Gold-bearing quartz veins are widespread for more than 1,500 km along the northern margin of the North China craton, also commonly referred to as the Sino-Korean platform or craton. The provinces of Hebei, Jilin, and Liaoning, and the Inner Mongolia Autonomous Region contain more than 100 active gold mines and hundreds of prospects. This east-west trending belt of gold deposits in northeastern and north-central China (Figure 1) contains about 600 tonnes t) of the nation's known 2,400 t gold resource (Nie, 1997b). During 1996, this region accounted for approximately 25 percent of China's 120 t of reported gold production.

The most productive cluster of deposits occurs in the Yan-Liao gold province (Nie, 1997b), located north and northeast of Beijing (Figure 1). Other large mines are located in the Changbaishan gold province to the east and in the Daqinshan gold province to the west (Figure 1). Individual deposits in all the provinces are commonly hosted by metamorphosed sedimentary and volcanic rocks, and less commonly by syn- to post-tectonic alkaline intrusions. These low sulfide systems are controlled by regional east- and northeast-striking structures associated with crustal scale faults, which presumably developed during tectonism along the present-day northern and eastern boundaries of the North China craton.

FIGURE 1. The eastern Asian continental margin showing location of the three main gold provinces of the northern margin of the North China craton as defined by Nie (1997b). Gold-bearing quartz veins are widespread for 1,500 km, with greatest deposit densities in the Daqinshan, Yan-Liao, and Changbaishan provinces.
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FOR CONTRIBUTORS—
The SEG Newsletter is published for the benefit of the worldwide membership of the Society of Economic Geologists. We invite news items and short articles on topics of potential interest to the membership. If you have questions on submission of material, please call the SEG office at +1.303.797.0353 or FAX details to +1.303.797.0347.

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

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

DEADLINE FOR NEWSLETTER
#33: May 29, 1998
1997 Was Indeed an Extraordinary Year!

As predicted in the January Newsletter, 1997 was a monumental year for SEG and its affiliates—the Foundation and PUBCO—and all three continue in sound financial condition. Operating results exceeded expectations, program funding is at record levels, and solid contributions were supplemented by a very generous second gift from our anonymous donor to enable the Society to construct its own permanent office.

<table>
<thead>
<tr>
<th>Year End Results</th>
<th>SEG</th>
<th>SEGF</th>
<th>PUBCO</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>($ in 000$)</td>
<td>12/97</td>
<td>12/96</td>
<td>12/97</td>
<td>12/96</td>
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<tr>
<td>Revenue</td>
<td>2,310</td>
<td>700</td>
<td>2,344</td>
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<td>Administration</td>
<td>156</td>
<td>138</td>
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<td>Programs</td>
<td>327</td>
<td>236</td>
<td>311</td>
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<tr>
<td>Total Funds</td>
<td>1,872</td>
<td>326</td>
<td>203</td>
<td>208</td>
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The Society continues to fund programs at unprecedented levels. For 1997, it spent $327,000 on publications, programs, and short courses—a 39% increase over 1996 levels. And still broke even at the operating level before contributions of approximately $1.8 million yielded a yearend surplus of a similar amount. With approximately $2 million in the building funding, the Society’s financial assets were at $3.6 million at year’s end.

Foundation Trustees are pleased to see the benefits of increased funding for programs while administrative costs are held at bay. In 1997, the Foundation funded $111,000 in grants, awards, subsides—a 68% increase over 1996 levels. Contributions approached $200,000, including BHP’s generous gift of $40,000 that will enable the Foundation to set up additional funding for student research grants. The Foundation’s financial assets were $2.85 million at December 31st.

PUBCO’s cost cutting and management efforts, both by Stanford and by Rapp Street, have paid off. A projected deficit of $70,000 was stemmed and PUBCO enjoyed a surplus of $72,000, a year ahead of schedule. At December 31, 1997, PUBCO’s financial assets were $2.3 million.

<table>
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<tr>
<th>Year End Financial Asset Values</th>
<th>SEG</th>
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<th>PUBCO</th>
<th>TOTAL</th>
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<td>($ in 000$)</td>
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<td>Total Funds</td>
<td>3,531</td>
<td>1,594</td>
<td>2,854</td>
<td>2,328</td>
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</table>

As the SEG and affiliates build their financial strength, their outlook is greater than ever. Budgeted funds for programs in 1998—such as publications and field trips but excluding administrative expenses—exceed 900,000, almost triple the level of spending of just four years ago when SEG and PUBCO commenced the centralization of activities into Denver. By comparison, and measured over the same timespan, administrative costs across all three organizations have fallen 12%. Happily, SEG and PUBCO can continue to operate for yet another year without a dues or subscription rate increase.

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Government Support for Mineral Deposit Research

What has research done for you? How important is research to our work as economic geologists and what proportion of government research budgets should go to research in mineral deposits? Finally, what have you done for research lately?

These are some of the questions that an ad hoc committee consisting of Phil Bethke, John Dreier and myself wrestled with at the recent 3rd Annual U.S. Science and Technology Day. During this function, scientists involved in research and technology descended on Washington, D.C., to convince legislators that government funding for research is important and, of course, that their activity deserves a healthy share of support. The American Geological Institute and some of its member societies, including SEG, attended the meeting.

Our committee’s objective was to highlight the need to fund research on mineral deposits. As Phil pointed out in his Presidential address at the Pathways meeting in Vancouver, funding for mineral deposit research has decreased significantly in North America. The situation is not as bad in other parts of the world, although it is probably only a matter of time.

The decrease in funding for research on mineral deposits can be attributed to two factors. First, is the worldwide disinterest in mineral supplies. People have become convinced that minerals will be available whenever they need them. They happily ignore the fact that ore deposits are being exhausted each day, and that exploration for new deposits takes ideas, money and time. Second, is the increasing concern shown for environmental and climate problems. People would rather fund research on these topics, which seem more immediate, even if they thought minerals were important. From our perspective as economic geologists, these developments are worrisome, both for us and for society.

The ad hoc committee came up with three things we could do to help alleviate the problem.

1) We need to remind law makers that minerals are important to society. As a start in this direction, Don Singer has agreed to spearhead a compilation of information about the importance of minerals in our lives. Don will seek help from others around the world in this effort to make it useful to all SEG members. His goal is to come up with information that will compliment the excellent material already assembled by industry advocates, thus making SEG a distinct voice for mineral deposits and related research.

2) We also need better evidence that research has actually improved the world mineral picture. In discussions at the Science and Technology meeting, we were surprised to see how few concrete examples could be cited for direct benefits from research in geology. It is no surprise then, that in the funding war, we might lose out to medical researchers who can claim to have put $1 million into a research project and saved $500 million on patient care. Art Soregaroli has agreed to chair a committee made up of Society Past- Presidents, whose unique perspective should help with this problem.

3) We need to communicate these two points (the importance of minerals and the benefits of research on mineral deposit) to legislators. During our visit to Washington, we learned two important points along these lines. First, legislators listen more closely to people from their own district. Second, they are easier to contact when they are back in their home districts—not when they are in Washington. A quick check with friends in other parts of the world suggests that this is a universal rule. Although we are a small society, we could have a big impact if each of us would contact our local legislator regularly, hopefully armed with material to demonstrate the importance of minerals and the benefits of research.

It will be some time before we know whether SEG can become a useful international advocate for mineral deposits and mineral-related research. If we are successful, however, we may find ourselves in a position to influence other aspects of mineral policy as they become important around the world. In the meantime, give some thought to these two questions: (1) what is the importance of minerals and (2) what are the benefits of research on mineral deposits? As Don and Art start their efforts to provide us with this information, they would be glad to hear from you with suggestions on material to include or ways to proceed, as would I.
The current SEG Foundation takes the opportunity to thank outgoing SEG President Bruce A. Bouley for two years of enthusiastic leadership in 1996 and 1997. Bruce will return to his position as a Trustee of the Foundation, where he will continue to serve through 1999. Additionally, we also wish to thank outgoing Trustees G.A. "Art" Barver, F. T. Graybeal and John R. Parry for their five years of diligent service to the Foundation, and T. G. Melrose for his two-year term as secretary, "above and beyond the call of duty" in serving the Foundation for six years. The continued success of SEG is, in large measure, due to Trustees of their caliber.

New Trustees, Donald F. Hammer, Leendert G. Krol and Donald G. Bryant are "welcomed aboard" and are already at work. Don Bryant will serve as secretary of the Trustees and is already ensconced in the responsibilities of that position. Don Hammer has agreed to serve on the Budget and Planning, and Nominating Committees while Len Krol will join the Fund Raising Committee.

Financially, the new officers and trustees have "inherited" a sound foundation with an asset base of some $2.85M, which represents a growth of $526,000, or 22%, over year-end 1996 total financial assets of $2.33M, due to both income from investments and new contributions. Clearly, 1997 was another good year.

Income generated by the Foundation's investment portfolio is used to fund various SEG programs.

Foundation funding support for SEG continues to grow, with $200,195 approved at the March 10, 1998 trustees meeting in Orlando, Florida.

Student grant support continues to expand as more funds become available. This support, which is stewarded by the SEG Foundation Committee (R. L. Nielsen, Chairman), and the McKinley, Hickok-Radford, and BHP Grants Sub-Committees, has grown from a few thousand dollars for six students in 1996 to $30,000 for 20 students in 1997. We anticipate awarding $50,000 during 1998. Grant funding is to be used by Masters or Doctoral candidates for field or lab expenses associated with the research.

The SEG Foundation has also increased its financial support to the Minerals Information Institute to $20,000 for its MI education programs. These programs provide information packets and projects for teachers and students in grades K-12. The packets demonstrate and document the unique importance of natural resources in everyday life. MI programs are clearly successful; in 1997 alone more than 39,000 resource packets were distributed to teachers and students. We plan to continue to support this effective program.

The Trustees look forward to a successful, ongoing fund-raising effort in 1998 through a new program and brochure seeking added corporate support, and of course continued support from SEG membership.

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**Contributions November 15, 1997 - March 4, 1998**

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<td>Up to $1000</td>
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<td>Rafael Aurelio Argaraya, Argentina</td>
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from numerous coal-burning plants using coal from extensive deposits in the Paleozoic and Mesozoic basins of the region.

A new mining law, adopted in 1986 and promulgated in 1994, in essence opened certain deposits to joint-venture foreign investment. However, gold mining is a “restrictive investment” thereby requiring central government (Beijing) approval. A working group from China has been collaborating with industry and government representatives from Canada, Australia, and the United States in an effort to update China’s mining law and bring it into accordance with North American and Australian standards. To this end, some recent changes as of February, 1998, include three decrees: (1) streamline mineral property licensing, (2) safeguard the lawful interests and rights of mining licenses and (3) streamline the transfer of exploration rights and mining licenses. In addition, the previously imposed regulations that required a company to sell gold at 90 percent of the world spot price and restricted foreign companies to pursuing low-grade or metallurgically complex properties have been repealed. These recent changes illustrate the progress the Chinese are making to enhance the climate for mining investment in their country. Several soft amendments were incorporated into the mining law in August of 1996, including language to centralize regulations, provisions to safeguard interests of foreign investors, and various regulations regarding mineral tenure. While the new mineral policy is referred to as law, it is actually a set of guidelines. Contracts are viewed as a flexible working platform, thus social and personal relationships are critical to successful business relationships.

REGIONAL GEOLOGY

The geology of gold-rich northeastern and north-central China is dominated by basement-cored uplifts of variably metamorphosed Archean and Early Proterozoic rocks, which are surrounded by unmetamorphosed basinal deposits of Middle to Late Proterozoic and Permin to Cretaceous age. The northern part of the North China craton is bordered by Early to Late Paleozoic accretionary complexes, collectively known as the “Manchurides” of Sengor and Natal’i (1996), which continue northward into Mongolia. These complexes make up part of the broader Mongolian-Great Hinggan fold belt located between the North China and Angara (or Siberian) cratons (Figure 1). Widespread calc-alkaline to alkalic granitoid plutons in the northern North China craton were emplaced into the region in Late Carboniferous to Late Triassic time and in Late Jurassic to Early Cretaceous time.

Archean and Early Proterozoic gneiss, schist, amphibolite, and banded iron formation crop out over about one-third of the area between North Korea and Baotou City, Inner Mongolia, between latitudes of 39 to 42 degrees N. This Precambrian basement, the probable protoliths of which include pelitic sedimentary rock, mafic igneous rock, and cherty iron formation, is locally as old as 3.8 Ga (Liu et al., 1992) within the Yan-Liao and Changbaishan gold provinces. Sengor and Natal’i (1996) divided the Archean units into the Early to Middle Archean Qianxian...
sequence and the Late Archean Fupinggin sequence. These are tentatively correlated with rocks of the undivided Anshan Group that crop out along China's eastern border (Trumbull et al., 1992). The Archean rocks were deformed, intruded by mafic magmas, and metamorphosed to amphibolite and granulite facies during the Fuping orogeny circa 2.3 Ga (Trumbull et al., 1992). Early Proterozoic turbidite successions, shed from Archean continental sources, are found in the basement uplifts. These rocks were metamorphosed to medium-grade facies by circa 1.8 Ga (Zhongtiao or Luliang) orogeny. Unmetamorphosed to slightly metamorphosed Proterozoic quartzite, slate, and limestone surround the Early Proterozoic and older basement rocks. The total thickness of these 1.85-1.05 Ga shallow water carbonate and clastic rocks, which at one time totally covered the older medium- and high-grade metamorphic rocks, was more than 10 km (Yin and Nie, 1993). Implantment of 1.7-1.4 Ga alkaline intrusions north of Baotou City, including syenites and carbonate sills, may have generated the world-class REE deposits at Bayan Obo during a rifting event. Continental basement, commonly coal-bearing, sedimentary and subaerial volcanic rocks of Permian through Cretaceous age, unconformably overlie Proterozoic sequences in valleys adjacent to uplifted Precambrian basement.

Detailed understanding of Phanerozoic intrusive events is difficult in the Archean and Early Proterozoic rocks of the northern margin of the North China craton. All known significant gold deposits occur within the Precambrian block and none occur north of the Junggar-Hegen fault zone, the suture between the block and Paleozoic accretionary complexes to the north.

![Figure 3](image)

**Figure 3.** Location of the late gold deposits within the Archean to Early Proterozoic rocks of the northern margin of the North China craton. All known significant gold deposits occur within the Precambrian block and none occur north of the Junggar-Hegen fault zone, the suture between the block and Paleozoic accretionary complexes to the north.

**TECTONIC HISTORY**

Archean cratonic blocks are globally widespread. Many underwent gold-vein forming orogenesis in the Late Archean (Kerrich and Cassidy, 1994; Groves et al., 1998), but were relatively isolated from significant tectonism throughout the Proterozoic and Phanerozoic. In contrast, the so-called North China craton (Figure 1) has undergone Phanerozoic accretion and collision along both its northern and southern borders, and has been exposed to a subduction-related(?), strike-slip fault regime along its eastern edge. This tectonism, remains relatively poorly understood, but has strongly influenced the Archean Fuping and Early Proterozoic Zhongtiao orogenic events.

A narrow belt of Paleozoic terranes and subduction complexes, the Mongolian-Great Hinggan fold belt (Figure 1), was accreted to and subducted below what is now the northern margin of the North China craton during a Permian and Early Triassic event (Sengör and Natalin, 1996; Davis et al., 1998). Gold deposits are located immediately south of these Paleozoic accreted terranes, within the Archean-Permian backstop, for distances of about 50-75 km in the west and for 200-300 km in the east. Pre-accretionary Paleozoic (Caledonian) granites and deformation are widespread in the accreted terranes north of the craton within northern Inner Mongolia and Mongolia.

Within the cratonic margin itself, deformation is mainly Variscan age and is characterized by major east-striking reverse fault zones. The most northerly fault along the ancient cratonic margin is called the Junggar-Hegen fault zone (Davis et al., 1998) (Figures 1 and 3) and, locally near Chifeng, it has also been called the Kanghao-Chifeng zone (Trumbull et al., 1996). The entire belt of east-west faults is described by Sengör and Natalin (1996) as the Fengning-Longhua zone and, according to their interpretation, strike-slip motion occurred within this belt during Late Paleozoic to Early Cretaceous time. North of the actively deforming North China craton margin and accreted terranes of the Mongolian-Great Hinggan fold belt, west-to-east closure of the Solonkair Ocean from Permian through Early Jurassic time led to amalgamation of the North China block with the Angara craton (Mueller et al., 1991).
It is uncertain whether a typical subduction-related magmatic arc developed in response to the Variscan collisional event along the northern margin of the North China craton. Carboniferous(?)/Permian intrusions occur along the entire length of the Fengning-Longhua fault zone and may represent the eroded and faulted remnants of the innermost part of a continental margin arc. Alternatively, some of the late Paleozoic bodies may be the products of back-arc extension. Deposition of continental basinal strata, as old as Late Permian, may be the result of late orogenic extension.

By the end of the Permian, the South China craton was being subducted northward beneath the North China craton along faults of the Qinling-Dabie fold belt (Figure 1). Resulting intraplate thrusting and folding in the North China craton, often called Indonesian or Cimmerian stage deformation, occurred as far north as the gold belt along the northern edge of the craton during Triassic and Early Jurassic time (Hendrix et al., 1996; Zheng et al., 1996). Davis et al. (1998) describe a poorly understood Jurassic-Cretaceous period of intracratonic deformation, perhaps a product of thin-skinned thrusting, which extends for 1100 km along an east-west trend immediately south of the gold belt. The resulting Zhanhua fold belt consists of uplifted anticlines cored by Precambrian rocks.

Late Jurassic and Early Cretaceous Yanshanian deformation is recognized in the eastern side of the gold belt and along the entire Pacific margin of China. This contractional event resulted from the onset of westward oblique subduction of the Indochina plate beneath the North China craton. The resulting magmatic arc now lies beneath the North China Sea bet. between China and Japan (Sengor and Natalin, 1996). Back-arc magmatism extended for another 1000 km inland, recorded by the widely distributed Yanshanian granitoids between the Korea Peninsula and the longitude of Beijing. Major NNE-trending, intracratonic transcurrent faults, many spatially associated with gold deposits in the eastern part of the North China gold belt, developed during this oblique convergence (Kumarapeli et al., 1998; Xu and Zhu, 1994). This belt of faults is approximately 200 km wide, from the Bohai Sea on the east to as far west as Beijing. The easternmost of the NNE faults, the Yan-Lu wrench fault system (Figure 1), extends for more than 3500 km from the South China craton into southeastern Russia and is spatially associated with gold occurrences and deposits along much of its length. These include deposits of the Shandong Peninsula, eastern Liaoning Province in our area of study, and the Sikhote-Alin fold belt of the Russian Far East (Figure 1).

NORTH CHINA GOLD DEPOSITS

Gold mines and prospects along the northern margin of the North China craton occur in three clusters—from west to east, these are Daqingshan, Yan-Liao, and Changbaishan provinces of NNE (1997b) (Figure 1). Although widely variable in range, the majority of the absolute ages reported by Chinese workers for deposits (Figure 3) in these three provinces are clustered around the timing of the Variscan, Yanshanic, and Yanshanian orogens, respectively. For purposes herein, the deposits have been separated into those associated with Variscan (late Paleozoic) and Yanshanian (Mesozoic) tectonism. Salient features of deposits that we visited in the Daqingshan and Yan-Liao provinces during this study are listed in Table 1. We are presently completing 40Ar/39Ar and Re-Os geochronological studies on samples collected from these deposits. We did not visit, and therefore do not discuss, the Yanshanian deposits of the Changbaishan province.

Variscan

Five deposits related to Variscan tectonism, and spatially associated with late Paleozoic intrusions, were examined during this study (Figure 3). These deposits include gold-bearing quartz veins hosted by metasedimentary rocks of Proterozoic (Saiyinwu) and Archean (Hadamengou) age in the Daqingshan province. The Shibaotingou, Liuyanghao, and Donghuofeng deposits, which have a combined production of 5-20 t Au, are hosted by high-grade metamorphic rocks of archean age within a 160 km radius to the north and east of the Hadamengou deposit (Nie, 1997a). In the western Yan-Liao province we visited two deposits (Dongping and Zhangshangou) hosted by late Paleozoic ultramafic rocks that intrude Archean and Early Proterozoic basement. Dongping is the largest gold deposit in this part of the Yan-Liao province. Other smaller deposits (Jiujianghong) in the region are hosted by Late Paleozoic ultramafic rocks and some (Hougou may be spatially associated with younger Yanshanian?) hydrothermal activity (Nie, 1997a). The Saiyinwu deposit is spatially associated with both Variscan and Yanshanian intrusions, but shows mineralogical features consistent with the Variscan-aged gold deposits.

Saiyinwu, western Inner Mongolia. The Saiyinwu gold deposit is located 15 km northwest of the Bayan Obo REE-Nb-Fe mine and 2 km south of the northern edge of the craton. Mining at Saiyinwu began in 1979 and more than 1 t of gold have been produced at an average grade of 5-6 gpt. Mineralization at Saiyinwu consists of a series of east- and northeast-striking, steeply-dipping shear zones that host three orebodies within quartz veins containing pyrite, galena, arsenopyrite and free milling gold. Host rocks include Late Proterozoic metasandstone and carbonaceous slate. The highest gold grades are in what mine geologists refer to as a "tectonic felsite" of unknown age. Most production comes from discrete veins or vein swarms in felsite, but mylonitic volcanic rocks are reported to locally contain an average of 1 gpt gold. This is the only Variscan deposit we visited that lacks anomalous potassium and tellurium. However, it does contain significant anomy and arsenic concentrations in ore zones.

Hadamengou, Wulashan district, western Inner Mongolia. Located 20 km west of Baotou City, Hadamengou is one of three major mines in the Wulashan district that have a combined gold resource of 40 to 60 t. It is hosted by Late Archean gneiss and amphibolite of the Wulashan Group, a few kilometers east of a Variscan granitic batholith (Gao et al., 1994; Nie and Bjorlykke, 1994). Granitic and weakly alkalic dikes that extend out from the batholith, and are parallel to mineralized shear zones, can be traced for 1.8 km along strike in an easterly direction. As in the Saiyinwu deposit, the gold occurs in the near ore-controlling structures at Hadamengou and the other deposits of the Wulashan district strike east and northeast and dip steeply north. Pyrite, galena, chalcopyrite, iron carbonates, and gold are found in low sulfide quartz veins. In quartz-potassium feldspar veins, and in potassially-altered wall rock. Most veins average 2-3 m in width. Veins have been mined to 400 m depth without any apparent change in grade. One of the most conspicuous features of the Wulashan district is intense potassium feldspar alteration of highly shocked metamorphic wall rock. Samples of gold-bearing veins and altered wallrocks contain as much as 6.6% K, 44 ppm Te and 4% Pb.
Table 1: Gold Mines Examined in Inner Mongolia and Hebei, China

**Abbreviations:** Ag = silver, Au = gold, ba = barite, car = carbonatite, Cs = caliche, ch = chalcopyrite, cpv = chalcopyrite, gal = galena, ksp = potassium feldspar, py = pyrite, C12 = quartz, rec = recovery, ser = sericite, SiO2 = silica, spl = splenite, tpd = tonnes per day.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Production/Reserves ( tonnes Au)</th>
<th>Gold Grade (ppt)</th>
<th>tpd / Recovery</th>
<th>Days per week (dwp), # of employees, &amp; cost</th>
<th>Dimensions (meters)</th>
<th>Host Rocks</th>
<th>Igneous Rocks, age</th>
<th>Structure</th>
<th>Minerals</th>
<th>Alteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saljinwusu</td>
<td>13+ / 15</td>
<td>5 to 6</td>
<td>600 tpd / 90° rec</td>
<td>5 dwp, 125 people</td>
<td>800 m long, pt to 15 m wide</td>
<td>Late Proterozoic volcanic and sedimentary rocks</td>
<td>Variscan granite (246 Ma)</td>
<td>E-W faults, NE faults</td>
<td>py, free Au, gl</td>
<td>ser, chl, carbo</td>
</tr>
<tr>
<td>Hadamengou, Wushan District</td>
<td>/ 60+</td>
<td>8 to 9</td>
<td>400-600 tpd</td>
<td>5 dwp, 125 people</td>
<td>1.8 km long, 500 m deep</td>
<td>Proterozoic metamorphic rocks</td>
<td>Variscan</td>
<td>E-W metamorphic fabric (280°, 70°N)</td>
<td>py, telluride, free Au, electrum</td>
<td>chl, cp, ksp</td>
</tr>
<tr>
<td>Dongping</td>
<td>/ 100+</td>
<td>6</td>
<td>600 tpd / 90° rec</td>
<td>7 dwp, 120 people, $300 / oz</td>
<td>-2.5 m mining width</td>
<td>Variscan alkali syenite</td>
<td>Variscan alkali syenite</td>
<td>NNE strike, west dip veins; flat veins in pegmatite dikes</td>
<td>py, chl, kspar</td>
<td></td>
</tr>
<tr>
<td>Zhongshangou</td>
<td>/ 0.23</td>
<td>4</td>
<td>100 tpd</td>
<td>2 km long</td>
<td>Variscan alkali syenite</td>
<td>Variscan alkali syenite</td>
<td>Variscan alkali syenite</td>
<td>NNE strike, 60-70°W dipping veins; NE &amp; NW strike veins</td>
<td>ser, clay, kspar, SiO2</td>
<td></td>
</tr>
<tr>
<td>Xiaojinpan</td>
<td>/ 68+</td>
<td>9.7</td>
<td>600 tpd / 93° rec 30,000 cost/year</td>
<td>6 dwp, 100 miners</td>
<td>2-10 m wide, 280 m deep</td>
<td>Archean metamorphic rocks</td>
<td>Archean metamorphic rocks</td>
<td>E-W-M strike, sub-horizontal veins</td>
<td>py, tellurium, free Au</td>
<td></td>
</tr>
<tr>
<td>Jinchangyu</td>
<td>/ 68+ or / 100+ @ 2g/t</td>
<td>7</td>
<td>1000 tpd</td>
<td>$19 / ton</td>
<td>1500 m long</td>
<td>Archean metamorphic rocks</td>
<td>Archean metamorphic rocks</td>
<td>E-W fractures, NW-strike, deep SW &amp; NE dip, sub-horizontal veins</td>
<td>SiO2, ep, chl, ser</td>
<td></td>
</tr>
<tr>
<td>Lianghuashan</td>
<td>/ 21</td>
<td>17 to 18</td>
<td>20 tpd and 20 tpd from farmers</td>
<td>1600 people, $19 / ton</td>
<td>1 vein to 420 m depth</td>
<td>Archean metamorphic rocks</td>
<td>Archean metamorphic rocks</td>
<td>veins strike NWW, dip E</td>
<td>py, ser, chl, carbo</td>
<td></td>
</tr>
<tr>
<td>Jinchangdian</td>
<td>25 / 50</td>
<td>12</td>
<td>500 tpd</td>
<td>7 dwp, $275 / oz</td>
<td>1000 m deep</td>
<td>Archean metamorphic rocks</td>
<td>Archean metamorphic rocks</td>
<td>N &amp; SW strike veins; ENE-strike splays</td>
<td>cpy, gl, spl, py, bn</td>
<td></td>
</tr>
</tbody>
</table>

**Dongping, northwestern Hebei Province.** The Dongping mine is located 15 km southeast of Chongli, northwestern Hebei Province, about 100 km from the northern border of the craton (Figure 3). The orebodies are hosted in the Variscan Shuangtong batholith, an asminorite syenite and monzonite complex that intrudes amphibolite to granulate facies rocks of the Archean Sengor Group complex (Nie and Wu, 1995; Zhang and Mao, 1995). Present reserves at the Dongping mine stand at over 100 t gold and are localized in quartz veins, quartz-K feldspar veins, and altered wallrock (Figure 4) in a series of NNE-striking and moderately steeply west-dipping structures. Individual veins attain maximum strike lengths of several km and dip dimensions of 600 m; typical widths average 3 m. Quartz and quartz-K feldspar veins contain knots of pyrite, calaverite, galena, and chalcopyrite; hematite is consistently abundant. Zhang and Mao (1995) described a change in the Te/Au+Ag ratio in the deposit...
reflecting relatively more abundant telluride minerals at shallow levels. Sulfides account for less than five percent of the vein material. As in the Wulashan district (Table 1), an ore-bearing, red potassic alteration halo (Figure 4) occurs for up to 20 m on either side of the veins (Nie and Wu, 1995). Ore grade vein and wallrock samples contained up to 5.9% K, but no more than 500 ppm of either Cu, Pb, or Zn.

