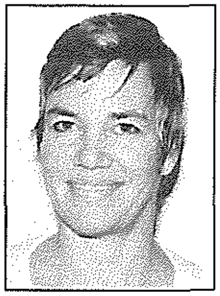
EXPLORE
Newsletter for the Association of Exploration Geochemists
NUMBER 89
OCTOBER 1995

PRESIDENT'S MESSAGE



The rather lively and emotional debate which took place at our annual general meeting in Townsville is still fresh in my mind. It centred on whether the AEG should embrace *environmental* geochemistry as a sister discipline in its activities and publications, and if so, to what degree. My personal opinion is that we should, not to attract more members to fill the void created by declining North American explorationists (actually we are quite healthy these days!), but rather to bring our expertise and experience to the attention of those working in the "environmental field". Let me show you why.

Together with about 20 colleagues from the Geological Survey of Canada, I recently attended a 2-day workshop at York University on issues related to long range transport of atmospheric pollutants (LRTAP), specifically dealing with mercury. It was organized by the Ecological Monitoring Coordinating Office (EMCO) of Environment Canada and was probably the first meeting of its kind where so many "geological types" came together with "traditional environmentalists", for want of better labels. Presentations were made by both "camps" in such areas as atmospheric modelling of Hg transport, use of the lake sediment core as an historical record of Hg input, levels of Hg in various media and health concerns for those living in the aquatic and terrestrial ecosystems (sport fish, otter, loon, whale, seal, homo sapiens..). Actually, it was very unclear as to whether there *was* need to worry about Hg levels in any of these species, the data being sparse and inconclusive. It was interesting to hear Hg described as a "persistent chemical" and that "it gets into the environment", as if it wasn't there already. The language is completely different, with its own slant. Watersheds are net "exporters" or "retainers" of Hg (deposited from the atmosphere), the term "leaching" is absent. The surficial environment is seen more in a static than kinetic mode, as passive rather than active. I saw a diagram of a tree where the input through the root system was given negligible importance compared to wet or dry deposition from above. It begs the questions: why is phytoremediation being seen as a way to clean up pollution around landfill sites and why are we bothering to use vegetation as a geochemical exploration tool?

As natural or geogenic fluxes of Hg have been so difficult to measure or estimate, they are usually left out of the input equation to the model(s). We, the geoscientific community, have a plethora of data on the diverse elemental compositions (not just Hg) of various media and we have at least some understanding of the complex interactions of metals in the environment (geochemical cycling). This meeting and others have highlighted the vital need for these two disciplines to come together in scientific collaboration to address some of the issues which are being brought to the fore now. One obvious and potentially enormous task is to come to grips with the *relative* contributions of anthropogenic and geogenic sources of metals, in air, water, soil etc., from a long and short range perspective, in a global, regional and local context.

Geoscientists may scorn the concept of "zero discharge of metals" and shrug, but more attention is needed. There are, from several organizations, criteria levels being proposed for metals in sediments which are so low that much of Canada's lakes would require action (dredging of greenstone belts?). The same criteria which have been used to assess whether certain organic chemicals are potentially dangerous to the environment are being transferred to the metal arena, with little regard to such facts that: metals occur naturally; many are essential to life; and they are involved in complex equilibria within their particular environment which dictates their species distribution. A crystal ball is not needed to deduce the ramifications of current environmental activities and future legislation for the mining industry.

This is not a Canadian issue, it is worldwide. Canada, through the Mining Association, the Ottawa headquarters of the International Council for Metals in the Environment (ICME) and the Federal Government, is hosting a series of workshops internationally to illustrate the weaknesses of these approaches and to encourage the development of more appropriate guidelines and criteria for metals. I believe we, the geoscientific community including the AEG, have an important role to play in bringing our expertise to the table, to improve the scientific database and understanding of the reactions occurring on our planet. Ultimately this should lead to better interpretation and decision-making.

Gwendy E. M. Hall

CONTENTS

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
Denver, CO 80225, USA

Information for Advertisers

EXPLORE

Newsletter No. 89 OCTOBER 1995

Editors: Sherman P. Marsh (303) 236-5521
J. Thomas Nash (303) 236-5515
Assistant Editors:
Steve Cone (303) 232-8371
Anne M. Leibold (303) 295-1101
Fredrick P. Schwarz (702) 758-9234
J. Stevens Zuker (303) 989-6608
Business Manager: Owen P. Lavin (303) 837-5820
FAX (303) 236-3200, ATTN: Sherman Marsh, USGS
e-mail: smarsh@helios.cr.usgs.gov

EXPLORE is published quarterly by the Association of Exploration Geochemists, P.O. Box 25046, MS 973, Denver Federal Center, Denver, CO 80225.
EXPLORE is a trademark of the Association of Exploration Geochemists.
EXPLORE is typeset by Network Graphics, Inc., Denver, CO (303) 433-1616.

NOTES FROM THE EDITORS

Sherman Marsh and Tom Nash

The Technical Note by Ravi Anand of CSIRO carries an acknowledgment that we would like to see more often: collaboration with the mineral industry and assistance and support of the mineral industry for his government-sector research. The science summarized in this Technical Note is evidence of the synergism that comes from this cooperation. In a similar manner, The AEG and **EXPLORE** play an important role in facilitating cooperative research programs among the mineral industry, academia, and government sector, chiefly through friendships and exchange of ideas through our publications and our regional and international meetings. These interchanges foster a sense of trust and integrity are cornerstones of professional careers in geochemistry, and are especially important in environmental studies, as noted in President Hall's Message. Much work remains to be done on geochemical baselines and on processes operating in mineral environments to provide a realistic and valid basis for regulatory actions.

Ironically, environmental studies, and earth science in general, are being cut during current major budget reforms. **EXPLORE** v. 89 is being assembled during a period of unprecedented upheaval in North American government-sector geoscience. The U. S. Geological Survey and the Geological Survey of Canada have suffered large cuts in staff, particularly in mineral resource programs, the U.S. Bureau of Mines is being eliminated and its functions and people are being assigned to other agencies. The U.S. Biological Survey is being dismembered, apparently because some politicians do not appreciate the economic impact of their science on private property and business. The role of government scientists in environmental research is being decided by politicians, while managers scramble to redefine programs that are politically correct. Capable scientists are in limbo at a time when the majority of the public does indeed care about the environment.

TECHNICAL NOTE

Genesis and classification of ferruginous regolith materials in the Yilgarn Craton of Western Australia: Implications for mineral exploration

R.R. ANAND

Introduction

Ferruginous regolith materials are abundant and widespread in the deeply weathered landscapes of the Yilgarn Craton. Many of these materials preserve geochemical dispersion patterns from concealed mineral deposits (Smith,1989; Anand, 1993). A wide variety of ferruginous materials exist, and their geochemical response to mineralisation and bedrock differs according to their mode of origin. They occur as crusts, as lag, as a gravel component in soil, colluvium and alluvium, and as segregations and infusions in saprolite. Several types may occur in a single weathering profile, having developed in different parent materials or substrates. Understanding these materials is important for selection of suitable sampling media and subsequent interpretation of geochemical data in mineral exploration. In addition, close study of the relationship of ferruginous materials to the landscape contributes to the general understanding of landscape evolution in the Yilgarn Craton.

Classification and environments of formation

The topographic relationships, position within the weathering profile, mineralogical, chemical, and mesoscopic characteristics of ferruginous materials suggest four main groups of material formed in different environments (Fig 1).

1. *Lateritic residuum.* Lateritic residuum is a collective term for lateritic duricrust and loose lateritic nodules and pisoliths. All of these are thought to have formed, during lateritic weathering, within the zone of water table fluctuation. Ferrous iron, released by breakdown of the primary minerals under relatively reducing conditions has been redistributed and precipitated as pisoliths and nodules under oxidising conditions in this zone. As a result, a ferruginous horizon typically develops in upper parts of the deeply weathered profile. Nodules and pisoliths commonly have thin (1 mm)

