EXPLORE

The Association of Exploration Geochemists Newsletter

NUMBER 62 FEBRUARY 1988

President's Message

By now you have seen and formed your own opinion on our newly formatted newletter, EXPLORE, and I am confident you were pleased. From the many telephone conversations I had with Chet Nichols and Clark Smith, I know a great deal of effort went into its preparation. On behalf of our membership, I would like to thank them and their helpers, particularly Mary Allen, for this effort in Reno and for the newsletters which will follow.

As part of your contribution to becoming involved in the AEG, I am asking for your observations, viewpoints, compliments, and criticisms regarding the ***Journal of Geochemical Exploration*** *which is the flagship of the AEG. Please write to Dr. Don Runnells (see page 19 of this issue) so that he can compile your comments for our editor, Dr. Eion Cameron, and for the AEG council.*

Certain actions have already been taken, such as ensuring regular publication of issues and prompt notification if you will not be receiving an issue for non-payment of current year dues (see last page of October EXPLORE). But other issues might be of concern to you such as the type of papers being published or the range of subject matter being presented. It is a duty of an organization like the AEG to critically review itself and its organs on a regular basis and to initiate changes where needed or mandated by its membership. Please help Dr. Runnells and Dr. Cameron in this endeavour.

Another subject worthy of critical review is that of the actions (or inactions) of your council on your behalf. I encourage submissions on how you believe the interests of the organization can be improved, particularly at this time when candidates are being nominated for the 1988-1990 term.

I believe the structure of the AEG council should be modified to ensure analytical and environmental representation, and if individuals make themselves and their concerns known to me, we can work together to form a better council. For those who are considering the council of the AEG, please do so only if you have enough time to become actively involved. The profession sorely needs leadership from the AEG if geochemistry is to deliver to its potential.

Stan Hoffman

CONTENTS

NEWS & COMMENT

Gold in Moss-Mat Sediments and Stream Sediments

An article in the last issue of EXPLORE presented current geochemical programs of the British Columbia Geological Survey Branch. Preliminary results for the northern Vancouver Island Regional Geochemical Survey orientation project have just been received, showing some exciting possibilities for the use of stream sediments trapped in moss-mats as a sampling medium in cool, humid, mountainous regions where sandy sediment is not adundant.

As part of the project, which was initiated to compare traditional and innovative sampling techniques, moss-mats were scraped from boulders and logs within the active channel well away from the banks. At each site, 1 to 2 kg of both moss-mats and sandy stream sediments were collected. Collection of moss-mats was very rapid as suitable sample sites are extremely abundant.

In the laboratory, samples of both types were dried at 60 C and moss-mats were hand-pulverised to release the entrapped sediment. Half gram splits of the -80-mesh (-177 μm) fraction from both the sandy sediments and moss-mat sediments were digested with aqua regia. Thirty elements were determined directly by ICP-ES while Sb, As, Se, Ge, Bi and Te were determined by ICP-ES following reduction to their hydrides. Gold was determined by aqua regia digestion of a 10-gram split, followed by MIBK pre-concentration and graphite furnace AAS finish.

The weight of -80-mesh material obtained from each sample immediately shows a potential advantage of moss-mat samples. Moss-mats typically yielded 50 grams of the fraction which contrasts with an average of 15 grams obtained from sandy sediments. Optimally, the Branch's Regional Geochemical Surveys require 23 g of sediment for the determination of 17 elements by a variety of analytical techniques as well as analysis of two 10 g splits for gold. Fifty-three percent of the conventional stream sediment samples yielded too little material to meet survey standards whereas all moss-mats yielded enough material for analysis in the current project as well as a remainder for future analysis of other elements.

Gold results for two areas of contrasting geology and physiography show the differing responses of moss-mat sediments and stream sediments. The Zeballos Au-Ag-Pb-Zn-Cu mesothermal vein camp is located in very wet, rugged mountains on the westcoast of Vancouver Island; Red Dog molybdenum-copper stockwork deposit is one of several similar occurrences exposed in the till-blanketed lowlands toward the northern tip of Vancouver Island. Results are very similar for moss-mat sediments and conventional stream sediments from Goldvalley Creek

continued on page 4

Notes from the Editor

Journal of Geochemical Exploration Volume 27, number 1-2 (October 1987) and number 3 (December 1987) have been issued since the last newsletter. Write Ines S. Filicetti at P.O. Box 523 (Metropolitan Toronto), Rexdale, Ontario, M9W 5L4, Canada about discrepancies.

Members who have not sent in **1988 dues** will receive EXPLORE but not the *Journal of Geochemical Exploration.*

The AEG mailing list has been updated as of the latter part of January to show current payment of dues. If your mailing label does not say **PAID-88** please write Ms. Filicetti at the address in the paragraph above.

The form at the back of this issue may be used for both renewals and new memberships. Payment by VISA and Master Card is available as indicated on the reverse side of the form — a feature of particular convenience to those who do not have ready access to U.S. funds.

As listed under the officers of the Association on the back page, **Dave Jenkins** has agreed to replace **Lynda Bloom** as Treasurer of the Association. We wish to thank Lynda for her gracious service and look forward to continued prosperity with Dave.

Paul Taufen has also assented to replace **Richard Lewis** as Brazillian Regional Counsillor. We're sure that Paul will do his best to fill the boots of his good friend Richard who passed on last year (EXPLORE no. 61, p.5).

Nominations for the third **Distinguised Lecture** series were requested in the previous issue of EXPLORE (p. 16). If you would like to volunteer or make a recommendation, please call D.M. Jenkins at 604-888-0358 without delay.

During the February 11 meeting of Council, **Graham F. Taylor** was approved for the new position of a second Australian Regional Councillor. This reflects the growth of our membership on that continent and the confidence of his peers.

This newsletter needs **Assistant Editors** located in major exploration centers and universities to solicit and prepare extended abstracts for publication and represent the Association in their respective professional communities. Please contact C.E. Nichols at Suite 290, 680 Greenbrae Drive, Sparks, Nevada 89431.

Issue number 61 was distributed to approximately **3,700 different professionals** from the combined membership lists of the Association of Exploration Geochemists, Society of Economic Geologists, Denver Regional Exploration Geologists Society, Geological Society of Nevada, and attendees at the April 1987 GSN Symposium at Reno.

The distribution of this issue is planned for approximately **4000** to include geologists of the Northwest Mining Association and most libraries with geologic collections.

The next issue will be distributed by the NWMA to a compliation of lists without duplicate names estimated at about **7000**.

Considering the dozens of other such illustrious groups of explorationists in the world which are listed in the Directory of Geoscience Organizations (*Geotimes* October 1987), there are many more people who should be interested in future issues of EXPLORE besides AEG members. We hope to maintain large promotional mailings, and certainly would appreciate a set of mailing labels from other appropriate international, national, regional, and local organizations.

There have been so many requests for additional copies of the October issue that a **reprinting** is being considered. If you or your organization is interested, please write EXPLORE indicating the number of issues wanted at $1.25 US each plus $5.00 per order for handling and shipping. Please respond by March 31.

A few of our bretheren have taken it upon themselves to conduct a **membership compaign** on behalf of the Association. Of these, the most notable is

EXPLORE

Newsletter No. 62 FEBRUARY 1988

EDITOR: Chester E. Nichols (702) 331-4223

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Assistant Editor: Harold F. Bonham (702) 784-6691

Editor of Pearl Harbor File: Stanley J. Hoffman (604) 682-8345

TELEX, Prof. H.F. Bonham, AEG Newletter 910 380 6050 NVU LIB

Information for Contributors to Explore

Scope In addition to contributions on exploration geochemistry, material on multidisciplinary applications, environmental geochemistry and analytical technology is encouraged. Of particular interest are extended abstracts on new concepts for guides to ore, model improvements, exploration tools, unconventional case histories, and descriptions of recently discovered deposits.

Format Manuscripts should be double-spaced and include illustrations where possible. Meeting reports may have photographs, for example. Text is preferred on paper *and* 5¼-inch IBM-compatible computer diskettes with ASCII (DOS) format, which can go directly to typesetting.

Length Extended abstracts may be up to approximately 1000 words or two newsletter pages including figures and tables.

Quality Submittals are copy-edited as necessary without reexamination by authors who are asked to assure smooth writing style and accuracy of statement by thorough peer review.

Deadlines Copy should be received by EXPLORE at Reno, Nevada before the middle of March, June, September and December to expect space in the next newsletter. Items of immediate interest may be accepted until the time of typesetting.

Stan Hoffman who sponsored ten of the new voting members listed in this newsletter. Runner-ups are Al Sinclair with four, Ivor Elliott and Pedro Herman with three, and K. Fletcher, Jane Plant, Graham Closs and Larry James with two each. If these busy and productive people have this time for the association, perhaps you do too. Please feel free to reproduce the membership form at the back of this issue.

Chet Nichols

A Note from the Secretary

At this time of the year we are once again faced with sending membership dues to the organization. I thought it might help "ease the pain" a bit if there were some explanation about why we collect the dues when we do and why we are so insistent about receiving payment for the current year before the end of the current year. The reason for this is that Elsevier (our publisher) establishes our total membership on December 31 of each year. This is the number of members used as the basis for substantial royalty payments to the organization. Any memberships for the previous year that are received after December 31 are not recognized by Elsevier as members and are considered as the Association buying a "back issue". As a result, we get no royalty for those members and the royalties are what helps fund your organization. It is very important that your organization receive your dues as early in the current year as possible.

Much of my mail concerns the status of individual members and their receipt (or not) of our publications. In the past it has taken an inordinate amount of time for the Council to approve new members and then notify them of their status. This is an ongoing problem that we are trying to resolve and we hope to be much more responsive to the membership, especially the new membership.

Sherman Marsh

PERSONAL

Information on Association members is received from around the world. To keep others informed of items such as moves and promotions, send a notice, preferably with photo, to EXPLORE.

Lloyd James wishes to inform members that he is now operating as an independent geochemical consultant. He may be contacted at 6170 E. Briarwood Circle, Englewood, Colorado 80112, U.S.A., (303) 741-5199.

Dr. Nigel W. Radford is now Supervising Geologist (Exploration) with Metana Minerals at 161 Great Eastern Highway, Belmont, W.A. 6104, Australia.

POSITIONS WANTED

Ph.D. Geologist/ Geochemist with 15 years experience in a major old-line mining company and 6 years consulting in Reno proposes to organize and manage a gold exploration and/or mining program in Nevada at a time of unusual opportunity. Call 702-331-4223.

Notices of positions wanted are published without charge to current members. Organizations may also list vacancies without charge by sending the appropriate copy with or without camera-ready logo to EXPLORE.

LETTERS

Nordic Countries Report

At present a local meeting of Nordic geochemists on reconnaissance and interpretation is planned for August 1988. Another meeting of semi-local character (with invited foreigners) on environmental aspects is planned for the first half of 1989. I will let you know more as planning progresses.

I will also set up a system of reporters in response to the request for local news.

Alf Bjorklund
Department of Geology
Abo Akademi
SF-20500 Abo, Finland
Phone: 358-0-298 8297

New Format of Explore

I thought that I should write and congratulate you on a fine effort — both in content and format — represented by EXPLORE. I know that this does not come easy.

Yours sincerely,

Eion M. Cameron
Department of Geology
University of Ottawa
Ottawa, Ontario
K1N GN5 Canada

Misprints Corrected

The newsletter EXPLORE no. 61 October 1987 page 4, "The Analysts Couch" has my name misprinted. L. Kothny is either my brother or my daughter. Also the country of the undersigned is mispelled (Zambia?).

Very truly yours,

E.L. Kothny, Ph.D
20 Rheem Boulevard
Orinda, CA 94563 U.S.A.

AEG-NWMA JOINT MEETING

CALL FOR PAPERS

Multidisciplinary Exploration Case Histories
Spokane, Washington • November 30 to December 2, 1988

The AEG will be co-sponsoring the annual general meeting of the Northwest Mining Association (NWMA) in Spokane, Washington on the topic of multidisciplinary exploration case histories. The meeting will focus on the use of geology, geochemistry and geophysics in the search for Au and Pt volcanogenic massive sulphides and other types of deposits. The annual NWMA meeting is probably the premiere event within the exploration community in the United States and should be placed on your calender of events worth attending.

