

Copper and Gold Exploration in Southeast Asia

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METALLOGENIC CONTEXT OF RECENT EXPLORATION

Several important events in the mid-eighties and early nineties had a marked effect on exploration worldwide, including the steady increase in Cu and Au prices on the stock market and the dramatic increase in the number of junior companies securing funds for mineral exploration. Both gave rise to an unprecedented level of exploration activity worldwide which continued through to the mid-nineties. Importantly, this period was also marked by a significant increase in our geological understanding of intrusion-related mineralized systems, in particular epithermal and porphyry styles of mineralization, the transitional relationship between these styles of mineralization, and their potential to host both world-class copper and gold orebodies. With a general weakening of tenure security as a result of growing environmental issues and land access problems

in countries such as Australia, Canada, Europe, and the United States, and a general feeling that exploration had matured in these countries, companies began moving further afield from their home ground. Countries opening up to foreign investment were increasingly targeted, including the relatively under-explored magmatic arcs of SE Asia. The mid eighties on have now been marked by numerous copper and gold discoveries in SE Asia, with the major portion of gold and most of the copper resources now known to be contained within gold-rich porphyry copper, epithermal gold and gold-copper, and copper-gold skarn deposits associated with the Cenozoic magmatic arcs, in particular those of the Philippines and Indonesia (Figure 1, Table 1).

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Report on the SGA/Mineralium Deposita Exhibit at the Prospectors and Developers Association of Canada 1999 Annual Meeting

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Following last years success of the SGA/Mineralium Deposita (MD) exhibits at two North American conferences, a new SGA exhibit was presented to the 1999 Annual Meeting of the Prospectors and Developers Association of Canada (PDAC) held in Toronto, Canada, March 14-17. In past years, attendance at this important meeting was usually between 5000 to 7000 people. Attendance at the 1999 meeting fell considerably below past attendance levels, reflecting the present depressed economic environment in the North American mining industry. Our exhibit contained information on SGA, including information on the SGA-IAGOD International Meeting in London, publication opportunities in MD, and highlighted the scientific merits of MD especially from an industry perspective. Also displayed at the meeting were a selection of Springer-Verlag books, copies of the past Proceedings of SGA Biennial Meetings, and the new Eilu, Mikucki, and Groves SGA Short Course Volume 1. Several hundred membership applications and copies of SGA News were given to visitors to the exhibit. The exhibit stand was staffed by David Leach, Steve Scott, and Susan Leach. Steve Scott was especially helpful in attracting local Toronto geologists and students into the stand. Special thanks are due to student members, Erin Marsh and Dorinda Bair for their help in preparation of the exhibit material.

We received 50 new applications for SGA membership, including one corporate membership. The most important selling point for SGA membership was combining membership with a subscription to MD. We also sold about 25 copies of the new SGA Short Course Volume 1. The new memberships and short course book sales are the most obvious and direct benefit of the exhibit. However, the most important benefit was the exposure and increased awareness of SGA and MD to the economic geology community in North America. As in past exhibits, we were surprised to find how poorly known SGA is in North America. Most people recognize MD as a high quality scientific journal but few were aware of the connection between SGA and MD. There was great interest in the London meeting and many people indicated that because of our presence at PDAC, they now plan to register for the meeting. ♦



The SGA Exhibit stand at the 1999 Annual Meeting of the Prospectors and Developers Association of Canada, Toronto, Canada (from left: Norman Russell, Susan Leach, Steve Scott, and Steve Kesler).

SGA News

N. 7 May 1999

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NEWS OF THE SOCIETY

News of the Council

Mineralium Deposita European Office Editor

The Council approved B. Lehmann (Clausthal, Germany) as candidate for the position of the European Office Editor of MD in the '99 SGA Election following the result of the Council Members' ballots (see page 15).

1999 SGA election

Z. Johan, the Chairman of the Nominating Committee, informed the Council that, after taking into account many factors such as geographical balance of Councillors, number of SGA members, mining industry activities and others, the Committee recommended the following candidates, approved by the Council, for the '99 SGA Elections:

Vice President: Purification Fenoll (Spain).

Councillors (term ending 31.12.2003): D.Eliopoulos (Greece), B.Gemmel (Australia), M.Ghisler (Denmark), I.R.Jonasson (Canada), F.Mitrofanov (Russia), H. Stein (USA).

