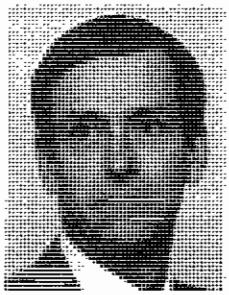
EXPLORE

The Association of Exploration Geochemists Newsletter

NUMBER 66 JUNE 1989

PRESIDENT'S MESSAGE



The 13th International Geochemical Exploration Symposium (IGES) and the Second Brazilian Geochemical Congress (BGC) will soon be convening in Rio de Janiero, Brazil. These symposia offer many significant opportunities for those of us in the exploration geochemistry community.

The 13th IGES is your Association's first international symposium to be held in Latin America. The Brazilian venue offers unique opportunities. The first is a chance to visit firsthand many world class mineral deposit localities. Perhaps more important, the 13th IGES and the 2nd BGC -- through workshops, oral and poster presentations, and field trips -- will provide an in-depth look at the geochemical problems associated with mineral deposits in deeply weathered tropical and sub-tropical environments.

Such environments are a particularly difficult challenge to the explorationist, cover a significant part of the world, and include many countries that offer important potential for the discovery of major new mineral deposits. We all need to learn more about exploration techniques and experiences that are particularly applicable to these areas.

These reasons alone should be sufficient to motivate each of you to attend. Suffice it to say that our Brazilian hosts are also prepared to treat you to events that will also please your palate and your cultural curiosity! Further details concerning the symposium and congress are to be found elsewhere in this issue. Plan to attend one or both. I think you will find them well worth your time, effort, and expenses. I hope to see as many of you as possible in Rio.

I would like to bring another important issue to your attention. Although most of our membership resides in just a few countries, both Council and I wish to emphasize that your Association is intended to be a truly international, worldwide organization. With the help of many of you, we are making strides toward increasing our membership in new areas.

Brazil is one good example of such an area. Your Association's sponsorship and co-sponsorship of international meetings is one way of emphasizing our internationality. The Journal of Geochemical Exploration is another important facet.

I am increasingly concerned, however, about our inability to communicate adequately with our colleagues in many parts of the world. A recent trip abroad brought home to me once again the devastating effects of inflation and currency exchange problems for scientists in many countries. Many highly educated, well-trained, dedicated scientists are losing touch with scientific advances because they simply are no longer able to afford subscriptions to scientific journals or to belong in any meaningful way to professional societies, let alone travel to scientific meetings such as ours in Rio. I plan to discuss this issue in more detail at a later time. In the meantime, I would welcome your comments and personal experiences on this frustrating but important issue.

Maurice A. Chaffee, *U.S. Geologicat Survey, Denver, Colorado*

TECHNICAL NOTES

Seasonal Variation in Transport of Gold in Harris Creek: Implications for Exploration

Introduction

Recent notes in *EXPLORE* on moss-mat (Matysek et al., *1988*) and overbank sediment sampling (Ottesen and Volden,1989) suggest that active stream sediments are not always the optimum medium for exploration geochemical drainage surveys. Our studies of transport of gold in Harris Creek, a small gravel bed stream in the southern interior of British Columbia, Canada, help explain this.

Study area

Harris Creek forms a series of meandering and braided reaches in which bars, armored with cobbles, form riffles. Sands are deposited in bar-tail pools. Stream flow is strongly seasonal with discharge increasing from less than 1 m^3/sec to a peak exceeding 10 m^3/sec during the annual snowmelt flood in early summer.

Experimental

Bedload sediment traps, each consisting of a length of 30 cm diameter concrete water pipe installed vertically with its upper rim flush with the bed, were placed at the head, midsection and tail of a bar. Sediment was removed from the traps as they filled between April 18 and June 17, 1988. In the laboratory, sediments were wet sieved into eight size fractions, dried and weighed. Magnetic and non-magnetic heavy mineral fractions (SG 3.3) were then separated from sediments from the bar-tail traps. The non-magnetic heavies were analyzed for gold by fire assay-atomic absorption.

Results

The increase in stream discharge from 4.28 m^3/sec, prior to the flood peak, to a maximum of 19.57 m^3/sec on May 14 increased the rate of sediment accumulation in the traps from less than 10 g to nearly 2000 g per hour. At the same time magnetite content of

Continued on page 8

CONTENTS

Information for Contributors to EXPLORE

Scope This Newsletter endeavors to become a forum for late advances in exploration geochemistry and a key informational source. In addition to contributions on exploration geochemistry, we encourage material on multidisciplinary applications, environmental geochemistry and analytical technology. Of particular interest are extended abstracts on new concepts for guides to ore, model improvements, exploration tools, unconventional case histories, and descriptions of recently discovered 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. Please include the metric system in technical material.

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

Quality Submittals are copy-edited as necessary without reexamination by authors who are asked to assure smooth writing style and accuracy of statement by thorough peer review. Contributions may be edited for clarity or space.

EXPLORE

Newsletter No. 66 JUNE 1989

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

Business Manager and Associate Editor: S. Clark Smith (702) 849-2235

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

Associate Editor: J. Howard McCarthy, Jr. (702) 784-1765

Assistant Editors: Keryl L. Fleming (702) 784-6691

Paul J. Lechler (702) 784-6691

Richard Meeuwig (702) 784-6691

Frederick P. Schwarz (702) 738-5600

FAX 702-826-7902, ATTN.: EXPLORE

NOTES FROM THE EDITOR

Journal of Geochemical Exploration Volume 31, Numbers 2 and 3 have been issued since the last newsletter and received by members who paid dues for 1988. There have been some awfully good articles in recent volumes, and what is coming up looks pretty impressive, too (see #65, p.4). Use the form on page 21 to get the 1989 issues and the flip side for older volumes.

Four notices of dues have been sent to members this year, two in previous issues of this newsletter and two by letter. This is the **last issue** of EXPLORE that will be received by members whose mailing lables read "PAID-88". No issues of the *Journal* are sent to members in advance of payment. Disregard this notice if you have paid within about two months of receipt of this issue.

Our new **T-shirts** are pretty nice, by the way. They have the AEG logo on the left front and the EXPLORE logo on the back. See the form on page 22 for colors and sizes.

Three departments are open for **Assistant Editors**: News and Comment, Meeting Reports, and Technical Notes. The principal duties are soliciting and editing papers. Please write or call the Editor if you might be able to help.

Anyone with a **position opening** may advertise without cost. Members seeking employment are offered a similar free service.

EXPLORE 65 was distributed to **4200** different professionals in the exploration industry. In addition to the AEG membership, it was mailed to members of the Society of Economic Geologists and the Arizona Geological Society. It is also regularly received by about 80 major geoscience libraries.

Chet Nichols

A NOTE FROM THE SECRETARY

We are about to have our annual election of Councillors. All Voting Members will soon be receiving their ballots. Nominees for Council are chosen in three ways: (1) by nominations from individual members of Council and Executive, (2) by a slate of nominees chosen by the Secretary and Ex-officio Presidents, and (3) by a petition from at least six voting members.

In addition, your Association has Regional Councillors who are nominated by any four Voting Members in a given region or by a resolution of Council. If you are a Voting Member living outside North America and feel that your region is under-represented you may petition Council for permission to nominate a regional Councillor. If more than one Regional Councillor is nominated, the Regional Councillor is elected from the Voting Members within that region. We currently have Regional Councillors representing Australia, Brazil, southern Africa, and northern Europe.

You may have noted that the nomination and election of Councillors is restricted to Voting Members. I would like to encourage those of you who have been Associate Members for several years to apply for Voting Membership. There are several advantages, not the least being that you become more active in the affairs of your Association.

As a Voting Member you can stand for election to Council and Executive, you can become active as a committee chair-person, and you will have a vote and be able to voice your opinion on how your Association is run. I think the amount of time required to fill out the Voting Membership form is amply compensated by participation in the affairs of the Association. Voting Membership forms may be requested from the Rexdale, Ontario office.

Sherman P. Marsh
U.S. Geological Survey
MS 973,
Denver, Colorado 80225

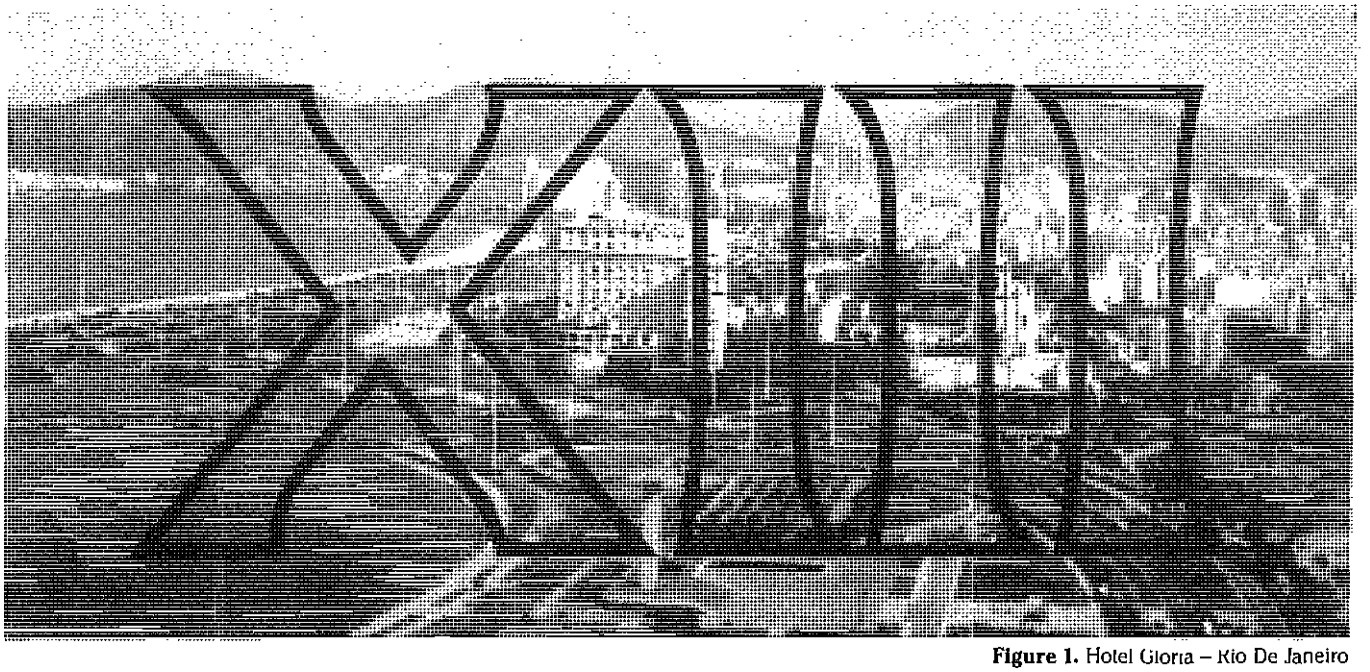


Figure 1. Hotel Gloria – Rio De Janeiro

13th IGES – RIO '89

Editor's note: **Stan Hoffman recently visited Rio and has returned with several travel tips for those planning to attend the Symposium in October. Here is a unique opportunity to be amongst personal and professional friends in a land that is a "must" for the traveller.**

Time is marching quickly towards our 1989 International Geochemical Exploration Symposium (the 13th IGES), October 1-6, 1989, in Rio de Janeiro, Brazil. Have you decided to attend? I suspect that many of our members and readership long ago "discounted" this one for one or more of a variety of reasons. As you will see, many of the factors which likely affected your decision should perhaps be reevaluated on the basis of the following article.

I have recently returned from a Rio vacation. My observations, and those of other North American and European tourists with whom I had discussions, all lead to the same conclusion - "a visit to Rio is a must." The 13th IGES additionally represents an opportunity to meet Brazilian geochemists/geologists who can provide an "inside story" to Rio and Brazil from a tourist as well as a geological/geochemical perspective.

I believe our readers must, at some time in the future, schedule a trip to Rio, and if it is independant of the 13th IGES, the many barriers and uncertainties being removed by our hosts will be a major benefit lost. Please feel free to contact the organizing committee on questions not covered here or in the circular and registration material sent to you in separate mailings.

Rio de Janeiro

There is no way of escaping the fact that Rio "is" a big drawing card. Undoubtedly, everyone has seen pictures; let me tell you they do not do justice to seeing the city in person. Fig. 1 is a black and white reproduction of the Gloria Hotel, the location of the technical sessions and workshops of the 13th IGES. I have read, and can easily believe Rio to be the world's most beautiful city.

For a convention, this has its plusses and minuses. The plusses can be summarized by "I want to go", the minuses by "the boss will never believe the 13th IGES is a business trip". Those of us who can control the decision-making process (i.e., can take the trip and the tax consequences) are ahead of the game, but the rest of us must give serious consideration to attending with/without? our "spouse" on our own account. I have found the IGES represents the best vehicle, an "opportunity" if you like, to visit a foreign country but be amongst friends, to tour as would not otherwise be possible if you elected to "come on your own" some other time.

An excellent guide is recommended by symposium organisers to plan your trip. It is called "An Insiders Guide to Rio de Janeiro" by Christopher Pickard and is available from symposium organisers for U.S. $12.00 post paid. Order it now to learn what is in store for you!

PLANNING YOUR TRIP

Passport - Visa:

Brazil requires North Americans and many others to obtain a visa, good for 90 days, before entry is permitted. To obtain a visa, an applicant must have a passport which is valid for at least 6 months from the time of the visa application. The visa, where necessary, must be obtained from a Brazilian consulate by completing a visa application form and submitting a recent passport photo within 90 days of departure (i.e., after July 3, for those plainng to arrive in Rio on October 1), no sooner. Costs vary (see box 1 with consulate addresses and costs for North American applicants). Visas can be applied for in person or by mail and turnaround is typically under 1 week. A xerox copy of the airline ticket showing travel dates must be included with the visa application. Those applying by mail should include a prepaid, preaddressed envelope for passport return at the level of security desired (i.e., priority post, insured mail etc.). Visa application forms are available from local Brazilian embassies.

Vaccinations:

Vaccinations are not required to visit Rio. Field trips to Bahia, Goias, and the Amazon require a vacination for yellow fever.

Money:

This point is very important. Brazil has an inflation rate which, in the developed world, is incomprehensible. On January 16, 1989, the Cruzado (CZ$) was replaced by the New Cruzado (NCZ$), worth 1000 Cruzados, and set equal to U.S.$1.00. In February, only old Cruzado bills were in circulation, a CZ$10,000 = NCZ$10.00. The previous currency, the Cruzeiro, was still in use but revalued in old Cruzados (i.e., a 100,000 cruzeiro note is worth CZ$100.00 or NCZ$0.1). Coins are not in widespread circulation.

Two exchange rates exist, the official which at time of writing had NCZ$1.00 = US$1.00, and a "floating" or "parallel" rate which, at time of writing had US$1.00 = NCZ$1.6, a 60% differ-

ence. The parallel rate can be obtained from many local sources, most notably jewelry stores.

Major credit cards are accepted, but currency regulations require that banks charge the official rate (i.e., a NCZ$80.00 hotel room will cost US$80.00 if you use your credit card. Paying your bills in cash will cost you about US$50.00 for the same room - a significant difference). But wait until your arrive in Brazil to purchase NCZ$. Bring US$ travellers cheques and some US$ cash, including low denomination (i.e., US$1 and US$5) bills. Keep your plastic for emergencies.

