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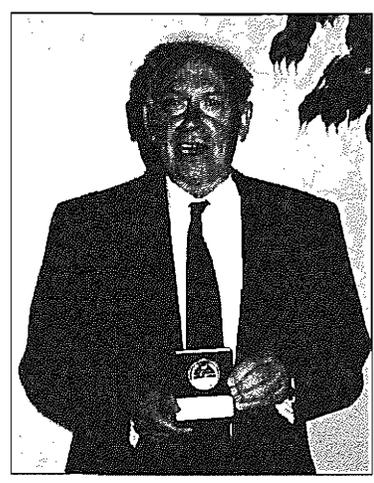
Newsletter for the Association of Exploration Geochemists

NUMBER 80

JULY 1993

AEG PAST PRESIDENTS' MEDAL

The Association of Exploration Geochemists is pleased to announce that Dr. Eion M. Cameron is the first recipient of the Past Presidents' Medal. The Medal is awarded for dedicated service to the Association.



Dr. Cameron, presently a research scientist with the Geological Survey of Canada and an Adjunct Professor in the Department of Geology at the University of Ottawa, has been a member of the Association since its formation in 1970 and, in the ensuing 23 years, has built a remarkable, distinguished and unbroken record of service to the Association and exploration geochemistry. His most outstanding service has been in organizing and editing the *Journal of Geochemical Exploration*. As Founding Editor and Editor-in-Chief, Eion Cameron has guided the Journal through challenging times and to enviable heights as, indisputably, the leading publication in the exploration geochemistry discipline and one of the leading international journals in the field of mineral exploration. His editorial wisdom and his insistence on excellence has been a major influence on the progressive development of exploration geochemistry and has served to establish the Association of Exploration Geochemists as an effective and influential scientific and professional society.

His contributions to the Association have not been limited to matters related to the Journal. He served on the Association's Council from 1971 to 1976 including two years as Vice President. He was a Chairman and Editor of the organizing committee for the first Symposium on Geochemical Prospecting held in Ottawa in 1966. and subsequently brought the benefit of his considerable experience to the organizing committees of several other International Geochemical Exploration Symposia.

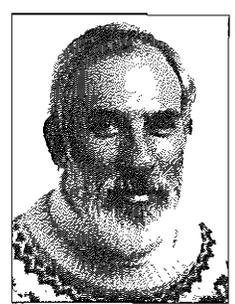
In summary, through the award of the Past Presidents' Medal the Association of Exploration Geochemists wishes to recognize the significant contribution that Dr. Cameron's dedicated efforts have made to the present stature of the Association of Exploration Geochemists and the *Journal of Geochemical Exploration*. The Medal was presented to Dr. Cameron on April 19, 1993 at the Association's Annual General Meeting in Denver.

K. Fletcher
Chairman, AEG Awards Committee



PRESIDENT'S MESSAGE

The SEG conference "Integrated Methods in Exploration and Discovery," partially sponsored by the AEG, attracted over 800 people to the Red Lion Hotel in Denver on 17-20 April. It was pleasing to note the number of geochemical papers and posters, particularly on application to mineral exploration in developing countries. However, there was very little evidence of integration with other exploration techniques and little reference to innovative techniques.



One forum addressed "Conflict between quality and cost in mineral (read assay) laboratories" and together with two short courses on environmental and exploration geochemistry was well attended.

While in Denver, the Association held Executive and Council Meetings by telephone. In addition, the annual general meeting (AGM) was held in conjunction with the SEG meeting and it attracted record attendance. The outcomes of these meetings are reported elsewhere in this issue. In his Presidential Address, Jeff Jaacks detailed the operations of AEG and noted that even though the membership continued to grow we are still losing far too many members. Another cause for concern is the relative decline in Fellow (voting) members. I hope that some of the measures initiated by the outgoing Council will reverse these trends.

One important outcome of the Denver Meeting was the appointment of a full-time Business Manager Art Clendenan who has had wide industry experience and who has been

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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:

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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 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.

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Editor: Owen P. Lavin (303) 837-5820

Associate Editors: Sherman P. Marsh (303) 236-5521

J. Stevens Zuker (303) 988-9677

Assistant Editors:

L. Graham Closs (303) 273-3856

Steve Cone (303) 232-8371

Gwendy E. M. Hall (613) 992-6425

Lloyd D. James (303) 741-5199

Anne M. Leibold (303) 295-1101

Richard Meeuwig (702) 784-6691

Fredrick P. Schwarz (702) 758-9234

Frederic R. Siegel (202) 994-6194

FAX (303) 236-3200, ATTN: Sherman Marsh, USGS

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NOTES FROM THE EDITOR

This issue of EXPLORE comes on the heels of the highly successful SEG conference in April and at the height of the North American field season. A highlight of this issue is announcement of the first AEG Past Presidents' medal to Dr. Eion Cameron. On the technical side, Dr. Gwendy Hall supplies us with a timely article on work she has recently performed on partial digestions, a subject that will not, and should not, die.

Owen P. Lavin

Editor



President's Message

Continued from Page 1

...serving on a part-time basis will be in the Vancouver office from 1 May, 1993 to undertake a host of duties. As Art takes over, Loraine Kluber who has been in the office for four years will be retiring to beautiful Vancouver Island to write family histories for the locals. We wish Loraine every happiness in her retirement and thank her sincerely for all the work she has done for AEG both in the office and on the ferry. Thank you Loraine.

Since returning to Australia I have been part of a team giving lectures on exploration geochemistry to senior undergraduates and postgraduate students at the University of Tasmania. Members of this team give similar lectures at James Cook (Townsville), Curtin (Perth and Kalgoorlie) and University of Western Australia whilst University of New South Wales continues to provide under- and post-graduate courses. The matter of geochemical education is continually before the Council. I have asked Al Sinclair (Education) and Colin Dunn (Short Courses) to present some plans to the Council for discussion later this year. I am sure they would welcome ideas and information on the teaching of exploration geochemistry to other countries.

Many thanks to Jeff and the out-going Council Members and welcome to Bill Coker and the new Council members.

Graham Taylor,

AEG President



TECHNICAL NOTES

The Diagnostic Capabilities of Selective Leaching

The use of selective leaching is enjoying renewed examination today in both exploration and environmental geochemistry programs. Undoubtedly, the interest amongst mining companies was stimulated by the success reported by the Soviets (e.g., by J.S. Ryss and I.S. Goldberg formerly of Rudgeophysika, St. Petersburg; see Antropova et al., 1992) in locating deeply buried mineralization employing, essentially, phase-selective analytical procedures. The premise is that ore and pathfinder elements are transported by various mechanisms from the source to the surficial environment where they are held in relatively labile forms associated with different reaction sites. Research indicates that organic matter and hydrous coatings of Fe and Mn are the most important surface-active phases, otherwise known as "scavengers," in environments ranging from soils to seawater. Thus, geochemical exploration methods should be geared towards detecting these secondary forms of elements and differentiating them from the "total" or near total signatures obtained by applying the more conventional aqua regia or perchloric/nitric acid digestions to soils, tills, humus and sediments. The Analytical Method Development (AMD) Section of the Geological Survey of Canada (GSC) has designed and is in the process of evaluating leaches that mimic the action of the two Soviet methods designated: "MPF", based on the extraction of metal-organic complexes (principally with humic and fulvic acids); and "TMGM", intended to preferentially extract those elements adsorbed by amorphous forms of Fe and Mn oxyhydroxides. While these directions have been pursued at the GSC, the USGS has concentrated on evaluating and modifying the other Soviet "electrogeochemical" method known as CHIM (see Smith et al., 1993), purported to be used at a more detailed scale than the former methods.

Concurrent with the above projects, a more comprehensive sequential selective extraction scheme was being devised by the AMD group as part of a multi-disciplinary project, known as "EXTECH", an aim of which was to develop new methods of exploration for volcanogenic massive sulphide deposits such as those at Snow and Ruttan Lakes in northern Manitoba. The scheme currently being implemented for soils and tills in EXTECH is summarised in Table 1. Various schemes have been published which differ-

entiate between metals held by the highly scavenging amorphous Fe oxides and organic matter and those held in other phases such as carbonates, crystalline Fe oxides, sulphides and silicates.

Table 1. Sequential extraction scheme.

EXTRACTANT	PHASE DISSOLVED
1M NaOAc.HOAc 1g sample/20 ml 2 x 6 h constant shaking	Adsorbed metals, exchangeable, carbonates, and some phosphates.
0.25M NH ₂ OH.HCl in 0.25 M HCl 20 ml reagent, at 60°C; first leach for 2 h, second leach for 0.5 h	Amorphous oxyhydroxides of Fe and Mn.
1M NH ₂ OH.HCl in 25% HOAc. 30ml reagent, at 90°C; first leach for 3 h, second leach for 1.5 h	Crystalline Fe oxides (e.g., hematite, goethite, magnetite maghemite, lepidocrocite)
KClO ₃ /HCl, 15 ml, for 0.5 h with mixing; followed by 4M HNO ₃ (10 ml) at 90°C	Sulphides and "less soluble" organic matter.
HF-HClO ₄ -HNO ₃ -HCl, 10 ml, to dryness	Silicates, residual crystalline fraction (refractory minerals could remain in a final residue).

Ac = acetate, h = hour

Applications in geochemistry up to 1984 have been reviewed by T.T. Chao and a more recent summary is given in the book edited by G.E. Batley (1989). The identification of the main binding sites of trace metals not only helps our understanding of geochemical processes but also allows us to discriminate between sources (e.g., atmospheric deposition vs. hydromorphic transport vs. clastic dispersion), to estimate the potential for remobilisation, and to determine the bioavailability of the metal.