Continued on Page 4

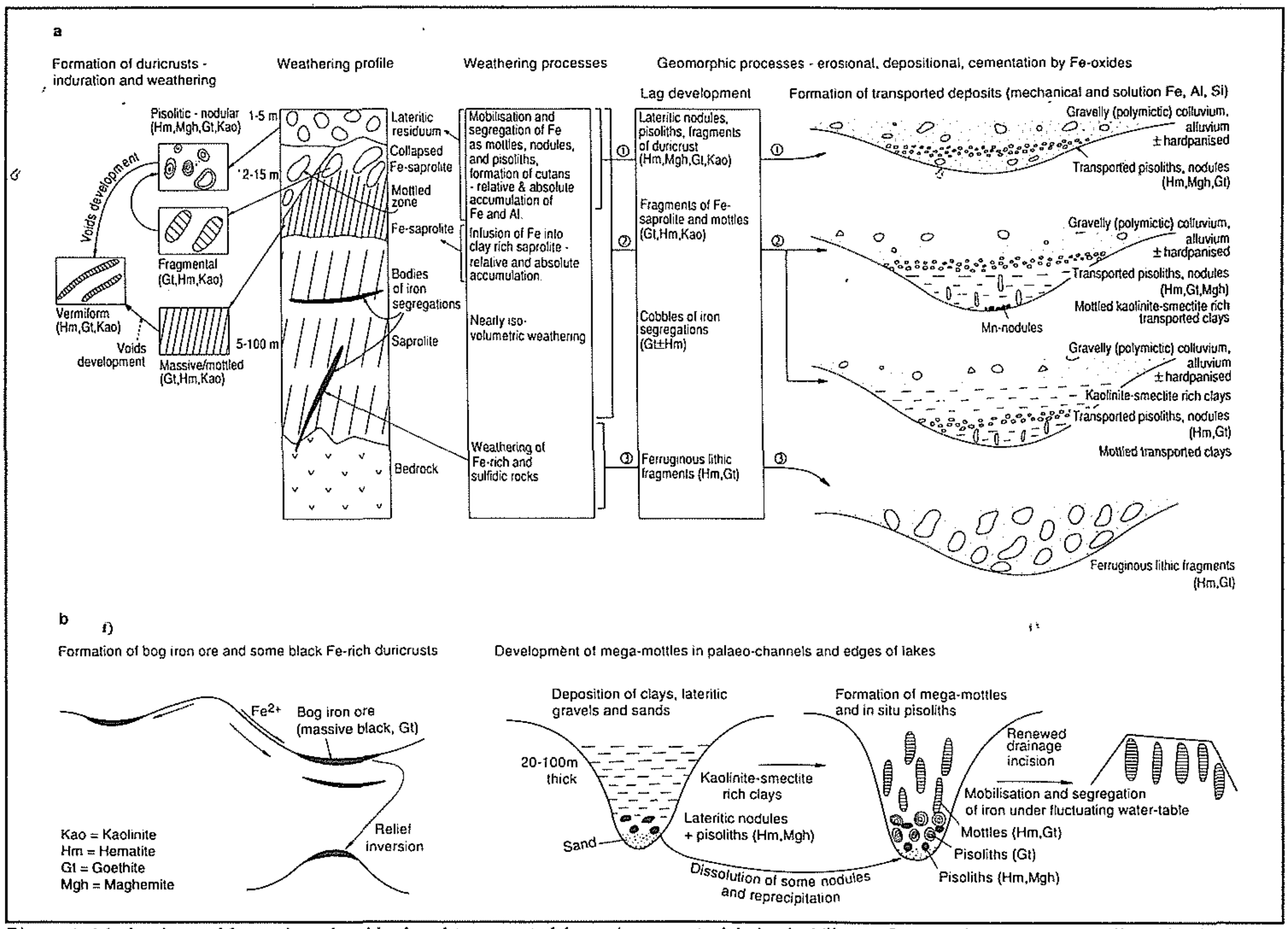


Figure 1. Mechanisms of formation of residual and transported ferruginous materials in the Yilgarn Craton of Western Australia and subsequent modification by geomorphic processes. (a) In a "typical" weathering profile. (b) In sub-aqueous environments.

Technical Note

Continued from Page 3

goethite- and kaolinite-rich cutans, which are rinds that have developed by deposition of Fe and Al around a core. Pisoliths with multiple cutans are rare, being found mainly at the base of palaeo-channel infill.

Major minerals are hematite, goethite, maghemite, kaolinite,and gibbsite with some quartz and other resistant minerals. Maghemite, which is formed by heating of goethite, for example during bush fires, is restricted to surface or near-surface pisoliths. Where maghemite-rich pisoliths are found at depth, it is probable that they have spent some time at the surface. Lateritic pisoliths and nodules contain highly Al-substituted goethites, indicating ample availability of aluminum during their formation. The major and trace element composition of these materials is largely litho-dependent at a landscape scale; Fe and Al are largely derived from the underlying rocks. However, lateral accumulation of Fe and Al also occurs.

Several types of lateritic duricrusts (massive, vermiform, fragmental, nodular, and pisolitic) have been identified in the Yilgarn Craton. Some are related to pisolitic-nodular lateritic residuum; others to ferruginous saprolite (Fig 1).

2. *Ferruginous saprolite and mottled zone* . Ferruginous saprolite is commonly developed over mafic and ultramafic rocks by infusion of kaolinite-rich saprolite with goethite and is hard, massive to mottled. This saprolite occurs below the ferruginous zone and is younger than overlying pisoliths and nodules. Fragmentation and collapse of ferruginous saprolite may lead to the generation of nodules. The mottled zone is characterised by hematite-rich mottles in a kaolinite-rich matrix. Mottles may evolve into nodules and pisoliths.

3. *Iron segregations.* These include stratabound and discordant to sub-horizontal Fe-rich bodies and lenses occurring dominantly in saprolite (Fig 1). They are dense, dark brown to black and rich in Fe, Mn, Zn, Cu and Co. They are non-magnetic and are dominated by low Al-substituted goethite (< 5 mole %), with variable amounts of hematite and quartz; maghemite and kaolinite are absent.

Iron segregations are the result of extreme ferruginisation, the Fe being derived from a variety of sources, including weathering of Fe-rich and/or sulphidic rocks, and by lateral enrichment by groundwater. Very low Al substitution in the goethites of iron segregations indicates that they must have developed in an environment that was very poor in Al.

4. *Ferruginous materials characteristic of sub-aqueous environments* consist of Fe-oxides that have impregnated and indurated sediments of various ages and may overlie either complete or truncated profiles (Fig 1). The Fe is contributed by broad-scale lateral movements so that there is no genetic relationship between these ferruginous materials and the underlying geology. Typical examples include bog iron ore, and mega-mottles in palaeo-channel sediments. These commonly mark former lakes, valley floors, swamps, rivers, streams and, channels. Some now occur on low hills as a result of relief inversion.

Modification and distribution

These ferruginous materials were formed within the regolith but their present distribution in the landscape has been affected by later *erosional and depositional processes* (Figs 1 and 2). The distribution can thus best be described by establishing a framework and regolith-landform regimes (Anand and Smith, 1992; Anand, 1993).

Lateritic duricrusts, lateritic gravels, and lag of lateritic nodules and pisoliths outcrop in *relict regimes* , whereas outcrop and lag of hardened mottles and ferruginous saprolite occur in transitional to *erosional regimes* . (Fig 2). Lateritic duricrusts, ferruginous saprolites, and mottled zones are commonly present beneath colluvium and alluvium in *depositional regimes* that have not suffered post-lateritic erosion.

Continued on Page 5

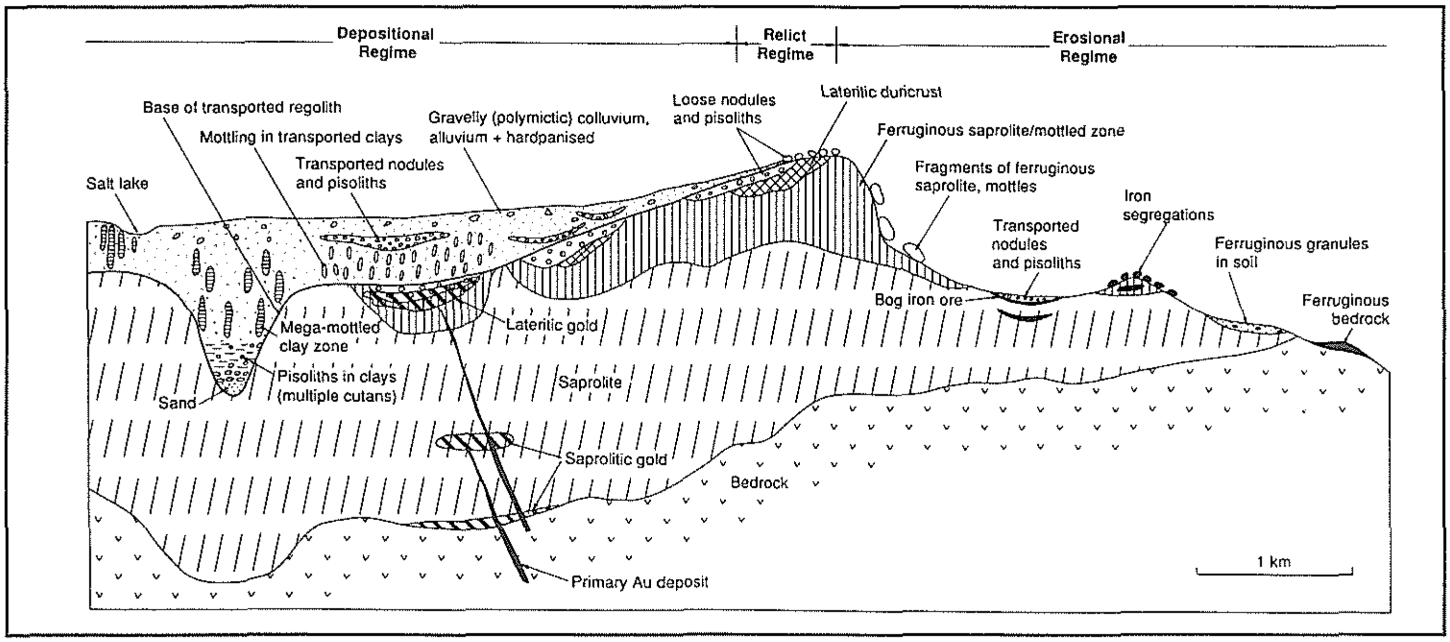


Figure 2. Idealised cross section showing the relationships between landforms and ferruginous materials in the Yilgarn Craton of Western Australia.

Technical Note

Continued from Page 4

Erosion of the upper saprolite has led to exposure of bodies of iron segregations at the surface, where they disintegrated and contributed to a coarse lag in the erosional regimes.