Papers are being requested where the use of a multidisciplinary approach can be described and its effectiveness commented upon. It is likely that the meeting will attract many gold papers, but submissions will be accepted on any commodity. Organizers hope to attract papers on many deposit types from North America as well as on other parts of the world.

But time is short. If you would like to contribute a technical paper (or papers), please direct your intentions to the address below by April 15. Extended abstracts of about 500 words are due June 1, 1988.

It is our intention to publish a proceedings volume of papers submitted for that purpose and meeting standards established by an editorial board. It is requested that papers be submitted by October 15, 1988 so that copies can be made and distributed to interested convention participants.

A premeeting geochemical short course is planned for November 28-30 (2 ½ days). Field trips are also being considered. Look for more information in the April issue of EXPLORE. Cost for the short course will be $425.00. Cost for the convention itself will be $75.00 for AEG and NWMA members, or $105.00 for non-members.

For more information and for submission of abstracts, please contact:
Jerry D. Lewis • *Convention Chairmen* • *414 Peyton Bldg.* • *Spokane, Washington* •*99201 U.S.A.*

NEWS & COMMENT

continued from page 1

near Zeballos (Figure 1). Here Au is thought to occur predominantly as coarse, native gold particles (as indicated by erratic results for duplicate analyses of 5 gram splits of conventional sandy sediments).

By comparison, duplicate gold analyses of 5 gram splits of sandy sediments from Red Dog Creek are fairly consistent, suggesting that gold occurs as relatively abundant fine particles. Nevertheless, gold is almost an order of magnitude more abundant in moss-mat sediments than in sandy sediments (Figure 2). In this case, gold concentrations in moss-mat sediments have the advantage of being considerably above the detection limit (1 ppb), providing greater geochemical contrast (relative to background defined as the detection limit) and better analytical precision.

Other elements in the 103-site survey indicate that concentrations in moss-mat sediments and stream sediments are comparable for many elements including Mo, Cu, Pb, Co, Fe, As and Hg. However, stream sediments generally show greater concentrations than moss-mat sediments in Zn, Ni and Mn.

A more detailed discussion can be found in a report by P.F. Matysek and S.J. Day entitled "Geochemical orientation surveys: northern Vancouver Island, fieldwork and preliminary results" in British Columbia Ministry of Energy, Mines and Petroleum Resources Geological Fieldwork and Current Research 1987, to be released in February 1988.

At this stage of the study, results are tentative. More analytical results are expected shortly, and next year a site-specific study is planned to investigate the causes of observed differences in trace element concentrations in moss-mat and sandy sediments.

Further information can be obtained from:

P.F. Matysek, S.J. Day or **J.L. Gravel**
British Columbia Geological Survey Branch
300-756 Fort Street
Victoria, British Columbia
V8V 1X4 Canada
Telephone: (604) 387-3234

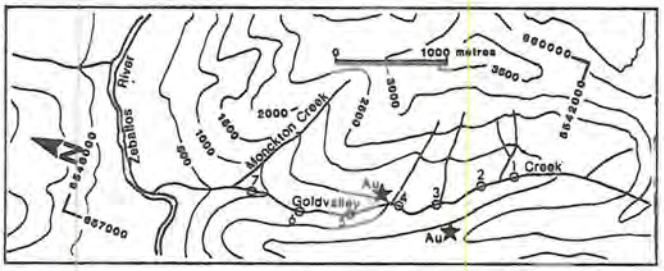

Figure 1a. Area of Zeballos camp with location of small mines shown by stars.

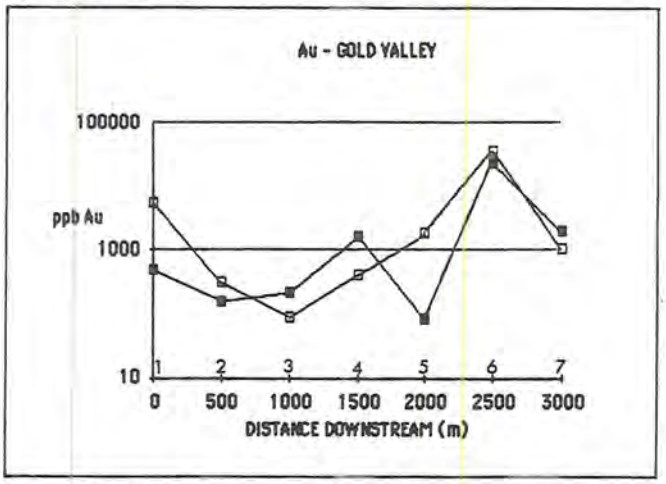

Figure 1b. Moss-mat sediment results (open squares) are similar to stream sediments in the Zeballos area.

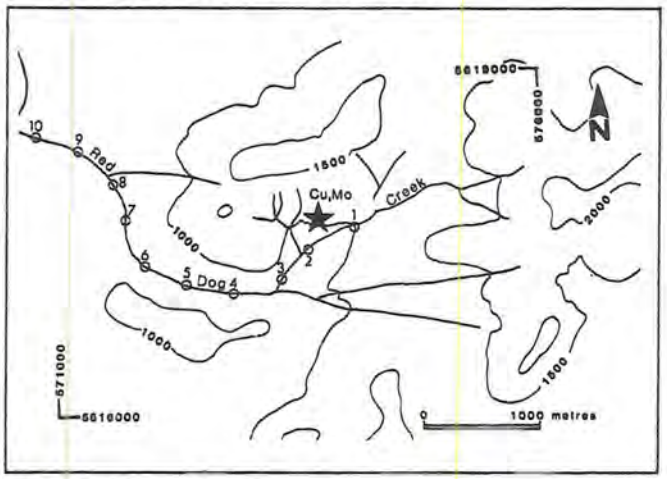

Figure 2a. Area of Red Dog stockwork deposit.

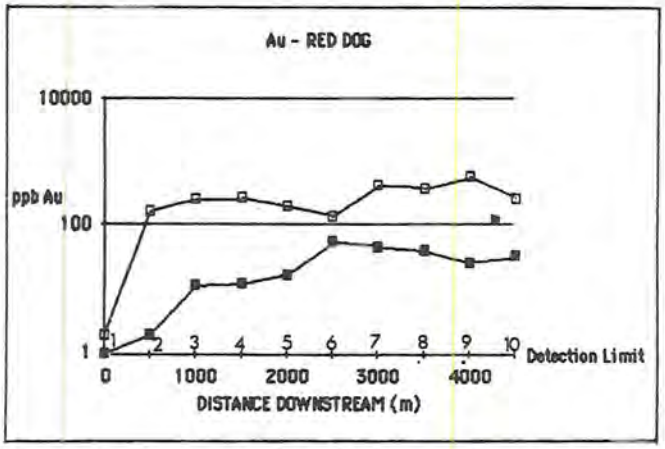

Figure 2b. Moss-mat concentrations are much greater than those for stream sediments (solid squares).

TECHNICAL NOTES

Microbial Methods of Mineral Exploration

The idea of prospecting for mineral deposits using microorganisms is not new. The Soviets in the late 1950's were the first to investigate whether the distribution of sulfur metabolizing bacteria in soils could be used in mineral exploration. Since then others have shown that several sulfur metabolizing microorganisms, *Thiobacillus* spp. and *Desulfovibrio* spp., are useful in locating ore. Although sulfur-utilizing bacteria may show promise in locating sulfur-rich deposits, such as sulfide and native sulfur ore, these organisms are not useful indicators of sulfur-poor deposits.

Alternatives to using sulfur-metablizing microbes in mineral exploration have been twofold: the development of assays that determine metal and anitibiotic resistances in soil bacterial populations associated with mineralized bedrock, and the development of a *Bacillus cereus* assay in which increases in populations indicate the presence of metalliferous terrain.

Although the former method has shown some promise in delineating metalliferous terrain, it is the latter method that has received the most attention primarily because of the cost effectiveness of the technique and the ease with which it can be applied. The *B. cereus* method was introduced in 1982 by John Watterson of the U.S. Geological Survey in Denver.

Watterson's interest in the distribution of *B. cereus* originated as a result of a study by Timoney and others in 1978. They were the first to show that heavy metals in the environment can selectively enhance antibiotic resistance in bacteria. This study led Watterson to investigate whether antibiotic resistances in soil bacterial populations coincide with the location of metalliferous soils associated with subsurface mineralized bedrock.

Results from his study in which soils were collected above the Poorman Creek porphyry deposit in Montana, show that penicillin resistance in total *Bacillus* spp. correlates significantly with soil metal content and that the most numerous of the *Bacillus* species displaying this resisitance phenomenon was *Bacillus cereus*. It was concluded that either penicillin resistance in total *Bacilluss species or increases in B. cereus* might be useful as an exploration method.

Since the introduction of the new microbial method to the exploration community, many surveys have been conducted over a variety of gold deposits: gold-quartz veins in the Empire District, Colorado; the Reid deposit veins near Redding, California; and disseminated gold deposits at Mesquite, Hemlo, and Hog Ranch.

Survey results from soils collected at the Hog Ranch deposit are illustrated in the Figure. Both soil gold and concentrations of *B. cereus* populations show anomalous values displaced slightly downslope from the known location of ore. Anomalous gold concentrations are subtle in comparison to *B. cereus* populations which increase to as much as 40,000 times local background. Results from the survey at Mesquite show that the greatest advantage over other exploration methods is that *B. cereus* populations are able to delineate ore as deep as 300 feet in extremely arid climates.

The need to integrate microbial surveys with geochemistry is evident, especially in areas where outcrop exposure is common. Geochemical and *B. cereus* correlations to date have not clearly answered the question of which specific metals *B. cereus* is responding to, suggesting a more complicated ecological relationship. However, with the advent of new micro-analytical techniques and the development of methods for studying soil microbial ecology, many of these questions will be answered. Interest in the distribution of microbes in relation to ore deposits will hopefully stimulate research in the field of microbial ecology as we now realize the amount of information available by looking at biological systems in relation to geologic problems.

Dr. Nancy L. Parduhn
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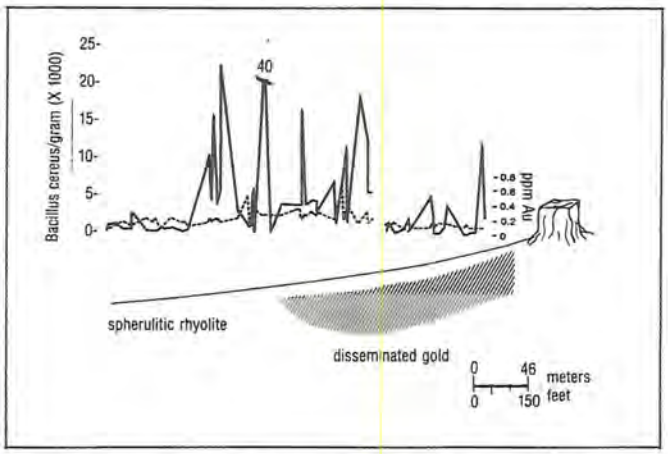
Phone: (702) 331-3013



Plot of *Bacillus cereus* per gram of soil and ppm Au in soil overlying disseminated gold mineralization at the Hog Ranch deposit in Washoe County, Nevada.

TECHNICAL NOTES *continued*

Geochemical Signature of the El Realito Gold Prospect, Sonora, Mexico

Heap leach Au potential along an oxidized mesothermal vein system has been investigated recently by the Luz del Oro S.A. de C.V. joint venture at the El Realito concession which lies 130 kms ESE of Hermosillo, Sonora, Mexico in the San Antonio Mining District near San Antonio de la Huerta. Geochemistry has augmented geology in rugged terraine with few outcrops. Initial exploration indicates from 400,000 to 800,000 tonnes of 2.5 grams per tonne Au in vein gossans. Au and Ag veins and Au placers have been exploited in the district since Spanish colonial times.