Zhongshangou, northwestern Hebei Province. Numerous apophyses of the Variscan Shuangou batholith occur in northern Hebei Province. The Zhongshangou deposit, about 25 km west of the Dongping mine, is also hosted by this batholith and consists of a north-striking, moderately to steeply west-dipping, 1-m-wide quartz vein that has been delineated for nearly 2 km along strike. Alteration selvages contain abundant K-feldspar along with sericite, chlorite, and silica. Vein mineralization at the Zhongshangou deposit is similar to Dongping, containing pyrite and tellurides as the dominant ore minerals that account for less than five percent of the vein material. Mineralization style at Zhongshangou is also similar to Dongping, although the system is less extensive as demonstrated by lower vein density. Rock samples yielding anomalous gold values also contain as much as 5% K, 5.3% Pb, and 217 ppm Te.

Xiaoyipan, northwestern Hebei Province. The Xiaoyipan deposit (Figure 3), also referred to as the Zhangjiakou mine, is located about 5 km west of Dongping and other Variscan gold deposits. In contrast to these deposits, the veins at Xiaoyipan crop out only 3.5 km from Jurassic granite and associated volcanic rocks, indicating overprinting Variscan and Yanshanian events in this part of the Yanshan gold province. Sub-horizontal quartz-gold veins of the deposit are hosted by amphibolite and granulite facies metasedimentary rocks of Archean age. The flathanging veins dip shallowly to the northeast and range from 2 to 10 m in width. Slickenlines are oriented northeast to north, indicating a general NESW to north-south contraction. Mineralogy consists of free-milling gold, electrom, pyrite, and tellurides. Ore samples contain as much as 8.4% K, 5.6% Pb, 0.1% Mo, and 81 ppm Te. Multiple stacked, sub-horizontal veins have been identified. Locally the veins are offset along north-west striking high angle normal and reverse faults.

Yanshanian

We examined three deposits that are most commonly assumed by Chinese workers to be of Yanshanian age. The deposits are all hosted by Archean metamorphic rocks within the Yanshan province and are spatially associated with Yanshanian intrusive rocks or have been dated as Yanshanian in age.

Jinchanggou, northeastern Hebei Province. Jinchanggou and associated deposits (Figure 3), intermittently mined for more than 1,000 years, are within a NNE-trending fault zone that extends for 5 km along strike and is nearly 1 km wide (Nie, 1997a). Retrograde shear zones in muscovite and chlorite schist localize the ore (Poulsen and Mortensen, 1993). Post-mineralization displacement along the shear zones has been reverse and strike-slip. Amorphous quartz veins and shear zones cut amphibolite and granulite facies rocks of the Archean Shangchuan Formation. Quartz and quartz-albite veins strike northeast and dip sub-verteically to the northwest and southeast. However, investigations underground and of cross-sections reveal zones of sub-horizontal quartz veins that cut the metamorphic fabric. These zones attain mining widths of tens of meters. Individual veins can be up to 300 m long and tens of m thick. Exploration drilling has defined gold ores to 550 m below surface, showing no downhole change in the grade of about 2 gpt Au. Quartz-albite veins contain less than ten percent sulfides (Nie, 1997a). Pyrite, lesser free gold, chalcopyrite, bornite, molybdenite, and rare tellurides are present. Gold-rich samples never contain more than a few hundred ppm Cu, Pb, or Zn. One sample contained more than 600 ppm Mo. Alteration halos around the veins consist of a proximal sericite-quartz zone and a more distal assemblage of epidote-chlorite. Reported ages of mineralization from K-Ar and Pb-Pb studies range from 133 to 197 Ma (Trumbull et al., 1992).

Lianhuashan, south-central Inner Mongolia. Approximately 40 km west of Chifeng, Inner Mongolia, several gold vein deposits including Lianhuashan (Figure 3) are located within Archean metasedimentary rocks that are overlain by Jurassic basalt, andesite, and tuff. In addition to metamorphic host rocks at the Lianhuashan deposit, mine personnel reported that some gold is hosted by an alkaline granite which had a Pb-Sr date of 180 Ma. Ore-controlling structures include a series of north-northwest-striking quartz veins in shear zones that dip steeply to the northwest and southeast. Vein widths range from 0.2 to 2 m and average 0.8 m. Strike lengths extend from 70 to 200 m. The veins have been traced for 420 m down-dip by mining with no reported change in grade. Quartz vein mineralogy consists of gold and pyrite. Total sulfide content of the veins is less than five percent. Both samples analyzed from Lianhuashan contained > 100 ppm U.

Jinchanggouling, south-central Inner Mongolia. The Jinchanggouling deposit (Figure 3) is one of a group of gold deposits clustered along the border of south-central Inner Mongolia, westernmost Liaoning, and easternmost Hebei provinces. The gold deposits in the easternmost edge of the Yan-Liao gold province are hosted by Archean plagioclase-hornblende gneiss and amphibolite. The metamorphic succession was intruded by an Early Cretaceous granodiorite that occurs a few kilometers south of the Jinchanggouling mine (Poulsen et al., 1989; Nie, 1997a). Gold ores are hosted by north-northwest- and east-striking veins that dip subvertically. The veins are lenticular pods within chlorite shear zones. Veins average 0.5 m in width and have strike and dip dimensions of hundreds of meters. Veins have been mined to 500 m below surface. Exploration drilling has encountered gold to a depth of 1,000 m, reportedly with no change in grade downhole. Sulfide contents of veins at Jinchanggouling are generally 10-20 percent, and locally as much as 30 percent. Pyrite is dominant; galena, sphalerite, and chalcopyrite are subordinate. Ore samples collected during this study contained up to 2.6% Cu, 4.5% Pb, and 1.1% Zn, as well as anomalous As, Hg, and Sb. Gold to silver ratios are reported to be 1.3 to 1.5 (mine staff, Poulsen et al., 1989), making Jinchanggouling the only deposit visited that is characterized by silver concentrations exceeding those for gold and with all base metals in the percent range. K-Ar dates of wall rock alteration are about 120 Ma (Wang et al., 1992).
DISCUSSION

Archean(?) Gold

Whether or not any of the lode gold deposits along the northern part, or within any part, of the North China craton are Archean is uncertain. Extensive belts of Precambrian basement uplifts, the products of Paleozoic-Mesozoic tectonics, characterize both the north and south cratonic margins. The belt along the south margin is apparently offset by the Tan-Lu fault system so that some of the basement uplifts are also exposed in a third area, that of the Shandong Peninsula (Figure 1). These three areas contain more than 80 percent of China's gold resource and indicate an undeniable spatial association between gold and the uplifted Precambrian rocks. Could any of the lodes be Archean in age? Have certain areas of uplifted basement specifically been affected by large-scale Late Archean hydrothermal cells? The determination of the absolute age of the various gold deposits clustered throughout the margins of the craton will be important for better delineating specific tracts for future exploration targets.

Trumbull et al. (1992) suggested that the basement uplifts of China are similar to the gold-poor Archean granulite-gneiss belts of Scotland, Greenland, and Labrador and unlike the well-studied, gold-rich, greenstone facies Archean greenstone belts. But the former are now generally recognized as simply high metamorphic grade equivalents of the latter (e.g., Jackson and Crunden, 1995; Kent et al., 1996). There is now a growing recognition that these high-grade metamorphic terranes may also be gold-favorable as summarized by Groves (1993) and Groves et al. (1998).

Gold Deposit Types: Alkalic, Orogenic, Both, or Neither?

The Chinese deposits are associated with major crustal structures, show a temporal/spatial association with orogenic activity along continental margins, have a relatively low volume of sulfide minerals, are characterized by CO₂-richer, low salinity ore fluids, and have a narrow and relatively high range for δDagua (Poulsen et al., 1990; Trumbull et al., 1992; Poulsen and Mortensen, 1993; Nie and Biodykke, 1994; Gan et al., 1994; Zhang and Mao, 1995; Trumbull et al., 1996; Nie, 1997a). It is difficult to classify the northern China gold deposits into a typical mineral deposit model. We think that both the Variscan and Yanshanian ores best fit into the orogenic (Groves et al., 1998) or so-called “mesothermal” type of gold deposit. Trumbull et al. (1992) also invoked such a model for at least the younger group of gold ores. However, the fit is less than satisfactory and a more detailed model for orogenic gold deposits is necessary.

There are notable differences between the gold deposits of northern China and typical orogenic lodes that have led some workers to suggest comparisons with the alkaline gold systems of the Rocky Mountains region, USA (Poulsen et al., 1990 and 1999; Poulsen and Mortensen, 1993; Lin et al., 1993). These include: (1) the Chinese deposits are in high-grade metamorphic rocks, but lack typical high temperature calc-silicate alteration assemblages; (2) a lack of strongly visible carbonate alteration; (3) low Au:Ag (≤1) for some ores, and (4) the relatively brittle nature of host structures. Some of these differences, however, are obviously the result of the imprint of later orogenies on the Archean basement rocks that were being raised at the time of vein emplacement into cooler, brittle environments. Also, many of the gold ores have Au:Ag ratios greater than one. The extremely low ratios that characterize many silver-dominant alkaline gold systems are rare in the deposits that we visited. Carbonate alteration may not always be readily visible, despite a high CO₂ content of ore-forming fluids. For example, such carbonate alteration, dominantly appearing as calcite, is likely to be minor and subtle in felsic host rocks (e.g., Cassidy and Bennett, 1993), relative to more Fe-rich igneous and sedimentary rock hosts.

Perhaps the most notable difference between the Chinese and typical orogenic deposit types is the location and timing of ore genesis within orogeny. In northern China, both the Variscan and Yanshanian deposits developed in back-arc regions. Such an environment is unusual for the formation of orogenic gold deposits (Groves et al., 1998), but there are examples where ores formed slightly landward of the arc (e.g., Bridge River, B.C., Canada). In the case of the Yanshanian age deposits, gold districts as far west as near Beijing were formed about 1,900 km from the trench, which is certainly an unusual situation for orogenic gold vein formation. In the case of Variscan age deposits, most of the gold appears to be broadly coeval with extension and uplift of the basement host rocks. Orogenic gold deposits, in contrast, typically are emplaced during compressional to strike-slip regimes, but again exceptions are known (e.g., Nome, Alaska, USA).

The emplacement of lodes so far landward within the North China craton and during extension is similar to environments of ore formation at Cripple Creek (e.g., Kelley et al., 1996) and other Rocky Mountain alkaline gold systems. Additionally, there is a spatial association between alkaline magmatism and gold ores in the North China craton (Nie and Wu, 1995). Geochemical data for some of the Variscan (Zhang and Mao, 1995; Nie, 1997a, 1997b) and Yanshanian (Trumbull et al., 1996) intrusions within the northern China gold districts indicate alkalic compositions. Whereas these relationships are similar to those seen in alkaline-type “epithermal” gold deposits (Richards, 1995), there are important differences. There is a lack of associated volcanic rock, although, as suggested by Poulsen et al. (1990), this may just reflect the somewhat greater depth of erosion of the hydrothermal systems in northern China. The consistently low ore fluid salinities and the lack of abundant fumarole contrasts with the alkaline-type ores. We would argue that like many orogenic gold deposits, and in contrast to many alkaline-type gold deposits, this indicates a less direct link to a contribution of magmatic fluids to the hydrothermal system. Much of the sulfur isotope data from many of the Variscan gold deposits (Wulushan: Nie and Bjønlykke, 1994; Dongting: Nie, unpublished data) is as negative as -10 to -15 per mil and also supports a non-magmatic sulfur, in contrast to many deeply-emplaced alkalic gold systems (Richards, 1995).

IS NOW THE TIME FOR GOLD EXPLORATION IN NORTHERN CHINA?

Numerous operating mines in northern China attest to the gold endowment of the region. Multiple orogenic events and associated magmatic activity, along with the crustal scale structures at tectonic crustal sutures, provide a metallogenic setting prospective for exploration and new discoveries of gold. The Variscan-aged auriferous lodes in northern and northeastern China continue to the westernmost Au-rich Ailai Shan (Balkyschik deposit) and Tien Shan (Muruntau, Kremtor, Daugysan, Kowyquezor, and Axi deposits) belts of China's Xinjiang province, Mongolia, Russia, Kazakhstan, Uzbekistan, Tajikistan, and Kyrgyzstan. The observations described here...
.highlight the importance of Variscan and Yanshanian orogenic events superimposed on Archean and Proterozoic rocks for the formation of gold mineralization. Such a model is in contrast to one employing an Archean age for mineralization and hence may change exploration methodology.

Recent changes in the mining law in China have enticed many mining companies to look to China for growth. These changes, combined with a region of rich gold endowment and prospective geology for gold exploration, all support the notion that this is the time to keep a watchful eye on China. Now is the time to learn about the geology of China and develop personal contacts. The level of exploration effort will vary depending upon the region and business agreement. What is clear is that along with sound technical work, patience and persistence will be critical in order for a company to be successful in China.

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REFERENCES

Special Publication Number 4
Carbonate-Hosted Lead-Zinc Deposits
75th Anniversary Volume

DIVIDED INTO 8 SECTIONS:
1. Special Contribution by Emile Ohle
2. District or Thematic Overviews (20 papers)
3. Deposit Descriptions (6 papers)
4. Paleohydrology/Fluid Flow (7 papers)
5. Ore Fluid Chemistry (3 papers)
6. Dating of Mineralization (6 papers)
7. Mineralogical Studies (4 papers)
8. Practical Aspects—Exploration and Mining (3 papers)

THIRTEEN COUNTRIES REPRESENTED:
AUSTRALIA (Lennard Shelf), AUSTRIA (Bleiberg), CANADA (Appalachia and Arctic Archipelago), CHINA, IRELAND, ITALY (Sardinia), MEXICO, MOROCCO, NAMIBIA, POLAND (Silesia), SPAIN, TUNISIA, and USA (Appalachia, central Tennessee and Gulf Coast Basin).

TOPICS PRESENTED:
- Descriptions of classical MVT deposits, carbonate-hosted SEDEX deposits, mantle and other intrusion-related Pb-Zn deposits, diapir-related deposits, and even a carbonate-hosted antimony deposit.
- Fluid flow dynamics in relation to deposits in the Upper Mississippi Valley, southeast Missouri, Tri-State, southern Appalachians, and in regions of continental extension such as France.
- Ore fluid chemistry: ore fluids derived from evaporated seawater, the solubilization of lead and zinc in basinal brines, and constraints on the genesis of high-temperature carbonate-hosted Pb-Zn-Ag deposits.
- Three different methods of dating carbonate-hosted lead-zinc deposits.
- Mineralogy of MVT deposits in the southeast Missouri Viburnum Trend, USA.
- Bioleaching of east Tennessee ores, oxidation processes in ore tailings in Russia, and lithogeochemical exploration methods in Spain conclude the volume.

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Legislative regimes for exploration and mining projects: Formulating guidelines to assess regulatory requirements

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The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of MMAJ and the World Bank.

GLOBAL TRENDS IN MINING POLICY AND LAW

More than 90 nations over the past decade have adopted new mining laws, have made major amendments to their existing mining laws, or are currently drafting new laws (Otto, 1997). These mining law revisions in resource-rich countries provide the mining industry with tremendous opportunities to increase their activities in new regions. The new or amended mining laws reflect a change in national mineral policies resulting in reduced restrictions on direct foreign investment in the domestic mining sector, and in many cases, redefining the role of many governments as that of regulator rather than producer. This note briefly overviews some of the recent global changes that are of interest to exploration companies and individual exploration geologists.

The recent changes in minerals policies vary considerably from country to country, but can be broadly summarized as:

- removing or reducing barriers to foreign investment in the mining sector;
- reducing fiscal restraints through revised taxation schemes;
- enhancing the transferability of mineral rights between parties;
- more careful definition of the linkage that connects an exploration right to a mining right;
- closure of some areas to mineral activities;
- imposing obligations to reduce the impact of mining operations on the environment and local communities.

Restrictions on direct foreign investment in mineral activities have been removed or reduced in most nations. This reflects both the general trend toward global markets, and a reduced perception by policy-makers that foreign investment in mining is a negative incursion on state sovereignty. Many nations have taken action to reform their mining fiscal systems to achieve increased global competitiveness. Import duties on mining equipment and export duties on minerals have been effectively reduced or eliminated, royalties have been reduced, and a greater emphasis is now given to the role of reasonable income or profit-based taxes (Otto et al., 1997).

IMPORTANT MINING LAW COMPONENTS

Property in mineral resources is usually vested in the state: governments manage mineral resources, domestic exploration and mining activities as well as initial processing of all types of minerals and other raw materials extracted throughout their domains. The mining industry is regulated under a wide variety of laws including corporate law, foreign investment law, tax law, labor law, environmental law and land law. Although many laws regulate various aspects of mineral-related activities, the “mining law,” or more rarely a negotiated mining agreement, is the main regulatory instrument and sets out the rights, obligations and duties of companies, individuals and governments. The basic framework of modern mining laws usually addresses at least the following topics: 1) government authority, 2) restrictions on mineral activity, 3) exploration and mining rights and obligations, and 4) the environment (Table 1).

Table 1. Legal aspects of exploration and mining: the basic components of mining law

GOVERNMENT AUTHORITY—
- ownership of minerals; powers granted to government officers; enforcement, penalties and fines; type and nature of government mining law related contracts and agreements

RESTRICTIONS ON MINERAL ACTIVITIES—
- who is qualified to be granted authorization to explore, mine and process; areas closed to mineral activities; mineral types subject to special controls or conditions; areas subject to special controls or conditions; land access; resolution of conflicting land uses

EXPLORATION AND MINING RIGHTS AND OBLIGATIONS—
- maximum extent of exploration or mining area; initial term for exploration and mining right; renewal of an exploration or mining right; cancellation or termination of a right; exploration area relinquishment; minimum exploration expenditure obligations; production requirements; security of tenure; reporting; mineral rights transferability; annual holding fees or rentals; royalties

ENVIRONMENT—
- environmental impact assessment; environmental impact mitigation; social or community impact; monitoring and reporting; reclamation; post-closure liability

Major mineral deposits discovered in the Circum-Pacific region during the past 25 years took an average of 19 years exploration time and required around nine years to develop from initial discovery to production; a surprisingly large number of the deposits were explored by at least two and sometimes as many as five or more companies (Sillitoe, 1995). This past regional experience shows that the exploration and development process requires strictly defined terms of mineral activities and transferability of mineral rights within a country’s mining laws, since exploration is such a long-term process, typically involving several players.

Governments grant a right to a qualified party for exploration and development activities in the form of a license, permit, lease or
concession tenement. Modern mining laws show a commitment to grant the mineral investor the exclusive right to explore, develop and then to extract minerals and materials in the tenement area. Exploration and mining rights are generally divided into several categories and stages, namely: prospecting, exploration, feasibility, mining and reclamation. Some countries provide for a number of different mining rights depending either on the type of mineral being extracted (industrial, base or precious metal or radioactive minerals) or on the scale of operation. Under the mining laws of most countries, the initial term for the “exploration activity” is typically at least 5 years with provisions for renewal. Mining and mineral production rights are granted commonly for a period of 20 to 30 years and can be renewed for a similar period (The World Bank, 1996; Myro et al., in prep.).

In transition and developing countries, changes have generally strengthened the linkage between the right of exploration and the right of development (security of tenure). A mining company obviously prefers to work in a legal environment that ensures that if it discovers an economically viable deposit, it will have the right to develop that deposit into a mine. Most newer mining laws recognize this concern and more clearly outline the requirements that must be met in order to progress from exploration to mining. For example, mining approval may require the submission of various reports, such as a feasibility study, mining plan and environmental impact assessments to the relevant government authority. While the transition from exploration to mining is not usually automatic, the power of a government officer to arbitrarily refuse the mining right is increasingly rare. At a minimum, most mining laws provide the holder of an exploration right with at least the first right of refusal—no other applicant can be granted the mining right until the discoverer’s application is first considered. With some notable exceptions, the most common threat to security of tenure now arises from policy requirements which seek to minimize the impact of mining operations on the environment and/or the local indigenous community.

Large companies that discover small deposits are not likely to mine them. Likewise, small companies that find large deposits may not have the resources to develop them. Many nations have recognized the usefulness of allowing a transfer of exploration or mining rights and now allow such transfers. In many instances, although the holder of the right is allowed to transfer that right, the transfer may be subject to government review and approval.

As public environmental awareness has grown, nations have increasingly moved to exclude or restrict mineral activities in areas such as national parks, historical and cultural sites, forest reserve areas and so forth. In areas where mineral activities are permissible, there has been a clear trend to impose increased environmental-related obligations. Thus it is essential for exploration companies to be aware of potential environmentally sensitive sites in regions of their interest.

**INVESTMENT AND REGULATION**

The policy and mining law changes over the past decade emphasize a desire by nations to attract transnational mining industry investment. In turn, mining policies and laws are carefully considered by transnational companies when shaping their global exploration and mining strategies. Prospectivity of a country must start with a geological basis, but overall stability of the country and its investment climate is a critical aspect to long term exploration projects (Sillitoe, 1995).

Countries in Latin America, such as Brazil, Chile, Argentina, Bolivia, Ecuador, Mexico and Peru have been in the process of reforming mining laws with improvement of political and economic stability for the last decade (World Bank, 1996). Liberalized mining laws plus attractive geology have resulted in significant levels of new foreign investment. Latin American experience clearly shows that resource-rich nations can enhance foreign-led exploration and mine development by removing or limiting regulatory uncertainty in mining laws and policy.

Similar reformation is also occurring now across Asia and has begun in countries of Africa, central and Eastern Europe, and Central Asia. For example, the recent status of mining law changes in a variety of emerging Asian countries is shown in Table 2. Since these regions also possess significant geological potential, transnational exploration and mining companies have tremendous opportunities to increase their activities in these regions. In many cases, however, these regulatory changes have also brought new challenges for the mining industry from country to country. The new laws are not well tested and most countries have not yet established a track record by which companies can assess their effectiveness. This is compounded by the various legal approaches adopted by different countries, which make it difficult for senior management in transnational corporations to become familiar with the rapidly changing regulatory systems of individual countries (Myro et al., in prep.).

