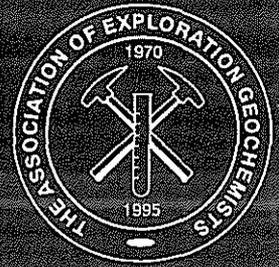


EXPLORE

Newsletter for
the Association
of Exploration
Geochemists



NUMBER 90

JANUARY 1996

PRESIDENT'S MESSAGE

As I start the 1996 term as President of the Association of Exploration Geochemists, I must first congratulate, and on behalf of all of the membership thank, Gwendy for the time and effort she has devoted to the AEG as President. It was a very busy year for her, as the AEG celebrated its 25th Anniversary at many events, including the outstanding 17th IGES in Townsville, Australia. The transfer of the business office to Ottawa, started during Graham Taylor's presidential term, was finalized by Gwendy, and Graeme Bonham-Carter, who were largely responsible for getting the office physically in place and running smoothly and efficiently under Betty Arseneault as Business Manager. In addition, Gwendy was heavily involved, working with Eion Cameron, over the last couple of years in finalizing a new five year contract with Elsevier for the Journal of Geochemical Exploration, including a larger sized format and new cover for the Journal. Gwendy had a very productive year and more than accomplished her goals as set out in the Presidential Message of January 1995. She raised the global profile of the AEG and through this effort the paid-up membership of the AEG almost doubled from 650 in April, 1995 to 1160 in December, 1995, of which 218 were new members. Gwendy has left the AEG in extremely good shape and I feel privileged to be taking over as President, although perhaps also feeling that Gwendy will be an extremely hard act to follow.



Bill Coker

This is a time of major change in my professional life. In addition to taking on the Presidency of the AEG, in February, I am leaving my position as Head of the Applied Geochemistry and Geophysics Subdivision, Geological Survey of Canada (GSC) to join BHP Minerals in Toronto. I am again returning to industry and enthusiastically look forward to the challenge of dealing with both exploration and environmentally-oriented geochemical issues with BHP Minerals.

My background — working for the GSC, mineral exploration companies, briefly as a consulting geochemist, as well as in holding an Adjunct Professorship at Queen's University — has made me aware of the state of geochemistry in the world today. I am particularly concerned with the fact that, certainly within North America, the education of geochemists, whether exploration or applied, *but with a strong geoscientific background*, is now almost non-existent. I believe this is an issue that the AEG must address. Whether this be through the AEG itself, through its members, designing, organizing and running workshops or by AEG members forming alliances with universities, other professional

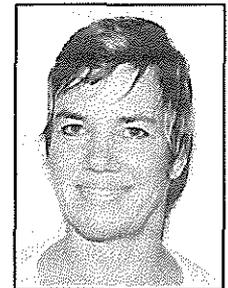
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PAST-PRESIDENT'S MESSAGE

I am writing this message from sunny Florida where I am attending the 1996 Winter Conference on Plasma Spectrochemistry with about 500 scientists from some 25 countries. This major analytical meeting brings together those studying the more fundamental aspects of the leading analytical techniques, particularly ICP emission and mass spectrometry (ICP-ES, -MS), with those using these tools in such fields as geochemistry, medicine, food, ceramics, steel, semi-conductors, petroleum chemicals and the environment. Instrument manufacturers, also in attendance here, have the opportunity to listen to the 'wish-list' of this broad spectrum of users and relay this information to their research and design laboratories. It is interesting to follow the change in themes at this biennial get-together. This year, ICP-MS clearly dominates even though we have seen exciting new developments in ICP-ES instrumentation (e.g. axial viewing and new detectors, CCDs) which have led to improved detection limits and performance. The high profile of ICP-MS in part results from the vast increase in sales during the past several years as other companies (e.g. Varian, HP, Finnigan) have introduced their own instrumentation onto the market, formerly 'owned' by SCIEX-PE of Canada and VG-Fisons of the U.K.

Early applications of ICP-MS in the mid '80s focused in the area of geochemistry. SCIEX cooperated with the Geological Survey of Canada and the Ontario Geological Survey while Alan Date of the British Geological Survey worked on the first VG prototype and demonstrated the power of the technique in detecting low abundance elements such as the

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Gwendy Hall

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Information for Contributors to EXPLORE

Scope This Newsletter endeavors to become a forum for recent 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 or developed deposits.

Format Manuscripts should be double-spaced and include camera-ready illustrations where possible. Meeting reports may have photographs, for example. Text is preferred on paper and 5- or 3-inch IBM-compatible computer diskettes with ASCII (DOS) format that can go directly to typesetting. Please use 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 re-examination 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.

All contributions should be submitted to:

EXPLORE

c/o J.T. Nash, Box 25046, MS973, Denver Federal Center
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Information for Advertisers

EXPLORE is the newsletter of the Association of Exploration Geochemists (AEG). Distribution is quarterly to the membership consisting of 1200 geologists, geophysicists, and geochemists. Additionally, 100 copies are sent to geoscience libraries. Complimentary copies are often mailed to selected addresses from the rosters of other geoscience organizations, and additional copies are distributed at key geoscience symposia. Approximately 20% of each issue is sent overseas.

EXPLORE is the most widely read newsletter in the world pertaining to exploration geochemistry. Geochemical laboratories, drilling, survey and sample collection, specialty geochemical services, consultants, environmental, field supply, and computer and geoscience data services are just a few of the areas available for advertisers. International as well as North American vendors will find markets through EXPLORE.

The EXPLORE newsletter is produced on a volunteer basis by the AEG membership and is a non-profit newsletter. The advertising rates are the lowest feasible with a break-even objective. Color is charged on a cost plus 10% basis. A discount of 15% is given to advertisers for an annual commitment (four issues). All advertising must be camera-ready PMT or negative. Business card advertising is available for consultants only*. Color separation and typesetting services are available through our publisher, Network Graphics, Inc.