The measurement of speciation is a much more challenging task than the determination of total content. A

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Technical Notes

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sequential extraction scheme consists of a series of successive chemical treatments of a sample, each being more drastic in action or of a different nature than the previous one. The order in which the extractants are used is critical and may well depend upon sample type and overall composition. It must be recognised that the results obtained are "operationally defined", i.e. selectivity is not 100% and is dependent upon such factors as the chemicals employed, the time and nature of contact, sample to volume ratio etc. Clearly, results will also be predicated on the grain-size fraction chosen for analysis and whether coarser grains have been made finer by ball-milling, thus increasing exposure to attack.

The reagents identified in Table 1 were selected for their specificity after reviewing the literature. The water-soluble and exchangeable metals are the first to be brought into solution by any partial technique and we have grouped these classifications together with carbonate held (calcite, dolomite, magnesite) metals in the first leach using sodium acetate buffered at pH 5. Associations of trace metals with Fe and Mn oxides range from exchangeable forms (formation of surface complexes of interfacing solutes and functional groups attached to oxide surfaces), through moderately fixed, still termed "labile" (coprecipitated with amorphous oxides, = "TMGM"), to relatively strongly bound or "non-labile" (e.g., occluded in goethite and other oxide mineral structures). We chose increasing reducing action via changing the strength of hydroxylamine hydrochloride to differentiate between metals held in amorphous and crystalline Fe oxides. While Tamm's reagent (ammonium oxalate-oxalic acid) in the dark and with UV irradiation has been used successfully to leach these two phases of Fe (Fonseca et al., 1992); however, this reagent was rejected as it is known to dissolve significant amounts of magnetite and lepidocrocite in addition to organic complexes (Chao and Zhou, 1983). While the selectivity of weak, alkaline EDTA may be superior for the dissolution of amorphous Fe, the long contact time (weeks) precludes its adoption for widespread application. Following the attack on Fe oxides, the reagent action changes from reducing to oxidising to dissolve sulphides using potassium chlorate/HCl followed by heating in HNO₃. Organics not dissolved in earlier leaches will obviously be attacked at this stage. Finally, silicates and more resistant minerals are dissolved in the mixed acid digestion of HF-HClO₄-HNO₃-HCl, leaving some

refractory minerals such as cassiterite, sphenes, barite, and tourmaline still largely untouched. The solutions derived by application of these leaches are analysed by either flame atomic absorption spectrometry (AAS) or ICP emission spectrometry (ICP-ES).

The extraction of the "soluble organic" component of humus material (= "MPF") or soil is treated separately from the sequential scheme. Metals adsorbed, complexed or chelated by organics (humics and fulvics) can be dissolved by various reagents such as NaOH, H₂O₂ and NaOCl but we have chosen a non-oxidative approach with sodium pyrophosphate (Na₄P₂O₇) which appears to be the most specific in that there is reputedly little attack on sulphides or amorphous Fe oxides at a highly alkaline pH of 10 (McKeague et al., 1971). The effectiveness of pyrophosphate in removing the easily extractable organic matter has been attributed to its ability to chelate with Ca and trivalent metal ions. The removal of cations bound to flocculated humates results in the subsequent conversion of the polyanion to its soluble sodium salts. The broad spectrum of binding mechanisms existing in this category of "organically bound" metal makes the goal of specificity in a reagent difficult to achieve and also leads to difficulty in minimising dissolution of this loosely described phase by other extractants in a sequential scheme. Partial attack on clays can be expected by alkaline pyrophosphate, and recoveries for Fe may represent not only the organically bound portion but also peptized finely-divided ferruginous particles, which have been dispersed and would require removal from solution by ultracentrifugation or ultrafiltration (Jeanroy and Guillet, 1981). Notwithstanding these potential limitations, we have been agreeably surprised with the usefulness and reproducibility of the pyrophosphate leach on humus samples. Our initial procedure was based on a 3 hour (h) continuous extraction of a 1 g sample (sieved to <80 mesh) in 100 ml of the 0.1 M reagent. This has since been reduced to 1 h. A second extraction with fresh reagent is carried out if the pyrophosphate step is to form part of a sequential scheme; usually the amount of elements such as Zn, Cu and Pb present in the second leach is about 10 % of that in the first, with proportions of Fe and Mn being somewhat higher and much more variable. Shown in Figure 1 are Thompson and Howarth (1978) log-log plots used to estimate precision based on replicate analyses of 23-25 humus samples. The mean of two results for each constituent is plotted against the difference in results. The two control lines drawn are the 90th percentile for the selected precision (twice the RSD). Most of the points for Zn and Mn lie within the 10% (5% RSD) precision line while those for Pb, Fe and organic carbon are within the 15% precision lines. Further data on precision by the pyrophosphate leach are gleaned from the mean and standard deviation values obtained for three controls randomly inserted in suites of humus samples and analysed by different operators at the GSC (Table 2). Relative standard deviations are generally better than 10% except at levels close to detection limits (i.e. at < 5-10 ppm).

Precision levels achieved in application of the amorphous Fe oxide leach are shown in the data obtained for two control samples (glacial till sieved to <80 mesh) inserted in two large suites of soils and tills analysed commercially employing the GSC methodology (Table 3). Again, precision for these elements at levels above several ppm is good, particularly since

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Table 2. Mean and standard deviation results in ppm for two 1 h pyrophosphate extractions (summed) of three control samples: LKSD-4 (n = 10), Humus 1 (n = 13), and Humus 2 (n = 12)

Sample	Zn	Cu	Pb	Ni	Co	Mn	Fe
LKSD-4	70.6 ± 2.6	8.8 ± 0.6	65.8 ± 2.9	8.3 ± 1.6	1.7 ± 1.2	229 ± 13	3500 ± 197
Humus 1	10.5 ± 0.8	6.8 ± 2.0	13.5 ± 4.1	8.7 ± 4.0	<2	184 ± 30	2005 ± 159
Humus 2	27.3 ± 1.9	4.2 ± 1.4	<2	3.9 ± 1.7	<2	844 ± 71	6830 ± 467

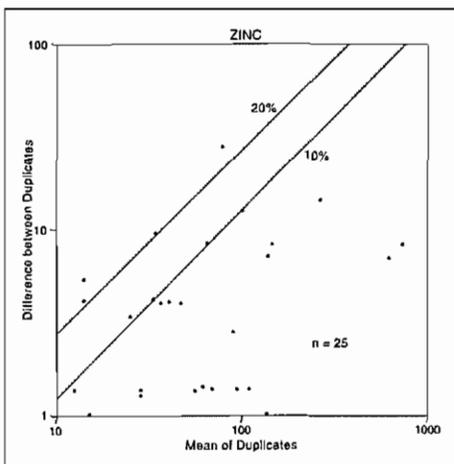


Figure 1a

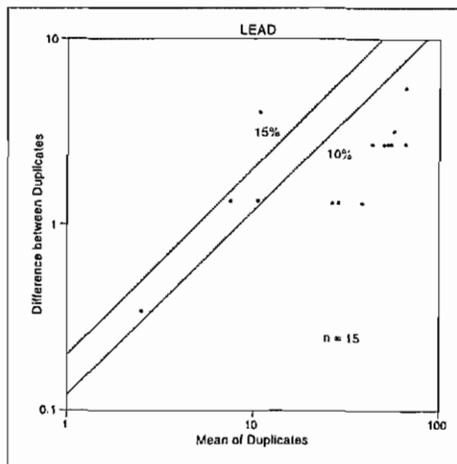


Figure 1b

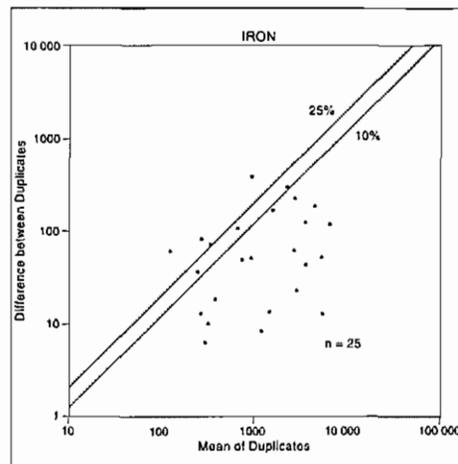


Figure 1c

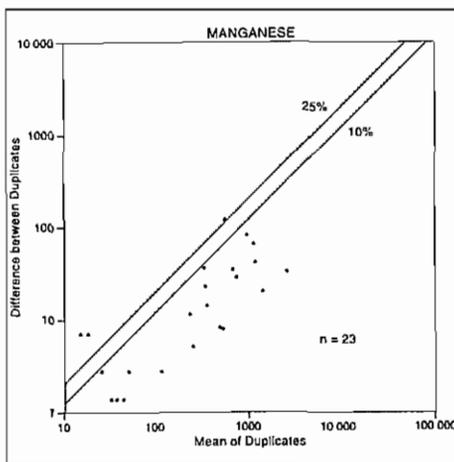


Figure 1d

Figure 1. Thompson and Howarth (1978) precision plots of duplicate results in humus samples for: (a) Zn, in ppm; (b) Pb, in ppm; (c) Fe, in ppm; (d) Mn, in ppm; (e) and organic carbon, in %.