**Table 2 Summary of the latest amendments to mineral laws in Asian countries.**

<table>
<thead>
<tr>
<th>Country</th>
<th>Law</th>
<th>Date Amended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malay.</td>
<td>State Mineral Enrichment Act</td>
<td>(under consideration)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Mining Law No. 1, 1967</td>
<td>Dec. 2, 1967</td>
</tr>
<tr>
<td>Viet.</td>
<td>Mining Law</td>
<td>Sept. 1, 1996</td>
</tr>
<tr>
<td>Laos</td>
<td>Mining Law</td>
<td>Apr. 12, 1997</td>
</tr>
<tr>
<td>Camb.</td>
<td>Mines and Mineral Law</td>
<td>(under consideration)</td>
</tr>
<tr>
<td>Myam.</td>
<td>Myanmar Mining Law</td>
<td>Sep. 6, 1994</td>
</tr>
<tr>
<td>Kyrgyz.</td>
<td>Law on Enrichment of the Earth</td>
<td>Jul. 2, 1996</td>
</tr>
<tr>
<td>Tagik.</td>
<td>Mining Code</td>
<td>(under consideration)</td>
</tr>
</tbody>
</table>

This article provides a very general overview of some trends in mining policy and law. The trends noted are not uniform among all nations and to determine the situation in any one nation requires thorough, detailed analysis. For ease of reference, the basic components of mining laws within Asian countries are available with their original statutes on the MMAJ website (http://www.mmaj.go.jp/mmaj_e/).

**REFERENCES**


The Eighth Chilean Geological Congress was hosted last October by the Universidad Catolica del Norte in the mining city of Antofagasta, located on the Pacific coast 1400 km north of Santiago. As is custom, SEG was visible by the number of members in attendance, the SEG exhibit booth, and the banners. Antofagasta, one of the legendary mining centers of South America, participated in the early minute and copper mining history of Chile, and lately is home to the mega-business of mining Chile's giant copper resources—porphyry copper, enigmatic manto-hosted, and in situ and exotic (transported) oxide copper deposits. The Congress was well-attended by more than 900 geoscientists. Many discrete mineral deposit papers were presented; several salient papers are described below. The overall quality of presentations was excellent.

Familiar faces from the classic days of porphyry copper exploration were present—including John Hunt and Lew Gustafson of the old Anaconda Company, and other important contributors to the understanding of porphyry copper deposits worldwide. Invited speakers included SEG's Regional Vice President, Francisco Camus (Vice President Exploration, CODELCO) who gave a seminar lecture on "Copper Porphyry Systems in the Chilean Andes." Nivaldo Ropas (BHP, Argentina) offered an excellent overview of Argentina's mineral deposit potential. Pedro Carrasco (Consultant) spoke on "The Value of Geological Information in Evaluation of Ore Deposits."

SEG and CODELCO (Corporacion Nacional del Cobre de Chile) co-sponsored the special symposium "New Findings in the Geology of the Chuquicamata District" which described significant advances in district structure, igneous and metavolcanic processes. The Chuquicamata district copper deposits are situated along the West Fissure, a splay of the 800-km-long Domeyko fault system in southern Chile. The West Fissure's key role in porphyry emplacement and current setting of the Chuquicamata ore body was recognized, including its net synchronous displacement (A. Tomlinson, N. Blanca). The size and endowment of the composite Fortuna/El Abra "porphyry copper batholith" was noted; it hosts nearly unbroken stretches of copper mineralization for >50 km (Ossandon and Zenidi; Dilles et al.), from Mansa Minas, Chuquicamata, Radomiro Tomic (P. Cuadra, et al.) to the El Abra porphyry system. On a deposit scale, knowledge gleaned from new studies and Chuqui's 80-year exploration and mining history elucidates several observations: synectonic emplacement of early porphyry and mineralization phases; the distribution of molybdenum veining associated primarily with early-stage copper, but strongly influenced by structural preparation (Quincero and Frezau); a broad, possibly supergene, zinc anomaly associated with secondary (List) copper enrichment (Aracena, et al.). The West Fissure remains under intense exploration, especially for covered porphyry targets. Full papers from the SEG-sponsored Chuquicamata Symposium are planned for a future special publication by SEG.

"Panchon Camus" (SEG South America Regional Vice President) and Mary Little (SEG 1991) staff the SEG booth at the Chilean Congress.

The host environment of the El Salvador porphyry copper deposit, classically described by Gustafson and Hunt (Econ. Geol., 1975), has been re-interpreted in light of a recently-published, major mapping project by SERNAGEOMIN (Chilean Geological Survey) geologists (Cornejo, Tomlinson, Apodocis) and Toidt (USGS). K-Ar and U-Pb age dates support two major igneous events focused by pre-existing fundamental structures: a 10-km diameter Late Cretaceous (63-58 Ma) rhyolitic collapse caldera, coincidentally superimposed by the Eocene (44-41 Ma) El Salvador porphyry copper complex, following a 14-year hiatus. Compositional trends through time towards more mafic magmas suggest successively deeper tapping of the magma chamber, rather than porphyry formation evolving in a closed magmatic chamber.

The generation of metal-rich deposits associated with Andean magmatic arcs corresponds to almost continuous plate subduction along the Pacific continental margin since Carboniferous time. Specific subduction environments such as steep or flat slab segments are migration, starved trench, subduction erosion, etc., have empirical association with development of copper or gold-rich systems. C. Stern and M. A. Suckewer synthesize the case for formation of large porphyry copper systems (Los Pelambres, La Disputada/Andina and El Teniente) in central Chile where a subducting oceanic ridge (Juan Fernandez) creates a unique focus of magmatic activity. Additionally, subduction erosion (incorporation of marine sediments) contributes to volatile (e.g., NaCl) content and prevalence of tourmaline breccias which characterize these deposits. (A parallel environment exists in southern Peru where subduction of
Convenors of the SEG Symposium on "New Findings in the Geology of the Chuquicamata District." L-R: Roberto Fréraud—Superintendent of Geology, CODELCO, Francisco Camus—Vice President Exploration, CODELCO, and Patricio Cuadra—Redomiro Tomic project, CODELCO.

an oceanic high correlates in time and space with a cluster of major porphyry deposits.)

New age dates for volcanic and mineralizing events in the El Indio gold belt were released by SERNAGEOMIN (Glauben, et al.; Martin, et al.). Four discrete hydrothermal alteration events are identified, but two are associated with main gold introduction, the Tambo event (12.9 Ma) and later Pascua event (7.5-8 Ma). South of the El Indio belt a tectonic transition is marked by porphyry copper rather than gold mineralization (Los Pelambres to El Teniente copper deposits) of essentially the same ages (9.4-7 Ma). Youngest Vallecito volcanism (7-5 Ma) corresponds with transition to "flat slab" subduction and inboard migration of the magmatic arc. Both high- and low-sulfidation styles of gold-silver mineralization are
present in the El Indio district (40 Moz contained Au).

Chile and Argentina are well advanced in a cooperative metallogenic mapping program along their shared southern border (34 to 56 degrees S. lat.). The final product should be available in 1998, and will complement the Metallogenic Map of the Argentina-Chile Border Between 22 and 34 degrees South Latitude, completed in 1995. Program results were warmly received by explorationists, and are timely as new bilateral protocols recently have been signed allowing development of major copper and gold deposits across the common border. Separately, the new Multinational Andean Project involving the National Geoscience agencies of Chile, Bolivia, Peru, Argentina and Canada will integrate geology, geophysical and metallogenic mapping from 8 to 22 degrees South Latitude, to finish in the Year 2000. Web contact: http://www.pmu.map.com.

Extended abstracts of many other papers, in Spanish and English, were presented at the Eighth Geological Congress and are contained in the 3 volume set of "Actas" (proceedings). These can be purchased directly through the Universidad Catolica del Norte, Department of Geological Sciences, Casilla 1280, Antofagasta, Chile; Tel: 56.55.255090, Fax: 56.55.255.755 e-mail: <dgeo@geo.compa.cecun.ucn.cl>; approximate cost is US $75 + shipping.

SEG looks forward to strengthening its activities in Chile—32 new member applications and many publication orders were received at the Chilean Congress. SEG Regional Vice President "Panchos" Camus tells me there is a new concept for regional SEG representation in South America, which will enhance SEG’s support. Avenues for sharing interests and activities with industry and academia may exist through cooperation with several strong professional societies. In Chile, without doubt, there is a real place and long-term future for the economic geologist in mining and exploration.

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"Salt dome-controlled sulfide precipitation of Paleoproterozoic Fe-Cu sulfide deposits, eastern Liaoning, north-eastern China"

by An-Jian Wang, Qi-Ming Peng & Martin R. Palmer

ECONOMIC GEOLOGY COMMENTARY

What are the sources, drives and plumbing systems for Fe-(Cu-
An-Co-Ag)-bearing mineral deposits? In their new paper
(Econ. Geol. v.93:2), An-Jian Wang and others describe high-
grade mainly stratiform pyrite-chalcopyrite-pyrrhotite-anhydrite
-barite deposits in a Paleoproterozoic rift sequence in Liaoning (they
report a Mt chalcopyrite in 15 Mt of ore equivalent to <0% Cu, plus
anomalously Co, Au, Ag). The authors describe a close spatial and
temporal association of mineralization with intense soda alteration
(basite + scapolite + actinolite + magnetite + pyroxene). Both alteration
and mineralization center on large, vertically extensive breccia
complexes within the volcano-sedimentary facies group. The authors
propose that saline metal-bearing fluids sourced within the rift sequence
were focussed by salt domes (now represented by the breccia) and
that the metals were precipitated by mixing with, and partial reduction
of externally derived sodium. Regionally associated evaporites (B-rich
Fe-oxide-Cu) deposits and VMS deposits are consistent with a
saline rift setting (Editorial Committee, 1996).

The Liaoning deposits have noteworthy similarities (and differences)
with a wide group of other hydrothermal systems including certain
Basshi-type VMS deposits, notably Windy Cragg, and Fe-oxide-Cu
deposits, such as Olympic Dam. These markedly different deposits
show enrichments in iron, copper, gold, cobalt and silver; moderately
warm and saline ore-forming fluids, regionally associated soda
alteration, and geologic relationships to their broader settings (Peter
and Scott, 1993; Paynes et al., 1995). Is the commonality among these
due to distinctive fluid chemistry or sources? Or a distinctive type of
metal source? Saline fluids with low sulfur content at moderate to high
temperatures can transport abundant metals, but are ineffective at
precipitating sulfides without an additional source of sulfur. Limited
sulfur could explain the paucity of lead and zinc sulfides, if indeed
these metals were mobilized as some source rock studies deconstate.

Are gold, copper and cobalt closely correlated, or are they largely
independent of one another as fluid chemistry and zoning in some
systems implies?

Collectively, these kinds of deposits pose many interesting academic
and exploration problems. Are evaporite fluids commonly involved
in hydrothermal systems, producing a distinctive alteration and metal
signature, as Barton and Johnson (1996) suggest? Is an external sulfur
source necessary for metal precipitation or could similar fluids be
generated by magmatic processes? To what extent are local hydrologic
controls (e.g., salt domes in Liaoning; the Atacama fluid system in
coastal Chile) key in making economically attractive deposits? In
comparison to other ore-forming environments such as porphyries, the
Fe-Cu-An-Cu-Ag association leaves more questions than answers in
understanding the distribution of metals and the fundamental processes
that lead to their generation. Does this reflect the diverse fluid and
metal sources, plumbing systems, and traps that can generate a
common geochemistry? The Shazhaga and related deposits, and the
Liaoning region as whole, offer an intriguing set of clues to a larger
puzzle.

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259–262


geochemistry of the Windy Cragg Basalt-type massive sulfide deposit,
229–248.

PROPERTY EVALUATIONS - PROJECT GENERATION
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RICHARD L. NIELSEN, CONSULTANT
Exploration and Mining Geology

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PET98 seeks to bring international attention the importance of the Pacific as a region for mining exploration, the exciting new developments taking place in Pacific mining today, and the challenges that face the region. The meeting is relevant to all involved in the mineral sector and geoscientists interested in economic geology and mineralization in the Southwest Pacific. It will focus on new science, technology and new frontiers in Pacific mineral exploration and development, with invited speakers, industry representatives and government researchers highlighting:

- world-class orebodies and new discoveries in the region,
- development of conceptual models in regional geology and metasomatism,
- technological developments including remote sensing, data handling and prospecting techniques,
- the interrelationships between mining, society and the environment.

Presentations, posters and workshops will encompass new airborne geophysical data sets, case studies of major deposits and exploration successes in the region, and research results applicable to regional prospectivity assessments. Pre- or post-conference field trips to the significant deposits in Fiji—the Tuvatu gold prospect and the 8 Moz Emperor Gold Mine—will complement and amplify the meeting presentations.

An abstracts volume, including maps, will be available at the meeting and selected papers will be considered for publication in *Economic Geology*. Registration fees are within the lower part of the range for international meetings. Deadline for submission of titles of papers, May 15th and for abstracts July 31st, forwarded to the address below.

To receive further information, please complete and fax, or post the form below to:

PET98 Secretariat, SOPAC - South Pacific Applied Geoscience Commission, Private Mail Bag, GPO, Suva, Fiji. Email: helena@sopac.org.fj Fax: (679) 370 040 Tel: (679) 381 377 or visit the PET98 web site at http://www.sopac.org.fj/pet98/

Registration fee is $300 Fijian or $US150; includes traditional Fijian welcome ceremony, lunch 23rd to 25th, morning and afternoon tea 23rd to 25th, cocktail evening 23rd, buffet dinner and meke (Fijian dance and song) 25th, abstract journal, morning and afternoon speakers 23rd to 25th and Fiji Aeromagnetic Workshop 25th. Guests of conference attendees fee is $150 Fijian or $US75; programme to be arranged. The registration fee will be waived for certified students on proof of student status (does not include abstract volume).

☐ Tick this box if you are interested in submitting a paper for the conference.

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Early registration is advised as places are limited. A processing fee of $20 Fijian will apply to all cancelled registrations. No refunds will be made after September 22nd, 1998. Cheques to be made payable to PET98 Secretariat.

☐ Tick this box if you would like to receive Fiji resort and tour information. Fiji is an international tropical holiday destination, with a wide variety of resort accommodation for all budgets. The weather in September can almost be guaranteed to be superb, the beaches, diving, snorkelling are breathtaking so why not combine work with pleasure?
Council Actions

The following actions were taken by the SEG Council at its regularly scheduled meeting held at the Little America Hotel in Salt Lake City, Utah on October 20, 1997.

- Approved the Action Minutes for the Council meeting held at the Marriott City Center in Denver, Colorado on February 24, 1997.
- Raised the following actions taken by the Executive Committee during the period February 25th through October 19th, 1997:
  - Approved a motion to eliminate the initiation fees of $25 and $5 for new members and student members, respectively. (This will require an amendment to the Bylaws and must be approved by a 75% majority of the full Council.)
  - Approved the establishment of an ad hoc committee, to be appointed by President Bethke, to review publications policy and procedures, and the structure of the Publications Committee. The ad hoc committee will be asked to prepare a report with recommendations for the Council meeting in Vancouver, January, 1998.
  - Approved a motion to recommend to the SEG Foundation that the level of Student Research Grant funding (including the McInnes and Hickok-Radford funds) be increased to at least $40,000 and preferably to $50,000, if possible, for 1998.
  - Approved the nomination of John M. Guilbert at the Society's International Exchange Lecturer for 1998.
  - Approved the following funding requests: (1) $2,000 to co-sponsor the symposium, "Mineral Deposits Associated with Mafic and Ultramafic Rocks," August 10-15, 1998, Toronto; (2) $500 for seed money, Curatin-type Field Conference, October 16-18, 1997, Elko, NV; (3) $500 for seed money, Santa Ana-Sonoya (Altar) Gold Belt Field Conference, October, 1998, southern Mexico; and (4) $2,000 seed money for Geology and Ore Deposits of the Oquirrh and Wasatch Mountains Field Trip, October 23-25, 1997, Salt Lake City, UT.
  - Approved Fellowship Candidate Lists #61 (31 candidates) and #62 (4 candidates).
- On behalf of the Society, accepted a gift of 40 shares of Berkshire Hathaway stock (market value $1,856,000 on July 16, 1997) from an Anonymous Donor, to be used for the planning, construction, and future operation and maintenance of a headquarters building for the Society. President Bethke will appoint an ad hoc Architecture Committee to finalize site selection and acquisition, and to make appropriate arrangements for design, planning and construction of the headquarters building.
- Authorized the Executive Director to hire a full-time "Publications Production Assistant," who will coordinate and assist with production work related to the journal, Economic Geology, and the other publications produced by the Society and PUCO.
- Authorized disbursement of up to $60,000 from the SEG Building Fund for acquisition of two adjacent lots in the Ken Caryl Business Center ("A Planned Business Park"), as recommended by the ad hoc SEG Headquarters Building Committee.
- Authorized the reopening of a new money market account with Merrill Lynch, and a new "SEG Building Fund" account with Hanifen Emhoff.
- Approved the applications from the University of Tasmania and the University of British Columbia to form SEG student chapters.
- Approved a recommendation to withdraw from an agreement with the Colorado School of Mines Library to archive SEG historical records. (With its own headquarters building, SEG will be able to archive its records.)
- Accepted and approved the Treasurer's report, and the report of the Finance Committee presented on behalf of that committee by the Treasurer.
- Approved a motion to accept the proposed 1998 budget dated 16-Oct-1997, with total expenses of $499,550, as presented in the Treasurer's report.
- Approved a motion to express, in the form of a letter to the Anonymous Donor, the appreciation and excitement of the Council for the gift of 40 shares of Berkshire Hathaway stock.
- Approved Fellowship Candidate Lists #64 (4 candidates) and #65 (2 candidates).
- Accepted the report of the Vice President for Regional Affairs.
- Approved a motion to bring two Regional Vice Presidents to the Parkways '98 meeting in Vancouver, BC in January, 1998.
- Authorized the Executive Director to publish a new Membership Directory during the first quarter, 1998.
- Approved a report from SEG's representative to AGI, J Briskiey, summarizing recent activities and new initiatives being undertaken by AGI.
- Approved the nomination of Ross R. Large, University of Tasmania, as the SEG Distinguished Lecturer for 1998.
- Approved the report of the Research Committee.
- Accepted the report of the Program Committee.
- Approved SEG sponsorship of a 3-day field trip to the Dominican Republic, following the SME 1998 Annual Meeting in Orlando, Florida.
- Approved the following funding requests: (1) $1,000 seed money for the 2-day work shop, "Mineral Exploration in Tropical Terrains" to be held prior to the SME 1998 Annual Meeting in Orlando, Florida; (2) $1,000 to support the "International Meeting on Metallogeny and Geodynamics of the North Asian Craton and Framing Orogenic Belts," to be held August, 1998 in Irkutsk, Russia (organized by the Siberian Branch, Russian Academy of Science, the U.S. Geological Survey and others); and (3) $1,000 to support IGCP 373 Field Conference, "Anatomy and Textures of Ore Bearing Granitoids of Sikhote-Alin (Primorye Region, Russia) and Related Mineralization," to be held September, 1998 in Vladivostok, Russia (organized by Far East Geological Institute of FEB of Russian Academy of Sciences, the U.S. Geological Survey, and GeoForschungszenrum Potsdam).
- Approved SEG sponsorship of a 10-day Carpathian (epithelial) Field Trip being organized by JW Hedengquist, F McNair and A Arribas R, to be held September, 1999 in Hungary and Slovakia.

* * * * *
The following actions were taken by the SEG Council at its
meeting held at the Hyatt Regency Hotel in Vancouver, B.C.,
on January 28, 1998, in conjunction with the Pathways '98
Conference—a conference co-sponsored by SEG and the
British Columbia and Yukon Chamber of Mines:

- Approved the Action Minutes for the Council meeting held at the
  Little America Hotel in Salt Lake City Utah on October 20, 1997.
- Received the report of the President as Chair of the Executive
  Committee and ratified the following actions taken by the
  Executive Committee at its meeting held at the Hyatt Regency
  Hotel in Vancouver, B.C. on January 26, 1998:
    • Received and approved the Treasurer’s report.
    • Received summary Treasurer’s reports for SEG and PUBCO as a
      matter of information.
    • Increased to $610,000 the amount that the ad hoc Architectural
      Committee is authorized to spend to acquire two adjacent lots
      (for the SEG Headquarters Building) in the Ken Caryl Business
      Center.
    • Authorized an expenditure of up to $1,000,000 (from the
      Building Fund) for architectural and construction contracts for
      the SEG Headquarters Building, contingent upon approval by
      the Executive Committee, acting on behalf of the Council, of the
      recommendations of the ad hoc Architectural Committee.
    • Received a report, requested by President Bethke, from R.M.
      Coveny, Jr., the Chairman of the Publications Committee,
      regarding the status of the Publications Committee, SEG
      publishing policy and related matters; with recommendations for
      future courses of action. The recommendations are to be
      reviewed and evaluated by President Bethke, S.E. Kessler, T.B.
      Thompson, and J.A. Thomas prior to the 1998 mid-year meeting
      of the Executive Committee, and presented for further
      discussion/action at that meeting.
    • Approved a request from John Stone for $1000 seed money for a
      workshop on “Ore Reserve Estimates in the Real World,” to be
      given in April, 1998 at the University of Staffordshire in England
      and co-sponsored by the University. (This will be a repeat of
      the successful workshop held at the same venue in 1996.)
    • Authorized President-Elect Kessler and one other to attend
      “Science and Technology Visits Day” on February 26 and 27,
      1998 in Washington, D.C. to provide information on mineral
      resources during a series of congressional visits, and to
      reimburse appropriate expenses incurred in conjunction with the
      visits.
- Accepted and approved the report of the Treasurer, and the
  Finance Committee report presented by the Treasurer on behalf of
  that committee, noting that the year-end figures for 1997 are
  preliminary, pending completion of the annual audit in February.
  For 1997, the Society recorded an operating surplus of about
  $20,600. The market value of the Society’s General Fund—held in
  the investment portfolio, including money market funds—toaked
  $1.6 million. Total financial assets, including the SEG Headquarters
  Building Fund, were $3.56 million at year-end 1997.
- Received the report of the Executive Director
- Received the report of the Membership Committee, with the
  recommendation that the Society’s membership list be posted to the
  SEG Web Page. Following discussion, it was decided to
  forward the recommendation to E.I. Petersen, the Webmaster, for
  his review and recommendations regarding the security issues
  involved in posting the membership list to the Society’s website
  and its possible access by non-members.
- Received the report of the Vice President for Regional Affairs, and
  a summary of activities presented by W.E.I. Miniter, Regional Vice
  President—Africa.
- Received the report of the Student Affairs Committee.
- Approved the application from the University of California—
  Berkeley to form an SEG student chapter.
- Approved the following slate of candidates recommended by the
  Nominating Committee for Officers and Councilors who would
  take office in the Society year beginning April 1, 1999: President-
  Elect—James M. Franklin, Vice President-Elect—Frederick M. Beck,
  Councilors—Virginia S. Gillenman, Robert W. Schafer, and John
  F.H. Thompson; and to re-nominate the six current Regional Vice
  Presidents. This slate will appear on the election ballot to be
  mailed to all members of the Society in August, 1998.
- Accepted the report and approved the recommendations of the
  Committee on Committees for nominees for Society committee
  positions coming open April 1, 1998. (The names of the new
  committee members will appear after April 1, on the list of Society
  officers, councilors and committees published on the inside back
  cover of each issue of the journal, Economic Geology)
- Approved the Lindgren Award Committee’s recommendation of
  Steffen G. Hagemann, University of Western Australia, for the 1998
  Lindgren Award.
- Received the report of the Research Committee and approved, in
  concept, the recommendation of having the Society sponsor a
  special conference, similar to the Penrose and Gordon conferences
  convened by GSA. Following a recommendation from the Program
  Committee, agreed to sponsor a “prototype” field-based research
  conference in early September, 1998, for 20 or more participants at
  Yerington, the Bueno Vista District and the Birch Creek pluton,
  based on a scaled-down modification of the original proposal. A
  request for $2,000 seed money for the conference was approved
  with the condition that a field trip volume be produced.
- Approved the following recommendations from the Program
  Committee:
    • To co-sponsor with the Society of Resource Geology (Japan), a
      symposium on “Granitoid Types and Mineralization” to be held
      June 18, 1998 in Tokyo, Japan; funding to be provided from the
      authorized 1998 budget of the Regional Vice President—Asia; no
      additional funds requested.
    • To co-sponsor with the Fiji Mineral Resources Department and the
      South Pacific Applied Geoscience Commission, a three-day
      international conference on Pacific Exploration Technology, to be
      held in September, 1998 in Fiji. SEG’s proportion of funding
      will be provided from the 1998 authorized budget for the Regional
      Vice President—Oceania; no additional funding was requested.
    • To co-sponsor a symposium at the Underwater Mining Institute
      meeting, “Marine Research Meets Land Exploration,” to be held
      in Toronto October 21-24, 1998, and to provide $3,000 seed
      money for “foreign speaker travel” at the symposium.
    • To co-sponsor with IGCP, an Aarhus—Regaland, Canada field
      symposium to be held July, 1999, with a field trip volume to be
      produced; no funds requested at this time.
    • To sponsor an Andean geology and metallurgy symposium at the
      31st International Geological Congress to be held August, 2000 in
      Brazil; no funds requested at this time.
- Approved a motion to hold the next Council meeting in Toronto,
  Ontario, in October, 1998, in conjunction with the GSA Annual
  Meeting.

* * * * *
Pathways ’98
Pathways to Discovery in Review

BRUCE A. BOULEY (SEG 1985)

The mining scene provided a potentially inauspicious backdrop for what was advertised as a sequel to SEG’s Integrated Methods in Exploration conference held in April, 1993, in Denver. The discouraging developments included Newmont announcing a 500-person layoff, Cominco retrenching exploration staff around the world, BHP dismissing a number of explorers and closing offices, Teck scaling back, and Bolden taking over Wesmin. Not to mention news that North Pacific Mining had completely shut down, Inco was rumored to be near a cutback, metals prices were sinking daily, and juniors were nervous about raising money—a seemingly endless recital of exploration worst-case situations.

