Gold Deposits of Southern Ecuador

By ilmars Gemuštš (SEG 1976), Guillermo Lopez, and Franklin Jimenez (SEG 1992)

Ecuador is a prosperous tropical democratic country, about the size of Nevada (Fig. 1), led by architect Sixto Duran, who was elected President in July 1992. A new mining law was passed in 1991 and, although regulations are pending, foreign investment is welcomed. The gold mining tradition began in 1549 with the Portovelo mine, and many small silver and gold veins and alluvial gold deposits were subsequently exploited. Increasing gold prices spurred development of new precious metal properties in the 1980s, including the now-famous Nambja and the lesser-known Chinchapuna, Bella Rica, La Playa, and Atlanta districts (Fig. 2). All are actively worked by "pequeños mineros" or "garapampiros."

This paper summarizes the geologic setting and prospecting potential of some of the older mines and districts, as well as most of the recent discoveries in southern Ecuador (south of 1° south latitude).

REGIONAL GEOLOGIC FRAMEWORK

The Andes divide Ecuador into three physiographic belts (Kennerley, 1980):

- "Costa," west of the Andes, includes the narrow coastal plain south of Guayaquil and the broad low-lying sedimentary Guayas Basin to the north.
- "Sierra" makes up the 120-km wide Andean mountain chain and includes two parallel ranges: Cordillera Occidental, mostly Cretaceous volcanic rocks and young intrusives, and Cordillera Real (>3,000 m), underlain by metamorphics.
- "Oriente" extends east from the Andean foothills into the Amazon jungle where Mesozoic and Cenozoic rocks form the few exposures.

The map of Figure 3 was derived from the Geologic Map of Ecuador prepared by the Dirección General de Geología y Minas (1982).

BASEMENT ROCKS. The oldest rocks are Precambrian to Cretaceous metamorphic and igneous rocks exposed along the crest of the Cordillera Real (Feininger, 1982). Lithologies include migmatic gneiss and schists with sheared intercalated Jurassic volcanic rocks, all of which are intruded by stressed granite-granodiorite batholiths of possible Jurassic and Cretaceous age. On the west side of the Cordillera Real, green schist to upper amphibolite facies Paleozoic (?) or Precambrian igneous rocks are cut by a Triassic mylonitic shear zone (Apodan and Litherland, 1992; also pers. commun.). Current research focuses on the geology, tectonics, and geochronology of the Cordillera Real (Litherland and Apodan, 1990).

Basement rocks lack major gold mines, but rich alluvial gold patches on the rivers within the Oriente (Fig. 2) and also on the Rio Shingata and Rio Ayllon may have been derived from quartz-rich schists within the basement. Small quartz vein mines are found in the Rio Ayllon and Peggy districts.
From The Editor

The innocent naiveté of a child can be both wonderfully refreshing and extremely frustrating. Most five-year-olds presume that there will be something to eat for dinner and that the lights will go on when they turn the switch. That there will be food and light is given in their minds, and they occupy their thoughts with really important concepts like unicorns or dragons. Why worry? With time, they learn that mom and dad go to work every day so that they can pay for food and electricity, but then, isn’t that what parents are for? Eventually, when they themselves are adults, they get first-hand experience at the realities of fending for themselves, like it or not.

However, being an adult in this complex world isn’t much better than being a child. Precious few adults have an inkling of the intricate interaction of politics and economics that dictate prices and demands for everything from petroleum to timber to the recreational value of a species of warbler. They, with the mind-set of a five-year-old child, presume that all will be taken care of. Who cares if scuffy loggers or some eete little owls win the battle of the Pacific Northwest? If the price of plywood at the local lumber store stays fairly low, does anyone really care? How many people are really affected by the low demand for finding additional moltenium resources, or are aware of the effect on a mining company’s slim profit margin of mandatory environmental remediation programs (not that I’m against them, but... they do cost companies and taxpayers a tremendous amount of money)? If land remains available at a reasonable cost (as measured by the cost and availability of the manufactured end products), the vast majority of the public isn’t aware of the juggling act that dictates the source and availability of a wide variety of tangible and intangible products.

Articles in this and other publications call for educating the public about the importance of minerals. After all, as I pointed out in an earlier column, our training makes us the most knowledgeable educators in this field. There is no doubt that minerals are essential. But minerals are a value, and values have a stratigraphy: the fundamental ones, like sustenance and shelter, are the absolute foundations of the sequence, and raw materials aren’t far above that base, even if it is as simple as some firewood to cook our mastodon. As the fundamentals become stable enough to support more layers, the stratigraphy thickens, adding other values to the sequence. The thicker the sequence, the more is removed from having to worry about the underpinnings, like just a child is removed from worrying about dinner and light and has more time to think about unicorns. It is only when one of the building blocks weakens or is removed that the importance (or even existence) of the fundamentals becomes apparent.

An excellent example was the effect of the OPEC oil embargo in 1973. Suddenly, people were forced to rebalance their pyramid when a major underpinning was removed. Afterwards, everyone grumbled about the higher price for gasoline and blamed the rich Arab oil barons for the problem, little realizing that they themselves, along with the insatiable demand for inexpensive gasoline, were culprits as well.

Part of the education process is teaching ourselves about the values that others believe to be “fundamental” to their lives. Part of the process is teaching others that raw materials be they primary or recycled are essential for maintaining the other values. And part of the process is to look at the problem in a global sense, not just focussed on one threatened industry, such as mining, or country, such as the United States. Minerals are essential, but they are intricately woven into the world’s political-economic framework. Face it: much of the world doesn’t give a damn about minerals because raw materials themselves rarely enter into the daily lives of most people and, when they do, people don’t think of them as such (when was the last time that you thought about “raw materials” when you ate an apple?). Just as a child takes it for granted that dinner will appear every evening, most consumers presume that the local automobile dealer will have a new car in just the right style and color. In most people’s minds, the source of the food for dinner or the materials for the car is irrelevant.

SEE ALSO: 2

The SEG Newsletter is published quarterly in January, April, July and October by the Society of Economic Geologists. Articles submitted for consideration are subject to the approval of the appropriate Editor. The FORUM is for commentary and exchange of ideas on matters of concern to economic geologists, however, please note that discussion of articles in Economic Geology should be directed to that journal, not the Newsletter. If you have questions on submission of material, please call the Editor at 303-256-5648 or FAX (303)-256-5661.

Format: Manuscripts should be double-spaced. If possible, please submit paper copy and a computer diskette in either DOS or Macintosh format, using Word or WordPerfect. Pertinent illustrations will be accepted in camera-ready form at publication scale. Authors are asked to obtain peer review of manuscripts to assure clarity and accuracy. 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 Secretary. Employment opportunities for economic geologists will be advertised free of charge.

DEADLINE FOR LETTER

#12: Dec. 4, 1992

ADVERTISE. By May 15, 1992, nearly 3,000 economic geologists know about your product or service. For information and rates, contact: John A. Thom, SEG Executive Secretary • 303-797-0332 • fax 797-0417.
President
Perspective

Two former presidents of the Society have been busy "pounding the pavement and ringing doorbells" to raise funds to support special endeavors at the April 1993 meeting in Denver. The expenditure of this time and energy has been provided by G. Arthur Barber and Paul A. Bailly, and the Society owes them a standing ovation, not only for their work but for their success. Tom Loucks, who has been counting the money and keeping score, informs me that the receipts to date total $23,800 and that additional funding has been promised. Donations thus far have come from: DREGS (Denver Region Exploration Geologists), Newmont, Teck, Cominco, Rio Algom, Johns Manville, ASARCO, and AMAX Gold.

Messrs. Barber and Bailly had three things in mind:

1. To keep the cost of registration for the meeting at a level that would not discourage attendance.
2. To subsidize student registration so that the coming generation of professionals can attend the meetings and the luncheon and the affairs of the Society that they will represent in the future.
3. To insure that the abstract volume of papers be printed is of A-1 quality.

Another member of our Society has in the recent past successfully undertaken a similar venture though on a smaller scale and for a different purpose. Robert W. Schaefer, the program chairman for the Reno meeting with SME in February 1993, has solicited funds from a number of companies with offices in Reno, and he has raised enough money to bring Sam Sawkins from Minnesota to Reno (hotel and return). Sam will be a guest speaker at the SEG Luncheon where he will present some new ideas on gold deposit models. Contributing companies are Kennecott, Phelps Dodge, BHP Minerals, Homestake, and Independence Mining Company. The Society certainly appreciates this support and our compliments to Bob Schaefer for his initiative and his powers of persuasion.

While passing out these well-deserved plaudits, I would be remiss not to mention the new Executive Secretary of the Society, John Thoms, and his wife Jean, the real "non-executive" secretary in our service. Both work conscientiously and effectively for your Society—and at absolutely minimal cost to the membership. I hardly know how to get "off this track," but one final comment seems in order. Paul Sims, a former president of the Society and currently president of the Publishing Company, has been responsible for the search for the last three Executive Secretaries, including John Thoms, and in convincing them to serve. After many years Paul remains a quiet, unassuming but very effective servant of your organization. We are fortunate to have such dedicated people.

Congress has approved a four-year geologic mapping program for the U.S. Geological Survey in cooperation with state governments and academic institutions. I applaud this move, but am concerned about the ability of the various agencies involved to field sufficient numbers of experienced, competent workers in a concentrated work program. Better to rebuild a cadre of professionals and retain mapping, supported by whatever laboratory disciplines are appropriate as a continuing function of the Survey.

So much for the good news—hard to come by these days. Homestake, an old and honored company of American mining, has disbanded its exploration group. I am distressed indeed with the state of our industry and the direction that a number of major companies have taken—substitution of generative exploration by listening post activities and evaluation groups to analyze submittals. Legislation now pending in Congress, if enacted in its present form, could pretty well do away with the prospectors and the small development companies on which evaluation groups depend for submittals. I think perhaps that is an oversimplification, but the trend seems both obvious and alarming.

Recently I have had the opportunity to examine a sizeable volume entitled "World Resources," a product of the World Resources Institute in collaboration with the United Nations Environmental and Development Program. Other than one table on production, consumption, and reserves of nine selected metals and a mention in two places of water contamination by mining operations, there is no direct mention of metals or industrial minerals. Obviously they are not considered as RESOURCES for men—just SOURCES of pollution. The inside cover of the volume lists an impressive Editorial Staff of seven, as well as six Senior Advisors and 19 members of an Editorial Advisory Board. I recognized only one name, but the lists include nothing but professors, doctors, excellencies, and honorables—no question about the erudition but great misgivings regarding common sense, if not that, intellectual honesty. Perhaps the title was simply an inadvertent misnomer, but I don't think so.

We've got to educate a lot of somebodies, but best to start with the young, I think. The Minerals Information Institute headquartered in Denver does an outstanding job of this. Jackie Evanger of that organization is a real "Pied Piper" and has talked to more than 14,000 "kids" primarily of grade school age. But where do we find 10,000 Jackiek MII also reaches teachers through lessons placed in the Instructor magazine, which is circulated throughout the Western Hemisphere and foreign countries elsewhere as well. Response to this is encouraging.

My statements about World Resources should in no way be taken to mean that the Society or any of its members are somehow against the environment. As a group and as individuals, I think we appreciate and enjoy nature as much as anyone and probably more than most—both on the surface and underground. Deep enough.
From The Executive Secretary

It seems like just the other day I completed my column for the July Newsletter, and now it’s time for this one. As the saying goes, “Time flies when you’re having fun!” I’m not entirely sure about that but August certainly did by pretty quickly, highlighted by attendance with Holly Huyck, SEG’s program chair, at GSA’s two-day planning session (“JTPC,” they call it) for the upcoming meeting in Cincinnati. The entire technical program for the meeting is put together in about a day and a half by representatives of GSA’s divisions and associated societies—an impressive accomplishment! The main task at JTPC is to accommodate the accepted papers in appropriate technical sessions and arrange the order of speakers in each session. Prior to the JTPC meeting, Holly and her collaborators did a thorough job of evaluating the abstracts submitted for SEG’s technical program. So it was possible to concentrate on the actual scheduling of papers, with a minimum of “second guessing” regarding the acceptability or appropriateness of papers. SEG will present four technical sessions, including one poster session, in addition to the two previously announced symposia. The symposia speakers comprise an impressive roster, and the lineup of papers and speakers for the technical sessions looks very good, but the final verdict, as always, must await actual deliveries.

The entire process is well organized as evidenced by the quality of the final product which emerges from apparent chaos at the start of the meeting. Of course, GSA has been doing this for a number of years and considerable planning takes place before the JTPC meeting. The GSA meetings planning staff is very professional, knowledgeable, and helpful, and it is a key element in the process.

For me it was an important learning experience. It is always informative to see how another group goes about its business. This experience will be very useful as SEG moves into the arena of “stand-alone” meetings.

On a different subject, Jack Murphy and Art Barber have completed revisions to the Constitution and Bylaws of the Society, based on guidelines previously established by Council. The most important change involves transferring “operating procedures” from the Constitution to the Bylaws, so that the principles and basic elements of the Society are retained in the Constitution and the procedures by which the Society is governed are now elaborated in the Bylaws. The revised drafts of these documents will be circulated to Council members for review and comment and then, with any further revisions, submitted to the Fellowship for approval. This will be the culmination of a long process and a lot of hard work on the part of Jack and Art, but it should pay off in terms of streamlining management of the Society.

SEG Foundation

The Hugh Exton McKinstry Fund

One of the most significant events in SEG history has been the establishment by Hugh and Elizabeth McKinstry of an endowed fund within the SEG Foundation that will be used to enhance in perpetuity the educational goals so splendidly developed by Professor McKinstry during his years at Harvard. At the SEG luncheon in Phoenix in February, Elizabeth McKinstry was present and very warmly and eloquently expressed the affection she and Hugh have had for our Society. In order that all SEG members may share the opportunity that was enjoyed by attendees in Phoenix, there is excerpted below parts of the agreement which have established the H.E. McKinstry Fund.

Part I: Terms, Conditions, and Purpose

“The Fund is to be called the Hugh Exton McKinstry Fund and is set up in perpetuity. Income from the Fund is to be used in support of grants for study, research, and teaching of the science of economic geology, or for related projects. Any awards committee of the Foundation may find it appropriate to remember that, although Hugh McKinstry worked wholeheartedly for the advancement of economic geology both as a profession and as a field for basic scientific study, he considered himself primarily a teacher, concerned with the development of continuing generations of qualified and able economic geologists.”

“Projects to be funded may include—

- Graduate scholarships and aid. Hugh McKinstry considered his teaching at Harvard University, and the honor of trying to carry on the tradition of the distinguished man who preceded him to be the climax of his career.
- Grants in aid for field or laboratory research and study to either graduate students, faculty, or to geologists on study leave from their employment.
- Projects that the Trustees of the Society of Economic Geologists Foundation, Inc., consider to be primarily beneficial to the science of economic geology, and especially its application to field situations.

Hugh E. and Elizabeth McKinstry

Hugh McKinstry took great interest in the potential of his students from countries throughout the world and, although it is understood that grants shall be based primarily on academic and professional qualifications, special consideration to Overseas and minority-group applicants may be desirable. It is assumed that women shall be considered on the same basis as men.”

In February, 1992, the McKinstry Fund Committee was formally established with the following membership: E.L. Ohle, Chair, D.L. Everhart, L.B. Gustafson, P.F. Howard, and D.M. Davidson, Jr. Proposals for use of the McKinstry Fund are welcomed.

Treasurer’s Common Cents

The SEG Foundation is in solid financial shape. Last February, I reported to the Board of Trustees that the Foundation ended the year with a small positive balance and approximately $105,000 cash reserves. In 1991, the Foundation covered nearly $70,000 in projects on behalf of the Society and the science.

