New SEG Headquarters Plans Well Underway

John A. Thoms, SEG Executive Director

Under the guidance of the ad hoc SEG Architecture Committee, chaired by Art Courtney, plans for SEG’s new Headquarters Building have been developed to the point where detailed construction drawings are now being prepared. By the time this issue of the Newsletter is published, we expect to have completed purchase of the land on which the building will be sited, with groundbreaking following shortly thereafter.

The Headquarters Building will be located in the Ken Caryl Business Center in the general metropolitan area of southwest Denver (Fig. 1, page 19). The Business Center is easily accessible from Denver International Airport via Interstate Highway 70 and the C470 beltway—about a 45-50 minute drive. It is also readily accessible from almost any place within the Denver metro area. Golden, the home of Colorado School of Mines (and the Coors Brewery!), is about a 15-minute drive to the north along C470.

The drawings and architect’s renderings that accompany this article illustrate the design and layout of the building. It is a two-level structure, long and relatively low, with a footprint and profile well-suited to the building site and surrounding topography. The main level of the building, approximately 8,000 sq. ft., will house offices for personnel and supporting administrative functions (mail room, copying, etc.) (Fig. 2, page 21). The lower level, approximately the same size as the main level, is a “walk-out level” with windows along the entire south side. Except for the west end, which will be utilized for storage of SEG and PUBCO publications, the lower lever will remain unfinished. It will be available for future expansion and will be accessible from the entrance hall on the main level by a stairway and an elevator. The elevator shaft will be completed when the building is constructed, so that only the elevator itself will need to be installed when expansion occurs. At present, access to the lower level is provided by a stairway adjacent to the mail room. A loading dock is situated at the west end of the building on the lower level and is connected to the main driveway by an inclined ramp.

The building will appear very attractive to passersby, but perhaps the most dramatic impact will be for those entering the building. As the plans indicate, from just inside the front doors, ever-widening sight lines pass through the entry hall, then through the entrance to the conference room—a glass wall with glass doors at either side—to a window wall, 34 feet wide by 16 feet high, at the far end of the conference room, and then beyond to capture a panorama of Colorado Front Range scenery. From the entrance to the conference room, the ceiling steps upward to a full 16 feet at the window wall. Thus, the sight lines not only widen horizontally, but also vertically, not unlike looking through the small end of a cone, as opposed to the view through a cylinder of small, uniform diameter. The result will be an ever-expanding vista as one enters the building and proceeds through the entrance hall and into the conference room. A patio deck will be constructed on each side of the conference room, but not directly outside, where it would interfere with the view from the conference room. The side walls of the conference room are to be lined with a series of bookshelves that step back toward the window wall. Using the terminology of the architects, this configuration creates “vanishing edges”—much like looking into the distance over the lip of a waterfall. The ends of the bookshelves are vertical vanishing edges, whereas the floor of the conference room where it meets the window wall is the lip of the waterfall. The total visual effect upon entering the building and proceeding into the conference room, with an ever-widening vista, should be truly spectacular. The only disadvantage
The Society of Economic Geologists is seeking a qualified candidate or candidates to fill the position of SEG Newsletter Editor. The position offers extensive interaction with SEG members worldwide, the economic geology community, and issues related to economic geology. This volunteer position is vital to continued communication among SEG members. Candidates should have a strong geological background and an established and successful record of writing and editing. Schedules should be flexible enough to permit significant time commitments around four quarterly deadlines for the Newsletter. The new editor(s) should be available to assist with the April, 1999 issue, and would assume full duties after that issue is published. If you are interested in the position, or wish to recommend a qualified person, contact John A. Thom, SEG Executive Director, at Tel. +1.303.797.0332, or Fax +1.303.797.0417, Email <socconengeol@csn.net> for more information. SEG

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SEG Newsletter
No 35—October 1998

EDITORIAL ASSISTANT
Lisa Laird

The SEG Newsletter is published quarterly in January, April, July and October by the Society of Economic Geologists, Littleton, Colorado, exclusively for members of the Society. Opinions expressed herein are those of the writers and do not necessarily represent official positions of the Society of Economic Geologists. When quoting material from the SEG Newsletter please credit both author and publication.

Designed and Produced by David M. Pratt
Fort Collins, Colorado

Printed by Vision Graphics, Inc., Cheyenne, Wyoming

FOR CONTRIBUTORS
The SEG Newsletter is published for the benefit of the worldwide membership of the Society of Economic Geologists. We invite news items and short articles on topics of potential interest to the membership. If you have questions on submitted material, please call the SEG office at +1.303.797.0332 or FAX details to +1.303.797.0417.

Format: Manuscripts should be double-spaced if possible. Please submit paper copy and a computer diskette in DOS format, using WORD or WordPerfect. Pertinent illustrations will be included in camera-ready form at publication stage. All contributions may be edited for clarity or brevity.

Advertising: Paid advertising is solicited to help offset publication and mailing costs. For rates, contact the Executive Director. Employment opportunities for economic geologists will be listed free of charge.

DEADLINE FOR NEWSLETTER
#36: Nov. 23, 1998
Group Affiliates on Course at Mid-year

Elsewhere in this issue of the Newsletter, we discuss some daunting undertakings (in particular, the proposed Headquarters Building where all three SEG affiliates—SEG, SEGF, and PUBCO—will share offices). In this column, I want to point out the continued financial strength of the three affiliates as these entities continue to expand their scope of activities:

- SEG, SEGF, PUBCO are on course—financially strong and on, or ahead of, budget at this point in the year. Combined 1998 budgets for publishing, speakers, and short courses exceed $825,000 (excluding administrative expenses);
- Total assets continue to grow: $9.8 million vs. $8.7 million a year ago (see table);
- Restricted funds are growing: the Building Fund stands at $2.5 million, including the September purchase of land for construction of the Headquarters Building. McKinstry, Hickok-Baldwin, and BHP Student Grant Funds total $250,000;
- Due to the generosity of the McKinstry estate, the Foundation has been named final remainderman in the McKinstry Trust. The Foundation has been alerted that it will receive formal notification of the amount of the bequest when all affairs of the estate and trust have been settled, probably after May 1999.
- The Finance Committee is to be complimented again: The Committee has continued to sell selected equities into this longest of bull markets, and has simultaneously been creating a $2.4-million ladder, fixed income portfolio, covering the General Funds of the three entities, with maturities extending out to the year 2007;
- The Architecture Committee is developing a budget for the Headquarters Building Replacement and Maintenance Fund. This effort is aimed at predicting the level of funding required to cover the ongoing costs of operating the building once it is up and running. The objective is to establish a fund that will generate an income stream large enough to completely pay these costs. It is due to the Anonymous Donor's foresight and generosity that we are able to do such planning;
- The financial status of the three entities is as follows:

Group Fund Balances
(Including cash-in-banks) • June 30, 1998 ($US000)

<table>
<thead>
<tr>
<th>Fund Type</th>
<th>SEG</th>
<th>SEGF</th>
<th>PUBCO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>$6,020</td>
<td>$6,020</td>
<td>$2,872</td>
<td>$2,634</td>
</tr>
<tr>
<td>Restricted</td>
<td>2,464</td>
<td>1,946</td>
<td>250</td>
<td>220</td>
</tr>
<tr>
<td>Total Funds</td>
<td>4,119</td>
<td>3,566</td>
<td>3,122</td>
<td>2,854</td>
</tr>
</tbody>
</table>

PRESIDENTIAL PERSPECTIVE

Join up...and bring a friend

Reading the SEG Membership Directory is fun. You run across names of so many people with whom you have worked or played, or both. But, I am also struck by the large number of our colleagues who are not in the directory. I don't have data on this, but would guess that the number of economic geologists who are not members of SEG is at least as large as the number of those who are.

In the "old days," membership status might not have been very important to many people. Back then, membership information was almost a secret. An SEG Membership Directory was available, but it was published only every few years and could not be updated with information on new members or changes of address for old members.

Fortunately, that is about to change. Erich Peterson, SEG's hardworking webmaster, has just completed an on-line membership directory that will be available on our web site (as noted elsewhere in this edition of the Newsletter, the SEG web site has a second URL that is more easily remembered...simply www.segweb.org). This new directory is not a membership list that can be copied and used by others for commercial solicitation. Instead, it is a list that can be searched. You must enter a name and, if that person is a member, the address and other contact information will be shown. Information in this directory can be updated easily, so that changes of address and new member information will appear shortly after they are recorded at headquarters. That means that we can use the directory more efficiently to find each other.

The other use of this new directory will be to tell us who is a member and who is not. No longer will it be possible to pass for an SEG member because one is holding a hard lens and a copy of the Newsletter or Economic Geology. One look at the web directory will be enough to find out who has really joined up! When you do this, you are likely to be surprised to see how many qualified people are not SEG members. Most surprising are those who subscribe to Economic Geology and/or take an active part in our technical programs, but have not yet joined the SEG. With membership, which includes a subscription to Economic Geology, costing $85/year and a subscription alone priced at $75 per year, membership is a bargain. The extra $10 is more than offset by the Newsletter and the membership price discounts on publications and meetings.

So, why hasn't everyone joined up? It can't be today's sharp downturn in the exploration cycle because most non-members did not join up even when the cycle was at its peak. One possible reason is a lack of opportunity: people have simply not gotten around to filling out a membership application form and sending it in. In the old days, this was a non-trivial exercise involving a long form and the need for three sponsors. Several years ago, however, the membership application was reduced to a one-page form and one sponsor. But lots of people don't know about this. Nor do they know that the membership form can be downloaded from the SEG web site or found in our publications, and that processing of the application is usually completed in a few weeks.

As we move into the new headquarters building, there will be an increase in the efficiency and effectiveness of SEG activities. It would be great if we could show a similar increase in membership at the same time. The more members we have in SEG, the stronger the organization will be, the more input we will receive from members, and the closer SEG will come to truly serving the needs and interests of economic geologists. So, let's use Erich's new directory to identify potential members in our midst and convince them to join us in support of economic geology!
Dr. E.H. (Ernie) Ohle, Chair of the McKinstry Grant Committee and past SEG Foundation Trustee, has informed us of the passing of Mrs. Elizabeth McKinstry, wife of former Harvard Professor and SEG Fellow, Hugh McKinstry. We are all deeply saddened by her passing, as both she and her late husband, Hugh, were avid supporters of the SEG Foundation, SEG, and the profession of Economic Geology in general. A more detailed obituary is provided elsewhere in this issue of the Newsletter.

Elizabeth will be missed. However, thanks to her generosity, future economic geology graduate students will receive financial support for field-oriented thesis work at the Master's and Doctoral level.

Also published elsewhere in this Newsletter are abstracts of some of the thesis research projects supported by the 1998 SEG Foundation Grant program, including the McKinstry, Hickok-Radford, BHP, and general SEG Foundation grants. Information for 1999 SEG Foundation grant applications is also included.

As reported in the previous issue of the Newsletter, the SEG Foundation Grants program awarded $50,000 for student support during 1998. The level of proposed funding for 1999 will be reviewed jointly with the SEG Executive Committee at the fall meeting in October in Toronto, Ontario. Hopefully, the funding for 1999 student research grants can be increased from the 1998 level.

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Elizabeth Farwell McKinstry 1903-1998

Elizabeth Farwell McKinstry, widow of Professor Hugh E. McKinstry of Harvard, and a loyal and generous friend of SEG, passed away in Tucson, Arizona, on August 1, 1998, at the age of 95. She had been in ill health for several years. Hugh McKinstry, the 1954 SEG President, died in 1961. At the time of Hugh’s death, the obituary in the Harvard University Gazette described Elizabeth as “a Colorado lady of charm and vitality with a venturesome spirit and great adaptability.” These characteristics endeared her to many friends and particularly students of Hugh’s, who were her family, as she never had children.

Elizabeth maintained an intense loyalty to the science Hugh loved and to his old colleagues. In 1985 she revealed that she and Hugh intended to convey their estate to the Society of Economic Geologists Foundation. In 1991, she established the Hugh Exton McKinstry Fund with the purpose of providing funding primarily for student aid for field and laboratory research in economic geology. This was the beginning of what is becoming an increasingly significant source of annual SEG Foundation grants for student support.

All of those who were privileged to know Hugh and Elizabeth will be saddened to have lost this great couple who enriched so many lives, and in the years to come, hundreds of students will benefit from their generosity.

— E.L. OHLE

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Students of mineral resources throughout the world may apply for thesis research grants available in 1999 from the Society of Economic Geologists Foundation and the Society of Economic Geologists. The purpose of this research grant program is to provide partial support of master’s and doctoral thesis research for graduate students. Grants from the Hugh E. McKinstry Fund are awarded to support research with a substantial field component. The Hickok-Radford Fund awards grants for field projects in arctic, sub-arctic, or other challenging field areas. A third group of student research grants is in part funded by gifts from BHP Minerals. The BHP Student Grants are awarded to students who propose systematic studies of mineral deposits based upon a wide range of methods, from field mapping and traditional lab research, to modern high-tech instrumental analyses.

The 1999 awards available will total $50,000. Individual grants may range up to $3,000 and are intended to fund specific thesis research expenses. Application forms may be obtained from:

Chair • SEG Student Research Grants
5808 South Rapp Street, Suite 209 • Littleton, CO 80120 USA
Phone: +303.797.0332; Fax +303.797.0417
E-mail: socconeconol@csn.net
Forms are also available on the web: http://segweb.org
Applications must be postmarked by February 15, 1999, and awards will be announced by April 15, 1999.
Research Results
FROM STUDENT RESEARCH GRANT RECIPIENTS

Appearing below are abstracts submitted by some of the recipients of the 1996 and 1997 SEG Foundation Student Research Grants. These research projects were supported by grants from the Hugh E. McKinstrey fund, the Hickox-Radford fund, and the SEG Foundation general fund. These abstracts provide a brief overview of current research underway in university graduate departments, and highlight some outstanding future economic geologists.

Late porphyry-related gold mineralization at the Kingking porphyry Cu-Au deposit, Mindanao, Philippines: John Fortuna, Department of Geological Sciences, University of Michigan, Ann Arbor, S. Kesler, advisor.

Gold is deposited with copper in the potassic zone of most porphyry copper deposits, but can be remobilized during retrograde alteration or by later, unrelated hydrothermal events. Gold at the Kingking porphyry Cu-Au deposit (400 Mt, 0.35% Cu, 0.31 g/t Au) in the Philippines is in quartz-pyrite veins on the periphery of the high-grade zone. These veins are enclosed in sericite-clay-chlorite alteration and cut main-stage quartz-chalcopyrite-borneite veins in deeper parts of the deposit. The gold-quartz-pyrite veins previously interpreted to be of epithermal origin, based on lack of sulfides and the location of Kingking at the south end of the eastern Mindanao epithermal gold belt. Quartz in the main-stage quartz-chalcopyrite-borneite veins contains isolated liquid-rich inclusions with halite, sylvite, nematic and chalcopyrite daughter minerals, and vapor. The inclusions homogenize at 650° to 700°C, have salinities of 70% NaCl equivalent, and define a halite trend. Quartz in the gold-quartz-pyrite veins contains identical primary inclusions with the same daughter minerals and similar salinities. These inclusions homogenize at slightly lower temperatures (550°-600°C) and fall on the same halite trend. Close similarity of fluids in the two vein types suggests that Au-bearing quartz-pyrite veins are part of the porphyry system, and formed at slightly lower temperatures and slightly later than main-stage copper mineralization. The combination of high gold grades and lack of copper values in these gold-quartz-pyrite veins is unusual, however, and suggests that conditions during retrograde alteration of porphyry systems permit significant movement of gold, with no copper.

Experimental determination of oxygen and carbon stable isotope fractionation factors for malachite, and their application to natural samples: Erik Melchiorre, Department of Earth and Planetary Sciences, Washington University, St. Louis, Missouri, R. Criss, advisor.