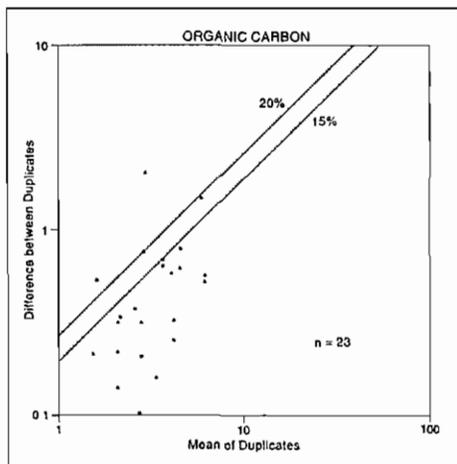


Figure 1e

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Technical Notes

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Table 3. Mean and standard deviation results for the amorphous Fe oxyhydroxide phase extraction ($\text{NH}_2\text{OH}\cdot\text{HCl}$) of two till control samples, separated into two batches.

Sample	Zn, ppm	Cu, ppm	Pb, ppm	Ni, ppm	Co, ppm	Cr, ppm	V, ppm	Ba, ppm	La, ppm	Mn, ppm	Fe, %
TC 3 (n=10)	61.1 ± 4.9	21.5 ± 1.9	10.6 ± 1.0	22.6 ± 2.9	13.2 ± 0.9	38.9 ± 4.6	41.6 ± 4.4	40.7 ± 4.0	10.6 ± 0.4	415 ± 16	2.04 ± 0.23
TC 3 (n=11)	51.2 ± 4.8	17.8 ± 1.5	9.0 ± 1.0	17.3 ± 2.3	11.6 ± 0.9	29.0 ± 4.2	33.6 ± 3.3	41.5 ± 18.8	9.3 ± 0.7	380 ± 20	1.57 ± 0.20
TC 4 (n=10)	5.6 ± 1.4	0.4 ± 0.4	<2	4.0 ± 1.3	<1	9.1 ± 0.9	11.1 ± 1.1	5.3 ± 0.5	2.1 ± 0.4	21 ± 2	0.65 ± 0.05
TC 4 (n=11)	4.7 ± 0.5	0.2 ± 0.3	<2	2.6 ± 0.5	<1	8.2 ± 0.6	10.2 ± 1.0	5.3 ± 2.2	1.9 ± 0.4	22 ± 4	0.59 ± 0.03

it represents variability in both the subsampling and analysis of 1 g aliquots. A bias (calibration?) is evident, however, in that lower absolute values are reported for the second set of controls.

The sequential extraction scheme (Table 1) was carried out on three types of samples: 1) humus, 2) B-horizon soil developed on glacial till (<180 and < 2 μm fractions), and 3) C-horizon glacial till (<180 and < 2 μm fractions) collected from 25 sites in the vicinity of the Chisel Lake mine (Zn-Cu), Snow Lake, Manitoba (Figure 2-facing page). Samples of C-horizon till reflect primary mechanical erosion and transport of mineralized bedrock. B-horizon till (soil) have been subjected to secondary chemical processes in the near surface environment and as a result may be depleted or enriched relative to the C-horizon, depending upon site specific weathering. Humus reflects a combination of surficial geochemical, biogeochemical and atmospheric processes. Four sample sites have been highlighted in Figure 2 to illustrate the benefits of selective leaching. All three sample types were treated according to Table 1 except that humus was first leached with pyrophosphate. The insoluble residue was then taken through the sequential scheme. Results for Zn in the five (soil, till) or six (humus) phases of the three media at these four sites are shown graphically in Figures 3-6. Data shown in Figure 3 for Zn at site four, remote from mineralization, typify background concentrations in this area (note the scale of this figure compared with those of 4-6). Organics are depleted in Zn with respect to till in both soluble and insoluble phases, suggesting no secondary

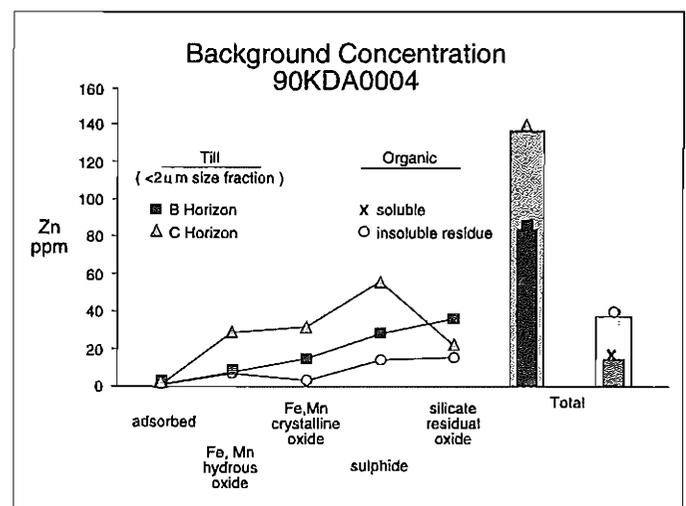


Figure 3. Results for Zn in various phases of humus, soil and till at site 4.

accumulation of metal. In this region, background concentrations reflect primary glacial erosion and transport of non-mineralized bedrock. At site nine, south of the Ghost and Lost mines, the presence of anomalies in all non-labile fractions of both till horizons and the absence of any signal in the labile adsorbed/exchangeable phase (though significant in the amorphous Fe fraction) indicate glacial erosion and transport (Figure 4). Equivalent concentrations of Zn in both horizons suggest that secondary chemical weathering at this site is minimal. At site five, hydromorphic dispersion is concluded from the anomalous concentrations in the labile fractions of Zn in both soluble (4607 ppm!) and the insoluble profiles of humus and the B-horizon (Figure 5). C-horizon till is depleted in Zn in all phases, reinforcing the argument for hydromorphic transport; if the high signatures were derived by movement of ions from depth, then anomalies should be visible here in the labile phases. With reference to Figure 6, the anomalous concentration of Zn in the sulphide phase of the insoluble organic residue of humus at site 11 reflects surface contamination. Probable cause of the anomaly is airborne contamination related to mine dust from tailings and open pit operations at the nearby mines. At site 11, Zn is high throughout all phases except for the first adsorbed/exchangeable phase, suggesting that the till

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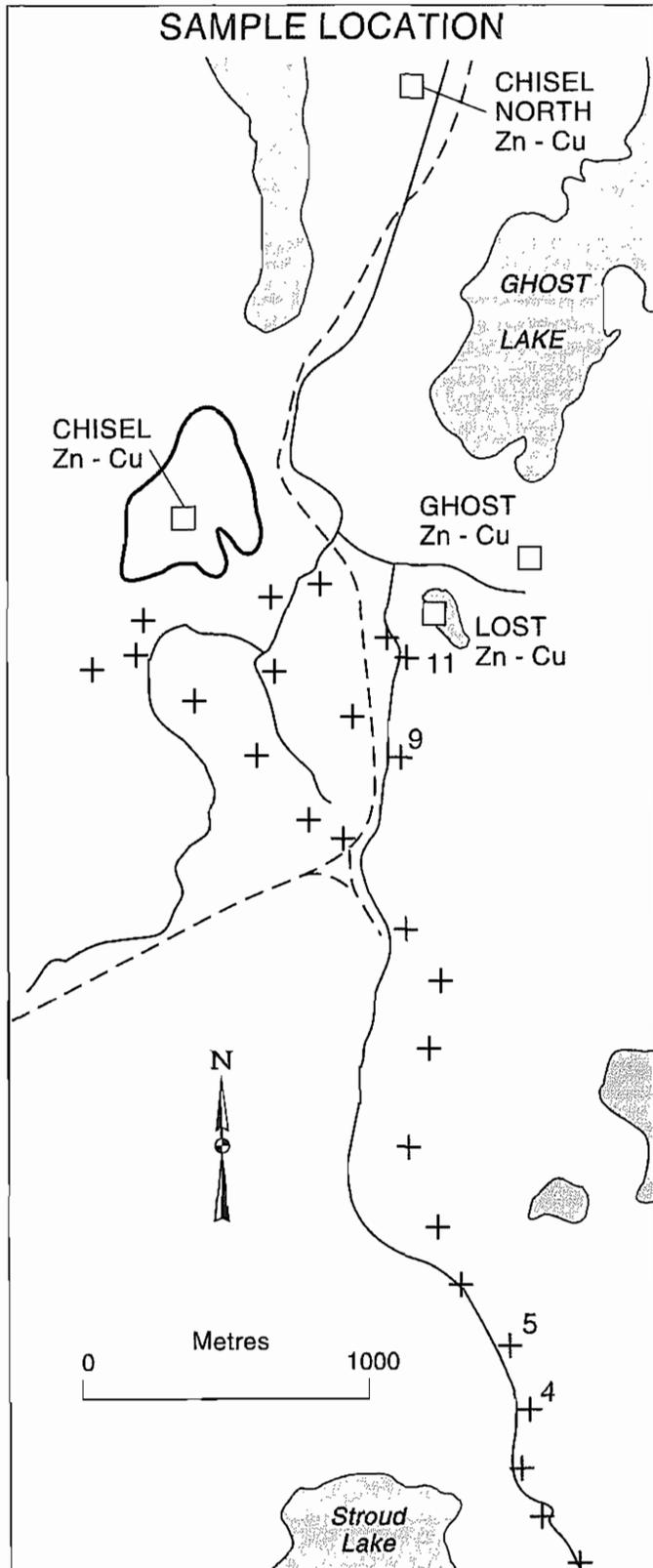


Figure 2. Sample location map at Chisel Lake, northern Manitoba, Canada.