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EXPLORE

Newsletter No. 89

OCTOBER 1995

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NOTES FROM THE EDITORS

Sherman Marsh and Tom Nash

This issue of EXPLORE includes a Technical Note that we hope will be the first in a series on the status and styles of exploration geochemical activities in specific parts of the world. The report on Ecuador by Bill Bagby and Miguel Mora gives an effective introduction to activities in Ecuador and conditions that influence work by geochemists; this report is required reading for anyone starting work in Ecuador and who is unfamiliar with the country. Anyone willing to share experience in other regions is encouraged to send a report or comments to the Editors. We are eager to publish those communications, short or long, general or specific.

Geochemists are increasingly called to work on environmental issues. We have access to the best libraries, yet have difficulty keeping abreast of new developments and burgeoning literature in unfamiliar journals. A recently released USGS Open-File Report on geoenvironmental models of ore deposits, described briefly on page 19, provides a useful summary of geochemical, geologic, and other parameters that influence environmental behavior. It demonstrates that a lot is not known, or is not published, about environmental geochemistry in ore systems. EXPLORE can be a forum for disseminating information to members about new geochemical methods and experiences in this rapidly expanding science; the Editors will be happy to assist in getting communications to our readers.



Sherm and Tom

Thanks to Bondar-Clegg and Company

EXPLORE would like to express thanks to Bondar-Clegg for their action on a recent issue. It seems that the EXPLORE staff accidentally ran an incorrect advertisement for Bondar-Clegg in a few issues last year. Normal procedure is that the publication does not charge for the incorrect advertisements. Bondar-Clegg, however, suggested that our mistake be forgiven and they happily paid the standard advertising fee, saying "we view our advertising in EXPLORE as not only a business transaction, but also as support for EXPLORE and the AEG". We greatly appreciate this attitude and support. Thanks again.

Owen Lavin
Business Manager



Past-President's Message

continued from page 1

PGEs and REEs. Not surprisingly, these early instruments were installed in research-oriented geochemistry labs in government and university. However, in Canada, two brave commercial geochemistry labs — Acme of Vancouver and XRAL of Toronto, recognizing the potential of this technique, jumped in with both feet and purchased these early models. The experience of these two labs was probably responsible for the delayed adoption of ICP-MS by commercial geoanalytical labs! Interferences were not well understood then and certainly the instrumentation was highly temperamental and prone to breakdown. Acme concentrated on low level PGE determination, using one instrument as a bank of spare parts for the other. XRAL's Terry Eagles spent many a long night becoming exasperatingly familiar with every nut and bolt of his ICP-MS while developing methods for the REEs and the six PGEs.

The time has come for exploration geochemists to regain their original position in this field and recognise the wealth of information available for a small expenditure. The instrumentation is now robust, fully automated and competitively priced. We can now concentrate on automating and improving the bottle-neck area in analysing geological samples — dissolution. Rather than replacing ICP-ES in determining trace and ultra-trace elements, I see ICP-MS providing us with new exploration methods. This sensitive technique is mandatory in analysing phase-selective leaches and surface waters collected in exploration-oriented hydrogeochemical surveys. The profit margin in geoanalysis is notoriously small, far lower by comparison to other industries (e.g. clinical, environmental). The mining community must accept that good quality trace element data do cost, but the dividends are there, in more efficient methods of locating mineralization. I look forward to the 1998 conference where I hope to be joined by colleagues from commercial ICP-MS geoanalytical firms!

1995 has flown by and I have enjoyed myself tremendously as President of the AEG during our 25th year. Many thanks to all members of Council and the Executive, especially to Sherm Marsh for all his help and constant optimism. Eion Cameron has done a sterling job as Treasurer, building our reserves back to a healthy level. Eion will continue to direct our investments but he will hand over the other duties of Treasurer to me in a combined position of overseeing the management of the business office. Very best wishes to Bill Coker in assuming two new roles — as President of the AEG and geochemist with BHP Minerals.

Gwendy Hall



President's Message

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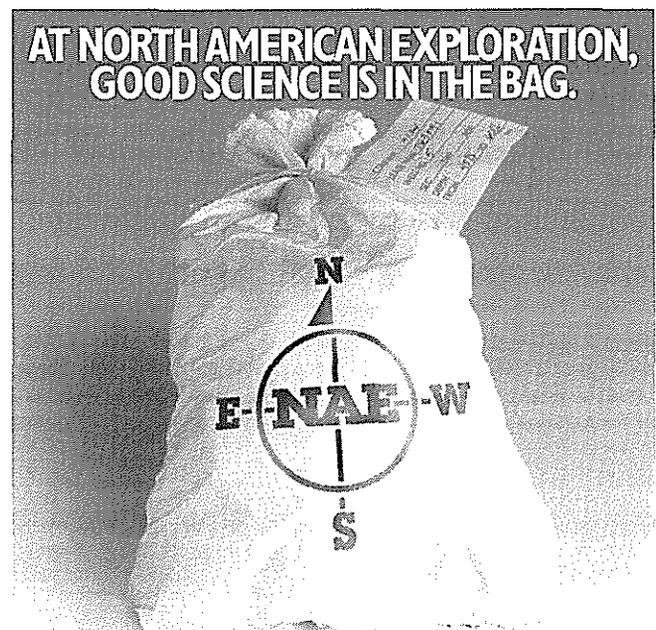
organizations or societies to conduct workshops or participate in teaching exploration/applied geochemistry courses within the context of geoscience. In some parts of the world, exploration geochemistry is being utilized very effectively as part of the overall integrated exploration strategy, in other parts of the world this is most certainly not the case. Education is the key to resolving this problem.