We have experimentally determined the carbon isotope fractionation factor for CO₂-malachite, developed an oxygen isotope thermometer for malachite, and examined the natural variability of carbon and oxygen isotopes in natural samples. Synthetic malachite was precipitated using both slow and rapid techniques. Slow precipitation was achieved by mixing calcite and a copper nitrate solution, while rapid precipitation was achieved by mixing copper nitrate and sodium carbonate solutions. These experiments were performed under specific isotopic conditions, over the temperature range of 0° to 50°C. Analyses of the synthetic malachite precipitates and other reaction products show that the oxygen isotope signature of CO₂ gas liberated by acidification of malachite is temperature-dependent. The fractionation of carbon between CO₂ gas and malachite was also experimentally determined. Natural malachite samples were collected from major localities worldwide (>60 samples). Stable isotope analyses of these samples provide new insights into conditions of malachite formation. Results strongly suggest that malachite forms in low-temperature environments within the weathering horizon above the water table, inheriting a carbon isotope signature from soil CO₂, and oxygen isotope character from recent meteoric waters. This is believed to be the first quantitative demonstration of the temperatures of malachite formation.


Mineralization at the Greens Creek Zn-Pb-Ag-(Cu-Au) volcanogenic massive sulfide deposit in the Alexander terrane in southeast Alaska occurs discontinuously at the contact of phyllite—believed to represent hydrothermally altered mafic volcanics/volcaniclastics—and stratigraphically overlying graphitic argilite. Structural mapping was done in the lower southwest orebody during the 1997 summer field season. Polyphase folding and faulting, including isoclinal and refolded folds, low-angle faults, and late-stage high-angle strike-slip faults, make prediction of ore extensions difficult. On a lower hemisphere equal area projection, poles to S₂ foliation form a well-defined girdle with two maxima interpreted to represent isoclinal (F₂) fold limbs. Limbs strike north-northwesterly and dip steeply (74° SW; 84° NE). The pi-axis to the girdle is generally coaxial with measured small-scale F₂ fold hinges, and plunges 20° SSE. Measured F₂ fold hinges plunge about 38° with a similar south-southeastern trend. Two models are proposed to explain this similarity in orientation between the F₂ and F₃ fold hinges of the studied section of the lower southwest orebody. The first suggests that the two fold generations developed coaxially. The second model suggests that the F₂ fold axes have locally been rotated to lie subparallel to the F₃ fold axes. Determination of which model is correct will have significant implications for the tectonic history of the area, as well as for strategies used to predict ore location.


Proterozoic Zn-Pb-Ag, Cu-Zn (Au), and galinite (zinc-sphalerite)-bearing sulfide mineralization are present within strongly deformed metavolcanic rocks and sediments at the Cinderella and Bon Ton mines of central Colorado. Early ductile isoclinal folds have thickened mineralized horizons in fold hinges, which represent viable exploration targets along

In page 6
9,000 ft of exposed strike-length. Detailed mapping documents at least three distinct Proterozoic deformations. The first identifiable, 
D1, formed inclined, disharmonic, asymmetrical, isoclinal folds (F1) 
with southeast dipping axial planes. Stretch lineations and minor 
fold axes show a consistent north-northeast trend, and a shallow 14° 
to 15° plunge. Folding was influenced by tectonic differences in 
the deforming rock masses leading to rootless intrafolial folds. 
Parallel geometry folds occur in rigid silicified rocks, whereas similar 
geometry folds occur in hydrothermally altered felsic rocks. S1 
folding is defined by alignment of micaeous minerals and is 
parallel to axial planes of F1 folds. Felsic rocks contain prolate 
quartz-muscovite-sillimanite pods parallel to foliation (S1). Their 
long axis defines a distinctive stretching lineation (Li), which is 
parallel to the tectonic transport direction. Metamorphic mineral 
assemblage in these D1 fabrics implies that amphibole-grade 
metamorphism accompanied deformation. The second deformation 
event, D2, formed upright, open folds (F2) with hinge lines that 
plunge moderately 30° to 35°, and trend N 40° to 45° E. F3 folds 
have a wavelength of about one mile. F2 asymmetric S-folds are 
common at the Cinderella and BonTon mines; both lie on 
the southeast limb of a major F2 antiform. Unoriented retrograde 
mineral assemblages and annealed quartz textures suggest a low 
pressure metamorphic stage following D2. A third period of 
deformation, D3, formed east-trending open asymmetrical folds that 
plunge east, with sub-vertical axial planes that transform to brittle 
faults with increased deformation.

**Geochemistry of porphyry Cu-Au-Mo potassic ore fluids: A 
case study from the Yukon, Canada:** David Selby, Department of 
Earth and Atmospheric Sciences, University of Alberta, Edmonton, 
Alberta, Canada; B. Nesbitt, advisor.

Stable and radiogenic isotope ratios are used to determine the 
geochemistry and origins of potassic ore fluids at the Casino, Mount 
Nansen, and Cash, Late Cretaceous (70 Ma) porphyry Cu-Au-Mo 
deposits. The plutons intrude country rocks of Devonian 
Mississippian metamorphic rocks and the mid-Cretaceous Dawson 
Range Batholith. Potassic quartz veins contain a dominant 
exsolution of coexisting saline and vapor-rich fluid inclusions. The 
incclusion fluids possess δD values of −140 to −160‰, which deviate 
significantly from values typically reported for primary porphyry 
fluids (−40 to −100‰). The 87Sr/86Sr (t=70 means isotope ratios are 
calculated for 70 Ma) values of the Late Cretaceous plutons are 
0.7055 (Casino), 0.7048 (Mount Nansen), and 0.7055 (Cash). The 
87Sr/86Sr compositions of hydrothermal K feldspar are 0.70551 to 
0.70834 (n = 8; Casino), 0.7063 to 0.7070 (n = 4; Mount Nansen), 
and 0.7058 (n = 1; Cash). Analysis of fluids derived from crushed 
incclusion fluids from quartz veins shows 87Sr/86Sr compositions that 
are virtually identical to K feldspar compositions. The 87Sr/86Sr values of K feldspar samples describe an increasing radiogenic Sr 
composition, which is also observed for identical samples for 
common Pb. The 87Sr/86Sr compositions of hydrothermal K feldspar 
and inclusion fluids from quartz veins range from values similar to 
the genetically related plutons toward more radiogenic composition. 
Hydrogen, Sr, and Pb isotope results indicate the presence of a low 
δD, radiogenic Sr, and Pb component in the potassic ore fluids. 
(Nd-143 isotope values of plutons are −0.1 (Casino), 1.6 (Mount 
Nansen), and −0.3 (Cash), which are distinctly more juvenile than those of neighboring country rocks: −4.8 to −6.1 (Dawson Range

**Structural geology and exploration in the San Dimas 
district, Durango, Mexico—an alternative geologic model:** 
Johannes T. Horner, Department of Mineralogy, University of 
Salzburg, Austria; W.H. Paar, advisor.

The San Dimas district, located in the central Sierra Madre 
Occidental, Durango, Mexico, was investigated to define structural 
control of epithermal Ag-Au mineralization in relation to the 
geologic evolution of the area. As the magmatic arc of western 
Mexico migrated inland during Cretaceous-Tertiary time, plutonic 
rocks were emplaced, uplifted, and eroded. The overlying rhyolites 
and andesites previously thought to be of Late Cretaceous or Early 
Tertiary age, should be intruded by the granodiorite. However, lack 
of structures related to shallow intrusions and lack of intrusive 
contacts favor a Late-Eocene age for this lower volcanic group, the 
host rocks for the veins. Major Laramide deformation had ceased at 
the time of mineralization, but weak compression produced east-

**Paleomagnetism of Mississippi Valley-type (MVT) 
mineralization in southern France and its relationship to fluid 
flow and orogenesis:** Michael T. Lewchuk, Inst. de Physique du 
Globe, Lab. de Geomagnetisme et Paleomagnetisme, St. Maur 
Cedex, France.

A temporal relationship between orogenesis, regional crustal fluid 
migration, dolomitization, hydrocarbon localization, and MVT 
mineralization has been inferred from geochemistry, isotopic dating, 
and palaeomagnetism in several orogenic belts and adjacent basins 
throughout the world. This relationship was tested in France by 
palaeomagnetic analysis of MVT mineralized carbonates collected 
from four locations (Villemagne, Trèves, Gatzuërs, and Le 
Beyland) in the structurally complex Cévennes MVT-mineralized 
district. The area has been subjected to both Hercynian (Variscan) 
and Pyrenean tectonism. Rock magnetic tests indicate that geothite, 
pyrrhotite, and magnetite all carry remanent magnetization. Step 
demagnetization isolated a single polarity from extremely weakly 
magnetized samples at all four locations—a northerly, steeply 
downward remanence. After correction for tilting of the hosts during 
Pyrenean compression, or perhaps allowance for a small amount of 
residual viscous overprint, the remanence direction is closest to the 
Eocene reference pole for the European apparent polar wandering.
path. This age is coincident with that of uplift and tilting of the basin from Pyrenean tectonism. Supporting geological, geochemical, and palaeomagnetic evidence argue that this is the age of both the magnetization and MVT mineralization. Thus, this district fits the accepted model for MVT ore formation for other districts around the world. MVT mineralization in the Cévennes was the product of basin fluid migration northeastward from the Pyrenees towards the Massif Central.

**The earliest record of life on Earth—field program in the Isua Supracrustal Belt, southern Greenland:** S.J. Mojsis, Scripps Institution of Oceanography, University of California, San Diego, G. Archenius, advisor.

The presence of liquid water requires that specific conditions of temperature and pressure on the surface of Earth have been maintained since the earliest known geologic record. Study of the geological history of the oldest sediments on Earth, contained in rocks from the Isua Supracrustal Belt (ISB) and enclaves of metasediments elsewhere in southern West Greenland, termed the Akitia Association (AA), provides information about physical-chemical conditions present on the surface of the Earth at the time of the emergence of life before ca. 3900 Ma (Mojsis et al., 1996). Rocks of the ISB are contained within extensive granitoid gneisses (Amitsaag gneisses) of Early Archean (3600–3900 Ma) age. The identification of water-laid sediments such as banded iron-formation (BIF), metachert, and pillow lava basalts attests to the presence of a developed marine sedimentary system. Depositional regimes operating in the earliest Archean provide data on the variety of microbial life-forms before 3850 Ma and their participation in the cycling and concentration of iron, phosphorus, and carbon. Furthermore, understanding of the modes of sedimentation will assist in determining the importance (if any) of a "continental type" geochemical influence to the sedimentary pile, the kind of weathering of subaerial surface, and of a possible meteoritic influence on the geochemical budget of the early Earth.

Fieldwork was carried out in July 1997 under a project sponsored by the Geological Survey of Denmark and Greenland (GEUS), and supported by the SEG Foundation Award for research in challenging terrain, and achieved a number of specific goals. These goals were: (1) to provide a general geologic overview of the Archean Isua Gneiss Complex; (2) to elucidate structural relationships among various dated gneissic suites in the Godhulóspalur area that enclose the rocks of the ISB and AA; (3) to examine field relationships between metasedimentary packets like BIF, and amphibolite and meta-ultramafic rocks in the supracrustals; (4) to collect characteristic metasedimentary and meta-igneous specimens for laboratory analysis; and (5) to identify geographic regions of low deformation that might preserve some portion of original sedimentary fabric, and possibly fragile morphological microfossils. Promising host rocks to be used in researching additional chemical traces of early life were identified.

**Metal migration at Limonite Creek, central British Columbia, Canada:** Cari Deyell, Department of Geology, University of British Columbia, Vancouver, B.C., Canada, L.A. Groen, advisor.

The Limonite Creek property, in the Omineca Mining Division of central British Columbia, hosts alteration and sulfide mineralization and is currently being explored for copper-silver-gold targets. Alteration assemblages include intense alunite-bearing acid sulfate and pyrophyllite-rich advanced argillic zones, widespread areas of sericitic and propylitic alteration, and local zones of andalusite-rich aluminous alteration. Extensive oxidation and leaching in near-surface alteration zones has led to partial dissolution of hypogene sulfides, consisting primarily of pyrite, with trace amounts of chalcopyrite, covellite, colussite, sphalerite, and enargite found in areas of most intense alteration. Oxidation of these assemblages releases significant amounts of sulfate, iron, and trace amounts of Cu, As, and Zn to solution. Metals are precipitated in deposits of exotic limonite up to 20 ft thick. The exotic limonite deposits have been characterized by mineralogy (selective dissolution-XRD), geochemistry, and radiocarbon dating. Mineralogical work indicates that iron oxides precipitate as ferrhydrite, and subsequently transform to crystalline goethite within 1.5 cm of the surface. Trace element ICP-MS analyses on selected samples show that limonite locally contains trace amounts of metals, particularly Cu, Zn, and Mn. Controls on the distribution and local precipitation of metals are unknown. However, analyses of surface waters derived from springs around the limonite deposits also show detectable levels of these metals in addition to trace concentrations of As and Pb. Radiocarbon dating of a limonite sample taken from the base of one deposit returned an age of approximately 8,000 years, providing a minimum duration for active limonite precipitation. Additional dating will be used to constrain the rate of precipitation and the rate of metal transport from the oxidizing sulfide system.

**Geochemistry of volcanic rocks from Cerro de Oro, Sonora, Mexico:** Inocence Espinoza, University of Colorado, Boulder, Colorado, W.W. Atkinson Jr., advisor.

Cerro de Oro mining district, an area of precious- and base-metal mineralization, is located in Sonora, 70 km northeast of Hermosillo. Mineralization is related to an episode of regional magnetism of Late Tertiary age. Middle to upper Tertiary volcanic host rocks include basalt, porphyritic andesites, and rhyolite tuffs with coeval porphyry intrusives. Major oxides show that concentrations of Al₂O₃, total iron, MgO, CaO, and TiO₂ decrease with increasing SO₂ typical of calc-alkaline magmatism in subduction zones. Compositional trends primarily reflect crustal contamination of partial melts derived from subcontinental mantle wedge and/or from a subducted slab. Trace elements show enrichment in incompatible elements (Sr, Ba + Th) and low concentrations of Na, Ce, P, Zr, Hf, Sm, Ta, Y, and Yb. These patterns also are characteristic of all magmas genetically related to subduction zones, emphasizing the role of subduction-zone fluids enriched in Sr, Ba, and Pb in their petrogenesis. In particular, the Sr (700 ppm) and Rb (75 ppm) concentrations in andesites are similar to those of subduction zones.

Rocks locally associated with skarn deposits have distinctive compositions, evidence of hydrothermal alteration and/or metamorphism. These altered rocks have low concentrations of Na₂O and CaO, and high concentration of K₂O, which reflects sericite alteration. Another group of altered rocks have high SiO₂, also a product of hydrothermal alteration. A select group of rocks shows high Al₂O₃ and low SiO₂, and this is interpreted as related to clay alteration, which increases alumina concentrations while silica remains unchanged.

**Proterozoic geology of the Sunset City area, McIntyre Hills quadrangle, Fremont County, Colorado:** John M. Shallow, Colorado School of Mines, Golden, Colorado, E.P. Nelson, advisor.

Several Precambrian rock types are exposed in the Sunset City area in the southern part of the McIntyre Hills quadrangle. Gray paragneiss contains quartz, biotite, and variable amounts of hornblende, feldspar, garnet,
sillimanite, muscovite, magnetite, and cordierite. This unit grades into schist as sillimanite and/or muscovite exceeds 15 vol%. Two foliated, layered, felsic gneiss units are recognized. A body of felsic gneiss is closely associated with schist and an exhalite horizion. A second felsic unit, structurally higher than the first, is located along the east-west ridge outside Copper Gulch road and the old town site of Sunset City. The two units are separated by paragneiss. Several exhalite units are: dark, iron-rich, fine-grained quartzite; thinly layered white, green, and red marbles and calc-silicate units; and sulfide-bearing quartzites. Granite intrusions, with medium-grained and pegmatite varieties, are both discordant and concordant to local structures. All Precambrian units show evidence of at least two periods of deformation. The first phase produced isoclinal folds and pervasive foliation. A second deformation folded the foliated stratigraphy into open folds.