But geoscientists, especially explorationists, rarely lose their optimistic perspective, and sickly metals prices with the prospect of pink slips could not dampen the enthusiasm of participants at Pathways to Discovery, held January 27 to 31 in Vancouver, B.C. After Integrated Methods, this marked only the second time in history that SEG had stepped outside of its traditional affiliations with GSA and SME, in this case for a meeting jointly sponsored with the British Columbia and Yukon Chamber of Mines. The annual Cordilleran Roundup preceded Pathways on Monday and Tuesday, providing updates dealing with exploration and development in B.C. and Yukon, and four sessions on new concepts about “Rifts and Resources” throughout Cordilleran History.

The venue for Pathways was the Hyatt Regency hotel in downtown Vancouver, with core shacks, poster sessions and exhibits across the street at the venerable Hotel Vancouver. Twenty-one hundred registrants and about 700 exhibits from around the globe were on hand for what was a force de main staged by conveners Gerry Carlson and Tom Schroeder.

The meeting and published proceedings have been dedicated to the late Colin Spence. During the SEG luncheon his widow, Andrée de Rosen Spence, accepted the thanks of the committee for the work Colin had done in helping organize the meeting before his tragic death in the Philippines. Of course, of this size and complexity, does not happen without a huge behind-the-scenes cast, and the organizing committee composed of 40 volunteers must be justifiably proud of the way the meeting came together.

As with the ’93 meeting, there were no competing talks, and the three-day program was organized into five technical sessions and two forums, in addition to the exhibits and various social functions. Each technical session began with a keynote address, followed by a series of papers related to the theme of the session.

The first session, Frontier Exploration, began with the lead-off keynote delivered by Hugo Durnam of BHP Minerals. Hugo presented a series of provocative questions about the fiscal and competitive environment of exploration on a global basis, and tried to answer the questions from BHP’s perspective within that spectrum.

During the second talk, the audience was silent, captivated by Stuart Blusson speaking on the discovery of the NWT kimberlites, leading to what is now the Ekati mine of BHP and Diatom. The exploration sequence—beginning with Superior Oil and the dogged persistence and belief of Blusson along with partner Chuck Fifke, aided by corporate support from Hugo Durnam (first while at Superior and later with BHP)—made for a fascinating tale of discovery. The remaining six talks in the session covered important new discoveries in regions regarded as Frontier (Voisey’s Bay, Canning, Finniss, Las Cristinas, Kuhaka and Bulynanhulu), and all were well-presented and well-received.

The next session, Corporate Strategies, was keynoted with the theme “planning for luck” by Jack Parry of WMC. For explorationists, this topic is about as controversial as religion is to the general public, and it invariably divides an audience into camps. Jack provided a thoughtful and well-prepared analysis of how he views luck in exploration, capturing his views with the quip, “the harder I work, the luckier I get.” The importance of sound and detailed business strategy was another theme, interwoven with luck. Four following talks gave glimpses into the strategic viewpoints of Barrick, Newmont, the Lundin group, and the consistent Dave Lowell. In many ways the views of Lowell, although probably considered iconoclastic by most of the audience, meshed nicely with the Blusson talk. The small, often underfunded guerrilla band is precisely the style of exploration approach espoused by Lowell, where sound, practical and persistent work pays off.

After this technical session came the first forum session, titled Risks in Exploration, with presentations by John Steele of Yorkton, John Morganti of Teck and consultant, Dave Barr. Attendance at this afternoon session was smaller than the morning meetings, probably due to interest in posters and core shacks. Although the topics were well presented, the audience did not actively participate in the forum, despite the prodding of Chairman Jerry Blackwell. The evening social events, highlighted by Alaska Night, provided the usual release from the intensity of the daytime activities, and needs no elaboration.
On Thursday morning the next technical session, Exploration in Explored areas, began with a keynote by John Main of Renova Corporation. John used the Mt. Isa Block in Australia as an example of an explored terrain that continues to generate quality resources. His view is that the data sets available in explored areas provide opportunities to create multiple interpretations and generate new targets in what is arguably elephant country. With aggressive and efficient testing, some of these become discoveries. His conclusion: “Explorationists should acknowledge that they can operate more effectively and efficiently in well-explored regions.”

Through the remainder of the session, seven additional talks were presented on significant deposits discovered recently in what are generally considered explored areas (North St. Caddia, Candelaria, True North, Sarstüt Hill, El Porvenir). Although not a keynote address per se, Tony Naldrett’s superb talk on the geologic and geochemical constraints on the origins of the North St. Caddia ores reveals a compelling and sophisticated geologic and geochemical model, backed up by years of data acquisition and refinement. This, in combination with the talk by Peter Lightfoot on Viozey’s Bay in the first session, reveals pattern recognitions useful in exploration for magmatic Ni-Cu-PGE deposits.

The SEG Presidential address, SEG luncheon, and SEG Distinguished Lecture took place after the Explored Areas session. For his Presidential address, Phil Brilke of the USGS presented data depicting the steady decline in government-funded geoscience research, both in Canada and the US. The societal consequences of this downturn are dire, although not currently recognized by the general public. Getting the message out is critical, and Phil’s hope is that SEG can play a role in the dialogue between science and government, not only in North America, but globally.

The SEG Distinguished Lecturer, Tommy B. Thompson, the Director of the Ralph Roberts Center for Mackay School of Mines, elected the Pathways meeting as the forum for his lecture. His title, “Porphyry-related Carbonate-hosted Mantos,” underscores the massive data set and insight that he collected during his years at Colorado State University. Many in the audience felt that the controversial issue about intrusion-related replacement versus MVT origins for this metallogenic province has now been laid to rest.

As an aside, the question of how Tommy manages to be editor for the SEG Guidebook Series, teaches his classes and conducts research, serves on various SEG committees and still maintain a personal life produces much wonder in his colleagues. Perhaps he should be cajoled into writing a book on time management.

Science or Serendipity was the theme for the Second Forum Session. Presenters Bill Lindquist (Homestake), Bob Horn (INCO), and Richard Silhaceck (Inco) made spirited presentations from their respective viewpoints, but once again the audience seemed to be depleted in numbers by those at other activities, and again the give-and-take with the audience was less than hoped for, despite Ron Britten’s attempts.

The Friday morning technical session on Mature areas began with a stellar presentation by Eliseo Gonzalez-Urten, Senior Vice President of Placer Dome. Although Placer’s around-mine exploration approach, termed “Minex,” and its success in integrating explorers and operators towards a common goal, was significant in the title and the published abstract, the real meat in El’s talk was the impressive data set he presented. This was the appropriate talk for the final session on the spectrum of exploration environments, and El presented discovery rates, and costs for the entire gamut from frontier to around head-frame. He concluded with the importance of Minex to Placer in finding low-cost ounces near infrastructure. More than this, however, the background data provided an important summary and perspective on frontier, explored and mature exploration settings. As with the prior technical sessions, there were seven additional papers (Nickel Rim, Matagami, Las Cruces, Red Dog, Goldstrike, Witwatersrand, Golden Mile), and these too were quality presentations.

Future Directions, the final technical session, was keynoted by Miske Nabhjian, who also received the Society of Exploration Geophysicists Gerald Hoffman award. Dr. Nabhjian concludes that past achievements and glories notwithstanding, we are now in a golden age. Unfortunately, shrinking facilities and declining enrollments and limited job opportunities will make awareness of the geophysics profession more difficult. The other four talks in this session provide important perspectives on where we are heading; I recommend the Extended Abstracts volume to those interested.

When I look back, what memories will I retain from Pathways? First, there was something for everyone: numerous poster sessions and core sessions with truly global representation, technical sessions encompassing activities around the world, and delegates from everywhere. There were all kinds of exhibitors and contact groups, including one-man niche services in areas such as petrology, as well as those with expertise in a specific deposit type or geographic region.

Larger, well-funded and integrated exploration teams make discoveries, but so do junior companies, and so do the two-man or three-man commandos teams. This was particularly evident when one compared the keynotes delivered by management from huge mining companies with the undeniable stories of success related by Lowell and by Blisson.

Even in times of depressed metals prices, there is a vitality to the exploration and mining business that is carried by the robustly upbeat people of the industry. And this is never more evident than when an international group convenes to talk about problems and successes. Thus the “Carbon and Schroeter Show” will be remembered as a statement of where we are, the state of the art, with the specifics in the geologic details presented for deposits and discoveries. And yet there was so much focus on process and content—strategy, luck, plans, frontier versus mature—that Pathways will also be remembered not only as a window into where we are and have been, but also as a guidepost to where we are heading.
The SEG Student Chapter at the Colorado School of Mines began the semester with a field trip to Vancouver to explore the business side of the minerals industry. A week was spent visiting with both junior and senior mining companies, securities firms, and law firms; touring the Vancouver stock exchange; and concluded by attending the Pathways to Discovery conference. Following the trip, our efforts were focused on arranging the semester’s schedule of talks. Dave Leach has already spoken on Mississippi Valley-Type Deposits. An e-mail list has been organized to inform interested parties of upcoming events. If you wish to have your name added to the list, please contact David Winterbourne at dwwinter@mines.edu. The student chapter homepage—<http://www.mines.edu/Stu_life/organ/seg>—has been redesigned and is an excellent way to follow student chapter activities. In addition to the schedule of events, there is a student member contact page, articles about recent events, and useful links to geologically-related homepages. A weekend field trip to Mount Sopris, near Carbondale, Colorado, is planned for the fall semester 1998, for new students.

We wish to acknowledge all of the great speakers we had last semester. Fred Stevenson (Goldfields of South Africa) presented a talk co-authored by Phil Lambert, concerning the use of 3-D seismic for mining exploration in the Witwatersrand Basin. This was a great interdisciplinary presentation, with an audience from the Geology, Mining, and Geophysics departments. Brian Hall discussed some aspects of diamond mining and exploration in southern and western Africa, based on his many years with the Namibian Geological Survey. Although techniques have improved for discovering diamondiferous kimberlites, interpretation of the geology of central Africa indicates that paleo-placer mining off the southwest African coast may be an even more effective mining strategy. Tom Loucks presented some economic aspects of the mining industry when he spoke about gold royalties. Dave Coulter spoke on the use of remote sensing in gold exploration, explaining some of the basics of the electromagnetic spectrum, discussed recent advances in remote sensing technologies, and finished with some examples of the use of remote sensing. Willie Gyapong gave a presentation on gold mining and exploration in Ghana, West Africa, where surface extent a local control on gold mineralization and may have regional exploration implications.

The Oregon SEG student chapter has nine active members and three faculty co-advisors: John Dilles (OSU), Cyrus Field (OSU), and Mark Reed (UO). Newly elected officers for 1998 are: Michael Winkler—President, Sebastian Geiser—Vice President, Martin Hannigan—Secretary, and Linna Zhang—Treasurer. Planned activities include ore deposits field trip and several invited guest speakers. Sebastian Geiser will oversee construction of an Oregon SEG Student Chapter web page, scheduled for completion in May.

Over spring break this year, a nine-day field trip to the southwestern U.S. is scheduled. It will include visits to several porphyry copper and copper skarn deposits: Ray deposit, AZ (ASARCO); Morenci district, AZ (Phelps Dodge, Inc.); Chino Mine, NM (Phelps Dodge, Inc.); Cananea district, Mexico (Minera Mexicana); and Sierra AZ (Cyprus Anax).

During the winter term, Harry Smedes of Southern Oregon University gave a talk on the geology of the Bingham Porphyry as part of the SEG seminar series. Two additional speakers have been invited for the spring term. Mark Barnett of Phelps Dodge, Inc. will give a lecture on the geology of the Morenci district, AZ; and Jeff Keith of Brigham Young University will speak on magnetism relative to the Bingham porphyry copper deposit, UT.

The Chapter has tentative plans for a late 1998 ore deposits field trip to Chile that would likely include visits to El Abra, Chuquicamata, La Escondida, and Quebrada Blanca.

—Michael Winkler, President
email: winklem@bcc.oregonstate.edu

We would like to thank SEG for recently acknowledging us as an official student chapter. Our membership is comprised of approximately a dozen graduate and undergraduate students from the Geology, Mineral Engineering, and Engineering Geosciences departments. Chapter Officers until May 1998, are: Timothy Mote—President, Terry Arcuri—Vice President, Joseph Gauduk—Treasurer, and Peter Higbee—Secretary. Chapter faculty advisers are Geology Professor George Brinham and James Britt of BHP, together with a network of young Berkeley Alumni in the Bay area. During the 1998 spring semester spring break, the chapter will conduct a field trip to Barrick’s Gold Strike mine on the Carlin Trend, Montana, Resources, open pit Cu-Ni mine in Butte and the Stillwater Mining Company’s Pit-Pal mine. Later in the semester, the chapter is sponsoring a guest lecturer in the Berkeley Earth Resources Center weekly seminar series: Marco Emaudi of Stanford University has been invited to speak. Please check our website—<http://damiante.gen.berkeley.edu/~segch/>—for more information. If you are passing through Berkeley, please stop in and see us.

—Timothy Mote, President
email: timote@socrates.berkeley.edu

The McGill Student Chapter of the Society of Economic Geologists is now nearing the end of its second year of operation. 1997-1998 saw a great influx of new undergraduate students, many of whom have taken interest in the field of economic geology and the chapter. With this new recruitment, we continue the strong tradition and philosophy of full undergraduate participation in all events, building a strong base for the future success of the chapter.

This year we are happy to report that we have benefited from strong financial support from the mining and exploration industry. This has allowed us to host several speakers (with more to come before the summer!), a trip to the Balmat-Edwards mining district in New York State, and a field trip to Nicaragua. A summer excursion to the Balmat mining camp is being planned.

Over the weekend of January 30, 1998, 11 students, led by chapter President Sandy Archibald, visited the Balmat-Edwards mining district. Mr. William deLorraine, chief mine geologist, hosted a tour of the American Zinc Corporation’s Balmat mine and mill. The marble-hosted zinc and tate deposits of the Balmat-Edwards district lie within the Grenville Province in the Northwest Adirondacks of New York State. The world-class, 1,300 Mt sedex
orebodies consist of recrystallized pyrite, pyrrhotite, sphalerite, galena, barite and chalcopyrite. The zinc ore occurs in Proterozoic siliceous dolomitic marble that was intensely metamorphosed and polydeformed (4 stages) during the Grenville Orogeny. The mine is a major US zinc producer, with 17 M t of ore grading 10.1% Zn, 0.3% Pb and subordinate Ag, Au, and BaSO4. The chapter also visited the Gouverneur Tall-Mine open pit, a tour that was only slightly hindered by the previous day’s heavy snowfall. Thanks to our students, these tours will finally make it up the ramp and out of the mine. Mr. John Reider kindly took time out of his weekend to present the geology of the talc-tremolite mining operation, as well as the difficulties of mining a pure mineral for direct use. We thank Mr. delRocca and Mr. Reider for accommodating us at a time when the district had just emerged from a long blackout caused by the infamous Ice Storm 98.

At the time of writing, 15 students, led by “Willy” Williams-Jones, were participating in a two-week geological tour of Nicaragua. Included in the itinerary are the La Libertad and Limon mines, Masaya and Concepcion volcanoes, and the geothermal energy plant at Momotombo. A full update on the remainder of our activities and a photo-illustrated summary of the Nicaragua field trip will appear in our next Newsletter available on our website. Thanks to everyone who has supported the Chapter this year.

Visit us at www.epsc.mcgill.ca/~seg/.

— Katherine Smith, VP McGill SEG

< University of Western Ontario, 1997-'98

The 1997-98 year proved to be a very busy and productive time for the SEG Student Chapter. Membership grew to more than 40 and an average of 20 members attended the regular monthly meetings. The first speaker of the year was Dr. Eric Owens, with Phelps Dodge at the time, who spoke on “Recent Experiences in North American Exploration,” including an overview of his varied career and his thoughts on the future of exploration geology. At the November meeting, Dr. David Eaton, formerly with the Geological Survey of Canada and now a faculty member at UWO, discussed “3-D Seismic Technology for Mineral Exploration: A Candid Assessment.” At an informal meeting held in December with industry, Dr. Rob Holdren, a former professor of economic geology at UWO, spoke on his most recent exploration work in Patagonia. In lieu of the January meeting, the Student Chapter became involved as an exhibitor and supporter of the Central Canada Geological Conference held in London, Ontario, in early February. The conference was a tremendous success with excellent talks by both undergraduate and graduate students, and by several keynote speakers including Dr. Roger Walker (formerly at University of McMaster), Robin Good (Fortune Minerals), John Buckle (Quantec Consulting), and Dr. David Corrigan (Geological Survey of Canada).

For the February meeting, Rhys Goodall and Simon Baker of C.J. Stafford and Associates (Toronto) provided some insight into the current climate of jobs related to the earth sciences. Their excellent presentation included tips on resume preparation, resources that are available to find a job, and how to approach industry for that first crucial job.

Plans for the month of March include setting up a display booth, in conjunction with the Department of Earth Sciences—UWO, at the Prospectors and Developers Association of Canada Trade Show in Toronto. Dr. Mike Lesher will be the guest speaker in April, and will discuss “Physical Volcanology, Geochemistry, and Petrogenesis of Magmatic Fe-Ni-Cu-Te-PGE sulphide Deposits.”

In early November, just in time for the first big snow storm of the year, seven members visited the world famous mineral collecting area of Bancroft, Ontario, and toured the mineral processing and environmental facilities at Lakefield Research in Lakefield, Ontario.

The highlight of the year was the field trip to Cuba (February 21-28th), attended by six students and two faculty members. The trip covered most of the western two-thirds of the island visiting epithermal gold, podiform chrome, VMS, and layered Cu-Zn-Pb mining projects. The trip was made possible by the generous financial support of R.J. Barnett Geological Consulting, Canadian Resources Corp. and others, and the cooperation of MacDonald Mines, Joulit Mines Ltd., and Holmer Gold Mines Ltd. The SEG also thanks Dr. Norn Duke and Dr. Bill Church for escorting the students on the trip and producing a field trip guide book: special thanks to Dr. Duke for his work in organizing the details of the excursion.

The outgoing student chapter executives would also thank the Department of Earth Sciences at UWO— in particular Dr. Fred Longstaffe, Mary Rice and Marie Schell—for their support throughout this past year.

> University of Tasmania

Although new, the SEG Student Chapter has been very active. The chapter held a field trip in early March to investigate the Precambrian geology of King Island—a small, isolated island north of Tasmania. A report will be presented in the July edition of the SEG Newsletter. On June 15-18, 1998, the chapter will be convening a short course entitled, “Basins, Fluids, and Ph-Zn Mineralization” at the Center for Ore Deposit Research (CODES). The course will cover the geology and fluid flow in sedimentary basins. Presenters include: Stuart Buhl, David Cooke, Grant Garvert, Wayne Goodfellow, Jeffrey Hanor, Murray Hitman, Ross Large, Peter McGoldrick, and Peter Muhling. Concurrently, the CODES “Ore Deposits and Exploration Models” Masters short course is being held on 15-25th June, and includes modules on VHMS, Porphyry, Epithermal, Magmatic, Broken Hill-type and Proterozoic Cu-Au-U deposits. For registration or further information, please contact Jessica Tyler, Center for Ore Deposit Research, University of Tasmania, GPO Box 252-79, Tasmania 7001, Australia, Tel. +613.6226.1863, Fax +613.6226.7662, email: <Jessica.Tyler@utas.edu.au>.

— David Rawlings, Secretary

Member Jason Ploeger (left) and President Scott Jobin-Bevans (right) man SEG display at Central Canada Geological Conference, London, Ontario, February 1998.
Techniques in Hydrothermal Ore Deposits

JEREMY RICHARDS (SEG 1985) and PETER LARSON (SEG 1986)
UNIVERSITY OF ALBERTA • WASHINGTON STATE UNIVERSITY

SEG is sponsoring a two-day short course, “Techniques in Hydrothermal Ore Deposits,” in conjunction with the GSA Annual Meeting in Toronto, Saturday and Sunday, October 24–25.

Modern geochemistry has produced many techniques that are applicable to the study of hydrothermal ore deposits, and these have been used to determine everything from the age of mineralization to the sources of hydrothermal fluids. However, the results of such studies are too often overlooked as being of “academic” interest only. The course aims to lift this veil, by showing that many of the methods are in fact quite straightforward, and by providing a basic understanding of data interpretation. The course is designed for the end-user, and will provide a grass-roots understanding of these techniques and how they can be applied in real systems. The presenters will start with the basics of their specialties, and work through hands-on applications. The course is designed for anyone with a beginner’s interest in modern techniques, and will provide a foundation for pursuing applications beyond the course.

The Short Course Volume will be available by the time of the meeting. The Volume’s chapters and authors correspond to the Short Course presentations (the Short Course presenter is shown in italics):

1. The Thermodynamics of Hydrothermal Systems: Greg Anderson
3. Calculation of Activity-Activity and Log(O2-pH) Diagrams: Scott Wood
4. Magmatic Contributions to Hydrothermal Ore Deposits: An Algorithm (MVPart) for Calculating the Composition of the Magmatic Volatile Phase: Phil Candela, Phil Piccoli
5. Modeling of Geochemical Processes in Hydrothermal Systems: Mark Reed
6. Fluid Inclusion Techniques of Analysis: Tom Shepherd, Andy Rankin
7. Fluid Inclusion Modeling for Hydrothermal Systems: Phil Brown
8. Introduction to Stable Isotope Applications in Hydrothermal Systems: Andy Campbell, Peter Larson
10. The Influence of Geochemical Techniques on the Development of Genetic Models of Porphyry Copper Deposits: Jeff Hedenquist, Jeremy Richards

The cost of the course for SEG members is $250 per person; for non-members, $350 per person, and for certified students, $200 each. Fee includes the short course volume and coffee breaks. Payment may be made by check or credit card — accept VISA, Mastercard, Amex and Discover; please provide credit card type, number and expiration date below. Include your name, address, telephone, fax, and email.

REGISTRATION

Name: ____________________________
Address: _____________________________
Phone/Fax: ____________________________ Email: ____________________________

PAYMENT:

☐ Check enclosed, or
☐ Credit card (circle one):

Credit card #: ____________________________ Expiration date: __________

Signature: ____________________________

Please submit registration information and payment to: SEG 1998 Techniques Short Course • 5808 South Rapp Street, Suite 209 • Littleton, Colorado 80120 • Tel: +1.303.797.0332; Fax: +1.303.797.0417 • Email: soccecon@csn.net
ZAMBIA
MINERAL DEPOSITS CONFERENCE '98
AUGUST 17-26, 1998 • KITWE, ZAMBIA

The Zambia Mineral Deposits Conference '98, sponsored by the Geological Society of Zambia, the Zambian Investment Centre, Zambia Privatisation Agency and Ministry of Mines and Mineral Development in association with the Society of Economic Geologists will be held August 17-26, 1998. The Zambia Copperbelt mineral deposits form part of the world class copper-cobalt Central African metallic province. For more than fifty years, Zambia has been one of the largest producers of copper and cobalt in the world. The vast and diverse mineral potential of Zambia is highly attractive, both geologically and economically.

PROGRAM:
August 17-19, 1998: 2- to 3-day pre-conference geological tour of Zambian Copperbelt mines
August 20-23, 1998: technical sessions and mining exhibitions
August 24-26, 1998: geological tour of the Congolese Copperbelt mines

REGISTRATION FEES:
US$200—Conference registration fee for members of Geological Society of Zambia (GSZ) or Society of Economic Geologists (SEG)
US$300—Conference registration fee for nonmembers
US$200—Geological tour of Zambia Copperbelt mines
US$500—Geological tour of the Congolese Copperbelt mines

FOR MORE INFORMATION, CONTACT:
Zambia Mineral Deposits Conference '98
Executive Secretary • Geological Society of Zambia
c/o School of Mines • P.O. Box 32379 • LUSAKA, Zambia
Tel/Fax: +260.1.256480 • email: bdewale@mines.unza.zm

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What makes for success in exploration? Is it money? Is a superior technology? Is it the presence of superior scientists? Is it a superior and persistent organization? All these attributes are desirable and their presence will enhance the chances of success; but we’ve all seen examples of well-funded, capable organizations that found nothing though they did some of the right things, such as exploring in the trends and using the latest models and technology.

What then are the critical ingredients without which no exploration group is going to make discoveries, except through blind luck or brute force? Much has been written about exploration philosophy, and many colleagues such as Paul Bailly and Stan Holmes have made important contributions to the literature on the subject. For the most part, however, they and others have concentrated on the character of the organization and on the scientific, technological, financial, and political aspects of successful exploration. Indeed, of the “five main ingredients of exploration success” given by Brian Mackenzie, the 1992 Denver Region Exploration Geologists Society (DREGS) Distinguished Lecturer, four are organizational and the other states the one we all put first: superior, scientific and technical skills.

To have any chance of success, an exploration effort has to be geologically and economically well conceived, directed, and executed. It has to be well funded, well staffed, organized effectively, and has to assess the political risk in the areas in which it operates. The unit has to have relaxed and open communications, and distinctive and strong leadership. These attributes deal solely with what we might call the front end of the exploration process and involve the scientific, technological, and management aspects of the organization—and there is general agreement as to the importance of these factors. They also involve effectiveness and efficiency, which are laudable characteristics, but do not furnish a real basis for successful exploration.

Very few authors have dealt with the role of the individual and his or her desirable characteristics. Those who have talk about “hunger,” “motivation,” “vigor,” “inquisitiveness,” “perseverance,” etc. There is no doubt that these are great qualities, but they are not enough; we have all seen hungry, motivated, and vigorous failures. In what follows, I will concentrate on the behavior, attitudes, and most importantly, the understanding of individuals, as they alone make the decisions leading to discovery. Organizations only set a permissive and favorable climate within which individuals act.