The Council noted its appreciation of the excellent work of the Nominating Committee (Z. Johan, F. Vokes and N. White) which resulted in the submission of this high quality list of candidates.

MD Best Paper Award

The Council decided to give the award to H. J. Stein et al. for their paper *Re-Os ages for Archean molybdenite and pyrite, Kuittila-Kivisuo, Finland and Proterozoic molybdenite, Kabeliai, Lithuania: testing the chronometer in a metamorphic and metasomatic setting* (Mineralium Deposita 33/4: 329-345). The prize will be presented at the SGA General Assembly in London (see page 9).

Mineralium Deposita

645 pages were published in Volume 33 in 6 issues during 1998. So far 225 pages of Volume 34 have been published in what will be 8 issues and 800 pages. Five new Associate Editors started their work on January 1, 1999 (see page 15).

SGA Corporate Members

The Council is aware of the importance of attracting more Corporate Members and agreed that SGA Corporate Members will be offered limited free space for advertising in SGA News.

SGA Promotion

The SGA Promotion Manager, G. Borg, has negotiated with Springer-Verlag regarding possible layouts to be used for

promotion of SGA. Four fold-up booth walls with 12 panels will be ordered and installed at all major meetings in different continents.

Joint SGA-IAGOD Meeting

The Council thanked the Secretary General (Ch. Stanley) and the Organizing Committee for their organization efforts.

The Council recommended that the SGA General Assembly will be held on Tuesday, August 24, from 16.00 to 17.00. The details will be announced in the Third Circular.

Revisions of SGA Constitution

The Council appreciated the efforts of E. Stumpfl (Leoben), past SGA President, for revising the SGA Constitution and suggested that its final version will be presented to all Councillors by the end of June 99 and discussed finally at the next Council Meeting. It will then be distributed together with the 1999 ballot and SGA News N. 8 to all SGA Members in November '99. The Executive Secretary will prepare a proposal for the SGA General Assembly in London to approve a delay in the distribution of the SGA 1999 ballot (November '99 instead of September '99).

North American Initiative

The Council expressed best thanks to David Leach, Steve Scott and Suzanne Leach who managed the SGA stand during the Prospectors & Developer Association of Canada Meeting (March 14-17, 1999, Toronto, Canada). Their efforts resulted in attracting 50 new applications and selling 25 copies of the new SGA Short Course Volume (see pages 2 and 12).

Future SGA Activities

-11th International Conference of the Geological Society of Africa (June 29-July 2, 1999, University of Cape Town, South Africa) - G. Borg will represent SGA as a keynote speaker.

-SGA-IAGOD Meeting (August 22-25, 1999, London, UK).

-Gold 2000 (November 7-10, 2000, Harare, Zimbabwe, organized by the IMM London, UK and the Geological Society of Zimbabwe).

-31st IGC (August 6-17, 2002, Rio de Janeiro, Brazil) - SGA will run 4 symposia: i) Pre-Atlantic Metallogeny of West Africa and Eastern South America (B. Lehmann); ii) Ore Deposits of the Central Andes (L. Fontboté); iii) Mineral Deposits Associated

CHANGE OF ADDRESS FORM

If you have changed (or will change in the near future) your address please fill in this form and send it to:

Peter M. Herzig, SGA Treasurer - Institut für Mineralogie, TU Bergakademie Freiberg, Brennhausgasse 14 - D-09596 Freiberg, Germany; phone: +49 3731 39-2662/2626; fax: +49 3731 39-2610; e-mail: herzig@mineral.tu-freiberg.de

Name:

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Your suggestions and ideas for any topic of interest to SGA are welcome! They can be addressed to any Council member or to

Dr. Jan Pasava
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with Black Shales (J. Pasava); iv) Organics in Major Environmental Issues (J. Pasava -IGCP 429).

IUGS-SGA

IUGS Secretary General, A.C. Boriani, informed the SGA Executive Secretary about the acceptance of SGA 1998 Annual Report and stressed that IUGS welcome the high scientific level of the Society Journal, *Mineralium Deposita*.

Candidature for the 2001 SGA Biennial Meeting

The University of Mining and Metallurgy (Krakow, Poland) has offered its candidature to organize the next SGA Biennial Meeting in 2001. Additional offers may be sent to the SGA Executive Secretary, Dr. J. Pasava (pasava@cgu.cz), as soon as possible. ♦

SOCIETY FOR GEOLOGY APPLIED TO MINERAL DEPOSITS (SGA)

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We expect your letters with comments, news, criticisms, ...

