipoli Conference Centre

ESPOO, HELSINKI, FINLAND

Topics for Discussion:

- 1) Change of By-Laws to allow Postal Vote*
- 2) Report of Association's Activities

*A copy of the proposed changes is included with this newsletter. You will be asked to vote on these changes at the meeting.

RECENT PAPERS ON EXPLORATION GEOCHEMISTRY

This list comprises titles that have appeared in major publications since the compilation presented in Newsletter 42. Journals routinely covered and abbreviations used are Journal of Geochemical Exploration (JGE), Economic Geology (EG), Geochimica et Cosmochimica Acta (GCA), the USGS Professional Papers (USGS PROF P), Circular (USGS CIR) and USGS Open File Report (USGS OFR), Bulletin of the Canadian Institute of Mining and Metallurgy (CIM BULL), Transactions of Institution of Mining and Metallurgy, Section B: Applied Earth Sciences (TRANS IMM). Publications less frequently cited are identified in full. Compiled by Donald D. Runnells and Sandra L. Jones, Department of Geological Sciences, University of Colorado, Boulder.

Amstutz, G.C., Goresy, A.E., Frenzel, G, Kluth, C., Moh, G., Wauschkuhn, A., and Zimmerman, R.A. (Eds.), 1982. Ore Genesis: The State of the Art. Society of Geology Applied to Ore Deposits Special Publication 2. Springer-Verlag, New York, 804 p.

Aubague, M., l'Homer, A., and Sureau, J.F., 1982. A search for exploration guides for stratabound Pb-Zn deposits in dolomitic rocks. The examples of Bois-Madame (Herault), La Croix-de-Pallieres (Gard) and Figeac (Lot) deposits. Chron. de la Recherche Miniere 50(466): 41 ff.

Binns, R.A., 1982. Future potential for geochemical methods in Australian mineral exploration. Proc. Australas. Inst. Min. Metall. 283: 21-28.

Burt, D.M., Sheridan, M.F., Bikun, J.V., and Christiansen, E.H., 1982. Topaz rhyolites--Distribution, origin, and significance for exploration. EG 77(8): 1818-1836.

Cerling, T.E., and Spalding, B.P., 1982. Distribution and relationship of radionuclides to streambed gravels in a small watershed. Env. Geol. 4(2): 99-116.

Closs, L.G., 1983. Exploration geochemistry. Geotimes 28(2): 20-21.

Closs, L.G., and Sado, E.V., 1982. Orientation overburden geochemistry and quaternary geology investigations of carbonatite-alkalic complexes in the Prairie Lake and Killala Lake Areas, District of Thunder Bay. Ontario Geol. Surv. Study 23, 65 p.

Crisci, G.M., DeVivo, B., LaFratta, R., LaValva, V., and Lima, A., 1982. Metal response in plants to sulfide mineralization in the Longobucco area (Calabria, southern Italy). JGE 17(3): 187-204.

Drever, J.I., 1982. The Geochemistry of Natural Waters. Prentice-Hall, Inc., 388 p.

Elderfield, H., Hawkesworth, C.J., Greaves, M.J., and Calvert, S.E., 1981. Rare earth element geochemistry of oceanic ferromanganese nodules and associated sediments. GCA 45(4): 513-570.

Giardini, A.A., and Melton, C.E., 1982. Evidence that stable carbon isotopes are not a reliable criterion for distinguishing biogenic from non-biogenic petroleum. J. Petrol. Geol. 4(4): 437ff.

Hallbauer, D.K., 1982. Geochemistry and morphology of mineral components from the fossil gold and uranium placers of the Witwatersrand, in Armstrong, F.C. (Ed.), Genesis of uranium- and gold-bearing Precambrian quartz-pebble conglomerates. USGS PROF P 1161-A-BB: M1-M22.

Hartree, R., and Veizer, J., 1982. Lead and zinc distribution in carbonate rocks. Chem. Geol. 37(3/4): 351-366.

Hawkes, H.E., 1982. Exploration Geochemistry Bibliography to January 1981. Special Volume No. 11, Assn. of Exploration Geochemists, 388 p.