The investment portfolio had a market value of $1,256,519 to start the year of which more than half is endowment. I anticipate that, despite a somewhat weaker investment market, the Foundation will undertake about the same number and level of projects to support, including support for this Newsletter. Other projects that are subsidized by the Foundation range from travel expenses for special lectures (Thayer Lindsey, Distinguished Lecturer, International Exchange Lecturer, Regional Lecturer) to co-sponsored symposia to SEG pages in Economic Geology.
The Druid Mine
A CASE STUDY IN REMINING AND ENVIRONMENTAL RESTORATION

By Maxine Stewart

Sometimes the best defense is a good offense. Such is the case at the Druid Mine, a remining and environmental restoration project in the historic Central City mining district, Gilpin County, Colorado. Solution Gold, Ltd., operator of the Druid Mine, has taken a bold stand politically, legally, and environmentally to demonstrate through accomplishment—rather than rhetoric—that remining of remnant mining wastes not only makes sense but can be done economically.

The Druid Mine site is situated on the north slope of Pewabic Mountain south of Central City. The majority of mining in this district occurred between 1860 and 1905, and left numerous large piles of pyritic “dump rock” and mill tailings. These materials have oxidized and weathered over the years, and they have created chronic environmental problems from the generation of acid—mine drainage to the mobilization of heavy metals into the environment. This situation is duplicated in many metal-mining districts throughout the western United States.

Impacts from historic mining wastes at Central City were severe enough that, in the early 1980s, five sites were listed on the National Priority List for cleanup. The area became known as the Clear Creek-Gilpin Superfund Study Area. The Study Area was later expanded to include all of Gilpin and Clear Creek Counties, and to take into account heavy metal loadings from both point (tunnel discharges) and nonpoint (dump rock and mill tailings) sources. There are now approximately 25 point and nonpoint sources listed as Superfund sites within the Clear Creek-Gilpin Study Area.

Solution Gold, Ltd. (SGL), began exploration and economic appraisal of mine dumps in the Central City area in 1988. A deliberate attempt was made to avoid the primary areas of Superfund interest and focus the project on the collection and reprocessing of dumps from other areas. A site in South Willis Gulch was selected for three reasons: first, numerous large dumps with economic concentrations of gold and silver were present; second, the area had been so severely impacted by the acid runoff from these dumps that removal of the waste material alone would begin the healing process of the impacted land; and third, the project could serve as a working demonstration of “remining and environmental restoration.”

After 2 years of baseline environmental studies, application, and permitting, the project began construction in June of 1990. Remining activities began in September, 1990, with the first core of gold and silver poured in October, 1990. By October of 1991, all of the large pyritic dumps in South Willis Gulch had been removed and were on the Druid Mine leach pad being reprocessed. Reclamation began immediately to control erosion, mitigate the impacts from the acid-mine drainage, and re-establish wildlife habitat at the former dump sites. Work continues today with a second leach pad coming on line to handle dump rock being delivered from adjacent Willis and Russell Gulch sites.

In 1990, SGL contacted the EPA and the Colorado Department of Health to receive authorization to process dump material and mill tailings from Superfund sites in the area. This material is physically and chemically identical to the material that has been processed at the Druid Mine to date. It has been designated as “Superfund” material because of its geographic location and the pathway exposure risk presented by being near streams, drainages, or populations.

Based upon good scientific reasoning, it would appear that removing the waste dump material from the vulnerable “pathway exposure” locations, neutralizing the material, and removing most of its heavy metal contaminants is sensible and desirable from both environmental and economic standpoints. However, this seems to be one of those trigger points where politics, the inability to make a regulatory decision without fear of litigation, and boiler plate regulations begin to polarize and obstruct the remediation process.

Because SGL is a mining company, it is regulated by Colorado’s Division of Minerals and Geology through the Mining Land Reclamation Act. In order to process the Superfund site waste dump material (which again is chemically and physically identical to dump material already being processed routinely by SGL), SGL’s Druid Mine must be additionally regulated and operated as a solid waste landfill.

Since August of 1990, SGL has pursued certification from the EPA and the Colorado Department of Health to allow it to receive Superfund related mine wastes. In January of 1992, SGL received a “conditional approval” to receive this type of material. The conditions for this approval included adopting criteria for construction, closure, and long-term maintenance and monitoring of the heap according to regulations for Subtitle D landfills. SGL has met these conditions and in place cash bonds to ensure that the long-term obligations are secure. In spite of this, SGL still waits, and waits, and waits for final certification to process waste dump material from Central City area Superfund sites.

The Superfund sites still wait too. Although remedial design is underway, not one site has been cleaned up, and no improvement has occurred in the mining-related impacts on the Clear Creek drainage system. SGL has demonstrated its ability to accept, process, and reclaim mining wastes in an environmentally-responsible manner for nearly 3 years.

By approving the Druid Mine as off-site waste repository, the EPA and State of Colorado also become partially responsible and liable for environmental cleanup and reclamation. This seems to be a responsibility and obligation that the Federal and State legal systems are not yet ready to accept. SGL feels that the environmental regulatory structure has become so protective of its own liability concerns that many opportunities for privatized cleanup, such as the repository at the Druid Mine, may never have an opportunity to help mitigate environmental problems.
SEG & Northwest Mining Association Convention

The Society of Economic Geologists will participate in the 98th annual Northwest Mining Association (NWMA) Convention New World of Minerals December 2-4, 1993, to be held in Spokane, Washington. The program includes a SEG-NWMA joint session in the Geology section of Friday morning, December 4. The convention will emphasize international minerals information and will bring new development, exploration, and operating facts from around the world. The geology sessions of the convention will present the newest geological and exploration philosophies and their application on a global scale. The joint SEG-NWMA session will provide geologic information and concepts for the new world of minerals. Specific topics include metallogenic of far eastern Russia, exploring skarn deposits, gold-bearing deposits of the Altiplano and Cordillera Occidental of Bolivia, precious-metal exploration in the eastern Caribbean, and a comparison of sediment-hosted copper deposit models. This is the first of what will be a continuing series of joint SEG-NWMA sessions at the annual NWMA conventions. For additional information regarding the joint session, contact Ronald G. Worl, U.S. Geological Survey, Spokane, Washington; phone 509-353-2639.

SEG Honors Geological Survey of Canada

The Society of Economic Geologists congratulated the Geological Survey of Canada on its 150th Anniversary in April this year. The Canadian Survey is second only to that in Great Britain in terms or longevity. At an anniversary banquet in Ottawa, Tony Naldrett, SEG Past-President, presented a certificate inscribed:

"The Society of Economic Geologists extends its warmest congratulations to the Geological Survey of Canada on the occasion of its 150th Anniversary in recognition of the many contributions its members have made over the years to the science of mineral deposits geology. By action of the Council of the Society, March 20, 1992, in testimony of which, on behalf of the Council and Membership of the Society, this certificate is presented this fourteenth day of April 1992."

Can You Help?

It has been suggested that the spouses of deceased formerly active SEG members might be interested in keeping in touch with Society activities and friends through receiving copies of our Newsletter. If you know someone who would appreciate the favor, please send the name and address to E.L. Ohle, 8989 E. Escalante, #120, Tucson, AZ 85730 USA. We will send an inquiry to confirm their interest. Any responding affirmatively will be put on the mailing list for future issues at no charge (the SEG Foundation will cover any expense involved).

Call for Nominations

The nominating committee of the Society of Economic Geologists invites the membership to nominate members to serve as President, Vice President, Councilors, and Regional Vice Presidents. Send your nominations by December 1, 1992, to the chairman of the nominating committee: Tommy B. Thompson, 2654 Shadow Mountain Drive, Fort Collins, CO 80525 USA.
Now it was not really because of the -20°C temperature and raging blizzard when I left Ottawa, Canada, that I chose to travel to New Zealand and Australia during February 28-April 12 this year to represent the SEG as the International Exchange Lecturer for 1992. But then, it didn’t exactly hold me back either! New Zealand and Australia offer such a wealth of well-known deposits and geologic settings, both ancient and modern, for the study of mineral deposits and magmatic/hydrothermal processes that, for me, the choice was easily made. And, since David Groves (University of Western Australia) came to North America as the 1991 Exchange Lecturer, and also Werner Giggenbach as the SEG Distinguished Lecturer, it seems like a fair trade for me to go “down under.” It was such an honor to have been selected, truly a high point in my career. I eagerly looked forward to my schedule of some 30 lectures, the opportunity to see and learn about many exciting geologic features, make new acquaintances, visit famous deposits, see old friends, compare notes in areas of common research interest, and beat the SEG drum. That the tour was, from my perspective, a resounding success, is due in large part to the many friendly, generous hosts (and often their families) whom I met, and the assistance of Holly Stein (USGS) during the organization of an itinerary. Unfortunately, not everyone is mentioned below.

I prepared three lectures for the tour: “Hydrogen isotope fractionation during magma degassing and the identity of magmatic water in hydrothermal systems,” “Carbon isotope evidence for CO degassing systematics of Kilauea and implications for magmatic hydrothermal systems,” and “Primary and secondary fluids in Mesozoic Mother Lode type vein deposits in western North America — multiple solutions to a problem with many faults.” Not all were presented at each university, government institution, society meeting, or mine visited, of course, and sometimes I modified a lecture slightly according to particular interests in the audience. Once I was even asked to speak extemporaneously on new frontiers in stable isotope research. My message emphasized the isotopic identification and tracing of magmatic fluids, and the importance of integrating stable isotope measurements with geological and geophysical observations and constraints that bear on the tracing of magmatic and hydrothermal processes related to a variety of ore deposits. Let me take you through a chronological review of the lecture tour.

New Zealand —

My two-week stay in New Zealand began March 1, after arriving red-eyed at 8:00 am in Auckland. Tony Christie (Inst. of Geological and Nuclear Sciences; IGNS, formerly DSIR) guided me for the next several days through the volcanic terrain of the Coromandel Peninsula, and arranged my first lecture (Coromandel Peninsula Geological Assoc.) and mine tours of Whitianga and Gold Cross (New Zealand’s only operating underground mine; epithermal Au). Between lectures to IGNS staff over the next four days, I immersed myself (not literally!) in the active geothermal fields and volcanic features of the Taupo Volcanic Zone (with Bruce Christianson, Bruce Houghton, and Colin Wilson). A highlight of the whole tour was a crater-close view of (and listen to) magmatic degassing on White Island, an active volcano. Other stops and (hosts) included: University of Auckland (Stuart Simmons), IGNS, Wellington (Werner Giggenbach, Bob Brithwaite), University of Otago, Dunedin (Dave Craw, Rick Sibson), and a tour of Macraes Flat (Au) mine (Paul Angus), which completed my tour of all working mines in New Zealand. I was sorely tempted by the scene on the cover of my travel guide of New Zealand: a bungy jumper in flight (fall?). But alas, there just wasn’t time.

Despite the adverse political climate that presently exists for exploration and mining in New Zealand, there was much interest in the talks presented. I had discussions with a number of enthusiastic students, many of whom will probably find employment outside of New Zealand. Government cutbacks in earth science funding, the lack of participation of universities in a formal research funding structure, and the “brain drain” were frequently discussed topics besides geology. This surprised me, considering the potential impact of geologic hazards on the inhabitants of New Zealand.

Australia —

I said “G-Day” to Sydney on March 14, and paid a visit to Ken Williams, a former professor of mine at Stanford. Stops and (hosts) during the next four weeks included, in order: CSIRO, Sydney (Anita Andrew); Australian National University (Allan Chivas, Stewart Eldridge, John Walsh) and Bureau of Mineral Resources (Chris Heinrich), Canberra; University of Tasmania, Hobart (David Huston, Ross Large); tours of the Hellyer, Mt. Lyell, and Rennison-Bell mines; University of Melbourne (Reid Keays) and La Trobe University (Teunis Kwak), plus a “footy” game (Australian rules football; Reid Keays tried hard to explain); University of Adelaide (Ross Both); Broken Hill (Pb-Zn; Barney Smith); Olympic Dam (Cu; Ken Gross), time out to pet a Koala; Kalgoorlie (Au; Kevin Lines), Victory (Au); and Otto Juan (Ni) mines, Kambalda (John Clout); University of Western Australia, Perth (David Groves; April Fool’s Day — three talks scheduled, including Geol. Soc. Australia). Next, the long haul: a flight to Alice Springs, then overnight bus to Mt. Isa (Pb-Zn; Bill Perkins), arriving in time to go underground, field day of regional geology (John Proffit); Mary Kathleen (Cu-U) skarn mine; James Cook University, Townsville (Neil Phillips; plus a Phillips-piloted bird’s-eye view of local geology). Here, I took a day off to snorkel on the Great Barrier Reef — sort of like swimming in your local pet store’s tropical fish aquarium! Finale: a three-day lecture day at the University of Queensland, Brisbane ( Sue Golding).

Key centers for economic geology were recently established at three Australian universities (University of Tasmania, University of Western Australia, and James Cook University) in an effort to foster university-industry cooperation and focus funding for ore deposit research. These are the places one finds
STATUS OF REVISIONS TO THE MINING LAW

By Russell Babcock & Ted Wilton
FOR THE SEG PUBLIC POLICY COMMUNICATIONS COMMITTEE

AUTHORIZING COMMITTEE ACTION

Early in the 102nd Congress, Congressman Rahall (D-WV) and Senator Bumpers (D-AR) introduced separate bills (H.R. 918 and S. 433) to repeal the U.S. General Mining Law. These bills were strongly opposed by the mining industry in hearings as being excessive, unreasonable, and capable of virtually stopping mine development on Federal public lands. Both bills would repeal the Mining Law to create a new system for locating and maintaining mining claims, including a combination of higher holding fees (or rentals), higher assessment work requirements, difficulty to achieve and overly strict permitting and reclamation requirements, and land use restrictions on mining in certain areas. In addition, the Bumpers’ bill imposed a 5 percent royalty on gross income.

Congressman Rahall introduced Substitute H.R. 918 bill on June 10, 1992, which was even more onerous than the original H.R. 918. Substitute H.R. 918 would require: (1) all federal lands to be reviewed for unsuitability for mining (a multi-decade, Rare II process similar to the U.S. Forest Service Wilderness suitability review), (2) more stringent permitting requirements including arbitrary denial of approval authority, (3) and detailed and unachievable reclamation standards, as well as other features. In total, Substitute H.R. 918 would make exploration and development of new mines in the United States almost impossible. As the result of a drafting slight-of-hand, the provisions of Substitute H.R. 918 would become applicable to both new and existing mining operations located on Federal, state, or private lands.

Substitute H.R. 918 was so offensive that Mr. Rahall, as Chairman of the Subcommittee on Mining and Natural Resources, lacked the votes in his own Subcommittee to approve the legislation. As a consequence, Congressman George Miller (D-CA), Chairman of the House Interior Committee, discharged the Mining Subcommittee and reported the Substitute H.R. 918 on June 24, 1992, without any public debate or review. An 8 percent gross income royalty was added to the bill during Interior Committee markup.

Because of the impacts of Substitute 918 on Forest Service lands, the House Agriculture Committee obtained sequential referral of the bill until September 10. On August 6, the Committee held a hearing on the environmental considerations (Title II), where Administration officials indicated they would recommend that President Bush veto the bill in its current form.

Mr. Miller is expected to try to bring Substitute H.R. 918 to the House Floor for passage sometime in September before Congress adjourns for the November elections. The mining industry is working hard to keep this bill off the House Floor.

Seeing movement in the House on Mining Law revision, Senator Bumpers introduced on June 26 a less controversial version of his original bill, Substitute S. 433, and requested immediate markup of this new bill before the Senate Energy Committee. His objective was to get legislation out of the Energy Committee and into Conference with the more onerous House Substitute H.R. 918 as quickly as possible.

Senator Bumpers’ Substitute S. 433 was much less comprehensive than the original S. 433. It did not repeal the General Mining Law, but would impose holding fees of $5 to $20 per acre per year (increasing in 5-years increments) and limit claim life to a 15-year term, subject to one 5- or 15-year extension, thus creating what is essentially a location-lease system. A reclamation plan would be required, but with standards close to those in the existing Forest Service and BLM regulations. The bill dropped the 5 percent gross income royalty, contained in the original S. 433.

If Senator Bumpers could get into Conference with the House Substitute H.R. 918, a new Mining Law could be created in Conference Committee, with the lead roles played by him and Representatives Rahall and Miller. However, much to Mr. Bumpers’ consternation, a group of Energy Committee members representing many of the western states, together with conservative members, prevented his Substitute bill from being reported. With the Senate Mining Law bill stalled by the Energy Committee, action in the Senate by the authorizing Committee is unlikely and no Conference with the House bill will be possible.