You can obtain cash from local banks or from American Express, but only in NCZ$ converted at the official rate. Come prepared to pay all your expenses by travellers cheque (cash)! See Box 2 for what a 2 week stay in Brazil should cost.

Suntan Lotion

You will need protection from the sun. Many local stores sell suntan lotions with SPF rating of 2 or 3, occasionally I have seen a 6. Suntan blocks normally recommended in North America start at 15. You may find blocks this high from a beach vendor, but it is advisable to come prepared.

Passports

If you intend to make local industry contacts, it is advisable to xerox the front page of your passport to act as identification, for building security at local office buildings.

YOUR STAY IN RIO

Arriving at the Airport

Box 3 summarizes the cost of return airfare from North American gateways to Rio, as well as from Vancouver and Reno.

Arrival in Rio International airport, passage through customs, immigration, and baggage claim follow normal routines. Customs specifies that no more than US$300 worth of goods can be imported into Brazil.

Arrangements have been made for the arrival of delegates and their families between September 28 and October 4 at the airport and for transport of passengers to their hotel. I recommend reserving a decision on a car rental for a couple of days until you become familiar with Rio. Taxi service is available from a service desk at about a US$10.00 cost. A list of rates to various locations in the city is posted at the taxi desk. Porters are willing to convert US$ to local currency.

Hotel

The congress has block booked rooms in 12 hotels which are publicized in circulars of the 13th IGES. I expect rooms renting for US$40-50 would meet the expectations of most delegates. The inexpensive Florida hotel (and several others nearby) renting for US$15 to US$30 would be suitable for the budget-minded (I visited these hotels, and rooms come with private bathroom, air conditioning, colour T.V. (optional), and continental breakfast). The lower prices relate to their location remote from the tourist areas of Copacabana and Ipanema, but they are within walking distance of the Gloria Hotel convention centre. Note that all rooms include breakfast!

Local Transportation - Taxi

A shuttle bus will pick up and deliver delegates from local hotels during the convention. At other times, taxis are recommended. They are inexpensive if drivers use the meter (meters were rated in cruzeiros at time of writing and drivers used a table to tell you what the rate is in NCZ$). For example, travel between the Gloria Hotel and Copacabana is in the order of US$1-2. Many drivers, particularly if they are parked in Copacabana, will suggest a flat rate. Albeit these are inexpensive by North American standards, they are 3X to 5X more expensive than if the meter was used. It's your move!

Meals

Restaurants are abundant and inexpensive. Moreover, you are treated to a level of service unparallelled in North America, except perhaps in the most expensive restaurants or private clubs. Food appearance and taste would stimulate a gourmet; portion sizes are huge. I estimate meals to cost 25% to 33% of an average meal in North America, or for budgetting purposes per day US$10.00 would be generous. It is possible to spend more, or less, depending on how many drinks are consumed. Even a nightcap on top of the Rio Othon Palace Hotel is only about US$1.00!

Crime

Warnings of crime aimed at tourists appear to be more severe in theory than in fact. To be sure, one can see the contrasts of affluence and poverty while sitting in a sidewalk cafe in Copacabana, and it is likely that a tourist sporting an expensive camera or handbag (filled with a wallet and other valuables), left unattended or poorly attended, will probably be "ripped off". Walking with a bulge in a pocket suggesting a wallet is a tempting target for a pickpocket, as is appearing to be affluent in terms of dress. The solution is simple. Keep money, air tickets, passport, etc., in a hotel safety deposit box and ensure a colleague has a copy of your travellers cheques numbers. Use your camera to take pictures and then return it to the hotel. Leave expensive watches, rings, jewelry and other items of value at home! If one takes care and stays aware, problems should be minimal.

Language

The official language of Brazil is Portugese. I speak none. This probably limited my appreciation of Rio, keeping me to tourist areas where you can always find someone who speaks English. Convention organizers are promoting interaction between Brazilian delegates and foreigners to bridge the language gap and facilitate maximum enjoyment of the city and environment.

Shopping

Bargains abound, but please competitive shop before purchasing. Our hosts will provide more details.

Rock Shops

A storehouse of crystals, polished slabs, fossil fish, rock carvings, etc., await the visitor. These rocks are about 10% to 20% of what similarly appearing materials cost in Toronto, Ontario and Seattle, Washington. I suspect few of the delegates will be able to leave Rio without one or more specimens. If you have an interest, be prepared to purchase gemstones at one of the many local retailers.

Summary

An opportunity to attend the RIO - 89 convention and meet with delegates of many other countries, to exchange ideas and procedures, exists at a reasonable cost. Every effort should be made to "afford" to attend this IGES, as the chances to appreciate Rio and Brazil will probably not be available at similarly low prices in the near future. The hospitality and experience of local Brazilian geologists/geochemists to guarantee a successful trip would be lost should the convention be missed, and Rio has got to be on your short list of places to experience at least once in a lifetime. Rethink your plans re the 13th IGES and plan to attend!

DATES TO REMEMBER AND OTHER CONSIDERATIONS

The organizers have block booked hotel rooms and meeting space. They need to know of your plans as quickly as possible once you know your plans. You should have received the second circular which summarizes critical dates. Recent discussions have enabled some variations, which will be formalized in a third circular, to be published and mailed about June 1, 1989. These include the following:

Continued on page 6

Searching for Gold?

▸ Chemex Labs plays a major role in the ongoing search for gold and other precious metals by offering quality analyses at low prices coupled with high volume capability and fast turnaround time.

Fire Assay

▸ This service is made possible through our extensive fire assay facilities — some of the largest in North America. Fire assay remains the most widely used method of analysis for gold, silver and platinum group metals. In addition to classical gravimetric finish, you may choose — depending upon the detection limit required — our inhouse neutron activation finish for a 1 ppb detection limit or the standard atomic absorption finish for a 5 ppb detection limit.

Chemex Labs Analytical Chemists Registered Assayers Geochemists

212 Brooksbank Avenue
North Vancouver, B.C.
V7J 2C1 (604) 984-0221
Fax: (604) 984-0218

Westend Industrial Park
Pasadena, Newfoundland
A0L 1K0
(709) 686-2119
Fax: (709) 686-2774

175 Industriel, C.P. #284
Rouyn, Quebec
J9X 5C3
(819) 797-1922
Fax: (819) 797-0106

5175 Timberlea Blvd.
Mississauga, Ontario
L4W 2S3
(416) 624-2000
Fax: (416) 624-6163

5640 B Street
Anchorage, Alaska
99518
(907) 562-5601
Fax: (907) 562-6502

994 Glendale Ave., Unit 7
Sparks, Nevada
89431
(702) 356-5395
Fax: (702) 355-0179

651 River Street
Elko, Nevada
89801
(702) 738-2054
Fax: (702) 738-1728

103 North Parkmont
Industrial Park
Butte, Montana 59701
(406) 494-3633
Fax: (406) 494-3721

2723 South Cole Road
Boise, Idaho
83709
(208) 362-3435
Fax: (208) 362-3358

Submission of Abstracts May 1. Note that consideration will continue to be given after May 1 postmark until September 1 (receipt in Rio), particularly to those who must submit a paper in order to attend (although receipt is not a guarantee of acceptance - submit early, if you need a response). Abstracts postmarked later than May 1 will not necessarily be announced in the program schedule and may be rejected outright if received too near the symposium date due to scheduling problems. Submit a paper and submit it early! Please also include the contribution on 5 1/4" diskette in formatted ASCII files, if possible.

Submission of papers (original plus 2 copies) ***October 6.*** Please also include the contribution on 5 1/4" floppy diskette in formatted ASCII files, if possible.

Registration fee schedule.

	To May 1	To Aug. 15	After Aug. 15
Member AEG	US $150	US $175	US $200
Non Member	US $175	US $200	US $225
Accompanying Guest	US $ 50	US $ 55	US $ 60
Students	US $ 50	US $ 50	US $ 50
Workshop AEG Member	US $ 25	US $ 30	US $ 35
Workshop Non Member	US $ 30	US $ 35	US $ 40

HOTEL BOOKINGS

A deposit of US $150 is requested. Refund policy and dates have been adjusted so that bookings may be made by August 15. If the hotel of your choice becomes fully booked, organizers will seek alternative accommodations in the same general locality, at the same approximate price, for the same general standards.

Box 1: Tourist Visa Requirements For Each Traveller

The following information has been abstracted from a form issued by the Brazilian consulate in Vancouver. Information is subject to change and travellers should contact a Brazilian embassy before travelling.

Tourist Visa is valid for 90 days from the date of arrival in Brazil and good to enter Brazil up to 90 days from issuing date. Tourists are *not allowed* to work in Brazil. Please send the following:

1. Passport with a validity beyond 6 months of the travel date.
2. Photocopy of the round-trip ticket or letter from travel agency or airline stating passenger name, itinerary, with dates of arrival and departure in and from Brazil, typed on letterhead and signed by the agent.
3. One Visa Application form (provided by the Consulate) completed and signed by the applicant. Parents sign application form for minors (see "8" below).
4. One passport size photograph. Instant photos are not accepted.
5. Consular Fees: In Canada: Can$ 16.00 for visa, another Can$ 16.00 for processing for Visa Application sent by Post, Courier or presented at the Consulate through Travel Agencies or Airline companies. Please send fees by Money Order or Certified Cheque to the order of the Brazilian Consulate General. Personal or company cheque *are not accepted.* In the USA, send US$10.00 and in Australia, send Aus$ for processing. Australian and U.S.A. Passports are free of charge for the Visa Fee only, by bilateral agreement. Please, send a self-addressed and stamped (for Registered Mail) envelope or a "Collect Courier slip" for the return of your passport.
6. Proof of financial means (letter from employer or from a bank, possession of Travellers' Cheques or other) may be requested.
7. Applicants under 18: (a) Travelling alone; (b) accompanied by only one parent; (c) accompanied by an adult other than a parent, must present a Letter of Consent to travel in one of the above mentioned conditions, signed: (a) by *both* parents; (b) by the parent not travelling; (c) by the Legal Guardian (proof of guardianship *must be* presented). Above mentioned Letter of Consent *must be signed in the presence of a notary public* and sent to the Consulate General for legalization, attached with a specimen of the Notary's signature and his name typed, on a separate filing card. A Money Order or Certified Cheque in the amount of Can$ 32.00 should (for Canada) be sent to the order of the Brazilian Consulate for the legalization.
8. Vaccination: Travellers that have been, in the last 90 days, in one of the countries listed below, must present a Certificate of Vaccination against Yellow Fever valid for 10 years.

In Africa: Burkina Faso, Gambia, Ghana, Republic of Guine, Mali, Mauritania, Nigeria, Sudan and Zaire;
In South America: Bolivia, Colombia and Peru.

For children between 6 months and 6 years of age, a Certificate of Vaccination against Polio is required (Certificate must be signed by a doctor and state dates and dosages applied as well as be stamped by the Local Board of Health.

9. Holders of valid passports of Argentina, Austria, Bahamas, Belgium, Chile, Colombia, Denmark, Ecuador, Fed. Rep. of Germany, United Kingdom of G. Britain & N. Ireland, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxemburg, Mexico, Monaco, Morroco, Netherlands, Norway, Paraguay, Peru, Phillipines, Portugal, Spain, Suriname, Sweden, Switzerland, Trinidad and Tobago and

Uruguay do not require a visa to visit Brazil as tourists.

For some countries a previous authorization from Brazil is required.

10. Brazilian born applicants and their children should contact the Consulate beforehand, for they must travel to Brazil with a Brazilian passport unless proof of loss of the Brazilian nationality is presented to the Consulate.

Box 2: Estimated costs*

12 nights - 14 days stay in Rio de Janeiro, Brazil
versus
13 nights - 14 days in Honolulu, Hawaii:

	Per Person, Single		Per Person, Double	
	Rio	Honolulu	Rio	Honolulu
Hotel	US $540	$1300	US $300	$650
Meals	US $140	$280	US $140	$280
Taxi	US $ 40	**	US $ 40	**
Souvenirs	?	?	?	?
Tours	?	?	?	?
Departure Tax	US $ 6	?	US $ 6	?
TOTAL:	US $726	$1580	US $486	$930

* Flights to Rio usually arrive about 8:00 a.m. and leave at about midnight, obviating the need to rent rooms on the arrival and departure days.

** Distances are not as great as in Rio, and local bus service would probably be used. Local buses in Rio are very much less expensive than taxi fares.

Box 3: Travel Packages

The AEG has negotiated group discount fares from Vancouver, Los Angeles, and Toronto gateways to Rio via Varig, the official carrier of the symposium. **ITP Thompson Holidays Ltd.** of Vancouver, B.C. will be acting as our agent to book airline reservations and hotel or other land packages. Departure date from Toronto is September 28, whereas departure date from Vancouver (via Delta Airlines) and Los Angeles is September 29. Airline fares require a minimum 7 day stay up to a maximum of 21 days.

Below are representative examples of several convention packages. Flexibility may exist in selecting departure dates, and packages can be put together using other hotels recommended by symposium organizers (depending on your selection, costs may be higher for departing before or after the dates listed above). Attractive *add-on* 3 day tourist packages have been formulated for delegates after the convention or field trips. Please contact our travel agent for more details.

Note that all prices listed below are in *Canadian dollars* and American departures would be priced in US dollars at the prevailing exchange rate.

BASIC CONVENTION PACKAGE.....EASTERN CANADA DEPARTURE:

(Depart Toronto September 28, 5 p.m.; leave Rio October 14, 10 p.m.; arrive Toronto October 15, 10 a.m.)

Package includes airfare from Toronto, Montreal or Ottawa, **8 nights hotel accommodation**, return transfers and 2 half day tours.

Price per person in *Canadian funds* is shown on Table 1.

BASIC CONVENTION PACKAGE....WESTERN CANADA/USA DEPARTURE:

(Depart Los Angeles September 29, 12:30 p.m.; leave Rio October 13, 11 p.m.; arrive Los Angeles October 14, 8:30 a.m.)

Package includes airfare from Vancouver or Calgary to Los Angeles via Delta Airlines or Air Canada, **7 nights hotel accommodation**, return transfers and 2 half day tours.

Price per person in *Canadian funds* is shown on Table 1.

Departures from Reno or Denver are via Los Angeles. Attendees will obtain the lowest available fare from either city to L.A. at time of booking.

NOTE: All packages include hotel service charges, taxes and breakfast, but ***do not*** include transportation from/to the convention.

Prices are subject to change without notice.

Canadian citizens require visa for entry into Brazil. Other nationalities please check with Brazilian Consulate.

Time is rapidly approaching the booking **deadline** of **July 15, 1989**. To reserve, or if you require more information, please contact Mariann at:

ITP Thomson Holidays Ltd.
390 - 1199 West Pender St.
Vancouver, B.C., Canada V6E 2R1
Tel: (604) 687-7611 FAX (604) 684-7190.

Please use a copy of the form below or supply the necessary information on your correspondence.

Name _____
Affiliation _____
Address _____
Province/State _____
Postal/Zip _____ Country _____
Telephone _____ FAX _____

Please specify your city of departure, dates, and hotel preference! Stopovers may be permitted (i.e. in Los Angeles). The travel agent will assist you in planning your itinerary. **Make liberal use of the FAX**, as time is short.