Geology and geochemistry of epithermal gold-silver telluride deposits of Montana, USA: Scott E. Thielen, Department of Geological and Atmospheric Sciences, Iowa State University, Ames, Iowa, P.G. Spry, advisor.

Epithermal Au-Ag telluride deposits in central Montana are spatially and genetically related to alkaline igneous intrusions of Cretaceous-Tertiary age and to the Great Falls Tectonic Zone. Mineralization styles include bonanza veins, carbonate replacement at igneous/carbonate contacts, breccia pipe-hosted, fault-controlled and sediment-hosted. More than one mineralization style may be present in a given deposit; however, all exhibit some structural control. Ore mineralogy is complex and consists of Au-Ag tellurides, native Au, and in some instances, Bi-tellurides and Bi-Au, and Ag sulfosalts. Alteration related to ore-stage fluids adjacent to veins is characterized by silica + fluorite + adularia + sericite + illite + kaolinite. A regional alteration halo is present in at least one locality and rosoeclite is associated with tellurides at several deposits. Several hundred fluid inclusion measurements suggest the gold telluride mineralization was deposited from low-temperature (130°-270°C), moderately saline (1-12 equiv wt % NaCl), nonboiling, CO₂-poor, oxidizing fluids with near-neutral pH. Oxygen and hydrogen isotope measurements indicate Au-Ag telluride mineralization was deposited by fluids with a meteoric or a mixed meteoric-magmatic source. Sulfur isotope data suggest a variety of magmatic and/or sedimentary sulfur sources. Some of these Au-Ag telluride deposits either contain molybdenite or have elevated Mo content and may represent one end member of a continuum with porphyry molybdenum deposits.

Mineralization and gold precipitation at the Getchell mine, Humboldt County, Nevada: Kelli Weaver, University of Nevada, Las Vegas, Nevada, J.S. Cline, advisor.

The objective of this study is to determine the location of gold in ore assemblages and to quantify trace-element geochemistry of gold-bearing pyrite at the Getchell sediment-hosted deposit. Mineralized and unmineralized sedimentary and igneous rocks were collected from high-grade ore and low-grade zones. Forty thin sections were analyzed by electron microprobe to determine major- and trace-element compositions of gold-bearing and barren pyrites, orpiment, realgar, stibnite, and galkhaite. Several types of pyrite are indicated by morphology, chemistry, and trace element compositions. Major elements, Fe and S, and trace elements, Ti, Au, Sb, As, and Hg correlate with crystal morphology and ore grade. Two types of high-gold pyrite form as framboïds in rock matrix and as rims on low-gold pyrite. High-grade pyrites contain elevated values for Hg, Ti, As, Sb, and Au. Low-grade pyrite contains nil to minor Hg, Ti, As, Sb, and Au. Co, Ag, Ni, Cu, Zn, and Mo trace-element values show erratic distribution and will require additional analyses and review. SIMS (Secondary Ion Mass Spectrometry) analyses are in progress to determine gold values in pyrite, realgar, and other gangue minerals.

Genetic model of a Carlin-type gold system: Mineral paragenesis and pressure-temperature constraints during mineralization at the Turquoise Ridge gold deposit, Nevada: Michiko Shigehiro, University of Nevada, Las Vegas, Nevada, J.S. Cline, advisor.

Gold ore at the Turquoise Ridge gold deposit, Nevada, is hosted by two types of variably metamorphosed sedimentary rocks. Mineralization occurs in brown hornfels at shallow levels and in black hornfels at deeper levels. Ore-bearing brown hornfels is clayerich with alternating bands of clay minerals and protolith. These clay bands are absent in black hornfels, a more competent graphitic rock. Gold is present in both types as sub-micron inclusions in ore-stage pyrite. Twenty-two samples from drill hole 94-172 were selected for detailed paragenetic and fluid inclusion studies. Three types of pyrite are identified: (1) coarse subhedral to euhedral pyrite; (2) banded pyrite; and (3) fine-grained pyrite. Type 1 pyrite is present in brown quartz veins and believed to be associated with a granodiorite stock. Bands of type 2 pyrite imply a sense of bedding, suggesting the pyrite is of diagenetic origin. Preliminary electron microprobe studies of type 3 pyrite confirm that these grains contain gold, arsenic, and elevated trace-metal values. Gold-bearing pyrite is consistently present both within jasperoid quartz and concentrated along jasperoid quartz grain boundaries, which suggests gold mineralization was introduced during jasperoid quartz deposition. Petrographic studies suggest a successive depositional sequence of (1) pyrite with gold, (2) jasperoid quartz, (3) orpiment, (4), realgar, and (5) calcite. Fluid inclusions in pre-gold quartz are abundant and approximately 5 μm in diameter. Most are two-phase and contain liquid and vapor, but vapor-rich and vapor-only inclusions also are present. Daughter crystals, possibly calcite, also are present in rare liquid-rich inclusions. Some inclusions occur along fracture planes, indicating a secondary origin. Inclusions in jasperoid are small, usually less than 2.5 μm in diameter, and are liquid-rich with a vapor bubble. Sparse liquid-vapor inclusions along ore-pyrite-bearing jasperoid quartz growth zones indicate a primary origin. Fluid inclusions are sparse in orpiment and realgar, and are generally less than 2.5 μm. Other than the few inclusions in growth zones, or healed fractures in pre-ore quartz, origins of most inclusions are unknown.

Genesis of Lower Carboniferous-aged Irish Zn-Pb-(Ba) deposits: An example of a deeply circulating hydrothermal system: Catherine Everett, Department of Geology and Geophysics, Yale University, New Haven, Connecticut, B. Skinner and D. Rye, advisors.

New evidence has been discovered in Ireland which supports the hypothesis that ore fluids circulated through and reacted with weakly metamorphosed, altered, and strongly fractured Silurian sedimentary basement rocks. Evidence from alteration and lead isotope studies negates the hypothesis that the Devonian to Lower Carboniferous Old Red Sandstone, directly overlying basement, could be the main source of lead for the carbonate-hosted deposits. The source for lead (and presumably other metals) is the Silurian
and Ordovician basement rocks. Fluid inclusion and stable isotope data from basement-hosted quartz-carbonate veins reveal the presence of a basement-equilibrated, high-temperature (>200°C), moderate salinity fluid which is strikingly similar to the high temperature ore fluids found in fluid inclusions in the Irish base-
metal deposits. There is also evidence for infiltration into the basement of low temperature surface fluids (both brines and either seawater or meteoric water). Chlorite + K - mica ± carbonate alteration in basement rocks is associated with major faults and with intense quartz-carbonate veining. Structural analysis of the faults and veins is consistent with a Lower Carboniferous age of formation. The sulfur isotope composition of vein-hosted barite (δ34S = +18.5%) is consistent with derivation of the sulfate from Carboniferous seawater. Hydrothermal alteration in the Old Red Sandstone is highly localized with little evidence for regionally extensive lateral flow of high temperature (>200°C) fluids proposed by Hitzman and Beary (1996). Observed chlorite + K - mica ± carbonate ± quartz ± pyrophyllite alteration, accompanied by bleaching of originally red strata, is restricted to the immediate vicinity of the deposits and is closely associated with faults that penetrate the basement (also noted by Mallon, 1997). Alteration in the Old Red Sandstone probably was produced by highly focused fluid flow along faults by basement-equilibrated high-temperature fluids. The Old Red Sandstone is isotopically homogeneous and does not appear to display the distinctive regional 206Pb/204Pb trends reported by O’Keefe (1986), Gauldfield et al., (1987), and LeHuray et al. (1987) in the metasediments of the basement and also in the Lower Carboniferous-aged deposit galenas. Therefore, it is most unlikely that the Old Red Sandstone could be the main metals source and have produced the distinctive regional lead isotope patterns of the Irish ore field. These results, in conjunction with previous Pb, S, C, O, and H isotope studies, imply that hydrothermal fluid flow within the basement rocks of Ireland was fundamental to the formation of the Irish deposits.

The Khory Mina project: A structure-controlled “mesothermal” gold deposit in the Cordillera Oriental, Bolivia: Peter Hanke, Department of Geological Sciences, University of Colorado, Boulder, Colorado, W.W. Atkinson, Jr., advisor.

The Khory Mina gold deposit is located about 300 km from La Paz on the west edge of Cordillera Oriental in central Bolivia. It lies within a second-order shear zone that parallels the strike of a large-scale regional anticline. Gold occurs in a widespread quartz-pyrite vein system that is connected to a spider web-like system of faults and fractures within a 40- to 100-meter-wide shear zone. Host rocks are mainly Paleozoic silica-clastic sedimentary units that are deformed and metamorphosed within the shear zone. Maximum metamorphic grade is quartzite-facies with a mineral assemblage of biotite-muscovite-chlorite-quartz-siderite. Wall-rock alteration is limited to secondary iron and silicification of strongly sheared rock adjacent to veins. Gold usually occurs as coarse grains (0.5-3.0 mm) in vein quartz that shows a vuggy fibrous character. Some gold is attached to pyrite crystals. The Khory Mina gold deposit belongs to the family of metamorphic (“mesothermal”) gold deposits, as indicated by structural setting of the deposit, character of the veins, weak hydrothermal alteration, brittle-ductile character of the rocks within the deposit, and relatively low metamorphic grade in the host rocks. Work is in progress to document the detailed structural setting of the deposit, and to define the relations between the second-order mineralized shear zone and the large regional structures.

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**Lindgren Award**

Each year the Society of Economic Geologists seeks to recognize outstanding contributions to economic geology by younger geoscientists. Contributions are assessed on the basis of one to three papers published by age 35. Nominees should be less than 37 years of age on 1 January, 1999.

This is one of the Society’s most prestigious awards, open to all persons contributing in a relevant aspect of economic geology. The award is truly international and is not restricted to SEG members.

Nominations should be sent to Bob Foster to arrive before 1 December, 1998. Each nomination should be supported by a detailed statement by the sponsor and should include the names of at least two additional supporters, preferably with their supporting statements.

Dr. R.P. Foster
Chair, Lindgren Award Committee
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Closing date for nominations: December 1, 1998
1997-1998 Thayer Lindsley Lecture Tour Report: North America and Asia

Jeffrey W. Hedenquist (SEG 1986)
DEPARTMENT OF MINERAL AND FUEL RESOURCES, GEOLOGICAL SURVEY OF JAPAN

"Finding a mine is nothing. You have to have people who can make them."
—THAYER LINDSLEY

Thayer Lindsley was born in Yokohama, Japan, in 1882, of New England parents. He received degrees from Harvard and Columbia, the latter in mining engineering. After World War I, he and his brother leased a rundown iron mine in Oregon. After finding new ore that netted $30,000, Lindsley was off to explore Canada. By 1928 he and his partners had formed Ventures Ltd., a holding company for a variety of properties, including those of Falconbridge Nickel Co. Ltd. Thus began 30 years of exploration and the acquisition of more than 180 properties.

Traveling from Japan it seemed appropriate, therefore, that I should begin my Thayer Lindsley lecture tour in Canada. My first stop was Ottawa, where I was hosted by Keiko Hattori of the University of Ottawa. I gave the first of my three talks, "Volcanoes, geothermal systems, and hydrothermal ore deposits: An intimate relationship," at an Ottawa-Carleton Geoscience Seminar attended by graduate students and staff from the two universities. A good group of economic geologists from the Geological Survey of Canada (GSC) also attended. The following day I spoke on, "Exploration for epithermal gold deposits in the Circum-Pacific region" at GSC.

Benöît Dubé later gave me an enthusiastic presentation of his work at the Hope Brook mine, a Late-Proterozoic high-sulfidation epithermal deposit in Newfoundland. Benöît showed how the principal characteristics of this deposit style were preserved despite a strong metamorphic overprint, and he stressed the potential for such deposits in similar terrain worldwide (Economic Geology, June–July, 1998).

I then flew from one national capital to another, arriving in Washington, D.C., where Phil and Jean Bethke looked after me. I visited the University of Maryland to present a lecture to Phil Candela's graduate students, as well as other students and staff from the department. This provided a challenge, to explain to non-specialists why studies of hydrothermal processes in active volcanic and geothermal systems can contribute to our understanding of how epithermal and porphyry deposits form, and in turn, help us in exploration. A tour of Phil's experimental laboratory brought me up to date on fundamental measurements of metal partitioning in melt-fluid systems. Such data, coupled with a range of other information, may soon enable geologists to predict which intrusions are more likely to have generated a metal-rich fluid, and why.

While in Washington I took the opportunity to visit the U.S. Geological Survey (USGS) in Reston, where I gave my third lecture, "Evolution of intrusion-centered hydrothermal systems: Coupling of porphyry and epithermal ore environments." The audience of old friends, was, nevertheless, critical, and had me dancing on a marshmallow at times. The talk was based on work that I conducted with Antonio Arribas, Jr., Jim Reynolds, and other colleagues at the Lepanto high-sulfidation epithermal system in the Philippines, which overlies the Far Southeast porphyry Cu-Au deposit of the same age (Economic Geology, June–July, 1998). Thus, I was confident that in at least one district these two types of mineralization are linked genetically through coupled processes.

The next stop was at the Virginia Polytechnic Institute in Blacksburg, where Bob Bodnar has established a world-renown group to study fluid processes, specializing in fluid inclusion techniques. Bob and his students kept me busy full-time by requesting all three of my talks, first to an early class, next to a departmental seminar, and finally to his group. One student was studying metals in melt inclusions that had erupted at different times from White Island Volcano, New Zealand. They found that continual degassing of the volcano resulted in a decrease in the metals left in the melt—as one
would predict, given the huge flux of metals accompanying the quiescent eruption, discharging as much as one million tonnes of Cu and 300 tonnes of Au over its short 10,000-year life.

Next in line was the University of Georgia, where Doug Crow and students were gathered for an evening discussion that never took place—canceled flights had meant that Jim Saunders waited patiently at the Atlanta airport for five hours (about a 6-pack in Georgia time) and we reached Athens in the wee hours. The following morning I gave the volcanoes talk to a broad range of students and staff. While in town I looked at a suite of Cripple Creek rocks that Doug and his student were working on, rocks with an interesting potassic style of alteration uncommon in most epithermal deposits.

In mid-December I was in Chile on other work and gave one of my Thayer Lindsley talks at the University of Concepción, where there have been efforts to establish an industry-oriented academic institute similar to Australian and Canadian examples. En route home to Japan, I was induced by Mark Barton to stop in Tucson and give an informal review of epithermal deposits, followed by my porphyry-to-epithermal-continuum talk; these were attended by students and faculty plus staff from the local U.S. Geological Survey office. Imagine the likes of Spencer Tice and John Guibert in the audience while I argued that advanced argillic and potassic alteration can be coupled in origin! Running late for a flight home may have saved me from more severe questioning.

Returning to Cripple Creek, what is beneath this giant Au deposit? We may yet find out, given the extensive drilling and development in the district, and further student research at the University of Arizona.

My Thayer Lindsley talks were modified and presented this past April at a mineral deposits study group symposium on Magnatism and Mineralization in Volcanic Arcs, at the Geological Society meeting in the United Kingdom, and again in June at an industry symposium in Mendoza, Argentina. Despite the recent downturn of exploration in Argentina, Victor Ramos was able to gather a large group for talks on a broad range of topics relevant to Andean exploration, from tectonic evolution to advances in remote sensing. My talk focused on the tops and bottoms of high-sulfidation deposits—in some cases acidic crater lakes and porphyry systems, respectively—incorporating research conducted by Antonio Arrichas during his post-doctoral stay in Japan. At Mendoza, Francisco Camus, Skip Cunningham, and I sat on a panel discussion. When academic backup to the mineral industry was discussed, we all stressed the developments in global activity by SEG, notably the many recent symposia commissioned in South America by Francisco during his just-completed SEG Regional Vice-Presidency.