I agree with Gwendy (President's Message, EXPLORE No. 89) that geochemists must become more firmly entrenched in addressing environmental issues related to

metals in the environment. In particular, from our experience at the GSC: in Canada dealing with the Canadian Environmental Protection Act (CEPA), Priority Substances Lists (PSL), and the Toxic Substances Management Policy (TSMP); and, on the international front dealing with the Organization for Economic Co-operation and Development (OECD) and the United Nations Economic Commission for Europe (UNECE) on various issues related to metals in the environment, we have come to know that it is essential that we, the geochemists of the world, ensure that sound science, and in particular geoscience/geochemistry, is brought to bear in determining how environmental policies and regulations related to metals are formulated and written. Who better to supply the basic information on the distribution and behaviour of metals in the environment than geochemists. In this context, Peter Simpson of the British Geological Survey and I just attended a technical meeting of the Canada / European Union Metals and Minerals Working Group on Biodegradation/Persistence and Bioaccumulation/Biomagnification of Metals and Metal Compounds in Brussels. At this meeting, we made a presentation on "Interactions of trace metals in the surficial environment, with illustrations of geochemical cycling processes and influences on dispersion and fixation of metals." The AEG needs to examine the role that it should play in this arena.

While the AEG is not involved in running or sponsoring many meetings in 1996 we are gearing up for several major meetings in 1997. Please refer to the Calendar of Events for details.

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President's Message

Continued from Page 3

I look forward to serving as your President during 1996 and welcome your questions, comments and suggestions. Please feel free to contact me or any member of the executive or council at any time: we seek your input and participation in your AEG.

William B. Coker,
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TREASURER'S REPORT

I am pleased to report that the financial affairs of the Association are in good shape. The investment account, which was established in 1994, has increased from US\$142,000 in January, 1995 to US\$230,000 in January 1996. This increase is the result of (a) all payments to Elsevier for the JGE having been deferred into the year that follows publication of the volumes; (b) capital gains and income on our investments; and (c) US\$24,000 from the Townsville IGE Symposium. With growth and conservation, the investment account will become an important means of subsidizing the activities of the AEG. During 1995, the computer-based accounting system of the AEG office was upgraded to be more closely compatible with that of our auditors. This is expected to substantially reduce the annual audit costs. This is my final report as your Treasurer. I would like to thank Betty and Al Arseneault, who made my job easy.

Eion Cameron



NEWS OF MEMBERS

Paul Taufen has completed work on his Ph.D. in aqueous geochemistry at the Colorado School of Mines. He has rejoined Western Mining Corporation as Chief Geochemist for the company's Geoscience Technology group. Paul will be located in Denver.

LETTERS TO THE EDITORS

Dear Sirs;

I would like to add my support to Gwendy Hall and the views she expressed in the President's Message in EXPLORE v. 89 concerning the Association "embracing environmental geochemistry."

I have not been able to understand why there is any question about this at all. For me there is no schism between exploration and environmental geochemistry. As a geologist,

exploration geochemist or more appropriately as an applied geochemist, I have always thought of myself primarily as an observer of the natural world. Although the goals of the projects with which I was associated at the beginning of my career in the 1970s and 80s were primarily for mineral exploration, we always reviewed and interpreted the data we had for any environmental implications. I would have considered it irresponsible if we had not drawn the attention of management to any potential geochemical environmental hazards or problems. If the geochemist does not do it who will? It is important not only for the sake of our common environment but also for the mining or exploration company which may have to defend itself against the often unwarranted and uninformed criticism from 'environmentalists' that the mineral extraction industry attracts.

I can well understand that members of the Association who have spent their life using their science for locating mineral deposits might feel distanced from environmental concerns. No doubt they see an environmental geochemist as an opponent. I would ask them to drop their defensive stance and look for the areas of correspondence. We share the same problems and technical solutions. We should not, therefore, be artificially separated because our objectives differ. Otherwise we shall end up with two different vocabularies (if it has not happened already) and will be unable to communicate with one another. (...and I for one will have to join two professional organisations when one should be enough).

I can not understand why we should want to restrict the range of our activities. Is it just the name of our association? I unfortunately was not amongst the founding members of the Association. If I had been, I would have recommended that it be called the Association of Applied Geochemists. My own work is more and more in the environmental field.

If we, as 'applied geochemists' do not 'embrace environmental geochemistry' much of our field of activity will be high-jacked by the environmental agencies: for example, the geochemical mapping techniques which as so useful for determining the fluxes of the elements and setting realistic background element levels for the natural environment. This could lead to much duplication of effort, the redevelopment of techniques and competition for precious and dwindling research resources.

My opinion is that the Association neglects the environmental aspects of our profession at its peril. I would move that the Association not embraces environmental geochemistry but claims it as its' own.

Yours Sincerely,

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TECHNICAL NOTE

Gold Exploration in Ecuador

William C. Bagby, Ph.D. and Miguel Mora, Ph.D.

The country

Ecuador has become the focus of gold exploration during the last four years due to several independent factors. These are a change in the mining law in 1991 that made foreign investment in mining more attractive than previously, new knowledge of the geology of the country, and discoveries of gold deposits.

The country has a relatively well-developed highway system along the coastal plains and throughout a major portion of the cordillera. Much of eastern Ecuador is somewhat less accessible. The major port cities on the Pacific coast are Guayaquil and Machala in the south and Esmeraldas and Manta in the north.

Ecuador is a democracy. The current presidential administration is about to end with elections forthcoming in May, 1996. There are approximately 17 political parties, with two or three holding most of the political power. In October, 1995, the vice-president of the country, Dahik, resigned under political pressure and allegations of corruption. He was the principal architect of economic changes under President Sixto Duran. These changes included privatization of many government agencies. His replacement has pledged to spend more time on social issues. Although the ultimate economic impact of Dahik's resignation is undetermined, there is already a slow down in some of the economic changes that he instituted.

The primary resources produced in Ecuador are from the oil industry and agriculture. Oil from east of the cordillera is the major source of foreign exchange for the country. Agricultural products include bananas, cacao, flowers, and shrimp. The shrimp industry along the coast, particularly in the Guayaquil area, is a huge, billion dollar per year industry. It remains to be seen whether mining will add significantly to the economy of the country.