APPROPRIATIONS COMMITTEE

The House Interior Appropriations Subcommittee, at the request of Congressman Regula (R-OH), added to the House Interior FY 1993 Appropriations Bill a moratorium on the issuance of patents under the Mining Law, and payment of an annual $100 holding fee per mining claim in lieu of assessment work. The holding fee provision was supported by the Bush Administration as a means to raise approximately $50 million annually. These provisions were approved unchanged by the full House and sent over to the Senate.

Senate follow-up action on their version of the Interior Appropriations bill resulted in inclusion of the $100 holding fee. An amendment offered by Senator Reid (D-NV) and other Western Senators was adopted on the Senate Floor to: 1) charge miners fair market value for surface rights when obtaining a patent, 2) provide for reversion of a patent to the federal government if the land is used for non-mining purposes or when mining is completed, 3) require conformance with state reclamation law or absent such law, federal reclamation standards (which will have to be created if Arizona and New Mexico do not implement state reclamation laws), and 4) some additional requirements for bonding and the removal of certain uncommon mineral varieties from the purview of the Mining Law. Senator Bumpers failed to get approval on the Senate Floor for a patent moratorium amendment, and did not offer a royalty amendment. Senator Stevens (R-AK), however, was successful in adding to the Senate Interior Appropriations bill a
provision to help small miners with the $100 holding fee. Under this provision, a mining claimant who is producing from ten or fewer claims in an integrated operating area and who has less than 10 acres of unclaimed surface disturbance can elect to either pay a $100 per claim holding fee or do annual assessment work.

Final resolution of the two versions of the bills will occur in the House-Senate Conference on the Interior Appropriations bill in September. How the Senate Reid (D-NV) amendment and House patent moratorium provision will shake out remains to be seen, but there is little doubt that the $100 holding fee is likely to survive.

CONCLUSION

One can expect some revision of the Mining Law from the 102nd Congress. How little or how much, how good or how bad, remains to be seen once Congress reconvenes in early September. There is a strong feeling by some in the mining industry that the Reid and Stevens amendments, if enacted, would "fix" several of the perceived problems with the current law, and may lessen support for radical Mining Law changes in the future. There are mixed feelings about the $100 holding fee as it will be an additional cost to miners who would no longer receive credit for money spent developing their claims. On the other hand, this fee may defuse the revenue/royalty issue and may create stronger pre-discovery rights.

Both Messrs. Bumpers and Miller are committed to abolishing the patent and imposing a royalty on hardrock mining on public lands. One could expect that they will continue the quest for these and other Mining Law changes in the next Congress. Pending the outcome of the Conference on the Interior Appropriations bill, and the possibility that other Mining Law amendments may be attempted via other pending legislation, the mining industry's involvement with Mining Law revision may not be over.

Clearly the question for the mining industry for the 103rd Congress is whether to take an offensive or defensive position on any additional changes to the Mining Law. Should the industry propose additional changes? Should the issue be studied further, or should the industry wait to see proposals by our detractors and then act? Now is the time for the industry to begin to ask these important questions and to develop an effective strategy that will preserve a viable domestic mining industry.

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EXCHANGE LECTURER, CONT.

the largest numbers of enthusiastic students of ore deposits. Thesis work typically involves the support of industry. In large part, the centers' success stems from the guidance and enthusiasm of the principal investigators: Ross Large, David Groves, and Neil Phillips. The centers also serve as sources for continuing education within the mining/exploration industry. Although this system develops an active "critical mass," a consequence is that good students in economic geology are drawn away from other universities, possibly limiting the breadth of the training base at the national scale.

The podium banner with the SEG global logo that I carried for display at each institution provided a humorous geography lesson and open line (which I used often), when it was pointed out to me that New Zealand is missing from the globe (probably subducted beneath the colliding plates), and that Tasmania is an island and not a tail-like appendage to the Australian continent as depicted. Still, I met with many positive comments about SEG and the Bulletin. The cost factor of belonging to more than one major society (and who doesn't understand those pressures today?) was the reason most frequently given when I asked about membership.

In closing, I wish to whole-heartedly thank the SEG for the opportunity to represent the society, to meet and learn from so many wonderful people during this once-in-a-lifetime experience, and to thank all of my hosts, and others who I met, for their warmth and hospitality.

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Still in the copper front, Corporación Nacional del Cobre de Chile (Codelco) has announced the discovery of a new porphyry copper deposit near its Chuquicamata mine. The deposit, called Mansa Mina or MM, is located between Chuquicamata and the city of Calama. Codelco has estimated a total resource of 612 Mt. averaging 0.9% copper, with a central zone of 291 Mt. grading 1.19% copper (within which exist 70 Mt. with a grade of 2.2% copper). With this discovery, and the previously discovered Chuqui Norte deposit (1,000 Mt. of oxide ore at 0.8% copper, or 650 Mt. at 0.85% copper), the Chuquicamata district qualifies as one of the major mineralized areas of the world. It is to be noted that MM has no surface expression of any kind. The discovery was made by stepping out, toward the south, on some drill holes that had intercepted mineralization thought to represent narrow veins.

The Michilla district, located about 100 km north of Antofagasta, continues to yield new ore bodies. Antofagasta Holdings discovered the new Estefanía zone (17 Mt. at about 0.4% copper) near its existing Susana and Lince mines. Mineralization in the district is contained within the Jurassic volcanic sequence known as La Negra Formation.

Equatorial Gold, a company linked to Niugini Mining, announced the acquisition of the Leonor copper project that had previously been discovered by a local miner. Leonor forms part of a larger exotic copper deposit, known for sometime, called El Tesoro (owned by Antofagasta Holdings). Reserves quoted for the Leonor portion of the deposit amount to twenty-four million tonnes grading 1.6% copper. The size of the total deposit may be at least double that amount. Subsequently, Placer Dome arranged to earn a 70% interest in the Leonor property by completing a feasibility study, arranging any necessary financing, and reimbursing previous expenditures by Equatorial Gold.

Cyprus Minerals Company, through its subsidiary Minera Orion Chile Ltda., is presently drilling its promising Chimborazo copper prospect, located about 10 km north west of the famous Escondida mine. With Outokumpu’s Zaldívar project (published resource: 235 Mt. at 0.92% copper) located nearby, this area is turning out to be another important mineralized district.

Another significant copper discovery announced recently is by Empresa Minera Mantos Blancos, a company controlled by Anglo American Corporation of South Africa. Published reserves on its Manto Verde oxide copper project amount to 85 Mt. averaging 0.85% copper. Manto Verde is located 40 km ESE from the port of Chañaral in the III Region of Chile. The deposit is associated to the Atacama Fault zone, which is a major regional structure recognized along most the northwest part of the country.

With respect to precious metals, during 1991 Amax Gold drilled the Guanaco property, located about 160 km south of Antofagasta, identifying a resource of about 900,000 oz. of contained gold. This is a significant new discovery in an old mining district. El Guanaco has been in intermittent production for the last 100 years. Estimates of past production are in the order of 1 million ounces of gold. The discovery by Amax puts El Guanaco among the significant gold deposits in the world.

In spite of the problems experienced by the owners of the Marte and Lobo projects, exploration continued at the Mariquina district in the III Region of Chile. Drilling by Bema Gold at the Refugio property developed a minable reserve of 112 Mt. with an average grade of 0.93 g/t gold. Amax Gold holds an option to acquire 50% of the project from Bema’s joint venture partner Compañía Minera Refugio. Cia. Minera de Oro, Ltda., a wholly-owned subsidiary of
Arizona Star Resource Corp., is carrying out an exploration program at the Aldebarán gold project. This prospect is also located in the Maricunga district. Through investment, Arizona Star plans to acquire a 51% interest in this prospect from Minera Anglo American (Chile) Ltda.

Also in the III Region, a group of three Chilean companies, acquired, and started to develop, the Can Can deposit, previously explored by Chevron. The deposit, located immediately north of the Placer Dome/TVX La Colpa mine, is thought to contain 600,000 ounces of gold, according to published data.

In the IV Region, Dayton Development Corp. extensively drilled the Andacollo gold project over the past two years, identifying 26.3 Mt. grading 1.05 g/t gold in several bodies. Andacollo is a structurally controlled epithermal gold-pyrite deposit in trachyandesites of lower Cretaceous age and alkaline affiliation, which emanated from two or more volcanic centers.

Finally, in the XI Region, near the town of Chile Chico, CDE Chilean Mining Corp., a subsidiary of Coeur d'Alene Mines Corp., is exploring its Pachalhuinc gold/silver property. The structurally controlled epithermal mineralization is hosted in acid to intermediate volcanics of the upper Jurassic to lower Cretaceous Ibañez Formation. Published proven and probable reserves amount to 13.5 million tonnes averaging 1.13 g/t gold and 55.3 g/t silver, for a total of 528,000 contained ounces of gold and 16,480,000 contained ounces of silver.

Argentina is receiving increased attention from the part of multinational and junior companies. Comsul of Bolivia completed recently a drilling program on its Pachon porphyry copper project in the San Juan Province. The government of this province is trying to generate interest in a series of alteration zones located near the border with Chile in claims controlled by the provincial government. A recent development is the contract signed by International Musto Explorations Ltd. of Vancouver, Canada, with Yacimientos Mineros de Plata de Dionisio (YMAD) on the Bajo de la Alumbre copper-gold porphyry deposit in the province of Catamarca, northern Argentina. Musto will finance and complete a feasibility study and has the option of bringing the deposit into production. A few multinational companies are conducting basic exploration in the country, but no major discoveries have been announced recently.

In Uruguay, American Resources Corp. of San Francisco acquired the Mahoma project and will start production with additional ore being trucked from nearby high-grade occurrences. Gold occurs almost exclusively in quartz veins in greenstone-granite terranes.

Exploration activities continued at a slow but steady pace in Brazil, with CVRD, RTZ, Gencor, Western Mining, and Anglo American as major players. No new discoveries have been announced, but several new mines came on stream, all greenstone belt-related. Morro Velho (Anglo American) started production at its Pitangui mine in Minas Gerais (600,000 tonnes at 3.5 g/t gold in oxides, and 2 Mt. at 5.5 g/t gold in sulfide ore). CVRD started production at its Ígarapé Bahia deposit in southern Paraná (12 Mt. at 4.7 g/t gold). Western Mining moved its plant to Ana Rosa, in Goiás (600,000 tonnes at 4.6 g/t gold). Finally, CVRD is completing its feasibility study on the Salobo #3 copper project. The project contemplates mining a higher grade section of 250 Mt. at 1.11% copper, 0.49 g/t gold and 2.68 g/t Ag contained within the huge 1,200 Mt. at 0.8% copper occurrence. Besides continuing exploration efforts by all companies in greenstone belts of Goiás, Paraná, Minas Gerais, and Bahia, a multi-company joint venture airborne EM survey over the Iron Quadrangle of Minas Gerais could spark renewed exploration interest in Brazil.

Exploration in Bolivia continues at an increased pace. However, most of the efforts are directed to reevaluate old mining districts. The new frontier constitutes the Precambrian of eastern Bolivia where Compañía Minera La Rosa, a subsidiary of EMUSA discovered the Don Mario copper occurrence. Initial drilling indicated about 10 Mt. at 2% copper, 2 g/t gold and 31 g/t silver. Exploration continues at this project in association with Battle Mountain Gold, EMUSA’s partner in the Ini Raimi gold mine.

Exploration in Peru continues to be bedeviled by the lack of personal safety for exploration crews in the field. Newmont Gold, in partnership with BRGM and Gia. de Minas Buenaventura, announced the imminent development of the Yanacocha deposit located in the department of Cajamarca. Reserves for Yanacocha have been quoted at 12 Mt. averaging 1.5 g/t gold, but considerable potential remains to be tested within a regional trend of favorable rocks.

In Ecuador, the main exploration players continue to be RTZ and BRGM. However, no new discoveries have been announced recently.

Colombia faces the same problems as Peru in respect to personal safety for geologists working in the field. As a result, exploration is almost at a standstill. However, Greenstone Resources managed to place its Oronorte deposit in production (411,525 tonnes at 17.5 g/t gold) at a rate of 30,000 t/y ore.

Venezuela experienced an increased level of exploration last year. The main focus was on the Guayaquil Shield in eastern Venezuela. Cyprus Minerals conducted an extensive drilling program for gold at La Camarillo, near El Dorado, under a joint venture agreement with Monarch Resources. However, Cyprus eventually withdrew from the project. Placer Dome did some exploration in the area known as Km 88 on the road to the Brazilian border.

Cambior replaced Placer Dome as the investor in the Omai project in Guyana. A reserve of 55.1 Mt. at 1.32 g/t gold was developed at this project. Start-up is projected for 1993.

Interest in the Society of Economic Geologists has increased in this part of the world. Since our last report, 12 new Fellowship applications and 5 Membership applications have been received and are at different stages of processing. This represents a 37 percent increase in SEG membership within the region. The Society also plans to present at the VI Geological Congress of Chile organizing an international symposium with the theme “Andean Copper Deposits: New Discoveries, Mineralization Styles and Metallogeny.” The event, which also will feature a field trip to some important copper deposits in Chile, will take place in late 1994.

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PAID ADVERTISEMENT
Data Integration and Modeling in Economic Geology

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In April 1992, the Mineral Deposit Research Unit (MDRU), a collaborative mining industry-University of British Columbia venture, organized a two-day workshop to assist the unit in defining a research focus for the next five to ten years. The first day of the workshop involved a series of invited presentations on a general theme, "The Future of Research in Economic Geology." On the second day, participants were divided into a series of discussion groups working on individual themes. The meeting involved over one hundred participants from industry, government, and academia, and it produced a consensus on a number of issues and thought-provoking discussion on others. One of the most important themes that recurred throughout the meeting was the development and influence of computer-oriented data integration and modeling. Ideas on this theme are summarized here based on contributions and discussion at the meeting and the presentations from the invited speakers and chairmen: D. Strangway, President of UBC; E. Gonzalez-Urriol, VP Exploration — Place Dome; B. Berger, USGS, Denver; H. Winnie-Edwards, President — Terracy; S. Kesler, University of Michigan; J. Guha, University of Quebec — Chicoutimi; R. Henley, Ehrington and Henley Geoscience Consultants, Canberra; P. Bradshaw, VP — Orvana and Chairman of the MDRU Board of Advisors; K. Fletcher, Head, Department of Geological Sciences, UBC; and J. Franklin, GSC — Ottawa.

Computers have been a feature of the mining industry for many years, particularly in ore reserve estimation, production, and plant operation. In the last five years, however, there has been an explosive increase in accessible computer power. The simultaneous development of new software, which in general is becoming increasingly user friendly, allows all geoscientists to utilize an amazing array of tools for analyzing and modeling data of different types. Geographic information systems (GIS) are a product of these developments and present multiple opportunities for all of earth science. Although the use of computers in exploration has been relatively limited compared to other areas of the industry, the prospect of easy and rapid data integration may change this.

Data integration is not a new concept. Most exploration companies and geologists have always assembled data (geological, geochemical, and geophysical) for a region or property at the same scale on mylar sheets and overlaid them in the search for coincident anomalies or supporting information. What is new is the speed with which this can be done, the ability to simultaneously interrogate the data, and the opportunity to combine or invert data; for example, the production of three-dimensional earth structure models from multiple geophysical data sets. For exploration, the opportunity to routinely utilize and visualize all data (digital terrain models, remote sensing, lithological, structural and alteration mapping, 30+ element rock, soil, or other geochemistry; geophysical airborne, ground and down-hole surveys) should improve target selection and will certainly allow exploration management to more rapidly review results and proposals.