James, G.V., 1982. Sampling of bulk materials, in Symposium on Sampling and Analysis for the Minerals Industry, the Institution of Mining and Metallurgy, London, Nov. 2, 1982: 11-16.

Keays, R.R., Nickel, E.H., Groves, D.I., and McGoldrick, P.J., 1982. Iridium and palladium as discriminants of volcanic-exhalative, hydrothermal, and magmatic nickel sulfide mineralization. EG 77(6): 1535-1547.

Kim, J.H., 1982. A study on geochemical prospecting in Chonjuill gold and silver mine. J. Korean Inst. Mineral and Mining Engineers 19(2): 75ff.

Kolpakava, N.N., 1982. Determination of hydrogen sulfide in gas-liquid inclusions in vein minerals. Geochem. Intern. 19(1): 184ff.

Lord, J.R., 1978. Geochemistry of the Frieda River prospect and the surrounding district, Papua, New Guinea. Proceedings of the Eleventh Commonwealth Mining and Metallurgical Congress, Hong Kong, May, 1978.

Loring, D.H., 1982. Geochemical factors controlling the accumulation and dispersal of heavy metals in the Bay of Fundy sediments. Can. J. Earth Sci. 19(5): 930-981.

Lur'ye, A.M., 1982. The relation of copper-ore composition to sedimentation conditions in a marine basin. *Geochem. Intern.* 19(1): 149-156.

Matthess, G., 1982. *The Properties of Groundwater*. John Wiley & Sons, 406 p.

Murphy, G.J., 1982. Some aspects of sampling in terms of mineral exploration and mine geology, in *Symposium on Sampling and Analysis for the Minerals Industry*, Institution of Mining and Metallurgy, London, Nov. 2, 1982, p. 93ff.

Pagel, M., 1982. The mineralogy and geochemistry of uranium, thorium, and rare-earth elements in two radioactive granites of the Vosges, France. *Mineralogical Magazine* 339: 149-162.

Pankratz, L.B., 1982. Thermodynamic properties of elements and oxides. *US Bur. Mines Bull.* 672, 509 p.

Piispanen, R., 1982. A consideration of some hidden hydromorphic effects on the fines of glacial tills in the Kuhmo-Suomissalmi area, eastern Finland. *JGE* 17(3): 237-254.

Ramsey, M.H., and Thompson, M., 1982. AAS and ICP: Complementary methods for the metals industry, in *Symposium on Sampling and Analysis for the Minerals Industry*, Institution of Mining and Metallurgy, London, Nov. 2, 1982, p. 63-72.

Rhoton, F.E., Meyer, L.D., and Whisler, F.D., 1982. A laboratory method for predicting the size distribution of sediment eroded from surface soils. *Soil Sci. Soc. Am. J.* 46: 1259-1263.

Robinson, G.D., 1982. Trace metal adsorption potential of phases comprising black coatings on stream pebbles. *JGE* 17(3): 205-220.

Saager, R., 1982. Geochemical studies on the origin of the detrital pyrites in the conglomerates of the Witwatersrand Goldfields, South Africa, in Armstrong, F.C. (Ed.), *Genesis of uranium- and gold-bearing Precambrian quartz-pebble conglomerates*, USGS PROF P 1161-A-BB: L1-L17.

Shacklette, H.T., and Erdman, J.A., 1982. Uranium in spring water and bryophytes at Basin Creek in central Idaho. *JGE* 17(3): 221-236.

Shannon, S.S., Jr., 1982. Geochemical provenance of anomalous metal concentrations in stream sediments in the Ashton 1:250,000 quadrangle, Idaho/Montana/Wyoming. 33rd Annual Field Conference--1982 Wyoming Geol. Assn. Guidebook: 323-333.

Sohn, M.L., and Hughes, M.C., 1981. Metal ion complex formation constants of some sedimentary humic acids with Zn(II), Cu(II) and Cd(II). GCA 45(12): 2393-2424.