The mining law and mining information

The new mining law of Ecuador was recorded in May, 1991. Copies of the law are available in an English translation provided by the Camara de Minería del Ecuador. The law established rights to mineral resources in the country and the mechanisms whereby individuals and companies may obtain and keep exploration and exploitation concessions. New reforms to the law that will facilitate the procedures for obtaining concessions have recently been published. Notably, the law calls for environmental impact statements at different times during exploration or exploitation of a concession. A new environmental law for the mining sector is currently under review.

The Dirección Nacional de Minería, DINAMI, is the agency responsible for awarding, recording, and tracking concessions throughout the country. Concession information (locations and ownership) is available from DINAMI as computer printouts and on either province or quadrangle maps. This information is essential for exploration because the country is now literally covered with concessions. In a sense, this makes exploration in Ecuador a land-driven

rather than a geology-driven business enterprise. Five regional offices are expected to be part of a computerized network where information can be readily obtained.

The Camara de Minería is a professional organization comprised of individuals and companies involved in the mining sector in Ecuador. The purpose of the Camara de Minería is to promote mining investment throughout Ecuador. This is accomplished by providing information to prospective investors, working with the banks in Ecuador to ensure that lines of credit are flexible for mining investors, and working with the government to ensure that mining will have long-term consideration as a business sector in the country. The Camara is a helpful first stop for anyone beginning exploration activities in the country.

Geology of the country

Ecuador is situated along the spine of the Andean cordillera. The geology can be grouped according to geomorphic and geologic provinces: the Costa, the Sierra, and the Oriente.

The Costa is an accretionary prism along the Pacific margin west of the Sierra. The region consists of Upper Cretaceous to Cenozoic fore-arc sedimentary basins. The basement is Lower Cretaceous marine basalts and basaltic andesites.

The Sierra is a young, active mountain belt formed by at least two orogenic events: the first was Paleozoic and the second late Mesozoic to Cenozoic. The Western Cordillera contain remnants of a Cretaceous island arc with overlying

Continued on Page 6

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Technical Note

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Lower Tertiary volcanic and volcanoclastic rocks. There is a series of Tertiary intrusions along the western flank of this cordillera. Plio-Pleistocene active volcanoes reach altitudes above 5000 meters along the western and eastern flanks of both the Western Cordillera and Cordillera Real. The Cordillera Real in the eastern part of the Sierra is composed primarily of metamorphic rocks and composite calc-alkaline batholiths ranging in age from Triassic to Tertiary.

The Oriente is a flat-lying province consisting of a series of Cretaceous back-arc sedimentary basins. The region is almost completely covered by a dense rain forest. Due to this vegetative cover, geologic knowledge in the province comes primarily from drill and geophysical data. Young, almost un-deformed Tertiary rocks cap all the pre-existing Cretaceous structures. Jurassic to Tertiary volcanic rocks occur along the western margins of the Oriente.

Mining areas

The majority of important identified metallic mineral deposits occur in the Costa and Sierra regions. There are several mining districts that are presently active, both in terms of production and exploration. Most gold production is from placer operations or cooperatives of local miners who are performing limited underground mining. In some of these localities, the exploration methods and living conditions resemble those of the American far west in the nineteenth century. There are presently no large, bulk-tonnage

mines operating as coherent business entities.

One of the most popular mining districts is the Nambija area in southeastern Ecuador. The continuous production of gold from Nambija since its discovery in 1982 by cooperatives has been the single driving force for exploration in this region. (There is an estimated one million ounces recovered during the last decade.) Exploration in this region includes TVX drilling at Pachicutza, northeast of Nambija and drilling by South African Goldfields at Sultana, Zamora-Granges at Mina Real, and Latin American Gold at Guysimi, all a few kilometers south of Nambija. There are also very large blocks of exploration concessions north of Nambija that are actively being explored.

A second very active district is the Ponce Enriquez district east of the Pan-American Highway between Machala and Guayaquil. This district includes the Gaby porphyry deposit and the Bella Rica and Pijili high grade veins. To the northeast, the district can be extended to include the Chaucha porphyry deposit.

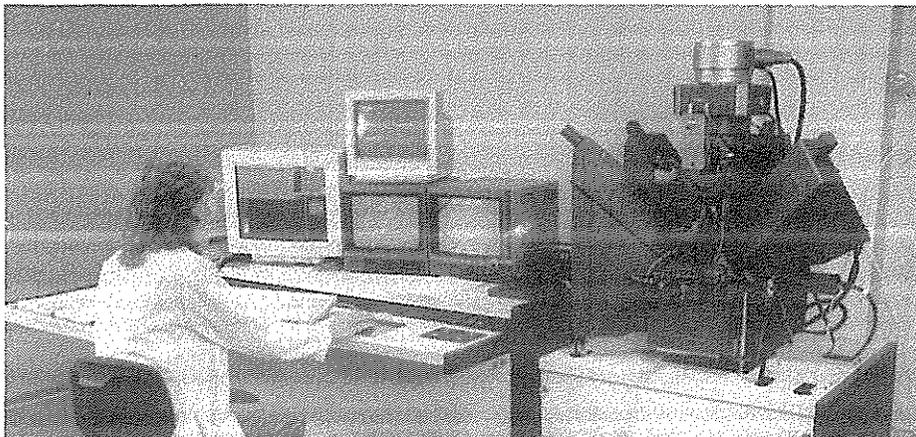
The Portovelo-Zaruma area in southern Ecuador continues to be of interest to exploration geologists. Rio Amarillo has put together an impressive land position in this old district and is currently performing detailed exploration on its concession block. This district is interesting historically as Atahualpa's mother is reported to have come from Paccha, a village in the northern part of the district.