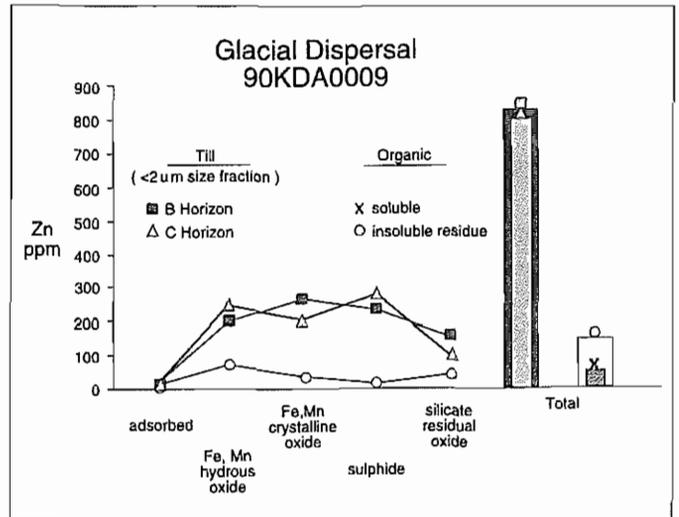


Figure 4. Results for Zn in various phases of humus, soil and till at site 9.

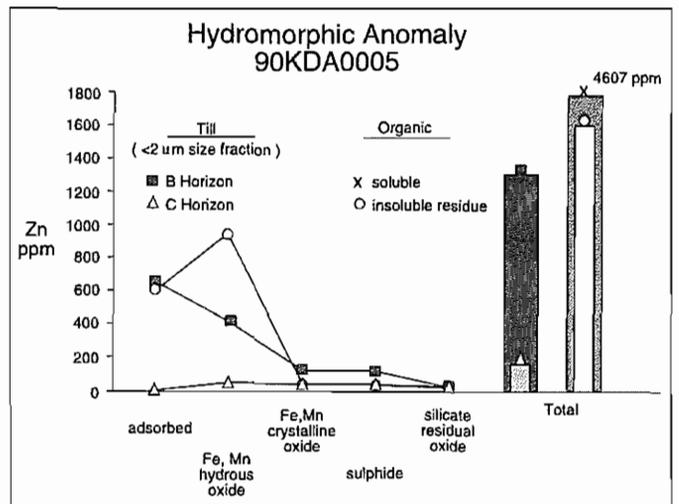
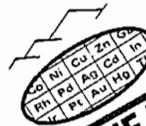


Figure 5. Results for Zn in various phases of humus, soil and till at site 5.

anomaly reflects glacial dispersal, and that leaching of the surface contamination in the humus in a downward direction is minimal. Data for control samples used to monitor precision in this sequential extraction scheme at the GSC, are given in Table 4. Continued on Page 8



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Technical Notes

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Table 4. Mean and standard deviation values in ppm for Zn, Cu, Pb, Ni, Co, Mn and Fe in five phases of control samples TILL-2 (n=8) and LKSD-4 (n=5).

Element	PHASE					
	AEC ²	am Fe ox	cry Fe ox	sulphides	silicates	total
Zn-TILL-2	3.0 ± 0.3	34.1 ± 1.0	44.9 ± 1.4	13.8 ± 2.0	24.0 ± 2.0	120 ± 3
Zn-LKSD-4 ¹	9.8 ± 1.8	64.4 ± 5.1	16.2 ± 1.5	9.6 ± 0.5	14.8 ± 3.5	191 ± 10
Cu-TILL-2	12.2 ± 0.9	56.1 ± 1.9	46.6 ± 1.3	8.3 ± 2.2	22.4 ± 2.0	146 ± 3
Cu-LKSD-4 ¹	<1	6.8 ± 0.4	4.6 ± 0.9	11.4 ± 3.0	2 ± 0.4	32.2 ± 2.4
Pb-TILL-2	4.8 ± 0.8	10.2 ± 0.4	<1	<1	8.0 ± 0.7	22.8 ± 1.4
Pb-LKSD-4 ¹	4.6 ± 0.8	16.0 ± 1.2	<1	<1	6.2 ± 3.3	84 ± 10
Ni-TILL-2	<1	8.1 ± 1.0	14.6 ± 1.6	6.8 ± 2.1	8.5 ± 0.9	39.3 ± 2.5
Ni-LKSD-4 ¹	<1	10.2 ± 0.8	4.0 ± 1.0	4.8 ± 0.4	5.2 ± 1.3	30.6 ± 1.5
Co-TILL-2	1 ± 1	4.8 ± 0.5	4.8 ± 1.7	<1	3 ± 1	13.5 ± 1.4
Mn-TILL-2	86.8 ± 8.3	292 ± 11	125 ± 8	43.8 ± 4.0	140 ± 30	688 ± 44
Mn-LKSD-4 ¹	16.0 ± 2.0	56.0 ± 6.0	42.2 ± 3.3	11.2 ± 1.7	83.4 ± 1.9	460 ± 39
Fe-TILL-2	403 ± 52	10190 ± 403	14866 ± 600	4131 ± 457	5821 ± 585	35403 ± 1036
Fe-LKSD-4 ¹	126 ± 20	4610 ± 580	7591 ± 620	5397 ± 278	4963 ± 354	26182 ± 142

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- 1 Pyrophosphate extraction had been carried out on LKSD-4 prior to this sequential leach. The total value includes this portion also.
- 2 AEC = adsorbed/exchangeable/carbonate.

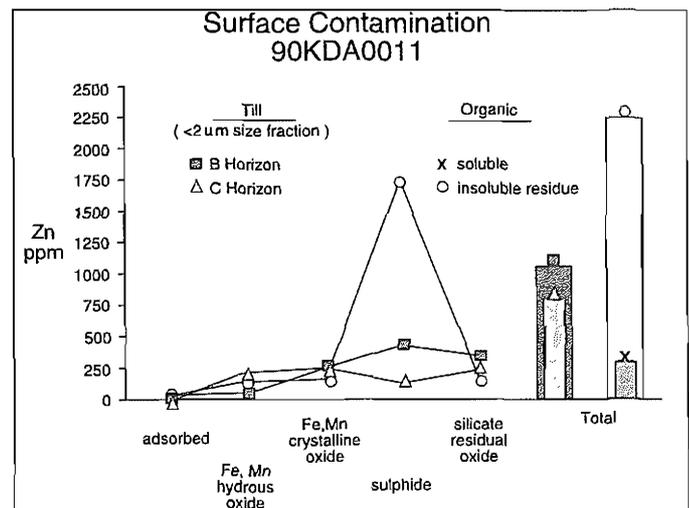


Figure 6. Results for Zn in various phases of humus, soil and till at site 11.

The above example of the usefulness of selective extractions in discerning the genesis of an element at a particular site illustrates the need to streamline the handing of and model the vast amount of data generated by application of such procedures. While evaluation of the application of these leaches continues in various programs at the GSC, laboratory research is progressing in directions such

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Technical Notes

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as: 1) automation and cost reduction of key leaches, 2) identification of problem areas in phase selectivity and their resolution, 3) and maintenance of sample integrity between collection and analysis. Methods are also under investigation in specific phase analysis for the precious metals but readsorption of these metals, back onto the substrate from the leaching solution, is yet another challenge to be addressed.

Gwendy E.M. Hall

Judy E. Vaive

Christine Kaszycki¹

Geological Survey of Canada

601 Booth St.

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¹ Ontario Geological Survey

933 Ramsey Lake Rd.

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AEG ANNUAL GENERAL MEETING

Annual General Meeting of The Association of Exploration Geochemists,
Denver Colorado, April 19, 1993

On April 19, 1993, The Association of Exploration Geochemists (AEG) held their Annual General Meeting (AGM) at the Red Lion Hotel in Denver, Colorado. The meeting was held in conjunction with the Integrated Methods in Exploration and Discovery Conference sponsored by the Society of Economic Geologists (SEG), the Society of Exploration Geophysicists (SExG), The Association of Exploration Geochemists (AEG), and the U.S. Geological Survey (USGS).

I. Call to Order

The President called the meeting to order at PM (MDT) and established that a quorum was present.

II. Minutes of the 1992 AGM

The President asked if there were any matters arising from the 1992 AGM minutes as published in **EXPLORE** number 75.

There were no matters arising.

It was moved (G. Taylor) and seconded (P. Rogers) that the 1992 minutes of the 1992 Annual General Meeting of The Association of Exploration Geochemists, as published in **EXPLORE** number 75 and filed with the Secretary, be approved. The President asked for a vote on the motion. Passed unanimously.

III. Presidents Report

The President noted that the preceding year had been eventful and one of change for the Association.

In 1992 the Association had 1192 members

1. 53% Affiliate (Member)
2. 34% Voting (Fellow)
3. 3% Corporate
4. Students (increasing from 1991)

Membership employment

1. 61% in industry
2. 20% in government
3. 13% in Academia

4. 6% other

Income

1. 38% from dues
2. 36% from Symposium
3. 11% from Royalties
4. 8% from publication sales
5. 5% from interest income
6. 2% from advertising

Expenses

1. 45% for publications
2. 21% for administration
3. 14% for publicity
4. 10% for the Directory
5. 2% for Distinguished Lecturer
6. 8% for General Expenses

There were numerous achievements in 1992. The major achievement during 1992 was the revision of the By-laws, an effort headed by Don Runnells. The Association published a 1992 Directory of members and services. Work progressed on the bibliographic database and a complete electronic exploration geochemistry bibliography is expected by 1995. The Committee on Environment, chaired by R. Glanzman, sponsored an issue of **EXPLORE** and has established a liaison with the Society of Environmental Geochemistry.