SOCIETY FOR GEOLOGY APPLIED TO MINERAL DEPOSITS

Report of the Executive Secretary about membership

16 Regular Members, 1 Junior Member and 12 Student Members applied for membership from November 98 to March 99

List of NEW SGA MEMBERS
(November 1998 - March 1999)

Regular Members

Alaster EDWARDS, Richmond, Victoria, AUSTRALIA

from 1: COPPER AND GOLD EXPLORATION IN SOUTHEAST ASIA**Porphyry Deposits**

While the majority of porphyry deposits associated with the magmatic arcs of the western Americas are primarily copper deposits, porphyry associated deposits distributed along the magmatic arcs of SE Asia form a spectrum of styles in terms of metal content from being copper-dominant, through gold-rich or molybdenum-rich, to molybdenum-dominant. However, the major portion of gold and most of the copper resources of SE Asia are contained within copper- and gold-rich porphyry style deposits. Major porphyry deposits have been identified within the magmatic arcs of Indonesia and the Philippines, but it is within several well defined belts and clusters related to the magmatic arcs of the Philippines that a concentration, and by far the majority, of porphyry deposits occur.

Unlike the majority of porphyries from the western Americas, porphyries of SE Asia are dominated by spatially limited and isolated, steep sided, cylindrical stocks and dykes of diorite, quartz-diorite, tonalite and granodiorite composition (Sillitoe and Gappe, 1984; Corbett and Leach, 1998) reflecting their generation in an island arc subduction setting. Two exceptions are noteworthy, and include two alkaline-associated gold-rich porphyry copper deposits in the Philippines (Marian and Didipio), which may have been generated through remelting of oceanic crust following back-arc reversal (Johnson, 1987; Solomon, 1990), and porphyry molybdenum deposits in Sulawesi, Indonesia, and Polillo Island, Philippines, which developed in association with monzonite or differentiated monzogranite stocks; the former was possibly generated as a result of continental-continental collision and crustal melting rather than island arc subduction (van Leeuwen et al., 1994).

In general, intrusion emplacement in the magmatic arcs tends to be controlled by major regional structures which vary according to subduction geometry and dominant stress regimes at the time of magma generation and emplacement (Corbett and Leach, 1998). Deposits believed to be associated with transfer structures include Grasberg in Indonesia, and, with arc-parallel or accretionary structures, Far South East in the Philippines.

The characteristic lithocap developed over many porphyry copper deposits of western America (Sillitoe, 1995) and the related copper supergene enrichment blankets are notably absent or poorly developed in the majority of porphyries in SE Asia. Documented exceptions of economically important supergene copper enrichment include King King in the Philippines and Tapadaa-Tombuililato in Indonesia. Sillitoe and Gappe (1984) suggest A-typical local conditions within arcs undergoing generally high uplift and erosional rates. Relatively high erosion rates, however, can indirectly be responsible for the generation of world-class ore deposits through telescoping of epithermal Au deposits over porphyry Cu systems following volcano sector collapse (Sillitoe, 1994).

The porphyry skarn association commonly developed in regions which have accumulated shelf carbonate sequences such as SW north America is notably poorly represented in SE Asian porphyries owing to the restricted distribution of major limestone formations along the volcanic front of the majority of

magmatic arc terranes in the region (Sillitoe and Gappe, 1984). Notable exceptions include the copper-gold skarn ore bodies in the Guning Bijih district of Indonesia (Meinert et al., 1997).

Au-Rich Porphyry Copper Deposits: The island arcs of SE Asia host a substantial proportion of major Au-rich porphyry Cu deposits and include Grasberg, Bata Hijau and Tombuililato in Indonesia, Far South East, Santo Tomas II, Dizon and Didipio in the Philippines and Mamut in Malaysia. All of these deposits contain an average of around 1 g/t Au with more restricted portions of the ore body reaching several g/t, e.g. Santo Tomas II, Philippines, 13 Mt @ approx. 2 g/t (Sillitoe & Gappe, 1984).

Gold-rich porphyries are overwhelmingly hosted by composite stocks of diorite to quartz-diorite, and, to a much lesser degree, more felsic compositions such as tonalite and monzogranite. Deposits are characterized by a strong correlation between the distribution of Cu sulphides (chalcopyrite and bornite) and Au as the native metal (e.g. Dizon, Philippines), in addition to having a notably higher magnetite content (Sillitoe and Gappe, 1984). Gold typically occurs as minute (<10-15 micron) inclusions in the copper sulphides (Corbett and Leach, 1998).