Metallic deposits are scattered along the Western Cordillera to Colombia. Many of the occurrences in this belt that are associated with shallow intrusions and that contain

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Technical Note

Continued from Page 6

copper and gold are referred to as porphyry gold deposits. We believe, however, that too little is known about the detailed geology of these occurrences to warrant this classification. RTZ is performing detailed exploration, including drilling, on one such occurrence in the Rio Verde area, north of the Rio Guayllabamba. This part of the orogen is structurally complex and successful exploration programs there will necessarily involve detailed structural investigations. The Cordillera Real also contains deposits along its axis and toward its eastern flanks, some of which are the targets of new exploration activities.

Geologic information

Geologic information is vital to the success of any exploration program. Ecuador is blessed with extensive geologic maps and publications that provide the results of work done by the Ecuadorians and by joint projects by Ecuador in cooperation with other countries. One of the most recent projects of this type was a study by the British Geological Survey and Ecuador on the Cordillera Real. As part of this study, the project produced a new geologic map of the country, together with a tectonic-metallogenic map at a scale of 1:1,000,000.

Excellent topographic maps and aerial photographs are available from the Instituto Geografico Militar (IGM) for most parts of the country. The exceptions are in border areas where the maps are considered sensitive. However, maps and photos of these areas may be obtained under special permission issued by the military. Although these border regions have favorable geology for mineral exploration, their sensitive nature puts a damper on exploration.

A good source of geologic information is CODIGEM, the Corporacion de Desarrollo y Investigacion Geologico - Minero. This agency is undergoing changes which may result in a name change and its *modus operandi*. The British Geological survey is presently working with CODIGEM on a World Bank project in the Western Cordillera. A visit to their offices in Quito is well worth the time.

Methods of exploration

The primary method of exploration for gold is gold-panning in rivers accompanied by stream-sediment geochemistry. This method is applied early in the exploration of both large and small concessions. In fact, visible gold in the pan is commonly used to identify areas for concession application. Each company has its own method of stream-sediment sample collection. In general, composite samples are collected just below the confluence of two secondary streams and above the confluence in each stream. Approximately 5 kilograms of sample are taken. Some companies sieve to -80 mesh on site, whereas others simply remove larger pebbles and sieve the sample in the lab. Altered and sulfide-bearing rocks as either float in the streams or bedrock are also collected at the same time as the stream-sediment sample.

The stream-sediment and rock samples are submitted for multi-element geochemical analysis of 28 or 35 elements. Gold is usually performed on a 30 gram split; some companies use a 60 gram split. In some cases, a bleg analysis is used.

Follow-up exploration of anomalous stream-sediment samples usually consists of more extensive rock-float and bedrock sampling and more detailed investigation of the upstream areas in an attempt to find the source of gold. Bedrock sampling commonly consists of chip-channel sampling in areas of extensive exposure in creek beds; particularly when alteration or sulfides are present. Chip channel samples are collected over 1 to 5 meters, depending on the company and the type and alteration in the rocks. If intriguing areas are identified, then soil sampling is usually the next method of data collection.

Methods of soil-sample collection are variable, depending upon the depth and type of soil developed in an area. In some cases, soil augers are used, in others, a clam-shell post hole digger proves exceptionally effective. Soil samples are not usually submitted for 28 or 35 element multi-element analysis. Instead, these samples are usually submitted for precious- and base-metal analysis with the addition of Sb, As, Hg. In areas of deep saprolite, soil sample anomalies may be tested by digging pits into the saprolite and collecting panel samples of 1 m² or 2 m² in the walls of the pit. Saprolite is easily sampled since a machete can be used to scrape 1 to 2 cm off a measured panel and all material is collected and analyzed.

Identification of anomalous and background values in both stream-sediment and soil samples is arbitrary in most cases. Maps showing sample locations and values for Au, Cu, Pb, Zn, As, and Sb are usually made. Value ranges are

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Technical Note

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arbitrarily chosen and are identified by size of circle on the map. Thus, a small circle may indicate any value <100 ppb Au, then graduated circle sizes to indicate 100-199 ppb, 200-299 ppb, etc. The determination of these groupings of values is seldom based on an interpretation of background and anomalous populations. In some cases, breaks in slope are used to identify a threshold value, but even this analysis is exceptional. The other elements analyzed in multi-element packages are seldom interpreted.

In conclusion

Ecuador certainly has the right geology and large gold deposits are there to be discovered as evidenced by the Nambija and Ponce Enriquez districts. The government's positive attitude toward mining is reflected in continuing changes in the mining law to make investment more attractive. There still exist minor problems regarding information and concession rights and the larger issue of local miner invasions. However, these are being addressed by the government. In all likelihood, the next couple of years of exploration and joint-venture partnerships will result in new mine development.

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REPRINT OF "GEOCHEMISTRY IN MINERAL EXPLORATION"

"Geochemistry in Mineral Exploration (2nd Ed)" by Rose, Hawkes and Webb went out of print at Academic Press last year. However, the authors now own the copyright and it has been reprinted in a hard-cover edition. The book is being sold by AEG for \$60 to AEG members and \$80 for non-members, postpaid by surface mail. For further infor-

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mation on ordering from AEG, see the AEG publications page in this issue of EXPLORE.

Art Rose
Pennsylvania State University



CALENDAR OF EVENTS

International, national and regional meetings of interest to colleagues working in exploration, environmental and other areas of applied geochemistry.

■ Feb. 5-6, '96 **Latin American Mining**, Scottsdale, AZ (M. Oliver or J. Harrell, Latin American Mining Conference, Institute of the Americas, 10111 N. Torrey Pines Rd., La Jolla, CA 90237; TEL: (619) 453-5560 ext 101 or 104; FAX: (619) 453-2165; email: cmorton@weber.ucsd.edu).

■ Feb. 5-7, '96, **Investing in African Mining Conference/Indaba '96**, Cape Town, South Africa, (International Investment Conferences, Inc., 9100 S. Dadeland Blvd., Suite 702, Miami, FL 33156; TEL: (305) 670-1963; FAX: (305) 670-4518).