Vein wallrocks at El Realito include hornsfelsed west-dipping shales, calcareous siltstones, sandstones, and conglomerates of the Upper Triassic Barranca Formation. Metamorphism and mineralization may be related to abundant local granite and granodiorite intrusives. Pebbles of intrusive rocks in middle Tertiary conglomerates suggest a Laramide age for intrusion.

The 25 sq. km San Antonio District shows geochemical zoning characteristic of porphyry Cu systems. Zoning is centered on the Luz del Cobre Mine — a breccia pipe which has produced 200,000 tonnes of 3% Cu, and which contains 4,000,000 drill-proven tonnes of 1.4% Cu.

The district is one of several spaced at approximately 10 km intervals along a 50 km ENE- trending regional zone of Cu-Pb-Zn-W-Au-Ag mineralization.

The district is characterized by a swarm of pyritiferous veins cutting, and extending 4 kms WSW from, the Luz del Cobre pipe. Intense oxidation has reduced veins and nearby wallrocks to gossans of silica, clay, and limonite. Au and electrum — as well as Pb, Zn, Mn, and Cu oxides, native Ag, and barite — can be panned from these gossans. From 1982 to 1984, small pits along the veins at Chalate, Promontorio, Golfo de Oro, and California (Figure 1) yielded 100,000 tonnes of 3.0 gpt Au ore. The San Antonio District also contains important placers.

Veins, generally less than 1 meter thick, are accompanied locally by sheeted, multistranded, enechelon veinlet swarms in zones 5 to 30 meters wide. Gossany material also occurs along the veins in stockworks, in breccias, and along bedding laminae of favorable sedimentary units. Best Au values and the strongest vein, stockwork, and breccia development occur along veins where they are intersected by cross-faults (Figure 1).

The base of sulfide oxidation, exposed in canyon walls at El Realito, gradually rises to the west. This profile, not parallel with the modern arroyo profile, is parallel with, and possibly related to, a profile defined by elevations of ridgespurs. Thus, the veins were probably oxidized during a time of valley formation earlier than the present geomorphic cycle, and are mostly being dissected at present.

Rock-chip geochemical data from a 0.5 sq. km grid of the district (figures 2, 3, & 4) show a zoned distribution of base metals and Ag — with boundaries of "anomalous" envelopes defined by assay average plus one standard deviation. Centered on the

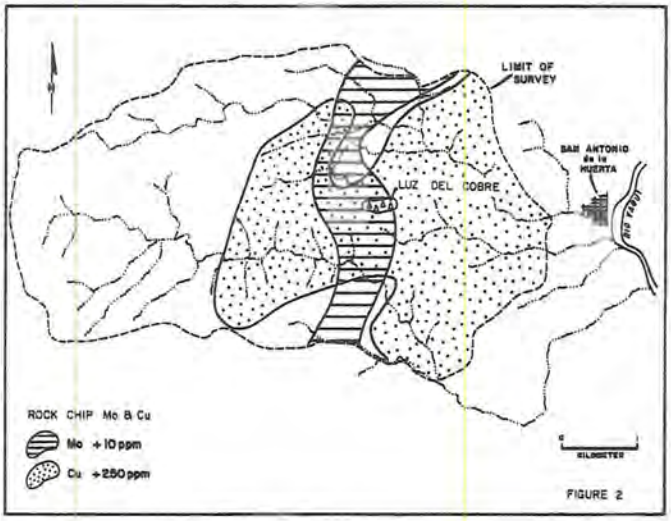


FIGURE 2

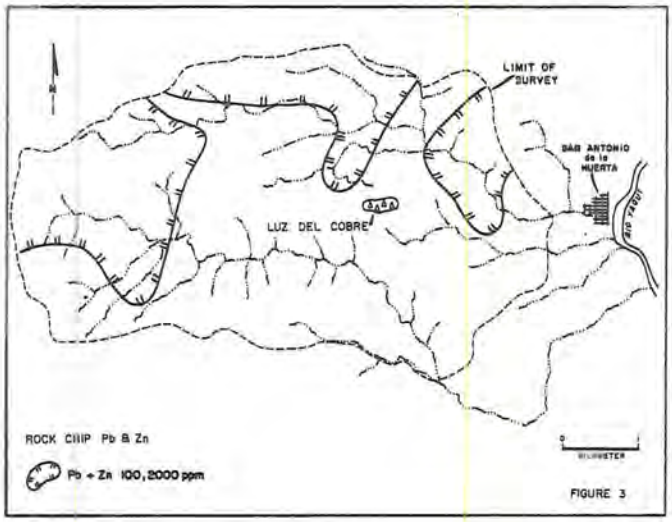


FIGURE 3

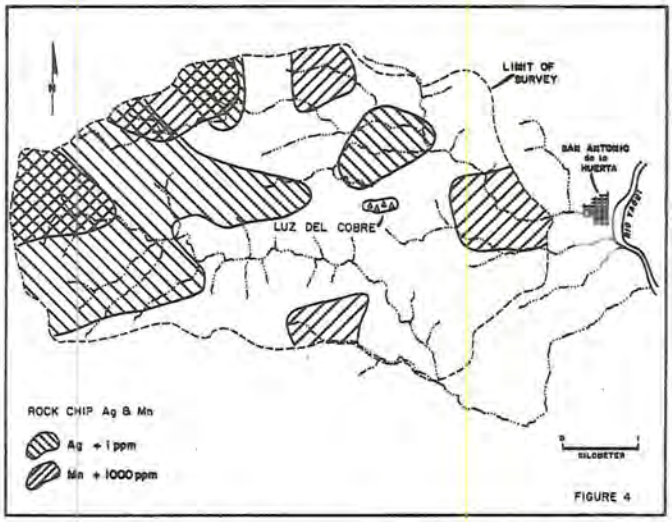


FIGURE 4

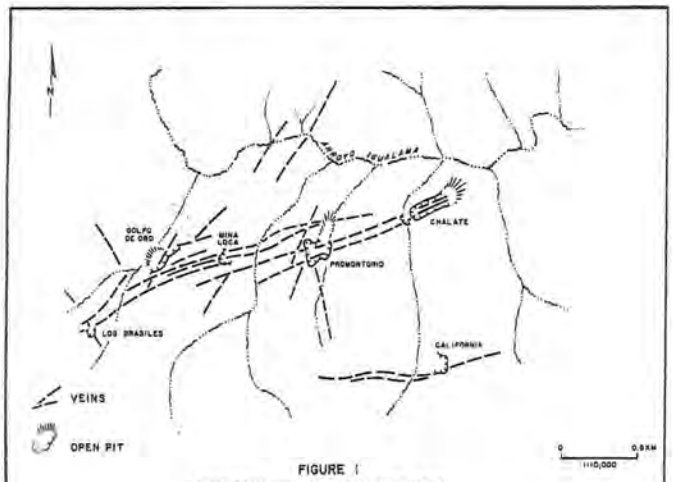


FIGURE 1
MINERALIZING STRUCTURES

Luz del Cobre breccia pipe, a 10 ppm Mo envelope is approximately surrounded by an envelope of 250 ppm Cu. This zone is surround by a halo showing plus 100 ppm Pb, 2000 ppm Zn, and 1000 ppm Mn. The 1 ppm Ag isograd overlaps and appears to be more peripheral than the Mn, Zn, and Pb anomalies. For the 61 samples taken, Au was below spectrographic and AA detection limits.

In a district-wide survey of arroyo sediments (Figure 5), each of 256 samples reflects a drainage area of not more than 0.5 sq. km. Samples were sieved to minus 80 mesh and analyzed for Au, Ag, and As. Excepting very high assays invariably downdrainage of current or historic workings, Au shows values up to 2.59 ppm, with an average at 0.37 ppm. Ag ranges up to 15.4 ppm, with an average at 2.75 ppm. As ranges up to 500 ppm, with an average at 153 ppm.

Soil samples (Figure 6) were taken at 10 m spacings along fences 50 m apart crossing the vein trends. A total of 1388 samples were seived to minus 80 mesh and analyzed for Au, Ag, and As. Values for Au ranged to 2.86 ppm, with an average at 0.22ppm. Values for Ag ranged to 4.80 ppm, with an average at 1.29 ppm. Values for As ranged to 450 ppm, with an average at 96.27 ppm.

Patterns of anomalous metals in soil confirm the continuity of vein mineralization and extend vein trends into mined areas. The data also indicates that the El Realito ENE trending veins are zoned: Au dominates to the east towards Luz del Cobre; strongly correlative Ag and As dominate to the west.

Thus, the rock-chip survey results reflect the regional structural setting, zonation, and the general limits of a Laramide porphyry Cu system centered on the Luz del Cobre breccia pipe. Arroyo sediments confirmed this setting and located current and historic Au/Ag prospects. Soil samples traced and projected the Au-bearing veins which are superimposed on a porphyry Cu system.

In past economic climates, location of Au in placers and veins was used with hypogene and supergene zoning concepts to point towards possible porphyry Cu deposits. At the El Realito survey, metal distribution patterns in a porphyry Cu system has focused and encouraged exploration for heap leach Au potential.

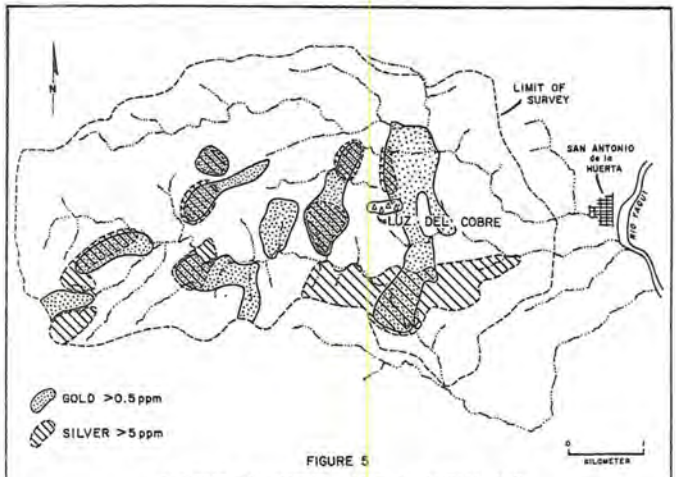


FIGURE 5
ARROYO SEDIMENT SAMPLE ANOMALIES

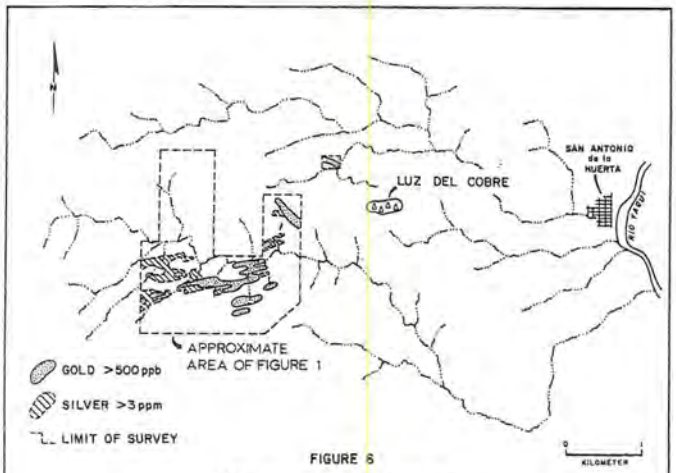


FIGURE 6
SOIL SAMPLE ANOMALIES

Frederick P. Schwarz
Coeur-Rochester, Inc.
P.O. Box 1057
Lovelock, NV 89419

Pearl Harbor File

The Pearl Harbor file is planned as a regular column in EXPLORE to publicize problems, deficiencies, omissions, and otherwise total disasters encountered by our readers on geochemical programs. We hope that by sharing real exploration experiences all can learn something from them. I have agreed to act as assistant editor for these case histories, and would appreciate your submissions.

I believe it is too simple to just present a Pearl Harbor file study in a narrative format. Rather, I think much more interest would be generated if the readership is first given a chance to consider the case history, identify one (or more) deficiency(ies) and recommend what remedial action(s) you would take if the project were yours. Readers are asked to define the anomalies, rate them by priority, and plan an appropriate followup program. The following is a case history of a recent soil survey from an exploration program looking for volcanogenic massive sulphide deposits (VMS) in Newfoundland, Canada.