In comparison to the porphyry copper-molybdenum deposits of the western Americas which develop at a mean depth of around 3-4km, gold-rich porphyry copper deposits of the SE Asian magmatic arcs are considered to have developed at shallower crustal levels, around 1km, although over vertical extents of 1 to > 2km (Cox and Singer, 1988; Sillitoe, 1993). Corbett and Leach (1998) suggest that the variation in Cu:Au ratios of the porphyry copper and gold systems of SE Asia partly reflects differences in the temperature of mineralization as seen in the associated alteration assemblages: gold-rich systems are cooler and associated with sericite, chlorite or clay alteration assemblages as opposed to copper-rich systems which are hotter and associated with potassic and calc-silicate alteration assemblages. The Grasberg deposit in Indonesia differs from the typical Cenozoic magmatic arc related Au-rich porphyries of the region having a higher biotite content associated with K-feldspar alteration in the potassic zone and the presence of widespread sericitic alteration (Van Nort et al., 1991).

Epithermal Deposits

Numerous epithermal deposits occur in SE Asia and are essentially confined to late Cenozoic magmatic arcs, predominantly of Miocene or Pliocene age, specifically the arcs of the Philippines and Indonesia. By far the majority of these younger epithermal Au deposits are low sulphidation in character and are targeted for their relatively high-grade gold content. High sulphidation epithermal deposits do occur however, although, apart from several notable occurrences, are small in size. Gold is the main economically recoverable metal among the smaller deposits while gold, copper, and silver are all important metals among the larger deposits.

Older epithermal style mineralization has also been reported from the region, though deposits are comparatively restricted in number and appear to be confined, with the possible exception of several deposits in Sumatra, to the Asian mainland (Mitchell and