Because I am based in Japan, the second leg of my SEG-sponsored travel focused on Asia, with visits to Bandung, Indonesia, Beijing, China, and Manila, Philippines, in May and July. In order to reach as many geologists as possible with the least amount of local travel, my host in each country arranged a two- to three-day series of lectures that incorporated my three talks plus a variety of background material. Lecturers and students from universities and staff from national institutes attended; industry representatives were also invited in Indonesia and the Philippines.

H. Ling Ong of the Institute of Technology, Bandung (ITB), organized my full-day lecture to a group of 45 with a broad range of backgrounds (Fig. 1). The following day I gave a general talk to a large gathering of students from universities in Bandung and around Java. The

FIG. 1. Attendees of a one-day Thayer Lindsley lecture series in May at Bandung, Indonesia. JEFF HEDENQUIST, lecturer, and H. LING ONG, local organizer, sit to the left and right, respectively, of the SEG banner.
morning highlight was a peaceful demonstration by hundreds of students at the main gate of ITB on my arrival, although I do not think I was the cause. Unfortunately, events the same day were not so peaceful in Jakarta, and my host needed some creative arrangements to get me out of the country just in time to make my next flight to China.

My host in Beijing was Yongfeng Zhu, a recent graduate from Moscow University and head of the economic geology division at Peking University, the oldest national university in China (Fig. 2). He and his assistant Zhaoshan Chang organized a three-day series of lectures and too many banquets to count. Students and staff from seven universities and national institutes from as far away as Wuhan attended (Fig. 3), and I was truly impressed by their keen interest and eagerness for learning. It was clear from my brief visit that China is moving ahead at a rapid pace in many ways.

I closed my Thayer Lindsley lecture tour in Manila, where Jun Yumul, associate dean of sciences at the University of the Philippines, did a tremendous job of beating the bushes. My two half-days of lectures were attended by 140 people (Fig. 4). I met later with Art Disini, president of Lepanto Consolidated Mining, to discuss their recent Victoria discovery. This huge low-sulfidation epithermal vein deposit contains spectacular Au grades, and is literally a stone's throw from the Lepanto high-sulfidation deposit. Since our study of Lepanto was just completed, I presented our results to a large gathering of the Geological Society of the Philippines during my final evening. Despite the pullout of some exploration groups from the Philippines for various reasons, several other companies have recently arrived, and it was good to see some old friends in new places. During discussion the exploration community was most interested in the relation of the Victoria deposit to Lepanto and the Far Southeast porphyry. Unfortunately, the answer to this one awaits further mapping and the next study.

In the Philippines I was advertised as the SEG Roving Lecturer. I enjoyed the roving tremendously, being able to meet such a wide variety of people, and receiving so much hospitality. In each of the countries that I visited outside North America, the SEG won a few more members. More importantly, the lecture program provided an opportunity for many to be exposed to
economic geology research conducted outside their countries, including students not involved in economic geology. I heard many times how universities are continually facing tighter budgets, making it difficult for many to invite outside speakers. Considering the recent decline of economic geology at many academic institutions, the Thayer Lindley lecture tour, along with our other lecture series, must surely be one of the best ways in which SEG can serve our worldwide membership and also, the Earth science profession as a whole.

Fig. 4. Part of the group that attended Thayer Lindley lectures given in July at the National Institute of Geological Sciences, University of the Philippines. **JEFF HEDENQUIST**, lecturer (front row, center), and **GRACIANO YUMUL**, Jr. (SEG 93; front row, far right), local organizer.
Thayer Lindsley Visiting Lecturers for Academic Year 1998-99

The Society of Economic Geologists announces the appointment of Michael J. Knuckey and C. Michael Lesher as the Thayer Lindsley Visiting Lecturers for 1998-99. Mr. Knuckey is Executive Vice-President, Exploration and Project Development, Noranda, Inc. Dr. Lesher is Director of the Mineral Exploration Research Center and Professor of Geology at Laurentian University. Mr. Knuckey travels widely in his business and possibly will be available for lectures outside North America. Dr. Lesher will be limited in his availability because of prior commitments.

Mr. Knuckey received his bachelor's degree (honors) in mining geology from the Royal School of Mines, London, in 1957. He worked as Chief Geologist for La Luz Mines (1967 to 1972), before joining Falconbridge Copper as Chief Geologist (1973 to 1981). He was named Vice-President, Exploration, in 1989, and served as Executive Vice-President, Exploration, Development and Technology, from 1993 to 1995. In 1995 he became President and CEO of Noranda Mining and Exploration, Inc., and took his present position in 1997. He is a fellow of the Geological Association of Canada (GAC), a member of the Canadian Institute of Mining, Metallurgy and Petroleum (CIMM), Prospectors and Developers Association of Canada (PDAC), and the Ontario Club of Toronto. He received GAC's Duncan Derryl Gold Medal in 1985 and was named Prospector of the Year (PDAC) in 1986; in 1993 he was the recipient of the A.O. Dufresne Award from CIMM.

Mr. Knuckey offers three talks: "World-Wide Exploration, Can We Afford It?"; "Exploration—Strategic Planning," and "Economic Implications of World-Wide Exploration." The first talk can be adapted to more general audiences; the latter two are more detailed, for advanced students and staff. He will be available during the week of November 16-21, 1998, and for the week of March 15-20, 1999.

Dr. Lesher was born in Indianapolis, Indiana, receiving a bachelor's degree in geology from Indiana University in 1974, and a master's degree in 1976. A summer job with the Iron Ore Company of Canada in Quebec led to a position as Research Geologist with the company until 1979. Work toward his Ph.D. at the University of Western Australia and as a post-doctoral fellow at the J. Tuzo Wilson Research Laboratories, University of Toronto, was followed by appointment as an assistant professor of geology at the University of Alabama. After 10 years at Alabama, he moved to Laurentian University to be professor and to serve as director of the Mineral Exploration Research Center. In 1989 and 1991, he was a visiting fellow at the Abteilung Geochemie, Max-Planck-Institute fur Chemie, Mainz, and in 1990 spent a semester as a visiting fellow at the Research School of Earth Sciences, Australian National University, Canberra, Australia. He is a fellow of both SEG and the Geological Society of America (GSA). He is a member of the American Geophysical Union (AGU), the Mineralogical Association of Canada (MAC), and the Society for Geology Applied to Mineral Deposits (SGA). He was a visiting lecturer for the CIMM during Spring 1998, and is very much involved in organizing the GAC-MAC meetings that will be held in Sudbury, May 1999. His research interests are diverse but the primary focus is on ultramafic rocks associated with magmatic Fe-Ni-Cu-(PGE) sulfide deposits, petrogenesis of komatiites, and the geology and metallogenesis of Archean-Proterozoic orogenic belts.

Dr. Lesher offers two lectures, primarily for advanced undergraduate and graduate students as well as faculty: (1) "Physical Volcanology, Geochemistry, and Petrogenesis of Komatiitic Basalt Lava Channels and Channelized Sheet Flows in the Cape Smith Belt, New Quebec," and (2) "Genesis of Magmatic Ni-Cu-(PGE) Sulphide Deposits." He will be available during the latter part of September 1998, and in January or February of 1999.

Collegiate institutions offering degrees in geology are eligible to request a Thayer Lindsley lecturer to visit their campus. The Society of Economic Geologists Foundation provides funds for the lecturers and the only cost to institutions hosting the visitors is for local transportation and/or special activities such as receptions or local dinners. Requests for visits are processed in order of receipt and priority is given to institutions who have never had a lecturer or to those who have not had a visit within the last two or three years. Inquiries and/or requests for visits by either Knuckey or Lesher should be addressed to: Dr. Clay T. Smith, Secretary, Thayer Lindsley Visiting Lecturer Committee, Department of Earth and Environmental Sciences, New Mexico Institute of Mining and Technology, Campus Station, Socorro, New Mexico, 87801. Phone: +1.505.835.5673 or +1.505.835.0453; Fax: +1.505.835.6436.
Announcing the SEG International Exchange Lecturer for 1998-99

The Society of Economic Geologists announces the selection of John M. Guilbert as SEG International Exchange Lecturer for 1998-99. He was a professor of Economic Geology at the University of Arizona for 29 years, until his retirement to emeritus status in 1994.

Dr. Guilbert earned a bachelor's degree from the University of North Carolina and received M.A. and Ph.D. degrees from the University of Wisconsin at Madison. He arrived at the University of Arizona, Tucson, in 1965, after eight years at the Geological Research Laboratory of The Anaconda Company in Butte, Montana. As a professor, he mentored several generations of economic geologists and made fundamental research progress in porphyry copper deposit geology. His major research contributions include studies in the petrology and zoning of porphyry copper deposits, development of geologic models and exploration methods for porphyry copper deposits, and classification of lithotectonic ore deposits. He is currently developing methods for multimedia instruction of field relationships in economic geology.

He has traveled extensively, visiting the world's most important ore fields as an academic on sabbatical, as a consultant, and as leader of University of Arizona student-industry field trips; a program he developed. He has run several short courses on quantitative alteration mapping of porphyry copper deposits and consulted on porphyry copper deposit exploration projects on almost every continent.

Dr. Guilbert was geologic advisor for the development of the world-class Bajo de la Alumbrera porphyry copper-gold deposit in northwest Argentina from 1993 to 1995. With James A. Briscoe, he recently formed, and chairs the board of, JABA, Inc., a publicly owned exploration company in Tucson, Arizona.

He is the senior author of The Geology of Ore Deposits, a widely used textbook and reference, and is currently preparing another edition of the text with Erich Petersen of the University of Utah.

A lecture tour of South America is planned, with possible excursions to South Africa and Australia during March and April of 1999. Possible talks include (1) "New insights from recent research on porphyry copper systems: sources, settings, and processes"; (2) "Bajo de la Alumbrera, Argentina: A case history of models application"; (3) "Exploration techniques for porphyry copper deposits in the 21st century"; (4) "Quantitative alteration mapping in porphyry copper, epithermal, and volcanic massive sulfide systems"; and (5) "Porphyry copper deposits in southwestern North America: A geologic update." Other titles may be added. Academic, government, and corporate institutions in South America, South Africa, and Australia interested in hosting one or more lectures are invited to contact Dr. Guilbert directly or, preferably, make arrangements through the Chairman of the SEG International Exchange Lectureship Committee, Robert J. Kamilli. Contact information follows:

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A symposium on Mineral Deposits in Mafic and Ultramafic Rocks, in honor of the retirement of Professor A.J. Naldrett, was held in Toronto on August 10-11, 1998, in conjunction with the 17th General Meeting of the International Mineralogical Association. The symposium, which was jointly sponsored by IMA, SEG, SGA, and IGCP Project 427 (Ore-Forming Processes in Dynamic Magmatic Systems), included two half-day (morning) oral sessions and two half-day (afternoon) poster presentations. The oral sessions included 13 invited speakers and the poster sessions included 19 volunteered presentations by participants from Australia, Canada, Denmark, Egypt, Finland, France, Germany, India, Italy, Portugal, Russia, South Africa, Ukraine, and the United States. Copies of the Abstract Volume are available from IMA (ima98@quartz.geology.utoronto.ca).

-Mike Leshner (SEG 1989)
FIELD CONFERENCE:
Epithermal Mineralization in the Tertiary Volcanic Belt of the Western Carpathians

SEG will sponsor a field trip to Hungary and Slovakia during the first half of September 1999, to examine areas of epithermal mineralization. The trip is being organized by Ferenc Molnár (SEG 1995), Eotvos Lorand University, Budapest and Jaroslav Lexa, Geological Survey of Slovakia, Bratislava. During evening lectures, local experts will speak on the geology of the region and ore deposits that will be visited. In addition, Antonio Arribas, Jr., Placer Dome Exploration, and Jeffrey Hedenquist, Geological Survey of Japan, will discuss the styles, characteristics, and genesis of epithermal deposits.

The Tertiary volcanic belt of the Carpathians was the principal gold-producing area of Europe during Medieval times. At present the region is undergoing renewed exploration interest by local and international companies. This 10-day, 1,000-km field trip will start and end in Budapest. Areas of low- and high-sulfidation epithermal mineralization in the Tokaj and Matra Mountains of northeastern Hungary and in the central Slovakian volcanic area will be visited. Participation is limited to about 25. A more detailed announcement, with itinerary, costs, and registration information, will appear in the January 1999 issue of the SEG Newsletter.

SEG Co-sponsors
Russian Meeting

The Society of Economic Geologists, together with the U.S. Geological Survey and others, co-sponsored the International Meeting on Metallogeny and Geodynamics of the North Asian Craton and Framing Orogenic Belts, held from August 25–28, 1998, in Irkutsk, Southern Siberia, Russia, with a companion pre-meeting field trip from August 20–24. SEG provided a grant of $1,000 to the conference, organized mainly by the Russian Academy of Sciences and the Ministry of Natural Resources. Dr. Mikhail Kuzmin served as Conference Chairman.

About 160 persons registered and attended the conference, including about 30 foreign scientists. This relatively large attendance was unusual considering the severe economic difficulties currently affecting Russia, including both the devaluation of the ruble, and the fact that Russian governmental scientists had not been paid for the two months prior to the meeting. About 30 scientists attended the pre-conference field trip to the relatively remote area of the Zun-Kholba gold deposit in the Altay-Sayan Mountains and the Southern Lake Baikal region. The theme of the conference, metallogeny and geodynamics (tectonics), including the tectonic analysis of the origins of belts of mineral deposits, was emphasized in many scientific presentations, all of which were very well attended. A large abstracts volume, about 350 pages long, was printed and distributed to all registrants. Substantial coverage of the conference by the Russian press occurred at the beginning of the conference. The sponsorship of the conference by SEG was warmly appreciated, as expressed by Dr. Kuzmin, in both his opening and closing remarks.

— Contributed by Warren Nokleberg, USGS (SEG 1988)
PACRIM'99
International Congress on Earth Science, Exploration and Mining Around the Pacific Rim, Nusa Dua, Bali, Indonesia
14-16 June 1999
PACRIM congresses are held every four years and provide an excellent opportunity to present new developments in Mining and Earth sciences in countries around the Pacific Rim

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The Society of Economic Geologists, Inc. celebrates 75 years of progress (1920-1995) with the publication of this special edition of the Society's history by E.N. Cameron, et al. The book chronicles the history of the Society from the year of its founding in 1920 through 1995. It covers, within the framework of the times, the events that led to the founding of the Society; the critical, formative years; and the subsequent periods of growth, development and change.

How the Society is constituted, governed and managed, and its objectives, activities and accomplishments are described and discussed. Chapters presenting the history of the Economic Geology Publishing Company (actually 15 years older than the Society!) and the SEG Foundation clarify the close relationship between the Society and these two organizations.

Sixteen appendices present supplementary information, including a photographic gallery of Society presidents, lists of officers, councilors, regional vice presidents, award recipients, society-sponsored activities and much more. With historic photographs and documents, hard bound, 246 pages, US$15—an elegant book you will be pleased to possess.

Order using the Publication Sales Order Form on page 43.
of this is that those attending meetings in the conference room will be tempted to gaze out the window, and not focus on the business-at-hand!

The building will be as functional as it is beautiful. The spacious offices are configured to optimize traffic flow and facilitate communication among personnel. Office furniture is being selected on the basis of functionality, ergonomic characteristics, and aesthetic considerations. State-of-the-art computer and telephone systems will be installed as the building nears completion. As can be seen from the plans, there is ample room for future expansion.