Exploration is like research, it is an intellectual activity and it is the decisions and actions of individuals, not their organizations, that lead to that discovery

I want to emphasize what we might call the tail end of the exploration process, the operational phase, where the actions and decisions of individuals come into play. It is these actions and decisions that are the added critical ingredients of success. How can we guide these individuals, be they exploration managers or field geologists? Or, put another way, what philosophy and principles can guide the successful explorer—the ore finder? I propose a set of principles—the exploration canons—that should be part of the intellectual equipment of ore finders, actual or wanna be.

The exploration process is moved along the track toward discovery, or failure, by the cumulative actions and decisions made in parallel or in sequence by individuals. Thus, one or more individuals determine the direction of the train. A basic premise is that most decisions are not made by consensus. One needs sound advice, but not a cast of thousands to make operational decisions.

Group decisions tend to average out good ideas until they reach mediocrity! If there is to be much of a chance of success, these individuals and their colleagues should be guided by the philosophy expressed and inherent in the proposed principles—the exploration canons.

My thoughts are obviously not all original. As is the case with most of us, I have been exposed over the years to wise individuals, all of whom influenced my thoughts and professional attitudes. Therefore, with thanks to my unnamed mentors, I hope that my thoughts might stimulate discussion and perhaps reduce the time and money needed to find that next ore body.

I want to preface my thoughts with an observation of Charles Park..."getting in close is the art of geology." One obviously needs to know the geology of the area being studied, and of the deposits that occur or may occur there. Be realistic about the geologic permisiveness of the area and develop a realistic model, one that distinguishes observations and facts from inferences and hopes. This aspect of the exploration process—the good science part—is not all that difficult. Many unsuccessful organizations are scientifically sound. Good science does not necessarily generate or trigger good exploration. It is what is done with the data that is important. Attention to the proposed canons will improve the odds for discovery.
THE EXPLORATION CANONS

■ Exploration is not a science. The aims of exploration are fundamentally at odds with those of science. Science seeks understanding, whereas exploration seeks discovery; by whatever means, with or without understanding. Paraphrasing John Ridge (CIM 1983), the way it gets there is really of no concern in the search for ore. The empirical model is more useful than the generic one. If I had to pick a basic flaw in the philosophical approach of many organizations to exploration, it would be here. Many geologists tend to ignore or disbelieve data and observations simply because they cannot explain them—no scientific cause can be established. As a result, many either walk away or they over-geologize and then walk away. Consider a classic case: the Wegener hypothesis of continental drift was dented primarily because no understandable cause could be developed, so plate tectonics lay "undiscovered" for many years. It follows that one should:

■ Go with the facts, forget the theory. If there is a question of genesis vs. empirically derived facts or observations, go with the facts, forget the theory, ignore the model. For example, in a drilling program, when the physical model has been tested, considerations of the genetic model, whether understood or not, should have no bearing on the decision to drop or continue.

Let me illustrate my experience at Escondida. The alteration pattern at Escondida fit the classic halo of the porphyry copper model and five holes drilled through alluvial cover in the most "promising" area were all blank. A secondary target did not fit the model, but was drilled because of the favorable appearance of the leached capping and the presence of a coincident geophysical anomaly. The first hole hit the ore body.

■ Try for the definitive test. An absolute essential of the "exploration kit" should be the concept of the "definitive test." One should consistently strive to test the target with the drill as soon as possible. If the test is negative, walk away, unless new ideas or data from the drilling justifies further work. Too many geologists become victims of excessive scientific arguments and do more work, even though the target could have been adequately tested relatively quickly with the drill. Sometimes it costs more to reduce risk than to take it by drilling.

■ The odds are best in the shadow of the head frame. This obvious, important principle reflects the fact that ore forming processes tend to occur as multiple events and produce multiple deposits in favorable geologic settings. This is not to say there cannot be isolated deposits such as Bingham, or the cryolite at Niguel, or the Kinnerm borax deposit. However, since deposits do tend to occur in clusters, the odds are improved by exploring in or close to mineral districts, the identified mineral trends, or the extensions of trends. Some groups tend to shy away from expensive districts or trend land plays, preferring to go where ground is cheaper. But remember, where land is cheap, it's cheap!

■ Save the agonizing for mineralized trends. Generally speaking, in areas without mines or prospects ("virgin" areas), unless early drilling of targets gets results, it is better to walk away. However, even negative results can lead to meaningful reassessment of the prospect, especially of geophysical or geochemical anomalies. From this might emerge a quite different interpretation or a new set of drill targets. This may be especially true in deeply weathered terrain or in the search for the deep blind ore bodies.

■ Look for ore, not mineralization. Mineralization furnishes clues, and in the early stages of exploration, mineralization (alteration) may lead to ore, but at the target stage, you should be looking for ore. An important corollary is:

■ To find an ore body, you have to drill ore holes. This may seem to be stating the obvious, but each of us knows of deposits that have been over-drilled in the vain hope of improving the grade, that mineral deposits, by definition, have to have continuity and grade to become ore bodies. It follows, that if an "ore hole" cannot be offset by others, there probably is no ore body there. Continued drilling usually results in finding more mineralization or alteration, neither of which can be put through the mill.

■ There needs to be room for the ore. This is such an obvious principle that is often ignored when drilling out a deposit. Is there actually room for the tonnage needed to make an ore body, or are there structural, stratigraphic, or other constraints on the necessary space? The more known about the detailed geology of the prospective area, the less attention should be paid to the model and the more given to this principle.

■ Improve it or drop it. Unless a property is improved, generally, at each stage of exploration, you should walk away, especially in virgin territory.

■ Do not chase spurious anomalies. Unless the model, or other knowledge of the local geology account for an unexpected anomaly, either geophysical or geochemical, disregard it and continue with the program at hand.

■ Do not be preoccupied with explaining anomalies. If the drill hole or other evidence has tested the anomaly and there is no evidence of an ore body, walk away, even though the anomaly is not explained. If, however, in the geologic environment being explored there is strong correlation between certain kinds of anomalies and ore, or conditions that are guides to ore, then perhaps more effort should go into trying to explain the anomalies. The key here is that the anomaly itself is tested. If it is a blank, it's best to walk away.

■ Do not be preoccupied with pathfinders. Generally speaking, the metal sought is its own best pathfinder. Some groups are enamored of expensive multi-element surveys, but John Prochnau claims that he has never seen a gold discovery in which indirect evidence—geochemistry or geophysics—played the principal role. Some use arsenic as a pathfinder for gold, claiming that its halo is larger than that of gold and therefore sampling can have a lower density. I am not convinced.

■ Do not be preoccupied with stereotyped concepts. Avoid overemphasis of such qualities as "ground preparation," "leakage," and yes, structural control, unless they can be clearly correlated with the occurrence of ore in the geologic setting or district being explored. These factors should not override the significance of ore intercepts or other favorable drill-hole or sample results. For years the conventional wisdom in the Republic district, Washington was that pyroclastic rocks were poor ore hosts; when the drill hit pyroclastic rocks, the hole was stopped. As a consequence, the three ore intercepts of the Golden Promise vein system, drilled in pyroclastic rocks in 1963, were ignored for over 20 years until further work showed that veins in pyroclastics do "make ore."

■ Do not be technology driven. Some organizations fall in love with a given geophysical method, with geophysics itself or with other indirect methods, such as satellite imagery, and oversee them, when more direct, simpler methods, such as mapping, sampling, and drilling will give faster, cheaper, and more definitive results.
**THE ORE FINDERS, CONT.**

- **Acquire first, study later.** It is amazing how this basic principle is so often ignored. When a discovery is made and the land play is on, some groups insist on taking samples or doing other work before making a commitment. As a consequence, they are commonly left with fringe acreage or a competitor gets the deal.

- **Disregard competitor’s previous actions.** Do not base exploration strategy on your supposition of the reasons behind a competitor’s previous action in the area you’re exploring. If the available data compel you to a course of action, take up the ground and plan a series of drill holes; do not be swayed by imagined scenarios of why a previous holder dropped the ground.

- **Go for the jugular.** If you have faith in your geology and judgement of the potential of an area, do not take half-way cheap measures: take the bold strokes that make for discovery, rather than nibbling away at the data.

- **It’s the drill hole, stupid!** The geologist cannot substitute his wisdom and cleverness for the drill hole. The problem here is that the scientist believes in the power of the scientific method: more work, more data ought to do the job. And, therefore more work is done because it “offends” many geologists (scientists) to just drill a hole without understanding the geology. On the other hand, there are those who believe that many prospects can be tested by indirect geophysical means. One geologist on a project with which I was associated once said (and believed), “...but we ought to be able to model the anomalies and test them without drilling.” Not so!

  The authors of “In Search of Excellence” found that the difference between successful and unsuccessful exploration companies is a dramatic difference in the amount of diamond drilling they do. Although diamond or other drilling looks expensive, it is really the only way to find out what is down there.

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EXPLORATION REVIEW

ALASKA
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Back in January when gold prices plunged to the $282 per ounce range, famed Wall Street financial wizard Louis Rukeyser declared gold "dead on arrival." A few days later a report released by the CPM Group of New York indicated that demand by small investors for gold bullion and gold coins had increased dramatically as gold prices declined. In line with the CPM Group's findings, Alaska remains a bastion against the negative S&P ratings, declining exploration budgets, and increasing rate of mine closures that have occurred over the last three months.

WESTERN ALASKA

Placer Dome indicated that its 3.6 million-ounce Donlin Creek project has received funding to continue exploration in 1998. No details were given regarding specifics of the program.

Newcomer NovaGold Resources Alaska announced acquisition of a 49.07% interest in the Shotgun gold and Siletz tin-tungsten properties north of Dillingham from Enstar Corporation. Terms of the US$900,000 acquisition price were not disclosed. NovaGold's Canadian parent is headed by Rick Van Nieuwenhuyse, former Alaska District Geologist for Placer Dome. Welcome back to Alaska, Rick!

No word yet on 1998 plans by Intercontinental Mining Corp. on their Big Hurrah gold deposit in the Solomon district 40 miles east of Nome.

Golden Phoenix Minerals announced the signing of a Letter of Intent with Calista Corp. to conduct exploration on certain lands with Calista's jurisdictional boundaries. No information is available regarding specific plans.

EASTERN INTERIOR

The best holiday news was the announcement by Teck Corp. and partner Sumitomo Metal Mining of their initial resource calculations for the Pogo deposit in the Goodpaster River country. The deposit contains resources of 10.9 million tons grading 0.31 oz/ton Au (4.47 million oz.) in two flat-lying quartz veins with an average thickness of 24 feet. A third, deeper zone was intercepted in one hole and graded 0.57 oz/ton over 70 feet and could add significantly to the reserve base if future drilling is successful. Mineralization in the upper two zones, the Main and Lower Lisse zones, has been extended over an area measuring 4,000 feet on a side and remains open laterally. Mineralization in these three zones ranges from 350 to over 1,100 feet below surface. Gold is strongly correlated with bismuth suggesting an intrusive relationship for the mineralization. The partners recently permitted and completed construction of a 68-mile ice road to the property from the Richardson Highway to bring in underground equipment for the 1998 exploration program. This equipment will be used to drive a decline from which additional definition drilling can be conducted. This program also calls for up to 70,000 feet of core drilling to further define the geometry and limits of mineralization. Estimated cost is $8 million.

In a case of carpe diem, Ventures Resource announced signing of a joint venture agreement with Teck Corp. on Ventures' 1,500 square mile Veta project east of Pogo. Teck has agreed to acquire CDN$4.1 million worth of Ventures Resource common stock and warrants that could net Ventures an additional CDN$5.5 million. Eighty-five percent of the proceeds from these sales will be expended on property exploration. Upon completion of a feasibility study on a selected prospect, Teck would earn a 60% interest in the property. Teck can gain an additional 10% by guaranteeing financing for both parties through production. The agreement also calls for retaining the services of WGM Inc., Ventures' current geological consultant on the project. Ventures Resource followed up the good news by announcing closing of a CDN$1 million private placement, the funds from which will be used for general working capital purposes.

The big news in February was the announcement of the merger between Amax Gold and Toronto-based Kinross Gold Corporation. The new company will become North America's fifth largest gold producer at 1.2 million ounces per year with total gold resources of 27.1 million ounces. The financial restructuring involved in the merger will significantly reduce all-in production costs at Fort Knox and at the Kubaka mine in Siberia. Cash operating costs for the new company are estimated at $210/oz.

Congratulations to Kinross, now the owner of the Fort Knox mine, on "buying their straw hats in winter" and welcome to Alaska! In the fourth quarter, the Fort Knox mine produced 94,837 ounces of gold at a cash cost of $176 per ounce. Total production for 1997 was 320,522 ounces of gold at an average cash cost of $170 per ounce, and all-in production costs of $342 per ounce. Congratulations to Steve Lang and on a stellar first year!

Fairbanks district joint venture partners Newmont Exploration (65%) and La Teko Resources (35%) announced the highlights of their 1997 exploration programs at the True North deposit near Fairbanks. The program helped define two new soil anomalies on recently acquired Mental Health Trust lands, extended mineralization 400 to 600 feet out from the known limits of the Central zone and defined high angle mineralization at the Murray zone. The 1997 work effort included 2,156 soil samples, 51,753 feet of reverse circulation drilling in 148 holes, 2,150 feet of core drilling in 10 holes, and preparation of two 25 ton metallurgical samples from the Hindenburg and Shepard zones. The companies also announced approval of a $3.6 million budget for 1998 which includes $2.1 million for metallurgical and follow-up pre-feasibility studies. The remaining $1.5 million will be directed toward exploration of prospects outside the current resource area. The companies also announced acquisition of an additional 4,200 acres of land from Placer Dome Exploration to the east and west of the True North property. This acquisition brings the project land
area to 14,300 acres. These lands will be the target of a large portion of the exploration budget.

Fregold Recovery Inc. USA announced that equity funding partner Barrick Gold Exploration has elected to continue funding exploration on Fregold’s Golden Summit project outside of Fairbanks. Barrick has purchased an additional CDN$1.5 million worth of Fregold stock. 95% of which is earmarked for the 1998 exploration program. Plans for the 1998 work program have not been released.

La Teko Resources announced closing of their option agreement with Silverado Mines on the Ryan Lode deposit near Fairbanks. Revised terms include issuance of 1 million shares of Silverado common stock to La Teko and cash payments of U$200,000 by January 31, 1998, and an additional U$50,000 by February 27, 1998. All other terms of the agreement remain unchanged and require Silverado to bring the property into commercial production by mid-2002. Silverado’s plans for the property for 1998 have not been made public. La Teko Resources recently received a 1997 Reclamation Award from the State of Alaska for its reclamation efforts on the property. Congratulations to La Teko President Gerald Carlson and Fairbanks operations manager Rich Hughes!

Silverado and Placer Dome Exploration announced that the parties have entered into an exploration and development agreement that gives Placer Dome the option to acquire 100% interest in most of Silverado’s Ester Dome mineral holdings. Silverado received $400,000 from Placer Dome and would retain a 15% net profits interest on production from the subject lands. In order to acquire 100% interest in the properties, Placer Dome must first earn 51% interest by expending $10 million over 5 years and purchasing 1 million shares of Silverado common stock valued at $5.350,000. Placer Dome may acquire the remaining 49% interest by producing a feasibility study and acquiring all mine permits. Silverado retains the right to the Grant Mine and Mill, the St. Paul deposit and the Ethel-Elmes shear zone deposit. Silverado’s agreement with La Teko on the Ryan Lode deposit is not affected by the Silverado-Placer Dome agreement.

Ventures Resource announced encouraging results from their Lead Creek base metal massive sulfide prospect west of Eagle. Values ranging from 2% to 14% Pb, 1% to 5% Zn and 1 to 8 oz/ton Ag were encountered during diamond drilling in 1997. Additional exploration is planned for 1998.

ASA Inc. has closed its Fairbanks office after nearly a decade of exploration efforts, primarily on Doyon Ltd. lands in Interior Alaska. Former ASA manager Jack DiMarchi recently accepted a position with Teck Corp. to assist their Interior Alaska efforts. Congratulations Jack!

Tri-Valley Corporation announced that it has terminated discussions with Placer Dome on its Richardson Project in the Richardson district and has signed a letter of intent with an unnamed mining company for exploration of the project. The company announced that encouraging results from their 1997 diamond drilling range from 1.2 to 5.6 g/t Au gold over 5- to 35-foot intervals. The company has invested $2.85 million on the project in the last 10 years and other parties have expended an additional $1.75 million.

Golden Phoenix Minerals continued their acquisition efforts by announcing the signing of a Letter of Intent to acquire Polar Mining Inc.’s property in the Richardson district. This property, in addition to the previously acquired Mack Riff and Banner Creek properties and an additional 4 sq. miles of staked lands in the area, have increased the company’s Richardson district holdings to 25 sq. miles. Golden Phoenix also announced that it has signed a joint venture Letter of Intent with an unnamed company (gee, I wonder which one it could be?) that if consummated, will further increase the size of Golden Phoenix’s land holdings in the district. Shortly afterward, Golden Phoenix announced the exercise of $1.4 million in options by officers of the company, with proceeds to fund ongoing property acquisition and general corporate requirements.

Golden Phoenix Minerals also continued their acquisition efforts in the Circle district by announcing acquisition of 9 sq. miles of properties in the Deadwood Creek and Bottom Dollar drainages. The company is continuing its land acquisition efforts in preparation for initial field exploration efforts in 1998.

La Teko Resources announced positive results from their 1997 exploration efforts on their Discovery Gulch property in the Circle district. Gold values in soils ranged up to 1.125 ppm, with associated anomalous arsenic. The company acquired additional lands in the area to consolidate its claim position in preparation for further exploration planned for 1998.

**SOUTHCENTRAL**

Golden Phoenix Minerals continued land acquisition in the Bonnifield District with acquisition of the Circque volcanogenic massive sulfide prospect and the Grubstake gold prospect. Previous efforts at the Circque prospect returned 0.1 to 1% Cu, 4% Pb, 16-20% Zn, 2 to 5 oz/ton Ag, 0.02 to 0.08 oz/ton Au, and 86 to 2,652 ppm tungsten from a 10-foot-thick massive sulfide horizon exposed over a 50-foot dip-length.

Grayd Resources announced that it is planning to mobilize a diamond drill to its Anderson Mt. volcanogenic massive sulfide property in the Bonnifield district. This property and the previously drilled Dry Creek North massive sulfide property are both scheduled for drilling in 1998. Grayd Resources also announced that it has acquired 12 massive sulfide and gold properties from Pacific Northwest Resources (PNR) and Pacific Alaska Resources Corp. (PAR). As part of this arrangement, Grayd will issue PNR and PAR 300,000 shares of common stock and assume obligations on the properties, including joint venture obligations in two joint ventures. The first JV, the Delta joint venture with American Copper and Nickel (ACNC) covers some 44 square miles of the Alaska Range in the Delta district 20 miles south of Delta Junction. Resources on the Delta joint venture stand at 14.6 million tons of zinc, lead, copper, silver and gold mineralization with values ranging from $50 to $250 per ton. Grayd has the option to increase its ownership from 17% to 38% by funding the $1.7 million exploration program for 1998. The other joint venture in which Grayd now has an interest is the Bonnifield joint venture with Inmet Mining Co. This venture covers approximately 38.5 square miles of the Bonnifield district 60 miles south of Fairbanks. Only one of the prospects in the venture has been seen drilling, and plans for the 1998 season are not yet known. The remaining properties acquired from PNR and PAR are located in the Valdez Creek, Bonnifield extension, Delta extension, Circle and Fortymile districts.
**NORTHERN ALASKA**

Ventures Resource reported ongoing acquisition discussions with several parties on its 440,000-acre Wissman property in the Chaidaraf Copper Belt. The company is awaiting the results of a BLM-funded airborne magnetic and resistivity survey conducted over portions of the property.

Kencott Exploration has received funding to continue exploration on its base metal properties in the Bornite area of the Brooks Range. Exact work plans and budgets have not been announced.

**OTHER NEWS**

Alaska Governor Tony Knowles’ 1998 capital budget allocates $500,000 for airborne geophysical surveys and $1.5 million for Federal pass-through funds for abandoned mine reclamation work. Where the geophysical surveys will be conducted is not clear, but the Tundra Telegraph is screenings for surveys in the Goodpaster River country—I wonder why?

**EASTERN CANADA**

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The state of exploration in Canada as of April 1997, is summarized in the ‘Overview of Trends in Canadian Mineral Exploration’ published last fall by Natural Resources Canada. Although suffering from a significant lead time to publication, it is a useful reference for those interested in Canadian exploration statistics, and can be downloaded from the Natural Resources Canada web site at <http://www.mecan.gc.ca/mms/eiib/invest/exploration/>. Gold exploration remains strong in eastern Canada, despite depressed prices. Exploration for volcanic massive sulfide deposits appears to have increased, perhaps in response to encouraging results from Cross Lake (see January column), or perhaps due to a desire for polymetallic deposits in these uncertain times. More unusual exploration news from eastern Canada includes rubies in kimberlite, sperrylite in peridotite, and a whopper of a petroleum deposit.

**GOLD**

XEMAC Resources has confirmed the potential of the No. 2 gold zone of their Lac Barry property in Quebec. Discovered last spring, the No. 2 zone was intersected by recent drilling and returned values up to 12 g Au/tonne over 8.42 meters and 12.6 g Au/tonne over 12.6 meters. The drilling has delineated the zone over a strike length of 137 meters, and to a depth of 100 meters. Drilling also led to the discovery of a third zone with an intersection of 1.22 meters averaging 6 g Au/tonne. Gold occurs predominantly as free gold, together with pyrite, sphalerite and chalcopyrite in shear-zone-hosted quartz veins. Last fall, a geological resource of 3,733,000 tonnes grading 5.42 g Au/tonne (650,000 oz Au) was reported for the Chevrier project of GeoNova Explorations. The property is located in the...
Chibougamau area of Quebec. Recent drilling, however, has identified a near surface mineralized zone that will certainly add to this resource. Intersections included 7.77 g Au/tonne over 4.9 meters, 6.04 g Au/tonne over 4.0 meters, and 10.25 g Au/tonne over 5.3 meters.

After last year’s acquisition of the Sigma and Rican gold mines from Placer Dome, McWatters Mining continues to expand by acquisition in Quebec. The latest addition to the McWatters stable is Breakwater’s interest in the East Anophi gold property located near Val d’Or, for which a resource of 265,000 oz of gold in the Hybrid Zone has been announced. A parallel zone, the Porphyry Zone, has been intersected by 11 drill holes to date, but no resource has been calculated.

Several Juniors are gearing up for drilling programs in the North Caribou Lake Greenstone Belt of northwestern Ontario. Romios Gold Resources has begun a 2,000-meter drill program to test a deformed banded iron formation on their Lundmark-Akow Lake property. The company reported significant gold in grab samples from the deformation zone. Drilling has intersected altered and sheared mafic volcanics, and associated quartz feldspar porphyry intrusives.

After staking the Caribou property in the North Caribou Lake belt, Tri Origin Exploration is targeting banded iron formation-hosted gold and felsic volcanic-hosted massive sulfides in their 1998 exploration program. The belt is still considered to be underexplored, despite the development of the Musselwhite gold mine of Placer Dome and TVX Gold.

Cash payments of CDN$200,000 and expenditures of CDN$56 million over the next four years will earn St. Andrew Goldfields a 50% interest in the Penn-Gib project of Rangea Goldfields. Exploration this year will concentrate on deep drilling to extend the known ore zones below 300 meters. Current reserves, calculated for the top 25 meters of the deposit, are 1.95 million tonnes grading 5.13 g Au/tonne (using a 2 g Au/tonne cut-off).

Joint venture partners Queenston Mining and Franco-Nevada Mining Corporation continue deep drilling on their Kirkland Lake joint venture in north-eastern Ontario. Recent highlights include 19.52 meters grading 1.24 g Au/tonne, and 9.15 meters grading 3.42 g Au/tonne on the Anoki Deep zone, and 1.24 g Au/tonne over 1.43 meters in the McBean Green Carbonate zone. Further drilling of the Anoki Deep zone, now outlined over a 600-meter strike length and to a depth of 600 meters, is underway.

Vedron Gold Inc. is attempting to outline sufficient tonnes for an open pit operation on their Fuller property in the Timmins area of Ontario. Drill testing of induced polarization (IP) anomalies detected last year turned up seven new gold zones. Hosted by east-west striking mafic volcanics, intersections of the N3 zone ranged from 9.6 g Au/tonne over 2.59 meters to 2.1 g Au/tonne over 19.82 meters.

**CU-Pb-Zn**

Noranda has signed an agreement giving them the right to earn a 60 percent interest in the Malliseet Mountain property of Mountain Lake. Two massive sulfide zones were intersected during fall drilling on the property situated 25 km west of the Heath Seecle Mine in the Bathurst camp of New Brunswick. Both zones occur within a 15.9 meter interval averaging 5.9% Zn, 0.24% Pb, 0.09% Cu, and 16.1 g Ag/tonne.

**CU-Ni**

A 15.7-meter massive sulfide intersection grading 1.13% Ni, 0.78% Cu and 0.20% Co. considered by some to be a discovery hole, was reported from the South Voisey’s Bay project of Donner Minerals and Northern Abitibi Mining. The mineralization is hosted by a trondhjemite intrusion. Other recent drilling highlights...
include a 25-meter intersection of disseminated sulfides containing 1 meter of massive sulfide with grades ranging from 1.4 to 1.9% Ni and 0.8 to 1.6% Cu, and a 1.1-meter interval of massive sulfide grading 11.8% Ni and 0.7% Cu in basement gneisses.