The survey area lies within central Newfoundland. The landscape is gently rolling and covered by a boreal forest. The climate is cool with a yearly rainfal of about 75 cm. Snow covers the ground from December through April. Contour interval on the accompanying geochemical maps is 18 m (50 feet), rising to a hill in the southwest. Accumulations of organic material are locally significant, and "holes" in the sampling plan denote areas where bogs could not be penetrated by a 1.3 m soil auger, the device used for soil sampling on the property.

Soils are normally podzols, except in boggy areas. Following the soil horizon nomenclature of Chapter 3, Reviews in Economic Geology, Volume 3, a typical profile comprises:

0-20 cm	LH	black, leaf-humus layer
20-40 cm	AE	white, leached A horizon
40-50 cm	BF	black, zone of organic and Fe/Mn accumulation
45-60 cm	BF	medium red-brown, zone of Fe enrichment
60+ cm	BM	medium olive brown horizon

The red brown BF is the horizon sampled.

Overburden comprises glacial till of variable thickness with outcrop exposed over perhaps 1% of the landscape. Overburden thickness from limited drilling in the area appears to be about 8-10 m. The area lies near a centre of ice accumulation during the Pleistocene, and ice flow appears to have been either to the northwest or to the southeast.

Figure 1 presents geochemical data for Cu, Zn and Pb superimposed on a topographic and geologic (bold screened lines) base. The three elements are part of the 30-element suite determined on the minus 80-mesh fraction with aqua regia

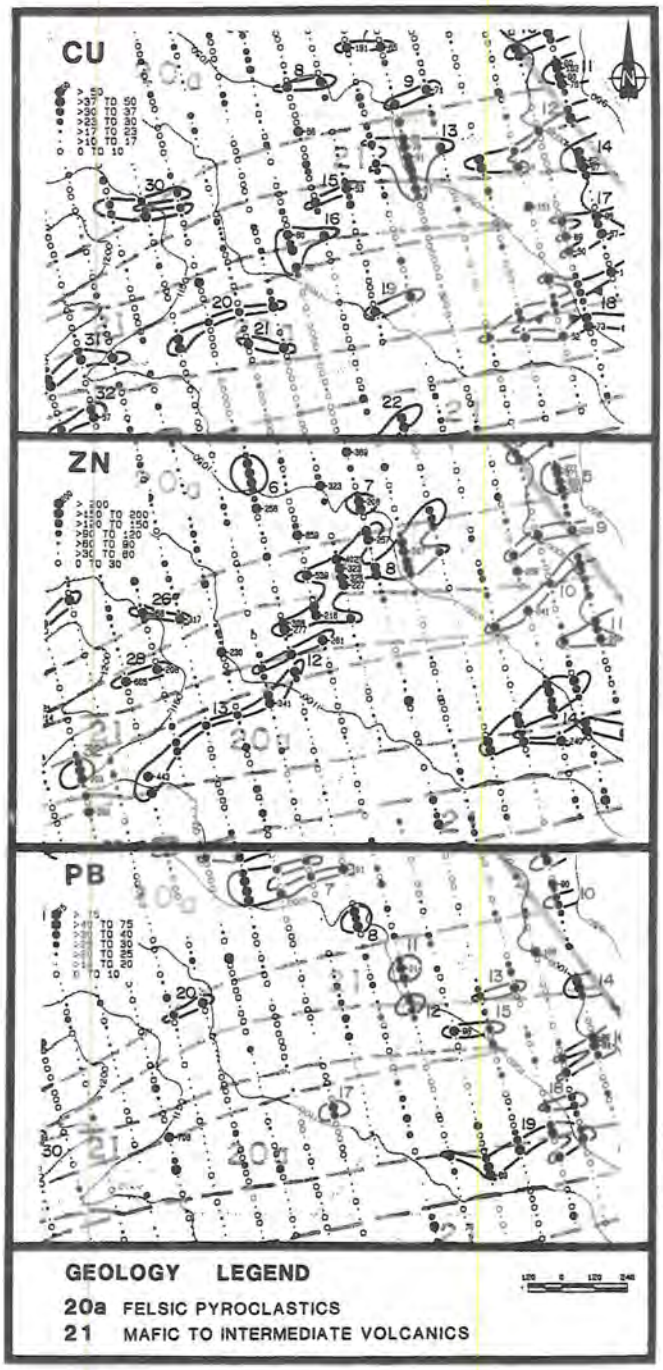


Figure 1

digestion. Results are part of a larger grid and anomalous conditions, representing at least contiguous pairs of anomalous samples, are outlined by the unscreened contour lines (an anomaly number label is attached). These highlight 5 to 10% of the survey area,which is about 3 times larger than that depicted on Figure 1.

Based on the data presented, which anomalies (if any) would you propose to followup and what procedures would you use? Recognizing that it is not possible in an article such as this to give you all the information you might need, is there any critical information you would require? Let me know so that I can incorporate your ideas in my response in the next issue of EXPLORE.

To give you a flavour of why this example is in a Pearl Harbor file, I will summarize discussions relating to precious metals exploration during the GEOEXPO/86 mine tour in Montana. Soil profiles were examined in view of questions raised regarding

the applicability of constant depth sampling for routine surveys. A standard profile could be described as having a thin (<1 cm) leaf humus (LH) surface horizon, underlain by a 2 to 6 cm A horizon with humus (AH), a non-descript B zone (BM) and a calcareous C horizon parent material (CA). The BM horizon would normally be sampled for routine work.

Soils examined near Montana Tunnels and Jardine suggested that a potential problem exists. Topographic depressions and gullys often contain accumulations of AH material up to 60 cm and greater in thickness. Soil sampling at constant depth would have the effect of collecting BM material most of the time and AH material some of the time.

Table 1

Selected trace element content (ppm) from two soil profiles near Montana Tunnel

Profile 1

	Mo	Cu	Pb	Zn	Ag	Au	Mn	Fe
AH	8	330	2100	960	5.9	420	1400	1.7
BM	8	100	2400	360	7.4	950	95	1.3
CA	17	159	4100	190	8.0	165	22	1.8

Au in ppb, Fe in %

Profile 2

	Mo	Cu	Pb	Zn	Ag	Au	Mn	Fe
AH	7	56	157	214	5.4	21	4200	1.6
BM	13	57	174	877	13.1	135	8700	2.1
CA	10	52	88	211	4.9	29	5500	1.7

Au in ppb, Fe in %

Table 1 from the Montana Tunnels area illustrates the character of some of the interhorizon trace element variations. There is evidence that, at least locally for some elements, the AH horizon is a zone of accumulation.

Suppose a routine survey were completed using samples taken at a constant depth, and the samplers were unaware that recognition of soil horizon was important. Deep development of the AH horizon in a shallow valley could produce a linear geochemical pattern following the valley. This anomaly would likely be interpreted as related to a geological structure, due to its linear shape. A drill or trench target might be identified in a depression as a consequence of coincidence of a very strong geochemical anomaly in the AH horizon and a mineralized structure, as in the case of profile 1.

By contrast, a more subtle geochemical anomaly in the BM horizon, also related to bona fide minierlization, as in the case of profile 2, might be missed. As a further complication, a false anomaly may be created as an artifact of sampling the AH horizon, with a resulting waste of time and money spent following it up.

How might this precious metal anecdote relate to the VMS example? I would appreciate your ideas and suggestions. Feel free to summarize a work program on an overlay to Fig. 1. The VMS example is to be continued in the next issue of EXPLORE. Please address your comments and/or your own case histories for following issues to:

Stan J. Hoffman
BP Resources, Mining Division
#700-890 West Pender Street
Vancouver, B.C. V6C 1K5
Canada

Ed. note: We promise not to embarass anyone.

MEETING REPORTS

Exploration 87

The Exploration 87 convention held in Toronto, Canada between September 26 and October 1, 1987 was attended by 970 delegates from 77 nations. The symposium was convened to examine and review technological advances in the fields of exploration geophysics and exploration geochemistry in the 10 years since the Exploration 77 meeting was held in Ottawa, Canada. Exploration 87 was the third in a series of meetings, the next of which is expected to be held in 1997.

In a world where numerous technical symposia are held each year, these decennial events are indeed unique, firstly for their international audience and secondly for their review nature. Think back to the norms of exploration 10 years ago. Exploration technology has seen an enormous expansion in data production; for example in readily available routine multielement analysis using ICP and DCP determination methods, and in data management using micro-computers.

Geophysics has seen the miniturization of field equipment and become a colourful science, with computer colour graphics now the norm for data presentation. These are but a few of the many significant advancements which are giving us new tools with which to do our jobs better as explorationists.

The convention, with its oral presentations and poster displays, was preceeded by field schools for both geochemical and geophysical training. During the meeting itself, evening discussions were held to review the contents of sessions held on the first two days. At the second of these discussions, a fundamental structural flaw in contemporary exploration philosophy became the focus of debate, that of the widespread failure of the various exploration deciplines to integrate with each other. Exploration 87 was structured for geophysicists and geochemists, and, although a geological thread held the program together, geologists were not mentioned by name.

An early geophysical topic, how to best represent IP data in pseudosection format, appeared to be very complicated, and the mathematical implications held geochemists and others in awe. The mystique was shattered when Phil Haloff explained that the most commonly accepted format was the norm simply because graph paper was readily available to display the data, the reason being no more complicated than that!

These discussions highlighted the fact that geophysicists could talk in a spirited fashion to each other, but exactly how the implication of these discussions would affect drill target selection was lost on the audience. Undoubtedly, geochemists could also have become involved in an esoteric discussion on some minor technical point to the distraction of the exploration theme.

Within the exploration industry it has long been recognized that the three main diciplines employed in the search process (geology/prospecting, geochemistry, geophysics) more often than not compete for funds rather than cooperate for progress. An example of this counterproductive attitude concerned whether or not airborne radiometric surveys are geophysical or geochemical surveys.

It is a pity that geochemists and geophysicists do not realize just how much they have in common. This is particularly true of the electrical and magnetic techniques of geophysics and the whole-rock alteration studies of geochemistry. Both are looking at changes in rock compositions. What is a magnetic survey but an expression of the relative abundance of iron and its oxidation state? Similarly, changes in resisitivity and/or chargeability can be due to water reactions, potassic metasomatism, silicification, and sulphidation reactions in rock. Both diciplines need to cooperate to provide the best possible interpretation of survey data. The radiometric example is surely a case in point.

Within my own career, I have seen various methods of operation. The most effective approach, in my opinion, was generated by an exploration geophysicist with a company who was able to commission more geochemical surveys than I could ever have achieved on my own, simply by asking a project manager one question: "What criteria do you need to define a drill target?". With the answer to the question in mind, the exploration process can then establish the most cost effective route to achieve the objective.

In this particular case, previous experience had indicated that a large number of geophysical anomalies would result from a geophysical survey covering a large area, and not all anomalies could be tested by drilling. The most effective way toestablish a priority for targets was a geochemical survey. If there were no geochemical anomaly, then money could be saved by not conducting the more expensive follow-up geophysical survey. If anomalies were outlined, then a more restricted geophysical survey coverage could be planned, also saving money.

I predict that, over the next 10 years, this much-needed cooperation will be one of the main advances initiated by Exploration 87. In that regard, I would encourage more geophysically-oriented individuals to join the association and authors to include geophysical aspects to case histories submitted

AEG 1989 ANNUAL GENERAL MEETING

CALL FOR PAPERS

13th International Geochemical Exploration Symposium
Rio de Janeiro, Brazil • October 2-4, 1989

This symposium is jointly sponsored by the Association of Exploration Geochemists and the Brazilian Geochemical Society. It will consist of three days of technical sessions, pre-symposium workshops, and field excursions both before and after the scheduled technical sessions.
Principal themes for the symposium are as follows:

1) Geochemical exploration in humid and tropical areas 2) New techniques in geochemical exploration for Au and PGE 3) Geochemical exploration for petroleum 4) Analytical techniques with emphasis on the precious metals 5) Computer applications in exploration geochemistry

Brazil has a well-developed minerals industry and a number of interesting, world-class ore deposits. Preliminary contacts with mining companies are now being made to arrange excursions to some of these, and possible technical visits include:

1) The Carajas Mineral Belt (Fe, Al, Mn, Cu, Au, Sn deposits) 2) The Minas Gerais Alkaline Complexes (world's largest Nb reserves and large Ti and phosphate deposits) 3) Jacobina Witswatersrand-type Au deposits 4) The Iron Quadrangle — Quadrilatero Ferrifero Au and Fe deposits of Minas Gerais 5) The Au and Ni deposits of Goias State.