The SEG Council previously authorized expenditure of up to $610,000 for purchase of land and an initial $1.0 million for design and construction of the building. Progress on the building was reviewed at the SEG Executive Committee's mid-year meeting (July 30–31, 1998). The Executive Committee accepted the recommendations of the Architecture Committee and approved the proposed design for the building and the corresponding preliminary cost estimate of $2,210,629 from the Buchanan Youneshwski Group (BYG), the firm recommended by the Architecture Committee to complete the design, construction, furnishing, and landscaping of the project on a turn-key basis. At the time of the Executive Committee meeting, the market value of the Headquarters Building Fund, established through the two previously announced gifts of Berkshire Hathaway stock from our Anonymous Donor, totaled approximately $2.4 million. Then, at the same time, our Anonymous Donor pledged a further gift of $1.6 million that will bring the Building Fund to a total of $4.0 million! These truly extraordinary gifts will cover all of the costs involved in the design, construction, and furnishing of the building, the cost for landscaping and other site improvements, and will allow the Society to establish a board-restricted fund that will provide a future income stream to offset the operating and maintenance costs for the building. Thus the entire project, including future operating and maintenance expenses, will be self-funding and should not require any direct financial support from the Society.

![Fig. 1: Location map — Site of New SEG Headquarters Building](image-url)
Summary of SEG Architecture Committee Activities

The ad hoc SEG Architecture Committee was appointed by then-President Phil Bethke in August 1997 and is the successor to the ad hoc SEG Headquarters Acquisition Committee (4/97 to 6/97). The Acquisition Committee was charged with determining the location and size parameters of a facility for the Society to conduct its activities. Prior committees had determined that the Society should have a permanent headquarters building in the Denver area (report of the Strategic Planning Panel, 2/23/97). The Acquisition Committee's report of June 23, 1997, recommended that the building be located in the southwest Denver area and that, depending on projected growth of the Society, be sized between 6,000 and 10,000 square feet. A preliminary, rudimentary estimate of the building cost was around $1 million.

The current ad hoc Architecture Committee, expanding on prior work, focused on selecting a building site, an architect, and developing a design for the building. The Committee located one site in the Ken Caryl Business Center (in the southwest Denver area) that met most of the Society's requirements. As part of a due diligence effort, a commercial realtor was retained to conduct a survey for comparable sites. During the land review phase, a search was undertaken to identify an architect/builder that could provide the Society with a "turn-key" design/construction arrangement. The commercial realtor provided the committee with a list of several such candidates.

During the next 10 to 12 weeks, eight sites were reviewed against the Society's requirements: a campus-like setting, spacious site, access to infrastructure (technology, mail, highways, hotels, etc.), front range mountain view, and in a general price range that would be affordable. By early November, a purchase-offer letter was delivered to the representative of the Ken Caryl Business Center. The offer was for two contiguous lots, totaling three acres, in the northern part of the center, near the original area considered by the Committee. The site is adjacent to a golf course currently under construction and within a newly developing area of the business center that will be composed of low- to moderate-rise professional office buildings. The site offers a view of the front range to the south of Denver, including Pike's Peak.

The selection of the site prompted a heightened effort to select an architect/builder. Inquiries were made and interviews conducted with local and national architects with offices in Denver. Three firms capable of designing and supervising construction of the building made the short list. Reference checking, visits to completed buildings, follow-up interviews, and discussions of design concepts were conducted into 1998. In early March 1998, the committee unanimously selected Scholar, Buchanan & Yonushewski (now known as Buchanan Yonushewski Group, LLC or BYG) of Denver to design and construct the new headquarters building. In the last several years, BYG has won several design awards for both commercial and residential projects in the Denver area.

The Committee was extremely pleased that at one of the very early design meetings, the architects presented a conceptual drawing of the building that was to become the foundation for all the subsequent design plans. The building concept was a low, peaked roof, "high plains" design with a stone/rock facing and large windows toward the front-range view.

During the past six months, the Committee has met with BYG on a weekly to bi-weekly basis to discuss and decide size, function, layout, materials, and numerous other aspects of the building and its landscaping. Concurrently, BYG is working with the business center developer, SEG's attorney, and various county planners, engineers and regulatory groups to obtain the approvals and permits necessary to complete purchase of the property and commence construction of the building. The current estimate is that ground-breaking for the building will occur in October. The building could be ready for occupancy by mid- to late-1999.

SEG Architecture Committee:
T.A. LOUCKS  J.A. THOMAS
R.A. NEWELL  A.W. COURTNEY, CHAIR
FIG. 2: NEW S.E.G. HEADQUARTERS BUILDING FLOOR PLAN
These drawings illustrate the "prairie-style" architecture of the SEG Headquarters Building. The long, low profile is enhanced by flagstone-like facings and a slate-like roof. The upward-tapering structural columns firmly "anchor" the building and create an impression of strength and stability. The "North Elevation" (Fig. 3A) is the front of the building, with the main entrance in the center, as viewed from Shaffer Parkway (Fig. 4). A skylight in the roof provides soft, indirect north-lighting in the conference room. The building, as situated on its three-acre setting (Fig. 4), fits well with the campus-like environment of the Ken Caryl Business Center and the surrounding topography.

The "South Elevation" (Fig. 3B) faces the 15th fairway of a links-type golf course being constructed between the Business Center and the curve of the C470 Beltway (Fig. 1, Page 19). The window-wall of the conference room on the main level provides the focal point for this side of the building. Views from the conference room and the two adjacent patio decks (Fig. 3C) extend across the golf course and beyond to the Colorado Front Range.
Landscape plans (Fig. 4) incorporate native trees, plants and grasses that will harmonize with the surrounding environment. The spacious parking area will readily accommodate the many visitors we hope to welcome to the building.
EXPLORATION REVIEW

CHILE

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Following the takeover of Westmin by the Swedish mining company Boliden last spring, mining and development, respectively, continue at the Lomas Bayas and Fortuna de Cobre copper deposits (Fig. 1). At Lomas Bayas, Compañía Minera Lomas Bayas is mining 25,000 tonnes per day (tpd) of heap leach copper oxide ore and 13–15 ktpd of dump leach oxide material. Heap leach material is defined using a 0.23% soluble copper cutoff grade and contains an average of 0.45% soluble copper. Dump leach material is defined using a 0.09% soluble copper cutoff grade and contains an average of 0.13–0.15% soluble copper. Copper production in 1998 is expected to be about 40,000 tonnes of SX-EW copper cathode, rising next year to 60,000 tonnes/year for the anticipated 12-year mine life.

The Lomas Bayas copper oxide ores are hosted by a Paleocene-age porphyry copper system comprising granodiorite intruded by a feldspar porphyry. These intrusions were emplaced along northeasterly trending regional structures, with east-west and low-angle north-west-trending structures providing local control on oxide mineral development. Quartz-tourmaline breccias are late hydrothermal features, and apparently host some of the highest copper grades. Wall-rock alteration, especially well developed in the granodiorite, consists of K-silicate constructive biotite + K feldspar + quartz, including biotite replacement of mafic mafic minerals.

Copper oxides include the sulfite minerals brochantite, antlerite, and local chalcanthite; subordinate are atacamite and chrysocolla. These oxides are dominantly fracture-controlled, and have been derived from the weathering of weakly developed chalcocite + minor covellite enrichment. Proteres at Lomas Bayas consist of veinlet and breccia-hosted pyrite + chalcopryite, with scant molybdenite; molybdenum values are typically 10–20 ppm. Proven and probable heap leach plus dump leach ores total 305 million tonnes containing approximately 0.4% Cu; the global resource at Lomas Bayas exceeds 1 billion tonnes at a grade of 0.2–0.3% copper.

Just north of Lomas Bayas, the Flor del Desierto prospect, drilled by BHP, has an estimated resource of 60 million tonnes containing 0.35–0.4% copper.

Over the hill from Lomas Bayas at Fortuna de Cobre, exploration continues on a very deeply oxidized, Paleocene-age porphyry copper system hosting copper sulfates and chlorides. Oxidation to depths of greater than 500 meters has generated a chalcanthite + minor atacamite resource comprising more than 240 million tonnes of 0.37% soluble copper, with a global resource several times greater.

Granodiorite, the K feldspar-bearing Lomas porphyry, and the tonalitic Fortuna de Cobre porphyry, along with near-vertical hydrothermal breccia bodies, host the low-grade Fortuna de Cobre proteres assemblage of pyrite-chalcopryite-scant molybdenite-chlorite. The intrusions show a northeast elongation, apparently emplaced along a local structural trend, although veinlets generally trend west-northeast. Alteration consists of a central phyllic zone with an argillic halo; this grades outward into a white phyllosilicate + chlorite assemblage, with outermost alteration characterized by chloritization of mafic minerals. No K-silicate constructive alteration is noted at Fortuna de Cobre.

Boliden geologists have defined upper and lower enrichment zones within the Fortuna de Cobre porphyry system. The upper enrichment zone consists of chalcanthite with minor atacamite and chalcocite, and relic pyrite overlying chalcocite and covellite, with relic pyrite and chalcopyrite. The occurrence of abundant iron sulfates within the oxidized and leached column at Fortuna de Cobre suggests that weathering generated a very low-pH environment, so that minerals such as voltaite, coquimbite,
copiapite, melanterite, and sideronatrite are the principal gangue minerals in the deposit. Exploration to define copper distribution within the Fortuna de Cobre oxidized zone is continuing.

The copper resource at Chaucuquizama continues to expand as CODELCO evaluates its leachable copper resources. Mining continues at 160,000 tonnes per day at an average grade of 1.08% Cu, plus an additional 30,000 tonnes per day of leach material. Production for 1998 is projected at 800,000 tonnes of fine copper, with about 60% of that derived from mill concentrates and the remainder from leaching operations, including copper cathodes from the newly-commissioned Radomiro Tomic mine.

The mineralized complex at Chaucuquizama, which includes the south-to-north mineralized zones at MM, Mina Sur (formerly Exotica), Chaucuquizama, Chuequi Norte, and Radomiro Tomic, is approximately 14 kilometers long, straddling the Falda de Domeyko (a.k.a. West Fissure). The total copper resource is greater than 11 billion tonnes of ore with 0.22% Cu cutoff grade, with an average grade of 0.76% Cu at 0.22% Cu cutoff. This yields a total of nearly 87 million tonnes of contained copper. Of this amount, production from Chaucuquizama and Mina Sur totals nearly 33 million tonnes of fine copper. For comparison, the total contained copper resource of the Morenci-Metallif District in Arizona is approximately 30 million tonnes. The remaining 55 million tonnes of copper in the Chaucuquizama District should keep miners busy for quite some time.

Whereas production of copper is from both sulfide and oxide copper minerals at Chaucuquizama, the Radomiro Tomic mine, located six kilometers north of the Chaucuquizama open pit mine, is producing leach ore from a copper oxide assemblage of atacamite, copper wad, and chrysocolla. The 4km by 0.8km area that defines the main part of the deposit is a porphyry system comprising low-pyrite, K-silicate constructive alteration-mineralization hosted by the Chuequi Porphyry, a granodiorite intrusion, and andesite volcanic rocks. Pervasive biotite development, including biotitization of hornblende, characterizes the K-silicate constructive alteration zone.

A locally developed supergene enrichment volume of chalcocite and covellite overlies a protolith containing the hypogene sulfide assemblage of chalcopyrite, bornite, and chalcocite (see note on El Abra, below). Planned copper production for 1998 is 150 to 180 thousand tonnes of fine copper.

And, if these figures are not stunning enough, CODELCO continues to identify new copper resources. Exploration continues at their Gaby property, located between La Escondida and Chaucuquizama, and their Apache prospect, located just outside of Calama and less than 10 kilometers from the Chaucuquizama open pit. The supergene chalcocite mineralization at Apache currently comprises several hundred million tonnes of material with a grade of 0.7 to 0.8% copper! Maybe the local adage is correct, “If one mined all of northern Chile, it would average 0.3% copper!”

Sociedad Contractual Minera El Abra (Cyprus Minerals 51%, CODELCO 49%) continues to produce fine copper from the leaching of copper oxides derived from the Oligocene-age porphyry system at El Abra, three kilometers east of the Falda de Domeyko Fault zone and only 50 kilometers north of Chaucuquizama. Copper oxides consist of brochantite, chrysocolla, and copper-bearing clays, along with cuprite and neocrocite, and are the result of weathering-derived oxidation of a low-pyrite, K-silicate protore of structurally controlled and minor disseminated chalcopyrite, bornite, and chalcocite. Copper oxides occur as fracture fillings and disseminated grains, apparently having replaced sulfide, over a vertical extent of 100 to 300 meters. Copper oxides outcropped in the present open pit area.

Oxides are controlled by west- to northwest-trending fractures—the principal structural trend of the El Abra District—including that of the Veta Maria copper vein system. Intrusive rocks at El Abra include diorite porphyry, monzodiorite porphyry, and quartz monzonite of the El Abra Porphyry. Well-developed K-silicate constructive alteration, similar to that at Radomiro Tomic, consists of biotization of mafic minerals as well as biotite + quartz + sulfide veinlet occurrence. Phyllic alteration, including sulfide-bearing “D” veins, forms a halo around a central K-silicate alteration zone. A peripheral propylitic alteration zone contains chlorite and carbonate.

The copper resource at El Abra contains proven + probable oxide reserves of nearly 800 million tonnes at an average grade of 0.55% Cu; an additional sulfide resource consists of approximately 1 billion tonnes of material containing 0.6% Cu.

Nearer to the Chilean coastline, copper production from Mesozoic volcanic rocks continues from andesite-hosted deposits at Mantos Blancos, the Michilla District, and Iván.

Empresa Minera de Mantos Blancos has evaluated the leach potential of their copper oxide-bearing dump material at Mantos Blancos, concluding that about 300 million tonnes of mineralized rock containing 0.3% Cu as paratacamite and chrysocolla exist in various stockpiles. Study is underway to see how this resource can be added to remaining proven copper reserves of 30 million tonnes of oxide ore containing 0.9% Cu and 40 million tonnes of sulfide ore containing 1.0% Cu; a floating copper cutoff grade of 0.3 to 0.5% Cu is used in ore reserve calculations. Silver is important in Mantos Blancos ores and occurs as a solid solution within copper sulfides. Sulfide ores comprise hypogene bornite, digenite, chalcocite, covellite, and chalcocyprite with local pyrite, hosted by albitized Triassic (?) volcanic rocks. Annual production is 85,000 tonnes of contained copper.

The Iván property of Minera Rayrock Limitada produces approximately 12,000 tonnes per year from copper oxides and sulfides hosted by hydrothermal breccias and mineralized flows within Jurassic volcanic rocks of the Coastal Cordillera. Subvertical breccia bodies and stockwork zones host hypogene bornite, chalcocite, djurleite, with subordinate pyrite and chalcopryite. Pyrite-dominant breccias also occur in the district, and may form a halo adjacent to copper-bearing breccias. Zoning of the orebodies at Iván and at Mantos Blancos is similar, with central bornite + “chalcocite” (digenite, djurleite, chalcocite) generally surrounded by chalcocyprite, with peripheral pyrite. Albition of andesitic host rocks, including albitite.
developed as a matrix material within breccias, is widespread, as is chlorite development. The total copper resource at Iván is approximately 7 million tonnes containing 2% Cu and significant Ag.

**MEXICO**

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I am certain that my suggestions in this column had nothing to do with SECOFI (the commerce secretariat with jurisdiction over the Dirección de Minas and the Consejo) finally deciding to go ahead with concursos on the best of the claims it holds in Mexico. You never know. As reported here previously, efforts by SECOFI in the past year to sell off national reserves have resulted in a collective yawn from the exploration industry. Then, even in the face of a dreadful downturn in the mining business, SECOFI decided to put up its best exploration holdings. The concurso announced this spring produced bids that exceeded my expectations by a decimal point and probably exceeded SECOFI’s expectations as well.