Taylor, C.H., Kesler, S.E., and Cloke, P.L., 1982. Sulfur gases produced by the decomposition of sulfide minerals: Application to geochemical exploration. JGE 17(3): 165-186.

Yablonskaya, N.A., and Melesko, A.I., 1982. Prediction of mercury deposits by interdisciplinary interpretation of satellite photographs and geochemical data (Khaydarkan ore field). Intern. Geol. Rev. 24(7): 814-818.

Yamada, R., and Hashiguchi, 1982. A practical indicator for delimiting the promising area around known Kuroko deposits: On the Cu-Pb-Zn haloes in the footwall mineralization zone of Fukazawa Mine. Min. Geol. 32(3), No. 173: 215-224.

Yeats, P.A., and Bowers, J.M., 1982. Discharge of metals from the St. Lawrence River. Can. J. Earth Sci. 19(5): 982-992.

Zaiyong, Y., et al, 1982. A preliminary environmental geochemical study on the radon springs in Xifeng, Guizhou Province. Geochimica 1: 81-101.

Zakrewski, M.A., 1982. Geochemical facies model of ore formation in the Grythyttan-Hallefors area, Bergslagen, central Sweden. Geologische Rundschau 71(1): 195-205.

Zumberge, J.E., Nagy, B., and Nagy, L.A., 1981 (1982). Some aspects of the development of the Vaal Reef uranium-gold carbon seams, Witwatersrand sequence: Organic geochemical and microbiological considerations, in Armstrong, F.C. (Ed.), Genesis of uranium- and gold-bearing Precambrian quartz-pebble conglomerates, USGS PROF P 1161-A-BB: 01-07.

A CRITICAL EXAMINATION OF THE KEY ELEMENTS OF EXPLORATION - ARE THEY AT A CROSSROADS ?

Mine Finders and Their Expertise

The Geochemist (and The Quaternary Geologist)

by William B. Coker, Senior Staff Geochemist, Kidd Creek Mines Ltd.,
Toronto, Ontario, Canada.

Is geochemistry really at any crossroads ? I have some strong opinions on the use - and abuse - of geochemistry in mineral exploration, but I wondered about the thoughts of other geochemists. So I asked them, the applied geochemists currently employed in the mineral exploration industry, working as exploration consultants or involved in exploration oriented research in government or university organizations. There are only about 25 qualified applied geochemists in all of Canada, and this number is decreasing as no significant number of new geochemists are being produced and as losses from mineral exploration industry to environmental organizations occur. Alarming ? Particularly so considering the increasing percentage of mineral exploration budgets being allocated to geochemistry every year. Also of concern is the omission of key participant from this panel, one whose value in exploring for mineral deposits under the glaciated landscape of Canada has been and generally continues to be neglected - the Quaternary geologist. Accordingly, I sought out the opinions of the few mineral exploration oriented Quaternary geologists with whom I am personally acquainted. What I have to say today represents a summary of the consistent themes outlined in a vast majority of these peoples' contributed comments.

Geochemistry in mineral exploration is at an extremely critical, and evolutionally dangerous, point in its development. Modern geochemistry applied to mineral exploration is now some 50 years old. During this time, major technological advances have resulted in improved analytical methodologies and instrumentation, and in the development of computer software specifically designed for manipulating geochemical data. However, there has been little real overall advancement in the effective application of geochemistry in mineral exploration. Geochemistry is still viewed, by an alarmingly large number of exploration managers and geologists, as relatively simple, straightforward and certainly of far less complexity than either geology or geophysics. Management and senior geologists have long recognized the shortcomings of not utilizing a geophysicist to conduct, or at the very least interpret data from, a geophysical survey. Similarly, they would, I hope, never think of using anyone but a qualified geologist to map the bedrock geology of a property or to log bedrock drill core. Nevertheless, geologists and technicians have historically been, and continue to be, used to design and conduct geochemical surveys and interpret the data derived therefrom even though very few have had any instruction in the techniques or principles of applied geochemistry.