In addition to the technical program, a worthwhile social program is being arranged for accompanying guests and for time available outside of the technical sessions. A first circular announcing the 13th IGES will be sent out shortly.

Please contact:
Dorival C. Bruni •*Sociedade Brasileiro de Geoquimica •P.O. Box 2432 CEP 20010 • Rio de Janeiro, BR RJ*

for publication in our Journal.

Towards the end of the evening discussion, a student asked why so much negativism seemed to pervade the audience. After all, to be in the exploration industry required an individual to be an optimist. It was indeed an upbeat way to end a rather stimulating discussion, and the wisdom of his message bears remembering as we look towards the future and how each of us might be able to help shape the industry in the years to come.

Dr. Harry O. Siegal officially closed the symposium with an observation by an Australian delegate that the geoscience industry needs to begin acquainting the popular media with the workings and products of the industry. An opportunity for public relations was missed at this meeting, but organisors of future events should consider this vehicle for advancement seriously.

A proceedings volume is scheduled for publication. Release date, price, and ordering information will be given in this newsletter when it becomes available.

Stan Hoffman
President, AEG

The First Brazilian Geochemical Congress

At the end of October and the beginning of November of 1987, the first Brazilian Geochemical Congress was held in the city of Porto Alegre, Rio Grande do Sul, the southernmost state in the country.

An enthusiastic turnout of over 400 delegates made the congress a great success in terms of attendance alone. Of the 82 papers given at the Congress, 75 were published in the proceedings distributed at the meeting, a tribute to the worthwhile efforts of the organizing committee and staff. Papers were published on the following topics:

Analytical geochemistry (21)
Rock geochemistry (16)
Environmental geochemistry (13)
Exploration geochemistry (11)
Rare earth element geochemistry (5)
Superficial weathering geochemistry (5)
Isotope geochemistry (4)

Apart from these presentations, Art Rose, Al Sinclair, and K. Fletcher gave a number of invited talks on new trends in exploration geochemistry, data interpretation approaches, and experiences in drainage geochemistry surveys.

Field trips covered areas of local geological interest including the Camaqua Cu deposit, the Santa Maria Pb-Zn orebody, and the Santa Catarina fluorite deposits.

Apart from the technical sessions, delegates experienced some of the southern Brazil "gaucho" hospitality at the social events.

Both a merry and informative time was had by all. The Congress went a long way toward establishing the Brazilian Geochemical Society, now with over 600 members and barely three years old, as a dynamic presence here.

Paul Talufen
Amcongen-Rio
APO Miami, Florida 34030-3090

SPECIAL NOTES

Wilderness Impact Research Foundation

Preservationist organizations aim their information at both government *and* the general public. Users of the land generally aim their information and influence regarding wilderness *only* at government, and the impact of specific users is generally not coordinated with other users to demonstrate the accumulative impact of proposed wilderness.

There has been ninety million acres of wilderness already designated and over one hundred and twenty million acres of land are presently under wilderness study area status in the United States. This combined acreage is equivalent to a strip of land 200 miles wide on the east coast from Maine to Florida or the entire states of California, Nevada and nine-tenths of Utah.

Congress has had no oversight hearings or studies conducted to determine the impact of the present ninety million acres of federally designated wilderness to determine whether it is wise to place additional lands into wilderness status.

The stated justification for federal wilderness designation by the preservationist movement, with a total membership of 5.8 million, is that it is beneficial to wildlife and the land. As the preservationists make their demands for additional multi-millions of acres, they present no proof that the previous designations were beneficial to the wildlife and the land.

The United States' largest conservationist-hunter organization, the National Rifle Association with 3 million members, and the

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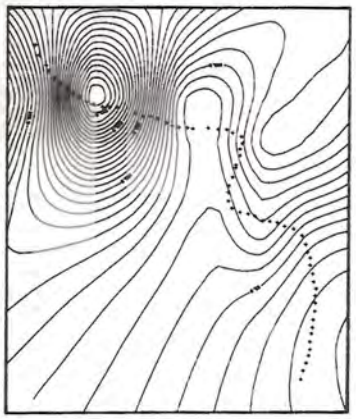

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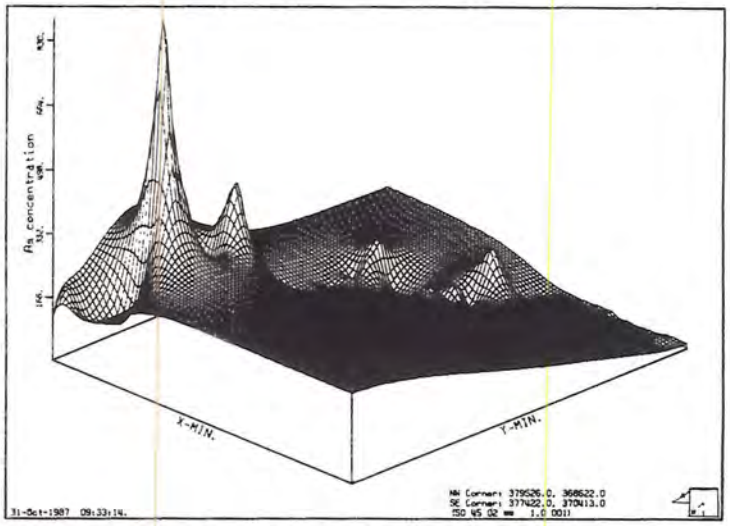

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Geochemical Services, Inc.

Main Laboratory: 2741 Toledo St., Suite 201 • Torrance, California 90503 • 213/320-3680 FAX: 213/320-9480
Fire Assay Laboratory: 55 Glen Carran Circle • Sparks, Nevada 89431 • 702/359-6600
Sample Preparation: 1800½ Frazer Avenue • Sparks, Nevada 89431 • 702/356-1568

SPECIAL NOTES

continued

largest agricultural organization, the American Farm Bureau with 3.5 million members, both directly challenge the assumption by the preservationists that "no management" is best to the wildlife and the land.

The National Rifle Association states in its 1987 Resolution on wilderness, that "These arbitrary and capricious regulations in fact do not promote the interests of wildlife conservation." The American Farm Bureau agrees, stating in their Resolution, "Experience has shown that the 'no management' concept applied... under the Wilderness Act of 1964 has resulted in the serious degradation of the resource."

All the preservationist organizations (Sierra Club, etc.) nationally have a total membership of less than 6 million with a total budget of $113 million. The combined membership of only the NRA and Farm Bureau at 6.5 million is larger, and their combined budgets are larger. Our job is to stir them into action. If we can motivate the NRA, the Farm Bureau and other affected groups such as the VFW and American Legion to action *we can win the war.*

The objectives of the Wilderness Impact Research Foundation are to conduct research to determine the impact of presently designated federal wilderness, develop projections on the future impact of wilderness, and distribute results of the research to the public and directly to the government.

The Foundation also presents information to the membership of the preservationist's groups as it has been demonstrated that reasonable people within those organizations, when presented with the facts, often will either work to modify the positions of their organizations or will leave the organizations entirely and join other organizations in opposing excessive wilderness.

To support this effort, please send $15 for your 1988 membership to:

A. Grant Gerber
Wilderness Impact Research Foundation
555 Sixth Street
Elko, Nevada 89801
Phone: 702-738-2009

International Geochemical Mapping

The development of methods for the international correlation of regional geochemical surveys.

OBJECTIVE

The purpose of the project is to encourage and facilitate the compilation of an international series of systematic surficial geochemical maps by national and/or international organizations, based on the most appropriate types of sample material.

The maps will show abundance levels, delineate regional trends and geochemical provinces, and permit the recognition of large scale anomalous features. They will complement existing international geological and geophysical map series, and will be published at scales suitable for direct comparison. To the greatest extent possible, primary data will be stored in digital form to facilitate its reproduction at different scales in a variety of formats, for mineral resource, general geological and environmental studies.

The data will be related to bedrock geochemistry wherever possible.

WORK PLAN

These preliminary plans are based on discussion at a working group meeting held in Toronto in October 1987. They are subject to approval and/or revision at the first meeting of a full Steering Committee, to be held at The Goldschmidt Symposium in Baltimore, Maryland during May 1988.

1988/1989: *There are four components in the first phase of the project.*

(a) Prepare and circulate information about the project. Request national organizations to designate a liaison officer.

(b) Prepare and distribute a questionnaire to national organizations to gather comprehensive information about existing publicly available geochemical survey data e.g.: purpose of surveys, materials and elements analysed, sampling and analytical methods, use of standards etc. "GSC Map 1661A, Index to National Geochemical Reconnaissance Surveys, 1973-1986" can serve as a model.

(c) Request participating national organizations to provide examples of published regional geochemical complications, with an interpretation of their significance, as a demonstration of their utility.

(d) Use the information supplied to identify major problems for international correlation.

1989/1990: *Establish working groups to provide practical recommendations on:*

(a) the correlation and normalization of data from different sample media and analytical methods.

(b) preferred sampling and analytical procedures for different geologic/climatic environments, including consideration of sample spacing.

(c) specifications for international data sets, including international map formats to facilitate the correlation of new data.

1990/1992: *Participating organizations to prepare examples of demonstration maps, incorporating the above recommendations so as to acheive international comparability.*

RESULTS

The project will provide evidence of the extent to which different portions of the earth's crust are characterized by distinctive geochemical assemblages and patterns. In conjunction with other geological and geophysical evidence, the data will assist in correlating areas separated through tectonic plate displacements.

The project will also:

(a) provide an inventory of existing publicly available geochemical survey data, with complementary information.

(b) provide surficial geochemical data for Zn, Cu, Pb, Ni, Co, Mn, Fe, Mo and U, which can be correlated with information concerning known mineral occurrences and deposits and be used to guide exploration; other elements will be added as the data base is expanded.

(c) permit the correlation and compilation of geochemical data on an international basis; 1:2 million is an appropriate map scale, already adopted in a number of countries.

(d) provide improved criteria by which the quality and adequacy of geochemical survey data bases can be evaluated.

(e) stimulate the preparation of publications describing the applications of regional geochemical map data.

(f) provide base-line geochemical information of use in global-change, environmental, agricultural and health studies as well as geological research.

FUTURE ARRANGEMENTS

Ongoing involvement and interest by a small number of key geochemists and analysts from national laboratories and/or universities in the participating countries will be essential to the success of the project. They will be required to:

(a) take time to participate in meetings, consider the problems involved and prepare reports;

(b) undertake limited sample collection and analytical work for comparative purposes;

(c) assist in the supply and/or analysis of standard samples;

(d) provide data compilation/recompilation facilities;

(e) undertake missionary work to publicise objectives and benefits to be derived from the project;

(f) provide advice to developing countries to enable them to obtain geochemical surveys which meet recommended international standards.

There will be the greatest prospects for progress if the project can be inplemented on a regional basis.

Building on the success of the Nordkalott Project, which undertook geochemical mapping in Northern Fennoscandia in 1980-1983, an Inter-European Geological Survey Committee is currently planning geochemical mapping of Western Europe, with Dr. Bolviken of Norway as leader. This proposal was conceived independently, but clearly the aims are similar. The European initiative can be regarded as one of several potential regional contributions to a longer term global objective.

The project has already been the subject of constructive discussion amongst interested parties thanks to the organizational support of the IAGC, the AEG and the International Atomic Energy Agency.

It is intended to indentify International Geochemical Mapping as an IGCP-UNESCO project to bring it to the attention of as many organizations and individual scientists as possible, particularly in developing countries.