Where erosion has removed most of the pre-existing lateritic regolith, more recent weathering has led to the formation of indurated, goethite- and hematite-rich bedrock. This later weathering has not been intense, and weatherable primary minerals are retained as important components. Disintegration has formed a coarse lag of ferruginous, lithic fragments.

Horizons of lateritic pisoliths and nodules are generally developed above, or laterally associated with, indurated, lateritic duricrust. This gravelly horizon commonly arises from *in situ* breakdown of pisolitic-nodular duricrust, followed by limited colluvial transport. However, if the lateritic residuum in upland areas is entirely dismantled, the resultant gravels may be deposited in flanking low lying areas. These gravels progressively lose their cutans on transport and are incorporated, with other clasts of diverse origin, within colluvial-alluvial units or occur as gravelly lenses (Fig 1). These lenses may be recemented by Fe-oxides and resemble the residual duricrusts from which they were derived.

There are also *regional trends* in the distribution of ferruginous materials in the Yilgarn Craton. For example, in the Leonora-Wiluna region, lateritic residuum and ferruginous saprolite commonly form extensive buried blankets whereas, in the Kalgoorlie region, ferrugenous materials are much less widespread. Similarly, iron segregations are abundant in erosional regimes of the Leonora-Wiluna region but rare to absent in the Southern Yilgarn Craton, around Kalgoorlie. These differences may reflect contrasts in the tectonic history, geomorphology and / or weathering conditions between the two regions. Thus, it may be that neither lateritic residuum nor Fe segregations were ever extensively develop ed in the Kalgoorlie region or that subsequent weathering has caused their modification or destruction.

Relief inversion

There is no evidence of large scale *relief inversion* within the Yilgarn Craton despite reports to the contrary (Ollier *et al.*, 1988). Dendritic patterns are lacking in exposed or buried duricrust, and palaeo-drainage systems dominantly occupy lower parts of the present landscape. However, very localised relief inversion is indicated by small hills formed by detrital duricrusts and mega-mottled zones along edges of some lakes.

Geochronology

The ferruginous materials are of varying ages but none has been dated precisely. However, stratigraphic relationships suggest that some pisoliths and nodules may date from at least the late Mesozoic. Transported maghemite-rich, pisolitic and nodular gravels occur in basal sediments of palaeo-channels that elsewhere contain late-Eocene lignites. The transported pisoliths were presumably derived by erosion of the earlier lateritic regoliths that predate incision of the palaeo-drainage. Eocene sediments themselves have been further weathered to form mega-mottles, probably during Oligocene and Miocene time.

Sampling strategies, regolith mapping, and identification of ferruginous materials

Understanding the nature and distribution of ferruginous materials helps to develop geochemical sampling strategies for weathered terrain. This knowledge can be obtained by regolith-landform mapping and by establishing regolith stratigraphy. When regolith-landform regimes are mapped in an area, it generally becomes clear which geochemical sampling media are the most appropriate (Anand, 1993).

Where preserved, lateritic residuum is an ideal sampling medium to detect the widespread dispersion haloes from Au and base metal deposits. Lateritic nodules and pisoliths may be collected from the surface or near-surface in relict regimes or by drilling in depositional regimes. Mechanical dispersion of loose nodules and pisoliths (5-50 m) is very common and thus results in a wider anomaly than does the underlying duricrust. There appears to be no special advantage in sampling magnetic nodules and pisoliths despite the greater homogeneity of the sample. On the contrary, some non-magnetic materials are more useful because both target and pathfinder elements are associated with goethite and hematite that can comprise either the core or cutans of nodules and pisoliths (Anand and Smith, 1992).

In drilling to sample buried laterite, an explorationist must be able to recognise and distinguish transported lateritic

Continued on Page 6

Technical Note

Continued from Page 4

debris from residual laterite. Nodules and pisoliths with yellowish-brown to olive green cutans are believed to be confined to residual or minimally transported aterite. Layers of well-sorted lateritic gravels and a large proportions of nodules and pisoliths with chipped cutans may indicate transported laterite. Similarly, layers of maghemite-rich gravels within clay-rich units are indicative of transported laterite (Fig 1).

Where the profile has been truncated, ferruginous saprolite, mottles and iron segregations are suitable sampling media, although much closer sample intervals are necessary. Drilling is necessary in depositional regimes. Different thresholds must be applied for each sample type.

Pisolitic and nodular lateritic residuum can be distinguished from ferruginous saprolite by loss of the primary fabric and by the presence of abundant hematite and less kaolinite. Maghemite is typically absent in mottles and ferruginous saprolite. Ferruginous saprolite differs from iron segregations in that it generally has yellow-brown colour, and less Fe; some have diffuse mottling and incipient nodular structures.

Ferruginous materials formed in sub-aqueous environments may not be suitable sampling media because they are not genetically related to the underlying lithologies. Low Al-substituted goethite is the dominant Fe-oxide mineral in bog iron ore, whereas hematite dominates mega-mottles of palaeo-channels. Hematite present in mega-mottles may reflect age differences; older materials are generally higher in hematite content than younger ones, and may reflect an ageing or warmer conditions during formation. Ferruginised wood fragments commonly occur in bog iron ore.

In some situations, mottling and pisoliths have developed in younger transported horizons overlying older lateritic residuum, mottled zone or saprolite. Small manganese nodules may also occur at the base of such units. Transport is indicated by unconformable contacts. Where no obvious unconformity is present, mineralogical data may demonstrate different origins of units in which separate parts of weathering profiles have developed.

This approach to geochemical sampling in regolith terrain, which was developed during the course of a series of AMIRA projects, played a part in the discovery of the world class Plutonic and Bronzewing gold deposits by Great Central Mines NL.

Acknowledgements

Most of the work reported in this paper was carried out between 1987 and 1993, in collaboration with the mineral industry, through AMIRA (Australian Mineral Industries Research Association Limited). The assistance and support of the sponsors of these projects are gratefully acknowledged.

Continued on Page 7

Technical Note

Continued from Page 6

References

Anand, R. R. and Smith, R.E., 1 992. Regolith-landform evolution and geochemical dispersion in lateritic regolith about the Mt Gibson Gold deposits, Western Australia: Sydney, CSIRO Exploration Research News, v. 6, p. 1-4.

Anand, R.R., 1993. The regolith and its exploration and economic significance. In: P.R. Williams and J.A. Haldane (compilers)-An international conference on crustal evolution, metallogeny and exploration of the Eastern Goldfields. Kalgoorlie, 1993 AGSO Record 1993/53, p. 75-100.

Ollier, C.D., Chan, R.A., Craig, M.A. and Gibson, D.L., 1988. Aspects of landscape history and regolith in the Kalgoorlie region: BMR Journal of Geology and Geophysics, v. 10, p.309-348.

Smith, R. E. 1989. Using lateritic surfaces to advantage in mineral exploration. In: G.D.Garland (ed.), Proceedings of Exploration 87, Third Decennial International Conference on Geophysical and Geochemical Exploration for Minerals and Groundwater. Ontario Geological Survey, special Volume 3, 914 pp.

R.R. ANAND
CSIRO, Division of Exploration and Mining,
Floreat Park,
W A 6014, Australia

REVIEW

The A.E.G. Exploration Geochemistry Bibliography — A hands-on review

compiled by
Eric C. Grunsky, L. Graham Closs and Dorthe Jakobsen
by Graham C. Wilson

The surprise arrival of a bibliographic diskette in the mail has provided many explorationists with a new tool to evaluate. The price is certainly right (free to A.E.G. members!) but is it possible to justify the time required? The reviewer thinks it is, and argues that this handy literature guide can rapidly be installed in exploration offices, everywhere.

The dramatic advent and evolution of the 'personal computer' has been followed closely by an explosive rise in the volume of technical publishing, from a variety of commercial, academic, government and private sources. A natural response to the glut of information, new and old, would seem to be some kind of 'watchdog' bibliographic service, whether wide-flung (GeoRef for Earth Sciences, INSPEC for Physics, etc) or specialized. A number of organizations, such as the U.S.G.S., have from time to time released collections of references, compiled by specialists, on a number of thematic and/or geographic topics, most commonly as readily-accessible ASCII files on diskette. An argument can be made for topical bibliographic databases aimed at an intermediate level of specialization. Such is the case of Grunsky et al., whose laudable effort addresses the broad field of geochemical exploration. The success of the 'AEGBIB', as I've come to think of it, and similar products, is largely a function of content and accessibility. A combination of ease of use and demonstrated retrievability of relevant information is critical. To see how the AEG product performs, this review addresses aspects of installation, structure and content, interactive use and possible future development.

Installation

The bibliography, plus an A.E.G. membership list, comes in the compact form of 3 files, 1.2 MB total size, on a single diskette. Transferred to the user's hard disk, the data files are readily decompressed to 14 MB,of which 13.5 MB is a .dbf file containing the bibliography. Unlike the earlier paper versions (dating to the original publication by Herbert E.Hawkes in 1972, subsequently updated by Hawkes and others) what follows depends in a broad sense on the reader/user's computer resources, and especially on the database management system into which the .dbf file is imported. For the record, this review was conducted on a 486/66 system with an old version of a 'flat-file' DBMS (Symantec's Q&A 3). When imported (a 7-minute operation), the resultant file size was 2.5 MB, <20% of the original .dbf file. With a little tweaking, each record was made to fit into a single 21x80 display screen. While details will vary, the product should work with most common database software which can import .dbf files, on any platform 286 and up.