Complex data sets can be integrated directly with ore deposit models, based on critical empirical features and supported, where possible, by genetic or process concepts. In many cases, this will still be performed by the individual explorationist based on instinct and experience, but in the future may be tested against diagnostic expert systems during the computer-oriented data analysis. Database expert systems are more likely to see routine use than the early generation of expert systems that attempted to provide artificial intelligence based on the inductive powers of a few individuals. Although there are no guarantees, more effective use of data should increase exploration efficiency, given that many discoveries result from a single new interpretation after multiple exploration phases. Many explorationists conclude that the new major breakthrough in exploration technology will come from new methods of data analysis and data integration which make better use of existing data, rather than a new geophysical or geochemical method. This is obviously a challenge to the geophysicists and geochemists.

Although there is considerable interest to GIS and data integration in the exploration industry, there is a virtual stampede in government agencies. This is partly practical — it provides an easy means of assembling and publishing large regional data sets — but it is also driven by potential applications in resource assessment and land use management. The technology is available for outlining mineral potential by combining regional data and ore deposit models. Ultimately, a quantitative estimate of mineral potential may be attempted, a goal which is politically desirable but fraught with potential pitfalls.

Research on mineral deposits has traditionally involved the combination of multiple types of data. It has been anchored on field work but has probably included every available branch of earth science, depending on the deposit type or problem. It could be argued that economic geology is the home of the generalist (not necessarily regarded as a complimentary term) or in current parlance, the multidisciplinary scientist (much more complimentary). Increased computing power has improved our ability to take multiple data sets, display them with powerful graphics, statistically analyze them, and model processes applicable to ore deposit formation. In addition, complex programs have been written to simulate natural ore-forming processes, for example, fractional crystallization and volatile/sulfide saturation with associated metal partitioning from magmas; chemical-mineralogical alteration and metal precipitation; boiling-mixing fluid models and metal transport; and quantitative evaluation of supergene processes. Not only are these models explaining natural assemblages or processes, but they are also becoming predictive, suggesting new metal associations or environments. The programs for these models are becoming routinely available and this type of analysis will become common-place in ore deposit studies.

Computer developments not only provide new and exciting applications but also represent a challenging area of research for those who can combine a knowledge of mineral deposits with computing skills, and experiment with theories such as chaos, fractals, and non-linear dynamics. In addition, computer technology has a significant role to play in education both in formal teaching and professional training for individuals.

The trend to use greater computing power in all areas of economic geology is absolutely inevitable. It is not, however, a panacea. As with any advanced tool, there are many opportunities for abuse. There is a tendency to use computer power as a magic black box without necessarily understanding the data or the functions that the computer is performing. A lack of attention to detail, no calculation or propagation of errors, and over-interpretation of results appear to be common problems in research that relies heavily on computer analysis. Furthermore, the ability to analyze data may be in danger of exceeding the quality of the primary database, and geological relationships based on field mapping and experimental constraints on fundamental variables. Support for, and acknowledgement of, the importance of this type of research is not as easy to obtain as that involving computer applications or advanced analytical equipment.

Data integration, GIS, advances in computer applications, and modeling will become regular features of all earth science conferences and will be the theme of the special Society of Economic Geologists—the Society of Exploration Geophysicists—the Association of Exploration Geochemists — U.S. Geological Survey conference in April 1993.
JURASSIC VOLCANIC ROCKS. Remnants of a Triassic-Jurassic island-arc ocean-floor terrane crop out on the east side of the Cordillera Real. Calc-alkaline volcanic rocks are intercalated with flood basalt lavas and hyaloclastite breccias. Andesitic volcanic breccia sequences are related to quartz feldspar porphyries. This poorly understood sequence, most of it in dense jungle, is called the Misahualli Volcanics. Time-equivalent rocks crop out along the west side of the Cordillera Real, where they form mafic schists within Apusden's Triassic shear zone (pers. comm.). This volcanic sequence is intruded by the calc-alkaline Zamora Batholith. The Nambija gold skarn occurs in an enclave of andesitic volcanic breccias in this batholith. Other significant Jurassic-Triassic gold deposits are stockworks at Chilapintaza, diatremes at Biche, and a porphyry Cu-Mo system at Hito (discussed below).

Much potential for base metal and gold discoveries exists within the volcanics east of Cordillera Real, north of Zamora.

CRETACEOUS VOLCANIC ROCKS. Exhumed ocean floor rocks are exposed in the Guayas Basin in a belt which parallels the coast, as well as inland within the Cordillera Occidental. These mafic, ultramafic, and possibly island-arc and back-arc rock sequences are believed to be part of an accreted volcanic terrane (Henderson, 1979; Shepherd and Moberly, 1981; Leyshon and others, 1987). All contain abundant pillow lavas, gabro- ultramafic differentiates, intercalated pelagic chert, and radiolarian ooze. These volcanic rocks contain gold-bearing massive sulfide deposits and are intruded by younger calc-alkaline plutons which locally contain gold-bearing porphyry systems (Gosnolds and Hollister, 1973).

TERTIARY-QUATERNARY VOLCANIC ROCKS. Most Tertiary gold deposits in South America are in eroded high-altitude volcanic complexes and correlate with relatively shallow subduction zones (Fig. 1). There are two such zones: one in Chile and the other in Peru and southern Ecuador.

The Ecuadorian zone underlies the central part of the Andes and consists of young calc-alkaline rocks which fill a graben. This central "rift zone" was the site of many calderas and shield volcanoes throughout the Tertiary. As coastal Ecuador emerged from the sea, the central Andes collapsed during volcanism which produced rhyolite domes and related calderas. volcanism persists today, with at least 12 active volcanoes north of Riobamba (Fig. 3), and an extensive cover of recent airfall tuff (to 20 m) makes prospecting difficult in northern Ecuador.

South of Riobamba, the Tertiary volcanic pile has been eroded to expose Eocene to Oligocene volcanically-hosted ore deposits. Locally the rocks were altered to an acid sulfate assemblage and are prospective for epithermal silica-rich gold-bearing systems (e.g. San Fernando and Garanir prospects). Large epithermal quartz stockwork vein deposits are being mined at San Bartolome and Portoveco and there is good discovery potential for new systems.

Late granite and granodiorite stocks ranging in age from Eocene to Oligocene and possibly younger intruded the volcanic rocks. Locally, these intrusives host porphyry copper-type mineralization (e.g. Pico Uroco).

YOUNGER COVER ROCKS. Eastern and western Ecuador are underlain by Cretaceous and younger sedimentary basins which have been prospected for oil, but which are believed to have little potential for precious metals. However, a good chance exists for discovery of mineralization related to intrusives, such as the Pascuales prospect.

RECENT ALLUVIUM. Holloway's (1932) classic paper on alluvial gold in Ecuador shows all significant alluvial gold deposits in Ecuador. Current alluvial gold operations exist at Los Lilines (400 m3 of 0.18 g/m3) and Shumiril on the west coast of Ecuador. Perched Quaternary gravels with gold and young intrusive dolerite sills occur at the Nayumbi and Plantza prospects, south of Zamora.
GOLD DEPOSITS IN SOUTHERN ECUADOR

Goossens (1972) described the metallogeny of Ecuador and summarized most of the then-known base and precious metal deposits. In this paper we expand upon his concepts and describe some of the new gold prospects not known at that time. Goossens (1972) drew from a large data base, gathered by United Nations and Ecuadorian geologists in the 1960s. They carried out detailed geochronological and geochemical surveys (Kroon and DeGroot, 1970) and drilled many prospects. Much of this data has not been used in recent exploration. Some of our new discoveries came from these files (e.g., Pascuales Au prospect). Paladines (1989) also has described the metallogeny of Ecuador.

JURASSIC-TRIASSIC DEPOSITS. The Jurassic volcanic rocks of Ecuador were poorly explored until the Nambla gold skarn was discovered. Since then, the eastern foothills of the Cordillera Real have become a major focus for prospectors and mining companies.

The Nambla district is located about 50 km south of Zamora (Fig. 2). Alluvial gold was discovered by the Spanish colonials in the 1600s. In 1981, prospectors followed the gold upstream to old Inca workings in an area called Aroco, where they discovered visible gold in exposures of gneissic skarn. Within two years, 500 miners were working the site supporting a shanty town of 10,000 people.

The district lies within a north-trending graben in an enclaves of Triassic(?), Mishaulli Volcanics, which is enclosed in the Jurassic Zamora Batholith. The volcanics consist of tholeiite, andesite, andesitic tuffs and breccias, and other island arc-related lithologies. The batholith consists of cordierite-plagioclase-granite stocks. The Nambla deposit lies within a flat-lying prograde skarn sequence in contact with quartz-feldspar porphyry intrusive related to the Zamora Batholith.

The ore body is one km long and 100 m wide; the total depth is unknown, but workings extend 100 m below the surface. We estimate that miners have extracted at least 1,000,000 ounces of gold. Other reserve estimates and geologic observations were made by Pillaio (1985) and McKeilw (1991).

Old workings mined steep, generally north-trending fault zones. Ore is concentrated along NNE-trending pegmatite breccias, faults, and dikes that cross-cut flat-lying stratigraphy. High-grade coarse gold occurs within retrograde zones within the skarn; these consist of quartz veins, K-feldspar (adularia?), chlorite, serpentine, clinozoisite, and hematite alteration zones. Most gold is enclosed within stockworks of thin quartz veins, but also within gossan garnet. Faults, breccia zones, and porphyry dikes cut the ore zones. The stopes are irregular "rat holes" which follow the high-grade pockets. The gold is very pure with virtually no copper or magmatic. Pillaio (1985) believes there may be a large subsurface skarn gold deposit immediately to the east, down dip, possibly under the Nambla townsite.

Other nearby skarn-related deposits are found at Guavsmi and Sultana to the south, and Camparrilla and Campana to the north. At Camparrilla, Plateau Mining (1990) is exploiting disseminated gold within quartz veins in a gneissic skarn, concentrated along steep NNE-trending fault structures in skarnified volcanic breccias. Ore shoots average 2 m x 2 m x 50 m long, plunging 30° SW. (Plateau Mining, 1990; Mining Magazine, 1990).

The source of the gold in the Nambla area may be younger, perhaps Tertiary, intrusives, or the district may be related to a series of diatremes. The potential for discovery of other systems exists north of Zamora and also east of Pachicuata where skarn-type gold mineralization was discovered at Nampintza (2-channel assay at 6 g/T Au) and Maria Elena (both within metamorphosed Jurassic volcanic sequences, equivalent to Mishaulli Formation).

The deposits of the Chinapintza district, east of Nambla, formed in the Mishaulli volcanics on the north side of the Zamora Batholith. The volcanic suite includes rhyolite, dacite, tuffs and breccias, intrusive breccia and black shale units, intruded by quartz feldspar porphyry and hornblende granite plutons of unknown age. These rocks are part of a nine km² volcanic center which is locally silicified, sericitized, and argillized. Chinapintza is a stockwork of narrow (<0.5 m) oxidized quartz veins with average grade of 50 g/T Au. The wallrocks are sericitized and clay-altered lithic and lapilli tuffs and quartz feldspar porphyries. The veins are exploited by 200 miners.

The Bihe prospect is located 2.5 km south of Chinapintza in a north-trending belt of sulfur-rich lithic lapilli tuffs, intrusive breccias, silicified crystal tuffs, and rhyolite flows. Intrusives consist of hydro-fractured quartz porphyry breccias and pegmatite, pyrite diatreme-like fluidized pebble and boulder (up to 10 m across) breccias. Mineralized rocks are restricted to a 500 x 500 m area. Smaller (50 m wide), gold-rich, pipe-like diatremes are also present. A discordant irregular "black breccia" pipe contains 5–10% disseminated pyrite with traces of sphalerite, chalcopyrite, and chalcocite. The black coloration is due to fine sulfides and local carbon concentration. Channel samples contain anomalous copper, lead, zinc, silver, and gold (to 10 g/T Au, average 1.5–2.0 g/T Au). The rocks are silicified, with quartz stockworks and veins, and sericitized within the lithic tuff and rhyolite sequences. The main quartz reefs and "felistic" zones trend 300°–40° N,” and dip 60° to 70° E.

The Bito porphyry copper prospect lies in a Jurassic granitoid 5 km south of Chinapintza and underlies an area of 2 km². It has an outer propylitic halo and an inner sericite-pyrite core, but it has no supergene enrichment. The country rock is coarse-grained porphyritic granite, quartz diorite, and granodiorite which was intruded by quartz-feldspar and hornblende-pyroxene porphyries. Gold was panned in creeks draining the northern part of the prospect. Rock chip samples of outcrop and scree with chalcopyrite and quartz contain up to 1.8% Cu. Most other stockwork zones assay 0.1 to 0.9% Cu. The prospect clearly warrants more work.

Other Jurassic porphyry-gold-type systems occur at Cutuniza, 5 km north of Nambla, and at Augusto, about 30 km south of Zamora. Both consist of quartz stockworks within quartz porphyry and granitic plutons, have skarn envelopes, and are weakly mineralized. Chalcopyrite, epidote, calcite, and manganan alteration halos are present. At Augusto, now a National Park, the Inca was followed by "pequeños mineros" working 20-meter-wide quartz reefs.

TERTIARY VOLCANIC-HOSTED DEPOSITS. The central Ecuadorian Tertiary volcanic belt contains many volcanic-hosted gold prospects and mines. These include large epithermal vein systems such as those along Portovelo, San Bartolome, Molleturo, Banos (near Cuenca), Uzqui and Guanuazu, as well as acid-sulfate systems at San Fernando, Garanar, Ticam, and Casayp (Fig. 2).

The Portovelo-Zamora district in southwestern Ecuador was discovered in 1599 and worked continuously until the free-milling oxidation zone ores were exhausted in the 17th century. Billingsley (1926) describes the mines as "fissure veins which form a linked-vein system and adjacent to a granitic intrusive cupola." The district is 3 km long (north-south), 1 km wide, and 600 m deep with at least 20 branching veins and stands up to 1000 m long. Wallrocks are porphyry andesite, rhyolitic porphyries, and volcanic breccias.

The veins range in width from one to three meters, dip 25–80° E, and strike northerly. The quartz-filled fracture network expands to widths to 5 m. The veins formed in an epithermal environment and are characterized by layered, radiating, coalescent quartz and calcite structures with 50-cm claysilicate alteration envelopes. The best gold ore contains abundant sphalerite with pyrite, pyrhotite, chalcopyrite, bornite, and chalcocite; secondary hematite is a good guide to higher grades.

At least four million ounces of gold have been mined from this district. The veins average 10 g/T Au (Mosquera, 1951), but oxidized ore contains 40 g/T Au or more. At present, miners are extracting 7 to 10 g/T Au from pillars. The presently quoted mineral resource is 100,000 tonnes at 7 g/T Au and 3% Cu.
VanThournout and others (1991) believe the Portovelo district lies within a Miocene volcanic center related to rhyolite doming and quartz andesite extrusion onto a basin unconformity (now faulted and folded) of Cretaceous or "Paleozoic" schists. They indicate the district is in the core of an intense silica-rich alteration zone with a clay-altered fringe. The silica alteration zone near Minas Nuevas workings north of Zaruma has a great potential for containing an undiscovered vein system.

An untested network of coliform silica veins exists at Shulata, close to the Guaranin Cemetery, and also at Yaro, 2 km north of the townsite, 50 km south of Cuenca. Channel samples across these veins contain 1 to 1.5 m of 3 to 10 g/T Au. These prospects remind us of a zone immediately above a Portovelo-Zaruma vein network. Drilling is needed to test the system.

Other precious-metal veins exist at Pilzham and Molleturo. Both prospects are quartz vein systems, similar to those at San Bartolome, and contain currently uneconomic silver, base metals, and gold. Goossens (1972) described a massive pyrite deposit near San Fernando where “opalinu silica, piscilite sulfides, and banded gysersite suggest metals were deposited by hot colloidal solution.” The rocks are extensively leached and silicified, and they contain 0.5 g/Ton Au. Similar silicified zones with repeated episodes of leaching, silicification, and sealing are found south of San Fernando at Ganarin prospect, in a one km² zone of weak silica replacement of volcanic rocks. In addition, the Casco prospect is located east of the Chauca porphyry. Porous sinter-like silicified rocks with alunite and gold occur above rhyolite domes. Many miners are working here.

These are the only Tertiary volcanic-hosted-type prospects known in 1991, but Ecuador’s high-altitude Tertiary volcanics hold much promise for further discovery of acid sulfate-type gold systems.