Procrastinators note that after July 15, space may still be available at the prevailing (or higher?) rates. **Last minute decision-makers should still contact ITP Thomson Holidays Ltd. after the July 15 deadline.**

A non-refundable CDN $300.00 deposit will be required by August 1, 1989 to hold space, and full payment must be in hand on

August 15, 1989. Cancellations made between Aug. 16 - Aug. 31 will be subject to a 25% forfeiture; Sept. 1 - Sept. 15, 50%; and after Sept. 15, 100%. Cancellation insurance and Package Tour Insurance are available and should be considered. Standard industry-wide policies on cancellation are in force. More information on cancellation is available from the travel agent.

Table 1

Air only and Air/Hotel packages (in Canadian dollars which are equivalent to approximately .83 U.S. dollars) from North American destinations. Note that eastern Canada package tour covers 8 nights accommodation whereas western Canada/U.S.A. package tour covers 7 nights.

City	Air Only	Hotel Gloria 5 Star		Rio Orthon Palace 5 Star		Copa d'Or 4 Star		Rio Copa 3 Star	
		DBL	SGL	DBL	SGL	DBL	SGL	DBL	SGL
Toronto Montreal Ottawa	1100	1599	1939	1529	1869	1439	1689	1329	1439
Saskatoon (via Toronto)	1420	1959	2299	1899	2229	1819	2069	1649	1749
Vancouver Calgary	1472	1969	2249	1899	2199	1829	2039	1699	1799
Los Angeles	1147	1629	1929	1579	1869	1499	1719	1379	1479
Johannesburg	995								

BRAZILIAN CONSULATES
IN THE UNITED STATES

Brazilian Consulate
Suite 2420, 229 Peachtree St. N.E.
Atlanta, GA 30303
Telephone: (404) 659-0660

Brazilian Consulate General
Suite 530, 20 North Wacker Drive
Chicago, Illinios 60606
Telephone: (312) 372-2172

Brazilian Consulate
Suite 174, 2050 Stennons Freeway
World Trade Centre
Dallas, Texas 75258
Telephone: (214) 651-1854/55/56/57

Brazilian Consulate
Suite 1100, 1333 West Loop South
Houston, Texas 77027
Telephone: (713) 961-3063/64

Brazilian Consulate
3810 Wiltshire Boulevard
Los Angeles, Calif. 90036
Telephoue: (213) 937-4044

Brazilian Consulate
11th Floor, 330 Biscayne Boulevard
Miami, Florida 33132
Telephoue: (305) 377-1734/35

Brazilian Consulate General
Suite 1306, 2 Canal St.
International Trade Mart Bldg.
New Orleans, Lousiana 70130
Telephone: (504) 588-9187/88/89

Brazilian Cousulate General
27th Floor, 630 Fifth Ave.
New York, N.Y. 10111
Telephone: (212) 757-3080 or (212) 757-3087

Braziliau Consulate
Suite 1160, 300 Montgomery St.
San Francisco, Calif. 94104
Telephone: (415) 981-8170 or (415) 981-8175

LOCATIONS IN CANADA

Brazilian Consulate
Suite 1700, 2000 Mansfield St.
Montreal, Quebec H3A 3A5
Telephone: (514) 866-3313

Brazilian Consulate
Suite 1109, 77 Bloor St. West
Toronto, Ont. M5S 1N5
Telephone: (416) 921-4534
or (416) 922-1058

Brazilian Consulate
1700 - 1055 West Georgia St.
Vancouver, B.C. V6E 2R5
Telephone: (604) 687-4589

LOCATIONS IN AUSTRALIA

Brazilian Consulate
11th Floor, "Camberra House"
40, Marcus Clarke Street
Camberra City - Act 2601
Australia
Tel. (062) 47.8466, (062) 47.8933

Brazilian Cousulate
AMP Centre, 25th Floor
50 Bridge Street
Sydney, N.S.W. 2000
Australia
Tel. 231-5077, 231-5465, 231-5621

TECHNICAL NOTES

Continued from page 1

transported sediments increased from approximately 10% to 20% (Fig.1) and gold concentrations increased abruptly from <15 ppb to 1115 ppb (Table 1). Thereafter, with decreasing discharge, concentrations of gold and magnetite fell to their normal values.

Discussion

Gold and magnetite content of transported sediments in Harris Creek is closely related to stream discharge with anomalous concentrations of gold *only* being transported during the peak discharge of May 13-14. For the remainder of the experiment "active" sediment collected in the traps contained background concentrations of gold. Day and Fletcher (in press) have shown that in Harris Creek gold and magnetite are preferentially stored in bar head gravels. The increased concentrations of magnetite and abrupt appearance of gold in the traps during peak discharge probably results from release of the heavy minerals from these sites when discharge becomes sufficient to disrupt the cobble armour and framework of the bars. This requires further study.

Whatever the reason, the increased concentrations of magnetite and gold in sediments transported during peak discharge have important implications for exploration geochemical surveys. These can be summarized as follows:

1. Gold content of "active" sediments in gold-rich streams depends on discharge conditions and may not be anomalous at all times.

2. Gold-rich sediments, deposited immediately after the flood peak, might be buried by gold-poor sediments as discharge falls. Once buried these anomalies will not reappear until a new flood releases the gold. *Sampling soon after a high discharge should give the best anomaly contrast.*

3. The extent to which gold-rich sediments are likely to be buri-

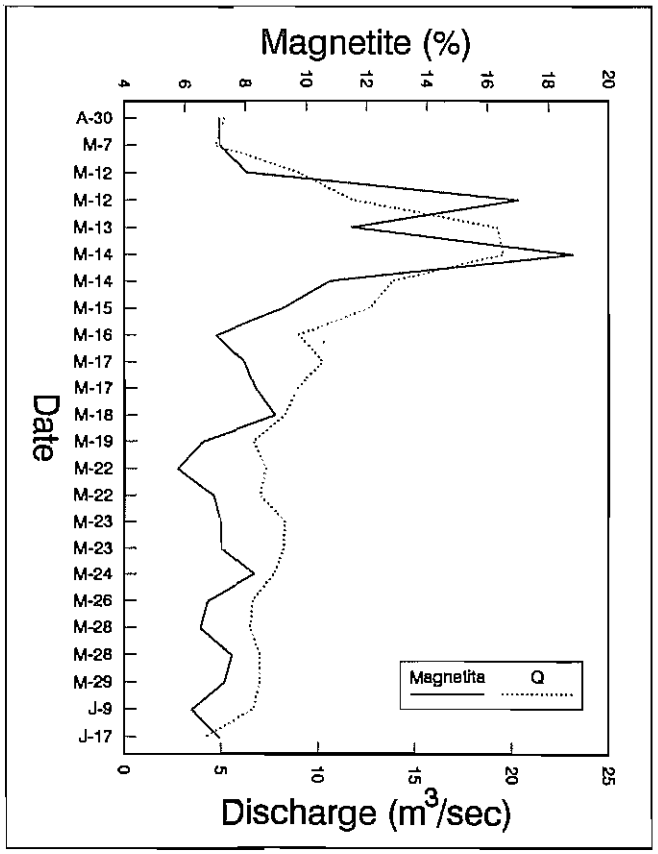


Figure 1. Magnetite content of transported sediments versus discharge (Q) in Harris Creek, British Columbia from April 18 to June 17, 1988.

GSI Has It!

GSI Brings A New Horizon To Soils...

15-ELEMENT RECONNAISSANCE PACKAGE FOR SOILS AND STREAM SEDIMENTS (SRP)

A new high precision quantitative analytical package with complete statistical support, contour mapping and interpretational support is now available from GSI. The package has been custom tailored to address the low level sensitivity and precision requirements of soil and stream sediment surveys for bulk mineable gold deposits and other metal deposits. It is designed specifically for use on soil and sediment samples that have been properly dried and sieved to -80 mesh. No other geologic materials or sample preparations will be analyzed using this package. Detection limits are reported at 2-sigma and samples containing elemental concentrations greater than the published upper limits of this package may be subject to significant analytical errors.

For data sets containing 500 or more samples, GSI will provide, at no additional charge, statistical data including contour plots of five elements or variables or any combination of the two, along with interpretational support of the data set. One additional contour plot will he run for each additional 100 samples in a given data set.

If you are not presently using GSI multielement data for soil and sediment reconnaissance programs, you should he. Experience the GSI difference. We're sure that when you do, you will have a new high powered weapon in your exploration arsenal.

	Detection Limit (ppm)	Upper Limit (ppm)
Precious Metals		
Ag	0.003	1,500
Au	0.0002	250
Volatile Elements		
As	0.25	2,500
Bi	0.05	2,500
Cd	0.02	2,500
Hg	0.02	1,500
Sb	0.05	2,500
Se	0.25	25
Te	0.05	1,500
Base Metals		
Cu	0.01	7,500
Mo	0.02	1,500
Pb	0.05	2,500
Zn	0.25	7,500
Chalcophile/Lithophile Elements (Alteration)		
Ga	0.1	1,500
Tl	0.1	1,500

Price: $15.00 - U.S. (15 gm. digest)
$16.50 - U.S. (30 gm. digest)

3805 Atherton Road • Rocklin, California 95677 • 916/624-4GSI
1498 Kleppe Lane • Sparks, Nevada 89431 • 702/359-6600 • FAX: 702/359-6605

ed by post-flood sediments probably depends on the elevation of the site above the normal water level. *Sampling at higher elevations on gravel bars or collection of overbank deposits (including moss-mats) should be investigated to see if these provide a more consistent record of the presence of gold in a catchment than do conventional sediments.*

Table 1. Gold content of non-magnetic heavies versus average discharges in Harris Creek, British, Columbia, 1988.

Date	Discharge (m^3/sec)	Gold (ppb)
April 18 – May 5	4.2	<15
May 5 – 12	5.6	<5
May 12	9.6	<10
May 12 – 13	15.8	10
May 13 – 14	17.4	1115
May 15 – 17	8.8	15
May 17 – 22	5.9	60
May 22 – 23	7.5	<10
May 23 – 28	6.0	<10
May 28 – June 17	4.1	<5

4. The erratic appearance and disappearance of gold anomalies in streams can be explained by the processes described. If gold anomalies can be buried, *it should not be assumed that the upstream cutoff of an anomaly is necessarily close to its source.*

Much useful advice was obtained from M. Church. The study is supported by funds from the Canada/British Columbia Mineral Development Agreement and a grant from the National Science and Engineering Research Council of Canada. Results will be described in more detail in a paper to be submitted to the Journal of Geochemical Exploration.

K. Fletcher and J. Wolcott
University of British Columbia
Vancouver, B.C., Canada, V6T 2B4

References Cited:

Day, S.J. and Fletcher, W.K. *Effects of valley and local channel morphology on the distribution of gold in stream sediments.* In press: Jour. Geochem. Explor.

Matysek, P.F., Day, S.J. and Gravel, J.J. 1988.*Gold in moss-mat sediments and stream sediments.* Explore No. 62, p.1

R.T. Ottesen and T. Volden, 1989.*Overbank sediment as a sampling medium in geochemical exploration.* Explore No. 65, p.1

The association of PGEs with chromitite in layered intrusions and ophiolite complexes

Many chromitites from layered complexes contain much higher proportions of Pt and Pd relative to Ru, Ir and Os than do those from ophiolite complexes (Fig. 1); this is attributed in part to the chromitites from layered intrusions originally containing more sulfide than those from ophiolites (Naldrett and von Gruenewaldt, 1989).

Within layered intrusions, the chromitites richest in PGE are those occurring close to or above the level at which plagioclase

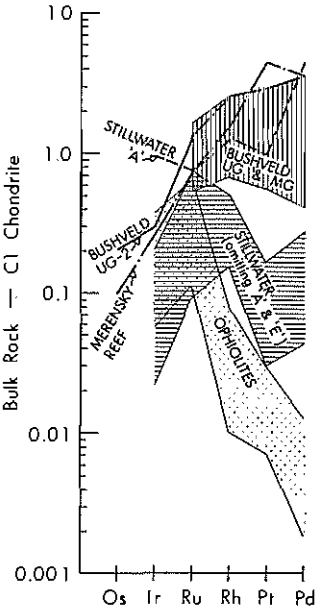


Figure 1. Chondrite-normalized plot of PGE concentrations in bulk rock samples (i.e. not normalized to 100 percent sulfides) of chromitite zones in the ophiolites of California and Oregon (Page et al., 1986), Newfoundland (Page and Talkington, 1984), the Polar Urals (Page et al., 1983), New Caledonia (Page et al., 1982a), Oman (Page et al., 1982b), the Stillwater Complex (Page et al., 1985), and the Bushveld Complex (von Gruenewaldt et al., 1986; Gain, 1985). Analogous data for the Merensky Reef (Naldrett and Cabri, 1976) and J-M Reef (Barnes and Naldrett, 1985) are shown for comparison. The values used for the chondrite normalization are those quoted by Naldrett and Duke (1980).

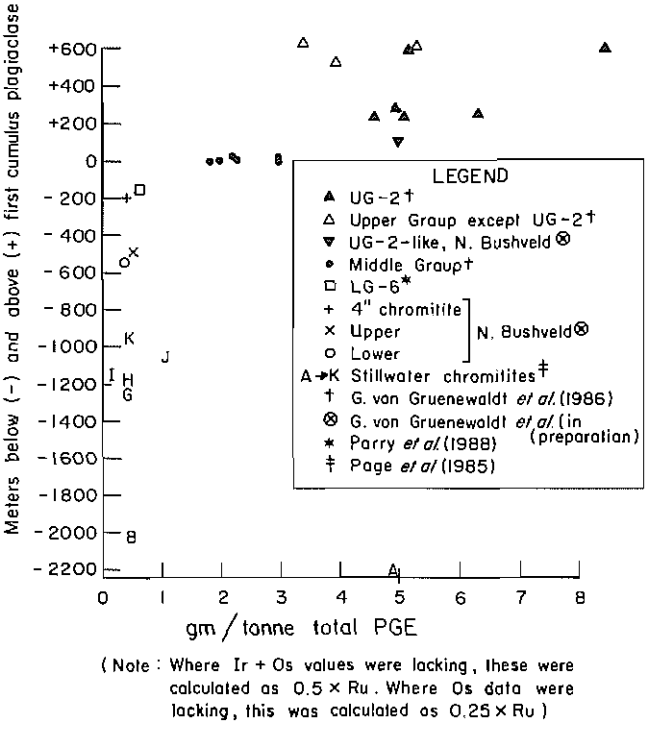


Figure 2. Plot of gm/tonne (= ppm) total PGE in chromitites from the Bushveld and Stillwater complexes against height in the cumulate stratigraphy. Data are plotted in terms of the vertical height that a given chromitite occurs above and below the first significant appearance of cumulate plagioclase in the intrusion. In some cases where Ir and/or Os values were not available, total PGE have been adjusted as described by Naldrett and von Gruenewaldt (1989).

first appears as a cumulate phase. Those situated well within the ultramafic cumulates are characterized by much lower PGE concentrations. Figure 2 shows concentration of PGEs plotted versus location within cumulate stratigraphy.