In an all too typical scenario a company geologist will be delegated to design and carry out a geochemical survey. The survey will be organized and conducted under the supervision of this geologist without him ever contacting a qualified geochemist. The samplers, cheapest labour possible, will likely be given minimal or no training in correct sample collection procedures. The geochemical principles and reasoning

governing the selection of material to be sampled will probably not be explained to the samplers, even if known by the geologist. Little if any field observational data will be recorded. Priority will be placed on the speed rather than the quality of the sampling. Once collected the samples will be shipped to a commercial laboratory, likely sieved to the universally accepted -80 mesh, subjected to a strong acid extraction and analyzed for four or so elements by atomic absorption (AA) or alternately, in recent years, for up to 30 elements by inductively coupled plasma (ICP) or direct current plasma (DCP). In all likelihood, the geologist will have specified only the elements to be analyzed for, and perhaps the mesh size to be sieved to, leaving the selection of the extraction techniques and instrumental determinative method up to the laboratory. The geologist will insert no hidden control samples to evaluate the quality of the analytical data. Interpretation will simply be a numbers game involving a scan of the data list for high values. If variations in the levels of the elements determined are not clearly contrasting, then they will be deemed insignificant and not worthy of further consideration. Sample pulps and rejects will be discarded or stored in such a way that they cannot be readily retrieved. So will end another geochemical survey with little immediate or lasting value except perhaps in applying for assessment credits.

Similar scenarios could be detailed where the expertise of a Quaternary geologist is not used and untrained personnel are used to collect the standard "Basal Till" sample or even log and sample glacially derived sediments from overburden drilling.

Harsh comments? Perhaps, but from the responses received these scenarios are closed to the rule than the exception within the mineral exploration industry. How do we, the geochemists and Quaternary geologists, overcome the false assumptions and ignorance related to our fields? One way, and one way only, through "EDUCATION".

This education must occur on at least four fronts:

1. We must inform exploration managers, senior geologists and project geologists of the principles, techniques and complexities of exploration geochemistry and Quaternary geology and demonstrate the need to use the expertise of properly qualified geochemists and Quaternary geologists to optimize chances for success in finding economic mineral deposits.
2. We must expose geology students to basic undergraduate level courses in the principles and methodologies (field, analytical and interpretative) of applied exploration oriented geochemistry and Quaternary geology. Such courses are currently available at only a few Canadian universities with many given by people from the mining industry, as few universities have staff qualified to teach these subjects.
3. We must produce more properly trained mineral exploration oriented geochemists and Quaternary geologists. However, most of this training comes from graduate level courses and theses which are ceasing to be offered at universities in Canada; current trends suggest that graduate training in these fields is approaching extinction.
4. Government and research institutions must abolish the unnatural union of geochemistry with geophysics. Interdisciplinary research should proceed along the natural associations that exist between

geochemistry and Quaternary geology and geochemistry and mineral deposits geology.

In order to accomplish this education qualified geochemists and Quaternary geologists, with mineral exploration experience, must assume a higher profile and offer workshops and short courses in their disciplines. This should be done through organizations such as the P. & D., C.I.M.M., A.E.G. or G.A.C. A recent G.A.C. questionnaire assessing the need for short courses placed exploration geochemistry among the most desired. Industry must encourage universities to maintain and expand, or develop undergraduate and graduate programs in geochemistry and Quaternary geology around qualified personnel with industrial experience. With encouragement should come support, in any way possible. No geology student planning to work in mineral exploration in Canada should be allowed to graduate without taking basic courses in applied geochemistry and Quaternary geology. Only when this education is achieved will significant crossroads be passed and meaningful advances be made in the use of geochemistry and Quaternary geology in mineral exploration.