PORPHYRY RELATED TERTIARY GOLD-(CU, MO) SYSTEMS. The Chauca prospect is the only Tertiary (11 Ma) porphyry copper identified by Sillitoe (1989) in Ecuador. Our work has shown that there probably are no other strong porphyry copper systems between Chauca and the border, but there are numerous porphyry-related (failed systems or tops of porphyries) gold, copper, and possibly molybdenum systems. These prospects are all in Miocene to Eocene calc-alkaline, mainly dioritic, plutons intruded into Cretaceous and Tertiary volcanic rocks in the Sierra Occidental.

The Chauca porphyry copper deposit (Goossens and Hollister, 1973) contains 74 million tons at 0.7% Cu and 0.03% Mo, and it is currently uneconomic. No gold assays are reported. The prospect covers about 4 km²; the wallrocks are Macushi Formation, and the host rocks are granodioritic-monzonite which have concentric argillic and phyllic alteration zones. Significant Cu-Mo ore occurs only in the phyllic zone, which covers 1 km².

The Gaby prospect is southwest of Chauca. The prospect is in a Tertiary intrusive breccia complex at the center of a 2-km-wide circular structure, a possible remnant of a volcanic cone. The complex was emplaced into sheared and fractured tectonic basalt of the Cretaceous Macuchi Formation. The intrusive breccia complex contains at least six rock types and several different intrusive breccias. A 1-km² alteration zone consists of a pyritic outer rim and a potassium-rich (biotite, sericite, and secondary potassium feldspar) core.

Disseminated copper, gold, and molybdenum at Gaby occur in two different settings:

- A porphyritic hornblende diorite breccia (Santa Monica breccia) which forms a NW-trending brecciated “crackle zone” with a sulfide-silica-sericite matrix and hornblende porphyry fragments. The fragments are weakly adularialized and tourmalinized. The principal ore minerals are pyrite, chalcopyrite, and molybdenite with fine gold in the matrix and within the pyrite lattice. The porphyry fragments contain thin parallel quartz veins.

- A NW-trending breccia which has an adularia-tourmaline-pyrite matrix and altered hornblende diorite clasts, and which is cut by quartz-tourmaline veins. Adularia replaces the plagioclase within the fragments and forms rims on the fragments. This type of breccia may be the volatile-rich “skin” to unexposed breccias similar to those at the Santa Monica breccia.

The Santa Monica breccia was tested by eight reverse-circulation drill holes. All holes intersected significant gold-bearing intervals, the best of which is 66 m at 3.91 g/T Au, 0.38% Cu, and 0.04% Mo. The weight average of all holes is 3 g/T Au, 0.50% Cu and 0.03% Mo. Drill results on the other breccia body results are not available. The property currently is being mined by heap-leach methods.

The Gaby breccia complex may lie above a porphyry system. Other similar “high level” breccia prospects occur about 6 km to the north at Phihil; 10 km SE at Mirador; and 20 km SE at La Tigrera, La Playa, and Pucara, and further south at Cerro Pelado (Fig. 2).

At La Tigrera (also known as La Soledad), an oxidized, 300-m-wide breccia pipe consists of large rounded and angular dioritic hornblende porphyry boulders, set in a ferruginous clay matrix. The highest gold grades are in the matrix, and, in one adit, 36 meters of combined matrix and boulders contain 5.48 g/T Au. Immediately to the west is La Playa, a pneumatolytic breccia pipe with fluidized, rounded, and angular dioritic boulders of various sizes surrounded and corroded by a matrix of tournilane, silica, and hematite, with locally significant visible gold. The country rocks are Tertiary rhyolite domes with associated lithic-crystral tuff and coarse volcanic breccia. Neither property has ever been drilled. Gold at Cerro Pelado (Plateau Mining, 1990) is in Tertiary silicified lithic tuff and rhyolite fragment breccias. Primary minerals are pyrite, marcasite, arsenopyrite, pyrrhotite, chalcopyrite, and free gold. Channel samples across the most oxidized zones indicated 0.5 to 14.2 g/T Au. Active exploration in the Bella Rica district near Gaby is focusing on at least five oxidized epithermal veins which average 80 g/T Au. These radial veins are peripheral to the Gaby-Papa Grande volcanic (caldera?) structure.

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Gold.

Base metals.

Coal.

Industrial minerals.
**Conclusions**

Ecuador has a stable economic environment, and it is ready for foreign investment in its mineral resources sector. We have outlined many new opportunities here; the main problem is the lack of serious commitment and scarcity of drilling funds. Southern Ecuador has had two significant gold producers: Fortovelo (c. 4 million ounces) and Nambija (c. 1 million ounces). We all wait for the discovery of the third major producer; after this, investment dollars will not be hard to find.

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EXPLORATION REVIEW

ALASKA
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News Alert: Canadian mining companies invade Paxson! An interesting comment on the industry; three companies and one geophysical contractor, all under the Maple Leaf, chance to meet in Paxson late in August: Cominco, ACNC (Inco), and Noranda were all on the ground refueling ASTAR 350's. The two of Inco's were just passing through, but Noranda had Aerodat in the Triassic section of Clearwater Hills, flying a combined mag, VLF, and EM survey. What's so attractive about 6000 feet of Nicolai Greenstone? Speaking of ACNC, the Dolomitic property on Prince of Wales was returned to Sealaska. At least certain consultants won't have to slulk around just out of sight in the forest primeval, nor quite certain of their exact whereabouts (Roger, carry a GPS unit—they really work).

The King of Prince of Wales Island — Boomert — and sidekick Phil Anderson kept changing logos this field season but never changed location — first Lac, then Cominco, then Kennebec, then Lac. . . . Boomert is the one with $500 worth of Roy Glifler products and hundred-year-old tin pants topped by a grey wool vest. The last of the geographic specialists in an age of generalists. Speaking of royalty, how does Owen Owens walk up creek without getting his feet wet?

Steve Newkirk's move of family and household to Anchorage from Tucson was heralded by the eruption of Mt. Spurr. A gritty welcome to the Last Frontier. SEG member and porphyry guru Spence Tisdale was in town and gave an expansive commentary on the composition and significance of the ash to the local newspaper. Other athen SEG members seen around town included Bob Hodder and Norm Duke, both out of Univ. Western Ontario, Richard Kyle from U-Tex, and Russ Babcock stuck around McGrath.

After a visit to a property near Haines, consulting geologist Toni Hinderman says that Phelps Dodge geologists are afraid of heights; too steep to get WVII out of the helicopter. This may explain why Bill put PD into a relatively flatter play at Zadikly, the Nerco copper gold skarn property north of the Denali Highway in the McKinley area. The Folk (Peter) at Teck are undaunted by heights, however, and are now working the Mt. Henry clay area for Windy Craggly wannabees. It always helps to have the right paradigm — the property wasn't farmable as merely a VMS target.

Pegasus is venturing pretty far afield from no-grade heap leaching in the Great Basin, what with taking on the new PD reject at Jullin at the north end of the Juneau gold belt. This interest is probably actually driven by recent SEG member Tom Burkhardt's yearning to catch a really big bull instead of the double uglies he got last time on Barnett's sailboat.

Hugo and new BHP Western Exploration Manager Bob Schafer made the rounds to see if Bob would advocate exploration in Alaska, not that Hugo has any preconceived notions. They went through the motions of the standard tour of well-kicked properties (there is now available a videotape so one doesn't have to leave home) and then off to Salt Lake City. This could portend a new Schafer/ASN series of "Bulk Minable Deposits of the Last Frontier." Diamonds, anyone?

Newmont: First it was a go on the Aspen ground on the Seward, then no signed work proposals (the AP malady) and everyone back to Denver, then back again in August. Probably enough airfare for a drill hole. Ten tons of samples finally got delivered to Chemrex late in August — that's a lot of trenching.

As seen through the eyes of Westmin's number one Marlin, some of the VMS terranes of Southeast Alaska have certain similarities with the very productive volcanic rocks of Vancouver Island. This explains the summer-long presence at Scandia house in Petersburg of Chris Rockinghorse and others. But what was Kurt Adler doing there all summer? And for whom?

The skies have finally cleared over Drenchwater—not of miserable weather (hence the name), but of helicopters, although Kennebec did leave its camp on the property. Sounds like the 1993 program has already been approved.

Re ILV: Jerry Booth replies, "Who knows how rumors get started?"

CANADA
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Canada is suffering from a dearth of new discoveries. Most of this year's major exploration projects, aside from the search for diamonds in the Northwest Territories, have focused on known deposits, particularly those with base-metal mine potential.

The juniors that fueled grassroots exploration in the 1980s have either closed up shop or turned their attention to diamonds. Many of the seniors, including Falconbridge, Homestake, and Echo Bay Mines, have abandoned certain offices in Canada in order to funnel exploration dollars into less hostile regimes.

Although it fits squarely into the "known deposit" category, the Izok Lake property, 225 miles north of Yellowknife, represents one of the few encouraging developments on the exploration front. The volcanogenic massive sulfide body was discovered in the 1970s by Texagulf, and subsequent drilling established a shallow reserve of 12 million tons grading 2.83% Cu, 13.7% Zn, 1.4% Pb, and 2 oz. Ag per ton. Falconbridge acquired the property when it purchased Kidd Creek Mines in 1985, but, without completing any additional work, turned it over to Minnowa in late 1991. Minnowa now shares the property with its soon-to-be controlling shareholder, Metall Mining.

Occurring within an Archean belt of mafic to felsic metavolcanics, the Izok Lake deposit lies near the top of a thick sequence of felsics and is overlain by a succession of volcanics, iron formation, mafic flows, and turbidites that have been metamorphosed to amphibolite grade. It features a hydrothermal envelope of sericite-biotite alteration, with lesser chlorite- cordierite-antigorite, aluminosilicates, and stilification of the host rocks.

Between March and July of this year, the joint venture partners completed 60,000 feet of drilling, mainly to confirm known reserves, but also to search for underground reserves accessible from the proposed open pit and to investigate other targets on the property. The work, including follow-up of a deep electromagnetic anomaly, led to the discovery of the Inukshuk zone. Based on seven widely spaced holes, the new massive sulfide deposit is estimated to contain a preliminary reserve of 2 million tons grading 2.6% Cu and 8% Zn. It remains open down-plunge. Minnowa and Metall are now in the midst of a detailed engineering and environmental feasibility study.

Other exploration projects of note include:

Kidd Creek: Falconbridge is spending at least $500,000 this year to find satellites of the huge Kidd Creek copper-zinc deposit at Timmins, Ontario, which is expected to run out of ore by the end of the decade. At the time of writing, the senior producer was reportedly operating three rigs in the area, two on ground held by White Star Copper Mines on the western boundary of the mine property.

Casa Berardi: TYX Gold and Golden Knight Resources discovered two new gold zones just northeast of their Casa Berardi Est gold mine in northwestern Quebec. The discovery hole cut 5.1 ft of 0.14 oz gold and, further down the hole, 31.1 ft grading 0.21 oz. The mine straddles the west-trending Casa Berardi fault zone.

Jouet: Agnico-Eagle Mines discovered a deep gold zone at its aging Jouet operation, also in
northwestern Quebec. An intersection of 0.35 oz gold over a true width of 25.9 ft is currently being tested along strike. Until the discovery was made, the Jouet operations had been slated to close by the end of this year.

**GREAT BASIN**

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**GOVERNMENT NEWS (BLUES)**

Well, the House has started taking action while we work. News to date involves the passage of an appropriations bill which prohibits the BLM from processing any applications for mineral patent for one year. Also, the bill implements the $100 per claim assessment fee in lieu of assessment work.

Good of Vulcanovich, R., NV lobbied for an amendment which would have allowed for pending patent applications to be allowed to proceed; her efforts were defeated. She still gets my vote.

**GENERAL INDUSTRY NEWS**

*Analytical Labs: My world-wide travails of late, reviewing extensive databases from properties hosting varied commodities, has made me recognize that a new section in this portion of the newsletter is warranted. Although it may not be timely (for some...) it’s never too late. This recognition is due, in no small way, to my prior experience (with an erstwhile analytical lab employer) which has proven invaluable in enabling the detection, deciphering, and distilling-out from project databases problems attendant to poor/inadequate sample prep and/or analytical procedure. In the past, I have done many of the routine commercial lab analytical procedures and supervised the rest. And while I am clearly not expert as a bench chemist, I am acquainted enough to have become first-hand familiar with the problems and common areas of slip-ups in QA/QC. In this case, “Bo knows.”

A recent surprise visit to a notable commercial lab was quite revealing (it always is...). There were obvious, and innovative (yet incorrect) variants upon acceptable sample prep going on; the lab was doing incorrect sample splitting of those deliberately large drill samples at the pre-pulp, -10 mesh coarse-crush stages, whereby only a small portion of the entire sample was being split for the pulping (where’s Don Hammer when you need him?)

Yikes! While this would have lesser (but still unacceptable) effects on drill samples from base-metal projects, strict adherence to procedure is crucial to adequate sampling of gold projects, particularly those with coarse gold (and how many have none?).

I encourage you to make periodic, unannounced checks through labs you are currently having a love affair with, or ones that are attempting to lure you in. Do so at sample rush hour. That’s when “routine” breaks down into what may really be routine procedure. A couple of two-bit recommendations (read: refreshed memories) might be appropriate here:

1. Request the lab to crush the entire drill sample to -10 mesh, and be willing to pay for the extra involved labor. Particularly on gold properties, it’s well worth it. Then make a randomly timed visit, especially after you just shipped them 1,200 samples, and go see what really happens.

2. Request the lab roll all your pulps before weighing, and insist that they sample the pulp from numerous places in the rolled pile during weighing. Again, be willing to pay for the extra labor involved. Then visit during “rush” hour and quietly stand in the back of the weigh room and watch what really takes place. This sure won’t make you (or me, for that matter) very popular with the labs, but we need to get what we pay for. And the drill samples are usually the most expensive and important non-bulk sampling conducted. Most importantly, it’s what those Banks gauge their risk assessment on.

Yes, it does matter.

**CORPORATE NEWS**

**AMAX Gold:** AMAX Gold announced improved earnings for the second quarter. Earnings increased a remarkable 56 percent, to $11.7 million (from $7.5 million). Net earnings for the first half climbed only slightly, by 1.3 percent, to $15.7 million (from $15.5 million). As expected, production continues to drop at Sleeper, and only minor gold trickles from the closed Wind Mountain operation. However, due to acquisition of interests in the Guanaco and Haile projects, exploration expenditures totaling $11.2 million could be capitalized, which contributed to the higher second-quarter results.

AMAX announced that the Fort Knox Project permitting and engineering is on schedule, and that this season’s drilling program is proceeding according to plan.

For the quarter, gold production dropped a startling 34.2 percent, by nearly 30,000 ounces, to 57,700 ounces (from 87,700). One only hopes that the forward-thinking purchases at Hayden Hill, CA; Fort Knox, AK; and Guanaco, Chile were timely enough to reverse this trend.

**American Barrick:** American Barrick Resources Corporation announced that company-wide gold production increased 32.5 percent for the first half to 495,200 ounces (from 373,700), the bulk of it coming from a 59 percent increase in production from the Goldstrike operation alone. Net income for the period rose by 49 percent, to $59.9 million, from $40.2 million a year ago. The improvements were met with cash costs decreased by nearly 15 percent, to $258 per ounce (from $303). With 1992 production targeted at 1.2 million ounces at Goldstrike, the recent smooth start-up of the 15,000-tpd mill expansion and two new autoclaves there was a positive sign. Corporate net income for the quarter rose by 50 percent to $36.8 million (from $24.6 million). Barrick’s forward sales and hedging programs had a realized average gold price of $424 per ounce for the first half, at a time when market prices sagged below $350 per ounce.

**Battle Mountain Gold:** Not a pretty picture here... Battle Mountain reported first-half earnings were down a scary 189 percent, for losses of $6.1 million, compared with earnings of $6.8 million a year earlier. Wow. The losses are attributed to ever-increasing cash costs, and to charges relating to amortization, depletion, and depreciation (sounds old and getting older...). Production forecasts for the year have now been revised, downward, by nearly 3 percent, to 430,000 ounces, in part due to less-than-expected through-put at their mine in San Luis, Colorado.