■ Mar. 10-13, '96, **Canada 96 PDAC**, Toronto, ON, Canada, (Prospectors and Developers Association of Canada, Congress Canada, 49 Bathurst St., Suite 100, Toronto, ON M5V 2P2, Canada; TEL: (416) 504-4500; FAX: (416) 504-4505).

■ Mar. 11-14, '96, **SME Annual Meeting and Exhibit**, Phoenix, AZ (Meetings Dept., SME, P.O. Box 625002, Littleton, CO 80162-5002; TEL: (303) 973-9550; FAX: (303) 979-3461)

■ Mar. 14-17, '96, **International Workshop and Exhibition on Geophysics**, Hanoi, Vietnam by Geophysical Society of Viet Nam (T. Muoi, Geophysical Society of Viet Nam, Thanh Xuan -Dong Da, Hanoi, Viet Nam; TEL: 84.4544311; FAX: 84.4.542223)

■ Mar. 27, '96, **Environmental and Legislative Uses of Regional Geochemical Baseline Data for Sustainable Development**, IGCP 360 Global Geochemical Baselines Workshop, Keyworth, Nottingham, UK (Peter Simpson, British Geological Survey, Keyworth, Nottingham, NG12 5GG; TEL: (0115) 9363532; FAX: (0115) 9363200; E-mail: k-prs@va.nkw.ac.uk)

■ Mar. 28-29, '96, **BGS Minerals Industry Forum**, Keyworth, Nottingham, UK (Peter Simpson, British Geological Survey, Keyworth, Nottingham, NG12 5GG; TEL: (0115) 9363532; FAX: (0115) 9363200; E-mail: k-prs@va.nkw.ac.uk)

■ Mar. 31-Apr. 1, '96, **V. M. Goldschmidt Conference**, Heidelberg, Germany (Goldschmidt Conference Secretary, Laboratorium Fur Geochronologic, Ruprechts_Karls-Universitat Heidelberg, Im Neuenheimer Feld 234, 69120 Heidelberg, Germany; FAX: 49-6131-371-051)

■ Apr. 15-19, '96, **Integrated Mining and Land Reclamation**, short course, Reno, NV (Yung Sam Kim, Nevada Institute of

Continued on Page 9

Calendar of Events

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Technology, Box 8894, Reno, NV 89507; TEL: (510)-757-2000; FAX: (510)-757-7997).

■ April 22-25, '96, **Investing in the Americas**, Miami, FL (International Investment Conferences Inc, 9100 S. Dadeland Blvd., Suite 702, Miami, FL 33156; TEL: (305) 670-1963; FAX: (305) 670-0971).

■ April 22, '96, **Societal Needs and the Environment: Earth Sciences and Public Health**, Forum, Washington, D.C. (Frederic R. Siegel, Department of Geology, George Washington University, Washington, D.C. 20052; FAX: 202-994-0450; E-mail: NDFRS@GWUVM.GWU.EDU)

■ April 28-May 2, '96, **International Mining Trade Show and 98th Annual Meeting of the Canadian Institute of Mining, Metallurgy, and Petroleum**, Edmonton Convention Centre, Edmonton, Alberta, Canada (Ian Muirhead, General Chairman, c/o University of Alberta, 606 CME Building, Edmonton, Alberta T6G 2G6, Canada; TEL: (403) 492-3810; FAX: (403) 492-3409; email: ianm@cominco.mineral.ualberta.ca)

■ May 19-21, '96, **Industrial Minerals**, ann. forum, Laramie, Wyoming (Ray E. Harris, Wyoming State Geological Survey, Box 3008, University Station, Laramie, 82071; TEL: (307)-766-2286; FAX: (307)-766-2605).

■ May 24-26, '96, **Geological Association of Canada/Mineralogical Association of Canada Short Courses, WINNIPEG '96**; 1) Trace element geochemistry of volcanic rocks; applications to massive sulphide exploration (GAC), 2) Geological modelling with GIS (GAC), 3) Geological remote sensing and radar application (GAC), and 4) Under-saturated alkaline rocks: mineralogy, petrogenesis and economic potential (MAC) (G.S. Clark, Dept. of Geological Sciences, University of Manitoba, Winnipeg, Manitoba, R3T 2N2; Tel: (204)-474-8857; FAX: (204)-261-7581).

■ May 27-29, '96, **Geological Association of Canada/Mineralogical Association of Canada, Joint Annual Meeting**, Winnipeg, Manitoba (G.S. Clark, Dept. of Geological Sciences, University of Manitoba, Winnipeg, R3T 2N2; TEL: (204)-474-8857; FAX: (204)-261-7581).

■ July 21-28, '96, **Fourth International Symposium on the Geochemistry of the Earth's Surface**, Ilkley, Yorkshire, England by International Association of Geochemistry and Cosmochemistry (Conference Secretariat, Dept. of Continuing Education, Leeds University, Leeds LS2 9JT, UK; TEL: 01132-333-241; FAX: 01132-333-240)

■ July 24-26, '96, **Mineral Exploration '96**, Brisbane, Australia (P. Newhall or Alan Butcher, CSM Associates Ltd., Trevenson, Pool, Redruth, Cornwall TR15 3SE, United Kingdom; TEL: (+44 1209) 717724/860141; FAX: (+44 (0)1209) 710893/861013; email: csma@csm.ex.ac.uk).

■ Aug. 4-14, '96, **30th International Geological Congress**,

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Beijing, China (Prof. Zhao Xun, Deputy Secretary General, 30th International Geological Congress, P.O. Box 823, Beijing 100037, P.R. China; TEL: 86-10-8327772; FAX: 86-10-8328928; E-mail: zhaox@bepc2.ihep.ac.cn)

■ Sept 22-25, 1996. 7th International Symposium - The Interactions between Sediments and Waters. Baveno (Stresa) Italy. For info: Dr. E.D. Ongly, NWRI, 867 Lakeshore Rd., PO Box 5050, Burlington, Ontario, Canada, L7R 4A6, tel: 416-336-6439; or fax the 7th Intl. Symp. in Italy at 39-2-33220299. Deadline for abstracts is Feb. 15, 1996.