Continued on Page 8

Review

Continued from Page 7

Data Structure

The database structure is very simple: each of the 11,114 records contains standard bibliographic data, viz. Author, Title, Reference (source) and Date (year of publication). In detail, there are 14 data fields: a unique number for each reference (1), author fields (2-8), year (9), title (10), publication name (11), volume and page numbers (12, 13) and a notes / keywords / memo field (14). Provided the fields are correctly filled in, this structure allows the user to search the database and construct their own desired bibliographic output using the facilities of their DBMS. The use of multiple Author fields makes for cumbersome name searches, unless the user's DBMS can concatenate the 7 fields and search them as one. There are 99 "et al."s in the first author field, a practice I have used myself where there are >>8 authors! In practice, most searches will probably address the Title field, perhaps using the Date field to limit the volume of output. There are minor typos, inevitable in this kind of compilation: sorting and displaying the records in assorted tabulations revealed only 9 records with errors in the date field, and 3 duplicates: not significant problems. There is a certain amount of blurring between the publication, volume and page fields. 1,161 records have additions a-n in the date field ("1991a", etc), useful in paper format but of questionable utility in a digital product (unless separated from the date in a companion field). The Date field is useful in recording the balance between current research and the older works, including the `classic' gems we all love to find: the quoted publication dates are as follows, 1894-1994:

Time Range	Records	Percent
Pre-1900	20	.02
1900-49	1201	.08
1950s	5074	.56
1960s	1365	12.28
1970s	4190	37.70
1980s	3926	35.33
1990s	973	8.75
No date given	310	.28
Total	11114	100.00

The peak in the 1970s is significant, reflecting the original compilation by Hawkes and its release by the A.E.G. in 1972, and most likely guaranteeing a maturity of selections which might not be found in more recent compilations (as curators and librarians will know, the retroactive entry of older material can be far more daunting, and more easily postponed, than the cataloguing of new acquisitions).

The 'Notes' field unfortunately fails to meet its potential: only 21 records possess 'notes', variously addressing synonyms (17), corrections, cross-references and availability (1 each). Only one record has a note containing a useful 'keyword', the proper name of a species of plant.

Scope of the Bibliography

A brief review of AEGBIB revealed major strengths in geochemical sample types (rock, soil, stream sediment, till and water samples). 756 records have "soil" in the title. There are at least 80 on laterites; 83 on weathering; 187 on "till" (excluding 14 on scintill.., still..); at least 414 on stream sediments; 81 on lake sediments; 21 on humus; and 127 on ground waters. There are at least 425 on biogeochemistry and geobotany, with 207 on plants ("plant", excluding 3 for pilot plants!). Key topics include the chemistry of surficial deposits and waters, geochemical analysis, lithogeochemistry and hydrothermal alteration, mineral exploration case studies, and sampling methods. Because the title field is the principal key to the content of the entries, a certain amount of ingenuity is required to obtain the maximum return of relevant entries. Skirting the more obvious pratfalls of nomenclature (Mexico versus New Mexico, etc), successive searches on geographic themes returned 1,056 records on Canada, 318 on Latin America (sensulatu, from the U.S.southern border down to Cape Horn, including the Caribbean region) and 236 for the Indian subcontinent. In terms of commodities, elements and lithological associations, two popular examples are gold (search for"gold", " Au ", and " Au,", 839 records) and diamonds and potential host rocks ("diamond", "kimberlite", "lamproit", 83).

User Amendments

It must be stressed that the basic database is a workable, 'no-frills' product, and thus the utility of the system depends to a large degree on the user, who has the option to customize this product for his or her own requirements. A simple form of optimization is described here. Because there is only one useful primary search field (besides the author fields), I found it helpful to set up small 'logical fields' to flag entries covering key topics or geographic areas. Each such manoeuvre employs semantic trickery, but a single example will suffice. On creating a field to flag all items referring to Canada, I traced all items in which occur 'Canada','Canadian' or the names of the 12 provinces and territories, and found 955 records. There is no sure way to update ALL records reliably without scanning each record individually, a daunting task, but another 100-odd Canadian records were easily found by title-searching for famous mining camps such as Timmins and Noranda, and automatically flagging the new 'Canada' field. Similar sleight-of-hand can be used to construct flags for other geographic entities, commodity groups and other specialties.

Continued on Page 9

Review

Continued from Page 8

Summary

It would appear that the most potent general use for AEGBIB lies in designing field sampling programs for soils, sediments, waters, plants and rocks, using keywords such as those tested here: this alone more than justifies the small investment in time needed to explore the database. With 12 years' experience of compiling an ongoing keyword-oriented bibliography which has partial overlap with the subject matter of'AEGBIB', I can appreciate the work taken to produce the first AEG digital bibliography. The 11,000-entry selection represents hard work, and also a foundation on which an improved digital product can be developed progressively. Retrograde changes are difficult: adding a few logical fields, as described above, might help the cause without adding appreciably to the long-term work load. Last but not least, in the course of this review I added ERRor and DUPlicate comments to the Notes field: if other keen users do the same, and send in their lists when solicited, the future compilers will have an easier time in assembling the next digital release. Happy browsing!

Graham C. Wilson
Turnstone Geological Services Ltd.
P.O. Box 130, Station B
Toronto, ON M5T 2T3
CANADA
E-mail: gcw@quartz.geology.utoronto.ca

NEWS RELEASE

The U. S. Senate Energy and Natural Resources Committee cleared by a 13 to 7 vote the path for a royalty of 2.5 percent of net proceeds for minerals taken from Federal land, and specifies the payment of fair market value of surface rights for mine patent s. An earlier vote in a House committee approved a somewhat different royalty scheme that would require payment of 3.5 percent of net proceeds from minerals taken from Federal land.

Yet, Interior Secretary Bruce Babbitt said both royalty proposals are inadequate, characterizing them as "token payments." Babbitt said that companies still would be able to purchase mining rights worth billions of dollars for only the surface value of the land. The concept of valuation of natural resources expressed in the bills may be applied to oil and gas.

"We are on dangerous grounds here," stated John B. Gustavson, Certified Minerals Appraiser and Instructor at the University of Tulsa. "Our elected legislators may certainly vote on new rules; however, messing around with apportionment between the surface and oil and mineral rights will totally nullify a century's worth of progressive court decisions. In short, as appraisers we will have to start over fresh."

Supplied by the University of Tulsa

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 b y 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 da te, 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.

FELLOWS

Carver, Richard N.
Chief Geochemist
WMC Exploration
Belmont, WA, AUSTRALIA

Goldberg, Isaai S.
Geoelectrochemist
Ionex
Sydney, NSW, AUSTRALIA

Hefton, Kristopher K.
Chief Exploration Geologist
PT Freeport Indonesia
Tembagapura, Irian Jaya, INDONESIA

McGregor-Dawson, James L.
Consultant Geologist
Geological Exploration Services
Townsville, QLD, AUSTRALIA

MEMBERS

Adjei, Joseph
Geologist
BHP Minerals
Herndon, VA, U.S.A.

Aquino, Romeo S.
Chief Geologist
Placer Pacific Exploration
Makati, PHILIPPINES

Arne, Dennis
University of Ballarat
Ballarat, Victoria, AUSTRALIA

Beams, Simon
Terra Search
Hyde Park, QLD, AUSTRALIA

Bell, Louis A.
Bullcreek, WA, AUSTRALIA

Birch, Jenny
Wellington Point, AUSTRALIA

Boadi, Isaac
BHP Minerals
Dar-Es-Salaam, TANZANIA

Boas, Jose M.V.
Geologist
CPRM
Manaus, BRASIL

Bogoch, Ron
Geol Survey Israel
Jerusalem, ISRAEL

Bonotto, Daniel M.
University Teacher
DPM-IGCE-UNESP
Rio Claro, BRASIL

Borges, Felicissimo R.
Geologist
CPRM
Manaus, BRASIL

Continued on Page 11

New Members

Continued from Page 10

Bright, Douglas V.
Perth, AUSTRALIA

Bristow, Andrew
Crawley, WA, AUSTRALIA

Bristow, D.M.
Randgold and Exploration Co
Southdale, SOUTH AFRICA

Buckle, Peter A.
Townsviille, QLD, AUSTRALIA

Campbell, Iain D.
Glendalough, WA, AUSTRALIA

Camuti, Kaylene
Senior Geologist
Lantana Exploration
Townsville, QLD, AUSTRALIA

Chapman, John G.
CRA Diamonds
Perth, WA, AUSTRALIA

Chiorean, Georgeta I.
Exploration Geochemist
Maramures, ROMANIA

Cook, Nick
Sr Geologist
Pasminco Exploration
Broken Hill, NSW, AUSTRALIA

Corlis, Nick
Leinster-Mt. Keith Nickel
Leinster, WA, AUSTRALIA

Correa, Sandra Lia De A.
Professor
University of Para
Belem, BRASIL

Crawford, James
Mineralogist
Golden Star Resources
Georgetown, GUYANA

Cross, Jim
Burekup, WA, AUSTRALIA

Cruikshank, Bruce I.
Australian Geol Survey
Canberra ACT, AUSTRALIA

Continued on Page 12

New Members

Continued from Page 11

Cussen, Michael J.
Regional Exploration Geologist
Arimco Mining
Hermit Park, QLD, AUSTRALIA

Dammer, Dusan
WMC
Geochemist
Kambalda, WA, AUSTRALIA

Davis, James W.
Vice President
Taiga Consultants
Calgary, Alberta, CANADA

Davy, Andrew T.
CRA Diamonds
Perth, WA, AUSTRALIA

Deakin, Stan
Argyle Diamond Mines
Perth, WA, AUSTRALIA

Dewhurst, Phillip A.W.
Reunion Mining
Harare, ZIMBABWE

Evans, David M.
Llanrhystyd, Dyfed, U.K.