**Crown Resources:** For the second straight quarter, Crown has reported operating losses. For the second quarter in 1992 losses totalled $1.6 million, compared with a year-ago loss of $732,000. For the first half of 1992 the loss totalled $2.8 million, as compared with net income of $1.4 million for the same period last year. The 1991 income included a one-time option payment receipt of $5 million relating to the Crown Jewel. Apparently, the low gold price has become a reality for this group, which has compounded their working capital plans. Cash costs at Kettle River rose by over 10 percent, to $285 per ounce.
Cyprus: Cyprus has re-added an exploration talent previously departed to the likes of Gold Fields. Perhaps the prior success which preceded that post were too much to hope to surpass in the new, entrenched Gold Fields. Where is Bill Lindqvist, anyway?

Homestake—Corona: Well, the much ballyhooed acquisition has been consummated, with attendant abrupt career shifts for the many rock-and-fil... In a surprise announcement, “Gomarona” will be closing the long-lived Golden, Colorado, operations and exploration headquarters, as they de-emphasize exploration activities in lieu of, their robust (7) property portfolio and ever-faithful acquisition optimism. Corporate expenditures are to be reduced by $25 million per year, starting with the one-time costs of $14 million in 1992 related to the elimination of 180 career posts. The Great Basin gang came out way ahead on this one (this time...), as their survivalist position will take responsibility for most exploration efforts. Major projects of continued focus by Homestake include Eskay Creek and the Lead exploration drift at North Homestake.

Newmont Gold Company: In an interesting twist, Newmont recently announced the purchase of 375,000 ounces of gold on the free market, at $335.95 per ounce. Curious, move for, sure. One wonders how long they can keep this up. NMC states that "$335.95 per ounce is just about (key word, there...), as low as gold is likely to go..." But really now, that’s what buyers of anything think (read: hope). J.P. Morgan (with some ex-Newmonts now on their staff) believe that “repeated selling by central banks (not in the Great Basin) which hold 38,500 kgs of the metal will deter price increases above 3 percent for some time to come, possibly for the rest of the decade. Curious, how we all hold so strongly to our perceptions of behavior for precious metals price trends.

Pegasus Gold: Pegasus has announced improved earnings for the second quarter. Net income for the first half improved by a remarkable 81.3 percent, to $5.5 million (from $3.2 million), with revenues up a notable 26.6 percent to $85.6 million (from $67.6 million). The improvements are attributed to a remarkable drop in cash operating costs, which decreased by 12.3 percent to $206 per ounce (from $235). In spite of rumors to the contrary, perhaps things aren’t going all that badly at Black Pine.

IDAHO

Black Pine: Pegasus Gold has announced that, in the first half of 1992, this new operation produced 19,600 ounces of gold and should easily meet the production target of 50,000 ounces by year end. There were no specific offers on the quality of the reserve base, though “basin-fill” rumors suggest continuity wasn’t what it should be. Undaunted, close-in exploration continues and should add reserves from what are currently resources.

Triumph: In an interesting event (hopefully a harbinger of things to come...), Blaine County, Idaho, has challenged the Environmental Protection Agency (EPA) to provide evidence verifying the EPA’s claim that rural families living near the historic Triumph Mine workings are indeed at health risk. A series of visits and short studies by the EPA in prior years revealed the presence of heavy metals (Pb, Cd, As) in the air, water, and soil, and made the site a candidate for superfund cleanup. However, last fall a series of biological tests of residents (possibly not unlike the study of “wired” goats in Alaska...) revealed no evidence of contamination. The EPA stands by their “concern” and recommends more testing during the dry summer months. We’ll stay on this one.

INDONESIA

Grasberg: Well, the “continuing series” department, Freeport has announced yet another one in this amazing district. The “Big Gossan” (that’s clear enough...) situated near Grasberg is returning the usually spectacular drill intercepts, quoted as ranging from 4.25 to 5.33 percent Cu, and 1.5 to 9.7 g Au (0.283 oz/t). In a refreshing bit of up-frontedness, FCL declined to speculate or even state the drill thickness involved, due to near-vertical drilling and the “apparent steepness of the mineralization” (although they should check with Robert Bates on the usage of that word — see the Glossary of Geology), pending further drilling. As per usual here, these are not “at-depth” kinda numbers; they don’t have to be.

NEVADA

Alligator Ridge: The “deal of the decade” continues to return success for its sole investor, USMX. The Yankee Mine is now the third operating property here for USMX, and they began pouring gold during the quarter. The operation should produce 15,000 ounces of gold this year and establish an averaged rate of 21,000 ounces per year for the next three years. This recent operation was capitalized within the $4 million budget. Sufficient pads were constructed for the mining of the 2-rt reserve which grades 0.045 oz/t Au, and should yield over 70,000 ounces during the mine life. Not bad, for supporting only a portion of the original $2 million purchase. Exploration continues (and should for some time to come).

Bucksin — National: In the “who has time to watch” department... Cameco (TSE) has begun to earn into a 60 percent interest here by completing $250,000 of exploration. Queenstake, the owner, has touted a “Sleeker analogue geological setting for the prospect (now that’s interesting)” which must forego the associated rock types and ages. After all, epigenetic is often epigenetic. The sinner has focussed current attention (where’s Peter Vikre when we need him?).

RECURSOS DEL CARIBE S.A.
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Illusions of high-grade, "larger-tonnage" (I like that one...) vein or vein-stockworks are hoped for at depth. Hmmm, it always gets deeper with depth.

Carlin Trend: The "cultural revolution" (I can't take credit for that one) continues at historic Newmont. The latest fashionable moves have seasoned explorationists re-focused along the Carlin Trend, and unseasoned mine-geos heading up the all-important frontier exploration offices. Curious. Perhaps the movers-and-shakers think the seasoned explorationist culture will bring with it dearly sought-after discoveries along the Trend, which have become somewhat recessive late. Perhaps the mine-geos will better recognize the early-warning signs of big yellow haul-packs in the wilds of the exploration areas! (Can you say 1,600,000? can you say 1,250,000?)

In other, albeit somewhat unrelated news, a quasi-new (or at least with a new name) claim block is soon to appear on Eureka County maps. The "Fog to File" lodes were hardly earlier this year within the confines of the closely held Trend by an over-your-shoulder watcher. They always seem to look harder from the outside, don't they. Curious how this appears to have left the infamous land department unscathed — it's a good thing for them they don't work for the geology department movers-and-shakers (can you say 1,250,000?)

Creekside Lewis: A new production record was set for this property during May: a total of 10,109 ounces gold and 58,700 ounces silver were produced. A higher tonnage of ore was mined during the first 5 months of the year, an 18 percent increase over the prior year. Exploration drilling continues to confirm the presence of a high-grade silver zone which extends to the south of the current pit area, and which apparently increases grade at depth. Granges (67% owner) announces that early stage feasibility studies are examining the mineability of the occurrence.

Deno: From the "too quiet department" this Carlin Trend property has announced encouraging results from drilling completed adjacent to the open pit operations. Recent results from the "southeast zone" have added 1.1 million oz of 0.31 oz/t Au to the heap-leach reserves. Other drilling to the north last year added 3.3 million oz of 0.03 oz/t Au. Many targets remain, even on this limited (read: hemmed-in) land position.

Flowery: Minmar (60%) continues to pull high-grade intercepts from this Stoney County property. The most recent announcement heralds a 60-ft. drilled thickness (110-170 ft) of 1.08 oz/t Au, within which occurs 5 ft of 10.3 oz/t Au (which would alone contribute 0.87 oz/t to that 60-ft. 1.08 oz/t Au). Run. Wonders of the steepness of this intercept, and hopes that its grade is prudently capped in future resource estimates. The currently mothballed operation is poised to re-open at a 40,000 st/month production rate at the Lady Bryan pit. The current "diluted minable reserve" is quoted at 1.1 million oz of 0.63 oz/t Au and 0.4 oz/t Ag.

Gold Acres - South (Pipeline): The saga continues... A more recent entrant into the legal fray, Royal Gold (VSE), alleges that they too were debunked in the sell-out to the Cortez JV (Placer-Dome and Kennebec) by the JV not disclosing to them "certain facts" prior to consummation of the sale (it's beginning to sound like "I really believed you would respect me in the morning"). This pie should have been big enough to go around, but the weary plumb wore out and are now anxious. Through their prior involvement with Royal Gold, the it's-bity ECM, Inc. of Montana, who originally staked much of this ground during 1988, is thusly also brought into the ring. Other takes?

Oohh, a hot one. A new entrant into the exploration scene here (not on the heels of Pipeline) Cathedral Gold (VSE; hmm, that sex thing...) has announced their staking of 1,900 acres "about 16 miles southeast of the Pipeline discovery." Wow, startling move for sure. Sixteen miles SE would put them in a vast pediment area somewhere between Toiyabe Dome and Tonkin Springs. The Vancouver trend-ruler never ceases to entertain. But, they claim the property is positioned "adjacent to a lower-grade window" (with respect to Connecticut...). Geophysics is touted as being the key here (I think I could draw this "anomaly" with my eyes closed... but then, drilling technology has come a long way). This one would appear to belong to the "ain't worth watching department."

Marigold: Rayrock Yellowknife Resources has increased their share of this Humboldt County property by purchase of the Placer Dome (US) interest for $17.5 million. Rayrock now controls 66-2/3 percent interest in the property (up from 33-1/3). The increased ownership will increase Rayrock's share of gold to 75,000 ounces at current production rates. Corona, holding the remaining 33-1/3, declined the opportunity to increase their ownership share.

Ruth: Magma has announced that the first-phase development of their Robinson Cu-Au project here has been approved with a price tag of $233 million. Current reserves stand at 201.4 million oz of 0.65% Cu and 0.011 oz/t Au. Annual production over the 16-year life should level off at 125 million pounds Cu, 87,000 ounces Au and 300,000 ounces Ag. All concentrates will be shipped (now there's an open word... to San Manuel, AZ, for smelting. With no rail head in the Ely, NV, vicinity, the shipping will likely be a costly combination of long-haul trucking, to either Caliente (south) or Cobre, NV, (north), the two nearest loading points for rail to San Manuel. You can bet extreme attention is being paid to the potentially high freight charges due to excessively moist (read: heavy) concentrates. Production will commence from three of the old Kennebec pits, the Liberty, Ruth, and Veteran/Tripp.

Sleepers: AMAX Gold announced that cost-reduction programs have resulted in a 9.6 percent drop, to $198 per ounce (from $219). Tonnage mined continues to increase (I hope it contains some grade...), as do the overall productivity figures. Hmmm, no comments on grade, these days.

Tenabo - Robertson: And this is how it starts... AMAX Gold has announced that drilling in the central area of the Coral Gold property here has returned long-awaited encouragement. Two holes are announced as intersecting high-grade mineralization. Hole 49 intercepted a 245-ft drilled-thickness zone grading 0.14 oz/t, which contained a 200-ft zone grading 0.124 ounces (this intercept alone carries 0.101 oz/t for 245 ft. What does the other 45 feet really contribute?). "Nearly" (225 ft) hole 51 intercepted 180-ft thick zone grading 0.08 oz/t Au including a 140-ft zone grading 0.015 oz/t (again, this intercept alone would carry 0.082 oz/t Au).

Drilling in the southern portions of the property along northern projections of the "Pipeline trend" discovery have been deferred due to the pending (and ever crowded) litigation there. However, the austerity timing of this news release nonetheless seeks to advantage itself by at least geographical proximity, if not Great Basin trend-ology hype.

UTAH

Kings Canyon: Certain portions of this joint venture property were dropped during the recent quarter: the drop is credited with "affecting second-quarter results." Sounds like the 4enuran (UT) deal is proving too rich for the likes of Crown. That would fit with the experience of others elsewhere (say Tintic with Western Mining, Noranda, TECK, etc).

Tintic: Speaking of Tintic, the "low-angle Twins," long renowned in more westerly reaches of the Great Basin, have surfaced here, and give "thumbs up" signs for the exploration potential. Surface exposures of apparently epithermal vein volcansics in the Sunbeam area suggest to them the potential for at-depth (here we are again...) sedimentary-rock
bodied gold systems (note plural). Drill, we must. How thick is that cover, anyway?

Oquirrh Mountains: More Genufex news (it seems there’s always more...). The great Kennewick finally belled-up to the bar and reached an agreement for the purchase of 20,000 acres of the northern portion of this range. At the agreed-upon price of $250,000, that’s only $12.50 per acre, which, considering the rugged terrain, ain’t too far above the anticipated costs of staking.

Salt Lake County: Well, the historic technological limits of the turn-of-the-century mining boom are raising some hackles at the EPA. A recent program completed the sampling of 16 abandoned smelter sites scattered from Murray to North Salt Lake City. The US Coast Guard was even involved (how deep is that lake?). The old smelters really belched it out into the Salt Lake Valley, raising concerns over the level of heavy-metal contamination resident in soils in what are now increasingly densely populated rural areas. Over 1,500 samples were collected. Poor timing this, as any negative results may only serve to taint the aggressive expansion and modernization program under way at Kennewick.

SOUTHWEST

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The assessment season and the summer monsoon are upon us. Unfortunately, so is the election year, and we find that when it rains it pours. Western Senators have recently sold out to preservationists and re-election interests, and they apparently have chosen to believe that a $100/claim holding fee will generate $40 million in new revenue for the government. Why don’t we focus on reducing the $5 million yearly staff cost per Congressman in Washington? A mere 1.5% belt-tightening/politician cost would amass some needed fat and more than make up the difference. Besides, how many claims will you file on next year at $100 per? Vaya Sud, joven!

On the exploration front, Bema has gotten real and decided the acquisition route is deeper than their pockets will likely ever be. They are now looking at “grass-rootsy” properties. Also copper is now OK. They picked up the West Hills copper oxide near Show Low, Arizona (nice deal, Phil!). Phelps Dodge staked adjacent ground to the west.

After years (seems like decades) of hanging on, Bill McGee finally dropped all but the core patents at Red Mountain near Patagonia with Phelps Dodge pounding posts on their heels. How’s that for a 21st century (warped) worldview?

Speaking of the recent porphyry fanaticism, Magma bought Poston Butte from Comco. A big resource: 800 million tons of 1/2 oxide/1/2 sulfide, both of 0.399% copper, 500 ft. deep, no supergene mineralization (high cp/py ratio), another 300-400 million tons faulted off deep, con mucho agua. What’ll you do: move the Gila River? Buena suerte, muchachos!

Correction from last installment: Phelps Dodge is still trying to acquire San Juan. Tough deal with lawyers and Mo’s involved.

Preservationists have scared most everyone out of Copper Basin. Any buyers?

Recent sampling at Gold Basin is encouraging to active Cambior. They optioned Mine Wells from prospectors and reportedly staked 600 surrounding claims in Tortolitas.

Contrary to previous exposé, undrilled leached cappings (this year’s buzzword, ask any chopper pilot) will crop out. A few more have been (re)discovered. I’ll bet Blanchard’s classic is due for reprint at Mackay School of Mines what with all these Nevada gold-types now looking for Martian urine. A major has picked up an undrilled copper oxide/leached cap showing in porphyry heartland. That should convince the average prospector not to out-think himself.

Enough of Ariz-zona. Moving east to cooler climes and hotter chile, we find that the Steeple Rock district continues as a small miner’s delight what with flux mining, VSE junior-types, and local prospectors and promoters active. Biron Bay-Nova Gold staked claims on 8000 ft. of “possible strike extensions” of previous drilling. Seems this clear epithermal mineralization has suddenly assumed porphyry characteristics. Is this what economic geologists recognize as telescoping or is it simply myopia? Actually, word on the street says deep disseminated zinc-lead in Miocene andesite porphyry. Top of a moly porphyry is a dumb field geologist’s guess. Have they assayed for the greasy metal?

Echo Bay drilled at Victory Peak near Denning for property owner’s assessment. A deal is in the making. Some think there’s a porphyry copper play here. We know of deep moly-tungsten skarn, shallow epithermal gold. Zoners take note.