Because sulfides concentrate Pt and Pd effectively, and chromite does not, while both appear to concentrate Ru, Ir, and Os, the (Pt+Pd)/(Ru+Ir+Os) ratio of a sample is a reasonable guide as to how much sulfide any given chromitite contained originally;

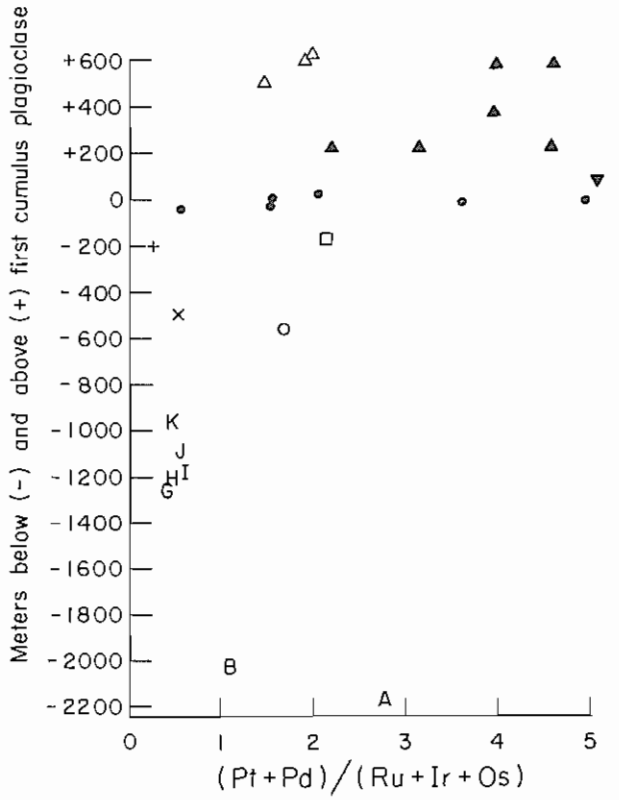


Figure 3. Plot of (Pt+Pd)/(Ru+Ir+Os) ratio for chromitites against height in the stratigraphy as described for Figure 2. Sources of data are those as given in Figure 2.

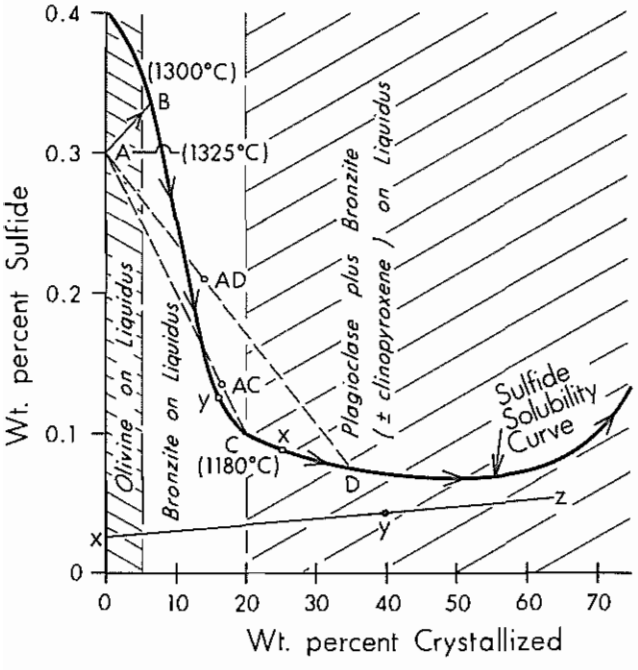


Figure 4. Schematic diagram illustrating variation in the solubility of iron sulfide with fractionation of a Bushveld chilled margin sample. See Naldrett and von Gruenewaldt (1989) for a discussion of the derivation of this curve.

thus a high (Pt+Pd)/(Ru+Ir+Os) ratio indicates appreciable original sulfide and a low ratio the reverse. Figure 3 shows this ratio plotted versus location within the cumulate stratigraphy. This plot is very similar to Figure 2. This relationship supports the contention that the present PGE content is a function of the original sulfide content.

Magma mixing would appear to be the best mechanism to explain the formation of massive chromitite layers in layered intrusions (Irvine, 1977). Under certain circumstances, magma mixing can also account for sulfide immiscibility (Naldrett and von Gruenewaldt, 1989). This is shown in Figure 4 where the available data on the controls of sulfide solubility have been used to predict how solubility is likely to change with fractional crystallization of a layered intrusion. The diagram indicates that the mixing of primitive magma (A) with an advanced differentiate that is already crystallizing plagioclase (D) is most likely to produce immiscible sulfides. The mixing of two relatively primitive magmas (A and B) will not. This can explain the observed association of PGE with chromitite layers that have formed after the first appearance of cumulus plagioclase.

These observations and hypotheses lead to the conclusion that chromites within or close to the level at which norites, gabbros and anorthosites first appear in an intrusion are better prospects for PGE enrichment than those deep within ultramafic cumulates.

The Stillwater "A" chromitite (see Figures 2 & 3) is evidence that chromitites situated close to the base of an intrusion, and forming at a stage in the crystallization when the resident magma in the intrusion had not reached its maximum MgO content, may also have contained original sulfides and thus be PGE-enriched.

Because high-temperature reaction between chromite and sulfide during cooling can lead to the removal of FeS from the sulfide (Naldrett and Lehmann, 1988), and in this way to a several-fold diminution in its mass, chromitites with little or no visible sulfide may nevertheless contain high concentrations of PGE.

A.J. Naldrett
University of Toronto
Toronto, Canada M5S 1A1
G. von Gruenewaldt
University of Pretoria
Pretoria, Republic of South Africa

References Cited

Barnes, S.J. and Naldrett, A.J., 1985, *Geochemistry of the J-M (Howland) Reef of the Stillwater Complex, Minneapolis adit area I. Sulfide chemistry and sulfide-olivine equilibrium:* Econ. Geol.80, p.627-645.

Czamanaske, G.K. and Moore, T.G., 1977, *Composition and phase chemistry of sulfide solubility in basalts from the mid-Atlantic Ridge rift valley near 390 N. Lat.:* Geol. Soc. Amer. Bull. 88, p.587-599.

Gain, S.B., 1985, *The geological setting of the platiniferous UG-2 chromitite layer on the Farm Maandagshoek, Eastern Bushveld Complex:* Econ. Geol. 80, p.925-943.

Irvine, T.N., 1977, *Origin of chromite layers in the Muscox intrusion and other stratiform intrusions; a new interpretation:* Geology 5, p.273-277.

Naldrett, A.J., and von Gruenewaldt, G., 1989, *The association of PGE with chromitite in layered intrusions and ophiolites:* Econ. Geol., 84, (in press).

Naldrett, A.J., and Lehmann, J., 1988, *Spinel non-stoichiometry as the*

explanation for Ni-, Cu-, and PGE-enriched sulphides in chromitites. in: "Geoplatinum '87". eds. H.M. Prichard, P.J. Potts, J.F.W. Bowles, and S.J. Cribb. Elsevier, London, p.93-110.

Naldrett, A.J., and Duke, J.M., 1980, *Platinum metals in magmatic sulfide ores:* Science, 208, p.1417-1428.

Naldrett, A.J., and Cabri, L.J., 1976, *Ultramafic and related mafic rocks: their classification and genesis with special reference to the concentration of nickel sulfides and platinum-group elements:* Econ. Geol., 71, p.1131-1158.

Page, N.J., Singer, D.A., Moring, B.C., Carlson, C.A., McDade, J.M. and Wilson, S.A., 1986, *Platinum-group element resources in podiform chromitites from California and Oregon:* Econ. Geol. 81, p.1261-1271.

Page, N.J., Zientek, M.L., Czamanske, G.K., Foose, M.P., 1985, *Sulfide mineralization in the Stillwater Complex and underlying rocks.* in: "Stillwater Complex"; eds. Czamanske, G.K., and Zientek, M.L.; Montana Bureau of Mines and Geology Spec. Pub. No. 92, p.93-96.

Page. N.J. and Talkington, R.W., 1984, *Palladium, platinum, rhodium, ruthenium and iridium in peridotites and chromitites from ophiolite complexes from Newfoundland:* Canad. Mineral. 22, p.137-149.

Page, N.J., Aruiscavage, P.J. and Haffty, J., 1983, *Platinum-group elements in rocks from the Voikar-Syninsky ophiolite complex, Polar Urals, U.S.S.R:* Mineral. Deposita, 18, p.443-455.

Page, N.J., Cassard, D. and Haffty, J., 1982a, *Palladium, platinum, rhodium, ruthenium and iridium in chromitites from the Massif du Sud and Tiebaghi Massif, New Caledonia:* Econ. Geol., 77, p.1571-1577.

Page, N.J., Pallister, J.S., Brown, M.A., Smewing, J.D. and Hafty, J., 1982b, *Palladium, platinum, rhodium, iridium and ruthenium in chromite-rich rocks from the Samail ophiolite, Oman:* Canad. Mineral. 20, p.537-548.

Parry, S.J., Sinclair, I.W., and Asif, M., 1988, *Evaluation of the nickel sulphide bead method of fire assay for the PGE.* in: "Geoplatinum '87"; eds. Prichard, H., Potts, P., Bowles, J. and Cribb, S; Elsevier, London. (in press).

Von Gruenewaldt, G., Hatton, C.J., Merkle, R.K.W., and Gain, S.B., 1986, *Platinum-group element-chromitite associations in the Bushveld Complex:* Econ. Geol. 81, p.1067-1079.

Wendlandt, R.F., 1982. *Sulfur saturation of basalt and andesite melts at high pressures and temperatures:* Am. Mineral. 67, p.877-885.

NEWS & COMMENT

AEG-PDA Short Courses, March, 1990

The Prospectors and Developers Association (PDA) is Canada's largest non-profit organization representing the mineral industry. The PDA will hold its next annual convention at the Royal York Hotel in Toronto, Ontario, Canada, March 11 - 14, 1990. The PDA convention (PDAC) is a legendary event on the calendar of most explorationists and mining people in Canada, typically attracting over 4000 participants to the technical sessions, trade show and other events.

In 1990, the AEG will join with the PDA in co-sponsoring two pre-convention events to be held March 9 and 10, 1990. These include a **Soils Short Course** and **Computer Applications in Mineral Exploration (CAME)** on computer treatment of exploration and mining data. The theme of the PDAC proper will be established in the fall of 1989.

Timing of AEG participation is advantageous to those normally attending the PDAC as a significant reduction in airfares is realized by including a Saturday night in the itinerary. The subject material is also topical.

SOILS SHORT COURSE The AEG, in association with the Society of Economic Geologists (SEG), has prepared a short course on soil geochemistry. Some of the course material in workshop format has been published in *Reviews in Economic Geology, Volume 3,* entitled *Exploration Geochemistry, Design and Interpretation of Soil Surveys*. Although the course, has been given previously in Denver, Spokane, Vancouver and Calgary, it has by no means saturated the market. To quote one of the organizers of the Calgary Mineral Exploration Group on the April 1989 course *I have heard nothing but rave reviews concerning the (Calgary) course. You really opened some eyes!* Subject material has been expanded since publication of the text and will include a section on reverse circulation deep overburden surveys to accommodate Canadian Shield explorationists.

Soil geochemical surveys are widely used, yet they are too often misused and abused. Many seasoned explorationists have allowed complacency, familiarity and perhaps pride cloud their perception of *not having much to learn about the subject*, to their own detriment. Jack Welch, CEO of General Electric, stated in a recent issue of Fortune magazine that *if you don't have a competitive advantage - don't compete*. A substantial majority of soil surveys today can be classified as *routine* and thus do not offer the type of competitive advantage which the technology can provide!

The course targets the seasoned professional, but is equally applicable to the development of less experienced individuals. You better believe that, in aiming the course to satisfy the critical review of experienced persons, it is unlikely that participants will leave learning nothing! Rewards, in the form of cost effective exploration (saving many times the cost of course, in time and expenditures) and better recognition of exploration opportunities are likely to accrue to those who attend. Pencil March 9 to 10, 1990 for this course on your calendar!

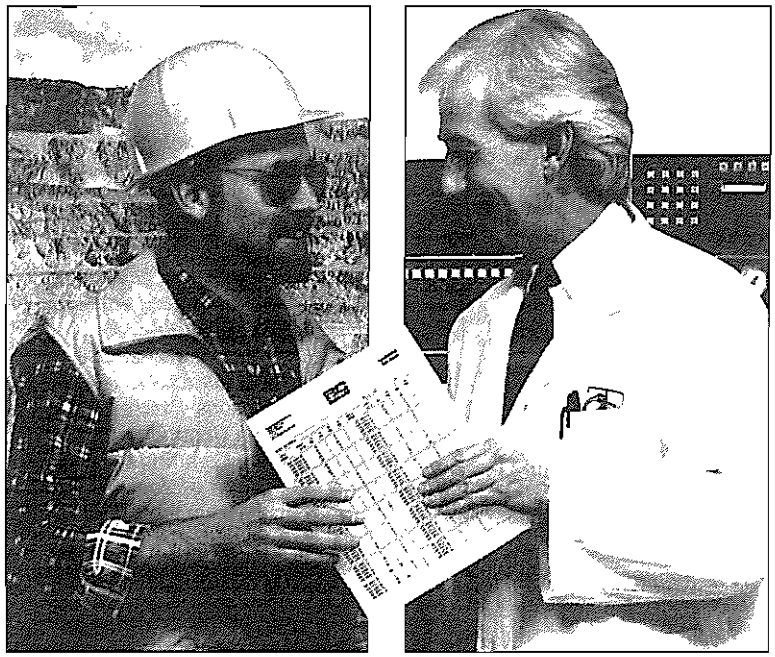
CAME SYMPOSIUM The AEG has been a cosponsor of two previous CAME conventions in Toronto. Many of the future advances anticipated in the field of geochemical interpretation, or for that matter in exploration technology as a whole, will be as a consequence of developing computer technology. This symposium on **Computer Treatment of Exploration and Mining Data - Do's and Don'ts** will run concurrently with the Soils Short Course, on March 9 - 10, 1990. The symposium provides an opportunity for authors to present examples of the problems encountered, and lessons to be learned, in the computer treatment of data.

Companies involved and interested in computer applications to exploration and mining are invited to exhibit their technology in a trade show accompanying the symposium. Attendees of the **Soils Short Course** will be allowed to attend the trade show at no additional cost.

The Chairman of the CAME symposium and the person to whom questions of participation are to be addressed is:
Normand Champigny
The Coopers and Lybrand Consulting Group
145 King Street West, 24th Floor
Toronto, Ontario, Canada, M5H 1V8
Tel: (416) 869-1130, FAX (416) 863-0926

Editor's Note. *Both the Soils Short Course and the CAME symposium will be held in the Toronto Convention Centre, a 5 minute walk from the Royal York Hotel. We are hoping EXPLORE 67 will be a joint effort with the PDA, expanding the distribution to in excess of 20,000 copies. Our regular advertisers will be appraised if negotiations with the PDA are successful. Those interested in advertising in our next issue, should contact* **Clark Smith** *at the address on page 2.*

Turnaround without compromise



Bondar-Clegg has built its reputation on providing the utmost accuracy in minerals testing. We do this by making sure that quality is *never* compromised for speed.

Does your current lab:

▶ *1. Keep drying temperatures at less than 55°C?*

At Bondar-Clegg, the answer is yes!