There are some encouraging signs in those mineral exploration companies, generally majors, currently employing the small number of qualified geochemists and Quaternary geologists available. Within many of these companies internal education programs on applied exploration geochemistry and in some instances exploration oriented Quaternary geology have been instituted. Emphasis is on resolution of the main problem areas depicted in my original scenarios. This is being achieved through internal exploration geochemistry workshops which cover:

1. The principles of geochemical distribution, dispersion and accumulation of elements in the primary and secondary environments.
2. The necessity for carrying out orientation surveys to determine optimum sample density, sample media, mesh size, element suite, analytical extraction and determinative techniques, etc. In many instances, field demonstrations are given to illustrate proper sample collection techniques, soil profile development, glacial sediment type, etc.,
3. The need to systematically record field observational data, site characteristics and sample compositional features required for subsequent data interpretation. This should be done in some computer processible format.
4. The various analytical extraction and determinative techniques available, whether partial or total, and possible interferences. Do not be afraid to talk to the laboratory analysts, they are eager to help and once the problem is clearly outlined they can likely resolve it. The absolute necessity for insertion of hidden control samples to evaluate the quality of all analytical data cannot be overemphasized!!
5. The requirement for documentation and archiving of all geochemical survey data including proper storage and cataloguing of sample pulps and rejects in a retrievable fashion.
6. The procedures of geochemical data interpretation including the need to normalize data, remove outliers and separate multimodal populations into their simplest entities before applying statistical analytical techniques. This requires a merging of the field information

with the analytical data. This is more efficiently done using computers. However, caution must be used as the computer is only a tool and not an interpretative entity in itself. The best interpretative tool the geochemist has weighs approximately 2 kilograms, takes about 10 to 15 years to program - and sits between his ears.

Similar internal workshops on the processes and mechanisms of glacial transport and deposition are being presented by Quaternary geologists. An understanding of these facets of Quaternary geology and the ability to identify different glacially derived sediments are critical to the application of geochemical exploration in glaciated terrain. This requires close liaison between geochemist and Quaternary geologist to maximize success in exploring for mineralization in glaciated terrain.

In all likelihood, what I have said here today is not what people expected to hear from the geochemist on this panel. Most probably foresaw comments on developments such as simultaneous multi-element analyses using the inductively coupled plasma (ICP) spectrometer, or sophisticated geochemical software packages for use on mini and microcomputers in both the office and the field, or perhaps on the utilization of the sonic drill for attaining undisturbed cores of overburden. Admittedly, all of these are significant technological advances, but unless we go back to the basics and educate people as outlined, how many companies in exploration will really benefit or improve their chances of exploration success using this modern technology.

Others perhaps expected comments on the need to do interdisciplinary research particularly on searching for blind deposits masked by overburden or bedrock cover. I must stress the critical need for cooperative research by geochemists and Quaternary geologists: to study and document glacial and chemical dispersion patterns in overburden associated with various mineral deposit types; to work towards a better understanding of the depositional and chemical characteristics of glacially derived sediment and their use in mineral exploration; and, to document sediment transport directions for the various types of overburden within areas under active exploration. Cooperative research is also needed between geochemists and mineral deposit geologists to document elemental zonation related to the formation and alteration associated with various mineral deposit types. Once again all good stuff, but who will benefit from this work unless qualified people are employed by mineral exploration companies to properly use the information? I could go on, but my time is nearly up.

In summary, I think we are proceeding at a very fast pace - pace - down the wrong road! I think we should apply the brakes, back up to the crossroads and choose the better way - education, understanding, cooperation and care.





THE ASSOCIATION OF EXPLORATION GEOCHEMISTS

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

President:

L.G. Closs
Geology Department
Colorado School of Mines
Golden, Colorado 80401
U.S.A.

April, 1983

Vice Presidents:

R.G. Garrett
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A 0E8
Canada

I. Thomson
Placer Development Ltd.
P.O. Box 49330, Bentall Stn.
Vancouver, British Columbia V7X 1P1
Canada

Secretary:

R.E. Lett
Association of Exploration Geochemists
P.O. Box 523
Rexdale, Ontario M9W 5L4
Canada

Treasurer:

R.G. Jackson
359 Broadway Avenue
Toronto, Ontario M4P 1X1
Canada

Councillors:

1983-84
G.H. Allcott
W.D. Goodfellow
S.J. Hoffman
S.E. Kesler
N.G. Lavery
K.A. Lovstrom

1983-85
W.B. Coker
B. Hitchon
A.A. Levinson
J.H. McCarthy Jr.
D.D. Runnells
A.E. Soregaroli

Australian Regional Councillor:
R.H. Mazzucchelli

European Regional Councillor:
B. Bolviken

Southern Africa Regional Councillor:
G.L. Coetzee

Brazilian Regional Councillor:
R.W. Lewis Jr.