The Distinguished Lecturer this year is Jane Plant and she has given very successful lecture tours in Asia and Australia, all organized by the Distinguished Lecturer Chairman, David Jenkins.

During 1992 the Association sponsored or co-sponsored several meetings:

1. The Society of Mining, Metallurgy, and Exploration (SME) in Phoenix, AZ
2. The Society of Mining, Metallurgy, and Exploration (SME) in Seattle, Wa
3. The Goldschmidt Conference in Reston, VA
4. The SEG-Sexg-AEG-USGS conference in Denver, CO

IV. Secretary's Report

Membership

1. There are 1192 current members in the AEG. In 1992, 127 new members were added.
2. The Secretary encouraged all Members to become Fellows and take an active part in the Association.

Elections

1. Regional Councilor
A new Regional Councillor for Brazil, Dr. Marcondes Lima da Costa, was elected by the Brazilian members.
2. Second Vice President
William B. Coker was elected Second Vice President by Council.
3. Council
Ballots were sent to all Voting Members and 182 valid ballots were returned to the AEG office.
4. Business Manager
Council has elected to hire Art Clendenen as full-time Business Manager.

Shea Clark Smith

MEG

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AEG Annual General Meeting

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By-laws

The Voting membership elected to accept the revised By-laws of The Association of Exploration Geochemists, as printed in EXPLORE number 77.

V. Treasurer's Report

The President read the report from the Treasurer (a copy of this report will be sent to members on request).

VI. Introduction of the 1993 Executive

The President announced that: the incoming President for 1993 would be Graham F. Taylor, the First Vice President would be Gwendy E.M. Hall, the Second Vice President would be William B. Coker, the Secretary would remain Sherman P. Marsh, and the Treasurer would remain David M. Jenkins until a replacement can be found.

VII. Announcement of 1993-95 Councilors

The following candidates have been elected to serve a two year term, starting in April, 1993.

1. Owen P. Lavin
2. Howard R. Lahti
3. Erick F. Weiland
4. John A. Fortescue
5. Fred R. Siegel

Due to the election of William B. Coker to Second Vice President a vacancy in Council has occurred. R. Steve Friberg was selected to fulfil the remaining one year of Coker's term as Councilor.

VIII. Motion to Destroy Ballots

It was moved (M. Chaffee) and seconded (P. Rogers) that the accountants, Nemoth Thody and Associates, be instructed to destroy the 1993-1995 Ordinary Councilor ballots. The President asked for a vote on the motion. Passed unanimously.

IX. Appointment of Auditors

It was moved (S. Marsh) and seconded (O. Lavin) that the Treasurer be given permission to reappoint the existing accounting firm of Nemoth Thody and Associates as auditors for The Association of Exploration Geochemists for the year 1993. The President asked for a vote on the motion. Passed unanimously.

X. Past Presidents' Medal Award

K. Fletcher (Past President) announced that Dr. Eion M. Cammeron had been elected to receive the Past Presidents' Medal of The Association of Exploration Geochemists. He outlined the achievements of Dr. Cameron for the Association including his editorship of the Journal of Geochemical Exploration since its inception. (complete text of the award ceremony is being published in this issue of EXPLORE). Dr. Cameron accepted the Past Presidents' Medal Award and thanked the Association

XI. Student Paper Competition Award

The President announced that Stephen Cook had been elected to receive the Student Paper Prize Award for 1993. Lynda B. Bloom from XRAL laboratories also awarded \$500 to Mr. Cook as part of the Student Paper Prize (complete text of the award ceremony will be published in a later issue of EXPLORE).

XII. Transfer of Meeting

The outgoing President, J.A. Jaacks, introduced the incoming President, Graham F. Taylor. G. Taylor thanked the outgoing the President and announced that it was a great privilege to take over the presidency of The Association of Exploration Geochemists. He stated that he intended to move the Association forward and continue to encourage geochemists throughout the world to become members of the Association. G. Taylor then introduced the Past President, J.A. Jaacks to give his Presidential Address entitled "Information Management in the 90's". (the full text of

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AEG Annual General Meeting

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this address will be published in a forthcoming issue of the Journal of Geochemical Exploration).

XIII. Other Business

There was no other business.

XIV. Adjournment

It was moved (B. Leonard) and seconded (E. Post) that the Annual General Meeting of The Association of Exploration Geochemists be adjourned. The President asked for a vote on the motion. Passed unanimously.

The 1993 Annual General Meeting of the Association of Exploration Geochemists was adjourned at 6:15 PM (MDT).

Sherman Marsh
AEG Secretary



AEG DISTINGUISHED LECTURER

Following her attendance at the IGC in Kyoto, Japan and a lecture tour of Malaysia, the AEG Distinguished Lecturer for 1992/3, Dr. Jane Plant of the British Geological Survey, arrived in Cairns, Queensland at the start of a 12-day whirlwind tour of Australia.

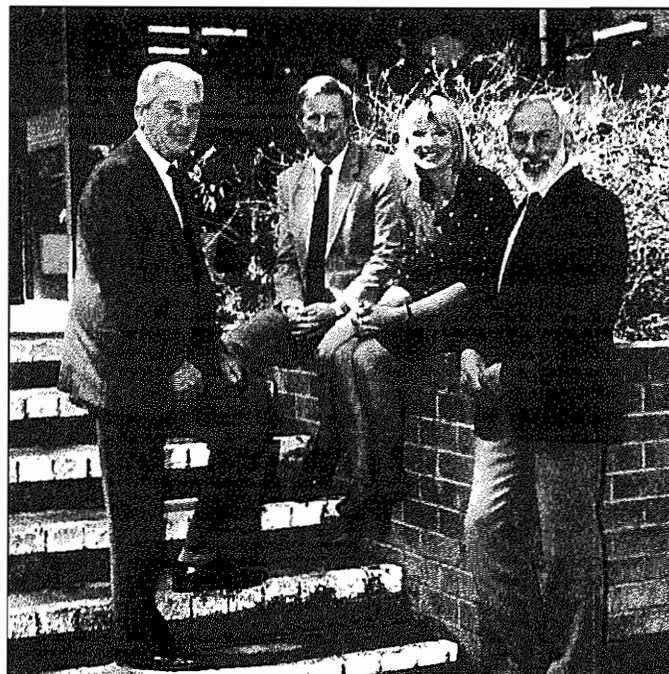
Dr. Plant's three lectures:

- 1) Geochemistry in the development of metallogenic models and exploration criteria for SEDEX and MVT base metal deposits,
- 2) Regional geochemistry - a basis for development and environmental planning?
- 3) The lithogeochemistry of granites and acid volcanics; implications for base-metal, tin-uranium and gold exploration

The lectures were presented to industry, academic and research geochemists at James Cook University, Townsville;

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Former Australian Regional Councillor, Jock Gilfillan (left), David Garnett (Regional Councillor) and Graham Taylor (Vice-President) with the AEG Distinguished Lecturer Dr. Jane Plant, after one of her many Australian lectures.

CSIRO Exploration Geoscience, Sydney; Sydney Mineral Exploration Discussion Group; University of New South Wales; Geological Society of Australia, Canberra; Australian Geological Survey Organization Canberra; University of Western Australia, Perth and Eastern Goldfields Discussion Group, Kalgoorlie. The meeting in Perth was the first organized by the newly-formed Specialist Group in Applied Geochemistry, a joint GSA/AEG initiative.

Lengthy discussions usually over a hearty Australian meal, were common, and enabled productive, expansion of the three themes, as well as reminiscences.

Dr. Plant also spent considerable time on 'in-house' discussions with exploration companies in Canberra, Melbourne, Perth and Kalgoorlie. These companies had contributed to Dr. Plant's visit to Australia and in turn, received valuable information on geochemical exploration techniques.

There is no doubt that the Australian Geochemical exploration community is highly supportive of the visits by AEG Distinguished Lecturers. We were extremely fortunate in benefiting from Dr. Plant's great experience and knowledge. Because of the hectic schedule which Dr. Plant undertook, two simple rules have been made for future Distinguished Lecturers:

- 1) Unless - even if - you have enormous stamina, do not try to stay the course at every place you visit, and
- 2) Even if you do not know where you are, why you are there or what day of the week it is just keep smiling.

Russell Birrell
David Garnett
Graham Taylor



NEWS OF MEMBERS

Erick F. Weiland has accepted the position of Senior Geochemist with SHB AGRA, INC, a firm providing engineering and environmental services. Erick will be based in the Tucson office (66-1870 W. Prince Rd., Tucson, Arizona 85705, TEL: (602) 792-2779). Erick will be available for projects throughout the world.



STUDENT PAPER PRIZE

The Association of Exploration Geochemists and X-Ray Assay Laboratories, a Division of SGS Supervision Services, are pleased to announce the 1992 Student Paper Competition Award.

The Association of Exploration Geochemists held its ninth Annual Student Paper Competition in 1992. Several papers were submitted which addressed an aspect of exploration geochemistry and represented research performed as a student. The submitted papers had to be published in a refereed scientific journal within five years of a student's graduation. The award was



given to the student paper with outstanding technical content, combined with an effective presentation.