Fraenkel, Heinz C.
Div Exploration Geologist
Anglo American Corp
Olifants Fontein, SOUTH AFRICA

Fraser, Stephen
Principal Research Geologist
CSIRO
Heatley, QLD, AUSTRALIA

Furnell, Ron
Rocsol
Townsville, QLD, AUSTRALIA

Gay, Libbi
Mundaring, WA, AUSTRALIA

Goulevitch, John
Managing Director
Exploremin
Darwin, AUSTRALIA

Goyne, Garry
Orange, NSW, AUSTRALIA

Hedger, Darryn
Project Geochemist
BHP Minerals
Paddington, QLD, AUSTRALIA

Henderson, Anne
Research Geologist
CSIRO
Aitkenvale, AUSTRALIA

Holmes, Peter K.
Senior Geologist
Monopros
Toronto, ONT, CANADA

Johnstone, Rob
Energy Mines and Petroleum Resources
Yellowknife, NT, CANADA

Kabette, Joas
BHP Minerals
Dar-Es-Salaam, TANZANIA

Lauricella, Paul
Newmont
Jakarta, INDONESIA

Lawrie, Kenneth C.
Lecturer
University of Papua New Guinea
PAPUA NEW GUINEA

Litsens, Kenneth R.J.
Australian Assay Labs
Mt Hawthorn, WA, AUSTRALIA

Continued on Page 13

New Members

Continued from Page 12

Locock, Andrew
Senior Mineralogist
Golden Star Resources
Georgetown, GUYANA

Lohan, Andrew
Port Moresby, PAPUA NEW GUINEA

Marcos, Danny
Geologist/Geochemist
WMC
Makati, PHILIPPINES

Marriott, Christian C.
Townsville, QLD, AUSTRALIA

McQueen, Kenneth G.
University of Canberra
Belconnen, ACT, AUSTRALIA

Moody, Timothy C.
Project Geologist
CRA Exploration
St Morris, SA, AUSTRALIA

Moore, Stuart
Plutonic Operations
Aitkenvale, QLD, AUSTRA LIA

Munday, Tim
CSIRO
Wembley, WA, AUSTRALIA

Myers, Russell
James Cook University
Townsville, QLD, AUSTRALIA

Nutter, Alex
Claremone, WA, AUSTRALIA

O'Sullivan, Roslyn
Exploration Geologist
Mt. Leyshon Gold Mines
Palmgrove, NSW, AUSTRALIA

Oliveros, Alberto F.
Docente
University of the Amazon
Florencia-Caqueta, COLUMBIA

Pfau, Mark
Managing Geologist
Tellurian Exploration
Missoula, MT, U.S.A.

Piazza Paul E.
Mining Analyst/Stock Broker
Merit Investment
Unionville, ON, CANADA

Potter, Joe I.
Mt Isa, QLD, AUSTRALIA

Ramos, Jader M.
Florencia-Caqueta, COLUMBIA

Sabatini, Giuseppe
Professor of Geochemistry
University of Siena
Siena, ITALY

Reeves, Shane
Universty of Melbourne
Melbourne, Victoria, AUSTRALIA

Seeley, John B.
Ainslie, ACT, AUSTRALIA

Seodne, J. Carlos Sicoli
Chief Geologist
DOCEGEO-CVRD
Belo Horizonte, BRAZIL

Spencer, Richard M.
Geologist
Gencor
Quito, ECUADOR

Stone, John O.
Australian National University
Canberra, ACT, AUSTRALIA

Stutman, Mark
Research Associate
W.L. Gore and Associates
Elkton, MO, U.S.A.

Sugden, Stephen P.
Orange, NSW, AUSTRALIA

Teluk, Alexander J.
Consultant Exploration Geologist
Geodyne Consulting Services
Winmalee, NSW, AUSTRALIA

Waldron, Helen
Senior Geologist
Becquerel Laboratories
Menai, NSW, AUSTRALIA

Continued on Page 14

New Members

Continued from Page 13

Walkland, Richard
Geologist
RTZ Mining and Exploration
Bristol, U.K.

Warman, Tim
Caledonia Mining
Oakville, ON, CANADA

Worraul, Lisa
CSIRO
Wembley, AUSTRALIA

STUDENTS

Barcelona, Elvira
University of New South Wales
Kensington, NSW, AUSTRALIA

Enriquez, Erme
Colorado School of Mines
Golden, CO, U.S.A.

Furniss, Rafael
James Cook University
Townsville, QLD, AUSTRALIA

Jones, Andrew
James Cook University
Townsville, QLD, AUSTRALIA

Kennedy, Theresa C.
The Open University
Milton Keynes, U.K.

Lawie, David C.
University of New England
Armidale, NSW, AUSTRALIA

Lucero, Abraham R.
James Cook University
Townsville, QLD, AUSTRALIA

Nunn, Andrew
James Cook University
Townsville, QLD, AUSTRALIA

Poulsen, John
James Cook University
Townsville, QLD, AUSTRALIA

CALENDAR OF EVENTS

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

■ Nov. 6-8,'95, Int'l Symposium on **Brazilian Mining,** Salvador, Bahia (Conference Coordinator, Institute for International Research, 708 Third Ave., 4th Floor, New York, NY 10017-4103; TEL: (212) 661-6777; FAX: (212) 661-8740)

■ Nov. 6-9, '95, **Geological Society of America,** ann. mtg., New Orleans, LA (Vanessa George, 3300 Penrose Place, Boulder, CO 80301; TEL: (303) 447-2020; FAX: (303) 447-1133

■ Nov. 19-22, '95, **PACRIM '95,** Auckland, New Zealand (Mrs. Charmayne Perera, The Australasian Institute of Mining and Metallurgy, P.O. Box 660, Carlton South, Victoria 3053, Australia; TEL: +61-3-662-3166; FAX: +61-3-662-3662; E-mail: J.Mauk@auckland.ac.nz)

■ Dec. 5-8, '96, **Northwest Mining Association,** int'l conf., Spokane, Washington (NWMA, Suite 414, 10N. Post, Spokane, WA 99201-0772; TEL: (509) 624-1158; FAX: (509) 623-1241)

■ Jan. 16-19, '96, Conference on **Tailings and Mine Waste,** Fort Collins, CO (L. Hinshaw, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523; TEL: (970) 491-6081; FAX: (303) 491-7727)

■ Jan. 22-24, '96, **Canadian Minerals,** mtg., Ottawa (Charlie Jefferson, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario K1A 0E8; TEL: (613) 996-4651; FAX: (613) 996-9820).

■ 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)

Continued on Page 17

4th International Symposium on Environmental Geochemistry

October 5 - 10, 1997 - Vail, Colorado

Organized by
U.S. Geological Survey (USGS)
Association of Exploration Geochemists (AEG)
Society for Environmental Geochemistry and Health (SEGH)
in collaboration with
USGS Center for Environmental Geochemistry and Geophysics (CEGG)
and International Association of Geochemistry and Cosmochemistry (IAGC)

Introduction

Since the 3rd Symposium in Krakaw, Poland, 1994, interests in envirnmental 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 drainaige 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 is 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 wokshops 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 nail: 4th ISEG, c/o USGS/CEGG, Federal Center, Box 25046, MS 973, Denver, CO 80225 USA; fax (303) 236-3200; or e-nail: iseg@helios.cr.usgs.gov.

Jame ______________________________

.ddress ______________________________

ountry ______________________________

hone ______________ Fax: ______________ e-mail: ______________

intend to participate in the pre- or post-conference field trips — Yes ☐ No ☐

intend to submit an oral presentation — Yes ☐ No ☐
nder which theme 1 - 12 (see "Proposed Themes" above) — Theme No. ______

intend to submit an poster presentation — Yes ☐ No ☐
nder which theme 1 - 12 (see "Proposed Themes" above) — Theme No. ______

will be accompanied by ______ persons.

am interested in being a corporate sponsor — Yes ☐ No ☐

am interested in purchasing commercial space — Yes ☐ No ☐

Venue
The Westin Resort and Convention Center, Vail, Colorado, is located 160 km west of Denver, Colorado, in the scenic Rocky Mountains. It is easily accessible by public transportation from Denver International Airport (DIA). Vail village is world-renowned for its beauty, outdoor activities, shops, and accommodations.

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
Dr. Ronald Severson, USGS
Dr. Larry Gough, USGS
Mr. Richard Sanzolone, USGS
Ms. Cathy Ager, USGS
Mr. Sherman Marsh, USGS

Scientific Committee
Dr. Willard Chappell
Dr. Brian Davies
Dr. Robert Garrett
Dr. Gwendy E. M. Hall
Dr. Betsy Kagey
Dr. Ollie Selinus

Correspondence
Contact persons:
Drs. R. C. Severson or L.P. Gough
U.S. Geological Survey, Federal Center
Box 25046, MS 973
Denver, CO 80225 USA
Phone: 303-236-5514 or 5513
Fax: 303-236-3200
e-mail: iseg@helios.cr.usgs.gov

Please share this information with colleagues.