■ Nov. 4-8, '96, International Symposium on the Industrial Application of the Mössbauer Effect, Johannesburg, South Africa (Prof. Herman Pollak, Mössbauer Laboratory, Private Bag 3, POWITS 2050, Johannesburg, South Africa; TEL: (27-11) 716-4053; FAX: (27-11) 339-6282; email: isiam@physnet.phys.wits.ac.za

■ May 25-29, '97, 18th International Geochemical Exploration Symposium, Jerusalem, Israel (Organizing Committee, International Geochemical Exploration Symposium, P.O. Box 50006, Tel Aviv 61500, Israel; TEL: (972 3) 5140014; FAX: (972 3) 5175674/660325; E-mail: iges@mail.gsi.gov.il)

■ Sept. 14-18, '97, Fourth Decennial International Conference and Exhibition on Mineral Exploration with a theme of Geophysics and Geochemistry at the Millenium, Toronto, Canada



■ Oct. 5-10, '97, 4th International Symposium on Environmental Geochemistry, Vail, Colorado (4th ISEG, c/o USGS/CEGG, Federal Center, Box 25046, MS 973, Denver, CO 80225; FAX: (303) 236-3200; E-mail: iseg@helios.cr.usgs.gov)

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NEW MEMBERS

To All Voting Members:
Pursuant to Article Two of the Association's By-Law No.1, names of the following candidates, who have been recommended for membership by the Admissions Committee, are submitted for your consideration. If you have any comments, favorable or unfavorable, on any candidate, you should send them in writing to the Secretary within 60 days of this notice. If no objections are received by that date, these candidates will be declared elected to membership. Please address comments to Sherman P. Marsh, Secretary AEG, U.S. Geological Survey, Mail Stop 973, Box 25046, Federal Center, Denver, Colorado 80225, U.S.A.

Editors note: Council has decided that all new applicants will receive the journal and newsletter upon application for membership. The process of application to the Nepean office, recommendation by the Admissions Committee, review by the Council, and publication of applicant's names in the newsletter remains unchanged.

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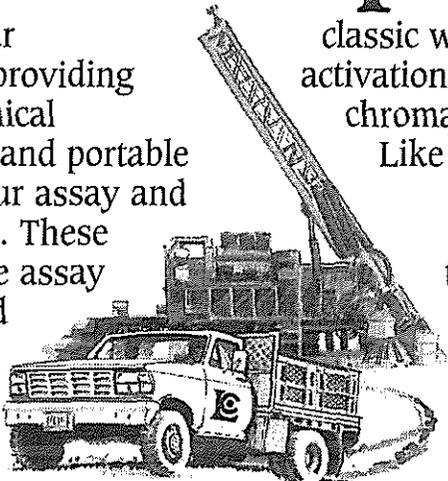
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Geologist

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Jakarta, INDONESIA

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Cobbitty, NSW, AUSTRALIA

Paulen, Roger C.

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Lloyd James

Admissions Committee
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RECENT PAPERS

The list comprises titles that have appeared in major publications since the compilation in **EXPLORE** Number 89. Journals routinely covered and abbreviations used are as follows: Economic Geology (EG); Geochimica et Cosmochimica Acta (GCA); the USGS Circular (USGS Cir); and Open File Report (USGS OFR); Geological survey of Canada Papers (GSC Paper) and Open File Report (GSC OFR); Bulletin of the Canadian Institute of Mining and Metallurgy (CIM Bull.); Transactions of Institute of Mining and Metallurgy, Section B: Applied Earth Sciences (Trans IMM). Publications less frequently cited are identified in full. Compiled by L. Graham Closs, Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO 80401-1887, Chairman AEG Bibliography Committee. Please send references to Dr. Closs, not to **EXPLORE**.

Afanas'yeva, Z.B., Ivanova, G.F., Miklishanskiy, A.Z., Romashova, T.V., and Kolesov, G.M., 1995. Geochemical characteristics of the tungsten mineralization at the Olimpiada gold-sulfide deposit, Yenisey Ridge. *Geochem. Intern.* **32**(8): 118-136.

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Recent Papers

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- Hsu, L.C. Bonham, H.F., Jr., Price, J.G., Garside, L.J., Desilets, M.O., and Lechler, P.J., 1995. Geochemical characteristics of the Paleozoic sedimentary rocks in the Winnemucca Quadrangle, Nevada, USA - Background values for gold exploration. *Explor. & Mining Geol.* **4**(3): 227-242.
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October 5 - 10, 1997 - Vail, Colorado

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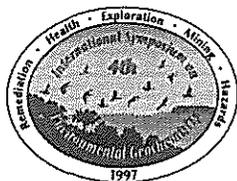
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Introduction

Since the 3rd Symposium in Krakaw, Poland, 1994, interests in environmental geochemistry have developed in areas that are driven by human and ecosystem health considerations. For example, in the Rocky Mountains of North America, abandoned mines on public lands and mine drainage that affects surface and ground water resources, as well as wildlife, are of great concern. Air quality is being affected by rapidly growing urban centers and the high reliance on the automobile for transportation. Radon gas that is emitted naturally from certain geologic terranes is being mapped and the effect it might have on human health is debated. Hazardous materials disposal (including radionuclides) remains a hotly debated issue and an understanding is needed of the processes and technologies that confine toxins. Experience has shown that interaction needs to be strengthened between scientists and regulators of environmental laws—especially at this time when revisions to laws are being made.

Aims

To provide a forum for the discussion of current investigations and new methodologies that focus on geochemical and biogeochemical processes that affect the health of humans and ecosystems through soil, sediment, water, plants, and the atmosphere.