The winner of the 1992 Student Paper Competition is Stephen J. Cook, a geochemist now with the British Columbia Geological Survey. He obtained a B.Sc. in Geology from Carleton University in 1984 and an M.Sc. in Geology from the University of British Columbia in 1991. From 1985 to 1988 he worked on regional geochemical surveys throughout Canada with the Exploration Geochemistry Subdivision of the Geological Survey of Canada. In 1991, he joined the Applied Geochemistry Unit, Environmental Geology Section of the B.C. Geological Survey in Victoria, where he has been primarily involved with lake sediment geochemistry research. He is currently working on the development of lake sediment geochemical exploration techniques in the northern Interior Plateau of British Columbia. He is a member of the Association of Exploration Geochemists and the Association of Professional Engineers and Geoscientists of British Columbia.

The 1992 award was presented at the AEG Annual General Meeting held during the Integrated Methods in Exploration Meeting in April. The award winner received a US \$ 500 cash prize donated by X-Ray Assay Laboratories, a division of SGS, a two-year membership in the Association of Exploration Geochemists, with receipt of the *Journal of Geochemical Exploration* and EXPLORE, a certificate of recognition and \$ 500 for expenses to attend the AEG Annual General Meeting.

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Student Paper Prize

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His award winning paper is entitled "Distribution and behavior of platinum in soils, sediments and waters of the Tulameen Ultramafic Complex, southern British Columbia, Canada" which was published in the Journal of Geochemical Exploration, Volume 46, No. 3, p 279-308. A copy of the abstract follows.

Cook, S.J. and Fletcher, W.K., 1993. Distribution and behavior of platinum in soils, sediments and waters of the Tulameen Ultramafic Complex, southern British Columbia, Canada. *J. Geochem. Explor.*, 46: 279-308.

XRAL



This paper reports Pt content of surficial media associated with Pt-rich chromitites in the dunite core of the Tulameen ultramafic complex. Platinum content of the -212 μm fraction of soils and sediments was determined by fire assay-inductively coupled plasma spectroscopy. C-horizon soils on dunite colluvium (mean: 24.2% MgO), locally-derived dunitic till (16.5% MgO) and exotic non-dunitic till (5.7% MgO) have median Pt concentrations of 88 ppb, 36 ppb and 8 ppb, respectively. Corresponding medians in ashed LFH horizons are 65 ppb, 13 ppb and 7 ppb Pt. Platinum values of 8-91 ppb are found in sediments from the small stream that drains the area. Stream and bog waters contain less than 1 ppt to a maximum of 2.45 ppt Pt.

Geochemical patterns for Pt indicate that glacial transport and mass wasting are the dominant processes that control distribution of Pt in soils on Grasshopper Mountain. There is also some (slight) evidence for a very limited hydromorphic mobility of Pt and its accumulation in bogs. During routine exploration geochemical programs the considerable local variability in soil parent materials and related variations in background concentrations of Pt need to be taken into account in evaluating the significance of Pt values. This requires careful identification of soil parent materials. Soil MgO content provides a useful index of their dunite content for this purpose.

J. A. Jaacks

Past Chairman, Student Paper Compilation Committee



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The United Kingdom's first ever international conference on geoscience education and training was held at the University of Southampton from April 20-24, 1993 and turned out to be a resounding success. Some 250 participants from 50 different countries worldwide attended; everywhere from Croatia to Vietnam, Lithuania to Columbia, Senegal to the Philippines.

But equal to the spectrum of nationalities represented was the range of questions addressed:

- how should we teach geoscience at school and where is it provided for in different national curricula?
- how are we coping with the challenges that face higher education today and are we keeping pace with the dramatic changes in education technology?
- why do so few girls choose to study geology at university and how can we redress the pyramidal decline of woman geoscientists moving up the career ladder?
- does the quality of geoscience degrees worldwide match the needs of society and how do we further meet the training needs of business and industry?
- is geoscience education responding adequately to the very real and live issues of global environment and development?
- how do we as geoscientists translate our knowledge and concerns into the language of politicians and planners?
- what are the ways in which we can raise the general

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First International Conference

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profile of geology in society? what role for geo-tourism, eco-tourism, etc.?

"At first we thought that this was far too much for a single event" said the Conference Convener, Dr. Dorrik Stow of the University's Geology Department, "but we divided the issues into five separate themes, each with it's own set of workshop sessions, and ran with it. The information exchanged, ideas generated, and enthusiasm promoted was quite astounding."

Several keynote speakers were invited to address the plenary sessions. Sir Ronald Oxburgh, Science Advisor to the UK Ministry of Defense, gave a lively and graphic illustration of how geology has changed from a sterile to a sexy subject. Jerry Leggett, Scientific Director of Greenpeace, spoke passionately of our overriding responsibility to the environment, to document the long term changes in global climate and to warn our politicians of the consequences of our actions. Diane Warwick of The Westminster Foundation for Democracy emphasized the importance of a stable social, economic, and political foundation as the template on which to build any meaningful educational system.

Southampton's Vice-Chancellor, Sir Gordon Higginson, warmly welcomed delegates to the University and to the city. "It is a remarkable achievement to bring together such a large and multinational group for the sole purpose of discussing education! Most conferences we host are exclusively research oriented."

But the ideas flowed and the momentum gathered pace. A geo-walk around the city demonstrated how effectively building stones can be used to teach geology. Good practice in field excursions was further examined during a wet evening in a local gravel pit and through a sunny day on some classical geological sections along the south coast. Workshop sessions were devoted to the use of self-instructional computer programs for teaching, the making of geo-movies, the greening of geoscience, adult education, and much more.

A late evening workshop on Woman in Geoscience was packed and brimming with anecdotes and statistics. Jane Plant, Assistant Director of the British Geological Survey, profiled this largest employer of geologists in the UK, clearly illustrating the slow change towards equality between the sexes (Jane Plant is the current Distinguished Lecturer of the AEG). Rosemary Enie recounted the struggles of being the only girl geology student in her class in Nigeria, whereas Zane Amante-Roberts portrayed the higher profile of woman geoscientists in the Philippines.

Despite a tightly packed work and social schedule, delegates were reluctant to bring proceedings to a close. Dorrik Stow, the Conference Convener, said "Geosciences play a vital role in underpinning the social and industrial infrastructure of nations, and the training of geologists is therefore crucially important for the future. We had hoped that this meeting would provide a valuable forum for the international exchange of ideas, methods and data, and that it would stimulate a continuing dialogue between

participants. On both counts we are delighted with the outcome."

Warm thanks were expressed by the President, Nelson Ellert (Brazil) and Chairman, Jerry Cooray (Sri Lanka) of the two main sponsors, the Association of Geoscientists for International Development (AGID) and the Commission on Geoscience Education and Training (COGEOED) of the International Union of Geological Sciences. "The meeting has received very significant financial backing from a wide variety of sources (as listed below) and has begun a dialogue and a process that we firmly intend to continue. This is a very important beginning.

Conference organized by: AGID and COGEOED (IUGS).

Associated with:

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Earth Science Teachers Association (UK)
The Geological Society
The Geographical Society
The British Geological Survey
Geology Department, Southampton University

Financial sponsorship provided by these organizations (above) together with:

Overseas Development Administration of the Foreign and Commonwealth Office (UK)
The British Council
The Commonwealth Foundation
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SEG CONFERENCE

INTEGRATED METHODS IN EXPLORATION AND DISCOVERY, an interdisciplinary conference held in Denver, Colorado, 17 - 20 April 1993 was sponsored by the Society of Economic Geologists, Association of Exploration Geochemists, Society of Exploration Geophysicists and the U.S. Geological Survey. Nearly 1000 participants attended technical sessions, exhibits, short courses and field trips. These activities were spread over 12 days. Alan Coope and his committee organized an excellent technical program with 80 oral and poster presentations selected from 140 invited and volunteered papers. A total of 31 countries were represented at the conference, with about 270 participants from non-North America countries attending, reflecting increasing internationalization of the mineral exploration business. Several publications are planned. Short course notes and papers on Environmental Geochemistry and GIS Mapping Systems will be published. A proceedings volume of papers from the technical program will also be published. A similar meeting devoted to new exploration technology is proposed for 1997 or 1998.

The SEG Conference 93 VOLUME OF EXTENDED ABSTRACTS can be purchased from:

Society of Economic Geologists
5808 S. Rapp Street, Suite 209
Littleton, CO 80120 USA
FAX: (303) 797-0417

Purchase price is \$US 15.00 for delivery in North America, and \$US 20.00 for non North American addresses.

Richard Nielsen

General Chairman,

Integrated Methods in Exploration and Discovery

LINDGREN AWARD

The Society of Economic Geologists requests nominations for the prestigious Lindgren Award.

This award is offered annually to a young geologist whose published research represents an outstanding contribution to economic geology. The award is not restricted as to the candidate's nationality, place of employment, or membership in the Society. The work for which the Lindgren Award is given must have been published as a single paper or series of papers in a recognized journal before the author's 35th birthday, and the awardee must be less than 37 years of age on January 1 of the year in which the award is presented. We are currently seeking nominations for the 1994 Award, for which nominees must have been born after January 1, 1957.

The award can be given for contributions to economic geology from any subdiscipline of geology (including, among others, structural geology, mineralogy, environmental

geology, hydrology, petrology, geochemistry, stratigraphy, geophysics, and mine geology).

Please contact G. Todd Ririe, who is chair of the SEG Lindgren Award Committee, at (714) 577-2315, for further information on how to nominate someone for the award.