Goldfield’s second round of drilling at Oro Grande was disappointing. But did they test all the targets? Can Ben get it drilled again? How many times has it been drilled? I’m counting on fingers and toes and although I was born in hillbilly heaven, there are the standard ten of each.

Hecla is drilling at Gallinas but managed to insult adjoining prospectors with low-ball buyout offers and no mention of NSR. What with $3.75 silver little wonder the “offer subject to approval by Hecla Senior Management.” Certainly was less than their salaries for the next month. FMC drilled a second round of ten holes at Vera Cruz near old Texaco trenches (nada metals at surface) and returned the property to vendors. But what about the steep slope between the pit and the trenches? Caracol Canyon would fit snugly in there. Placing is once again in vogue at White Oaks but is fine gold recoverable? Noramco’s looking for a JV partner to fund drilling at Mudpuppy-Waterdog. Greenbacks are a problem for VSE juniors outside of tundra diamond plays.

Good news from Colfax County as York Mine lives again with 15 year, 30 million ton coal contract for light bulbs in Cheeselander. $1 million in coal, 100 car/day train, 400 new jobs in Raton? Bet SFPM wishes they hadn’t sold that 6 sq mi of prime 6-point bull elk ground in the middle.

I was castigated soon after publication of last newsletter that no mention was made of Copper Flat. To refresh your memory, it is fully permitted, a shrewder contract is in place, and financing should be completed in 30 days. Is there an echo in here? Reminiscent of a fairy tale of bays, wolves, and crying.

Champion Resources turned a JV with Western Mining for Jones Hill. On the last hour of the last day of the extension of the long drawn-out due diligence, Western’s legal beagles on Howe Street got cold feet and pulled the plug. Or was it a budget shortfall down-under? Champion marches on with drill permits in hand. Dollars are being counted. This is too good to ignore for VMS fans. Yeah, I have an interest.

Rock of the Easties rumors have renewed interest in red-bed copper occurrences from Scholle to Coyote. Although SW-EX types are active, forward thinkers envision Olympic Dam targets on basement geophysical highs as the preferred (hoped-for) source. Unconfirmed recent lookers include Placer-Dome, FMC, and Canuckies (“consultants”). Only Phelps Dodge is a player at present. Texas Gulf reportedly has drilled for sulfur in the Santa Rosa region and Solvay Geologists have been seen in the area.

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NORTHERN ROCKIES

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IDAHO

Black Pine: Formation Capital Corp. recently acquired a lease (with option-to-purchase terms) on this Lemhi County copper property. The Black Pine mine was a small-scale producer in the 1940s and 1950s from high-grade massive sulfide lenses hosted in the Proterozoic Yellowjacket Formation. The property is estimated to contain a reserve of about a half million tons that grade 3.5% Cu. This reserve is contained in about one third of the nearly 6,000 ft of strike along the presently identified copper-enriched stratigraphy. The property is located within the Idaho Cobalt Belt about midway between the Blackbird (Noranda) Co-Cu-Au deposits and the Iron Creek (Centurion Gold/Cominco) Cu-Co deposits.

Blue Dog: Company rotation appears to be accelerating at this Washington County gold property controlled by Gold Canyon Resources. Last year's 20-hole (4,000 ft) drill program by Noranda was quickly followed by an even shorter review by Gold Fields Mining. Now it looks as if Minnova will be next in line of those opting to explore the epithermal gold targets on the property. Current reserves are estimated at about six million tons that grade somewhere between 0.025 and 0.035 oz/ton Au.

Galena Giant: Kennecott is reported to be conducting preliminary examinations at this base metals project prior to drill testing scheduled for the latter part of the field season. The property is controlled by Canadian junior companies Arbor Resources and Wealth Resources, and it is located near the Idaho-Montana border about a dozen miles north of Wallace, Idaho. The target is cast as a stratiform Pb-Ag deposit hosted in the Precambrian Formation of the Proterozoic Belt Supergroup; correlative stratigraphy to that hosting the giant Sullivan massive sulfide deposit.

Yellow Pine: Yellow Pine Resources reached an agreement with American Barrick to earn an interest in the yellow Pine gold project. Yellow Pine Resources holds a major deposit composed of refractory sulfide ores estimated to contain up to four million ounces of gold. The five-year option period calls for $7 million in payments to Hecla and completion of a feasibility study. Hecla retains the option to continue as a 30 percent partner in the venture. American Barrick is considering the opportunity to take the project off of its radar.

MONTANA

Anaconda Tailings: This well-known Superfund site has recently been the subject of some innovative ideas that should interest those who want to see the glories of the future. No joke; the matter is now being studied by planners and landscape architects for Jack Nicklaus Golf Services who feel the challenge is worth looking into. The aim would be to seal, cover, and, of course, camouflage the waste that has been left by more than 100 years of mining at nearby Butte. Nicklaus Golf Services personnel are trying to create a series of garbage dumps, gravel pits, and undesirable swamps that have now been reclaimed by golf course construction. Identified as the major challenges are a suitable drainage system and selection of "correct" vegetation. A guidebook for such a course might also contain some interesting rules that give new meaning to the words "golf hazard", take over a free drop."

Blue Joint: Pegasus Gold plans to drill on its claims in the Blue joint wilderness study area in southwestern Ravalli County. Results from surface mapping and sampling have provided the encouragement to proceed with the drilling stage on this large-scale project of hydrothermally altered Tertiary volcanic rocks that overlie thick sequences of Proterozoic quartzites. The initial helicopter-supported drill program calls for six holes to be drilled near the Idaho-Montana border west of Blue Joint Creek.

Montanore: Noranda has decided to seek full permitting of the entire mining operation at this megaproject located adjacent to the Cabinet Wilderness south of Libby, Montana. Rather than obtain a variance to the Montana state water quality laws that have shut down the underground exploration activities for nearly a year, the company plans to proceed with the drilling stage on this large-scale project of hydrothermally altered Tertiary volcanic rocks that overlie thick sequences of Proterozoic quartzites. The initial helicopter-supported drill program calls for six holes to be drilled near the Idaho-Montana border west of Blue Joint Creek.

Montana: For an undisclosed price, RTZ Corp. recently acquired all of Cyprus Minerals Company's talc operation in the U.S. The acquisition includes four Montana mines and plants as well as operations in Japan, Spain, and Belgium. RTZ's new holding company, Luzenac America Inc., will oversee the Montana operations which have given RTZ the largest tcalc position in the U.S. The sale is considered to be a result of Cyprus' desire to focus on its core businesses of copper and coal production and sales.

New World: The current reserve base of 12 million tons grading 0.22 oz/ton Au, 0.87 oz/ton Ag, and 0.75% Cu is expected to increase significantly following the results from the most recent underground drilling at this Park County project operated by Hemlo Gold Mines. The increases
will be largely in the Homestake deposit where intercepts up to 250 feet wide have encountered as much as 0.31 oz/ton Au, 1.31 oz/ton Ag, and 1.25% Cu. A new reserve figure will be calculated following a current 30-hole underground drilling program.

In a somewhat surprising event, property owner Crown Butte Resources announced recently that the gold recovery process would not involve standard cyanide extraction techniques. Noting that the bulk of the reserves are contained in sulfide-rich ores, Crown Butte states that the favored recovery process now involves only gravity separation of gold followed by froth flotation to produce a gold-bearing sulfide concentrate that would be further processed at a smelter. This move is expected to reduce much of the emotional opposition to the project that has mounted mainly because of its proximity to the northeast boundary of Yellowstone National Park.

**MIDCONTINENT**

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**MICHIGAN**

General: Diamond exploration continues in several areas of the Upper Peninsula. Crystal Exploration has been active and Exmin recently nominated an undisclosed area for a state lease. Western Mining continues its precious metals exploration efforts also in several areas of the UP. Pfizer Chemical recently reopened its limestone-dolomite operation at Gulliver with new state-of-the-art equipment. Copper Range Co. has recently been involved with litigation brought by the National Wildlife Federation for alleged infractions of the Clean Air Act at the White Pine Mine. Cleveland Cliffs Iron Ore Company also is involved with litigation. Their problems stem from a class-action lawsuit filed by some 60 Palmers residents that claim damage from the mine operation's dust and blasting vibrations.

Keweenaw County: Great Lakes Minerals continued efforts toward obtaining a mining permit for its 543-S Project near Gratiot Lake. The underground copper mine is expected to have a mine life of up to 8 years and employ about 40 people. The mine property encompasses 400 acres, only 20 of which will be disturbed by operations. Ore processing and tailings disposal will be off site, probably at the nearby Centennial Mine. Details on the treatment of concentrates are yet to be resolved.

Houghton County: Noranda Exploration Inc. has opened an office in Calumet. Late last year Noranda and Great Lakes signed a 4-year $4-million exploration agreement. Noranda could earn a 60% interest in 42,000 acres controlled by Great Lakes.

**MINNESOTA**

General: The Minnesota Department of Natural Resources will, by the time you read this, have held its Fall 1992 State Metallic Minerals Lease Sale. Bids opening was October 6, 1992. Areas included are in portions of Aitkin, Beltrami, Cass, Crow Wing, Itasca, Koochiching, Lake of the Woods, Morrison, Roseau, and Todd Counties. Bidding results will be reported in the next issue of the SEG Newsletter. In the meantime, if you need additional lease information, please contact William Bice, Director, Division of Minerals, 500 Lafayette Road, St. Paul, Minnesota, 55155-4045, telephone (612) 621-4807.

Exploration rates in Minnesota are reported by the DNR to be generally very slow this year. One bright spot may be the interest by several companies in the Red River Valley kaolin deposits. The interest is believed to be for a high-purity kaolin suitable for paper manufacturing.

**MISSOURI**

General: The Doe Run Co. continues to battle opponents to its exploration leases in the Mark Twain National Forest. The area has been the subject of controversy for 10 years. Last year Doe Run received permission from the U.S. Forest Service to drill 20 exploration holes. In March 1992, the company was given approval by the Bureau of Land Management. Since then 12 groups have filed appeals opposing the exploration. The issue now rests with the Interior Board of Land Appeals. A decision by the Board is expected in a year because of a backlog. In the meantime, a Cominco American source has reported that the company has ceased its U.S. exploration efforts. The reason given is the dearth of available Federal lands.

**SOUTH DAKOTA**

General: The South Dakota Department of Environment and Natural Resources reports that exploration has increased this year over last. In 1992 ten exploration permits have been issued through September 14th compared with seven for the same period last year. Interest in exploring for manganese has been revived. BHP Minerals International has received permits for Miner County. The interest is in a Pierre Shale target, first identified by the U.S. Geological Survey and the Minnesota and South Dakota geological surveys, adjacent to a Sioux Quartzite high with several occurrences of manganese. The South Dakota Geological Survey has had a modest geologic mapping and drilling program in several eastern counties in recent years. Their efforts identified several manganese anomalies. Also showing interest in eastern counties has been Airlage Minerals of Arvada, Colorado. They have acquired permits for areas in Clark and Spink counties.

Lawrence County: Wharf Resources has announced plans to propose mining of its Green Mountain gold deposit, east of the current operations at Annie Creek and northwest of the Golden Reward Mine. Green Mountain reportedly has one reserve of about 17.3 million short tons with an average grade of 0.039 ounces of gold per ton, for 675,000 ounces. Wharf and Golden Reward Mining Company are expected to complete the merger of their operations very soon. The State Department of Environment and Natural Resources and the Board of Minerals and the Environment are in the process of completing the mine permit transfers.

Pennington County: Newmont Mining Corporation has been acquiring property in the

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central Black Hills. An agreement has apparently been reached to explore some of the former Noranda properties around Rochford. Newman also has been seeking property in the northern Black Hills. Western Mining is reported to be actively acquiring a land position in the county, too. Cyprus Mining has abandoned its interest in claims near Keystone. They had been active in the area for the past several years.

WISCONSIN

Forest County: Exxon and Phelps Dodge continue their discussions about the Grondan deposit. Apparently there is interest by Phelps Dodge in looking at the mountain of data accumulated in Exxon's previous attempt to secure a mine permit. Phelps Dodge also is assessing Wisconsin's regulatory environment.

Oneida County: Noranda Minerals Wisconsin Corp. announced it is currently in the process of evaluating the proposed Lynne zinc project. The Lynne deposit is estimated to contain 6.5 million tons of ore, mostly zinc but also lead, copper, silver, and traces of gold. The deposit was discovered in 1990 on lands leased from the county.

Taylor County: E.K. Lehmann and Associates continues its negotiations regarding the Bend Project with the Jump River Joint Venture, which includes Asarco Inc. and Cyprus Minerals. Activity has slowed dramatically since last year, in spite of what were reported to be encouraging drilling results.

Rusk County: Flambeau Mining Co. continues construction at its Flambeau Mine at Ladysmith. Work on the administration building and water treatment plant is nearing completion. Stripping is expected to begin in February 1993 and ore shipments will commence in June. A final decision on where the ore will be shipped is expected in the near future. The deposit is reported to have ore reserves of 2.4 million tons grading 10.5 percent copper, 0.10 ounce of gold per ton, and 2.1 ounces of silver per ton.

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1993 Inaugural Haddon Forrester King Medal
for work in the field of mineral exploration

This award recognizes the contributions of the late Haddon Forrester King to the search for mineral deposits in Australia and elsewhere. Haddon King joined Zinc Corporation as its Chief Geologist in 1946, became Director of Exploration for the merged Consolidated Mining and Smelting Co. in 1962, and continued in this capacity until his retirement in 1970. He was a consultant to CRA until 1986.

The Academy acknowledges the support of family and friends of Haddon King, and CRA.

Nomination of candidates for the inaugural medal is invited. Proposals should be accompanied by a curriculum vitae and sufficient details of the candidate's professional work and its impact on the Academy to assess it in the light of the criteria for the award. Nominators (at least 2) should forward copies directly to the Academy to arrive by the closing date.

NOMINATIONS ARE CONFIDENTIAL AND SHOULD BE ADDRESSED TO:
The Executive Secretary
Academy of Science
P.O. Box 783
Canberra 2600

Closing Date: March 31, 1994

BHP-Utah now has two of the four permits necessary to proceed with drilling a decline to explore for underground gold and to collect a bulk sample from their Alder Pond massive sulfide deposit in central Maine. The two permits in hand are the Land Use Regulation Commission zoning permit and the Corps of Engineers permit for wetlands disturbance. The two remaining permits are the water discharge permit and the site location permit: both are expected to be granted in late September by the Department of Environmental Protection. BHP-Utah has indicated that it will continue to do more drilling to expand the size and confidence level of the reserve before beginning the underground work. Also, BHP is continuing an active grass-roots exploration effort throughout the Northeast.

Aur Resources, Inc., has entered into an agreement with both Morgain Minerals and Boise Cascade to continue to explore the properties in New Hampshire and Maine controlled by those companies. In the Boise Cascade situation, Aur has taken over management of the Allagash Joint Venture, Teck is the other partner in the JV. Aur has inherited the former Boise office in Scarborough, Maine, (Boise operated under the name Ososco Minerals, Inc.) and has indicated that they have made a long-term commitment to explore in the northeastern U.S. This is encouraging news from a company with an exceptional track record in Canada.

Black Hawk Mining Company (with a nickel deposit in coastal Maine) is continuing to work with the Warren Planning Board to modify some of the onerous provisions of the recently passed mining ordinance. Bolden has made no announcements related to its Bald Mountain massive sulfide deposit in northern Maine. And finally, two major exploration groups have started modest exploration programs in Maine. Perhaps success with these initial programs will lead to bigger and better programs next year.
CANDIDATES FOR SEG FELLOWSHIP

TO ALL FELLOWS:

Pursuant to Article V, Section 2, of the Society's Constitution, names of the following 15 candidates, who have been recommended for Fellowship by the Admissions Committee, are submitted for your consideration. Each applicant's name and current position is 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 November 31, 1992. If no objections are received by that date, these candidates will be presented to Council for approval.