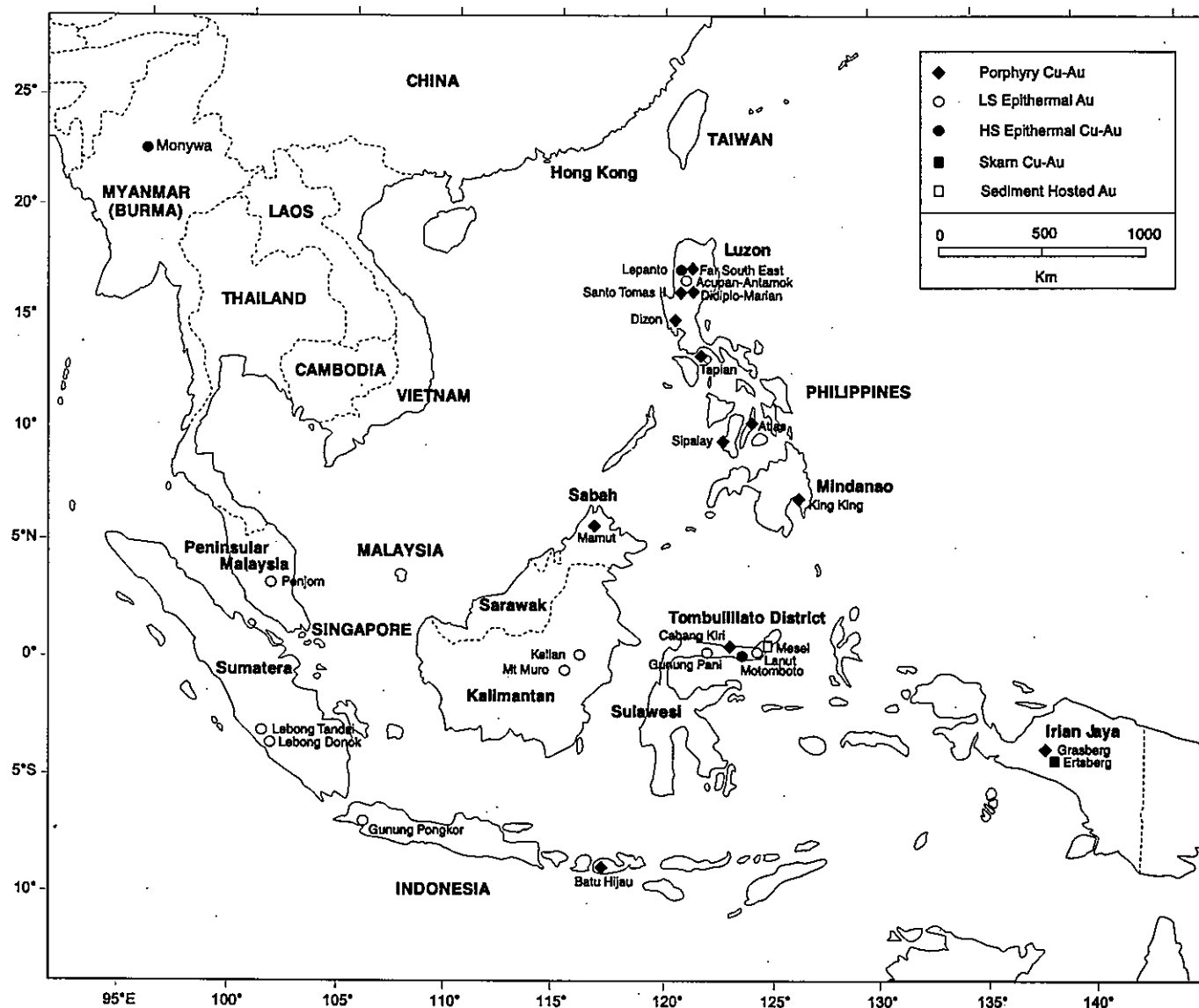


Figure 1: Location of major copper-gold deposits mentioned in the text.

Leach, 1991; Carlile and Mitchell, 1994).

According to Mitchell and Leach (1991) the oldest epithermal province coincides with a calc-alkaline magmatic arc of probable latest Permian to early Triassic age (Kumanchan, 1989) extending from Laos through Thailand to the east coast of the Malay Peninsula. In addition, a minor epithermal province occurs in southeastern Vietnam coinciding with a Jurassic to Cretaceous magmatic arc (Doi Hai Dzung, 1988; Nguyen Kinh Quoc, 1989).

Low Sulphidation Au Deposits: Several authors, including Sillitoe et al. (1990) and Carlile and Mitchell (1994), have noted significant textural and mineralogical variations among epithermal deposits of the SE Asia region. Corbett and Leach (1998) have recently suggested that these variations among epithermal deposits of the southwest Pacific have arisen as the term "epithermal" has been used flexibly to include, among others, "all porphyry-related gold deposits formed outside the porphyry environment". These authors suggest that a continuum of intrusion-related low sulphidation styles can be identified, and distinguish between the classic epithermal quartz-adularia-sericite veins and epithermal quartz gold-silver systems, the

latter having a more obvious magmatic association. Readers are referred to Corbett and Leach (1998) for a more detailed discussion.

Low sulphidation epithermal deposits may host significant gold reserves and are well documented from the magmatic arcs of SE Asia. The majority of large low sulphidation deposits occur in association with the Western Luzon and Philippines arcs in the Philippines, and the western Sunda-Banda and Central Kalimantan arcs in Indonesia. Less economically important examples are numerous, and occur in association with almost every Cenozoic arc in the region.

Low sulphidation deposits, although often not obviously spatially associated, have been shown to be genetically related to calc-alkaline intermediate to silicic intrusions, with mineralization often being hosted by co-magmatic volcanics of similar composition. Less commonly, deposits are also associated with intrusions of alkaline composition. Deposits display a wide variety of mineralization styles including banded fissure veins, sheeted veins, vein-breccias, and stockwork forms, all of which may occur within one deposit. Minor mineralization in the form of disseminations (e.g. Kelian and Gunung Pani, Indonesia,

Table 1: Reserve and grade figures for major Cu and Au deposits of southeast Asia (Data from Metals Economic Group, 1998; Sillitoe & Gappe, 1984). *Data from Sillitoe and Gappe, 1984 includes past production.