Todd Ririe

Chairman of the SEG Lindgren Award Committee

THE CANADIAN GEOSCIENCE COUNCIL

Editors note: The following is a report from the Canadian Geoscience Council to its member societies, of which the Association of Exploration Geochemists is one. It is reproduced here for the benefit of members.

"The Canadian Geoscience Council provides an open forum for communications, discussion and debate to ensure the effectiveness and influence of the geosciences in addressing the needs and desires of the people of Canada, especially with regard to the quality of life, economic prosperity, and the maintenance and improvement of the natural environment."

The Association of Exploration Geochemists is one of the 13 member societies of the Council, and your association has a designated representative on Council.

The Canadian Geoscience Council (CGC) was formed in 1972, and since then has met 81 times at various centres across Canada. In 1993, the Council met in Ottawa in January and in Edmonton in May. It will meet in Sudbury in September. Each Council meeting attracts between 25 and 40 geoscientists representing the constituent societies, standing and advisory committees or associates member bodies.

The Council is doing a lot on behalf of geologists, geotechnical engineers, engineering geologists, geophysicists and other geoscientists in Canada. Here are some of the activities that might be of interest to you.

PROFESSIONAL REGISTRATION COMMITTEE

All engineers in Canada who wish to be licensed to practice are provincially registered. All such geoscientists are not, and the Council feels that they should have this opportunity. Under CGC auspices, the Professional Registration Committee was formed to coordinate registration activities across Canada. The Committee has members from different provinces and territories and obtains input from interested constituent societies of the Council. For further information contact Gordon Williams in Alberta - FAX (403) 240-6664 / TEL. (403) 240-6966

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EDUCATION

The Council supports two initiatives in the education field. One is called *EdGEO* and the other is the *Canadian Geoscience Education Board*. The *EdGEO Program* provides training in the geosciences to public school and high school teachers across Canada. The program is fully funded and has a dedicated group of 12 to 14 very experienced earth scientists operating out of Calgary.

Bob Greggs in Alberta would be pleased to explain the program to you. Contact him by FAX (403) 265-1870 or TEL. (403) 266-3789.

The *Canadian Education Board* is a recent venture by the CGC. The Board was formed to coordinate the efforts of the Canadian Geoscience community in matters related to geoscience education and public awareness of geoscience. *Laing Ferguson is the Chair of the Board and he can be contacted in New Brunswick, either by FAX (506) 364-2216 or by TEL. (506) 364-2311.*

The Council recently published a careers booklet called "Explore Careers in Geoscience". The booklet is 31 pages long and is available from:

Dr. Alan Morgan at Waterloo, FAX (519) 746-7484, TEL. (519) 885-1211 X3029/3231.

INTERNATIONAL AFFAIRS

The CGC is responsible for Canadian participation in most international programs in the geosciences other than those between governments. Canada can be rightfully proud of our contributions to leadership on the international geoscience scene. Over the past few years our geoscientists have led many of these societies. Here are a few names: 1) Dr. Bill Fyfe of The University of Western Ontario is the President of the International Union of Geological Sciences, 2) last year Dr. Glen Caldwell of the same university was the Vice-President, 3) Dr. Owen White of The University of Waterloo is the Past President of the International Association of Engineering Geology, 4) Dr. Norbert Morgenstern from the University of Alberta is the President of the International Society of Soil Mechanics and Foundation Engineering, and 5) Dr. John Franklin of The University of Waterloo is the Past President of the International Association of Rock Mechanics, 6) Dr. Ray Price of Queen's University is Chairman of the Scientific Committee of the International Geological Correlation Program. And the list goes on.

Colin Stearn from Montreal, our Foreign Secretary, can provide

Lloyd D. James

Consulting Exploration Geochemist

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Englewood, Colorado 80112, U.S.A.

Telephone and Fax: (303) 741-5199

you with more details. Contact Colin by FAX at (514) 398-4680; TEL. (514) 398-3590.

LITHOPROBE

"Dancing Elephants" are sending sound waves many kilometers below ground surface. Measurements of these sound waves allow geoscientists involved in the Lithoprobe program to investigate the lithosphere that separates and protects us from the fiery interior of our planet. These Dancing Elephants are mammoth mechanical vibrators mounted onto large trucks that provide the energy source for these seismic studies. More than 400 Canadian geoscientists are involved. This research is unique in the world, and it is producing many benefits, not only for scientific research, but also in applied research dealing with earthquakes, continental drift, and how the continents were formed. The Canadian Geoscience Council maintains a standing committee on Lithoprobe.

Ron Clowes, Director of Lithoprobe, in British Columbia, would be pleased to tell you more. Contact him by FAX at (604) 822-6958 / TEL (604) 822-4138.

OCEAN DRILLING PROGRAM

Another unique international program that the Canadian Geoscience Council is involved in is the Ocean Drilling Program, commonly referred to as "ODP".

Canada, in consortium with Australia, forms part of an international team of nations that are part of this study. The program is one of the most successful of all collaborative, interdisciplinary, international ventures in "big science". The drilling ship *JOIDES Resolution* plies the oceans, coring deep into the ocean floor. The program has yielded much information and is contributing not only to scientific research, but also to applied research.

Contact Ian Gibson, Chair of CGC/ODP Committee at FAX (519) 746-7484 / TEL (519) 885-1211 X2054.

ADVISORY AND REVIEW COMMITTEES

The Council is represented on a Technical Advisory Committee to Atomic Energy of Canada Ltd. (AECL) by four people from our constituent societies. They provide advice to AECL in developing their long range plan for the safe, permanent disposal of high level radioactive waste.

George Skippen from Carleton University can give you more information at FAX (613) 788-4490 / TEL (613) 788-2600 X4420.

In 1992, the CGC commissioned a study on "Groundwater Issues and Research in Canada" which was funded by the Geological Survey of Canada. This report will be published in 1993, and if you would like a copy please contact:

Dr. Alan Morgan FAX (519) 746-7484 / TEL (519) 885-1211 X3029.

The Council publishes an annual report of its full activities. Contact Dr. Morgan above and he will send you a copy.

During its 21 year history, the Canadian Geoscience Council has provided advice to provincial and federal policy makers on a wide range of matters concerned with the geosciences. Traditionally, these matters have been involved with the resource and energy segments. Today, and in the future, these matters are going to involve environmental

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concerns and decisions concerning land use. The need for continued support of the Council will be required by all those interested in geoscience in Canada.

We look forward with pleasure to continued active participation in Council by the Association of Exploration Geochemists.



NEW MEMBERS

To all Fellows:

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 Vancouver office, recommendation by the Admissions Committee, review by the council, and publication of applicant's names in the newsletter remains unchanged.

FELLOWS

Brozdowski, Robert A.
Sr. Project Geologist
Western Mining Corp.
Negaunee, MI, USA

Pirajno, Franco
Consultant
Duncraig, WA, Australia

Thomas, Jed M.
Consultant Geologist
Sage Resources
Missoula, MT, USA

MEMBERS

Alexandru, Adriana
Chemex Labs
Mississauga, ON, Canada

Amacher, Michael C.
Research Soil Chemist
USDA Forest Service
Logan, UT, USA

Bajc, Andy
Geologist
Ontario Geol. Surv.
Sudbury, ON, Canada

Bills, R.T
Senior Geologist
Western Mining Corp
Preston, Australia

Bolter, Ernst
University of Missouri
Rolla, MO, USA

Chapin, Charles
New Mexico Bureau of Mines
Socorro, NM, USA

Colliver, Ian C.
Principal Geologist
CRA Exploration
Northland Centre, Victoria,
Australia

Danti, Kathy J.
Research Geologist
Western Mining Corp
Roxby Downs, SA, Australia

Dunlop, A.C.
University of NSW
Kensington, NSW, Australia

Gilmore, Kelly V.
Hudson Bay Exploration
Flin Flon, MB, Canada

Lane, David C.
Heemskirk Resources
Zeehan, TAS, Australia

Morrissey, Peter J.
Senior Geologist
Newcrest Mining
Milton, QLD, Australia

Piepar, Paul S.
Prospector
Petersburg, AK, USA

Pila-Laviste, Augusto
Senior Geologist
Riomin Exploration
Madrid, Spain

Podemski, Maciej A.
Geologist
State Geol. Inst.
Warsaw, Poland

Rabinowitz, Michael B.
Geochemist
Marine Biological Lab
Woods Hole, MA, USA

Ross, Anita L.
Geologist
Placer Exploration
Sydney, NSW, Australia

Simmons, Barry D.
Teck Exploration
Toronto, ON, Canada

Slater, Jock
General Manager
Riotur Madencilik
Ankara, Turkey

Spatz, David
BHP Minerals
Tucson, AZ, USA

Thomson, Roger M.
Delta Gold
Perth, WA, Australia

Walter, Michael
Cologne, Germany

Waring, Marcus H.
Consultant
Rio de Janeiro, Brazil

Williams, Cory
BHP Minerals
San Francisco, CA, USA

STUDENT MEMBERS

Grimes, Jonathan
Auburn University
Auburn, AL, USA

Kuntawang, Kiatisak
ITC
Delft, The Netherlands

Loomis, Amy M.
W. Washington University
Bellingham, WA, USA



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Edited by

F.W. DICKSON

*Department of Geological Sciences, Mackay School of Mines,
University of Nevada, Reno, NV 89557-0138, USA*

L.C. HSU

*Nevada Bureau of Mines and Geology and Department of
Geological Sciences, Mackay School of Mines, University of
Nevada, Reno, NV 89557-0088, USA*

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RECENT PAPERS

This list comprises titles that have appeared in major publications since the compilation in EXPLORE Number 79. 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 (GCS Paper) and Open File Report (GCS OFR); Bulletin of the Canadian Institute of Mining and Metallurgy (CIM Bull); Transactions of Institute of Mining and Metallurgy, Section B: Applied Earth Sciences (Trans IMM). Publications less frequently cited are identified in full. Compiled by L. Graham Closs, Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO 80401-1887, Chairman AEG Bibliography Committee. Please send new references to Dr. Closs, not to EXPLORE.