When samples are analyzed for elements such as Hg and As, or are high in clays, drying at a temperature higher than 55°C will drive off these elements and the water of crystallization, giving inaccurate results. Drying faster isn't better!

▶ *2. Perform custom fluxing for each sample?*

At Bondar-Clegg, the answer is yes!

In order to produce an effective fusion and complete collection of Gold, it may be necessary to adjust the flux for each individual sample. Quality requires attention!

▶ *3. Ensure top-notch in-house quality control?*

At Bondar-Clegg, the answer is yes!

In order to provide effective Quality Assurance, we have strict Quality Control procedures at every step in the laboratory process – from sample preparation to data presentation. Anything less just isn't effective!

▶ *4. Show willingness to accommodate your needs?*

At Bondar-Clegg, the answer is yes!

Published services in a fee schedule often will not provide the information you want. We discuss your specific needs and design an analytical package to meet your requirements. It's all part of our service!

If you can't answer YES to all of these questions, your lab might be sacrificing quality for turnaround. If you can't answer YES, you need us. Call Bondar-Clegg today.

BC BONDAR-CLEGG

Mining stakes its reputation on our analyses...as it has for over 25 years.

Bondar-Clegg, Inc.
Sparks, Nevada (702) 359-9330
Lakewood, Colorado (303) 989-1404

Bondar-Clegg & Company Ltd.
Ottawa, Ontario (613) 749-2220
N. Vancouver, B.C. (604) 985-0681

Chimitec Ltée
Ste-Foy, Québec (418) 683-1777

NEWS & COMMENT

Geologists and Canada - US Free Trade

Members living in North America will be aware that, in December 1988, the United States of America and Canada signed a Free Trade Agreement intended to facilitate the development of a common market place for goods and services. As a part of this Agreement, National laws and regulations governing the temporary entry of American and Canadian business travellers, as defined in the Agreement, to each others countries are liberalized and entry procedures made quick and simple.

It had been anticipated that Geologists (generically all Geoscientists) would be able to take advantage of the new legislation by being designated business professionals under the terms of the Agreement. However, although it is understood that Geologists were included in early drafts of the Agreement, they are not mentioned in the final documentation.

It may sound as if something has happened that prevents crossborder travel. In fact nothing has changed. The complicated rules for temporary entry to work in each others country that Canadian and U.S. geologists, geochemists and other geoscientists have had to deal with for years remain in effect.

In Canada, the professional geoscience organizations have responded to what they regard as, at best, an unfortunate omission, by lobbying their government to seek an amendment to the Free Trade Agreement. This effort is co-ordinated by the Canadian Geoscience Council, of which your Association is a member, who has issued the following statement:

Under the terms of the recently negotiated Canada/United States of America Free Trade Agreement provision is made for the Temporary Entry of Business Persons including those engaged in professional and commercial services related to activities "across the border". The agreed rules for the liberalized entry requirements, which are quick and simple when compared to the existing legislation, are described in Chapter 15 of the Agreement. A list of professions recognized as eligible for entry under the Free Trade Agreement is given in Schedule 2 to Annex 1502.1 of the Agreement. Geologists are not included. The only geoscientists recognized under the present rules are Geophysicists and Scientific Technicians/Technologists working in direct support of professionals in geology and geophysics.

The Canadian Geoscience Council regards the absence of geologists from the designated list as a serious omission. Many geoscientists have had problems entering the USA to work on projects for Canadian based groups. There is need for revision of the list to include geologists so that the benefit of temporary entry provisions under the Agreement can be obtained.

Article 1503(b) of the Agreement sets out that Canada and the USA shall establish a procedure for consultation respecting, inter alia, the development of amendments and additions to Anex 1502.1. However, such procedures have not yet been established and a political decision is required to initiate the process.

The Canadian Geoscience Council has made representations to government on behalf of the geoscience community but more individual statements are needed to apply political pressure.

We urge concerned geoscientists, and companies that would benefit from liberalized entry into the USA by their employees, to write to The Honorable John Crosbie, Minister of International Trade, Parliament Hill, Ottawa, Ontario, KIA 0G2, requesting that he initiate discussions that will put geologists on the list of recognized professions. Please send a copy of any letter you write to the Canadian Geoscience Council and also to Al Johnson, M.P., The House of Commons, Ottawa, Ontario, KIA 0A6, as the back bench M.P. (and geologist) with particular interest in this matter.

Association members in the United States may also wish to lobby their government and are encouraged to contact their local members of Congress and the Senate and also the American Geological Institute.

Ian Thomson
Past President, AEG
Past President, CGC

PEARL HARBOR FILE

Gold Exploration - Northern California

The Gladstone property in northern California is located near the town of French Gulch, 25 kilometers northwest of Redding. The terrain is moderately steep (20-30° slopes) and covered by a generally thin (1 meter) residual chernozemic soil. The semi-arid climate supports sage brush and manzanita on south and west facing slopes, dwarf oak on north and east facing slopes and mature pine along gulches and valley bottoms.

The French Gulch area is an old gold mining camp. Placer gold was first panned from local creeks in the late 1840's. Lode deposits were discovered in the early 1850's. The Gladstone property, comprising the Gladstone, JIC and Old American mines, was worked from the 1880's until the early 1930's, with a combined recorded production of over 200,000 ounces.

The Gladstone property lies at the eastern end of the 1.5 km by 15 km east-west trending French Gulch - Deadwood vein system. Native gold and minor sulfides are found in steeply dipping quartz-calcite veins cutting greywackes and graphitic argillites.

Prior to undertaking a soil survey, an orientation study was conducted over known showings. Results uncovered five pertinent geochemical features:

(1) Gold exhibited limited dispersion, generally less than 50 meters;

(2) Duplicate soil samples gave essentially identical concentrations in nearly all elements, including gold (Table 1);

(3) Profile sampling showed that variation in gold concentrations between the BH and BM horizons (see Fletcher et al., 1986, page 61 for soil nomenclature) was minimal;

(4) Arsenic consistently correlated with gold in soils and rocks; and

(5) Mineralized veins cutting wackes had low base-metal concen-

HELP THE A.E.G. AND FIND OUT WHAT YOU'RE MISSING!

For every 50 samples submitted for neutron activation analysis (INAA) to ACTLABS for the "AU + 33" Rock-Soil-Sediment Package or the "Au + 34" Vegetation Package we will supply a FREE A.E.G. T-SHIRT (limit 4 T-Shirts/customer; please specify Small, Medium or Large.)

"Au + 33" Rock-Soil-Sediment Package

ELEMENT	DETECTION LIMITS		ELEMENT	DETECTION LIMITS	
Ag	5	PPM	Mo	5	PPM
As	2	PPM	Na	0.05	%
Au	5	PPB	Nd	5	PPM
Ba	100	PPM	Ni	50	PPM
Br	1	PPM	Rb	30	PPM
Ca	1	%	Sb	0.2	PPM
Ce	3	PPM	Sc	0.1	PPM
Co	5	PPM	Se	5	PPM
Cr	10	PPM	Sm	0.1	PPM
Cs	2	PPM	Sr	0.05	%
Eu	0.2	%	Ta	1	PPM
Fe	0.02	%	Tb	0.5	PPM
Hf	1	PPM	Th	0.5	PPM
Hg	1	PPM	U	0.5	PPM
Ir	5	PPB	W	4	PPM
La	1	PPM	Yb	0.2	PPM
Lu	0.05	PPM	Zn	50	PPM

*Preparation costs extra

SPECIAL PRICE – CDN $10.50 / SPL
OR US $ 8.50 / SPL

"Au + 34" Vegetation Package

ELEMENT	DETECTION LIMITS		ELEMENT	DETECTION LIMITS	
Au	0.1	PPB	Rb	1	PPM
Ag	0.2	PPM	Sb	0.005	%
As	0.01	PPM	Sc	0.01	PPM
Ba	5	PPM	Se	0.1	PPM
Br	0.10	PPM	Sr	10	PPM
Ca	0.1	%	Ta	0.05	PPM
Co	0.1	PPM	Th	0.1	PPM
Cr	0.30	PPM	U	0.01	PPM
Cs	0.05	PPM	W	0.05	PPM
Fe	0.005	%	Zn	2	PPM
Hf	0.05	PPM	La	0.01	PPM
Hg	0.05	PPM	Ce	0.1	PPM
Ir	0.1	PPB	Nd	0.3	PPM
K	0.05	%	Sm	0.001	PPM
Mo	0.05	PPM	Eu	0.05	PPM
Na	1	PPM	Tb	0.1	PPM
Ni	2	PPM	Yb	0.005	PPM
			Lu	0.001	PPM

*For drying and macerating costs please enquire.

*PRICE:			
	8 gram Briquette	CAN $14.50	US $12.00
	15 gram Briquette	CAN $15.00	US $12.75
	30 gram Briquette	CAN $16.00	US $13.50

Preparation facilities: Vancouver, B.C.; Saskatoon, Sask.; Timmins, Ont.; Mississauga, Ont.; Thunderbay, Ont.; Deer Lake, Nfld.; Carson City, Nevada (vegetation only).

ACTLABS

For further information contact: Dr. Eric Hoffman
Activation Laboratories Ltd.
P.O. Box 1420, 383 Elgin St.
Brantford, Ontario, Canada N3T 5T6
Phone: 519-758-0310 Fax: 519-758-8766

trations while veins hosted by argillites contained enhanced levels (Table 1).

TABLE 1. Analysis of select samples

Element	Field duplicate 1	Field duplicate 2	Wacke hosted quartz vein	Argillite hosted quartz vein
Ag ppm	0.2	0.2	0.1	6.0
As ppm	24	21	1337	736
Au ppb	30	40	1060	960
Cu ppm	47	42	9	150
Co ppm	16	14	1	11
Fe %	3.39	3.19	.69	11.34
Mo ppm	1	1	1	96
Mn ppm	963	1060	49	353
Ni ppm	35	35	5	55
P %	.063	.059	.005	.391
Pb ppm	18	17	5	101
Sb ppm	2	2	2	43
Zn ppm	106	94	12	282

Aqua Regia digestion of -80 mesh soil and -150 mesh pulverized rock fractions, ICP determination for all elements except Au which was analyzed by AA following a fire assay fusion.

Encouraged by the results of the orientation study, a 1000+ soil sample survey was conducted later that year. Local individuals were retained as samplers. They received a one day lecture and field demonstration stressing the basics of good geochemistry and the necessity to collect quality samples. Field notes and samples were periodically checked as a quality control measure. One kilogram samples of the BM horizon were collected at a 25 m X 100 m density near old workings and along the trace of the vein system. Elsewhere samples were collected at a 50 m X 100 m density. Potential sites of contamination from adits and dumps were noted when apparent.

Results from the first half of the sampling program were received during the final week of the field program. Hand plotting of the results confirmed the strong gold-arsenic association. Coincident anomalies highlighted all known mineralized areas and hinted of significant lateral extensions. Moderate strength gold anomalies of limited area are associated with old workings; elsewhere gold forms spot anomalies (Fig. 7a). Arsenic defines broad anomalies over the workings and along the trace of the vein system (Fig. 7b).

Six sites were chosen for detailed follow-up sampling. They were selected based on coincident gold-arsenic enrichment and their position relative to known workings and the vein system. Mini grids, with sample density varying from 10 m X 10 m to 25 m X 25 m, were centered over these sites to: (a) confirm the initial results, (b) determine anomaly trends, (c) define optimal follow-up sample spacing, and (d) provide trenching or drilling targets. Three of the sites were sampled by the project geochemist; the remaining were done by one of the contract samplers.

Results from the detailed follow-up orientation were received well after the completion of the program; a return to the field that season was not possible. The three sites covered by the project geochemist near the Old American deposit produced strong gold-arsenic anomalies with well defined trends, agreeing with vein orientations in nearby workings (Fig. 8a and 8b).

Follow-up of the Gladstone ore shoots (not shown in Fig. 7a or 7b) assigned to one of the local contractors failed to reproduce the original anomaly at one site while at two others (Fig. 8c and 8d) gold-arsenic correlation was poor. Sample results were relatively uniform for the base metals and spiky for gold. Was it possible that the nature of the mineralization was different (i.e. an increase in average gold grain size producing a severe nugget effect) near the Old American ore shoots compared to the area

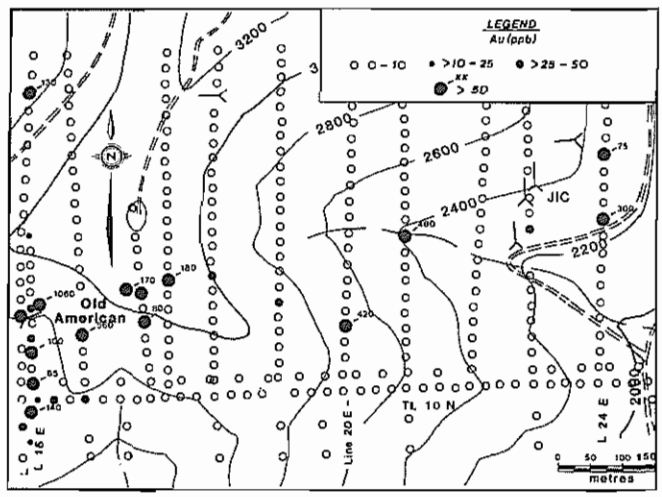


Figure 7a. Plot of gold concentrations in soil samples collected near the Old American and JIC workings.

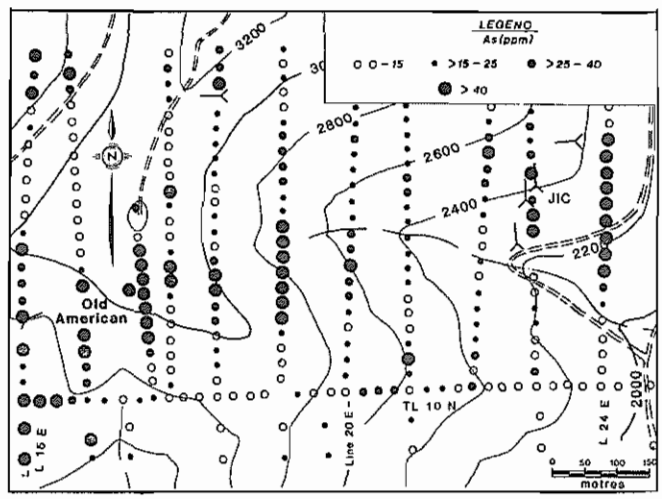


Figure 7b. Plot of arsenic concentrations in soil samples collected near the Old American and JIC workings.