4th International Symposium on Environmental Geochemistry
c/o U.S. Department of the Interior—USGS
MS 973, Box 25046, Federal Center
Denver, CO 80225-0046

Calendar of Events

Continued from Page 14

■ 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)

■ Apr. 15-19, '96, **Integrated Mining and Land Reclamation**, short course, Reno, NV (Yung Sam Kim, Nevada Institute of Technology, Box 8894, Reno, 89507; TEL:(510)-757-2000; FAX: (510)-757-7997).

■ 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**, annual forum, field trips May 18, May 22-24, Laramie, Wyoming (R.E. Harris, Wyoming State Geological Survey, Box 3008, University Station, Laramie, WY 82071; TEL: (307) 766-2286; FAX: (307) 766-2605)

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

■ July 21-28, '96, Fourth Internatinnal 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)

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

■ 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: isiame@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**, Denver, CO (U.S. Geological Survey, The **Association of Exploration Geochemists**, the Society for Environmental Geochemistry and Health and the International Association of Geochemistry and Cosmochemistry, Dr. Ronald C. Seversen or Dr. Larry P. Gough, U.S. Geological Survey, MS973 Denver Federal Center, Denver, CO 80225; TEL: (303) 236-5514; FAX: (303) 236-3200; E-mail: lgough@helios.cr.usgs.gov)

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, DC 20052
USA
TEL: (202) 994-6194
FAX: (202) 994-0450
e-mail: ndfrs@gwuvm.gwu.edu

Deadlines for the Next Four Issues of EXPLORE

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

Issue	Publication date	Contributor's Deadline
90	January 1996	November 30, 1995
91	April 1996	February 29, 1996
92	July 1996	May 31, 1996
93	October 1996	August 31, 1996

RECENT PAPERS

This list comprises titles that have appeared in major publications since the compilation in **EXPLORE** Number 88. 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.

Beeson, R., 1995. A drainage sediment geochemical orientation study at Boddington, Western Australia. J. Geochem. Explor. 54 (1): 63-71.

Bierlein, F.P., 1995. Rare-earth element geochemistry of clastic and chemical metasedimentary rocks associated with hydrothermal sulphide mineralization in the Olary Block, South Australia. Chem. Geol. 122 : 77-98.

Cameron, E.M., Hall, G.E.M., Veizer, J., and Krouse H.R., 1995. Isotopic and elemental hydrogeochemistry of a major river system: Fraser River, British Columbia, Canada. Chem. Geol. 122 : 149-169.

Cerny, P. and Lenton, P.G., 1995. The Buck and Pegli lithium deposits, southeastern Manitoba: The problem of updip fractionation in subhorizontal pegmatite sheets. EG 90 (3): 658-675.

Cook, S.J., Levson, V.M., Giles, T.R. and Jackaman, W., 1995. A comparison of regional lake sediment and till geochemistry surveys: A case study from the Fawnie Creek area, central British Columbia. Explor. Min. Geol. 4 (2): 92-110.

Ewers, G.R., Mackenzie, D.E., Cruikshank, B.I, and Andrews, A.S., 1994. Whole-rock regional oxygen-isotope depletion patterns as a guide to epithermal gold exploration in north Queensland. AGSO J. Aust. Geol. and Geophysics. 15 (4): 395-412.

Ferreira Filho, C.F., Naldrett, A.J., and Asif, M., 1995. Distribution of platinum-group elements in the Niquelandia layered mafic-ultramafic intrusion, Brazil: Implications with respect to exploration. Can. Min. 33 (1): 165-184.

Fletcher, W.K., Cook, S.J., Hall, G.E.M., Scagel, R.K., and Dunn, C.E., 1995. Enrichment of platinum and associated elements in organic seepage soils of th e Tulameen ultramafic complex, southern British Columbia. J. Geochem. Explor. 54 (1): 39-47.

Fyffe, L.R., 1995. Regional geology and the lithogeochemistry in the vicinity of the Chester VMS deposit, Big Bald Mountain area, New Brunswick, Canada. Explor. Min. Geol. 4 (2): 153-173.

Goldfarb, R.J., Borden, J.C., and Winkler, G.R., 1995. Geochemical Survey of the Valdez 1° x 3° Quadrangle, South-Central Alaska. USGS Bull. 2084. 77 p.

Hall, G.E.M., MacLaurin, A.I., and Vaive, J.E., 1995. Reabsorption of gold during the selective extraction of the "Soluble organic" phase of humus, soil and sediment samples. J. Geochem. Explor. 54 (1): 27-38.

Konstantinov, M.M. and Strujkov, S.F., 1995. Application of indicator haloes (signs of ore remobilization) in exploration for blind gold and silver deposits. J. Geochem. Explor. 54 (1): 1-17.

Kovalenko, V.I. and Yarmolyuk, V.V., 1995. Endogenous rare metal ore formations and rare metal metallogeny of Mongolia. EG 90 (3): 520-529.

Kovalenko, V.I., et al., 1995. The peralkaline granite-related Khaldzan-Buregty rare-element (Zr, Nb, REE) deposit, Western Mongolia. EG 90 (3): 530-547.

Kravchenko, S.M. and Pokrovsky, B.G., 1995. The Tomtor Alkaline Ultrabasic Massif and related REE-Nb deposits, Northern Siberia. EG 90 (3): 676-689.

Levitski, A., Filanovski, B., Bourenko, T., Tannenbaum, E. Ban-Am, G., and Dukhanin, A., 1995. A preliminary study of the diffusion sampling technique in locating buried mineralization and an oil field in Southern Israel. J. Geochem. Explor. 54 (1): 73-86.

Lindsey, D.A. and Clark, R.F., 1995. Copper and Uranium in Pennsylvanian and Permian Sedimentary Rocks, Northern Sangre de Cristo Range, Colorado. USGS Bull. 2116. 23 p.

Loferski, P.J. and Ayuso, R.A., 1995. Petrography and mineral chemistry of the composite Deboullie pluton, northern Maine, USA: Implications for the genesis of Cu-Mo mineralization. Chem. Geol. 123 : 89-105.

London, D. and Manning, D.A.C., 1995. Chemical variation and significance of tourmaline from Southwest England. EG 90 (3): 495-519.

Lotter, N.O., 1995. Review of evaluation models for the representative sampling of ore. J.S. African IMM 95 (4): 149-155.

Lottermosen, B.G., 1994. Carbonatites and ore deposits. Aus. IMM Proc. 299 (2): 35-41.

Makinen, J., 1995. Effects of grinding and chemical factors on the generation and composition of the till fine fraction: an experimental study. J. Geochem. Explor. 54 (1): 49-62.

Continued on Page 19

Recent Papers

Continued from Page 18

Melcher, F., 1995. Genesis of chemical sediments in Birimian greenstone belts: evidence from gondites and related manganese-bearing rocks from northern Ghana. Min. Mag. 59 (2): 229-251.

Mills, R.A. and Elderfield, H., 1995. Rare earth element geochemistry of hydrothermal deposits of the active TAG Mound, 26° N Mid-Atlantic Ridge. GCA 59 (17): 3511-3524.

Morteani, G., Preinfalk, C., Spiegel, W., and Bonalumi, A., 1995. The Achala Granitic Complex and the pegmatities of the Sierras Pampeanas (Northwest Argentina): A study of differentiation. EG 90 (3): 636-647.

Mulja, T., Williams-Jones, A.E., Wood, S.A., and Boily, M., 1995. The rare-element-enriched monogranite-pegmatite-quartz vein systems in Preissac-Lacorne batholith, Quebec. I. Geology and Mineralogy and II. Geochemistry and Petrogenesis. 33 : 793-815 and 817-833.

Nesbitt, B.E. and Muchlenbachs, K., 1995. Geochemical studies of the origins and effects of synorogenic crustal fluids in the southern Omineca Belt of British Columbia, Canada. GSA Bull. 107 (9): 1033-1050.

Oberthur, T. (Ed.), 1994. Metallogenesis of Selected Gold Deposits in Africa. Geologisches. Jahrbuch Reihe D., Helt 100. 679 p.

Partington, G.A., McNaughton, N.J., and Williams, I.S., 1995. A review of the geology, mineralization and geochronology of the Greenbushes pegmatite, Western Australia. EG 90 (3): 616-635.

Pollard, P.J., 1995. Geology of rare metal deposits: An introduction and overview. EG 90 (3): 489-494.

Pollard, P.J., Nakapadungrat, S., and Taylor, R.G., 1995. The Phuket Supersuite, Southwest Thailand: Fractionated I-type granites associated with tin-tantalum mineralization. EG 90 (3): 586-602.

Raffensperger, P. and Garven, G., 1995. The formation of unconformity-type uranium ore deposits: I. Coupled groundwater flow and heat transport modeling. Am. J. Sci. 295 (5): 581-.

Raimboult, L., Cuney, M., Azencott, C., Duthou, J.L., and Joron, J.L., 1995. Geochemical evidence for a multistage magmatic genesis of Ta-Sn-Li mineralization in the granite at Beauvoir, French Massif Central. EG 90 (3): 548-576.

Robinson, D.A. and Williams, R.B.G. (Eds.), 1994. Rock Weathering and Landform Evolution. Wiley. 519 p.