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- July 19-25, '93 Geological Sciences in Latin America, int'l mtg., Campinas and Ouro Preto, Brazil, by International Union of Geological Sciences, and others (M.M. Lopes, IG/UNICAMP, Box 6125, 13081, Campinas, Brazil; TEL: (55) (192) 39-7352; FAX: (55) (192) 39-4717)
- July 24-29, '93 Society for Environmental Geochemistry and Health mtg., New Orleans, LA (Dr. Howard Mielke, College of Pharmacy, Xavier University of Louisiana, New Orleans, LA 70215; TEL: (504) 483-7523)
- Aug. 1-3, '93 Geochemistry of the Earth Surface. Third International Symposium on Geochemistry of Weathering and Diagenesis of Sediments, University Park, PA (Dr. Lee R. Kump, Secretary General, GWDS-3, Department of Geosciences, The Pennsylvania State University, 210 Deike Building, University Park, PA 16802 USA; TEL: (814) 863-1274; FAX: (814) 865-3191)
- Aug. 26-28, '93, Energy and mineral resources of central Montana, field mtg., Billings and Lewistown (Ray Boles, Montana Geological Society, Box 844, Billings, MT 59103; TEL: (406) 656-0069)
- Sept. 1-3, '93 International Symposium on Mineralization Related to Mafic and Ultramafic Rocks (IAGOD, Symposium Secretary/D. Ohenstetter, CRSCM, La rue de la Feqrollerie, 45071 Orleans, Cedex 2, France; TEL: 33-38-51-54-01, FAX: 33-38-63-64-88)
- Sept. 3-5, '93 16th International Geochemical Exploration Symposium, and Sept. 1-2, '93 5th Chinese Exploration Geochemistry Symposium, Beijing, CHINA (Dr. Xie Xuejing, Honorary Director, Institute of Geophysical & Geochemical Exploration, Langfang, Hebei 102849, CHINA; TELEX: 22531 MGMRC CN; FAX: 86-1-4210628; and, Dr. Lin Cunshan, Deputy Director, Institute of Geophysical and Geochemical Exploration, Langfang, Hebei 102849, CHINA; TELEX: 26296 LFPBLCN; FAX: 86-0316-212868)
- Sept. 5-10, '93 Trace Elements, 2nd Int'l Conference on Biogeochemistry of Trace Elements, Taiwan, ROC (Dr. D.C. Adriano, University of Georgia, Savannah River Ecology Laboratory, Drawer E, Aiken, SC 29802)
- Sept. 7-9, '93 Gold, mtg., Beaver Creek, CO (Lezlee A. Bryan, Randol International Ltd., 21578 Mountsfield Drive, Golden, CO 80401; TEL: (303) 526-1626; FAX: (303) 526-1650)

- Sept. 9-11, '93 Application of Recent Geologic Concepts to Exploration in the Northern Appalachians, Third Annual CIM Geological Society Field Conference, Technical sessions and field trips (New Brunswick, Newfoundland, Maine, Quebec and Portugal), Bathurst, New Brunswick, Canada (S. McCutcheon, P.O. Box 50, Bathurst, New Brunswick, Canada, E2A 3Z1; TEL: (506) 547-2070; FAX: (506) 546-3994)

- September, '93 International symposium "Cultural Heritage Collected in Libraries of Geoscience, Mining and Metallurgy - Past, Present and Strategy for the Next Millennium, Freiberg, Saxony, Germany (Dr. Peter Schmidt, Bibliothek, Bergakademie Freiberg, Schliessfach 47, D-)9200 Freiberg, Germany)

- Sept. 15-17, '93 Mining Development, int'l mtg., Philadelphia, by Society for Mining, Metallurgy and Exploration (SME, Meetings Dept., Box 625002, Littleton, CO 80162; TEL: (303) 973-9550; FAX: (303) 979-3461)

- Sept. 21-23, '93 Andean Geodynamics, int'l symposium, Oxford, England, by University of Oxford and Institut Français de Recherche Scientifique pour le Développement en Coopération (Orstrom). (Piere Soler, Orstrom, CS1, 213 rue Lafayette, 75480 Paris Cedex 10, France; FAX: 33-1-48 03 08 29)

- Sept. 25 - Oct. 1, '93 International Association of Volcanology and Chemistry of the Earth's Interior, mtg., Canberra, AUSTRALIA (IAVCEI ACTS, GPO Box 2200, Canberra ACT 2601, AUSTRALIA, TEL: (61) 6-257-3299; FAX: (61) 6-257-3256)

- Sept. 26 - Oct. 1, '93, Analytical Environmental Chemistry, Symposium on Analytical Chemistry incorporating the 3rd Environmental Chemistry Conference, Perth, Western Australia (12 AC, The Conference Office, University of Western Australia, Nedlands, WA, Australia 6009)

- Sept. 28 - Oct. 1, '93 Environmental Pollution, int'l mtg., Barcelona, Spain, by European Centre for Pollution Research and others (ICEP Conference Office, ICTR Secretariat, 11-12 Pall Mall, London SW1Y 5LU, England; TEL: 44 71 930 6825; FAX: 44 71 976 1587)

- Oct. 2-7, '93, IV Congresso Brasileiro de Geoquímica, Brasilia, Brazil (Geraldo Resende Boaventura, Instituto de Geociencias, Universidade de Brasilia, Caixa Postal 04465/70910 - 900 - Brasilia DF; TEL: (061)3482391; FAX: (061) 2724286)

- Oct. 25-27, '93 Dredging and placer mining conference, Sparks/Reno, NV (Yung Sam Kim, Nevada Institute of Technology, Box 8894, Campus Station, Reno, NV 89507; TEL: (702) 673-4466; FAX: (702) 673-4386)

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- Nov. 5-21, '93 Circum-Pacific and Circum-Atlantic terrane, intl. mtg., Guanajuato, Mexico (David G. Howell, USGS, MS 902, 345 Middlefield Road, Menlo Park, CA 94025; FAX: (415) 354-3224)
- Nov. 7-9, '93 Underwater Mining Institute anl. mtg., Estes Park, CO (Karynne Chong Morgan, UMI, 811 Olomehani St., Honolulu, HA 96813-5513; TEL: (808) 522-5611; FAX: (808) 522-5618)
- Nov. 9-13, '93 Mineral resources of Russia, mtg., St. Petersburg, by State Committee on Geology and Mineral Resources of Russia, and others (Organizing Committee, Box 215, 199004, St. Petersburg; TEL: (011-7-812) 355-7952; in U.S., TEL: (505) 291-9812)
- Nov. 11-1, '93 The 15th New Zealand Geothermal Workshop, Auckland, New Zealand (Professional Courses, Centre for Continuing Education, The University of Auckland, Private Bag 92019, Auckland, New Zealand; FAX: 64-9-373 7419)
- Nov. 14-20, '93 2nd Congress of Geochemistry of the Portuguese-Speaking Countries (II Congresso de Geoquímica de dos Países de Língua Portuguesa) and 9th "Geochemical Week - Portugal", Porto, Portugal (Dr. Fernando Noronha, Mineralogia e Geologia, Faculdade de Ciências, 4000 Porto Portugal; TEL: (351-2) 310 290; FAX: (351-2) 316-456)
- Aug. 28-Sept. 3, '94 European Association of Geochemistry Meeting and 4th Goldschmidt Conference, Edinburgh (Dr. B. Harte, Department of Geology and Geophysics, Grant Institute, University of Edinburgh, West Mains Road, Edinburgh, EH9 3JW UK)
- Sept. 12-15, '94, 3rd Symposium on Environmental Geochemistry, Kraków, Poland (Dr hab. Edeltrauda Helios Rybicka, Faculty of Geology, Geophysics and Environmental Protection, University of Mining and Metallurgy, Al. Mickiewicza 30, 30-059, Poland; TEL: (48) 12-333290; FAX: (48) 12-332936)
- Sept. 6-10, '94 Joint International Symposium on Exploration Geochemistry, Irkutsk: a tribute to Academician L.V. Tauson (Pavel Koval, Institute of Geochemistry, P.O.Box 4019, 664033 Irkutsk-33, Russia; TELEX: 133 163 Taiga SU; TEL: 395(2) 46-59-78)
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- Mar. 6-9, '95 SME Annual Meeting and Exhibit, Denver CO (Meetings Dept., SME Inc. PO Box 625002, Littleton, CO 80162-5002 USA; TEL: (303) 973-9550; FAX: (303) 979-3461)
- Apr. 10-13, '95 Geology and Ore Deposits of the American Cordillera, Geological Society of Nevada Symposium III (Bob Hatch, Geological Society of Nevada, P.O. Box 12021, Reno, NV 89510; TEL: (702) 323-4569; FAX: (702) 323-3599)
- May 15-19, '95 17th International Geochemical Exploration Symposium, "Exploring the Tropics", Townsville, Queensland, Australia (Russell Myers, 17 IGES, National Key Centre in Economic Geology, James Cook University

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