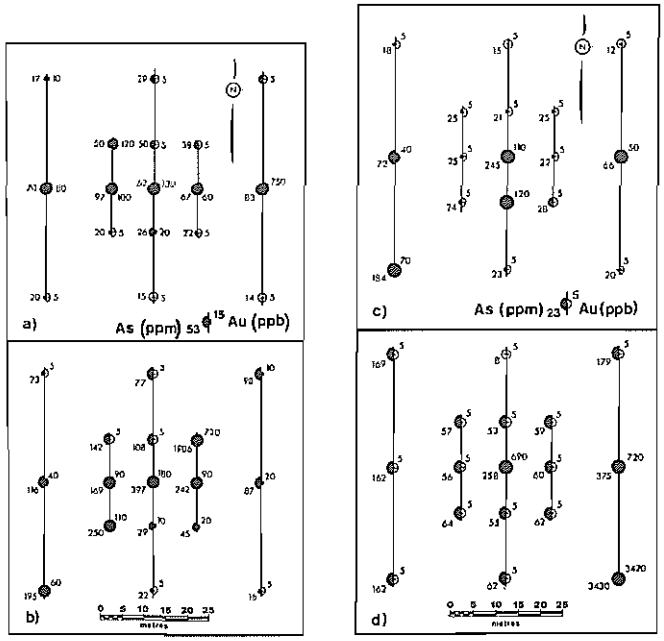


Figure 8a & 8b. Mini grids centered on anomalous gold values located at Line 15E, 14+50N and at Line 17E, 11+25N. Samples were collected by a geochemist.
Figure 8c & 8d. Mini grids centered on anomalous gold values located at Line 33E, 11+75N and at Line 34E, 12+25N. Samples were collected by a local contractor.

around the Gladstone? The geochemist was faced with a dilemma on how to interpret the results and therefore on how to advise his clients, the property owners. What was the problem and what remedy do you suggest?

John L. Gravel
Ministry of Energy, Mines and Petroleum Resources
Geological Survey Branch
756 Fort Street
Victoria, B.C., V8V 1X4

Reference Cited

Fletcher, W.K., Hoffman, S.J., Mehrtens, M.B., Sinclair, A.J. and Thomson, I. (1986) *Exploration Geochemistry, Design and Interpretation of Soil Surveys.* Reviews in Economic Geology, Volume 3. Society of Economic Geologists, El Paso, Texas

Editor's Note: *In order to make the* ***Pearl Harbor File*** *of interest to all members of the Association, the editor would appreciate contributions from a variety of regions and environments. The contributions should be presented in two parts, the first a narrative giving geochemical survey objectives, data, and conditions. The first section should leave our readership with a "cliff-hanger" in order that those interested can contemplate an answer. The second part should be the contributor's response. Address all problems to:*

Dr. Stan J. Hoffman
Prime Geochemical Methods
630 - 1199 West Pender St.
Vancouver, B.C.
Canada V6E 1R2

SPECIAL NOTES

Dues Notices and Reminders for 1990, Request for Advertisers

Dues notices and reminders will consist of 4 pages. The outside cover is a status report by the President of the AEG. The inside left hand page will be devoted to advertising whereas the inside right hand page will be the 1990 notice of dues. The back cover will list publications available from the AEG.

The dues notice will be distributed to 1400 members who are PAID-88 and PAID-89 as of September 1989. Reminders will be mailed out in March 1990 and May 1990 to an estimated 300 to 500 individuals who did not act on the first notice. Advertising is ideally suited to individuals who wish to make their consulting activities known world-wide. Ten advertisers are sought for a business card-sized insertion (50h x 86w mm or 2h x 3 3/8 w inches) for a US $150.00 charge. Availability of space is limited. Fifty percent will be reserved for North Americans and 50% for others elsewhere in the world until August 1, 1989. Thereafter location of advertisers will not be considered a factor. All advertising must be in hand by September 1, 1989 to accommodate our publication schedule.

Send camera ready copy and cheque made out to the AEG to:

Stan Hoffman
c/o Prime Geochemical Methods Ltd.
630 - 1199 West Pender St.
Vancouver, B.C., Canada V6E 2R1
Tel: (604) 684-0069

General Reminder to Members

Most members are aware that the AEG operates with a volunteer work force of individuals concerned about the status and direction of the science. We employ a part time secretary to handle incoming mail at our Rexdale, Ontario, Canada, office. She operates relatively independently of the AEG Executive and Council, and handles most of the day to day questions directed to Rexdale. (Note that correspondence of substance should be directed to the AEG Secretary, currently Sherman Marsh, in Denver, Colorado).

Discussions with our Rexdale office indicate that the AEG dues renewal forms and other printed forms are sometimes not as clear as we imagine them to be. Members can appreciate that, in order to keep administrative costs down, correspondence with members has to be kept to a minimum. Members should be aware of the following problem areas:

Payment of dues/purchases by Master Card or VISA Many members are incorrectly copying their card numbers to the form, or are using cards which expire before the debit can be made. Many are signing their names, which, in the absence of a printed

record, cannot be read. Please ensure that your name and address are printed on all forms where payment is enclosed. Several individuals will not be receiving their membership because their signature could not be read and an address was not included!

The US $12.00 charge for cheques written on banks outside Canada or the US Many of our colleagues, particularly from Australia (but also from elsewhere), are not examining their cheques closely. Many are written on local banks, that have clearing facilities in New York. If this is the case you do not need to include the US $12.00. If in doubt, you might consider using your Master Card or VISA, which are not subject to these charges.

Purchase of extra or back issues of EXPLORE Members in good standing each year receive EXPLORE as part of their membership. On your notice of 1989 dues and in the future, members who join in the current year but want back issues from the previous year have been asked to pay US $5.00 per back issue to help defray administrative costs. In retrospect, use of dates (dues notice) may have been misleading to some, and use of quarters (EXPLORE) may have confused others! This will be rectified in the future. Remember, if you are a current member in good standing, you will receive all your current EXPLORE issues at no cost. If you want additional copies or back issues, you have to include the US $5.00 per issue.

Stan Hoffman, *2910 E. Spruce Street, Seattle, Washinton 98122*

Workshops/Sessions for Brazil Meeting

Workshops

Workshops will be held Oct. 2-3 coinciding with the Brazilian National Geochemical Congress.

1. Analytical Techniques for the Determination of Gold and PGE's; Selective Extractions used in Exploration Geochemistry. Co-Chairmen: G.Hall (Canada), J.Plant (U.K.), E.Cardoso (Portugal)

2. Geochemistry of Precious Metals in Laterite. Co-Chairmen: H.Zeegers (France), R.Smith (Australia), S.Oliveira (Brazil)

3. Design and Interpretation of Geochemical Surveys; Microcomputer Applications in Geochemistry. Co-Chairmen: S.Hoffman (Canada), G.Closs (U.S.A.)

4. Geochemical Exploration Techniques for Petroleum. Co-Chairmen: G.Demaison (U.S.A.), R.Bustin (Canada)

5. Carbonatite Exploration. Co-Chairmen: A.Mariano (U.S.A.), L.Scheibe

6. Exploration Geochemistry of Ironstones/Gossans including Isotope Applications. Co-Chairmen: G.Taylor (Australia), G.Carr (Australia)

7. Exploration Geochemistry of Uranium in Humid Tropical Areas. Co-Chairmen: A.Melfi (Brazil), J.Schmitt (Brazil).

Technical Sessions

The call for papers for the 13th IGES has been met by a resounding response, with 145 works submitted for the technical sessions. As perhaps expected, papers did not exactly fit the originally suggested themes for the symposium, and some themes have been eliminated while others have been added. All papers have been reviewed by committee. The Organizing Committee would like to thank all those who contributed their technical papers to Rio '89; the effort and time applied to generating and submitting these works is much appreciated.

1. Geochemical Exploration for Precious Metals and Stategic Metals (20 papers)

2. Laterite Exploration Geochemistry (11 papers)

3. Lithogeochemistry (12 papers)

4. Geochemistry of Carbonatites and Rare Earth Metals (6 papers)

5. Analytical Techniques and New Developments in Exploration Geochemistry (8 papers)

6. Computer and Statistical Applications in Exploration Geochemistry (6 papers)

7. Petroleum and Coal Exploration Geochemistry (6 papers)

8. Uranium Exploration Geochemistry (6 papers)

9. Geochemical Applications in Base Metal Exploration (4 papers)

10. International Regional Geochemical Mapping (5 papers)

11. Environmental Geochemistry (7 papers)

12. Unconventional Methods in Exploration Geochemistry and Other Papers (5 papers)

Paul Taufen, *AEG Regional Councillor, Brazil*

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.

Dr. I.G.L. (Glen) Sinclair of BP Resources Canada will be taking early retirement August 1, 1989. Dr. Sinclair can be engaged as a consultant in the fields of ore mineralogy, geochemistry and petrology. He can be reached at: Min Scan Consultants. Ltd., Suite 2550, P.O. Box 77, Toronto Dominion Centre, Toronto, Ontario, Canada M5K 1E7, Tel: (416) 867-8901

A Cry from the Heart

Aaar...gh! Not again, I'm at my desk reviewing yet another paper, for our Journal this time, and what do I read, "thresholds were derived by the conventional method (Hawkes and Webb, 1962) of mean plus 2 standard deviations".

I keep reading words like these and it frustrates me beyond measure, especially when the writer clearly has access to a computer. I actually wonder whether the authors have ever read and understood Hawkes and Webb (1962). They should read it again, it is all neatly laid out on pages 28 to 31, and how right Herb Hawkes and John Webb were almost 30 years ago.

Before proceeding further we should understand each other. In the simple situation of positive anomalies and one element at a time, threshold to me is the upper limit of background variation. This also implies that background is not a single value but a data range centred around some most likely value. If a survey is undertaken in an area where there are several background populations, e.g., related to different lithologies or surficial environments, there will be several thresholds. It may be possible to combine these separate thresholds into one or more values, but that has to be established and cannot be simply assumed.

Firstly, Hawkes and Webb state on page 28: *A fully dependable value for threshold can come only from an orientation survey in an area of known geology and mineralization, conducted and interpreted by a geologist experienced in geochemical interpretations. There is as yet no real substitute for a competent, visual estimate based on a comparison of the geochemical patterns given by a series of tentative threshold values, correlated with the known distribution of metal in the bedrock.*

Then they continue to describe a situation that we have all met on many occasions: *Unfortunately, for many exploration problems, areas suitable for orientation studies are either lacking or not fully suitable. Here the threshold levels chosen on basis of simple, qualitative analysis of the data may need further confirmation before interpretation is made. For problems of this kind, semi-quantitative and quantitative statistical approaches are attracting increasing attention...*

Secondly, they describe two statistical procedures after a brief caveat: *It should be stressed, however, that statistical methods should be used solely as a disciplinary guide and never as a replacement for qualitative appraisal.*

The first technique they describe is the mean plus two standard deviations procedure to identify the top approximately two percent of the data. They note right at the beginning of their description: *If the data are from a single population and distributed normally, the plot shows the familiar 'bell-shaped' symmetry...*and continue to note that a lognormal distribution will plot similarly if plotted on logarithmic paper. What to do if the data are not from a single distribution is left until later.

Then Hawkes and Webb continue: *For a single population of values that are distributed symmetrically (either normally or log-normally), the threshold for that material may be conventionally taken as the mean plus twice the standard deviation. This is equivalent to saying that only 1 in 40 background samples is likely to exceed the threshold content, whereas only 1 in 667 background samples is likely to extend the mean plus three times the standard deviation.*

Thus the authors have explicitly stated that this procedure should only be used for single normal or lognormal populations. What is not stated explicitly is that the objective is to identify some arbitrary top few percent of the data for further inspection. For the ideal normal distribution two and three standard deviation limits correspond to the upper 2.275 and 0.135 percent of the data respectively. If Hawkes and Webb are to be faulted for anything it is perhaps calling this value a threshold. It might have been that calling it an inspection level, or something similar, and admitting that no true threshold could be determined would have saved many years of misunderstanding.

The second technique is based on ordering (ranking) the data from lowest to highest as one would in preparing a cumulative frequency plot (see for example Appendix 3 of Writing Geochemical Reports). Then any gross erratically high values are set aside and the top 2, 5, or some other appropriate percentage of the data are selected for further inspection. The authors describe this approach as follows: *With small bodies of single-population background data, or where the statistical distribution is irregular, probably the best approximation is to take the median value as background and to estimate threshold as that value which is exceeded by no more that 2.5 percent of the total number of observations, excluding markedly high erratic values.*

This approach is far more general and can now, by the use of computers, be applied to data sets of any size likely to be met in a geochemical survey. Also, importantly, the resulting cumulative frequency plot is a starting point for the frequency decomposition and threshold selection procedures developed by A.J. Sinclair and C.R. Stanley at the University of British Columbia. These procedures, either graphical or digital, permit any discrete background and anomalous populations to be separated and their summary statistics estimated if they are well enough represented in the total data set. Threshold(s) can then be selected on the basis of the expected range(s) of the background population(s) and the misclassification of samples, i.e., number of true anomalies lost or red-herrings introduced, as a tentative threshold is moved up or down.

We should view all of this in a historical context. Herb Hawkes and John Webb wrote their book in 1959 and 1960. To my knowledge the only people using computers in exploration geochemistry at that time were Al Miesch and his colleagues at the USGS. Computers in those days were rare beasts, anomalies, and it took until the mid 1960's for others to gain access to them in the U.S.A., Canada and the U.K. I was lucky enough to be a student of John Webb's when in 1964 IBM gave Imperial College in London what was then a very powerful computer, a 32K IBM 7090/1401 machine that had started life in a nuclear research facility. In the period of my graduate studies we went from tally sheets, slide rules, log tables and mechanical calculators (those must bring back memories to some!) to digital computers.

Together with a careful inspection of the data on a geological map base, Hawkes and Webb's second procedure is the one we should be using today in the absence of carefully selected thresholds based on geochemical and geological grounds, e.g., orientation surveys. However, when they wrote their book they had to write, *"With small bodies of single-population background data..."* as it was incredibly difficult and tedious to manually sort large data sets into ranked order.

In fact everything numerical was tedious. The method to both construct histograms and compute summary statistics was to set up the histogram 'bins' on a sheet of paper and go through all the data putting a stroke in the appropriate bin and making the fifth stroke in a 'bin' a line through the previous four strokes to indicate a block of five.

Once the number of samples in each 'bin' was known the grouped data formula (see for example M.J. Moroney's *Facts from Figures*) could be used to compute a mean and an approximate standard deviation if the histogram had the familiar bell shape. It was the frustration of doing this by hand for 12 elements in a regional reconnaissance data set of 1012 samples from West Africa (and not always getting 1012!) that caused me to start using computers in 1964. For large regional data sets the histogram is very commonly bell-shaped when plotted on a logarithmic scale.

However, we have learnt over the years that this is an artifact caused by mixing data from many individual populations related to bedrock types, environmental phenomena and mineralization, and does not represent data drawn from a single underlying lognormal population or process. Thus this situation really fits the case of *"...where the statistical distribution is irregular..."*, for which Hawkes and Webb advocate their ranking procedure.

Today, in addition to the original Hawkes and Webb (1962) we have Rose, Hawkes and Webb (1979) and Levinson (1980). The new Rose, Hawkes and Webb dwells far less on 'mean plus 2 standard deviations' and more on the use of ranking and plotting procedures. This extended discussion from pages 35 to 42 is far more appropriate for today's world. The discussion of statistical procedures in Levinson's book is more extensive (Chapters 12 and 12a), and relatively little mention is made of 'mean plus 2 standard deviations'. More recently a whole book, edited by Howarth (1983), has been published concerning the application of statistics and data analysis to exploration geochemistry, and it is hard to find any reference to 'mean plus 2 standard deviations' at all.