Rub, M.G., Rub, A.K., and Salmin, Yu.P., 1995. Compositional features of the REE and rare-elements of zircons from mineralized granitoids. Geochem. Intern. 32 (7): 1-14.

Speczik, S., Bechtel, A., Sun, Y.Z., and Puttmann, W., 1995. A stable isotope and organic geochemical study of the relationship between the Anthracosia shale and Kupferschiefer mineralization (SE Poland). Chem. Geol. 123 : 133-151.

Stewart, K.C. and McKown, D.M., 1995. Sagebrush as a sampling medium of gold exploration in the Great Basin - evaluation from a greenhouse study. J. Geochem. Explor. 54 (1): 19-26.

Suwimonprecha, P., Cerny, P. and Friedrich, G., 1995. Rare metal mineralization relate to granites and pegmatites, Phuket, Thai land. EG 90 (3): 603-615.

Trumbull, R.B., 1995. Tin mineralization in the Archean Sinceni Rare Element Pegmatite Field, Kaup vael Craton, Swaziland. EG 90 (3): 648-657.

Whateley, M.K.G. and Harvey, P.K. (Eds.), 1994. Mineral Resource Evaluation II: Methods and Case Histories. Geol. Soc. (London) Spec. Pub. 79. 271 p.

Wignall, P.B., 1994. Black Shales. Oxford Univ. Press. 127 p.

Yin, L., Pollard, P.J., Shouxi, H., and Taylor, R.G., 1995. Geologic and geochemical characteristics of the Yiehun Ta-Nb-Li deposit, Jiangxi Province, South China. EG 90 (3): 557-585.

Young, L.E., 1995. Empirical applications of common lead-isotope ratios to exploration. SEG Newsletter #22: 1, 7-12.

Zhongfu, C., Wenda, L., Webin, W., et al., 1994. Geochemical behavior of microelements of south China basalts during laterization. Volcanology and Min. Res. 15 (2): 35-46.

ASSOCIATION OF EXPLORATION GEOCHEMISTS

SPECIAL BOOKS OFFER 1994/1995

The following books published by ELSEVIER SCIENCE are available from the AEG on a post-paid basis. Members are entitled to a reduction of the normal price.

Author/Title	Non-member Price US$	Member Price US$	
Augustithis, S.S. Atlas of Metamorphic-Metasomatic Textures and Processes	195.50	117.50	________
Bárdossy, G. and Aleva G.J.J. Lateritic Bauxites	186.00	112.00	________
Buchanan, D.L. Platinum-Group Element Exploration	105.50	63.50	________
Butt, C.R.M. and Zeegers, H. Regolith Exploration Geochemistry in Tropical and Subtropical Terrains	205.50	123.50	________
Chapman, N.A. et al. The Poços de Caldas Project: Natural Analogues of Processes in a Radioactive Waste Repository	214.50	128.50	________
Das, H.A., Faanhof A. and van der Sloot, H.A. Radioanalysis in Geochemistry	132.50	79.50	________
David, M. Handbook of Applied Advances Geostatistical Ore Reserve Estimation	96.00	57.50	________
Didier, J. and Barbarin, B. Enclaves and Granite Petrology	168.00	101.00	________
Fletcher, W.K. Analytical Methods in Geochemical Prospecting	116.00	69.50	________
Govett, G.J.S. Rock Geochemistry in Mineral Exploration	172.00	103.00	________
Gulson, B.L. Lead Isotopes in Mineral Exploration	112.50	67.50	________
Hedenquist, J.W., White, N.C. and G. Siddely Epithermal Gold Mineralization of the Circum-Pacific: Geology, Geochemistry, Origin and Exploration	302.50	181.50	________
Howarth, R.J. Statistics and Data Analysis in Geochemical Prospecting	168.50	101.00	________
Kauranne, L.K., Salminen, R. and K. Eriksson Regolith Exploration Geochemistry in Arctic and Temperate Terrains	160.00	96.00	________
Kwak, T.A.P. W-Sn Skarn Deposits and Related Metamorphic Skarns and Granitoids	155.50	93.50	________
Laznicka P. Breccias and Coarse Fragmentites	222.50	133.50	________
Mysen, B.O. Structure and Properties of Silicate Melts	112.50	67.50	________
Naqvi, S.M. Precambrian Continental Crust and its Economic Resources	151.50	91.00	________

Total Payment enclosed ________

To qualify for discount, all orders must be received by the AEG before June 1, 1995. Orders must be accompanied by payment. Orders will be shipped by surface mail.
Send orders to AEG, P.O. Box 26099, 72 Robertson Rd., Nepean, Ontario K2H 9RO, Canada. Fax orders (+1) 613 828 9288

Please note that cheques, International Money Orders, UNESCO coupons, International Postal Orders, VISA and MasterCards are acceptable. All payments are in US funds.

For users of VISA or MasterCard, minor variations in billing may reflect currency exchange rates at the time of bank posting. Please note that the cheques drawn on overseas banks require an additional US$ 15.00 to be submitted to reimburse the AEG for bank charges.

Charge: ☐ MasterCard ☐ VISA

Credit Card Account number here:

____

Expiry date: ________

Signature ________

Name ________

Address ________

____

AEG PUBLICATIONS

The following special volumes are available from the AEG on a post-paid basis (surface mail) to all.
Both member and non-member prices are listed.

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	______
14	✱	PROBPLOT, An Interactive Computer Program to Fit Mixtures of Normal (or Log Normal) Distributions with Maximum Likelihood Optimization Procedures (C.R. Stanley). *On 3.5" diskette; requires 1 mb hard disk space*	*US $30.00*	*US $55.00*	______
4+14	✱	Combination offer	US $35.00	US $60.00	______
7		Geochemical Exploration 1977 Proceedings of the Denver Geochemical Symposium (ed. J.R. Waterson and P.K. Theobald)	US $20.00	US $40.00	______
10		Gold-81, Precious Metals in the Northern Cordillera (ed. A.A. Levinson)	US $ 7.50	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 October 1984 (complied by H.E. Hawkes)	US $10.00	US $17.00	______
11.2		Exploration Geochemistry Bibliography Supplement 2 to October 1987 (complied by H.E. Hawkes)	US $10.00	US $17.00	______
—		Digital bibliography - entire AEG bibliography through 1994. A *.dbf file on 3.5" diskette (requires 14 mb hard disk space)	US $10.00	US $20.00	______
12		Writing Geochemical Reports (S.J. Hoffman)	US $ 5.00	US $ 7.00	______
—		Geochemical Exploration 1980 - Hannover (ed. A.W. Rose and H. Gundlach). Hard cover edition	US $35.00	US $50.00	______
—		GEOEXPO/86, Proceedings of an exploration symposium focussing on Cordilleran environments held in Vancouver May 12-14, 1986 (ed. I.L Elliot and B.W. Smee)	US $25.00	US $25.00	______
—		Reviews in Economic Geology Volume 3. Exploration Geochemistry; Design and *Interpretation of Soil Syrveys (ed. W.K. Fletcher). This volume was co-sponsored by the SEG.*	*US $20.00*	*US $25.00*	______
—		1992 AEG Membership Listing and Directory of Exploration Geochemical and Environmental Services	US $10.00	US $20.00	______
—		Epithermal Gold Mineralization of the Circum-Pacific; Geology, Geochemistry, Origin and Exploration, Volumes 1 and 2. Journal of Geochemical Exploration, Volumes 35 and 36: Hard-Covered Edition)	US $160.00	US$246.25	______
—		Soils of the World. Colour wall chart. 95 cm x 135 cm in size. Published by Elsevier.	US $22.00	US $28.00	______
SPECIAL 1.		Practical Problems in Exploration Geochemistry, 1987. (A.A. Levinson, P.M.D. Bradshaw and I. Thomson) 269 pp.	US $35.00	US $80.00	______
—		17th IGES Extended Abstracts from "Exploring the Tropics", 15-19 May, 1995, Townsville Australia (for airmail add $20)	US $50.00	US $65.00	______
—		A Global Geochemical Database for Environmental and Resource Management, Recommendations for International Geochemical Mapping, Final Report of IGCP Project 259. (A.G. Darnley A. Bjorkland, B. Bolviken, N. Gustavsson, P.V. Koval, J.A. Plant, A. Steenfeld, M. Tauchid and Xie Xuejing; with contributions by R. Garrett, and G.E.M Hall).	US $20.00	US $20.00	______
—		Journal of Geochemical Exploration in Subscription Years 1994 and earlier, whole year or part	US $70.00	N/A	______

NOTE: Members may order back issues or volumes for the usual membership fee. The member may elect to receive all issues of that subscription year or just the issue/volume desired (the price is the same). The 1995 subscription year will be "back issued" six months after completion (ca. Oct., 1995).