PROPOSED BY-LAWS CHANGES

The recent introduction of a new Student Member rate for membership and the continued growth of the Association, especially in its non North American membership, has made three changes to the By-Laws desirable.

1. Students now receive the Journal for their US \$15 annual subscription. Thus, on providing evidence of their bona fide student status Students have the same privileges and benefits as Affiliate Members. The proposed change brings the By-Laws into conformance with the new practice.
2. As the Voting membership of the Association has grown it has become unwieldy to count the election for Ordinary Councillor ballots during the Annual General Meeting. Thus a mechanism is proposed whereby the ballots will be counted before the Annual General Meeting.
3. In order to involve as large a proportion of the Voting membership in decisions to amend or repeal, or enact any new by-law, a proposal to amend the voting process to a letter ballot is being made.

One further change to the By-Laws, which effects two clauses, is also being proposed. On occasion the Association holds its spring Annual General Meeting in conjunction with the meetings of other professional groups in order to facilitate as large an attendance as possible. This can result in Annual meetings being held as early as March, or as late as May. Currently the By-Laws allow the executive to hold office for 14 or 26 months, depending on whether the appointments are for one or two year terms. To allow greater flexibility for Annual meeting arrangements it is proposed to modify the terms of office to 16 and 28 months respectively.

PROPOSED BY-LAWS CHANGES

Old 2.05 Time of Election. - Members, Affiliate Members and Corporate Members elected prior to October 1st in any year shall pay full annual subscription for that calendar year and shall be entitled to receive upon request, all publications of the Association for that year. Those elected subsequent to September 30th shall pay no annual subscription for the balance of the calendar year, nor shall they be entitled to any publication of the Association for that year.

Student Members elected prior to October 1st in any year shall pay the full annual subscription for that year and those elected subsequent to September 30th shall pay no annual subscription for that year. Student Members will not be entitled to receive all publications of the Association, but will qualify to receive, upon request, The Journal of Geochemical Exploration and other specified publications at special subscription rates negotiated by the Association and approved by Council.

New 2.05 Time of Election - Members, Affiliate Members, Student Members and Corporate Members elected prior to October 1st in any year shall pay full annual subscription for that calendar year and shall be entitled to receive upon request, all publications of the Association for the year. Those elected subsequent to September 30th shall pay no subscription for the balance of the calendar year, nor shall they be entitled to any publication of the Association for that year.

Old 4.05 Election of Ordinary Councillors. - The Council shall issue to the Voting Members, at least two calendar months before the date of the Annual Meeting of members, the list of members nominated for election as Ordinary Councillors in accordance with 4.04 above, which shall be regarded as the balloting list.

Each Voting Member wishing to vote shall erase from the balloting list sufficient names to reduce the number of names on the list to not more than the number to be elected.

The balloting lists shall be returned to the Secretary and shall be opened at the Annual Meeting of members by the Scrutineers (appointed for the purpose by the Meeting) who shall examine them and report the result of their scrutiny to the Meeting. Any balloting list shall be deemed invalid if the number of names not erased therefrom shall be more than the number to be elected. The candidates elected shall be those who, in relation to the number of vacancies, receive the highest number of votes. In the event the Scrutineers are unable to report the election of the prescribed number of persons to fill the vacancies on the Council owing to an equality of votes, they shall submit the names of the candidates having the same number of votes to the Chairman of the Annual Meeting, who shall determine by his casting vote, or votes, which of such candidates shall be elected.

New 4.05 Election of Ordinary Councillors. - The Council shall issue to the Voting Members, at least two calendar months before the date of the Annual Meeting of members, the list of members nominated for election as Ordinary Councillors in accordance with 4.04 above, which shall be regarded as the balloting list.