To conclude, Hawkes and Webb's suggested procedures were devised for the pre-computer era of exploration geochemistry. Their 'mean plus 2 standard deviations' guide was quickly overtaken by the new technology and really has no place in today's world. It should be seen for what it was, an attempt to introduce rigour through numerical methods into a science before the tools (computers) were available to do the job properly. As such it was foresight on Hawkes and Webb's part to see the role that data analysis would have in exploration geochemistry.

There, catharsis, I've got this out of my system, it has been bugging me for many years. Now let's start using those computers and wonderful little microcomputers the right way! If anyone needs a computer program to sort data see Chapter 8 of a book entitled Numerical Recipes by Press et al., which includes Fortran and Basic routines for a wide range of tasks.

Robert G. Garrett
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A 0E8
Tel. (613) 995-4517

References Cited

Hawkes, H.E. and Webb, J.S.,(1962) *Geochemistry in mineral exploration.* First edition, Harper and Row, New York, 415p.

Hoffman, S.J.,(1986) *Writing geochemical reports.* AEG Spec. Vol. 12, 29p.

Howarth, R.J. (ed.) (1983) *Statistics and data analysis in geochemical prospecting.* Vol. 2 of the Handbook of Exploration Geochemistry. Elsevier, Amsterdam, 437p.

Levinson, A.A.,(1980) *Introduction to exploration geochemistry.* Second edition, Applied Publishing, Wilmette, 924p.

Moroney, M.J., (1953) *Facts from figures.* Second edition, Penguin Books, Harmondsworth, 472p.

Press, W.H., Flannery, B.P., Tenkolsky, S.A. and Vetterling, W.T.,(1986) *Numerical recipes—The art of scientific computing.* Cambridge University Press, Cambridge, 818p.

Rose, A.W., Hawkes, H.E. and Webb, J.S., (1979) *Geochemistry in mineral exploration.* Second edition, Academic Press, London, 657p.

Sinclair, A.J.,(1976) *Application of probability plots in mineral exploration.* AEG Spec. Vol. 4, 95p.

Stanley, C.R.,(1987) *PROBPLOT, an interactive computer program to fit mixtures of normal (or lognormal) distributions with maximum likelihood optimization procedures.* AEG Spec. Vol. 14, 1 diskette.

RECENT PAPERS

Exploration Geochemistry

This list comprises titles that have appeared in major publications since the compilation in Newsletter No. 65. Journals routinely covered and abbreviations used are as follows: Economic Geology (EG); Geochimica et Cosmochimica Acta (GCA); The USGS Journal of Research (USGS JR); Circular (USGS CIR); and Open File Report (USGS OFR); Geological Survey of Canada Papers (GCS Paper) and Open File Report (GCS 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, Chairman AEG Bibliography Committee. Please send new references to Dr. Closs, *not* to EXPLORE.

Anon. 1988. *Recognition of Uranium Provinces: Proceedings of a Technical Committee Meeting on Recognition of Uranium Provinces.* IAEA. 459 p.

Barrows, J.A.N., Siegel, F.R. and Barrows, E.M. 1986. *Plant-soil chemistry in exploration for gold-quartz ores in the Appalachian Piedmont, Great Falls, Maryland (abst.)*: Presented at the NE Geol. Soc. Amer. meeting, New York.

Bradford, W.L. and Horowitz, A.J. (Eds.) 1988. *The role of sediments in the chemistry of aquatic systems.* USGS Cir. 0960. 75 p.

Bohlke, J.K. 1988. *Carbonate-sulfide equilibria and "strata-bound" disseminated epigenetic gold mineralization: a proposal based on examples from Allegheny, California, USA.* Applied Geochem. 3(5): 499- 516.

Carmichael, I.S.E. and Eugster, H.P. (Eds.) *Thermodynamic Modeling of Geological Materials: Minerals, Fluids and Melts.* Min. Soc. Am., Rev. Min. v. 17, 499 p.

Coates, J.M. and Siegel, F.R. 1985. *A stream sediment survey using bottom and suspended sediments in the Pb-Zn sulphide area of the Shenandoah Valley, Virginia* (abst.): GSA Mtg. Abstracts Book.

Colin, F. and Lecomte, P. 1988. *Etude mineralogique et chimique du profil d'alteration du prospect qurifere de Mebaga-Mvomo (Gabon).* Chronique de la Recherche Miniere 56(491): 55-66.

Connor, J.J. and McNeal, J.M. 1988. *Geochemistry of mineralized quartzite beds in the Spokane Formation (Belt Supergroup), Rogers Pass area. Lewis and Clark County, Montana.* USGS Bull. 1762. 17 p.

David, M. 1988. *Handbook of Applied Advanced Geostatistical Ore Reserve Estimation.* Elsevier. 232 p.

Elder, J.F. 1988. *Metal biogeochemistry in surface-water systems: a review of principles and concepts.* USGS Cir. 1013. 43 p.

Evans, A.M. 1987. *An Introduction to Ore Geology.* 2nd Ed. Blackwell. 358 p.

Fletcher, W.K. 1989. *Exploration Geochemistry (Annual Review).* Geotimes 34(2): 11

Giggenbach, W.F., Minissale, A.A. and Scandiffio, G. 1988. *Isotopic and chemical assessment of geothermal potential of the Colli Albani area, Latium region, Italy.* Applied Geochem. 3(5): 475-486.

Groves, D.I. and Phillips, N. 1987. *The genesis and tectonic control on Archean gold deposits of the Western Australian shield - a metamorphic replacement model.* Ore Geology Reviews 2(4): 287-322.

Guha, J. 1988. *Gold mineralization patterns in relation to the lithologic and tectonic evolution of the Chibougamau mining district, Quebec, Canada.* Min. Deposita 23(4): 293- 298.

Hicock, S.R. and Kristjansson, F.J. 1989. *Gold exploration using tills of the Beardmore-Geraldton area, northern Ontario.* CIM Bull. 82(922): 50-54.

Hirsch, R.M., Alley, W.M. and Wilber, W.G. 1988. *Concepts for a National Water-Quality Assessment Program.* USGS Cir. 1021. 42 p.

Ho, S.E. and Groves, D.I. (Eds.) *Recent Advances in Understanding Precambrian Gold Deposits.* Univ. Western Aust. 368 p.

Holland, P.T., Beaty, D.W. and Snow, G.G. 1988. *Comparative elemental and oxygen isotope geochemistry of jasperoid in the Northern Great Basin: Evidence for distinctive fluid evolution in gold-producing hydrothermal systems.* EG 83(7): 1401-1423.

Hood, P.J. 1989. *Mineral exploration trends and developments.* Can. Min. J. 110(1): 11-34.

Kirouac, F. 1988. *Repertoire des publications et des donnees geochimiques du Gouvernement du Quebec.* DV 88-02. 95 p.

Konstantinov, M.M. 1988. *Stratiform gold mineralization.* Intern. Geol. Rev. 30(6): 684- 690.

Korobeynikov, A.F. et al. 1988. *Background gold levels in rocks and iron ores at the Taiga Deposit, Central Aldan.* Geochem. Intern. 25(11): 45-51.

Kovalevskii, A.L. 1988. *On the relationship between the biogeochemical aureoles and the ore bodies and their primary haloes.* Geologiia Rudnykh Mestorozhdenii (Geology of Ore Deposits) 30(3): 75- 83.

Kozlov, V.D. et al. 1988. *Geochemical evaluation of granitoid mineralization in the Iul'ta Orefield, Central Chukotka.* Geochem. Intern. 25(11): 35-45.

Kucha, H. 1988. *Biogenic and non-biogenic concentration of sulphur and metals in the carbonate-hosted Ballinalack Zn-Pb deposit, Ireland.* Min. and Petrol. 38(3): 171-

Leonard, J.E. 1989. *Database-Part Ib: PC Applications with well-file data.* Geobyte 4(1): 31-38.

MacLean, W.H. 1988. *Rare earth element mobility at constant inter-REE ratios in the alteration zone at the Phelps Dodge massive sulfide deposit, Matagami, Quebec.* Min. Deposita 23(4): 231- 238.

Marsal, D. 1987. *Statistics for Geoscientists.* Pergamon. 186 p.

Nechayev, Ye. A. and Nikolenko, N.V. 1988. *An adsorption mechanism for supergene gold accumulation.* Geochem. Intern. 25(11): 52 - 56.

Nesbitt, H.W. and Young, G.M. 1989. *Formation and diagenesis of weathering profiles.* J. Geol. 97(2): 128-147.

Ollier, C.D. et al. 1988. *Aspects of landscape history and regolith in the Kalgoorlie region, Western Australia.* BMR J. (Aust.) 10(4): 309-322.

Panov, Ye. N. et al. 1988. *Geochemistry of present-day granitoid weathering in a cold climate.* Geochem. Intern. 25(11): 57-64.

Parassis, A., Siegel, F.R. and Pierce, J.W. 1986. *Marine exploration geochemistry with inshore sediments around Giglio Island, Mediterranean Sea* (extended abs.): Presented at the Southern European Geochemical Exploration Symposium, Athens, in abstracts booklet.

Parnell, J. 1988. *Metal enrichments in solid bitumens: A review.* Min. Deposita. 23(3): 199-199.

Polya, D.A. 1988. *Compositional variation in wolframites from the Barroca Grande mine, Portugal: evidence for fault-controlled ore formation.* Min. Mag. 52 (4): 497- 503.

Reed, S.J.B. 1989. *Ion microprobe analyses - a review of geological applications.* Min. Mag. 53(1): 3-24.

Richardson, S.M. and McSween, H.Y., Jr. 1989. *Geochemistry: Pathways and Processes.* Prentice-Hall. 488 p.

Ridgway, J. and Dunkley, P.N. 1988. *Temporal variations in the trace element content of stream sediments: examples from Zimbabwe.* Applied Geochem. 3(6): 609-621.

Schindler, K.S. (Ed.) 1989. *USGS Research on Mineral Resources - 1989, Program and Abstracts (5th McKelvey Forum).* USGS Cir. 1035. 98 p.

Scott, K.M. 1988. *Phyllosilicate and rutile compositions as indicators of Sn specialization in some southeastern Australian granites.* Min. Deposita 23(3): 159- 165.

Selner, G.I. and Taylor, R.B. 1988. *GSMAP and other USGS microcomputer programs for earth science applications.* Geobyte 3(4): 36-43.

THE ASSOCIATION OF EXPLORATION GEOCHEMISTS
P.O. Box 523, Rexdale, Ontario, M9W 5L4 Canada

APPLICATION FOR AFFILIATE MEMBERSHIP

The Association of Exploration Geochemists (AEG) is a professional nonprofit organization promoting interest in the application of geochemistry to the mineral industry and related fields. The AEG encourages membership from individuals or organizations working with geochemical data for a variety of uses including mineral exploration, analytical technology, computer processing, environmental geochemistry, geobotany, biogeochemistry, and other applications.

Membership in the AEG offers many benefits. Advances in geochemical technology are presented regularly in symposia, short courses, distinguished lecturers' workshops, field trips, the *Journal of Geochemical Exploration* (1200 pages annually), this newsletter, and Special Volumes published or cosponsored by the AEG. Annual membership dues of $42.50 U.S. include the *Journal of Geochemical Exploration,* EXPLORE, bibliography updates, discounts on most Special Volumes, and discounts on registration fees for symposia or short courses.

PLEASE CHECK ☐ Renewal ☐ New Member ☐ New Address (i.e. different from address label)

Your Name and Address: Date _____

NAME _____

TITLE _____

AFFILIATION _____

ADDRESS _____

_____

Annual dues payable	US $ 42.50	_____
Student membership (requires the signature of a member of the academic staff to verify full-time student status)	$ 20.00	_____
Professor _____ Institution _____		
Corporate member	$100.00	_____
☐ Check here if you do **not** want your name and address released as part of the AEG mailing list.	**TOTAL A**	_____

Payment of annual dues automatically makes you an affiliate member.
If you would like to become an active (voting) member of the A.E.G., please mark this box to receive the *appropriate forms.* ☐.

Personal checks, International Money Orders, UNESCO Coupons, International Postal Orders, VISA and MasterCard are acceptable. All payments are in **U.S. FUNDS**. For users of VISA or MasterCard, minor variations in your billing may reflect currency exchange-rate fluctuations at time of bank posting. Please note that checks not drawn on U.S. or Canadian banks require an additional $12.00 U.S. to reimburse the AEG for bank charges. Make checks payable to ***The Association of Exploration Geochemists***.

Charge: MasterCard ☐ VISA ☐

Credit Card Account Number Here:

Inter Bank # | | | | |

Expiration date _____

Signature _____

Severson, R.C. and Shacklette, H.T. 1988. *Essential elements and soil amendments for plants: sources and use for agriculture.* USGS Cir. 1017. 48 p.
Siegel, F.R. 1988. *Marine Exploration Geochemistry* in The Encyclopedia of Field and General Geology. Van Nostrand Reinhold. 553-563.
Siegel, F.R. 1988. *Geochemically defined excesses and deficiencies of trace elements in rocks, soils, vegetation and waters - an asset to nutritional epidemiologists* (abst.). AGM American College of Nutritionists. Jour. Amer. College Nutrition 7: 412.
Siegel, F.R., Decheng, H., Zaiming, W. and Vaz, J.E. 1988. *Buried TLDs in Oil Exploration, Shengping Oil Field, China* (abst.). AGM Amer. Assoc. Petroleum Geologists. AAPG Bull. 72: 247.
Siegel, F.R. 1987. *Plants in Metal Prospecting.* Earth Science Jour. 40: 18-19.
Siegel, F.R. 1985. *In-situ recovery of suspended sediments from streams.* Jour. Geol. Education 33: 132- 133.
Siegel, F.R. 1984. *Applied Geochemistry* in Encyclopedia of Applied Geology, Vol. XIII, Van Nostrand Reinhold: 207- 215.
Taner, M.F. and Trudel, P. 1989. *Bourlamaque batholith and its gold potential, Val d'Or, Quebec.* CIM Bull. 82(922): 33- 42.
Valeton, I. et al. 1987. *Genesis of nickel laterites and bauxites in Greece during the Jurassic and Cretaceous, and their relation to*