	Reserves MT	Total Resources MT	Certainty	Cu %	Au g/t	Ag g/t
PHILIPPINES						
Far South East	66,000,000		Proven	0.90	1.99	
Didipio	17,200,000		Proven & Probable	0.66	2.37	
		120,928,000	Measured & Indicated	0.39	0.97	
Marian	16,000,000		Geologic	0.5	0.62	
	750,000		Drill Inferred		5.31	
Dizon	5,974,040		Proven & Probable	0.29	0.72	
	11,600,000		Proven & Probable	0.314	0.41	
Santo Tomas II*	328,000,000		Proven & Probable	0.34	0.61	
	121,000,000		Proven & Probable	0.47	0.93	
Tapian*	177,000,000		Proven & Probable	0.52	0.12	
Atlas (Biga)*	395,000,000		Proven & Probable	0.43	0.25	
Atlas (Carmen)*	390,000,000		Proven & Probable	0.43	0.24	
Atlas (Lutopan)*	533,000,000		Proven & Probable	0.50	0.31	
Lepanto	4,399,000		Proven & Probable	1.76	2.37	
Antamok	505,000		Mineable		2.02	
		12,113,000	Drill inferred		3.48	
INDONESIA						
Bata Hijau	1,020,000,000		Proven & Probable	0.52	0.41	
Grasberg-Ertsberg etc	3,511,000,000		Proven & Probable	1.044	1.023	
Kelian	73,600,000		Proven/Probable/Possible		1.54	
Mt Muro	5,183,000		Proven & Probable		4.18	92
		13,700,000	?		3.2	69
Gunung Pongkor	5,000,000		Proven & Probable		12.1	130
Gunung Pani		30,000,000	Drill inferred			
Lanut		5,480,000	Unknown		2.8	
MALAYSIA						
Mamut						
Penjom	3,940,000		Proven & Probable		3.49	
		5,300,000	Drill inferred		3.39	
MYANMAR						
Monywa	155,000,000		Proven & Probable	0.47		
		560,000,000	Estimated	0.32		
Monywa (Letpadaung)	1,069,000,000		Proven & Probable	0.4		

Carlile and Mitchell, 1994) and replacements (eastern Mindanao, Philippines, Mitchell and Leach, 1991) may also occur. Ore minerals common to the majority of deposits include native gold, electrum, pyrite, marcasite, sphalerite, galena and Ag-sulphides and sulfosalts. Sulphide contents are generally low, marcasite common, and in some deposits a mineralogy which is Ag-rich occurs. Outstanding examples with around 1 million ounces or more of Au include, in the Philippines, Acupan (84 t Au), Antamok (257 t Au, 150 t Ag), and, in Indonesia, Gunung Pongkor (102 t Au, 972 t Ag), Lebong Tandai (45 t Au, 479 t Ag) and Lebong Donok (41 t Au, 229 t Ag) in the Sundra-Banda arc, Kelian (176 t Au) and Mount Muro (46 t Au, 1,023 t Ag) deposits in the Central Kalimantan arc, and Gunung Pani (40 t Au) and Lanut (29 t Au) in the Sulawesi-East Mindanao arc (White et al., 1995; Carlile and Mitchell, 1994).

High Sulphidation Au-Cu Deposits: Although high sulphidation systems occur in association with the Cenozoic magmatic arcs of SE Asia, large, mineralized high sulphidation deposits are restricted in number. Gold is the only economic metal recovered among the smaller deposits while both gold, copper and, to a lesser extent, silver are important metals recoverable from the larger deposits (e.g. Lepanto in the Philippines and Monywa in

Myanmar). It is also worthy of note that several high sulphidation epithermal deposits occur within several kilometres of a porphyry Cu system. Examples include the Far South East-Lepanto deposits in the Philippines and the Cabang Kiri deposit in Indonesia. The recent work by Hedenquist et al. (1998) on the FSE-Lepanto deposits unequivocally reconfirms the close genetic relationship that exists between porphyry Cu and high sulphidation epithermal systems.

Skarn Deposits

A variety of skarn types occur in SE Asia, but the only known economically significant deposits are restricted to the copper-gold skarns of the Medial Irian Jaya arc which straddles the Irian Jaya and Papua New Guinea border. The four major ore bodies in Irian Jaya, Ertsberg, Ertsberg East, Dom and the newly discovered Kucing Liar, occur in the Early Eocene dolomitic basal units of the New Guinea Limestone in association with dioritic porphyry stocks which are also associated with deeper porphyry style copper-gold mineralization (Meinert et al., 1997). This complex of skarn ore deposits contains greater than 2.16 bt @ 1.2% Cu, 1.2 g/t Au, 3.95 g/t Ag with over 2500 t (80 Moz) of contained gold. The Kucing Liar deposit accounts for an

additional 222 mt @ 1.42% Cu, 1.57 g/t Au, 5.12 g/t Ag (Widodo et al., 1998).