The project is potentially suitable for implementation in every country, irrespective of the details of its geology. Correlation is an essential element in the project because many geochemical surveys undertaken in the past, regretably, have lacked this consideration.

The initial areas selected to demonstrate the significance of regional geochemical data compilations are those where good data bases are already known to exist and a relatively small amount of work would make it available so that it could become more widely known and discussed viz.: Norway-Sweden-Scandinavia; Germany- France; Canada-Greenland; China; USSR.

More work will be required to compile data from the following larger areas: Western Europe; North America, including USA; China and USSR; Thailand-Malaysia-Indonesia; Brazil; Australia; Nigeria.

Undoudtedly, revisions will be required and more possibilities will open up as the project becomes more widely known.

FUTURE MEETINGS

A meeting of the Steering Committee for the International Geochemical Mapping Project is tentatively scheduled in conjunction with the Goldschmidt Symposium in Baltimore during May 1988.

A Canadian Workshop is arranged to coincide with the Geological Association of Canada Annual Meeting in Newfoundland, also in May 1988. On this occasion it is intended to show recent data to demonstrate a geochemical correlation between Labrador and southwest Greenland.

A Workshop in conjunction with the International Geological Congress in Washington in 1989 can provide the opportunity to display the first demonstration maps from several continents to a broad geological audience.

A.G. Darnley
Geological Survey of Canada

Publicity Committee Report

The committee wishes to thank Stephen Bolivar for his kind offer to provide a circulation list of departments of geology at U.S. universities. The committee is still searching for volunteers who can act as contacts in government institutions, the exploration industry and libraries. In particular, we are looking for members living in the major mining centres who are willing to liase between the Association and their community. This would involve advising industry, government, and academic institutions of upcoming Association events and acting as local contacts to promote membership in the Association.

Additionally, the committee needs volunteers who are members of other associations in related fields (like geologists, analysts, environmentalists, soil scientists) and who are willing to assist our Association in reaching new markets.

Please contact:

John Gravel or **Stephen Day**
B.C. Geological Survey Branch
300-756 Fort Street
Victoria, B.C. V8V 1X4, Canada
Telephone: (604) 387-3232

The Journal of Geochemical Exploration

Earlier this year your president asked me to summarize the activities of the *Journal of Geochemical Exploration* (JGE) for the benefit of Council Members. More recently Chet Nichols suggested that this be included in the Newsletter.

HISTORY

The JGE was started in 1971 as a joint venture of Elsevier Science Publishers and the AEG. In terms of subscriptions, it has been in the top one or two of Elsevier's 40 or so earth science journals for several years. At the outset, submissions came mainly from North America. Today, most of the submissions come from outside this region.

COMPOSITION

There are three types of publication: regular papers, special issues on selected topics, and proceedings volumes. This mix was arrived at after careful consideration. Special issues have had a good response from readers and are a major ingredient in our success. The proceedings issues provide a well established means of publication for AEG symposia held throughout the world and are received by the AEG membership at no extra cost.

ASSOCIATE EDITORS

It is important that the JGE should not be the product of one person; instead, its activities are delegated as widely as is practical.

The first Associate Editor (although we did not describe it as such at the time) was **John Hansuld**. As Business Editor he is one of the chief reasons for there being a viable journal today. It was not easy to establish the journal. Therewas more than one crisis early on which John helped to resolve with skillful negotiation. He included a

clause on royalty payments (see below) in the first contracts when it seemed very optimistic that the JGE would reach a subscription level where these would come into effect.

Charles Butt was our first regional editor. Australia has a highly developed exploration geochemistry community. It seemed logical that they could handle their own affairs, rather than send m/ss across thousands of miles of ocean. Charles has complete autonomy to arrange for the review and acceptance of m/ss. I believe that he has done an outstanding job and Australian papers are among the best that we publish.

This concept was expanded to include **Alf Bjorklund** as regional editor for Fenno-Scandinavia and, more recently, by **Louis Coetzee** for southern Africa and **Xie Xuejing** for China.

Some Associate Editors are responsible for special topics. **Peter Bradshaw** initiated the Case History series, which have been outstandingly popular. **Brian Hitchon** served admirably as the editor responsible for Petroleum Exploration until he resigned to form his own journal.

Biogeochemistry has been one the burgeoning fields of exploration geochemistry and **Robert Brooks** is widely regarded as its principal exponent. He is responsible for m/ss published in this field.

More recently, **Steve Kesler** has taken charge of the use of Gases in Mineral Exploration and we look forward to a special issue on this topic in the near future. Like other Associate Editors, Steve has an opportunity to have major influence on the development of a field within exploration geochemistry.

Last, but not least, is **Art Rose** to whom this journal owes many debts. More than once he has stepped in when we have had a problem. He edited the Hannover volume when it seemed that it would not be published and acted as chairman of the publications committee during a formative time in the history of the journal. More recently he has served as a strongly activist Book Reviews Editor.

EDITORIAL BOARD

Probably the single most important task of the Editor-in-Chief is to invite persons to join the Editorial Board. More often than not each manuscript is reviewed by one member of the Editorial Board, including associate editors,as well as by other referees.

Authors who submit papers have the right to expect that their work will be judged by persons who publish fairly frequently themselves and who write well first time. Moreover, the reviews should be prompt, careful and fair. Initially, persons are asked to review papers and, from time to time, some of these are invited to join the Editorial Board. We try to keep a reasonable geographic balance.

EDITOR-IN-CHIEF

Contrary to perceptions, I do not spend most of my time editing. The editor is akin to a CEO of a small international company and 70% of my time is spent on administrative matters. For example, each special issue generates a file of correspondence. In terms of editing, most time is spent on borderline m/ss and on m/ss where reviewers disagree. The editor is jointly appointed and re-appointed by AEG and Elsevier.

EDITORIAL OFFICE

The biggest single improvement in our operations was to establish an independent office outside of the GSC. Mrs. **Anne Brown** is a superb colleague and, with her help, we can offer a far more timely service to authors. Before, in retrospect, it was a shoestring operation.

I am a member of the faculty at Ottawa University and the successive chairman of the Geology Department. **Brian Rust** and **Bill Fyson**, have been very kind in allocating scarce space to our office. Moreover, the University providesfinancial and mailing services which greatly aid our work. If we had to pay cost for any of this it would amount to a tidy penny.

FINANCE

Seemingly the least well understood issue throughout AEG history is the net or real cost of the journal to the membership. The gross cost per member at $32.50 has not changed since inception. However, contracts with Elsevier have included a royalty schedule to benefit the AEG in proportion to the financial success of the JGE. While the royalty payment changes from year to year because of such variables as exchange rates, it has shown a secular increase, which is directly applied to lowering our payments to Elsevier. In recent years the royalty per member has been around $15, which has reduced the net cost per member to about $18. Since the other costs of the AEG have risen, this has permitted the AEG subscription to remain stable. Most ofthe royalty payments are derived from the institutional subscribers, who pay much more than AEG members.

Added to the net decrease in subscription costs, the number of volumes per year has recently increased by 50% at no increase in cost. The additional payments by institutions for this extra volume will likely generate further royalty payments. In sum, since inception, the JGE has increased considerably in size, while the net cost to the association during a strongly inflationary period has almost halved.

NEW INITIATIVES

Marketing a scientific journal is not very different from marketing any other product. Our market niche are persons and organizations who are interested in exploration for minerals. This is narrow relative to some competing journals. We serve this niche by providing information on the science of geochemistry applied to mineral exploration. But we have captured as readers only a minority of this market.

We have not attracted many papers that use geochemistry in various forms to study ore deposits. Such work is expanding rapidly and is of increasing interest to economic geologists to permit construction of con-

ceptual models to assist in exploration.

This summer I discussed with Elsevier and brought to the attention of your president my intention of more actively soliciting papers in this area. The first major initiative was to arrange for the special issue on epithermal gold around thePacific to be published in the latter part of 1989. The editors (**Jeff Hedenquist** of DSIR, New Zealand; **Noel White** of BHP, Australia; and **Gordon Siddeley** of St. Joe, USA) hope to blend genetic considerations with practical exploration technology into one volume. I expect that **Steve Kesler's** special issue on gases will also straddle these two aspects.

QUALITY

One of the facts of life in operating an international journal is the wide variation in experience of exploration geochemistry around the world and practice in preparing English language manuscripts. Many international journals resolve this problem by restricting publication to an elite of scientists, mostly from well developed countries, and with a good command of English. We have tried, very deliberately, to expand our service to all parts of the world. This inevitably leads to extra work for reviewers and editors. Scientific writing is not simple, but it does become easier with practice.

We recognize that many of the papers submitted to this journal will be by persons whose primary job is not to publish scientific papers.

All of this contributes to some variance in "quality" of articles published, and I hear about this from time to time. Last year one of the members of the Editorial Board wrote to me on this topic. The comments were made in a helpful manner and I took them seriously.

I thought it worthwhile to survey the opinion of others. Mrs. Brown sent lists of the papers that we have published over the last several years to all Associate Editors and members of the Editorial Board. They were asked to rate the papers that they had read from "outstanding" through to "should not have been published".

The response showed an even greater variance than I had expected. It ranged from one editor who felt the majority of the articles he read were outstanding to an editor who felt that a significant percentage were marginal to poor. Judgement of quality, like that of beauty, depends very much on the perspective of the person making the evaluation. We have a relatively high rejection rate, and, for better or worse, we represent the present status of exploration geochemistry in the World.

As will be apparent from the above, the Journal of Geochemical Exploration is a "community project" to which many within and outside the AEG have contributed. In particular, the successive Councils have given unstinting support. This has helped to make my job both rewarding and pleasurable.

Eion Cameron
Ottawa, Ontario

Exploration Geochemistry Bibliography

I have just sent off the typescript for the next Supplement to the AEG Bibliography. I don't know how long it will take to get it printed and distributed, but I guess we can hope it will be out in April or May.

I worked up the enclosed statistics on this Supplement, which I thought might be of general interest to the AEG membership.

Citations by Year of Publication

Decade	Years within decade 0	1	2	3	4	5	6	7	8	9	Totals
1890s	0	0	0	0	1	0	0	1	0	0	2
1920s	0	0	1	1	0	0	0	4	0	2	8
1930s	0	0	0	0	0	3	6	6	7	10	32
1940s	5	10	5	5	2	4	7	8	13	18	78
1950s	27	32	21	20	26	47	58	76	104	93	504
1960s	38	84	86	106	88	119	143	205	179	263	1311
1970s	248	359	407	514	417	493	546	483	394	546	4407
1980s	524	524	441	546	573	481	373	399	208		3545
Total											9887

Citations by Publishers

Publisher	No of Citations	Percent of total
AEG Publications	222	13.4%
US Geol Survey*	117	7.0
Theses	76	4.6
Inst Mining & Metall.	67	4.0
Russian translations	54	3.2
Geol Survey Canada	50	3.0
Economic Geology	45	2.7
Geol Soc America	44	2.6
Applied Geochemistry	39	2.3
Chemical Geology	36	2.2
All others	912	55.0
Total	1866	100.0%

*Figures do not include 437 references to USGS papers that present purely the results of field surveys, and that are cited only in the index.

Citations by Source

Source	No of Citations	Percent of total
United States	546	32.9%
AEG publications	222	13.4
Canada	197	11.9
United Kingdom	123	7.4
India	62	3.7
Russian translations	54	3.2
China	45	2.7
France	35	2.1
Netherlands	28	1.7
Australia	24	1.4
Others	326	19.6
Total	1662	100.0%

Languages

Publisher	No of Citations	Percent of total
English	1494	90.0%
French	48	2.9
Chinese	45	2.7
Spanish	30	1.8
German	19	1.1
Swedish	10	0.6
Finnish	5	0.3
Italian	4	0.2
Others	7	0.4
Total	1662	100.0%

Herbet E. Hawkes
6120 Santa Valera
Tucson, Arizona 85718

INFORMATION REQUESTED

Certified Reference Materials Questionnaire

The heads of the Provincial Geological Survey Laboratories of Quebec, Ontario, and British Columbia met recently in Victoria. They decided to present the need for control reference materials for trace elements such as rare earths, precious metals, and others, to officials of the Canadian Certified Reference Material Program in CANMET. In order to receive as much input as possible before approaching CANMET, it was decided to send out a questionnaire to give industry an opportunity to comment on its requirements.