Drill testing of a strong ground EM anomaly on the Harp Lake 2 property of Gallery Resources in southern Labrador has failed to explain the anomaly. Four shallow holes intersected disseminated sulfide mineralization, but not the massive sulfide expected.

Meanwhile, after spending approximately CDN$4.2 million on projects in Labrador, Takla Star Resources and NDT Ventures have decided to discontinue exploration this year. Instead, they will try to interest a major company in funding more geophysical surveys to be followed by deep drilling.

In neighboring Quebec, Tominin and SOQUEM are planning to drill recently discovered mineral showings assaying up to 1.7% Ni on their 22K/16 property. The showings were discovered during follow-up of airborne electromagnetic (EM) anomalies. The airborne surveys were flown over areas of anomalous Ni, Cu, and Co in lake sediments. Mineralization is associated with mafic gneiss at the contact between anorthosite and a suite of gneisses, paragneisses and charnockites.

**MISCELLANEOUS**

Rubbles are the latest commodity to be found during exploration for diamonds in eastern Canada. The rubbles were found in bulk samples of kimberlite from the Gukfont Township property of Tandem Resources in northern Ontario. Two samples of whole drill core weighing 34.7 and 53.2 kilograms contained a total of 1790 rubbles, of which 40 are designated macro size and range between 0.8 mm and 2 mm in size. As part of a 20-ton bulk sampling program, a one-half ton sample of kimberlite has been sent to a commercial laboratory for testing of rubies and diamond content. Samples are being collected by large diameter (6.3 inch) drilling.

Drilling of the Wolf Mountain platinum-palladium project, located 90 km north of Thunder Bay, Ontario, will test the continuity of mineralization discovered last year. Avalon Ventures sampled surface workings in a peridotite, interpreted to be part of a layered mafic-ultramafic intrusion, that assayed up to 3.8 g Pt/tone and 3.8 g Pd/tone. The mineralization is predominantly disseminated pyrrhotite, pentlandite and chalcopyrite, although sapphire (Al$_2$Si$_3$) has been observed associated with the sulfides.

Further west, Avalon has now dedicated a giant rare metals pegmatite deposit on their Separation Rapids project near Kenora, northwestern Ontario. The Big Whopper pegmatite deposit has an estimated resource of at least 7.1 million tonnes grading 1.285% Li$_2$O and 0.346% Rb$_2$O to a depth of 250 meters. The lithium is contained in pegmatite (Li$_2$SiO$_3$), and the rubidium in K-feldspar. Associated tantalum and cesium mineralization is present in a series of highly fractionated pegmatites in the western part of the Big Whopper, with grades up to 0.014% Ta$_2$O$_5$ over 14.5 meters at a vertical depth of 50 meters. Metallurgical and market studies are underway, and the deposit is expected to undergo a pre-feasibility study this year.
WESTERN CANADA

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NORTHWEST TERRITORIES

Exploration by WMC International (operator), Cumberland Resources and Complex Minerals continues at Meliadine West, 15 km north of Rankin Inlet on the west coast of Hudson Bay. The company has split the area into two projects of which the more prospective, now referred to as Wesmex, will be advanced to a pre-feasibility stage with a 1998 budget of $5,900,000. WMC recently announced a resource of 6.8 million tonnes containing 11.9 g/t Au (2,600,000 oz) in the Trinuinak deposit at Wesmex. A further $1,300,000 will be directed to drill testing other targets on the Meliadine West property which includes an outcrop area and three boulder fields with respectable gold grades.

As part of Echo Bay Mines’ severe belt tightening exercise, the company first cut all development of Ulu, which was to provide some mill feed for Lupin, then at the beginning of 1998, announced that operations at Lupin itself would be suspended temporarily. As Lupin is getting costlier to operate, and the ore is rapidly running out, a re-opening in the near future is unlikely. Kit Resources (formerly Arauco Resources) is in the process of trying to purchase the Izok Lake volcanogenic massive sulphide deposit from Inner Mining; if they succeed, look for Kit to attempt to acquire the Lupin mill from Echo Bay. Izok Lake is about 70km due west of Lupin and contains a resource of some 12 million tonnes with 1.9% Zn, 2.5% Cu, 1.4% Pb, and 78 g/t Ag. Regional metamorphism has recrystallized Izok mineralization and imparted a relatively coarse-grain size. The Izok is amenable to open pit mining methods, has good average grade, and the course-grained mineralization will help metallurgy; however, the deposit is still a long way from tidewater.

YUKON TERRITORY

Considerable exploration was done during 1997 in the Finlayson Lake volcanogenic massive sulphide district of southern Yukon. Westmin Resources (recently purchased by Boliden) and Atina Resources have increased the size of the Wolverine deposit and now quote a resource of 6.2 million tonnes containing 2.7% Zn, 1.3% Cu, 1.6% Pb, 1.9 g/t Au and 370 g/t Ag. The deposit is now closed-off except for the down-dip portion that may extend onto Cominco ground. The partners also have the nearby Fisher and Sable zones which may help build resources. Wolverine lost some of its lustre with the recent revelation that the deposit contains high levels of selenium. This may be fun for mineralogists, but a scourge for smelter operators and investors. Boliden’s entry may help, as they have a wealth of metallurgical expertise in complex ores.

Approximately 100km south of the Finlayson Lake district, and 100km west-northwest of Watson Lake, is the Logan deposit. Pacific Bay Minerals recently negotiated an option to acquire a 69 percent interest in the property. Previous owners had blocked out 12 million tonnes of mineralized material with an average grade of 6.2% Zn and 26 g/t Ag. This grade is a bit thin, but Pacific Bay suggests the deposit is open at depth where grade appears to be improving. Logan is on the opposite side of the Tintina Trench to the Finlayson Lake district and is a structurally controlled deposit. Mineralization is related to a brecciated portion of a steeply-dipping fault zone. The fault zone has cut through granodiorite and in turn has been intruded by a variety of dikes.

WESTERN UNITED STATES

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■ General Comment. It is getting pretty ugly out there gang! As would be expected, falling gold prices are having a drastic effect on exploration in the western United States. Several companies have greatly reduced programs (and staff), while others have just plain closed their offices. For example, Phelps Dodge has closed all of their U.S. exploration offices and have only a handful of geologists working out of their homes. ARASCO closed the Reno office and is allowing the Great Basin staff to continue to foreign assignments. Echo Bay downsized to a couple of explorationists who reside in the Reno office. Pegasus Gold filed Chapter 11 Bankruptcy and suspended mining at the Florida Canyon mine in Pershing County. Vista Gold, or whatever their name is this month, has closed the Crofoot-Lewis mine. Yet, a few well funded companies are considering this period as a tremendous opportunity to acquire properties, and maybe even companies (i.e., reserves). It is going to be interesting to watch how this all shakes out. Which is another way of saying we have seen this before and it is no fun.

CALIFORNIA

In yet another example of the long leak time between writing this article and its publication, the news about Royal Gold’s Loog Valley property (Mono County) has been reversed. Amax Gold has terminated the option, and then being in such a state of remorse about the lost opportunity, downsized and merged into Kinross Gold.

IDAHO

Idaho Consolidated Metals Corp. reports that the results of eleven recently completed core holes at the Petsite/Friday joint venture, with Cyprus Amax (Idaho County), are very encouraging. Having said that, they reported results for only one hole: hole PC10 contained 288 feet of 3.81 “grains per tonne Au.” If you read this literally it gives an entirely different view of what is there, rather than reporting it as grams of Au per tonne. One also wonders why results from the other holes were not reported.

MONTANA

Canyon Resources is reporting a revised mineable gold resource at McDonald Meadows (Lewis and Clark County) of 6.3 million ounces (up from 5.2 million), at current gold prices. They claim the crushed grade of ore will be 0.547 oz Au. The new anticipated mine life will be 12 years (or is that required permitting time?), rather than the 16 years previously report. This suggests that the cut-off has been raised to obtain the higher grade, but it is curious as to how the ounces could increase so dramatically without additional drilling.
**NEVADA**

Coromandel Resources has published what has to be an extremely optimistic news release. They are reporting an “open pit gold resource” of 71 million tons with an average grade of 0.016 opt Au and a 0.1:1 stripping ratio at the Wildcat property in Pershing County. The SEC would probably have a lot to say about the term “open pit gold resource,” most of which would be negative.

Alta Gold has poured the first gold at the Griffen mine in White Pine County. Drilling last year expanded the proven and probable reserves to about 100,000 ounces of gold, which should extend the mine life one additional year. The new mineable reserve is 3.86 million tons at 0.026 opt Au. The question has to be, “How can Alta Gold mine such low grades profitably?”

Echo Bay Mines has decided not to continue the “Strategic Alliance” with Fairmile Gold at the Buffalo Valley property in Humboldt County. What this means is that Echo Bay will no longer fund the exploration program, but according to Fairmile there is a list of interested parties that extend at least to 1:80 (that is several miles to the north for those of you who don’t eat dust in Nevada). Separately, Fairmile has announced a geologic resource of about 20 million tons with an average grade of 0.029 opt Au around the site of the old Buffalo Valley mine.

Echo Bay has also removed itself from the Ratto Canyon property. Eureka County, which is being taken over by Alta Gold. Alta Gold feels that there are “near-term ore reserves” that can be mined, in addition to gold exploration potential.

Royal Gold has made a major move to take over the Manhattan district. Nye County. In two separate deals they have acquired more than 200 claims from New Concept Mining and Nevada Manhattan Mining. New Concept has reported a geologic resource of 5.5 million tons with an average grade of 0.19 opt Au (yes I said 0.19) on one portion of the property, and several mineralized zones in other areas. The Nevada Manhattan Mining property includes the White Caps mine, which was one of the higher grade underground operations in the district.

Coral Gold is reporting the results of the Cortez joint venture drilling in the western portion of the Robertson property (Lander County) along the projection of the Pipeline/South Pipeline structural trend. Although altered and faulted Silurian Roberts Mountains Formation was encountered at slightly more than 1,000 feet deep, only narrow intervals of low-grade gold mineralization were detected. Apparently Cortez is planning more drilling in 1998.

Joint venture partners Great Basin Gold and Cornucopia Resources have drilled six core holes at the Ivanhoe property in Elko County. They are reporting multi-stage quartz veins with visible gold and silver over intervals of 2 to 20 feet, which are hosted in Ordovician Valmy Formation. They interpret this mineralization as a possible feeder system(s) to the overlying 3,000,000 ounce Hollister deposit. Big stretch??

Royal Gold states that the South Pipeline (Lander County) resource has been expanded to 117,000,000 tons with an average grade of 0.047 opt Au, or about 5.5 million ounces of gold. At about the same time, Placer Dome released a new proven and probable reserve of 67,162,000 tons with an average grade of 0.097 opt Au, or about 3,171,500 ounces of gold. The new reserve is an increase of 577,500 ounces over the 1996 reserve. A new drilling program has started to continue the delineation of the deposit.
OREGON

Tombstone Explorations have signed an agreement with Atlas Corp. to option the Grassy Mountain gold deposit in Malheur County. Apparently, they are looking at the possibilities of developing a smaller high-grade deposit that could be mined underground. The target is about 2 million tons with an average grade of 0.35 opt Au. No comment will be made here about mining, or the use of cyanide, in Oregon.

UTAH

Silver Standard just completed eight drill holes totalling 5,000 feet on the Silver Reef property, Washington County. Silver-copper mineralization occurs in sandstone of the White Reef Formation, and they think it is analogous to the Troy silver-copper mine in Montana. Drill hole intercepts are commonly 5 to 10 feet thick with silver grades in the 1 to 5 opt range. Copper may, or may not, be present and commonly in amounts of less than 1%. Mineralized intervals are more than 450 feet below the surface.

WASHINGTON

Yamana Resources is reporting positive results from their Wenasiche project, which is about two miles southeast of the Cann near mine, Chelan County. They report that the Matthews property contains a mineralized zone, about 1,800 feet below the surface, that is at least 600 feet wide and 2,500 feet long. Several drill hole intervals have intersected gold mineralization, including 50 feet of 0.26 opt Au and 5 feet of 1.15 opt Au. Mineralization is hosted by a sandstone with a central core of silicification.

MEXICO

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Teck and Western Copper’s huge intercepts of massive sulfides on the San Nicolas discovery in Zacatecas have saved the exploration industry in Mexico from the disastrous effects of low gold prices. Zacatecas and surrounding states have been blanketed by a sea of huge claims. During one week in February, 2 million hectares were applied for at the Mining Agency in Zacatecas. As open ground has now disappeared, the rush is on to do deals on smaller existing claims. Majors are talking to juniors with land, and junior are talking to Majors with land, and everyone is talking to the pequeños mineros who have had the only showings tied up since before most of knew where Zacatecas was.

What’s best is that all be in the great Faja de Plata (silver belt), which is so ill defined that you can draw it any way you want. There is no doubt that you are on trend, in fact your 200,000 hectare claim surely lies right in the middle. Beyond this, the Zacatecas play is great to promote because there are so many types of projects your 400,000 hectares (it was so well located you had to stake another claim) of alluvium can morph into. Right now the target is a monster VMS that might be large enough to deflect the orbit of a satellite. But if your work shows no Cretaceous volcanic rocks in the subsurface, you can jettison the VMS model. Surely you have some argillites, you must, there’s 400,000 hectares. You can go to a sedex model using Francisco I. Madero as your type example. If this model fails, the fall back position is so strong it probably should have been your first target model. The Faja de Plata was not named for VMS and sedex deposits, it was named for the most productive bonanza silver veins and the largest skarn-manto systems ever discovered. Core holes from the discovery you are about to make may not weigh as much as if they were in massive sulfide, or look so good at the PDA core shack, but the guy who will ultimately be running the mill will think it is beautiful.

The boom in Zacatecas really is an exciting one and with the funding that will be pouring in over the next two years, there should be some more successes. I would not be surprised if these successes included discoveries of all the deposit types discussed above. It will not be easy. Virtually every target to be tested will have some geophysical support, but will be primarily conceptual and blind in nature. I know from personal experience in this belt that not all strong I.P. anomalies in Cretaceous volcanic rocks are caused by massive sulfides.

With the drop in the oil price and the huge effect this has on Mexico’s budget, the Hacienda (tax authority) is getting more difficult and picky. Getting the 15% I.V.A. value-added tax back is not as easy as it was. Frequently, the case arises where the Mexican subsidiary of a foreign mining company will use the services of the Mexican subsidiary of a foreign exploration services company. In the past, payment for services could be handled outside of Mexico by a wire transfer of funds from one parent company to the other. If a proper factura was provided, by the Mexican services company to the Mexican exploration company, I.V.A. was still recoverable even though the funds for payment of the invoice never passed through Mexico. With large drill programs, the amount of I.V.A. to be recovered goes to six figures. You want a back and plan on getting it back. The Hacienda: no longer allows this or at least it is contesting I.V.A. recovery on such transactions. The funds for payment have to pass through the bank account of the Mexican exploration company prior to payment of the invoice.

With gold dropping to the $300 per ounce level, there have to be some casualties. In Mexico two gold development projects—Echo Bay’s Paradores Amarillos and Placer-Kennecott’s Mulas—have been put on indefinite hold. A few others are sure to follow. One that does not appear to have fallen victim to low gold prices is Metallica’s Cerro San Pedro. It appears that the drop in gold is being offset by the rise in silver. Now, Camibor has entered the picture to arrange project financing, and we look forward to seeing a production decision. The most exciting gold project in Mexico continues to be Francisco Gold’s El Sauzal, where recent drilling is showing significant extensions to mineralization. When the road is finally in to the project, progress on delineation and definition should improve dramatically.

Acquiring back-in rights has become an integral part of the exploration strategy of several majors, apparently as part of their “re-focusing” exploration. (The most important activity in “re-focusing” remains of course “office closing” and “employee cutting.”) In the past, I have seen many cases where a company let a property go for a small retained interest or a back-in right, but in these cases the back-in right was to recover yourself just in case you had screwed up. The property being let go was generally viewed as a dog. What we are seeing now is just the opposite.

Majors are farming out prime properties to juniors which are going into the deal earning a majority interest. The major gets the option to back-in at some
pre-agreed upon point by paying the junior some multiple on the junior's expenses and possibly arranging financing for the junior's share of development. Cominco has just concluded a deal with Ecostall Mining for 12 properties in Mexico, where Ecostall can earn a 100% interest in each primarily through exploration. I know nothing of the specifics of each project, but they are all well located. I suspect some are excellent projects. Cominco, however, can earn back 60% by doubling Ecostall's expenditures on any single property. Well, it's more complicated than that - you need to read the full press release.

More complex yet is the deal Kennecott did with Western Copper for all of Kennecott's properties, excepting porphyry copper projects in Zacatecas. Among these is the polymetallic discovery at Penasquito, located just west of Concepcion del Oro and a huge package of claims north of Western Copper's San Nicolas discovery. As noted, the deal is complex but basically gives Kennecott the right to re-acquire 51% of anything found for a substantial price.

The last case, the El Salvador Project, also involves Western Copper and has such a convoluted history of deals, sales of shares, joint ventures, back-in, and interest earning accords amongst Teck, Western Copper. Thermal Exploration, Prime Equities, a Zacatecas junior, "sophisticated investors," and Lusinian that I got a migraine reviewing the press releases. Incredibly there are no lawsuits yet. The main point to be made is that when San Nicolas finally gets through feasibility Western Copper's 45% interest is likely to have shrunk to 22.5%. That is unless they have a back-in right that I missed.

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**ASIA**

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Editor's Note: With this issue, we welcome Craig Feebrey as Regional Correspondent for Asia. Craig holds geology degrees (BSc and Grad. Dip. Sci.) from the University of New England in Australia, and received MS and PhD degrees from Hokkaido University, Japan. He has been employed by the Metal Mining Agency of Japan as an exploration geologist since 1995. As we have not had specific coverage for this large region of increasing importance for exploration, we are pleased to add this column to the Exploration Reviews section of the Newsletter.

To kick-off my first review I would like to make an appeal to any of you who may be able to provide information on activities in the Asian region. All of us who accept the task of writing a regular review quickly come to the conclusion that this would be a far more productive assignment if, rather than relying heavily on press releases, information would flow in from those of you who have NEWS. All that is needed is to quickly boost the quality and appeal of the review is your assistance by way of an occasional email or fax. Looking forward to hearing from you!!

**PEOPLES REPUBLIC OF CHINA**

China is a world leader in proven reserves of antimony, boric, molybdenum, rare earths, titanium, tungsten, and vanadium. Major gold deposits are in Hebei, Hohhot, Henan, Hunan, Shandong, Major base and precious metal deposits occur in Guangxi, Guizhou, Henan, and Shanxi. Lead and zinc deposits are in Fujian, Guanzhong, and Guangxi. China has a shortage of chemicals. The only important discoveries of chronium are located in Xinjiang and Xizang (Tibet) where exploitation conditions are difficult. China's mining industry has been highly monopolized with all major minerals and metals being State-owned. Authority over various mineral and metal commodities is characterized by considerable overlap. The Ministry of Metallurgical Industry (MMI) is responsible for bismuth, iron, iron ore, manganese, and steel production, as well as some magnets and dolomite mines and plants. Non-ferrous metals and byproduct bismuth, gold, and silver fall under the jurisdiction of the China National Nonferrous Metals Corporation (CNNMC), whereas primary gold production is under the supervision of the State Gold Bureau.

In 1984, China new mining regulations were introduced to open up China's mineral industry by promoting foreign investment. This effort was instigated by government realization that the mineral sector plays a crucial role in the national economic growth of China, and that existing mining legislation was not in line with its market-oriented economic development policy nor with international practices. The changes became effective in January, 1997. Until then, China's policy was to pursue exploration and mining activities through state-owned enterprises, almost to the total exclusion of foreign investors. Gold mining, for example, was only open to foreign companies if the grade was too low to be treated by locally
available technology, or if the ore presented metallurgical recovery problems. Under the new regulations these restrictions do not apply.

At the end of 1994, seven copper, ten gold, and several antimony, bauxite, manganese, silver and tin projects were selected as part of a pilot program to introduce foreign investment to China's mining industry. The gold mines selected were reported to have reserves of between 10 and 50 million tonnes, but of low grade and difficult to mine. However, this didn't seem to deter some companies. Barrick Power Gold Corp. (a JV between Barrick Resources and Power Corp. of Canada) wasted little time in signing two letters of intent with China National Gold Corp. for interests in the Paishanlou gold mine in north-eastern Liaoning Province (75%) and the Changkeng gold mine in southern Guangdong Province.

China's output of copper has continued to fall short of demand, resulting in the government increasing its exploration investment in an attempt to locate additional copper resources. Several new copper resources have been found and include: Huaushugou and Nanqoigou in Gansu Province, Zijinshan in Jiangsu Province, Yinshan in Jiangxi Province, Leyyang in Shanxi Province, Longbohe in Yunnan Province and Ashele and Xiangsheng in Xinjiang Zizhiq. Gold production figures were first made public in early 1996, indicating China had produced 108 mt of Au in 1995. The latest figures indicate that China's approximately 1,200 gold operations have combined an ore processing capacity of approximately 73X mt/d and produced 120.6 mt of gold in 1996, an increase of 11.8% over the previous year. Gold production is expected to reach 150 mt by the year 2000. China's gold industry has been hampered by a large number of unauthorized small-scale gold operations that cause serious pollution problems and waste natural resources because of low extraction ratios. As part of the move to clamp down on illegal mining practices and centralize control of natural resources, 413 illegal gold mines were closed in the first half of 1996.

Accompanying the changes to the mining laws, several companies have been active and continue to acquire properties. Breckenridge Resources has again signed another memorandum of understanding (MoU) with a division of the Sichuan Bureau of the Ministry of Geology concerning two silver-rich Kuoko-type volcanogenic massive sulphide deposits, the Xiasai and Gayiqiang deposits. They are hosted in the same belt of Tertiary volcanic and sedimentary rocks as Breckenridge Resources' Xiachuan silver-rich base metal deposit. Thirteen significant mineralized horizons, with two hosting the bulk of the deposit and averaging Zn in thickness and 2,000m strike length, have been identified at the Xiasai deposit. Zones 1 and 2 have average grades of 385.7 g/t Ag, 3.9% Pb, 3.2% Zn, and 433.7 g/t Ag, 6.5% Pb, 2.5% Zn, respectively. The Gayiqiang deposit remains at an earlier stage of exploration. Preliminary results for the Xiasai deposit reported in 1996 indicated a mineable resource of 9.1 M containing 9.1% Zn, 5.6% Pb, 1% Cu, 225 g/t Ag and 0.6 g/t Au, with approximately 60% of the orebody being mined by open-pit methods.

London-based European Mining Finance (EMF) and Keynes Investment recently entered into an option for the issued share capital of China Zinc Pty. China Zinc Pty. has a 60% interest in the Caijiaying zinc-gold project located 300 km NW of Beijing. A feasibility study has been completed and six mineralized zones have been identified with a reported mineable reserve of 27.4 Mt containing 6.87% Zn and 0.5 g/t Au.

### MiningPro Files: CONCISE 4-PAGE COUNTRY PROFILES

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Provincial authorities from Guizhou have been trying to attract foreign investment to develop the Lannigou gold mine, with Newmont Gold. BHP and Gencor apparently showing interest. The deposit is located in the Miao-Buoyei prefecture and has reported reserves averaging 6 g/t Au. It is one of several in the area and surrounding provinces that are reported to be of carbonate-displaced-type with characteristics similar to the Carlin-Trend deposits in Nevada.

Early in 1997, Kensington Resources (a Canadian junior) signed an option agreement to acquire a 50% stake in a diamond mine located 300 km south of Beijing. The mine is currently China's largest producer, recovering an estimated 40-45,000 ct/year, and is reported to have a measured and indicated resource of 1.77 Mt at an average grade of 1.17 ct/t to a depth of 300 m, with another 1.5 Mt containing 0.77 ct/t between 300 m and 600 m. A proposal has been put forward to upgrade the processing plant to recover 250,000 ct/year. In addition, separate JV agreements have been signed to explore on two nearby diamond prospects. Asia Minerals Corporation continues to add to its list of projects, this time signing a co-operation agreement with the Xinjiang Bureau of Geology and Mineral Resources. They intend to explore jointly in the West Junlin Shan and Altay Shan mountain ranges where the Bureau earlier identified regional gold and gold-copper targets. Previously, Asia Minerals in association with Royal Oak Mines Inc. had been evaluating several gold
projects and entered into a joint venture with the Shandong-based Zhaoyuan City Gold Corporation to acquire a 50% interest in the Yingezhuang gold mine. The mine, located in Shandong province, commenced production in 1992 and operates at 400 t/day mining and milling capacity. A prefeasibility study completed in 1994 indicated a resource of 19.4 Mt grading 2.8 g/t Au in two semicontinuous orebodies. Asia Minerals Corporation and Zhaoyuan City Gold Corporation also entered a joint venture in 1995 to develop the Yie Gezhuang gold mine, following approval by China’s State Planning Committee.

Princess Resources (Vancouver-listed) has received approval from the Chinese National Gold Bureau for its Xinxian gold project, which is a joint venture with Hunan Xinxian Geological Mining Corporation. It contributes $2M to the joint venture. Princess will earn a 51% interest in 3 properties. The project must be approved by the State Planning Commission.

Southeast Asia Resources, Co. Ltd. (Boand Gold Corp.) of Canada and Guangxi-based Bai-se Gold Industry Co., have entered into a joint venture aimed at developing mines in the Gaolong area, with estimated reserves of 11.5 mt and proven reserves of 7.15 mt containing 5.71 g/t Au at 11.5 mt. Projected expansion capacity is estimated at 55.5 mt/yr with annual gold production to be around 985 kg. All gold produced will be sold to the People’s Bank of China.