The big winners, assuming discoveries are made, were the Teck-Miranda joint venture, Peñoles, and Grupo Mexico. Peñoles came in with the high bid for any claim with US$5 million and a 2.5% NSR for Pinos Altos in the Sierra Madre of western Chihuahua. Peñoles has been working on its claims in the same area for several years and is clearly in on to a gold-silver discovery of significance. Judging from its bid, their discovery extends into the adjacent Consejo claim.

The long-awaited concurso on the Morelos claim in Guerrero did not disappoint. The claim was divided into two blocks, Morelos Norte, a block contiguous with Nukay, and Morelos Sur, a block contiguous with Bermejal. Teck and Miranda, with a bid of $3.2 million and a 2.5% NSR, were the non-surprise winners of the Morelos Norte block. Of real surprise, to me at least, was that Grupo Mexico, which until now has not shown too much interest in the gold business, blew away the competition (Peñoles and Teck) with a $4 million bid and a 2.5% NSR on the southern block.

Grupo Mexico was also most aggressive on the large Guanajuato 1 claim, the location monument for which was so close to Leon that it was overrun by the city and now lies in a warehouse. On this claim, Grupo Mexico bid $2.8 million in cash plus the ubiquitous 2.5% NSR to earn out-bid Peñoles. This claim has skarn, veins, and VMS occurrences with potential for gold, silver, copper, lead, zinc, and even tungsten. It is a truly wonderful budget property. Peñoles did not come up empty in the area, having the high bid on the adjacent Guanajuato 2 and 3 claims. These went for the lowest cost of all, $800,000 and (surprise), a 2.5% NSR.

I guess I have zero chance now of convincing SECOFI to do away with the NSR requirement in these concursos. However, this does not mean I still don’t have a few dull axes to grind. The one I would like to grind most and which I have worked over before to little effect concerns the release of abandoned ground to mineral entry. As everyone working in Mexico knows, once a claim is dropped by the title holder the ground it covered is not automatically open to staking. The libertad of the claim must first be published in the Diario Oficial. There has always been slow release of claims that were dropped: a couple of years might be the average for the libertad to be published. Not so for ground that has been dropped by way of reducing a claim in size. This ground has not been opened to staking, at least since 1992, producing a huge backlog of ground that is effectively closed to mineral entry.

A remedy has been sought by industry for some time and, in April, the Dirección de Minas decided to solve the problem. They published in the Diario Oficial, declaring all such ground open in 30 days. It was a brilliant, bold stroke to solve the problem—to too brilliant and too bold. The week before the big rush was to start, and well after many companies had spent significant sums preparing claims in field and paying filing application fees, the Dirección de Minas postponed the whole thing. As the new date approached in early July, the Dirección de Minas changed course again. The new decision was that abandoned ground would be treated like dropped claims and each reduction would be published for staking individually. I suspect lawyers are behind this mess.

If history is a guide, abandoned ground will be published for staking, claim by claim, and over a period of years. A lot of ground that the Hacienda could be collecting taxes on will remain closed to entry. What is worse is that the Dirección de Minas has tripled the investment required to hold ground. Actually, this is probably good because it will promote evaluation of ground and turnover, but it is bad that many huge claims are going to be reduced in the coming year without being properly evaluated. Prime exploration ground will be dropped and will be off-limits for who knows how long.

As an example, a number of companies have more than a million hectares in either the gold belt of the Sierra Madre or in the VMS belt of Zacatecas. The first year these are titled will require something like $5 million in work to hold. Starting in year two this will go to $15 million and huge reductions in claim sizes will occur. Literally millions of hectares in Mexico’s most favorable mineral belts are going to be abandoned and may be off-limits for years.

There is going to be yet another source of ground coming open and this is due to failure to pay taxes. Historically, not paying taxes on your claims was not cause for the Dirección de Minas to cancel them and a lot of small claim holders ignored taxes. Even though you could get in big trouble with the Hacienda for not paying the taxes and were likely to face big fines and interest charges, your claim would not be canceled. Then, too, the Hacienda and Dirección de Minas did not talk to each other, so the Hacienda was never going to come after you.

Well, all good things come to an end, sometime. Anyone who owes back taxes has or will receive a quite threatening letter from the Dirección de Minas to pay up or have the claim canceled. Thousands of these notices are going out and many have very large tabs owing to the aforementioned penalties and interest charges. You don’t have to pay if you drop the claim, as long as the Hacienda doesn’t come after you—and, as already stated, they never have before. Unfortunately, the Hacienda is now “randomly” selecting claims to audit tax payments. I suspect the income-producing results will result in claims being randomly selected until there are no more to select. These tax matters are sure to result in thousands of small claims being canceled, which will further clog up the publication of libertades pipeline.

As far as exploration is concerned, I am not aware of any new major discovery and will leave it at that. I hope I won’t get deported, and will be here to report news of big discoveries at Christmas.
WESTERN UNITED STATES
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CALIFORNIA

After all these years (since about 1979), Glamis Gold has finally completed mining at Picacho in Imperial County. This was either the first, or one of the first, large heap leach gold mines in the U.S.

IDAHO

Twin Gold Corp. has completed a "scoping study" at the Atlanta project (Boise County), concluding that there are 1.5 million ounces of gold, with 3.2 million ounces of silver in the deposit. The study projects the recovery of 754,000 ounces of gold at a cash operating cost of $176.47 per ounce of gold. Twin Gold is now looking for financing, but then who isn't?

MONTANA

Hanover Gold has commenced a 10,000-foot drilling program at its Virginia City (Madison County) project. They will test six targets with 200- to 600-foot holes.

Brimstone Gold Corp. has reported high-grade drill hole intercepts from a hole at the Mayflower mine in Madison County. The intervals vary from one of about one ounce of gold per ton to 5.5 feet of 9.6 opt Au and 28.2 opt Ag. The best interval is 2 feet with an average grade of 20.8 opt Au and 47.9 opt Ag. This, plus other recent drilling, suggests bonanza grade ore should up to 440 feet below previous mining.

Canyon Resources has started a go-slow process for permitting McDonald Meadows, in Lewis and Clark County. They are citing: (a) low gold prices, (b) lack of cash to fund the $500,000 per month EIS cost, (c) the Turners don't like it and (d) all of the above - "take your pick."

NEVADA

Not all of the news in the gold mining industry is bad. Placer Dome is reporting that the first half year cash cost at the Pipeline mine (Lander County) was $64 per ounce of gold. Grade does count! Placer Dome is also estimating that the South Pipeline mine will be in production by 2002.

Cortez Joint Venture has resumed exploration of the western portion of Coral Gold's Robertson and Ruf properties in Lander County. Two holes on the Ruf claims (south of the Robertson mineralized area) encountered only Slaven Chert in the upper plate of the Roberts Mountains thrust. Two holes are being drilled in the western portion of the property, along the "Pipeline fault" (no comment). Assay results were not reported for any of the holes.

Great Basin Gold has to be given the award for guts at their Wilson Independence property in Lander County. They are drilling 3,000+ foot holes to test a nearly flat lying gold zone in Anler Sequence rocks below the Golconda thrust. Hole WI-00 encountered 11.8 feet of 0.445 opt Au, with a lower interval of 5.2 feet of 2.16 opt Au. Hole WI-002, which was drilled more than 2,000 feet away, encountered 5 feet of 0.108 opt Au.

In Central America...
Geologic Mapping, Geochemical Exploration, Data Analysis, GIS, Property Evaluation

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PAID ADVERTISEMENT
Construction has started at Alta Gold’s Olinghouse project in Washoe County. They are anticipating producing about 100,000 ounces of gold per year at a cash cost of less than $200 per ounce of gold. Reserves at the end of 1997 were placed at 12.2 million tons with an average grade of 0.04 opt Au.

Kinross Gold is continuing to drill on Exploration Mirador’s Railroad project in Elko County. Results from six holes have been reported, with intervals of gold mineralization that exceed 100 feet and average grades (per interval) from 0.016 to 0.022 opt Au. Additional holes have been completed, or are in progress.

Romarco Minerals has drilled 16 reverse circulation and 5 core holes totaling 12,331 feet at the Red Rock property in Esmeralda County. High-grade gold mineralization on the pediment was originally discovered by Phelps Dodge in the late 1980s, in an east-west striking gold-adularia-quartz vein zone. Romarco Minerals is drilling in the same vein swarm, and has intersected high-gold grades up to, and exceeding, one ounce of gold per ton over 5-foot intervals. The one piece of information that was missing from the news release that I read, was the locations of the Romarco holes. This makes it difficult to determine if the new drilling represents an extension of the zone, or was within the area of previous drilling.

Romarco is also reporting the first results from this season’s drilling at Converse in Humboldt County. Drilling is mainly in the North Redline deposit. The best hole contains 605 feet that averages 0.050 opt Au, including 210 feet that averages 0.052 opt Au. Mineralization is in hornfels and schist. Another hole in the deposit contains 45 feet of 0.293 opt Au in a structural zone within a porphyry intrusive. Converse is starting to smell like a mine.

Cambior Explorations USA (in a joint venture with Golden Phoenix Minerals) is continuing the drilling program at Graben/Freedom Flats (Mineral County) in an attempt to expand the sulfide resource. The deposit is reported to contain 205,000 ounces of gold with an average grade of 0.22 opt Au. A recent drill hole about 200 feet north-northeast of the resource encountered 229 feet that averages 0.10 opt Au, starting at 1,027 feet down the hole. Several high-grade intervals of a few tenths of an ounce of gold per ton, up to one ounce, occur within the wider interval.

Battle Mountain Gold is reporting an additional 500,000 ounces of gold mineralization at its Phoenix project, in the Battle Mountains, near Battle Mountain, along the Battle Mountain trend in Lander County. (Why isn’t it Battle Mountain County?) They feel that with additional drilling most of this new mineralization can be turned into reserves that would be added to the 2.5 million ounce gold reserve base at the Battle Mountain Complex. Or as the BMGC geologists call it—The Complex: Drilling is also underway in Copper Basin where high-grade gold intercepts, some with significant copper grades have been encountered. Love those old mining districts. I wonder when they will start drilling at the Buckingham moly deposit?

More news from Royal Gold! (ever wonder where I get all this good information?) Royal Gold has completed several “deals” in the Manhattan district (Nye County) that consolidates most of the district, except for land held by Round Mountain Gold Co. An extensive drilling program is in progress that will test gold mineralization in Ordovician calcareous lithologies. In the second “deal,” Royal Gold has entered into an exploration agreement with Placer Dome in the southern part of the Alligator Ridge district (Mooney Basin and south for those of you who speak Alligator).
SOUTH DAKOTA

The South Dakota Bureau of Mines and Environment has granted a Large Scale Mine Permit to Goldcorp Inc. for its Clinton project in Lawrence County. The Clinton project will expand the gold reserve base by 647,000 ounces to 1,275,000 ounces.

UTAH

Nevada Star Resources Corp. has acquired the OK mine, and surrounding 10 square miles of claims in the Beaver Lake mountains, Beaver County. Nevada Star has completed 44 holes as part of a feasibility study of the copper oxide deposit that was originally defined by Centurion Mines Corp. Apparently, the new holes have expanded the reserve base and enhanced the grade of the deposit.

WASHINGTON

Word has filtered out that the Crown Jewell project has been delayed yet again by legal action. It now appears that construction will not begin until 1999, at the earliest.

WESTERN CANADA

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YUKON TERRITORY

The Taiga property, currently being explored by Blackstone Resources and joint venture partner Glenhaven Resources, hosts an interesting stratiform Ni-Zn-PGE occurrence. Taiga is located in the north-central Yukon 95 km northeast of Dawson City (Butterworth & Caulfield, Yukon Expl. & Geol., 1997, p. 125-127). Mineralization occurs as a laterally extensive, but generally thin, layer of pyrite plus vaesite (NiS) within a sequence of bedded banded carbonate shale and carbonaceous shale of the Devonian-Mississippian Lower Ender Group. The nickeliferous horizon is in the contact between a unit of limestone spheroids (concretions) and overlying chert. The best drill intersection to date encountered 1.4% Ni and 0.7% Zn over a 5.3 m core length. This occurrence is very similar to Nick, also located in the Yukon 150 km east of Taiga. Nick is also a thin (0.4-10 cm), stratiform, Ni-Zn-PGE enriched layer which occurs at the contact between a unit of limestone spheroids and overlying chert. The mineralized unit was deposited over an entire 80 km² sub-basin, within shales very similar to the age-equivalent Ender Group (Hubert, et al., 1992, Expl. Mining Geol., v. 1, p. 39-62). Average grade of the sulfide layer is 5.3% Ni, 0.7% Zn and approximately 770 ppb PGE+Au; Re, Se, As, Mo, V, P, Ba and U are anomalous. The mineralized horizon is readily oxidized and consequently very pervasive. Intrusive rocks are not known in the vicinity of either Taiga or Nick.

The Yukon occurrences are very similar to those in China described by Coveney, et al. (Expl. Mining Geol., 1992, v. 1, p. 21-28). The Chinese deposits occur in a 1600 km long belt and are also thin, generally less than 15 cm thick. They contain up to 7% Ni, 7% Mo, 2% Zn and 2.5% As, plus anomalously Au, PGE, V, Se and U. Mining activities have recovered Mo and Ni. Ni minerals include vaesite, polylamite, gersdorffite, millerite, violarite and nickelian pyrite; Mo is a non-sulfide phase, possibly jordisite. The sulfide bed is within black shale and in some districts the underlying shale contains black calcite concretions up to 1.0 m in diameter. The geological setting and unusual metal assemblage has led geologists working on the Yukon and Chinese occurrences to suggest they belong to a distinct deposit type of exhalative origin. Features such as vein stockwork zones, siliceous horizons and locally thickened carbonate units possibly represent hydrothermal vents along basin faults.

EASTERN CANADA

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CU-PB-ZN

After acquiring BHP's 50% interest in the Caber Property in March, South Africa Minerals Corporation has optioned the property to Noranda Mining and Exploration, who can earn up to a 70% interest by bringing the deposit to production. Noranda is an obvious choice for a partner, as the property is only 25 km west of Noranda's Matagami operations in northwest Quebec, and ex-Noranda exploration manager Denis Francoeur is now president of South Africa Minerals Corporation. Noranda is currently drilling the deposit in an attempt to increase the inferred resource of 1.3 million tonnes grading 1.3% Cu.
5.54% Zn, 10.2 g Ag/tonne and 0.26 g Au/tonne. The presence of a zinc-rich core was confirmed earlier this year, with a drill intersection of 14 meters of massive sulfide (10% Zn, 0.4% Cu, and 6.0 g/1 Ag) at a depth of 150 meters.

Four massive sulfide lenses have been identified in the Caber North Zone, two of which are copper-rich, with intersections up to 3.3% Cu over 6.6 meters and 4.3% Cu over 6.3 meters. A third lens returned values up to 7.9% Zn over 9.3 meters. The copper- and zinc-rich zones are contained within a larger volume of massive pyrite, pyrrhotite and magnetite. Completion of the spring drilling program will allow the partners to assess the feasibility of mining the deposit via a ramp system.

Joint venture partners Globex Mining Enterprises and Amblin Resources have announced the discovery of massive sulfides in a deep drill hole on their Lyndhurst Property 25 miles north of Rouyn-Noranda, Quebec. Drilling to test a down-hole electromagnetic anomaly intersected 7.92 meters grading 0.19% Cu, 3.5% Zn and 10.6 g Ag/tonne and 18.79 meters averaging 0.45% Cu, 1.54% Zn and 12.7 g Ag/tonne.