Notes for Short Courses on Biogeochemical Exploration. Each book comprises 200-250 pages of text, figures, tables, and photos. The content of each is similar, except different aspects are emphasized. All prices quoted are for surface mailing; if airmail is desired please add (US)$15.00

	Description	Member Price	Non-Member Price	
—	Biogeochemical Exploration, Simplified - with emphasis on arid terrains (C.E. Dunn, J.A. Erdman, G.E.M. Hall, and S.C. Smith) *Note: this text includes geobotanical aspects in some detail*	US $50.00	US $50.00	______
—	Applied Biogeochemical Prospecting in Forested Terrain (C.E. Dunn, G.E.M. Hall, and Scagel) Note: this text includes a 42 page discourse on plants	US $50.00	US $50.00	______
—	Applied Biogeochemistry in Mineral Exploration and Environmental Studies (C.E. Dunn, G.E.M. Hall, R. Scagel, D. Cohen, P. Catt, and M. Lintern)	US $55.00	US $55.00	______

Note: This text is an expansion of the volume 'Applied Biogeochemical Prospecting in Forested Terrain' and includes several case histories from Australia. In Australia the volume can be obtained from Dr. David Cohen, Dept. Geology, Univ. New South Wales, Sydney, AUSTRALIA, for Aus$60.00.

	Member Price	Non-Member Price	
AEG T-Shirt Size: S ☐ M ☐ L ☐ XLG ☐ Colour: Royal blue - white print Grey - ice green print White - rich blue print	US $10.00	US $12.00	______
Do you need a receipt? Include self-addressed envelope and US $ 2.00, otherwise your cancelled check or bank card statement is 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 $ 15.00.	US $15.00	US $15.00	______
☐ *Do you require airmail? If yes, add US $10.00 per volume, unless otherwise noted. (Specify number of volumes)*	____ X	US $10.00	______
	TOTAL US $		______

Send Orders to: P.O. Box 26099, 72 Robertson Road, Nepean, Ontario, K2H 9R0, CANADA; FAX: (613) 828-0199

AEG APPLICATION FOR NON-VOTING MEMBERSHIP*

to the Association of Exploration Geochemists

Please complete the section relevant to the class of membership sought and supply your address on this form. Mail the completed application, together with annual dues, to the address below.

MEMBER

I ______________________________ wish to apply for election as a Member of the Association of Exploration Geochemists. I am presently employed by:

______________________________ as a ______________________________.
(employer) (employment title)

I am actively engaged in scientific or technological work related to geochemical exploration and have been so for the past two years. Upon receipt of the Code of Ethics of the Association I will read them and, in the event of being elected a Member, agree to honour and abide by them. Witness my hand this_____day of__________19_____. ______________________________
(Signature of applicant)

STUDENT MEMBER

I ______________________________ wish to apply for election as a Student Member of the Association of Exploration Geochemists. I am presently engaged as a full-time student at ______________________________, where I am taking a course in pure or applied science. I have read the Code of Ethics of the Association and in the event of being elected a Student Member agree to honour and abide by them. Witness my hand this_____day of__________19_____.

____
(Signature of applicant)

Student status must be verified by a Professor of your institution or a Fellow of the Association of Exploration Geochemists. I certify that the applicant is a full-time student at this institution.

______________________________ ______________________________
(Signature) (Printed Name and Title)

NAME AND ADDRESS

(to be completed by all applicants)

Name: ______________________________
Address: ______________________________
____
____
____

Telephone:
bus: ______________________________
fax: ______________________________
home: ______________________________
email: ______________________________

Annual Dues

All applications must be accompanied by annual dues. Select one or two below:

1	1995 member dues	US$	70	________
2	1995 student member dues		40	________
	If you require a receipt, include a self-addressed envelope and add		2	________
	If your check is not drawn from a U.S.A. or Canadian bank, add		15	________
			TOTAL	________

All payments must be in US funds. Payment by check, International Money Order, UNESCO Coupons, International Postal Orders, VISA and Master Card are acceptable. For users of VISA or Master Card, minor variations in your billing may reflect currency exchange rate fluctuations at time of bank transaction.

If you pay by charge card, please provide the following information: type: Master Card _____ VISA _____

Credit card account number: ______________________________ Expiration date: ____________.

Name: ______________________________ Signature: ______________________________

Please note: Your completed form should be mailed to the Business Office of the Association and will be acknowledged upon receipt. The Admissions Committee reviews all applications and submits recommendations to Council, who will review these recommendations at the next Council Meeting or by correspondence. If no objection is raised the names, addresses and positions of candidates will be listed in the next issue of the Association Newsletter. If after a minimum of 60 days have elapsed following submission of candidate information to the membership no signed letters objecting to candidates admission are received by the Secretary of the Association from any Member, the Candidate shall be deemed elected, subject to the receipt by the Association of payment of required dues. Send completed application, together with annual dues to:

Association of Exploration Geochemists, P.O. Box 26099, 72 Robertson Road, Nepean, Ontario, CANADA K2H 9R0
TEL: (613) 828-0199, FAX: (613) 828-9288, email: aeg@geology.isis.org

*Application for voting membership requires the sponsorship of three voting members. Request a voting member application from the Association office.

THE ASSOCIATION OF EXPLORATION GEOCHEMISTS

P.O. Box 26099, 72 Robertson Road, Nepean, Ontario K2H 9R0 CANADA
Telephone (613) 828-0199

OFFICERS

January 1994 - December 1995

Gwendy E.M. Hall, *President*
Geological Survey of Canada
Room 702, 601 Booth Street
Ottawa, Ontario K1A 0E8
CANADA
TEL: (613) 992-6425
FAX: (613) 996-3726
email: hall@gsc.emr.ca

William B. Coker, *First Vice President*
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A 0E8
CANADA
TEL: (613) 992-2378
FAX: (613) 996-3726
email: coker@gsc.emr.ca

David Garnett, *Second Vice President*
Becquerel Laboratories Pty, Ltd.
P. M. B. 1
Menai, New South Wales 2234
AUSTRALIA
TEL: (612) 543-2644
FAX: (612) 543-2655
email: bq@atom.ansto.gov.au

Sherman P. Marsh, *Secretary*
U.S. Geological Survey
MS 973, Denver Federal Center
Denver, Colorado 80225
USA
TEL: (303) 236-5521
FAX: (303) 236-3200
email: smarsh@helios.cr.usgs.gov

Eion M. Cameron, *Treasurer*
Geochemistry Subdivision
Geological Survey of Canada
601 Booth Street
Ottawa, ON KIA 0E8, Canada
TEL: (613) 496-6420
FAX: (613) 996-9990
email: cameron@gsc.emr.ca

COUNCILLORS

1993-1995
John Fortescue
Jeffrey A. Jaacks (ex-officio)
Owen P. Lavin
Howard R. Lahti
Frederic R. Siegel
Erick F. Weiland

1995-1997
Graham F. Taylor (ex-officio)
John S. Cone
Mark A. Fedikow
R. Steve Friberg
Alistair J. Sinclair
Barry W. Smee

Australia 1994-1996
Russell D. Birrell
Mark Elliott
Brazil 1993-1995
Marcondes Lima Da Costa
Chile
Chris J. Oates
China
Vacant

Europe 1992-1994
Günter Matheis
Northern Countries 1992-1994
Agnete Steenfelt
Southeast Asia 1994-96
Tawsaporn Nuchanong
Southern Africa 1995-1997
Hannes Henckel
UK and Republic of Ireland 1994-96
Peter R. Simpson

COMMITTEES

Australian Geoscience Council Representative
Russell D. Birrell

Canadian Geoscience Council Representative
Colin E. Dunn

Awards and Medals Committee
Graham F. Taylor, *Chair 1995-1996*
John S. Cone
Robert G. Garrett
Günter Matheis
Barry W. Smee

Bibliography Committee
L. Graham Closs, *Chair*
Robert G. Garrett
Richard K. Glanzman
Eric C. Grunsky
Gwendy E.M. Hall
Peter J. Rogers

Distinguished Lecturer Committee
Graham F. Taylor, *Chair*

Education Committee
Alastair J. Sinclair, *Chair*

Election Official
Ray E. Lett

Environmental Committee
Richard K. Glanzman, *Chair*
Cecil C. Begley
Peter H. Davenport
Gwendy E.M. Hall
Keith Nicholson

EXPLORE
Sherman P. Marsh, Editor
J. Thomas Nash, Editor
Owen P. Lavin, *Business Manager*

Journal of Geochemical Exploration
Eion M. Cameron, *Editor-in-Chief*

Admissions Committee
Lloyd D. James, *Chair*
L. Graham Closs
Jeffrey A. Jaacks

Publicity Committee
Andrew Bourque, *Chair*
Sherman P. Marsh
J. Stevens Zuker
R. Steve Friberg

Regional Councillor Coordinator
David L. Garnett

Short Course Committee
Colin E. Dunn, *Chair*

Student Paper Competition Committee
Ian Robertson, *Chair*
Frederic R. Siegel
Arthur E. Soregaroli
Todd Wakefield

Symposia Committee
Frederic R. Siegel, *Chair*
Gwendy Hall
Eion Cameron
Graham F Taylor
Barry W. Smee

Betty Arseneault, *Business Manager*
P.O. Box 26099, 72 Robertson Road, Nepean, Ontario K2H 9R0 CANADA, TEL: (613) 828-0199 FAX: (613) 828-9288, e-mail: aeg@geology.isis.org

LIST OF ADVERTISERS

EXPLORE

Newsletter for The Association of Exploration Geochemists

P.O. Box 9777, University Station, Reno, Nevada 89507-9777, USA

Please send changes of address to:
Association of Exploration Geochemists
P.O. Box 26099, 72 Robertson Road, Nepean, Ontario, K2H 9R0, Canada · TEL: (613) 828-0199 FAX: (613) 828-9288
e-mail: aeg@geology.isis.org

NON-PROFIT ORG.
U.S. POSTAGE
PAID
PERMIT NO. 3550
DENVER, CO