**MONGOLIA**

Mongolia and its mining industry have undergone dramatic changes over the past few years; Mongolia adopted a new Constitution in 1992, followed by the introduction of a new Foreign Investment Law effective July 1, 1993, and a new Law on Mineral Resources, effective January 1, 1995. Under the Investment Law, foreign mining companies may be entitled to a 5-year tax holiday and 50% tax relief during the subsequent 5 years. Investment conditions for both Mongolian and foreign companies are apparently equal. Under the Law on Mineral Resources, exploration licenses are granted for a period of 3 years with two renewals of 2 years possible on request. Mining licenses are for a period of 30 years, with a renewal possible for 20 years on request. Holders of exploration licenses have the first right to change their exploration license to a mining license.

Mongolia is located in part of the Central Asian mineralogical belt where three important metallogenic zones, Altai-Sayan, Mongolian Transbaikalian, and the south Mongolian, have been identified. Around 500 deposits are being mined with copper-molybdenum, gold, fluorite, and coal being the main commodities. In the Altai-Sayan zone of NW Mongolia, deposits of tungsten, molybdenite and copper occur in association with intrusions of Caledonian age, in addition to vein-gold and iron deposits. The largest number of deposits identified so far occur in the Mongolian Transbaikalian zone in NE Mongolia. Copper, molybdenum, tungsten, zinc, gold, fluorite and iron deposits are found in a variety of geological settings. To the south, the southern Mongolian zone occurs in Hercynian terrain, which is host to deposits of copper, polymetallic gold, lead, molybdenum, tungsten, arsenic, zinc and rare earth metals.

Armona Gold Corporation has entered into a joint-venture with Erdnet Mining Company, a Mongolian national enterprise, acquiring a 49% interest in the Erdmin copper project. Production
began in January, 1997, recovering copper through SX-EW processing of waste rock at the Erdenet mine. Full production capacity is 10 t/d. The waste dumps are estimated to contain 100,000 t of copper. Mongolia Resources announced the discovery of a large, well-defined Au soil anomaly, referred to as the Naangar zone, on their Bumbat property in an area of seriferous stockwork quartz veininig and alteration. The anomaly is 1.700m long and 200m wide, and open in both directions. Grades are said to average 1.25 g/t Au, with some samples as high as 62.5 g/t Au.

Mongolia Gold has been exploring its recently acquired property, which is reported to have potential for Carlin-style Au mineralization.

In the 1980s, the Mongolian government identified several Au anomalies up to 10 km in length on the property. Mongolia Gold has also reported results from the Damb prospect on its Lomgeton property. Reportedly favourable for Olympic Dam-style mineralization, trench sampling returned elevated values of Cu, Co, and U.

**JAPAN**

Japan has a long history of exploration and mining, with over 5,000 mines having been in operation at one time or another. In terms of exploration and mining (as opposed to smelting), the mining industry has been on a dramatic decline for several decades. In 1973 there were 41 metal mines employing over 20,000 people; by 1986 the number of mines had dropped to 15, and today only 5 mines are operating. These are the Hishikari Mine (a low sulphidation-state epithermal Au deposit owned by Sumitomo Metal Mining) in the Kusatsu area of Kyushu, the Kasuga Mine (a high sulphidation-state epithermal Au-Cu deposit, held by a subsidiary of Nippon Metal Mining) in the Nankatsu area to the south, the Kuroyama Mine (a low sulphidation-state epithermal Au deposit) in SW Hokkaido, the Toyoda Mine (epithermal Pb-Zn-Cu-Ag deposit owned by Mitsui) also in SW Hokkaido, and the Kainuoka Mine (Pb-Zn skarn owned by Mitsui) in central Honshu.

Facing rising costs of operation, the last foreign companies finally pulled out of Japan several years ago. Since 1967, the Metal Mining Agency of Japan (MMAJ) has assumed an important role in domestic exploration in cooperation with the major Japanese mining companies. In fiscal year 1997–1998, the MMAJ conducted exploration in 8 regions. In the Hokkaido-Hokkub region of northern Japan, twelve core holes totalling 2,700 m were drilled on the Seta prospect during the 1997 field season, in conjunction with an airborne electromagnetic survey covering 800 line km. A NWT-trending low sulphidation epithermal vein system was defined with the best reported intersections being 15m containing 5.09 g/t Au, 63.41 g/t Ag and 18m with 7.94 g/t Au, 110.37 g/t Ag. Locally, crustiform quartz veins have returned values as high as 63.5 g/t Au and 1.095 g/t Ag. Exploration is continuing. The deposit is one of more than 50 epithermal Au-Ag deposits which occur in association with the Monbetsu-Kamishihoro graben and andesitic-dacitic volcanic host rocks. Kohnomon, the largest Au deposit of the region, historically produced 73,2 tons of gold.

In northwest Hokkaido-Hokkub region at the Essaiti prospect, a major reconnaissance stream sediment survey covering 1,930 km² was carried out in order to identify epithermal Au-Ag targets; preliminary data indicates several probable targets. At the other end of the country, a major effort is underway to find epithermal Au mineralization in the 2,600 km² Hokukatsu-Kushikino region, well known for the 260-tonne Hishikari epithermal Au deposit. Sumitomo Metal Mining recently reported that the mine had produced a record total of 83.1 tonnes of Au—the most Au produced by a single Japanese mine. In fiscal 1996–97, an airborne aeromagnetic and radiometric survey totaling 1,255 line km with 200m line spacing, was flown by WorldGeoscience of Australia over the Hokukatsu-Kushikino region, and a ground truth program being carried out by the MMAJ is now nearing completion.

**VIETNAM**

Vietnam is regarded as being relatively well-endowed in a diversity of mineral resources when compared with other countries of Indochina. The main commodities are iron, chromite, copper, tin, lead, zinc, tungsten, rare earths, placer gold, gemstones, and coal.

Spectrum Resources completed two drilling programs during 1997 on their 600 km² Ta Khoa concession (70% interest) at Ben Phuoc west of Hanoi. The new results for the shear-hosted massive sulphide mineralization indicate a proven reserve of 658,500 t containing 2.5% Ni, 2.0% Cu, and indicated reserves of more than 1.1 million tonnes containing 1.9% Ni and 0.9% Cu. A feasibility study is planned to be completed in early 1998. Several other ultrafracture intrusions having potential to host Ni mineralization have also been discovered, in addition to a potential porphyry-type Cu-Mo target in the western part of the concession.

Golden Tiger Resources NL (an Australian-based company), has spent over US$4 million since entering Vietnam in 1993. A strategic alliance was formed in 1995 with Teck Exploration to explore for precious metals in Vietnam. The Na Tum joint venture project is a manganese-base metal deposit located 120 km NW of Hanoi in Bac Can Province. The deposit has an inferred resource of 12.7 Mt containing 9.95% manganese with Ag, Pb, and Zn credits. A similar higher grade deposit has also been discovered in the northwest part of the license where further work is required. Tiberon Minerals Ltd has been carrying out detailed mapping, sampling, and a ground magnetic survey on their Col Ky stratabound Pb-Zn-Ag deposit, 90 km NW of Hanoi. Soil sampling has identified an anomaly with average values of 101 ppm Cu, 907 ppm Pb, and 70 ppm Zn. They have also been carrying out diamond drilling with their joint venture partner, Vietnam Resources Corporation Ltd, to define mineralization at depth below the old workings of the Col Ky deposit.

Vietnam joins several of its Asian neighbours by recently “upgrading” their laws concerning the exploration and mining of mineral resources. Although a framework within which foreign companies can operate has been set out, there are several points of concern. These include doubt as to a successful companies exclusive right, rather than the stated “special right,” to obtain a mining license, ambiguity as to the prospectors and explorationists sole right to conduct exploration activities within the area of their license, and the ability of a foreign mining company to export unproduced minerals. The granting of mineral titles falls under the jurisdiction of the Ministry of Industry and includes Mineral Prospecting Permits (MPP) and Mineral Exploration Licenses (MEL) with a maximum size of no more than 2,000 km² with initial terms of 1 year in the case of the former, and of no more than 100 km², or 50 km² in the case of precious minerals and stones, with an initial term of 2 years in the case of the latter. An annual holding fee of US$20/km² (1 year), US$30/km² (2 years), US$40/km² (3 years), and US$50/km² (4 years.
or more) applies to MEL's with a duration greater than 12 months. The total number of MEL's held cannot exceed five at any one time. MPP's and MEL's are transferable and may be renewed for a maximum period of 1 and 2 years, respectively. There is also no obligation for annual relinquishment nor a minimum expenditure requirement. Mineral Mining Licenses (MML) and Mineral Processing Licenses (MPL) are also issued by the Ministry of Industry. A MML is valid for a maximum period of 30 years and can be extended several times but for no more than a total of 20 years. There is no restriction on the number of licenses held. MPL can be issued on the strength of a feasibility study to those not holding a MML. There is no annual holding fee in the case of exploitation, however a royalty of 1 to 13% exists.

LAOS PEOPLE’S DEMOCRATIC REPUBLIC

Although artisanal mining had been going on long before the arrival of French explorers in the 19th century, mainly through local people panning for gold in the dry season at more than 2,000 known sites throughout the country, there has been no historically significant mining activity. Recent mining activity includes barike near Vientiane, gyepen in the Savannakhet province, alluvial tin at Nam Pathene, and high quality sulphides at Houei Xai. The mining sector remains very small and of little, although growing, economic importance, contributing about 1-2% to GDP. The most notable occurrence of alluvial gold occurs within the north-south belt west of Vientiane province, an extension of the Loei Gold Belt of Thailand across the Mekong river. Various reports indicate that virtually all streams draining into the Mekong along a 50 km section in this area are gold-bearing. Tin resources are found in the Nam Pathene Valley where cassiterite occurs in lutitic clay resulting from the weathering of tin-bearing granites. Reserves have been estimated at 112.9 million tonnes @ 0.12% Sn, equivalent to 133.9 tonnes of metal. Alluvial tin, with up to 900 gms of cassiterite per cubic metre, has also been reported to occur directly north and west of the valley. Copper is known to occur as disseminated and vein deposits related to granodiorite intrusions, as well as both strathbound and stratiform deposits. Although lead-zinc (with appreciable silver) occurrences are common in many areas throughout Laos, mainly as lodes dominated by galena or sphalerite, there is no record of past or present mining.

Under a technical assistance program funded by the former Union of Soviet Socialist Republics from 1979 to 1987, a geological study of Laos was conducted which, in some areas, led to exploitation programs that generated cash flow through alluvial gold mining. By the end of the program, however, these activities had ceased. In 1988, Laos opened the door to foreign investment by promulgating the 1st Foreign Investment Law and issuing a limited number of mineral concessions to foreign corporations. Until this time, mineral exploration was essentially confined to the activities of the Department of Geology and Mines (DGM), with or without technical assistance from overseas. Similarly, apart from the artisanal mining mentioned above, all mining is by the State Mining Enterprise.

In 1990, following a preliminary visit in 1989, CRA (now Rio Tinto) Exploration was the first major company to seriously look at Laos. A literature review and field visits led to the application in February 1991 for a 5,000 km² area in Savannakhet/Khammouane provinces. A contract was signed in 1993, based on Indonesia’s Contract of Work system (introduced because of the lack of mining legislation in Laos at that time). Exploration is now at an advanced stage with an in-situ inferred resource of 13 Mt at 3 g/t Au having been announced. In 1991, Normandy Anglo Asia entered Laos and proceeded to negotiate an agreement similar to CRA’s; however, they abandoned their program after several targets were unsuccessfully drilled and exited Laos in 1996. Normandy Anglo Asia entered Laos in 1992 and also under an agreement similar to CRA’s, continues to actively explore their Phonsavan licence area. Scant drilling of several targets within the Phu He, Khambolie, and Bohr Thane prospects returned intersections with significant widths of gold and copper mineralization. Further drilling to test deeper levels of the Phu He prospect late last year were reported to be successful. Shallow drill intersections from Long Chiang Track were also reported, with 51m containing 2.1 g/t and 25.6 m with 2.7 g/t in separate holes. These were to be further tested during the March quarter of 1997.

Two small entrepreneurial companies, Century and Hanuman, also signed contracts with the Lao government but were unable to turn up anything of significance. A number of Chinese and Thai entrepreneurs have also signed-up blocks of limited extent in Laos, but the nature of the agreements and current status is unknown. On 12th April, 1997, Laos first mining law was promulgated. The maximum size of concessions for Prospecting Permits (PP) and Exploration Permits (EP) are 2,000 km² and 100 km², respectively, with initial terms of 2 years (PP) and 3 years (EP), during which annual relinquishment of >25% (PP) and >50% (EP) applies. Maximum size of concessions for exploration and holders of a Mining Permit (MP) is 10 km² with an initial term of <30 years renewable for another two 10-year period. An annual holding fee of US$3-12/ha/acre applies, along with a royalty of 2.5% of sales. Mining rights are transferable.

MYANMAR

Although only a small number of mines are currently in operation, the Union of Myanmar has had a long history of mining copper, lead, zinc, tin, tungsten, antimony, cassiterite, iron and gemstones, and has more recently seen a revival in exploration and mining activities. Prior to gaining independence from British rule in 1948, British private companies held most of the mining leases for producing lead, zinc, silver, gold, tin and gemstones. These were continued during the 1950s as joint ventures with the Myanmar government. Since the 1960s, however, when all private companies were nationalized under the Government’s socialist economic development plan, mining has been carried out almost entirely by the State. In 1989, the Government began encouraging foreign investment in the Mineral Sector with the promulgation of an open door economic policy. In order to encourage investment, the Government has called for four times for international bids for properties based on the Myanmar Mining Law of September 6, 1994. The first round covered 26 pre-selected blocks, which had been previously surveyed and indicated potential for mineralization. The first round of bidding resulted in Ivanhoe Myanmar Holdings Ltd. International Panorama Resources Corporation (Canada), Pacific Arc Exploration NL (Australia) and East Asia Gold Corporation (USA) being granted permits. The second round of
properties included those for which no bids were received during the first round plus several new blocks. The third round of bidding is currently in progress and involves an open tender on a 'sealed bid' basis with a total of 12 blocks of approximately 1,400 km² each.

Indochina Goldfields and its partner, Mining Enterprise No.1 of Myanmar, a 50:50 joint venture, has awarded contracts to provide financing, construction and copper marketing for Phase I of mining and production at the Myintwa copper project in the north-central part of the country. Myintwa ore is suited to heap-leaching and SX-EW treatment, eliminating the need for a mill or smelter onsite. Production from the Sabetango-Kyintaung deposit at a rate of 25,000 t/y of copper cathode is scheduled to begin in 1999 at a cash operating cost of 48 cents (US) a pound. Reserves are sufficient to support mining at planned rates for at least 20 years. A separate feasibility study has also been completed on the adjacent 480 million tonne Leitadaung copper deposit, which is planned to be a 65,500 t/y producer of copper cathode.

Myanmar First Dynasty Mines Ltd. was successful in acquiring three Au and Cu exploration blocks of 1,400 km² each during the first round of bidding. First Dynasty has a period of 5 years to carry out and complete prospecting, exploration and feasibility studies. If the feasibility study should lead to a development and production recommendation, a joint venture between First Dynasty and the appropriate government mining enterprise would result. Following geological mapping, stream sediment and rock chip sampling, encouraging results were reported from an area near the axis of the Burma Volcanic Arc, approximately 250 km north of Mandalay in north-central Myanmar. To date, eight Au anomalies have been identified within the block, generally close to the contact zone between the granodioritic Pinlha-Intrusive Complex and older metavolcanic rocks. Sampling along this contact at Naungpat Ridge and in the central part of the claim block returned promising results with 142 samples averaging 8 g/t Au. Samples from dump around prospect pits and shafts returned an average of 11.1 g/t Au, whereas chip channel samples across 1 to 3 m of exposed bedrock returned average gold values of 0.74 g/t. Stream sediment sampling in the Namma area, 8 km northeast of Naungpat Ridge, returned maximum values of 0.5 g/t Au. Sampling is also being carried out on a 1 km x 2 km structurally complex area where silicified, iron-stained volcanic rocks outcrop. Sampling at Lei-U, 4 km east of Naungpat Ridge, has returned an average value of 5.5 g/t Au. The better gold values are found in a quartz vein network hosted by granodiorite. The granodiorite is highly altered and also contains highly anomalous Au values. Core drilling on these prospects was scheduled to begin in November 1997.

AUSTRALIA AND SW PACIFIC
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AUSTRALIA

The announcement on June 4, 1997, of the progressive sale of 167 t of gold by the Reserve Bank of Australia over six months was enough to drive the international price of gold into the ground. The action highlighted the fact that of all metals, the stocks of gold above ground, including the 35,000 t held by the Central Banks, represents an overhang. Other actions following the financial meltdown in several Asian countries forced the US gold price to an 18 year low of US$279/oz in early January, 1998. The only saving grace DownUnder has been the depreciation of the Australian dollar vs. the US$ (down to AUS$0.62/US$ in early January 1998), which yielded about the same revenues to the Aussie gold producers as the pre-meltdown gold price. This, coupled with the strong forward sales of the major producers, indicates an overselling situation. I guess we are all hopeful that the Swiss people will reject the 1999 referendum notion that their Central Bank should be allowed to sell 1,000 t of gold.

Although the Australian dollar gold price is pretty well unchanged and demand for gold is still high, perceptions and sentiment in the market place have been different. Australian exploration is undergoing a major rationalization. Several norther-southern gold executives are having their Australian weighting and several joint ventures are up for reallocation of equity. Exploration layoffs are occurring and the junior, particularly those strapped for cash, are seeking big brothers and sisters.

A very pick-and-choose buyers market is opening. Stocks have been oversold and investors are hesitating to back resource developments where commodity price weakness, coupled with the Asian banking and economic backwash, is causing concern. Gold mine closures include Youanini, Palm Springs, Norseman, Charters Towers, Copperhead, Golden Pig, Frasers, Mt. Todd, and Bullabulling. For all of this concern, Australia has surged to a gold production of some 300 t in 1996/97, potentially second only to South Africa in world production.
Australian exploration prides itself on maintaining a modern technological approach. The current round of digital data releases by the government continues the open availability of data at reasonable cost. Government mineral resource departments are opening web sites and selling information on CD-ROM. The national open file system coupled with the Australian Mineral Foundation’s AESIS bibliographic indexing ensures that rapid search of information is possible. The backing of Australian exploration by State governments is reflected in initiatives such as Discovery 2000, New South Wales where $A350m is being spent on exploration initiatives, including large aeromagnetic surveys.

In one of the wins by the Australian mining industry in recent times, the High Court in the Coronation Hill dispute, ruled that the government cannot expropriate tenements for inclusion in a National Park without paying compensation.

• NORTHERN TERRITORY •

The Central Desert joint venture (managed by Acacia Resources 40%) has announced further drilling results with the Beaver prospect, 35 km west of the Tanami mine, returning encouraging results. Significant intercepts of 2m containing 8.8 g/t Au and 14m containing 9.9 g/t were among the results which are reported to confirm the continuity of high grade mineralization along strike and at depth. At the adjacent Bonsai prospect, low-grade mineralization was intercepted including 12m at 2.3 g/t Au. A new high-grade mineralized zone appears to have been intersected at Banjo. Giant’s Reef Mining has obtained some interesting intersections at Ganymede, (6m containing 9.5 g/t Au) and at Callisto (20m containing 2.5 g/t), in an area without the magnetic signature so typical of the Tennant Creek field. At the Maude Creek gold deposit, with resources of 1.5 Mt containing 7.3 g/t Au, Kilkenny Gold NL is assessing mining and production for projected output of 50,000 oz/y.

The focus of Cu-Au exploration remains on the porphyry systems found in the Ordovician shoshonitic and calc-alkaline basalts, andesites, and comagmatic monzonites and diorites. Three principal magmatic belts are recognized in the central west of New South Wales. The Parkes-Narromine belt is the westernmost and hosts the Northparkes porphyry Cu-Au deposit, (resources of 120 Mt 1.1% Cu, 0.5 g/t Au). This belt also hosts large, gold-only deposits such as the Peak Hill oxide-sulphide deposit, and the Lake Cowal deposit containing 63 Mt with 1.5 g/t Au. The belt extends north under increasing cover. To the east is the Molong volcanic belt of special exploration interest. The low grade Cadia Hill gold mine of Newcrest Mining comprising of 202 Mt 0.73 g/t Au, 0.17% Cu and containing 9 Moz is scheduled for production in August, 1998. Cadia East is an additional low grade resource. Greatest interest rests with Newcrest’s deep (below 475m depth) Ridgeway deposit. An inferred resource of 28 Mt 3.3 g/t Au, 0.95% Cu is the basis for a $24M feasibility study including an $11M decline. In the same region as Cadia, Golden Cross Resources and Imperial Mining NL have been receiving encouraging results at Cargo with the Spur zone having a strike length of 320m and containing resources of 3.3 Mt with 1.2 g/t Au. Gold production began from the MayDay open cut, where a small resource of 0.240 Mt at 2.1 g/t Au (16,000 oz) is being extracted using Vitrocrete ion-exchange technology Cu-by-product. Nord Resources and Straits Resources announced the discovery of Triltion deposit containing 10 Mt with 3% Cu, 25 km from their Girilambone mine.

• QUEENSLAND •

Cloncurry Mining has successfully tendered to purchase Placer Dome’s 70% interest in Mt. Rawdon, with measured and indicated reserves of 24.8 Mt at 1.15 g/t Au and 4.4 g/t Ag; construction is expected to start in late 1998.

The epithermal Vera-Nancy gold deposit in the North Drummond Basin is being developed by Normandy Mining and Battle Mountain Australia on resources of 3.2 Mt at 1.4 g/t Au, containing 1.4 Moz Au, to a depth of 400m. Drilling has targeted resistivity anomalies reflecting silicification and optimum levels of mineralization in the epithermal system. At Twin Hills, Plutonic Resources and Gold Mines of Australia reported additional resources to be added to the base resource of 0.309 Moz Au.

The world’s largest silver mine has been opened by BHP at Cannington, 160km south of Cloncurry; in 1998 the mine will produce 750 tonnes of silver, 6% of the world’s production. The Ernest Henry Cu-Au deposit of MIM and Savage Resources, also in the Cloncurry district, started operations in August, 1997.

• SOUTH AUSTRALIA •

Equinox, working with partner Phelps Dodge (51%) in the Gawler Craton, has continued to find gold in altered granite and breccia at the Nuckulla Prospect. Equinox controls about 150km of the Yalbrinda Shear zone. Helix Resources NL continues to investigate the Yalbrinda Shear zone near Tunkilla.
Grenfell Resources continues to drill granite and adjacent sediments at the Perseverance deposit, where mineralization extends along 600m of strike. Resolute Ltd. and Dominion Mining have commenced studies to mine the Challenger deposit on the Gawler Craton. Resources at the Challenger and Golf Bore gold deposits have been confirmed at 0.4 Moz and a total of 1 Moz is on the horizon.

- **TASMANIA** -

On the north coast of Tasmania, the feasibility study, assessing the possibility of reopening the old Tasmania mine is coming to a conclusion; the mine has a reserve of 1.5 Mt containing 22 g/t Au. Siluro-Devonian Mathinna Beds host the quartz vein deposit of probable Devonian age. Nearby, at Andersons Creek, Allegiance Mining continues to assess a small laterite deposit of 6 Mt containing 1% Ni.

In northeastern Tasmania, MPI has been drilling in the Scamander area at Golden Ridge, following previous work by Billiton. One hole intersected high grades with 4m containing 20 g/t Au in steeply-dipping, sulphidic carbonate veins in Siluro-Devonian Mathinna Beds.

In southern Tasmania, Sedimentary Holdings has been drilling the Forster gold prospect in a metamorphic infill of Precambrian siliciclastic and dolomitic rocks overlain by Cambrian volcanic rocks. These, and the overlying sequences, are intruded by a felsic intrusion of Mesozoic age. Skarns and hydrothermal alteration are present in the surficial and zinc-bearing zones.

- **VICTORIA** -

As a direct outcome of the Victorian Government’s regional aeromagnetic surveys, RGC Exploration has discovered heavy mineral sands deposits in NW Victoria around the Ouyen area. Three deposits, at Kulwin, Woornack, and Rowack, are high energy beach placer in Pleistocene sands. RGC has established resources of 1 Mt of premium grade rutile (3% in situ), 0.6 Mt of ceramic-grade zircon (3% in situ), 0.9 Mt of ilmenite (6%) under burden of 10-15m. Aberfoyle and RZM have a resource at Wemen of 6 Mt heavy mineral sands and are considering a 30,000 tpy mining operation.

- **WESTERN AUSTRALIA** -

Numerous and encouraging drill intersections of Archean bedrock gold mineralization continue to be made in WA as a result of many exploration programs undertaken during 1997-98. At the Rosemont deposit in the NE Yilgarn, held by Johnsons Well Mining (earning 70%), high-grade gold mineralization was intersected in a steeply-dipping quartz dolerite intruding ultramafic rocks, north of the old open pit. Inferred resources are 7.4 Mt at 2.9 g/t Au. Drilling at Binduli North by Intermin Resources Corp. yielded high-grade intercepts at the Janet Ivy prospect where the average grade has been only 1.2 g/t Au. Two kilometres to the northeast, a new prospect, the Judith Vera, has returned drilling results of 15m at 5.1 g/t Au.

In the west Pilbara area, near the site of an old gold rush to high-grade quartz veins, Resolute Ltd. has made a virgin discovery of gold at their Indee project. As follow-up to soil geochemical anomalies, drill results have identified a E-W shear zone 60m wide and 2km long.