Please fill out and forward this questionnaire to one of the following as soon as possible:

Dr. Marc Pichette, *Directeur*
Direction de l'Analyse minerale
Centre de Recherches minerales
2700 rue Einstein
Sainte-Foy, Quebec, G1P 3W8

Dr. Chris Riddle, *Chief Analyst*
Geoscience Laboratories
Ontario Geological Survey
Ministry of Northern Development and Mines
77 Grenville St.
Toronto, Ontario, M7A 1W4

Dr. Wes Johnson, *Chief Analyst*
Analytical Sciences Section
Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
541 Superior St.
Victoria, B.C. V8V 1X4

SUGGESTIONS FOR A CERTIFIED REFERENCE ROCK MATERIAL

SUBMITTED BY:
AFFILIATION:
ROCK MATRIX:
SUGGESTED SOURCE:
INTENDED USE:
REMARKS:
ELEMENTS and LEVEL/RANGE OF INTEREST:

Journal of Geochemical Exploration

The *Journal* represents one of the main benefits of your annual dues in the Association. Commencing with the 1987 volume, its size increased from a historical 800 pages per year to 1200 pages per year.

From time to time it is worth reflecting on the contents of our *Journal* and determining if there are ways to make it a better scientific forum more relevant to the needs of the membership. The council of the AEG feels now is a good time to encourage comments from our members so that we can work towards providing a better journal in the future.

Over the years readers have undoubtedly formed opinions, as I have. I have recently written to Elsevier to encourage more regular publication (an issue should appear every two to three months) and more timely printing of submitted papers. I feel confident that Elsevier will recognize the need to enhance the Journal and will assist in the process.

I have asked Don Runnells to compile your suggestions on behalf of the Association. Please address any comments, observations, issues of concern, or recommendations to:

Dr. D. D. Runnells,
Department of Geological Sciences,
Campus Box 250,
Boulder, Colorado 80309-0250
Telephone: (303) 492-8323

Stan Hoffman
President, AEG

GEOEXPO/86 Proceedings Returned

The following individuals have paid for their copy of GEOEXPO/86, but it has been returned as undeliverable by the post office. Owners or friends of the owners are asked to send the correct address to claim the volume.

Stephen Butrenchuk
Port Coquitlam, B.C.
J.B. Murowchick
Edmonton, Alberta
Gordon Richmond
Calgary, Alberta
Rhyolite Resources
Saskatoon, Sask.
E. W. Yarrow
Vancouver, B.C.
W. H. Myers
Vancouver, B.C.
Robert Dickinson
Vancouver, B.C.
Murray McClaren
Vancouver, B.C.

AEG 1988 ANNUAL GENERAL MEETING

V. M. GOLDSCHMIDT CONFERENCE

Baltimore, Maryland
Hunt Valley Inn
(conference headquarters)
Noon, Thursday, May 12, 1988

The AEG is a co-sponsor of the V. M. Goldschmidt Conference in Baltimore where the Annual General Meeting will be conducted. A full day symposium sponsored by the AEG on Thursday, May 12 will feature 17 papers on Platinum-Group Element Geochemistry and a keynote address by Norman Page of the U.S. Geological Survey. During the morning of Wednesday, May 11 there will be a half-day session of 8 papers on International Geochemical Mapping. These symposia are just 2 of the 14 that make up this milestone conference, taking place from 11 to 13 May.

For further information contact **Donna Ricketts**, Conference Coordinator
409 Keller Building, The Pennsylvania State University
University Park, PA 16802, U.S.A.
Phone: (814) 863-1743

For detailed information on the PGM session call **Colin Dunn** (613) 996-2373 and for the Geochemical Mapping session, call **Arthur Darnley** (613) 995-4909.

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 bylaws, 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. The Association apologizes to those on this list whose applications have been delayed.

Editor's note: *Council has decided that all new applicants will receive the*

journal and the newsletter upon application for membership. The process of application to the Toronto office, recommendation by the Admissions Committee, review by Council, and publication of applicant's names in the newsletter remains unchanged.

MEMBERS

Burlinson, K.G.
Geochemical Consultant
Australia

Busche, F.D.
Geochemist
Shell Mining Co.
Texas, U.S.A.

Collins, J.A.
Exploration Manager
Cominco Ltd.
Belgium

Downey, P.J.
Western Energy Co.
Montana, U.S.A.

Font, X.
Professor
Univ. of Barcelona
Spain

Hall, G.E.M.
Section Head
Anal. Meth. Dev.
Ontario, Canada

Herzberg, W.
Geological Survey
South Africa

Laskowski, K.A.
Geologist
Newmont Exploration
Minnesota, U.S.A.

Lippitt, C.R.
Geologist
Billiton Exploration
Washington, U.S.A.

Locutura, J.
Mining Engineer
Dept. Min. Res. (IGME)
Spain

Loredo, J.
Professor
Oviedo Sch. Mines
Spain

Pelletier, M.
Geochemist
Geokemex Enr.
Quebec, Canada

Schwab, R.G.
Professor
University F.A.U.
Germany

Shei, E.N.
Geologist
Min. Mines & Power
Cameroon

Viladevall, M.
Professor
Univ. of Barcelona
Spain

Wang, G.
Assoc. Professor
Xinjiang Eng. Instit.
Uyumqi, China

Zuker, J.S.
Geological Consultant
Colorado, U.S.A.

AFFILIATE MEMBERS

Birk, D.
Geofuel Research Inc.
Nova Scotia, Canada

Christensen, L.
Consultant
Washington, U.S.A.

Dean, L.S.
Geol. Surv. Alabama
Alabama, U.S.A.

Dixon, D.
Quanta Trace Lab., Inc.
British Columbia, Canada

Dixon, S.
Coeur-Rochester Inc.
Nevada, U.S.A.

Docherty, B.
Ontario, Canada

Enders, D.L.
Loring Laboratories Ltd.
Alberta, Canada

Flynn, J.S.
Prospector
New Hampshire, U.S.A.

Foster, J.R.
Galveston Explorations Ltd.
British Columbia, Canada

Hahn, R.J.C.
Consulting Geologist
Montana, U.S.A.

Holman, R.M.
Geologist
Rossing Uranium Ltd.
Namibia

Koch, J.D.
Monitor Geochem. Lab Inc.
Nevada, U.S.A.

Lahr, M.
District Geologist
Ameri. Copper & Nickel Co.
Nevada, U.S.A.

L'Orsa, A.T.
Consulting Geologist
British Columbia, Canada

Margeson, G.B.
Geologist
Callahan Mining Corp.
Michigan, U.S.A.

Meixner, H.
Shangri La Minerals Ltd.
British Columbia, Canada

Moskal, W.L. *
Geologist
Min. North. Dev. & Mines
Ontario, Canada

Olver, F.A.S.
Librarian
Inst. Min. & Metall.
Great Britain

Querol, F.
Chief Geol. Researcher
Cia Fresnillo
Chihuaha, Mexico

Shea, J.J.
Gam Rad West Inc.
California, U.S.A.

Thiede, D.S.
Tellis Gold Mining Co.
Colorado, U.S.A.

Vasconcelos, P.
Univ. Texas, Austin
Texas, U.S.A.

Winters, R.A.
Geologist
U.S. Bur. Mines
Washington, U.S.A.

*Application for Member pends receipt of referee reports.

COUNCIL MINUTES

Actions of December 10, 1987 Council Meeting

1. Council discussed the first issue of EXPLORE and a motion was passed unanimously to continue with this design, format, and printing.
2. Nominations to Council for 1988 were discussed and a listing of candidates will be sent to the membership.
3. A motion to admit 55 new members to the AEG was passed unanimously. (The list in this issue of EXPLORE includes three members under a new membership status.)
4. A motion was passed to make the official deadline for paying dues December 31 of the year for which the dues are owed (see NOTE FROM THE SECRETARY, this issue).
5. It was moved and passed that the 1990, 14th international meeting of the AEG be held in Prague, Czechoslovakia. The 1991 meeting in Reno then becomes the 15th International Geochemical Exploration Symposium.
6. Council discussed the regularity of publication of the *Journal of Geochemical Exploration* and agreed unanimously that the publication should be at regular intervals throughout the year.
7. The Council discussed the possibility of changing the bylaws to add 3 new non-voting Councilors who would be specialists in: (1) the analytical field, (2) the computer field, and (3) the environmental field. At present the chances for representation in these fields is low.

The Council welcomes any input from the general membership about matters discussed or any other matters of import to the organization. Please address your comments to the Secretary:

Sherman P. Marsh
U.S. Geological Survey
MS 973, Denver Federal Center
Denver, Colorado, USA.

STUDENT MEMBERS

Abeme Nguema, M.J.
Service Geologique National
Gabon

Brozdowski, R.A.
U. Western Ontario
Ontario, Canada

Elkins, P.R.
U. British Columbia
British Columbia, Canada

Harraz, H.Z.
Tanta University
Alexandria, Egypt

In addition, recently approved names received by EXPLORE without further information include: **G. Voyer** for member; **J. Biggs, C. G. Costa, J. A. Kantor, J. Kronfeld, L.A. Landefeld, G. Lohman, R. R. Price, D. Reid, R. S. Tolbert** and **D. R. Webb** for affiliate member; and **D. Craig** and **T. Wakefield** for student member.

Recent Papers
on Exploration Geochemistry

This list comprises titles that have appeared in major publications since the compilation in Newsletter No. 61 . Journals routinely covered and abbreviations used are as follows: Economic Geology (EG); Geochimica et Cosmochimica Acta (GCA); The USGS Journal of Researh (USGS JR); Circular (USGS CIR); and Open File Report (USGS OFR); Geological Survey of Canada Papers (GCS Paper) and Open File Report (GSC OFR); Bulletin of the Canadian Institute of Mining and Metallurgy (CIM Bull); Transactions of Institute of Mining and Metallurgy, Section B: Applied Earth Sciences (Trans IMM). Publications less frequently cited are identified in full. Compiled by **L. Graham Closs,** Department of Geology and Geological Engineering, Colorado School of Mines, Golden, Colorado 80401, Member of the AEG Bibliography Committee. Please send new references to Dr. Closs, *not to* EXPLORE.

Abrahams, P.W. and Thornton, I. 1987. *Distribution and extent of land contaminated by arsenic and associated metals in mining regions of southwest England.* Trans. IMM. 96: B1-B8.

Agomor, A.K., Gordiyenko, V.V. and Lazarenkov, V.G. 1987.*Regional mineralogical and geochemical zoning of a pegmatite field in southern Ghana.* Intern. Geol. Rev. 29(2): 151-159.

Anhaeusser, C.R. and Maske, S. (Eds.) 1986. *Mineral Deposits of Southern Africa.* Geol. Soc. S. Africa. 2 V. 2335 p.

Bajawah, Z.U., Seccombe, P.K. and Offler, R. 1987. *Trace element distribution, Co:Ni ratios and genesis of the Big Cadia iron-copper deposit, New South Wales, Australia.* Min. Deposita 22(4): 292-300.

Baskov, E.A. 1987. *The Fundamentals of Paleohydrology of Ore Deposits.* (Trans. from Russian). Springer-Verlag. 225 p

Benmoussa, L. et al. 1987. *A geochemical study of the concentration process of tungsten and tin in the "Taourirts" granites of central Ahaggar, Algeria.* Chem. Geol 63 (3/4): 121-132.

Bheemalingeswora, K., Deb, M. and Banerjee, D.M. 1986. *Geochemical studies of soil, bedrock and stream sediment around base metal mineralization in Tiranga.* J. Geol. Soc. India. 28 (6): 431-441.

Billstrom, K., Aberg, G. and Nord, A.G. 1986. *Stable isotope data of Bergslagen carbonates and their potential use for sulphide ore prospecting.* Geologiska Foreningen. I Stockholm. Forhand Lingar 107 (3): 169-184.