GOLD

The latest drilling of St. Andrew Goldfields' Taylor-West Porphyry Zone, situated in the Abitibi greenstone belt east of Timmins, has returned better results ranging from encouraging to spectacular. Intersections assayed up to 68.9 g Au/tonne over 1.5 meters, and visible gold is present in many of the holes. The drilling program consisted of infill and wedge holes, part of more than 170 holes that have been drilled to define a reserve. St. Andrew plans to continue exploration underground, using a ramp to facilitate drilling and testing.

Camco Gold Inc. has completed a seven-hole deep program on Major General Resources' Despinass gold property located 70 km north of Val-d'Or, Quebec. Gold mineralization is associated with porphyritic felsic intrusions, and is enclosed by two broad deformation zones. The drill program was designed to follow up real section induced polarization anomalies outlined earlier this year, and to test known gold-bearing structures. Significant results include 2.2 g Au/tonne over 2.6 meters, 4.9 g Au/tonne over 1.2 meters and 9.9 g Au/tonne over 0.3 meters.

A recent re-interpretation of the gold occurrences of the Southern Gaspé Appalachians by geologists from the Quebec Geological Survey has led to the development of a new exploration target. Extensional veins containing Au-Sb-As mineralization are hosted by Devonian limestone and occur within large argillic alteration halos. This type of mineralization, related to Devonian magmatic activity at depth along the regional Grand Pabos-Restigouche fault system, has similarities to Carlin-type mineralization. Across the border in northern New Brunswick, the Minerals and Energy Division of the provincial government is hoping to stimulate exploration for skarns and Carlin-type gold mineralization in a similar geological environment, with the release earlier this year of geochemical and airborne geophysical and radiometric data.

NI-CU-PGE

As Inco continues to struggle with the legal, environmental and political headaches associated with developing their Voisey's Bay deposit in Labrador, the South Voisey's Bay area, located 90 km to the south, is the subject of a 22,500-meter drill program. Drilling is concentrating on the property of Northern Abitibi Mining and Donner Minerals in order to follow up on the successful fall drilling program (see SEG Newsletter No. 35). However, with a third of the program now complete, last year's results have yet to be duplicated. Narrow zones of semi-massive to massive sulfides intersected at the base of an olivine gabbro generally contain less than 1% Ni and less than 1% Cu over widths of 0.2 to 1.3 meters.

The South Lake property of Major General Resources, in the South Voisey's Bay area, is also being drilled this summer. Drilling will follow up results of last year's program that intersected 14 meters of disseminated pyrrhotite in an extension of the troctolite found on the Northern Abitibi-Donner Minerals property immediately to the west.

Several juniors are now actively exploring platinum group elements (PGE) in Ontario, possibly in response to the continuing lack-luster performance of gold. In addition to Avalon Resources' Wolf Mountain Property (see SEG Newsletter No. 35), Band-Ore Resources and Cross Lake Minerals have recently announced discoveries of PGE mineralization.

Band-Ore intersected anomalous Ni, Cu, Pt and Pd over 50 meters during spring drilling on their Windward property 50 km to the southeast of Timmins. The mineralization is hosted by a layered mafic-ultramafic intrusive beneath glacial overburden. Assays returned values up to 1.3 g Pd+Pt/tonne and 0.5% Ni over 1 meter intervals.

Drilling of a nickel showing on the Reeves-Sewell property of Cross Lake Minerals, 50 km southwest of Timmins, resulted in the discovery of PGE mineralization in a layered ultramafic intrusion. Up to 4.5 meters of disseminated and stringer mineralization consisting of pentlandite, pyrrhotite and rare chalcopyrite was intersected in three holes at depths of 40 to 125 meters. Results include 0.55 meters grading 1.19% Ni, 0.23% Cu and 1.5 g Pt+Pd/tonne, 0.2% Ni and 1.3 g Pt+Pd/tonne over 0.75 meters, and 0.29% Ni and 0.36 g Pt+Pd/tonne over 1 meter. East West Resource is currently earning a 50% interest in the property, and is using induced polarization to explore the zone to the south.

ALASKA

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Exploration spending and activity reached its usual annual peak from June through August. Now, win/loss records are being compiled and ERAs (Exceptional Results Averages) calculated to see which projects will move on to the play-offs. Despite the continued low prices of most metals, the “Rush of 98” continued unabated in Alaska through the summer.

WESTERN ALASKA

Cominco American's Production Rate Increase project at the Red Dog mine remained on schedule and under budget for the second quarter of 1998. Zinc production was up 24%, a result of mill upgrades and higher grade ore. Nevertheless, first-half profits were down to $12 million—versus $38 million for the first half of 1997—a reflection of low metal prices. Looking to the future,
Cominco's research division is investigating bioleaching of mine waste dumps carrying an average grade of 3 to 5% zinc. In addition, the company plans to spend $5 to $6 million in the mine area over a three-year period. On the agenda is testing of the Alvinella prospect, 5 miles north of the mine, where previous drilling encountered 5% zinc over significant widths in one hole. The Palaq deposit, believed to be a deep extension of the Red Dog system, is Cominco's newest orebody, with an estimated 14 million tonnes grading 14% zinc at depths ranging from 600 to 1,400 ft below surface. On the drawing board are plans to supplement open pit operations with underground production from Palaq within five years.

Real del Monte (formerly Consolidated Nevada Goldfields) announced year-end 1997 and first-quarter 1998 results from operations. The Nixon Fork underground gold-copper mine near McGrath produced 39,666 oz of gold in 1997, and an additional 12,259 oz during the first quarter of 1998. Mill head grades from the Crystal/Garnet portion of the mine ranged from 1.3 to 1.7 oz/tonne. The company plans to explore previously discovered mineralization below the Crystal/Garnet orebody.

Encouraging results came from phase one drilling of Shotgun, the Novagold Resources Alaska gold project north of Dillingham. The first 1998 hole intercepted 557 ft grading 0.036 oz/ton gold beginning at the surface, and a 233-ft interval grading 0.064 oz. Hole two, drilled to a depth of 160 ft, averaged 0.074 oz/ton over its entire length. Mineralization is hosted in brecciated and silicified quartz porphyry and is open in all directions. A second rig began drilling in mid-August.

**EASTERN INTERIOR**

Kinross Gold Corporation took over active control of operations at their Fort Knox mine. Second-half cash costs at Fort Knox remained steady at $186 per ounce. The company plans to spend approximately $1.1 million on exploration in 1998, searching for additional resources at the mine site; an additional $400,000 is being spent for exploration elsewhere in the company's 50,000-acre land block.

**FAIRBANKS DISTRICT**

Teryl Resources and joint-venture partner Fairbanks Gold (a subsidiary of Kinross Gold) announced initial drill results from their Gil prospect, east of Fort Knox. Four holes and 1,500 ft of trenching have been completed. Gold assays from the first hole returned 160 ft grading 0.09 oz/ton and an additional 45 ft grading 0.04 oz/ton. The hole bottomed in 0.20 oz/ton mineralization. Other reports are pending.

Placer Dome Exploration reported additional drilling results from the Ready Bullion and Silver Dollar prospects on their Ester Dome gold project in the Fairbanks District. Drilling at the Ready Bullion prospect produced intercepts up to 28.5 ft grading 0.04 oz/ton gold and 57.7 ft grading 0.05 oz/ton gold. At the Silver Dollar prospect, drill intervals to 20 ft grading 0.17 oz/ton gold and 6.4 ft grading 0.04 oz/ton were encountered, with 0.18 oz/ton gold over 6.6 ft in trenching. Work continues.

Int'l Frecgold Minerals and equity funding partner Barrick Gold completed phase one drilling on the Golden Summit project outside Fairbanks, including over 8,000 ft of reverse circulation drilling on the Charles.
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Iowa, Cleary Hill, Wolf Creek and Creeks prospects. Additional soil sampling outlined new targets on the Coffee East and Tamarack prospects. Phase two drilling, 15,000 ft of reverse circulation and diamond core drilling began in mid-August.

Golden Phoenix Minerals had promising results from the Switch Creek and Spectrum/Vetter properties in the Circle District. Rock sample gold values as high as 0.1 oz/ton were found on the Switch Creek prospect, and values to 0.95 oz/ton were reported from arsenopyrite mineralization on the Spectrum/Vetter prospect.

Newcomer North Star Exploration Inc. hit the ground running with a joint-venture agreement with Doyon, Ltd. North Star can earn up to a 100% interest in 7 million acres of Doyon lands subject to retained royalties and back-in rights. North Star must expend $9 million on exploration and make payments totaling $1.3 million through 2001. Doyon contributed its +$10-million minerals database and access to the Anaconda Alaska +$100 million database. North Star has spent $2 million to date on the newly acquired lands in the eastern Interior, including an additional 30 square miles of recently staked claims.

La Teko Resources optioned its Discovery Gulch project in the Circle Mining District to Cannor Resources Ltd. To earn a 51% interest in the property, Cannor must make payments totaling US$215,000, issue 400,000 shares of Cannor stock to La Teko, and complete US$800,000 in exploration expenditures over four years. Exploration plans for 1998 include a $75,000 program to expand and better define the 1,200 ft by 400 ft Switch anomaly and the 1,500 ft by 400 ft Discovery anomaly. On the Twin Buttes project at the northeastern end of the Fairbanks district, La Teko completed a $60,000 auger drilling program to test resistivity and magnetic anomalies outlined by airborne geophysical surveys conducted in 1997. Assays are pending.

Canadian-based Redstar Resources Corp. has optioned a portion of Tri-Valley Corporation's 44-square-mile Richardson Project. The agreement, not including Tri-Valley's Democrat Dike prospect, allows Redstar to earn a 51% interest in the property by completing US$6.3 million in work expenditures over five years, including US$300,000 in 1998. Redstar must also make staged payments totaling US$700,000, and can earn an additional 29% interest by carrying out a feasibility study.

Teck Corp. and partner Sumitomo Metal Mining continue to get good results from the Pogo deposit. The 70,000-ft surface drilling program is ahead of schedule and may be increased to 90,000 ft. Drilling indicates a high probability that a third horizon of gold mineralization is present about 500 ft below the Lower Lishe zone. With 1998 project expenditures in excess of $11.5 million, the companies expect to increase their current 4.5-million-oz reserve base before year-end.

Busy Bear Mountain Exploration Services recorded over 1,100 new mining claims (approx. 44,000 acres) in the Goodpaster River District—not bad for a newcomer. The Tundra Telegraph rumor mill suggests that Bear Mountain may be looking for mineralization similar to the Pogo deposit, and that it's backed by experienced Canadian professionals.
Alaska Range

Grayd Resources finished its season with a bang by announcing intersections of massive and semi-massive sulfide mineralization in the Fosters Creek Zone on its Dry Creek property. Hole 98-40 intersected 95 ft grading 6.22% zinc, 2.56% lead, 0.22% copper, 5.3 oz/ton silver and 0.029 oz/ton gold; and hole 98-60 intersected 160 ft averaging 4.19% zinc, 1.96% lead, 0.10% copper, 2 oz/ton silver and 0.014 oz/ton gold. Higher grade intervals within this zone range from 16 to 47 ft containing 10% combined lead-zinc with comparable silver, gold, and copper values.

In other Grayd news, the company announced that a 3,500-ft core-drilling program was completed at its Glacier Creek prospect, which is joint ventured with Inmet Mining (60%). Initial drilling concentrated on an area containing a 5,000-ft long EM anomaly near the Sheep Creek-Mystic Creek stratigraphic boundary. The anomaly is associated with a felsic volcanic center containing strong alteration and widespread disseminated pyrite. Grayd completed drilling at its Delta joint venture project with American Copper and Nickel. Previous drilling on the PP2, DDS, DDN, DW, Trio, and Super Cub prospects returned grades ranging from 3 to 114% combined copper-lead-zinc, 0.5 to 11 g/tonne gold and 33 to 191 g/tonne silver.

Cannonor Resources Ltd. completed its exploration program on Bonnfield District projects acquired from Golden Phoenix Minerals. Fieldwork concentrated on Cirque and Dry Creek West massive sulfide prospects and the Glory Creek gold prospect. Assays are pending.

Fort Knox Gold Resources announced that results from phase one UTEM geophysical surveys have prompted it and operating partner American Copper and Nickel to initiate diamond drilling on their Nickolai project near Isabel Pass. Drilling on the Canwell and Fish Lake properties will test previously identified Cu-Ni-PGE anomalies. Phase one geophysical surveys outlined a 3,000-ft-long conductor between the Odic and West Ridge showings, with a stronger conductor—stretching over 4,000 strike ft—outlined farther to the west.

Southeast Alaska

Abacus Minerals extended its $8 million convertible debenture offering through the end of August. Revenue will be used to complete 1,200 to 1,500 m of road, underground drilling and 5,000 to 6,000 m of underground drilling at its Lookout Mt. prospect on the Niblack massive sulfide project.

Rubicon Minerals executed a joint-venture letter agreement with newcomer Atina Resources Ltd. on its 340-claim Palmer base-metal project near Haines. Atina can earn a 50% interest in the property by expending $2 million by 2001. Rubicon will be the operator during the first two years of the agreement. Fieldwork began in early August and will include drill core re-logging, mapping, sampling, geophysical orientation surveys, and approximately 3,000 ft of diamond drilling.

Northern Alaska

Silverado Mines began underground exploration and development work on the Swede Channel prospect at its Nolan Creek placer gold project near Wiseman. Drifting is in progress in an area south of the Mary's Bench deposit and upstream from previously mined ground where Silverado extracted a 31 oz nugget.
CANDIDATES FOR SEG FELLOWSHIP

To all Fellows:

Pursuant to Article I, Section 2, of the Society's Bylaws, the following eight candidates have been recommended for Fellowship by the Admissions Committee. Each applicant's name and current position are followed by the names of the three SEG sponsors. If you have any comments, favorable or unfavorable, on any candidate, you should send them in writing to the Admissions Secretary before December 15, 1998. If no objections are received by that date, these candidates will be presented to Council for approval.

ADDRESS COMMENTS TO:
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Tsvetkov, Andrei A., BHP Minerals International, Moscow, Russia: Noel C. White, Hugo T. Dammert, Raymond L. Morley

THE SOCIETY ALSO WELCOMES THE ABOVE CANDIDATES AS NEW MEMBERS

THE SOCIETY WELCOMES THE FOLLOWING NEW SEG FELLOWS:

Graham M. Brown, Minerox, Budapest, Hungary; Katharine F. Ball, Exploration Unlimited, Fairbanks, AK; Kenneth G. Chappel, Union Mining NL, Colwood, Canada; David L. Giles, Cimmaron Exploration Inc., Corrie, NL; Brian E. Morten, Rio Tinto Mining and Exploration Ltd., Newbury, Berkshire, England; Great Britain; William C. McClelland, University of Idaho, Moscow, ID; Steven R. McCutcheon, New Brunswick Dept. Natural Resources, Bathurst, New Brunswick, Canada; John M. Moore, Rhodes University, Grahamstown, South Africa; Carl E. Nelson, Recursos del Caribe, S.A., Boulder, CO; Ronald L. Parratt, Homestake Mining Company, Reno, NV; Andrew L. Smith, Aurion Resources Ltd., Vancouver, B.C., Canada; Brian W. Wakeman, Yamana Resources, Spokane, WA; Andrew R. Wilde, BHP Minerals, San Francisco, CA; Taihe Zhou, Quantum Resources Ltd., Glen Waverley, Victoria, Australia.

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Postdoctoral Opportunities

The U.S. Geological Survey, Geologic Division, is conducting a national competition to find outstanding scientists, who have recently completed doctorate-level research, to fill 1-2 year contractual positions as guest Research Associates. The objective of the program is to provide guest Research Associates of unusual promise and ability a formal opportunity to conduct research in an area of their choice that falls within the realm of Geologic Division's long-term scientific strategy goals as follows:

- conducting geologic hazard assessments for mitigation planning
- providing short-term prediction of geologic disasters and rapidly characterize their effects
- advancing the understanding of the Nation's mineral and energy resources in a global, geologic, economic, and environmental context
- anticipating the environmental impacts of climate variability
- establishing the geologic framework for ecosystem structure and function
- interpreting the links between human health and geologic processes
- determining the geologic controls on ground water resources and hazardous waste isolation.