The importance of using drilling as almost the sole exploration technique to test concepts of buried mineralization have been no better exemplified than the discovery by Plutonic Resources at Centenary down pitch from the Darlot gold deposit. Plutonic undertook 400m spaced step-out drilling into covered areas east of the Darlot lode. The first 15 holes were negative until, 3km away, 700m-deep drill hole 363 returned an assay of 2 g/t Au over 6 meters, in quartz. Full assays revealed an intersection of 42m at 7 g/t Au—a major discovery in which the gold was not restricted to the quartz. Determination and corporate leadership to persist in continuing drilling to test a concept led to this discovery.

AMX Resources has announced resource estimates of 5.9 Mt at 5 g/t Au in Archean granite at Havana in their Golden Cities project near Paddington, Kalgoorlie. Encouraging intersections are also being returned at the Jakarta deposit 1km to the south. AMX Resources will consider a low-cost, heap-leach operation for these deposits. Nearby, Centaur Mining and Exploration Ltd. is planning to start mining at the Federal gold deposit in mid-1998.

Sipa Resources continues to intersect good grades at the Dublin Hill joint venture over the Mt. Olympus deposit with indications of a resource of 0.5 Moz. Accacia Resources, at the Sunrise Dam mine, has indicated extensions to the Cleo orebody where a revised estimate has increased the mineral resource to 18.3 Mt at 4.2 g/t Au for a deposit total of 2.4 Moz. Mineralization remains open on three sides and drilling is continuing to identify further extensions. Sunrise Dam poured its first gold in March, 1987. At Boddington (Accacia 33%), drilling has confirmed a thick zone of higher grade copper-gold south of the Wandoon prospect. Resources at the White
Foil gold deposit held by Mineral Commodities and Cogema have risen to 10.8 Mt at 2.5 g/t, 0.874 Moz.

Kimberley Resources Ltd. has found a non-magnetic lamproie pipe on the Blina project adjacent to the Ellendale cluster of magnetic pipes, 100 km east of Derby, WA. Some 35 diamonds have been recovered. Striker Resources have recovered diamonds from their Ashmore prospect.

Jubilee Gold Mines NL discovered the Cosmos nickel deposit as the result of drilling an electromagnetic anomaly in a 5km-long ultramafic unit north of Leinster. Intersections include 5.0m with 12.2% Ni and 8.3m with 11.3% Ni; near surface Co and anomalous Pt and Pd are present. Capricorn Resources Australia has an indicated resource at their Emily Anne deposit of 2 Mt containing 4.1% Ni. In the Johnsons Lake joint venture, Capricorn Resources Australia (25%), with Lioncor and Gencore, has discovered new nickel resources at Roundtop East, 4km north of the Emily Anne prospect. The Murrin Murrin laterite nickel project of Anaconda Nickel is under construction for a scheduled startup in late 1998, and will become one of the world’s largest nickel mines. Production by the Sherritt acid leach method is expected to be 45,000 t/y Ni, and 3,000 t/y Co.

Western Australia is the world’s biggest exporter of iron ore, and producers continue to look at new developments. Hamersley Iron (Rio Tinto) is to develop the A$700M Yandicoogina iron deposit with piloting iron ore reserves of 300 Mt and a planned production rate of 15 Mt/y. An Feng Kingstream is continuing to assess development of the Tallaring Peak iron deposit and the A$1.4B Oakajee steel project, near Geraldton. Robe River Iron Associates are assessing development of the West Angelas prospect 100km east of Mt Newman; bodies A & B have a mineable reserve of 540Mt, containing 61.5% Fe2O3.

FIJI

Fiji continues to be a hive of activity with over 20 companies holding mineral tenements. The government’s lifting of the pegging moratorium on Vanua Levu led to a rush and new companies to Fiji were successful in acquiring tenements including New Challenge Resources and ISCOR. The focus of exploration expenditure recently has been on Vatukoula, Tuvatu and Vuda (Emperor Mines), Rakiraki (Beta) and Navakasali (Bruce Resources). The Tavatu deposit occurs in shoshonitic volcanics intruded by monzonite and is the subject of feasibility studies for a new open pit gold mine; resources are 2.7 Mt at 3.7 g/t Au. The old Vuda workings, near Tuvatu, are being investigated by Emperor Mines. On the south coast of Viti Levu, the Namosi deposit of 950 Mt at 0.43% Cu, 0.14 g/t Au, using a cut-off of 0.3% Cu, held by Royal Oak Mines remains dormant. Climax and Hallcroft Mining are planning to drill at the Faddy’s (Misty) prospect where some 1 Mt at 5 g/t Au has been indicated. Camelot Resources has defined a low-grade gold resource on their Ciraniu prospect in Vanua Levu, where 1.3 Mt at 1.5 g/t Au has been estimated; detailed aeromagnetic surveys have been flown recently in an attempt to define new target areas.

Fiji is a significant gold producer with Emperor Mines, on Viti Levu, having resources of 16 Mt containing 7.6 g/t Au; the mine
 plans to achieve a production of 200,000 oz Au by the year 2000. Emperor currently produces about 0.6 Mt/y from many operating faces via two shafts and a decline and, on a recovery of 87%, yielded 124,661 oz Au in 1996/97.

On Vanua Levu, Pacific Islands Gold's Mt. Kasi gold mine, opened in 1996 at a capital cost of $10M, produced 12,200 oz Au and 960 oz Ag in 1996 from 0 Mt/y ore, mainly alluvial. Hardrock resources at Mt. Kasi are now 1.2 Mt at 3.0 g/t Au, and alluvial resources are 0.8 Mt at 1.9 g/t Au. Pacific Islands Gold has made a new gold discovery at Mango North near the Mt. Kasi gold mine. As part of a Japanese Government aid program, the Metal Mining Agency of Japan drilled several prospects with encouraging results at Dakinuba, Vanua Levu. In a clay-quartz breccia vein, the best intersection was 2.3m at 11.5 g/t Au; follow-up drilling is planned.

**INDONESIA**

The massive development of the **rupia** and the potential for political upheaval that may follow economic hardship are causing uncertainty in Indonesia. **Aurora Gold** signed a 4th Generation Contract of Work at the **Toko Tindung** deposit in NE Sulawesi; the deposit has resources of some 12 Mt at 2.8 g/t Au and 7 g/t Ag. The project will be developed at a cost of US$151M and produce 1 Mt/y to produce 350,000 oz Au by 1999, with cash costs of some US$235/oz. The deposit was discovered by geologists following previously located epithermal quartz samples upstream to source. At the **Gunung Selendok** deposit, **Golden Valley Mines** has been getting encouraging diamond drill intersections below anomalous Cu. Zn. Au geochemistry and geophysical targets.

In the Halmera Group, **Newcrest Mining** has indicated a viable project at the **Gosowong** gold project with production over four years of 0.7 Moz Au and 0.7 Moz Ag at the low operating cost of US$151/oz and a capital cost of US$631M. In Sulawesi, **Lone Star Exploration** has the **Awak Mas** deposit with low-grade resources containing 3.2 Moz Au at a cut-off grade of 0.5 g/t. This has been supplemented by discovery of the hardrock deposit, 3km to the north, with wide drill intersections of gold following channel sampling.

**BHP** is considering development of the **Gag Island** laterite nickel resource of 175 Mt, 1.55 Ni with target production of 40,000 t/y Ni if the costs can be contained within US$1.20/lb.

**Austpacific Gold**, **Indomin** and others are investigating the **Kumamba** deposit in northern trian Jaya where a potential resource of 450 Mt with 5% heavy minerals is present. Austpacific’s ERMS reverse-magnetic separation process is proving to be effective in separating ilmenite and chrome in the beach sands.

**MALAYSIA**

In Sarawak, **Menzies Gold** has been exploring the Bau gold deposit and has established 13.8 Mt at 2.2 g/t Au. Feasibility studies indicate that the gold, in shale and limestone, is refractory and sub-economic.

In Peninsular Malaysia, **Target Mining Corporation** holds a 50% interest in tailings and 70% in hardrock at the **Selinsing Gold** project, where resources are heading towards 0.5 Moz, some of the ore is refractory. **Wells Gold Corp** (49%) is considering working the **Raub Australia** gold mine tailings with 2 Mt of material containing 0.75 g/t Au; production is estimated at 50,000 oz/y.

**PHILIPPINES**

Current applications for mining rights are about 1500 MPSA’s, 112 FTAA’s, and 19 EP’s covering 3% of the Philippines land area. Only about 20 mines are operating in the Philippines. Following the Placer Dome-Marcopper tailings dam spill, the government is revising the terms of the FAA.

**Eastern Gold Corp** continues to receive encouragement at the T'biol gold and silver project in southern Mindanao, with 800m of strike to the epithermal system. The gold is so fine-grained that it can float in water; a sludge technique has been introduced to capture losses from clay zones. At **Lam Asam**, tunnel sampling has yielded values in excess of 1000 g/t Ag and gold values have been sampled along the Double SS vein.

Resources at the Malbato gold prospect of **Philippine Gold** are now 32.8 Mt at 1.2 g/t Au containing 2 Moz; a feasibility study is in progress. **Talon Resources NL** (earning 60%) plans to investigate the **Sulat** project on Samar Island, 525 km south of Manila. Resources are believed to be 7.5 Mt at 1% Cu, 0.6 g/t Au, 21 g/t Ag; zinc is also present. On Mindanao, **Nagold Hill Mines** is acquiring 80% of the **Sunshine** gold mine, where small-scale miners have been working a high-grade epithermal vein since 1990; it has never been drilled. **Yinnamon NL** is exploring the **Guainog** porphyry copper deposit on Luzon Island, where resources are 133 Mt at 0.6% Cu, 0.7 g/t Au at 0.85% Cu-equivalent cut-off. **Clayton Mining** is at the bankable feasibility stage of study on the **Didipio** porphyry Cu-Au deposit, and has a joint-venture with **Cyprus-Amax** over the old **Suluro Peninsula** goldfield in northern Mindanao. **Oxiana Resources** is exploring the **Gambang** project, north of Manila on Luzon where drilling of a geophysical target returned low gold and copper values. At **Pao**, 15km south of Didipio, stream sediment sampling has outlined gold anomalies of over 200 ppb in six areas.

**PAPUA NEW GUINEA**

In the highlands, at their **Morobe** project, **Australian Gold Fields** (AGF), via Provincial Gold Fields, has acquired an option to a major interest in Rio Tinto’s Wafi Co-Au. Zone A has inferred resources of 32 Mt at 2 g/t Au and a porphyry copper system with 100 Mt at 1.3% Cu, and 0.6 g/t Au. AGF plans to begin production at a rate of 300,000 oz/y from its high grade **Havata** gold deposit (1 Moz) by mid-1999. This will be followed by development of the **Hidden Valley** and **Kaveri Creek** deposits. Overall, the Morobe project has 51 Mt at 2.3 g/t Au containing 5 Moz Au and 84 Moz Ag. At **Mt. Kere, Madison Enterprises**, earning 65%, has extended the mineralized Western Roscoelite zone with intersections such as 50m at 13.7g/t Au. On the Tabar Islands, **Nord Pacific** has expanded the **Simberl** oxide resource to 0.44 Moz in an area of 2km x 4km; surface anomalies are about 0.2 g/t Au. Also in the highlands of PNG, 100km west of the Wafi area, **Macmin NL** and **BHP** have discovered the **Crater Mountain** deposit below auger soil anomalies of up to 18 g/t Au. **Union Mining NL** continued exploration of the D’Entrecasteaux Islands and has indicated a resource at **Ganeta** on Fergusson Island of 2.3 Mt at 2.3 g/t Au. At **Wapoli**, drill indicated resources are 7 Mt at 1.5 g/t Au.

**SOLOMON ISLANDS**

At the Gold Ridge mine, **Ross Mining** plans a first gold pour in June, 1998 after a development capital cost of $64.5M; proven and probable reserves are 19.5 Mt at 1.65 g/t Au. Recent drilling has increased the main Valebalchichili pit reserve to 0.808 Moz Au.
CANDIDATES FOR SEG FELLOWSHIP:

To All Fellows:

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

Address Comments To:
Virginia S. Gilleran, Admissions Secretary, SEG
IDAHO GEOLOGICAL SURVEY, MC-229
Boise State University • Boise, ID 83725 USA
e-mail: vgillem@bsu.idaho.edu

Bull, Katharine F., Exploration Unlimited, Fairbanks, AK; Helen E. Farnstrom, Madelynn A. Millholland, Trini K. Hindemier
Chappell, Kenneth G., Union Mining NL, Callanvalle, Queensland, Australia; Chris Briolli, Daniel B. Robertson, Richard J. Keinmeier
Giles, David L., Cimarron Exploration Inc., Cordova, NM; Tommy B. Thompson, Miles L. Silbermann, Peter H. Kiwir
Moore, John M., Rhodes University, Grahamstown, South Africa; W.E.L. Minter, Ronald W. Sheets, Felix Mendelssohn
Nelson, Carl E., Recursos del Caribe, S.A., Boulder, CO; Richard L. Nielsen, Thomas L. Thorsen, Thomas A. Loucks
Wakeman, Brian W., Yanamzu Resources, Spokane, WA; Chris Briolli, Daniel B. Robertson, Richard J. Keinmeier
Wilke, Andrew R., BHP Minerals, San Francisco, CA; John E. Larson, Bruce A. Boulter, Richard R. Heid

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SRG/SEG Joint Symposium: Granitoid Types and Mineralization

JUNE 17, 1998

This international symposium, sponsored by the Society of the Resource Geology and the Society of Economic Geologists, will be held June 17-19, 1998, at the Sumitomo building, Tokyo, Japan, during the annual meeting of the Society of Resource Geology. A Japan-based organization dedicated to the study of earth sciences related to metallic and non-metallic mineral deposits. The theme of the symposium is the re-evaluation of the relationship between granitoid types (such as magnetite-series, ilmenite-series, 1-type and 5-type) and mineralization.

For further information, contact: Society of Resource Geology, Fax: +81.3.3475.0824, email: js0117@simail.ne.jp

--- COORDINATORS ---
Shunso Ishihara (SEG 1978) and Eiji Izawa (SEG 1986)

--- PROGRAM ---
1. Introduction: "Granitoid series and mineralization in the Circum-Pacific Phanerzoic granitic belts, revisited" — Shunso ISHIHARA, Geological Survey of Japan
2. "Alpine granitoid series and associated mineralization in the Carpathian-Balkan fold belt" — Ion-Tudor BERZA, Geological Survey of Romania
3. "Activity and types of igneous rocks in Sikhote-Alin" — Tomru SAKIYAMA, Institute of Natural Environmental Science, Kobe and Takaaki MATSUDA, Himeji Institute of Technology
4. "Title not yet fixed" — JWA Yong Joe, Kyungsang University
6. "Isotope geochemistry of granitoids in South China and their metallogeny" — HONG Daraer, GACS
7. "Title not yet fixed" — ZHU Jinchun, Nanjing University
8. "Title not yet fixed" — Bruce W. CHAPPELL, ANU
9. "Intrusion-related gold-lithophile metal deposits" — Richard H. SILLITOE, Consultant

CALL FOR PAPERS

McLaughlin* Symposium On Mining Geology

To be held during the GSA Cordilleran Section, Centennial Meeting
June 2-4, 1999
at Berkeley, California

Presenters from the mining industry are invited to address topics relating to:
1. Definition and Application of Geologic Ore Controls in Mine-Scale Exploration, Mine Planning and Development, and Mine Operations and Grade Control.
2. Drilling Programs and Practices.
3. Ore Reserve Estimation Techniques.
5. Geotechnical Practices.
7. Input into Environmental Assessments and Operating Procedures, including Mine Closure and Reclamation.

To participate, please respond with a tentative title no later than August 1, 1998 to:

DIANE WOLFGRAM,
Dept. of Geological Engineering
Montana Tech, Butte, MT 59701
Dwolfgram@psl.mtech.edu (406) 496-4553

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Remote Sensing SHORT COURSE

Dr. Floyd F. Sabins is offering a one-day short course entitled "Introduction to Remote Sensing for Mineral Exploration in Southwestern U.S. and Northwest Mexico" on October 18, 1998, in Tucson. This course will include image selection, spectral signatures of altered rocks, models of vein systems, and porphyry copper deposits, new hyperspectral technology, and hands-on exercises. The cost is $125 per person. Registration is separate from the SEG-sponsored Sonora Gold Deposits of Northern Sonora Field Conference. For further information, contact Rebecca Dodge, Tel +1.915.747.5073, Fax +1.915.747.5073, email: <dodge@geo.utsb.edu>, or Floyd F. Sabins, Tel. +1.562.694.7370, Fax +1.562.694.7122, email: <ffsabins@usa.net>.
SYMPOSIUM ON
Ore Deposits in Mafic and Ultramafic Rocks

On August 9–14, 1998, at the 17th General Meeting of the International Mineralogical Association in Toronto, Canada, a symposium, co-sponsored by SEG, is being presented on Ore deposits in Mafic and Ultramafic rocks in honor of the retirement of Professor E.J. Naldrett. Invited speakers for the morning oral sessions are:

- Dr. Sarah-Jane Barnes, University of Quebec-Chicoutimi (co-Chair)
- Dr. Stephen Barnes, CSIRO (co-Chair)
- Dr. Gerhard Brugmann, Max-Planck-Institut fur Chemie
- Dr. Louis Gabri, CANMET
- Dr. James Crockett, McMaster University
- Dr. Stanislav Goronsectve, National Mining University of Ukraine
- Dr. Zdenek Jethan, BRGM
- Dr. Reid Keays, Laurentian University/Monash University
- Dr. Peter Lightfoot, Inc., Ltd.
- Dr. Heikki Paanen, University of Turku
- Dr. Allan Wilson, University of Natal

Abstracts are invited for the accompanying afternoon poster sessions, which will be the principal communication medium during the meeting. Abstracts may be submitted electronically to: <ima98@geology.utoronto.ca/IMA98> or by mail. Details regarding abstract submissions, field trips, and other symposium at the meeting may be obtained by pointing your web browser to: <http://www.geology.utoronto.ca/IMA98>.

For further information, contact: Dr. C.M. Lesher, Mineral Exploration Research Center, Department of Earth Sciences, Laurentian University, Sudbury, Ontario, Canada P3E 2C6, Tel: +1.705.673.6572, Fax: +1.705.673.6508, email: <leshernickel@laurentian.ca>

SEG FIELD CONFERENCE
Gold Deposits of Northern Sonora, Mexico

The newly discovered, disseminated gold deposits along the general northwest-trend between Santa Ana and Sonoyta—the so-called Altar Gold Belt—and selected other gold deposits in northwestern Sonora will be visited during a six-day field trip, October 19–24, 1998, prior to the GSA meeting in Toronto, Canada. Gold deposits to be visited include, among others: Santa Cereñitas (Campbell Resources), San Francisco (Geonautic), Cerro Colorado (Laramide), La Herradura (Peñoles-Newmont) and La Choya (Hecha). Gold mineralization in these deposits occurs in a variety of host rocks ranging in age from Precambrian to Recent. The deposits are broadly coincident with the postulated trace of the Mojave-Sonora Megashear, a core complex, and other controlling structures. This SEG sponsored field conference will start and end in Tucson, Arizona. The cost, including all transportation, food, accommodation (double occupancy), and guidebook is US$570. Field trip registration is limited to 45 participants. For further information, contact Kenneth F. Clark, Tel. +1.915 747.5843, Fax +1.915.747.5073, e-mail: clark@geo.utep.edu.

SEG Web Page Update

http://www.mines.utah.edu/~wmgg/SEG.html

Several interactive forms are now on the SEG webpage; they are: “Change of Address” and “SEG Publications Order Form.” These forms can be filled out right on the screen and will generate an e-mail report to the intended recipient. As always, your comments and suggestions are welcomed.

MINING AND METALLURGICAL SOCIETY OF AMERICA
MINERAL RESOURCES STUDENT PAPER PRIZE

The “Mineral Resources Student Paper Prize” contest is sponsored annually by the Mining and Metallurgical Society of America. Three awards of $2000, $1000 and $600, and recognition will be presented in October, 1998, to the student authors of the mining mineral resource papers. For more information, contact W.C. Peters, Chairman Student Prize Committee, Mining and Metallurgical Society of America, 476 Wilson Avenue, Novato, California 94947.
personal notes & news

CAREER-RELATED CHANGES

► Rick Van Nieuwenhuysen (SEG 1985), formerly with Platinium Discovery Exploration, has been appointed President and COO for both Novagold Resources Inc. and Ericsson Enterprises Ltd. Placer and Novagold are significant shareholders in Ericsson.

AWARDS & ACCOMPLISHMENTS

► Donald W. Kohls (SEG 1973), President of Kohls Exploration Ltd., received the Ben F. Dickerson Award from the Society of Mining Engineers (SME) in recognition of his professional contributions to the mining industry. The award was presented at the recent SME Annual Meeting in Orlando, Florida.

► Donald E. Ranta (SEG 1975) has been elected President of the Society for Mining, Metallurgy, and Exploration (SME) for 1995. He has served SME in many capacities during his 39 years of membership, and becomes the latest in a number of SEG members to hold an executive position in SME. He is President of Union Hill, a Toronto-based mining investment company formed in early 1997.

► Mark C. Rebagliati (SEG 1992) received the Prospector of the Year award from the Prospectors and Developers Association on March 10, 1998 at their recent annual meeting held in Toronto. He was recognized for his contributions to British Columbia’s mining industry, especially in the identification of the M. A. Scatchard, Southern Star and Keno gold-copper deposits, and also for his work in Mexico in delineation of the Reforma VMS gold-silver-copper deposit, and three other VMS deposits in the Campos de Aragón district. He began his geological career in 1970 following receipt of a BSc degree from Michigan Tech in geological engineering and one year of graduate study at the University of Western Ontario. In 1980, he diversified his career path as an exploration geologist with several major mining companies, including Teck Corp., Northwest Canadian Exploration, Saskatchewan Mining Development Corp., Anaconda-Canada, and SemaEP. In 1986, he formed his own company, Rebagliati Geological Consulting Ltd.

DEATHS

► William H. Swayne (SEG 1961; SF92) died on February 16, 1998 at age 85 at his home in Hollis, New Hampshire. He received a B.A. degree in Mining Engineering from the University of California-Berkeley in 1934, and after two years of graduate study, began his professional career as an exploration geologist and mine manager for Napa. In 1940, he started a long career with the Anaconda Company when he became a research geologist at Butte, Montana. From 1948 to 1959 he worked for Anaconda in Chile first as an exploration geologist and then as Chief Geologist - South American Operations at Chuquicamata. In 1959, he was appointed Chief Geologist, South American Division, based at Anaconda’s headquarters in New York, where he also served as Executive Director for various worldwide geological research and exploration projects. Following his career with Anaconda, he was Vice President-Mining and Construction for Morgan Guarantee Trust in New York until 1978, and then engaged as a consulting mining geologist for European Bankers Co., Ltd., London until 1988. During his early years in Chile, he was involved in the development of the El Salvador copper ore deposit. For this work and other contributions to the Chilean mining industry, he was awarded the Gold Medal of Merit from the Institute of Mining and Metallurgical Engineers of Chile. He was a long-standing member of the American Institute of Mining Engineers and various other professional organizations. He served the Society as a Councilor (1972-74) and as a member of the Research and Finance Committees.

OTHER PUBLICATIONS OF INTEREST

Patricia Sheahan • Konsult International, Inc.
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Economic Geology Monograph 9: Mineral Deposits of Alaska
EDITED BY R. J. GOLDFARB AND L. D. MILLER • 483 P., 9 COLORED FIGURES

Gold Deposits in Metamorphic Rocks of Alaska
— R. J. Goldfarb, L. D. Miller, D. L. Leach, and L. W. Snee
Plutonic-Related Gold Deposits of Interior Alaska
Precious Metals Associated with Late Cretaceous-Early Tertiary Igneous Rocks
— T. K. Bundtza and M. L. Miller
Epithermal Mercury-Anomaly and Gold-Bearing Vein Lodes in Southwestern Alaska
— E. W. Steele, C. A. Gent, C. W. Snee and F. H. Wilson
Porphyry Copper Deposits in Relation to the Magmatic History and Palinspastic Restoration of Alaska
— L. E. Young, P. S. George and B. A. Bailey
Porphyry Molybdenum Deposits of Alaska with Emphasis on the Geology of the Quartz Hill Deposit, Southeastern Alaska
— J. C. Ashelman, C. D. Taylor and P. R. Smith
Skarn Deposits of Alaska
Mineral Occurrences Associated with Mafic-Ultramafic and Related Alkylne Complexes in Alaska
— J. V. Foley, T. O. Light, S. W. Nelson, and R. A. Harris
Tin Deposits in Alaska
— J. L. Hudson and B. L. Rand
Uranium, Thorium, and Rare Metal Deposits of Alaska
— T. B. Thompson
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- Oct 19-21, Gold Deposits of Northern Sonora, six-day field conference, Tucson, Arizona, and Northern Sonora Mexico. Kenneth F. Clark, Tel.: +1.915.747.5843, Fax +1.915.747.5073, email: clerk@seg.org (See announcement p. 52 this issue.)

- Oct 26-29, SEG Annual Meeting with the Geological Society of America (GSA), Toronto, Ontario, Canada. Lee Barker, Southern Resources, Ltd., 33 Yonge St., Ste. 1040, Toronto, Ontario, M5E 1S6 Canada, Tel.: +1.416.359.9832, Fax +1.416.359.9141, email: inbox@southernera.com. Includes pre-meeting short course Techniques in Hydrothermal Ore Deposits (see announcement p. 26 this issue); full day research symposium “Las de Gras Diamonds,” and two days of technical sessions.

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