Bliss, J.D. Orris, G.J. and Menzie, W.D. 1987. *Changes in grade volume and contained gold during the mining life-cycle of gold placer deposits.* CIM Bull. 80 (903): 75-80.

Both, R.A. and Stumpfel, E.F. 1987. *Distribution of silver in the Broken Hill orebody.* EG 82: 1037-1043.

Bowers, T.A., Jackson, K.J. and Helgeson, H.C. 1984. *Equilibrium Activity Diagrams.* Springer-Verlag. 397 p.

Boyle, R.W. 1987. *Gold: History and Genesis of Deposits.* Van Nostrand Reinold. 676 p.

Brimhall, G.H. 1987. *Preliminary fractionation patterns of ore metals through Earth history.* Chem. Geol. 64 (1/2): 1-16.

Brookins, D.G. 1987. *Platinoid element Eh-pH diagrams (25oC, 1 bar) in the Systems M-O-H-S with geochemical applications.* Chem. Geol. 64 (1/2): 17-24.

Brown, G.C. et al. 1987. *Geochemistry of granites beneath the north Pennines and their role in ore field mineralization.* Trans. IMM 96: B65-B76.

Brugmann, G.E. et al. 1987. *Noble metal abundances in komatiite suites from Alexo, Ontario, and Gorgona Island, Columbia* GCA 51: 2159-2169.

Buchanan, D.L. and Jones, M.J. (Eds.) 1984. *Sulphide Deposits in Mafic and Ultramafic Rocks.* IMM. 164 p.

Butuzova, G. Yu. 1986. *Sources of matter in hydrothermal-sedimentary oceanic metallogeny, Paper 1: Sources of water, gas, sulfur, and the formation of the principal salt compositions of ore-forming solutions.* Lith. & Min. Res. 21 (5): 413-425.

Butuzova, G. Yu. 1986. *Sources of matter in hydrothermal-sedimentary oceanic metallogeny, Paper 2: Sources of ore-forming elements.* Lith. & Min. Res. 21 (6): 511-523.

Cameron, E.M. and Hattori, K. 1987. *Archean gold mineralization and oxidized hydrothermal fluids.* EG 82: 1177-1191.

Canterford,J.H., Davey, P.T. and Tsambourakis, G. 1986. *Supergene sulphide ore from Mutooroo mine, SA: Characterization and dissolution of copper.* Aust. IMM Bull 291 (1): 51-58.

Chon, H.T. and Ri, D.W. 1987. *Multi-element geochemistry of granitoids in relation to tin mineralization in Ulchin area, Korea.* J. Korean. Inst. Min. & Mining Engr. 24 (1): 8-29.

Christiansen, E.H., Sheridan, M.F. and Burt, D.M. 1987. *The Geology and Geochemistry of Cenozoic Topaz Rhyolites from the Western United States.* GSA Spec. Paper 205. 82 p.

Cigolini, C and Chaves, R. 1986. *Geological, petrochemical and metallogenic characteristics of the Costa Rican gold belt: contribution to new explorations.* Geologische Rundschau. 75 (3); 737-

Cullers, R.L. et al. 1987. *Rare-earth element and mineralogic changes in Holocene soil and stream sediments: A case study in the Wet Mountains, Colorado, USA.* Chem. Geol. 63 (3/4): 275-297.

8th SYMPOSIUM ON PROSPECTING IN AREAS OF GLACIATED TERRAIN

Halifax, Nova Scotia • August 28 to September 3, 1988

TECHNICAL SESSIONS will be held on Friday, September 2nd and Saturday, September 3rd. Papers will discuss aspects of exploration in glaciated regions of North America and Europe. Sessions will cover till prospecting, stream sediment geochemistry, case histories on gold, lake sediment geochemistry, biogeochemistry, data integration, data interpretation, and case histories other than gold.

FIELD TRIP on *Geology and Mineral Deposits of Eastern Nova Scotia* will be held August 29-30th. It will feature bedrock and surficial geology and mineral deposits of mainland Nova Scotia. Stops include a developing gold mine, a drumlin coastal section, the Wisconsinan sequence along Northumberland straight, the Walton barite-base metal-silver deposit, the South Mountain Batholith, the Millet Brook U-Cu-Ag deposit, and dispersed trains from granite bodies in various till sections.

WRITE **Peter Rogers**, Nova Scotia Department of Mines and Energy, P.O. Box 1087, Halifax, Nova Scotia B3J 2X1 (902-424-4700) for the second circular which includes the title of papers, details of field trips and forms for registration and accommodations. Room reservations should be made soon, as the meeting time is also the peak of the tourist season. A symposium volume will be mailed to registrants before the conference begins.

Dale, L.S. and Fardy, J.J. 1986. *Element abundance data for Australian oil shales.* Aust. IMM Bull. 291 (7): 61-

Dostal, J. and Dupuy, C. 1987. *Gold in Late Proterozoic andesites from northwestern Africa.* EG 82: 762-766.

Dousset, P.E. and Sandjivg, L. 1987. *Analyse krigeante des donnees geochimiques multivariate prelevees sur un site stannifere en Malaisie.* Sciences de la Terre 26: 1-22.

Ehrlich, H.L. (Ed.) 1987. *Anaerobic Mineralization. Special Issue. Geomicrobiology J. 5 (3/4): 1-447.*

El-Bouseily, A.M. et al. 1987. *Primary dispersion and relative mobility of elements in the mineralized zone of the El Sid Gold Mine, Eastern Desert, Egypt.* EG 82: 767-772.

Ellewood, D.J., Bonham-Carter, G.F. and Goodfellow, W.D. 1986. *An Automated Procedure for Catchment Basin Analysis of Stream Sediment Data: Nahanni River Map Area, Yukon and Northwest Territories.* Geol. Sur. Can. Paper 85-26.

Ferguson, J. 1987. *The distribution of uranium in space and time.* Uranium 3 (2/3): 131-144.

Friedrich, G. et al. (Eds.) 1986. *Geology and Metallogeny of Copper Deposits.* Springer-Verlag. 258 p.

Fritz, P. and Fontes, J. Ch. (Eds.) 1986. *Handbook of Environmental Isotope Geochemistry, v. 2, The Terrestrial Environment.*

Fryer, B.J. and Taylor, R.P. 1987. *Rare-earth element distributions in uraninites: Implications for ore genesis.* Chem. Geol. 63 (3/4): 101-108.

Gautier, D.L. (Ed.) 1986. *Roles of Organic Matter in Sediment Diagenesis.* Soc. Econ. Paleon. & Min., Spec. V. 38. 203 p.

Ghosh, A.K. and Biswas, A. 1986. *Petrochemical features of the metabasics from the lead-zinc ore field of Gordubathan, Durjeeling Foothills, eastern Himalaya.* Quart. J. Geol. Min & Met. Soc. India 58 (1): 35-

Giblin, A.M. 1987. *Applications of groundwater geochemistry to genetic theories and exploration methods for Early Tertiary sediment- hosted uranium deposits in Australia.* Uranium 3 (2/4): 165-186.

Giuliani, G. 1987. *La cassiterite zonee du gisement de Sokhret Allal (Granite des Zaer; Maroc Central): Composition chimique et phases fluides associees.* Min. Deposita 22 (4): 253-

Gize, A.P. and Barnes, H.L. 1987. *The organic geochemistry of two Mississippi Valley-type lead-zinc deposits.* EG 82: 457-470.

Gleeson, C.F. and Rampton, V.N. 1987. *The use of near surface materials in gold exploration — Kirkland Lake area, Ontario.* CIM Bull. 80 (904): 62-67.

Goldie, R. 1987. *Conference Report Seminar on Platinum Group Elements.* Geoscience Canada 14 (3): 177-182.

Gorzherskiy, D.I. 1987. *On the role of organic matter in ore formation.* Intern. Geol. Rev. 29 (2): 207-217.

Govett, G.J.S. 1987. *Exploration geochemistry in some low-latitude areas problems and techniques.* Trans. IMM 96: B97-B116.

Grigor'yev, N.A., Sazonov, V.N. and Murzin, V.V. 1987. *The gold mineral balance in the weathering products of a primary lithogeochemical aureole.* Geochem. Intern. 24 (3): 83- 90.

Haynes, D.W. and Bloom, M.S. 1987. *Stratiform copper deposits hosted by low-energy sediments: III. Aspects of metal transport.* EG 82: 635-648.

Henley, R.W., Hedenquist, J.W. and Roberts, P.J. (Eds.) 1987. *Guide to the Active Epithermal (Geothermal) Systems and Precious Metal Deposits of New Zealand.* Mon. 26. Gebrunder Borntraeger. 211 p.

Howard, K.W. and Hanor, J.S. 1987. *Compositional zoning in the Fancy Hill stratiform barite deposit, Ouachita Mountains, Arkansas, and evidence for the lack of associated massive sulfides.* EG 82: 1377-1385.

Huston, D.L. and Large, R.R. 1987. *Genetic and exploration significance of the zinc ratio (100 Zn/(Zn ¢ Pb)) in massive sulfide systems.* EG 82: 1521-1539.

IMM. 1985. *High Heat Production (HHP) Granites, Hydrothermal Circulation and Ore Genesis.* IMM. 593 p.

IMM. 1986. *Mining Latin America/Mineria Lationamericana.* IMM. 441 p.

Jaireth, S. 1987. *Fluid inclusion geochemistry of quartz-wolframite-sulphide veins of Chhendapothor, Bankura District, West Bengal, India.* Trans. IMM 96: B59-B64.

Juras, S.J. et al. 1987. *A practical method for the analysis of rare-earth elements in geological samples by graphite furnace atomic absorption and X-ray fluorescence.* Chem. Geol. 64 (1/2): 143-148.

Kaiser, C.J. et al. 1987. *Geologic and geochemical controls of mineralization in the Southeast Missouri Barite District.* EG 82: 719-734.

Kishida, A. and Kerrich, R., 1987. *Hydrothermal alteration zoning and gold concentration at the Kerr-Addison Archean lode gold deposits, Kirkland Lake, Ontario.* EG 82: 649-690.

Kogarko, L.N. and Romanchev, B.P. 1987. *A geochemical criterion for the metalliferous nature of alkali magmas.* Geochem. Intern. 24 (5): 41-47.

Korobeinikov, A.F., Nomokonova, G.G. and Erofeyev, L.Y. 1987. *Regularities of gold ore occurrences in the geologic-geochemical and physical fields around the granitoid intrusions.* Geologiia Rudnykh Mestorozheniv 29 (2):58-70.

Kroner, A., Hanson, G.N. and Goodwin, A.M. (Eds.) 1984. *Archean Geochemistry* Springer-Verlag. 287 p.

Lange, I.M., Moore, J.N. and Krouse, H.R. 1987. *Diagenesis and copper mineralization in carbonates in the Spokane Formation, Belt Supergroup, at Wolf Creek, Montana.* EG 82: 1234-1347.

Latham, A.G. and Schwarcz, H.P. 1987. *The relative mobility of U, Th and Ra isotopes in the weathered zones of the Eye-Dashwa Lakes granite pluton, northwestern Ontario, Canada.* GCA 51: 2787-2793.

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Your 1988 dues renewal form has been included on page 25 of this newsletter. The cost of running the Association is such that we would appreciate payment of annual dues as soon as possible.

In order to facilitate payment we will accept VISA and MASTERCARD charges. Your cooperation is requested, as determining the size of our membership early each year facilitates our planning process and helps to determine what new projects may be undertaken.

A label prepared from AEG files is affixed to your membership renewal form. If it indicates that dues are still unpaid for 1987, please consider paying dues for two years. All 1987 issues of the *Journal of Geochemical Exploration* may be received by paying 1987 dues before December 31 of this year. Previous issues are available to members through the Rexdale office (see below) at U.S. $50 per year.

Our past methods of reminding existing members of their membership status have been lax, and, if this has adversely affected your subscription to the Journal, please accept our apologies. Elsevier operates on a prepayment basis, and they must receive monies from the Association (as we receive the dues from you) before journal issues are mailed.

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