ADDRESS COMMENTS TO:
Bruce R. Johnson, Admissions Secretary, SEG
U.S. Geological Survey • 656 U.S. Courthouse
W. 920 Riverside Ave. • Spokane, WA 99201

Aoki, Masahiro, Geological Survey of Japan, Tsukuba, Ibaraki, Japan: Jeffrey W. Hedenquist, Yukihiko Matsumiha, Shunro Ishihara

Barnes, Sarah-Jane, Université du Québec à Chicoutimi, Québec, Canada: J. F. K. Thompson, A. J. Macdonald, Michael L. Ziemek

Candioti de los Rios, Hugo, Mauricio Hochschild Group, Lima, Peru: Donald C. Noble, Victor R. Eyjofsson, Pesar E. Vidal

Concepcion, Rogello A., Lepanto Consolidated Mining Co., Makita, Philippines: Jeffrey W. Hedenquist, Yukihiko Matsumiha, Tetsuro Urabe

DesRosiers, David F., ATIM S. A., Las Viñas, Lima, Peru: Donald C. Noble, Victor R. Eyjofsson, Pesar E. Vidal

Guerrero Méndez, Tomás, Mauricio Hochschild Group, Magdalena, Lima, Peru: Donald C. Noble, Victor R. Eyjofsson, Pesar E. Vidal

Hidhida, Hajime, Metal Mining Agency of Japan, Tama-ku, Kawasaki City, Japan: Jeffrey W. Hedenquist, Tetsuro Urabe, Kohei Sato

Hueste, Carlos H., Gold Fields Chile S.A., Santiago, Chile: Nicolas S. Rendic, Francisco Camus, Christopher R. Petersen

Lyall, Robert A., Anglo American Corp. of S. A., La Reina, Santiago, Chile: Cristoph R. Petersen, Merwin Bernstein, Roy D. Corrans

Morishita, Yuichi, Geological Survey of Japan, Tsukuba, Japan: Jeffrey W. Hedenquist, Yukihiko Matsumiha, Tetsuro Urabe

Ortega, Franklin, Universidad Nacional de Colombia, Medellin, Colombia: Jorge Oyarzun, G. C. Amstutz, D. E. Large

Payne, Curth M., Battle Mountain Exploration, Sparks, NV: David W. Blake, John B. Squires, Robert A. Metz

Redwood, Stuart D., Minera Tecnica Consultores Asociados, La Paz, Bolivia: Cristoph R. Petersen, Merwin Bernstein, Richard H. Sillitoe

Richardson, Ronald E., Pegasus Gold Corp., Winnemucca, NV: James M. Brady, Gregory A. Hahn, Martin A. Nelson

White, Noel C., BHP Minerals, Burwood, Victoria, Australia: Jeffrey W. Hedenquist, Yukihiko Matsumiha, Lawrence P. James

THE SOCIETY WELCOMES THE FOLLOWING NEW SEG FELLOWS

Guillermo H. Alfaro, Consultant, Concepcion, Concepcion, Chile; John M. Allen, CMS New Zealand, Ltd., Devonport, Auckland, New Zealand; Angel M. Alvarez, Centromin-Perú S.A., Lima, Peru; David S. Andrews, RTZ-CRA, Aitkenvale, QLD, Australia; Carlos A. Angeles, Soc. Min. El Brocal, Lima, Peru; Alwyn E. Annels, University of Wales, Llanishen Cardiff, Wales, United Kingdom; Masahiro Aoki, Geological Survey of Japan, Tsukuba, Ibaraki, Japan; Daniel Arias Prieto, University of Oviedo, Asturias, Spain; Henry J. Aumack, Equity Engineering Ltd., Vancouver, B.C., Canada; Harold A. Backer, Consultant, Parker, CO; Richard G. Barker, Barker Exploration Services, Auckland, New Zealand; Sarah-Jane Barnes, Université du Québec à Chicoutimi, Québec, Canada; Trevor J. Beardsmore, University of Papua New Guinea, N.C.D., Papua New Guinea; William C. Block, Boomer and Co., Inc., Anchorage, AK; William L. Boettcher, Badin Corp., Austin, TX; Jean J. Bouillon, Les Mines Selshe, Jonqu, Quebec, Canada; David J. Bridge, University of British Columbia, North Vancouver, B.C., Canada; Arthur E. Burford, Geosec, Inc., Houston, TX; Thomas H. Burkhart, Pegasus Gold Corp., Spokane, WA; Stephen D. Burrell, Beloit College, Stoughin, WI; Alberto Caballero N., Buenaventura Ingenieros S.A., Lima, Peru; Hugo Candioti de los Rios, Mauricio Hochschild Group, Lima, Peru; Punya Charusiri, Chulalonghom University, Bangkok, Thailand; John M. Chisholm, Continental Resource Management, Wilton, Western Australia, Australia; Suck-Won Chol, Konju National University, Konju, Korea; Hyo T. Chon, Seoul National University, Seoul, Korea; Mike Clarke, Cypress Exploration, Tucson, AZ; Rogello A. Concepcion, Lepanto Consolidated Mining Co., Makita, Philippines; Douglas R. Cook, Southwest Company, Sebagaya-ku, Tokyo, Japan; David R. Cooke, University of Tasmania, Hobart, Tasmania, Australia; John A. Coote, CMS New Zealand, Ltd., Auckland, New Zealand; Gregory J. Corbett, Corbett Geological Services, Waveron, N.S.W., Australia; Michael Cosic, Ontario Geological Survey, Sudbury, Ontario, Canada; Russell L. Cranswick, Kennebeco Canada, Inc., Vancouver, B.C., Canada; Andrew L. Dall, ABM/Sonora Mining, Jamestown, CA; Wilbert R. Danner, University of British Columbia, Vancouver, B.C., Canada; Richard Davy, Geological Survey of Western Australia, East Perth, W.A., Australia; James M. Dawson, Soregaroli, Vancouver, B.C., Canada; Charles F. Dearin, South Coast Resources, Inc., Calgary, Alberta, Canada; David F. DesRosiers, ATIM S. A., Las Viñas, Lima, Peru; Garcia H. H. Diaz, Minera San Francisco del Oro, S.A., San Francisco del Oro, Chihuahua, Mexico; Jeff L. Dobrich, U.S. Geological Survey, Reno, NV; Ferdinand B. Dumlao, Eon Metals NL, Mount Lawley, W.A., Australia; Michael Fornari, University of La Paz, La Paz, Bolivia; Fess W. Foster, Golden Sunlight Mine, Whitehall, MT; Masanori Furuno, Nittetsu Mining Co., Ltd., Chiyoda-ku, Tokyo, Japan; Wayne G. R. Gifford, Gamen, Pty. Ltd., Perth, W.A., Australia; Roger D. Gill, Asmera Minerals Inc., East Wenatchee, WA; Paul Gilmore, Consultant, Tucson, AZ; Jennings B. Gordon, Jordon Minerals, Rome, GA; Mark J. Gordon, Mount Isa Mines, Townsville, Queensland, Australia; Neil N. Gow, Consultant, Burlington, Ontario, Canada; Tomas Guerrero Mendez, Mauricio Hochschild Group, Magdalena, Lima, Peru; Satoshi Hamasaki, Geological Survey of Japan, Tsukuba, Ibaraki, Japan; Jay W. Hammitt, Kennebec Exploration, Salt Lake City, UT; Eric T. Hansson, BHP Minerals Inc., San Francisco, CA; Stephen D. Hendron, Pegasus Gold Corp., Missoula, MT; Noel W. Hicks, Exxon Coal & Minerals Co., Houson, TX; Robert P. Highsmith, Kennebec Rdgway Mining, Columbia, SC; Richard Hine, Climax Mining Ltd., Westen, ACT, Australia; Richard A. Hipsey, Central Alask Gold, Phoenix, AZ; Hajime Hidhida, Metal Mining Agency of Japan, Tama-ku, Kawasaki City, Japan; C. Jay Hodgson, Queen's University, Kingston, Ont., Canada; Eric L. Hoffman, Activation Laboratories Ltd., Amcster, Ontario, Canada; Stephen S. Howe, University of Vermont, St. Albans, VT; Carlos H. Hueste, Gold Fields Chile S.A., Santiago, Chile; Martin J. Hughes, Ballarat University College, Mount Clear, VIC, Australia; Akira Ihma, University of Tokyo,
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Rota, Newmont Mining Corp., Elko, NV; Neil F. Rutherford, Rutherford Mining Resource Consultants, Coogee, N.S.W., Australia; Rodney A. Sainty, Outokumpu Exploration Aust. Pty. Ltd., Charters Towers, QLD, Australia; Mark V. Sander, Magna Copper Co., Tucson, AZ; Salem R. Sangameshwar, University of Technology, Sydney, N.S.W., Australia; Clayton R. Saunders, Ocean Mineral Assoc. Ltd., North Vancouver, B.C., Canada; Wilson Scarfelli, Anglo American Corp. of S.A., Sao Paulo, S. Paulo, Brazil; Russel A. Schreiner, U.S. Bureau of Mines, Denver, CO; Erich Schroll, Consultant, Wiener Neustadt, Germany; Michael Seaward, Minera Rayrock Inc., San Jose, Costa Rica; Sultan J. Shales, Ministry of Petroleum and Mineral Resources, Jeddah, Saudi Arabia; David B. Sinclair, Geological Survey of Canada, Nepean, Ontario, Canada; Peter Smith, Black Mt., Johannesburg, South Africa; David M. Spatz, BHP Minerals, Salt Lake City, UT; Timothy R. Stokes, BHT Agra Ltd., Nanaimo, B.C., Canada; Irwin G. 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Stephan Zajas, Consultant, Toronto, Ontario, Canada.

The Society Welcomes the Following New Student SEG Members

Gary J. Adams, University of Adelaide, Australia; Michael L. Bemski, Colorado School of Mines; Scott A. Bennett, University of Colorado; René D. LaBerge, Oregon State University; Maureen P. Leshendok, University of Nevada - Reno; Richard M. Vielreicher, University of Western Australia, Australia.

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upcoming meetings

- The Twentieth Annual Geoscience Forum will be held in Yellowknife, NT, Canada, November 25-27, 1992. The Forum covers mining development, mineral exploration, and geological survey work, including NWT Geology Division-sponsored projects done in cooperation with six Canadian universities. For additional information, please contact the Geoscience Forum Committee, Bag 9100, Yellowknife, NT X1A 2R3; phone 403-920-8212.

- A Symposium on Layering in Igneous Rocks, commemorating the 25th Anniversary of the publication of Wager and Brown's book Layered Igneous Rocks, will be held in South Africa September 8-17, 1993. The conference will begin with a two-day technical session on the theme of phase layering in igneous rocks. Two field excursions will include an eight-day trip to the Bushveld Complex and a three-day visit to the Pilanesberg Complex. Additional information and registration forms can be obtained from Professor R. Grant Cawthorn, Symposium Convener, Department of Geology, University of the Witwatersrand, Private Bag 3, 2050 Wits, Republic of South Africa; phone 011 716 2711, Fax 011 339 1697.

- The Specialist Group in Economic Geology (SGEG) of the Australian Geological Society will hold its annual meeting at the University of New England, Australia, Jan. 30-Feb. 7, 1993. This will be held in conjunction with the NEWSP conference/field seminar on the New England Orogen of eastern Australia. The SGEG meeting will focus on gold deposits and rare metal deposits associated with felsic magmatism and micro- and macro-stratigraphic relationships in strata-bound ore deposits with special reference to the timing of the introduction of the ore metals. Two one-day post-conference field trips are planned to the Sh/At Hillgrove Mine and the VMS deposits at Halls Peak, east of Armidale, and one to the Tertiary sapphire deposits near Lavelle. Papers are invited for the above topics for both oral and poster presentations (Deadline for abstracts: Sept. 30, 1992). Extended abstracts will be published by the AGS. For further information in the form of registration forms, please contact: Dr. Joanna Parr, Department of Geology, University of Newcastle, Newcastle NSW 2308, Australia; Fax 61 49 215 925.

personal notes & news

- Bob Schaffer (SEG 1986) has recently moved from Nevada to become the Manager of Western U.S. Exploration and New Business Development for BHP Minerals International in Salt Lake City, Utah. Although no longer in Nevada, he will continue in his position as SEG Program Chair of the SEG/SME meeting in Reno in February, 1993. His new telephone number is 801-261-1103 should you need to contact him regarding the meeting.

- Thomas B. Nolan, former President of the Society of Economic Geologists, died on August 2, 1992, at the age of 91. Born in Massachusetts in 1901, Nolan attended Yale University, where he received his Bachelor's degree in metallurgy in 1921 and his Doctorate in geology in 1924. He subsequently joined the U.S. Geological Survey and embarked upon a long and productive career in economic geology. His research carried him to many mining districts in the western United States, most notably the Eureka district in Nevada, which became the focus of his studies throughout his career. He was the tungsten commodity specialist for the USGS, and his name is an important part in the country's ability to meet the increased needs for tungsten during World War II.

- Nolan was named Assistant Director of the USGS in 1944 and Director in 1956. He held that position until 1965, when he returned to his research in mineral deposits, an endeavor that he pursued until his death. He was a member of many organizations and was elected to the National Academy of Sciences in 1951. He is survived by his son, Thomas B. Nolan, Jr.; his wife, Mabelle, died in 1983. A formal memorial will appear in an upcoming issue of Economic Geology.

- We also regret to report the deaths of W.E. Petrascheck (SEG 1954) of Austria and Arthur R. Still (SEG 1960) of Tucson, Arizona.

Publications of Interest

By Patricia Sheahan
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Unlen List of Geologic Field Trip Guidebooks of North America, 5th Ed., 1989. $60.00 US, Visa accepted. Available from AGI, 4220 King St., Alexandria, VA 22302 USA; Fax 703 379-7563.


Tuscun-area Mountain Ranges. Publications Sales, Arizona Geological Survey, 845 N. Park Ave., Suite 100, Tucson AZ 85719 USA. $11.00, includes shipping; add $1.00 for a rolled copy.


Alluvial Mining. Institution of Mining and Metallurgy • 610 p. Approximate cost $175.00 US. Available from Elsevier Applied Science, P.O. Box 945, Madison Square Station, New York, N.Y. 10160 USA.

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1992

Oct. 26-29. Fall meeting, Cincinnati, Ohio, with Geological Society of America: Holly Huyok, SEG Program Chair, P.O. Box 28161-16, Denver, CO 80228 USA.

Nov. 9-14. SEG Field Trip, Active and extinct epithermal systems of the North Island, New Zealand: Stuart F. Simmons, Geothermal Institute, Auckland University, Private Bag, Auckland, New Zealand; phone 64-9-737-999 ext. 6710; fax 64-9-307-1183 (NL #7).

1993


Sept. 1-3. International Symposium of Mineralization Related to Mafic and Ultramafic Rocks, co-sponsored by CODMUR, IAGOD, SGA, and SEG, Orleans, France; D. Ohnenstetter, CRSCM, 1A rue de la Finillerie, 45071 Orleans Cedex 2, France; phone 33-38-61-54-01; fax 33-38-63-64-98.

OTHER EVENTS

1992

Nov. 25-27. Twentieth Annual Geoscience Forum, Yellowknife, NT, Canada: Geoscience Forum Committee, Bag 9100, Yellowknife, NT X1A 2R3; phone 403-990-8212 (this issue).


1993

Jan. 30-Feb. 7. Annual meeting, Specialist Group in Economic Geology, Australian Geological Society, University of New England, Australia: Dr. Joanna Parr, Department of Geology, University of Newcastle, Newcastle NSW 2308, Australia; Fax 61 49 216 925 (this issue).


Sept. 8-17. Symposium on Layering in Igneous Complexes, Johannesburg, South Africa: R. Grant Cawthorn, Department of Geology, University of the Witwatersrand, Private Bag 3, 2050 Wits, Republic of South Africa; phone 011 716 2711; Fax 011 339 1697 (this issue).

Sept. 21-23. 2nd International Symposium on Andean Geodynamics (ISAG 93), Oxford, England: Dr. P. Soler, ISAG 93, ORSTOM, CS1, 213 Rue Lafayette, 75480 Paris Cedex 10, France; Fax: (33) 1 48 03 08 29.

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