AEG SPECIAL PUBLICATIONS

Sp. Vol. No.	Description	Member Price	Non Member Price	
4	Application of Probability Plots in Mineral Exploration (A.J. Sinclair)	US $ 8.00	US $12.00	
7	Geochemical Exploration 1978 Proceedings of the Denver Geochemical Symposium (ed. J.R. Waterson and P.K. Theobold)	US $20.00	US $40.00	
10	Gold-81, Precious Metals in the Northern Cordilleran (ed. A.A. Levinson)	US $10.00	US $18.00	
11	Exploration Geochemistry Bibliography to January 1981 (complied by H.E. Hawkes)	US $10.00	US $20.00	
11.1	Exploration Geochemistry Bibliography Supplement 1 to Oct. 1984 (complied by H.E. Hawkes)	US $10.00	US $17.00	
11.2	Exploration Geochemistry Bibliography Supplement 2 to Oct. 1987 (complied by H.E. Hawkes)	US $10.00	US $17.00	
12	Writing Geochemical Reports (S.J. Hoffman)	US $ 5.00	US $ 7.00	
14	PROBPLOT, An Interactive Computer Program to Fit Mixtures of Normal (or Log normal) Distributions with Maximum Likelihood Optimization Procedures (C.R. Stanley) Graphic card type _____ ; (e.g., CGA, EGA, Hercules) 8087 chip (Y/N) _____	US $30.00	US $55.00	
4 + 14	Combination offer	US $35.00	US $60.00	
—	GEOEXP/86, Proceedings of an exploration symposium focussing on Cordilleran environments held in Vancouver May 12-14, 1986 (ed. I.L. Elliott and B.W. Smee)	US $37.00	US $37.00	
—	Reviews in Economic Geology Volume 3. Exploration Geochemistry; Design and Interpretation of Soil Surveys (ed. W.K. Fletcher) This volume was cosponsored by the SEG.	*TO U.S.A.* US $20.00 *OR FOREIGN* US $23.00	*TO U.S.A.* US $25.00 *OR FOREIGN* US $28.00	
—	1988 Membership Listing and Directory of Geochemical Services	US $10.00	US $20.00	
—	Journal of Geochemical Exploration for 1988	US $50.00	N/A	
	for 1987	US $50.00	N/A	
	for 1986	US $50.00	N/A	
	for 1985	US $50.00	N/A	
NEW ITEM	AEG T-Shirt Size: ☐ S ☐ M ☐ L ☐ XLG Colour: ☐ Royal Blue - white print ☐ Gray - bright green print ☐ White - rich blue print	US $10.00	US $11.00	
	If you need a receipt, include 2 self addressed envelopes and US $2.00; otherwise your cancelled check or bank card statement will be your receipt	US $ 2.00	US $ 2.00	
	Is your check drawn on a bank outside U.S.A. or Canada? If yes, add US $12.00.	US $12.00	US $12.00	
			TOTAL B	
			+ TOTAL A (from previous page)	
			TOTAL PAYMENT ENCLOSED US$	

Please check that your address is completed on the other side of this form.

ultrabasic parent rocks. Ore Geology Reviews 2(4): 359-
Walsh, J.F. et al. 1988. *Fluid inclusion geochemistry of high-grade, vein-hosted gold ore at the Pamour Mine, Porcupine Camp, Ontario*. EG 83(7): 1347- 1367.
Watson, D.F. and Philip, G.M. 1989. *Measures of variability for geological data*. Math. Geol. 21(2): 233-254.
Wilson, M.A. 1987. *NMR Techniques and Applications in Geochemistry and Soil Chemistry*. Pergamon. 353 p.
Wilson, M.R. and Kyser, T.K. 1988. *Geochemistry of porphyry-hosted Au-Ag deposits in the Little Rocky Mountains, Montana*. EG 87(7): 1329-1346.

Recent Papers on Analytical Geochemistry

This column highlights analytical papers of geochemical interest published in major international journals. These include: Analytical Chemistry (Anal. Chem.), Analyst, Journal of Analytical Atomic Spectrometry (J. Anal. At. Spectrom.), Analytica Chimica Acta (Anal. Chim. Acta), Talanta, Applied Spectroscopy (Appl. Spectrosc.), Spectrochimica Acta Part B (Spectrochim. Acta), Atomic Spectroscopy (At. Spectrosc.) and Analytical Proceedings (Anal. Proc.).

Pertinent papers from Geostandards Newsletter, published in April and October yearly, are too numerous to cite. This journal is a "must" for the geochemist. Where the number of authors on one paper is greater than four, "et al." is used. This list covers those issues received by the author since those listed in EXPLORE 65.

Compiled by **Gwendy E.M. Hall**, Head of Analytical Methods Development, Geological Survey of Canada, 601 Booth Street, Ottawa, Canada K1A 0E8. Please send new references to Dr. Hall, *not* to EXPLORE.

Buckley, F. et al. 1988. *Minerals, refractories, chemicals and metals. This is a yearly review of analytical papers on these materials*. J. Anal. At. Spectrom., 3: 203R-253R.
Chung, Y.S. and Barnes, R.M. 1988. *Determination of gold, platinum, palladium and silver in geological samples by inductively coupled plasma atomic emission spectrometry after poly-(dithiocarbamate) resin pre-treatment*. J. Anal. At. Spectrom., 3: 1079-1082.
Hall, G.E.M. and Vaive, J.E. 1989. *Comparison of the determination of sulphur in geological materials by pyrohydrolysis and ion-chromatography with other production-oriented methods*. Geol. Surv. Can., Curr. Res., Pap. 89-1F: 17-21.
Hinds, M.W. and Jackson, K.W. 1988. *Lead atomisation from soil by slurry introduction electrothermal atomisation atomic absorption spectrometry, Part 2. Atomisation characteristics with various matrix modifiers*. J. Anal. At. Spectrom., 3: 997-1003.
Huang, J., Goltz, D. and Smith, F. 1988. *A microwave dissolution technique for the determination of arsenic in soils*. Talanta, 35: 907-908.
Kane, J.S. 1988. *Optimisation of flame parameters for simultaneous multi-element atomic absorption spectrometric determination of trace elements in rocks*. J. Anal. At. Spectrom., 3: 1039-1045.
Motooka, J.M. 1988. *An exploration geochemical technique for the determination of preconcentrated organometallic halides by ICP-AES*. Appl. Spectrosc., 42: 1293-1296.
Perämäki, P. and Lajunen, L.H. 1988. *Determination of antimony in geological samples using hydride generation and direct current plasma atomic emission spectrometry*. Analyst, 113: 1567-1570.
Takekawa, F. and Kuroda, R. 1988. *Determination of gallium in geological materials by graphite-furnace atomic-absorption spectrometry*. Talanta, 35: 737-739.
Wouters, L.C., Van Grieken, R.E., Linton, R.W. and Bauer, C.F. 1988. *Discrimination between coprecipitated and absorbed lead on individual calcite particles using laser microprobe mass analysis*. Anal. Chem., 60: 2218-2220.

CALENDAR OF EVENTS

International, National and Regional Meetings of Interest to Colleagues Working in Exploration and Other Areas of Applied Geochemistry

■June 26-30, '89 **Gold geology & exploration,** intl. mtg., Shenyang, China (Zhu Fengsan, Chinese Soc. of Metals, 46 Dongsixi Dajie, Beijing, People's Republic of China. Tel: Beijing 553768)
■July 9-19, '89 28th Intl. Geological Congress, Washington, D.C. (Bruce B. Hanshaw, Box 1001, Herndon, VA, 22070-1001. Tel: 703-648-6053)
■Aug. 7-11, '89 **Caribbean Geological Conference,** Christiansted, St. Croix, U.S. Virgin Islands (Fred Nagle, Dept. of Geological Sciences, Box 249176, Univ. of Miami, Coral Gables, Fla., 33124. Tel: 305-284-4253
■Aug. 14-17, '89 Symposium, Precambrian Granitoids **(Petrogenesis, geochemistry, and metallogeny**), University of Helsinki, Finland (Precambrian Granitoids Symposium, Department of Geology, University of Helsinki, P.O. Box 115, SF-00171 Helsinki, Finland. Tel: Int. + 358 0 1914426 [Prof. I. Haapala] or Int. + 358 0 1914432 [Mr. Y. Kahkonen])
■Aug. 14-19, '89 Symposium: **Precambrian Granitoids** (petrogenesis, geochemistry, and metallogeny (Organizing Committee, Dept. of Geology, Univ. of Helsinki, P.O. Box 115, SF-00171 Helsinki, Finland)
■Aug. 15-Oct. 12, '89 8th Postgraduate Training Course in **Geochemical Prospecting Methods** (Geological Survey Prague, GEOCHIM, Malostranske nam. 19, 118 21 Praha 1, Czechoslovakia. Tel: 533 642-8)
■Sept. 10-13, '89 New frontiers for **hazardous waste management**, mtg., Pittsburgh, by United Nations Environmental Programme, World Federation of Engineering Organizations, U.S. EPA, and American Academy of Environmental Engineers (Lynne Casper, NUS Corp., Box 6032, Gaithersburg, MD, 20877-0962,. Tel: 800-245-2730)
■Sept. 10-15, '89 **Crustal geochemical cycles**, symp. in remembrance of Robert M. Garrels, American Chemical Society National Meeting, Miami Beach, Florida (James R. Herring, U.S. Geological Survey, MS 939, Box 25046, Denver, Colorado 80225, Tel. (303) 236-5559)
■Sept. 17-22, '89 **World energy congress**, Montreal, (World Energy Congress, 2 Place Felix-Martin, Montreal, H2Z 1Z3. Tel: 514-878-3124)
■Sept. 23-26, '89 - Geoscientific **information systems** applied to exploration and research, symp. (Denver GeoTech '89, c/o C.B. & Associates, 133 S. Van Gordon, #200, Lakewood, Colorado 80228, Tel. (303) 980-1648)
■Oct. 1-4, '89 3rd Multidisciplinary Conference on **Sinkholes and the Engineering and Environmental Impacts of Karst**, St. Petersburg, Florida (Barry F. Beck, Florida Sinkhole Research Institute, University of Central Florida, Orlando, Florida 32816, Tel. (407) 658-6834)
■Oct. 1-6, '89 13th International **Geochemical Exploration,** Symposium (Dorival C. Bruni, Sociedade Brasiliero da Geoquimica, P.O. Box 2432CEP 20010, Rio de Janiero, BR RJ)
■Oct. 2-4, '89 Today's **technology for the mining and metallurigical industries**, Kyoto, Japan (Secretariat, MMIJ/IMM Joint Symposium, c/o International Communications, Inc., Kasho Bldg. 2F, 2-14-9, Nihombashi, Chou-ku, Tokyo 103, Japan, Tel. (03) 272-7981, Telex: 222-3585 ICS, FAX: (03) 273-2445)
■Oct. 2-6, '89 **Remote sensing for exploration geology,** mtg., Calgary, Alberta (Robert H. Rogers, Box 8618, Ann Arbor. Mich., 48107-8618. Tel: 313-994-1200
■Oct. 16-20, '89 **Mathematical methods in geology,** intl. mtg., Pribram, Czechoslovakia (Vaclay Nemec, GEOINDUSTRIA, Geologicka 2, 152 00, Praha 5 Barrandov, Czechoslovakia
■Oct. 17-19, '89 Symposium on **Environmental Geochemistry** in Northern Europe, Rovaniemi, Finland (Eelis Pulkkinen, Geological Survey of Finland, Geochemistry Department, P.O. Box 77, SF 96101 ROVANIEMI, Finland, Telex: 37295 GEOLO SF, FAX:

358-60-297289)

■Oct. 22-25, '89 **Gold 89** mtg., Reno, Nev., Soc. of Mining Engineers and Australasian Inst. of Min. and Metall. (Meetings Dept., SME, Box 625002, Littleton, Colo., 80162. Tel: 303-973-9550

■Nov. 6-9, '89 **Geological Society of America** ann. mtg., St. Louis, with associated societies (Vanessa George, GSA, Box 9140, Boulder, Colo., 80301. Tel: 303-447-2020)

■Dec. 17-22, '89 PACIFICHEM '89, **Organic geochemistry** of hydrocarbon basins, int. symp., Honolulu, Hawaii (Joseph A. Curiale, Unocal, Inc., Science & Technology Div., P.O. Box 76, Brea, California 92621, Tel. (714) 528-7201 X 2312)

■Apr. 1-5, '90 **Geology and ore deposits** of the Great Basin, Reno, Nev. (Geol. Soc. Nevada, Box 12021, Reno, 89510)

■May 6-12, '90 **Pacific rim**, 90 Congress, Gold Coast, Queensland, Australia, by Australasian Institute of Mining & Metallurgy (Aus-IMM-PACRIM 90, Box 731, Toowong, Queensland 4066, Australia. Tel: 617-371-7900)

■May 16-18, '90 **Geological Association of Canada/Mineralogical Association of Canada,** ann. mtg., Vancouver, B.C. (R.I. Thompson, 801-750 Jervis St., Vancouver, V6E 2A9. Tel: 604-681-5226)

■June 3-7, '90 **GEOANALYSIS 90**, analysis of geological materials, symp., Hidden Valley Resort, Ontario, Canada (Dr. Chris Riddle, Ontario Geological Survey, Room 1117, 77 Grenville St., Toronto, Ontario M7A 1W4, Canada, Tel. (416) 965-1337, FAX: (416) 963-3983)

■Aug. 12-18, '90 8th Symp. of Intl. Assoc. on the **Genesis of Ore Deposits,** Ottawa, Canada (L.M. Cumming, Secretary, 8th IAGOD Symposium, Geological Survey of Canada, 601 Booth St., Ottawa, Ontario, Canada KIA 0E8)

■Aug. 15-17, '90 **Arctic geology & petroleum potential,** mtg., Tromso, Norway (Norwegian Petroleum Society, Box 1897, Vika, 1024 Oslo 1)

■Aug. 26-29, '90 **14th International Geochemical Exploration** Symposium, Praha, Czechoslovakia (Geological Survey /UUG/, Symposium on geochemical prospecting, Malostranske nam. 19, 118 21 Praha 1, Czechoslovakia)

■March, '91 International Conference on Economic **Evaluation of Mineral Resources** (Intergeoekonomika 1991 CSSR, GEOFOND Bratislava branch Kosice, Eng. St. Richter, Ph.D./, Garbanova 1, 040 11 Kosice, Czechoslovakia. Tel: 437 649

■Apr.-26 May 1, '91 Assoc. of Exploration Geochemists, **XV IGES**, Reno, Nev. (Richard B. Jones, Nevada Bureau of Mines & Geology, Univ. of Nevada, Reno, 89557-0088. Tel: 702-784-6691)

*Note to AEG Colleagues: There will be more than 1000 spaces available for low-cost housing for the **28th International Geological Congress** in Washington, D.C., **July, 1989**, at University dormitories at The George Washington University and American University. Read the third (final) circular for the Congress carefully when you receive it and make your reservations for the low-cost housing as soon as you can because these spaces will undoubtedly be "exploration targets" for our association as well as other professional groups and colleagues*

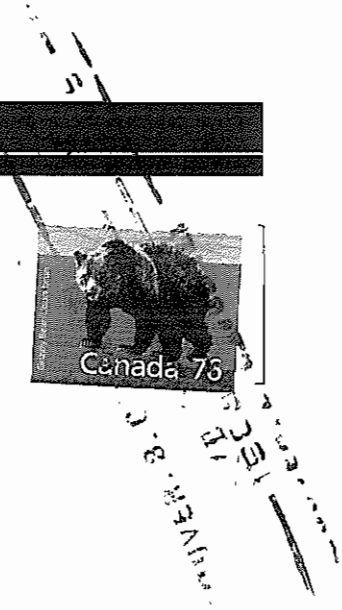
Please check this calendar before scheduling a meeting to avoid overlap problems. Let this column know of your events.

Fred Siegel
The George Washington University
Department of Geology
Washington, D.C. 20052

EXPLORE

The Association of Exploration Geochemists Newsletter
P.O. BOX 9777 UNIVERSITY STATION, RENO, NEVADA 89507-9777, U.S.A.

Please send changes of address to the Association office at P.O. Box 523 (Metropolitan Toronto) Rexdale, Ontario, M9W 5L4, Canada. EXPLORE does not maintain its own mailing list.



W.B. COKER
GEOLOGICAL SURVEY OF CANADA
601 BOOTH STREET
OTTAWA
ONTARIO, K1A 0E8
CANADA

PAID-89