Each Voting Member wishing to vote shall return a properly marked ballot to the Secretary, to be received by the Secretary no later than 10 days before the date of the Annual Meeting of members. The Secretary shall transfer the sealed ballots received to the auditor of the Association, or to disinterested persons appointed by the auditor, for opening and counting. The candidates elected shall be those who receive the highest number of letter ballots returned to the Secretary by the prescribed date. The result of the balloting shall be reported to the Annual Meeting. In the event that candidates receive an equal number of votes, the candidates names shall be submitted to the Chairman of the Annual Meeting, who shall determine by his casting vote, or votes, which of the candidates shall be elected.

Old 5.02 President. - The President shall be the chief executive officer of the Association and, subject to the authority of the Council, shall have the general supervision of the affairs of the Association; and he shall have such other powers and duties as the Council may prescribe. The President shall not hold office for a period of more than 14 months, except as provided in Section 7.08, and may not be appointed President following the end of his term of office for a further three-year period.

New 5.02 President. - The President shall be the chief executive officer of the Association and, subject to the authority of the Council, shall have the general supervision of the affairs of the Association; and he shall have such other powers and duties as the Council may prescribe. The President shall not hold office for a period of more than 16 months, except as provided in Section 7.08, and may not be appointed President following the end of his term of office for a further three-year period.

Old 5.02A The Vice-Presidents of the Association shall not hold office for a period of more than 26 months, except as provided in Section 7.08. One Vice-President shall be appointed before each Annual Meeting of members and the Vice-President who has held office for the longer period shall be referred to as the First Vice-President.

New 5.02A The Vice-Presidents of the Association shall not hold office for a period of more than 28 months, except as provided in Section 7.08. One Vice-President shall be appointed before each Annual Meeting of members and the Vice-President who has held office for the longer period shall be referred to as the First Vice-President.

Old 5.05 Before each Annual Meeting of members, the Secretary and Treasurer shall be appointed. The period of office of the Secretary and the Treasurer shall not exceed 14 months except as provided in Section 7.08, and each retiring appointee shall be eligible for reappointment.

New 5.05 Before each Annual Meeting of members, the Secretary and Treasurer shall be appointed. The period of office of the Secretary and the Treasurer shall not exceed 16 months except as provided in Section 7.08, and each retiring appointee shall be eligible for reappointment.

Old 13.01 Amendment. - This by-law may not be amended or repealed, nor any new by-law enacted, unless such amendment, repeal or enactment is proposed by the Council or by not fewer than twenty Voting Members. Upon receipt of such a proposal, the Secretary shall send notice of the proposed action containing particulars thereof to each Voting Member at least four months before the proposed action is to be considered at a general meeting. No such amendment, repeal or enactment shall be effective unless confirmed by at least two-thirds of the votes cast at a general meeting of the Voting Members of the Association at a meeting duly called for that purpose and filed with and approved by the Minister of Consumer and Corporate Affairs.

New 13.01 This by-law may not be amended or repealed, nor any new by-law enacted, unless such amendment, repeal or enactment is proposed by the Council or by not fewer than twenty Voting Members. Upon receipt of such a proposal, the Secretary shall send notice of the proposed action containing particulars therefore, and a ballot paper, to each Voting Member at least four calendar months before the proposed action is to be considered at a general meeting. Each Voting Member wishing to vote shall return a properly marked ballot paper to the Secretary, to be received by the Secretary no later than 10 days before the date of the general meeting called to consider the proposed action. The Secretary shall transfer the sealed ballot papers received to the auditor of the Association, or to disinterested persons appointed by the auditor, for opening and counting. No such amendment, repeal or enactment shall be effective unless the number of sealed ballots returned to the Secretary by the prescribed date exceeds 10% of the number of Voting Members, or the quorum for the Annual Meeting of members (15), whichever is the greater number, and is confirmed by at least two-thirds of the votes cast. The result of the balloting shall be reported to the general meeting. Furthermore, no such amendment, repeal or enactment shall be effective unless filed with and approved by the Minister of Consumer and Corporate Affairs.