Proposed Themes

1. Environmental analytical techniques
2. Mine-drainage formation and geochemistry
3. Use and determination of baselines and backgrounds
4. Natural and man-made radiogenic hazards
5. Methods of geochemical monitoring, modeling, and mapping
6. Geomedical research
7. Industry/government cooperation
8. Environmental models (mineral deposits, global change, pollution migration, waste disposal)
9. The "acid" problem (air deposition, natural and mine drainage, ecosystem buffering)
10. Trace substances, ecosystems, and bio-accumulations
11. Environmental geochemistry and health
12. The importance of geology in environmental geochemistry.

Scientific Program - October 6-10, 1997

The program will include invited and key-note speakers as well as oral and poster presentations.

Excursions

A 2-1-2 format will be followed (2 days of meetings—1 day of excursions—2 final days of meetings). Pre- or post-conference field trips and workshops are also planned.

See over

Preliminary Registration

To remain on our mailing list, please complete and return this preliminary registration form by January 1, 1996. Reply by mail: 4th ISEG, c/o USGS/CEGG, Federal Center, Box 25046, MS 973, Denver, CO 80225 USA; fax (303) 236-3200; or e-mail: iseg@helios.cr.usgs.gov.

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Accommodations

Full details and a booking form will be included in the next circular. The Westin Resort in Vail is a 5-star hotel with more than 300 rooms and first-class meeting facilities. They are offering a very attractive conference rate for this Symposium.

Publishing

Papers presented by invited and volunteer speakers and poster presenters will be published, following peer review, in special issues of Environmental Geochemistry and Health and (or) the Journal of Exploration Geochemistry.

Deadlines and Key Dates

- Return of First Circular Jan. 1, 1996
- Second Circular mailing/ call for papers June 1996
- Submission of abstracts March 1997
- Final registration and payment March 1997
- Confirm payment and hotel May 1997
- Final Circular and preliminary program July 1997
- Submission of manuscripts Oct. 6, 1997
- Symposium Oct. 6, 1997
- Publication of papers July 1998

Language

English

Registration Fees

This information will be included in the Second Circular.

Chairpersons of the Symposium

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- Mr. Sherman Marsh, USGS

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Continued from Page 14

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Deadlines for the Next Four Issues of EXPLORE

Contributors's deadlines for the next four issues of **EXPLORE** are as follows:

<u>Issue</u>	<u>Publication date</u>	<u>Contributor's Deadline</u>
91	April 1996	February 29, 1996
92	July 1996	May 31, 1996
93	October 1996	August 31, 1996
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- Schwartz, M.O., Akanyang, P., Trippler, K., and Ngwisanyi, T.H., 1995. The sediment-hosted Ngqako Pan copper deposit, Botswana. *EG* 90(5): 1118-1147.
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The geoenvironmental models in this report follow the classification scheme and numbering of the mineral deposit models presented in Cox and Singer (1986) and Bliss (1992). The geoenvironmental models presented should be considered as a descriptive guide concerning the potential for environmental impact and not used as tools applicable to quantitative risk assessment. These models can provide a basis for understanding and interpreting environmental processes related to mineral deposits in a systematic geologic context.

This report can be obtained from the U.S. Geological Survey Open-File Services Section, MS 517, P.O. Box 25046, Federal Center, Denver, CO 80225-0046, USA. TEL: (303) 236-7476.



NEW RESEARCH

Research on Carlin deposits to begin at the Mackay School of Mines, Reno, Nevada

The goals of the research are to foster collaboration, discussion and communication between geoscientists at the Mackay School of Mines and the mining industry. Research will address the common needs of the industry as defined from the input of the industry geoscientists with advice from the Economic Geology Steering Committee, and will be focused on providing practical and timely solutions to problems associated with the exploitation of Carlin deposits. Funding will be provided by the participation of 1 to 15 mining and exploration companies. The projects will be integrated and specifically concentrate on generating new, innovative ideas applicable to mine geology and exploration, based on detailed field observations and working closely with the mining industry staffs. The research effort is designed to result in a strong and viable Economic Geology program within the Mackay School of Mines within 5 years. Anticipated funding will support students (as Research Fellowships), a new Director of the Ralph Roberts Center for Research in Economic Geology, a postdoctoral position and possibly a new distinguished professor position in Economic Geology. Those interested in more information about the program should contact Richard Schweikert, Chair, Department of Geological Sciences, Mackay School of Mines, University of Reno 172, Reno Nevada 89557 (Ph: 702-784-4002).



Research Fellowships

Ralph Roberts Center for Research in
Economic Geology
Department of Geological Sciences, Mackay
School of Mines
University of Nevada, Reno

The Department of Geological Sciences, Mackay School of Mines, University of Nevada, Reno seeks to fill several one-half time graduate research fellowships for studies on Carlin-type gold deposits in Nevada and related topics. The successful applicants will have strong backgrounds in one or more of the following areas: metallogeny, stratigraphy, structure, geochemistry, tectonics, petrology, and an interest in studying Carlin-type precious metal mineralization. A Bachelor of Science degree is a minimum requirement and a Master of Science degree is desirable. Candidates with a background in economic geology and experience in the minerals industry will be given preference.

The successful applicants will work on research projects under the direction of faculty, U.S. Geological Survey scientists, and industry geologists, with coordination and integration of their research into the goals of the Center by the Director of the Ralph Roberts Center for Research in Economic Geology. Most of the projects will have a major field component.

The fellowships will be funded competitively and funds will be provided for research expenses. Additional specific projects funded by industry may also be available. Interested geoscientists should contact the Department of Geological Sciences, MS-172, Mackay School of Mines, University of Nevada, Reno, 89557 for applications. The University requires that the Graduate Record Examination be taken and a satisfactory score achieved prior to consideration for admission. The completed application should be accompanied by a letter of interest citing a Carlin Research Fellowship and a statement of qualifications, along with the names and addresses of at least three references. The completed application package should be sent to the Chairman, Department of Geological Sciences at the above address. Application deadline for the 1996-97 academic year is March 15, 1996. The University of Nevada is an affirmative action equal opportunity employer.



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