Approximately five (5) Research Associate opportunities are available. The principal duty stations will be Reston, VA, Denver, CO, or Menlo Park, CA, depending on the candidate's chosen research area. Limited opportunities, however, may be available at other field locations. Compensation will be in fixed weekly stipends for the geographic area in which they work. Approximate stipend amounts are as follows: Reston, VA, $820.00; Denver, CO, $855.00; and Menlo Park, CA, $886.00. Awarded are offered a services contract initially for 12 months. However, a 1-year extension may be granted at the discretion of the USGS should funds be available.

For more information about the program and the application materials required, complete details are provided in the Postdoctoral Research Associateship Program Announcement which is available on the web at http://geology.usgs.gov/postdoc/ or you may call (703)-648-6630 to request a copy.

The U.S. Geological Survey is an equal opportunity employer. Qualified applicants will receive consideration without regard to race, creed, color, age, sex, national origin, political preference, labor-organization affiliation or non-affiliation, marital status, or non-disqualifying handicap.
ANNOUNCEMENTS

ROUNDUP ‘99
VANCOUVER: WHERE DISCOVERIES START
JANUARY 26–29, 1999

Following on the heels of a very successful Pathways ’98 Conference last winter, the British Columbia and Yukon Chamber of Mines is in the advanced planning stages for the sequel—“Vancouver: Where Discoveries Start”.

Vancouver boasts the largest concentration of junior exploration and mining companies in the world and the largest group of exploration geologists. It is home to offices of many of the world’s major mining companies and it has a broad service and supply base—assay labs, equipment supply companies, exploration consultants and contractors and large and small mining consultants. These are the ingredients that combine to make Vancouver the starting point of many of the world’s exciting exploration plays and discoveries. The Vancouver Stock Exchange and the city’s large array of brokerage and finance houses provide much of the capital that fuels this process.

Roundup ‘99 will follow the Pathways theme: What are the key components leading to successful exploration, with emphasis on recent exploration successes in snapshot sessions and core shacks, and in some specific focus sessions, including Mexico and Alaska-Yukon. To this is added the activity updates of the government geological surveys of Canada, British Columbia and Yukon, which provide that all-important geological base.

The successful Cordilleran Roundup format will be followed. Technical sessions will be restricted to the mornings, leaving the afternoons for core shacks, posters and commercial displays, and the evenings for the ever-popular social events. After all, socializing with friends and colleagues is what this meeting is all about.

GOVERNMENT DAY • TUESDAY, JANUARY 26

This joint venture among the Geological Survey of Canada, the B.C. Geological Survey and the Yukon Geology Program will highlight the results of recent mapping projects with technical talks in the morning and posters in the afternoon.

B.C. – YUKON – ALASKA UPDATES: THE TINTINA GOLD BELT • WEDNESDAY, JANUARY 27

The morning sessions will include exploration updates for B.C., Yukon and Alaska, followed by a special session on the emerging Tintina Gold Belt of Alaska, Yukon and possible extensions into British Columbia. Speakers will include representatives from government, industry and academia. The session will focus on the parameters that define the belt and some of the major new discoveries that are propelling the belt onto the world mineral scene. The afternoon will include posters and core shacks.

INTERNATIONAL SNAPSHOTs • THURSDAY, JANUARY 28

Starting with a keynote speaker, this session will include snapshot updates on a wide array of new, international discoveries. The formal lunch will also include a keynote speaker with a talk related to the conference theme. Core shacks in the afternoon will relate to the morning talks and other recent discoveries.

MEXICO SESSION • FRIDAY, JANUARY 29

This thematic session will include a keynote speaker and several key overview papers on VMS and carbonate-hosted polymetallic deposits of central Mexico. These will be followed by a number of snapshot papers on recent new discoveries in the area, such as Campo Morado (Farallon Resources) and Peñasquito (Western Copper Holdings). More core shacks will follow in the afternoon.

The meeting will offer its traditional Roundup hospitality with the Ice Breaker on Monday night, Yukon Night on Tuesday, Alaska Night on Wednesday and Northwest B.C. on Thursday. This is an opportunity to catch up with old friends and new discoveries, and to rub shoulders with all the movers and shakers in mineral exploration in western North America, the rest of the Pacific rim and beyond.

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CO-CHAIRS/CONTACTS

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VANCOUVER: WHERE DISCOVERIES START
CORDILLERAN EXPLORATION ROUNDPUP 1999
HOTEL VANCOUVER – HYATT REGENCY VANCOUVER
January 26-29, 1999

Following on the success of Pathways '98, plan now to participate in the West Coast’s Premier Exploration Show, The Cordilleran Exploration Roundup.

THEME: VANCOUVER: WHERE DISCOVERIES START
(Vancouver as an exploration technology and mine financing centre)

FOCUS: Western Canada and USA plus a special Mexico session

HIGHLIGHTS: •Technical Presentations  •Industry, Government & Supplier Exhibits
•Drill Core Displays  •Social Events

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For up-to-date details
http://www.bc-mining-house.com/roundup99
The Association of Exploration Geochemists

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1998 AEG Student Paper Competition

The Association of Exploration Geochemists will hold its twelfth biennial Student Paper Competition this year. Papers eligible for the competition must address an aspect of exploration geochemistry and represent research performed as a student. The student must be the principal author, and the paper must have been published in any refereed scientific journal no more than five years after completion of the degree for which the research was performed. A nomination may be made by anyone familiar with the work of the student. Nominations must be accompanied by four copies of the paper. The deadline for receipt of the nominations is December 31, 1998.

Win $500
and receive a travel allowance
to an AEG-sponsored meeting

The prize consists of a $500 Canadian cash prize, donated by XRAL Laboratories, a Division of SGS Canada, a two-year membership to the Association of Exploration Geochemists with receipt of the Journal of Geochemical Exploration and EXPLORIE, and up to US $500 for expenses to attend an AEG-sponsored meeting. A photograph and curriculum vitae of the author and an abstract of the prize-winning paper will be published in EXPLORIE as soon as possible after the announcement of the award.

Mail to: Dr. Ian D.M. Robertson
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Cooperative Research Centre for Landscape
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*Full details are available from the Chairman of the competition (address above) or from the AEG Home Page (http://www.aeg.org) or, more specifically at http://leme.anu.edu.au/education/aegstudent.html

ANNOUNCING

"Geology and Economic Minerals of Ukraine"

The National Academy of Sciences of Ukraine, State Committee on Geology and Utilization of Mineral Resources of Ukraine and other national agencies have created an atlas, "Geology and Economic Minerals of Ukraine" at a scale of 1:5,000,000. The atlas is published in Ukrainian and English. There are 67 different maps in seven sections: maps with general data; geophysical maps; maps of structural regionalization; lithologic and facies maps; ecological and hydrogeological maps; and maps of mineral deposits. There is also a brief statement of the laws and regulations.

The atlas is available in an A-3 format album and on CD-rom. For more information, contact Professor L.S. Galetskiy, Institute of Geological Sciences of Ukrainian Academy of Sciences, 55-b O. Honchar St., UA-252054, Kiev, Ukraine; Tel. +38044.216.63.51; Fax. +38044.216.93.34 or +38044.516.58.21; email: geos@info.kiev.ua; webpage: http://www.awmag.com/geo.

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PAID ADVERTISEMENT
Chile Ore Deposits Field Trip
Viaje a Yacimientos Metalíferos Chilenos

The third joint academia-industry field trip, to be held January 3-17, 1999, to visit the mineral deposits of Northern Chile is being organized by the joint SEG Student Chapter of the New Mexico School of Mines and the University of Utah. Northern Chile is host to numerous world-class deposits including Chuquicamata, Cerro Colorado, Quebrada Blanca, El Abra, El Salvador, Candelaria, Mantos Blancos, and Escondida. The trip, led by Drs. William X. Chavez, Jr. and Erich U. Petersen, will cover aspects of porphyry Cu and Mo deposits, andesite-hosted Cu-Ag and Cu-Au systems, and vein-type gold occurrences, including exploration history, ore mineralogy, wall rock alteration and zoning, mining methods and engineering, and economics to the environmental dimension.

The trip will be conducted in English and Spanish. Industry professionals are especially invited to participate. For further information and trip reservations, please contact either Dr. William X. Chavez, Jr. (Tel. +1.505.835-5317, Fax +1.505.835-5252, e-mail: wxchavez@mail.host.nmt.edu) or Dr. Erich U. Petersen (Tel. +1.801.581.7238, Fax +1.801.581.7065, e-mail: eupeters@mines.utah.edu).

Please visit the field trip website at <http://www.mines.utah.edu/~wmep/chile99.html>.

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Seeking Quality Base and Precious Metals Properties
19th International Geochemical Exploration Symposium
APRIL 11–16, 1999 • HOTEL VANCOUVER • VANCOUVER, BC, CANADA

This symposium will be the last major Geochemical Exploration meeting of this Century. In keeping with the theme, Exploration Geochemistry into the 21st Century, the conference will aim to stimulate and disseminate new ideas and innovations.

If you would like to receive more information, please complete the Reply Form and mail or fax the IGES Secretariat Office.

SHORT COURSES
Short Courses will take place April 10-11th before the symposium.

FIELD TRIPS
Field trips will take place after the meeting, starting April 17th. The field trips are intended to complement short course and technical session themes by providing applied demonstration of methods and interpretation.

TECHNICAL SESSIONS
Technical Sessions will be held on April 12-13, 15-16. April 14th will be a mid-symposium break to give delegates and guests the opportunity of enjoying the many attractions offered by Vancouver and the surrounding area.

Topics include:
- Integrated exploration case histories—discoveries and disappointments
- Search for concealed deposits (including diamonds)
- New sampling methodologies at all scales
- Data presentation & interpretation
- Analytical methods (including quality control)
- Lithogeochemistry
- Envirogeochemistry related to the minerals industry

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REPLY FORM
19th International Geochemical Exploration Symposium
Vancouver, BC Canada • April 11 - 16, 1999

Please send more information on the 19th IGES to:

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My chances of attending are:
☐ Good  ☐ Fair  ☐ Poor

☐ I am interested in participating in the Exhibits. Please send information.

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SOCIETY OF ECONOMIC GEOLOGISTS

Membership Application

Membership in the Society is open to all geoscience graduates holding the bachelor's degree. Student Members must be full-time students. Annual dues are US$85 for Members and US$42.50 for Student Members. Subscriptions to Economic Geology, the quarterly SEG Newsletter and SEG Membership Directory are included in the membership. Application may be made by completing this form and submitting it with the appropriate sponsor signature to Society of Economic Geologists, Inc., 5808 S. Repp St., Suite 209, Littleton, CO 80120, USA, phone: 303-797-0332; fax 303-797-0417.

NOTE: PLEASE DO NOT INCLUDE ANY PAYMENT WITH THIS APPLICATION.

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NEW SEG PUBLICATIONS

REVIEWS VOLUME 10
Techniques in Hydrothermal Ore Deposits Geology: Jeremy P. Richards and Peter B. Larson, editors; 1998; 264 p.; US$34.00.

This publication is both a reference guide and a handbook containing practical information ranging from the construction and interpretation of diagrams, to the size and type of samples required for geochronological analyses. Individual chapters provide basic principles of their respective topics and explore the practical applications of techniques in the study of ore deposits.

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REVIEWS VOLUME 7

Recent technological advances have enabled in situ sampling and analysis of individual growth bands within crystals, and of tiny solid and fluid inclusions within crystal lattices; this opens a level of detailed geological information heretofore unavailable. This publication is divided into four topical sections: Geochemistry and Radiogenic Isotopes, Stable Isotopes, Elemental Analysis, and Fluid Inclusions. Each chapter provides an overview of a microanalytical technique and its practical applications to understanding mineral and rock forming processes.

Other Publications of Interest
Patricia Sheahan • Konsult International, Inc.
44 Gemini Road, Willowdale, Ontario, Canada M2K2G6
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■ Mineralized intrusion-related skarn systems, D.R. Lentz, ed., Short course v. 26, 664 p., US$48.00 (member price), plus postage and handling. VISA accepted. Available from Mineralogical Association of Canada, P.O. Box 78087 Merlino Postal Outlet, 1460 Merlino Rd., Ottawa, Ontario, Canada K2E 1B1. Fax +1.613.226.4651; email: cammin.mac.ottawa@sympatico.ca

■ Modern approaches to ore and environmental mineralology, L.J. Cabri and D.J. Vaughan, eds., Short course v. 27, 421 p., US$48.00 (member price), plus postage and handling. VISA accepted. Available from Mineralogical Association of Canada, P.O. Box 78087 Merlino Postal Outlet, 1460 Merlino Rd., Ottawa, Ontario, Canada K2E 1B1; Fax +1.613.226.4651; email: cammin.mac.ottawa@sympatico.ca

■ Atlas of micromorphology of mineral alteration and weathering, J.E. Deligne, Canadian Mineralogist Special Publication no. 3, 500 p., US$125.00, plus postage and handling. VISA accepted. Available from Mineralogical Association of Canada, P.O. Box 78087 Merlino Postal Outlet, 1460 Merlino Rd., Ottawa, Ontario, Canada K2E 1B1; Fax +1.613.226.4651; email: cammin.mac.ottawa@sympatico.ca

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★ Oct 25-28, 1998 SEG Annual Meeting with the Geological Society of America (GSA), Denver, Colorado. Bill Atkinson, Department of Geological Sciences, Campus Box 250, University of Colorado, Boulder, Colorado, 80309-0250, Tel. +1.303.492.0199, Fax +1.303.492.2600, email: sf@stripo.colorado.edu

OTHER EVENTS


Nov 29-Dec 4, 1998, Northwest Mining Association 104th Annual Meeting and Exhibition, Spokane, WA. For more information contact: Hazel Hoelt, Northwest Mining Assoc., 10 N. Post St., Ste. 414, Spokane, WA 99201, Tel. +1.509.624.1158, Fax +1.509.623.1241, email: hh@cwcom.net (See announcement on page 16 of this issue)

★ Jan 26-29, 1999, 16th Annual Cordillera Geology and Exploration Round-Up, "Where Discoveries Start," Vancouver, B.C., Canada. Contact: B.C. and Yukon Chamber of Mines, Bruce McKnight, Tel. +1.604.681.5328; website: www.bc-mining-house.com/roundup99 (See announcement on page 36 of this issue.)

★ Apr 21-23, 1999, Murray Basin Mineral Sands Conference, Mildura, Australia, (AusIMM, GSA, AG). Contact: P.O. Box 1298, Mildura, Mildura, Victoria 3504, Australia, Fax +61.50.333.6616, email: geolog95@ats.agovc.gov.au

May 26-28, 1999, Geological Association of Canada—Mineralogical Association of Canada, Joint Annual Meeting, Sudbury, Ontario. Contact: Dr. J. P. Cooper, Dept. of Earth Sciences, Laurentian University, Sudbury, Ontario P3E 2C6, Tel. +1.705.675.1151 (ext. 2267), Fax +1.705.675.4486, email: <gmac99@nickel.laurentian.ca>.

Aug 22-25, 1999, Society for Geology Applied to Mineral Deposits (SGA) 5th Biennial Conference, "Mineral Deposits: Processes to Processing," Imperial College/Natural History Museum, London. Contact: Dr. Chris J. Stanley, Associate Keeper of Mineralogy, Department of Mineralogy, Natural History Museum, Cromwell Road, London SW7 5BD, UK. Tel. +44.171.938.9361, Fax +44.171.938.3288, email: cjstanley@nhm.ac.uk

WEB PAGE UPDATE

http://segweb.org

The old URL will continue to work, but we urge you to use SEG's new address.

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