Sediment Hosted Au Deposits ("Carlin-type")

Although sediment hosted gold is not a primary target among most companies in the SE Asian region, the Mesel deposit in North Sulawesi, Indonesia, with a reported resource of 12.25 Mt @ 5.21 g/t Au (Turner et al., 1994) is worthy of mention as it is the only well documented mineralization of this type within the region. As typical among deposits of this style, mineralization displays a combination of structural and lithological control, but, unlike the economically important deposits from north-central Nevada, U.S.A., the Mesel deposit formed in an island arc environment as opposed to a continental setting. Reactivation of existing structures within a Miocene carbonate stratigraphy provided the pathways for upwelling low pH, volatile-rich, metal-bearing fluids to mix with shallow meteoric fluids, leading to characteristic decalcification and dolomitization followed by quartz-sulphide deposition and gold mineralization (Corbett and Leach, 1998). Common among this style of mineralization is the submicron gold size associated with very fine-grained (<10 micron) arsenical pyrite, late stage stibnite along structural zones within the ore body, and realgar, orpiment and cinnabar present at the periphery of the deposit (Turner et al., 1994).

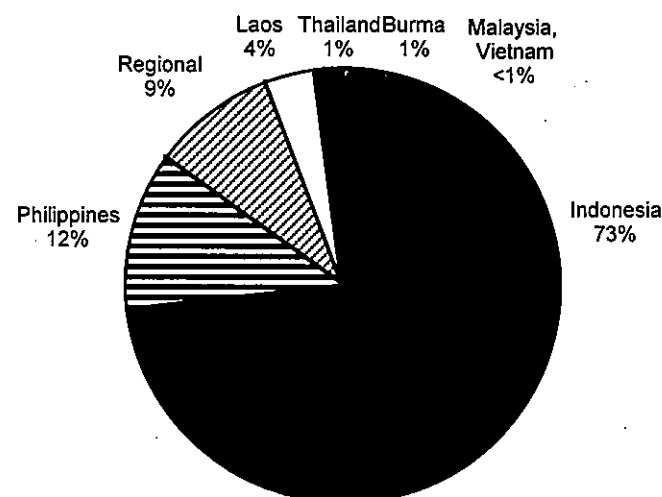


Figure 2: Exploration expenditure in the SE Asian region (Metals Economics Group, 1998).

RECENT DEVELOPMENTS IN MINERAL AND MINING POLICY

In terms of mineral policies, mining laws, and fiscal systems, the SE Asian region has seen quite dramatic changes take place with almost all countries making amendments or introducing new policies and laws over the past several years. The countries of SE Asia, however, differ significantly in many ways, including government structure, policy, metallogenic potential and mining history, and have therefore reached different stages in their transition to a fully open, market-orientated mining industry. Accompanying growth has been a tendency for governments to focus on transnational mining company activities at the detriment of small-scale subsistence mining by individuals and communities, social issues and the environment.

Indonesia has undoubtedly succeeded in developing a stable fiscal regime acceptable to the mining sector and is the

outstanding example within SE Asia. Enacted in 1967 with the Freeport copper agreement, the Contract of Work system (CoW) was Indonesia's first mining law which is now in its seventh generation. The observed success of this system has led other countries, both in SE Asia and elsewhere, to base contracts on a similar system. Following the Bre-X affair, however, criticism mounted from various individuals and groups that the CoW system was not maximizing the benefits to the people of Indonesia. The Government is now considering amendments to the 7th Generation CoW's and will soon introduce 8th generation CoW's. Nevertheless, these are unlikely to be implemented before the national elections. In early 1998, the government approved 38 seventh-generation CoW's: 34 for Au, 3 for Ni, and 1 for diamonds.

Intended to resurrect the mining industry and create a positive investment climate for both local and foreign investors, the Philippine government introduced The Philippine Mining Act of 1995. The mining act is a comprehensive system which stipulates the laws governing all the major aspects of mining right applications, development, operation, and monitoring of mining activities. Continued and lengthy delays in processing Financial or Technical Assistance Agreements (FTAA's can allow a foreign company up to 100% equity) and the introduction of the Indigenous People's Rights Acts (IPRA), which contradicted the mining legislation, significantly dampened foreign company interest in the Philippines. However, recently some companies are beginning to take a more positive view that Exploration Permits (EP's) are a more appropriate level of commitment at the exploration stage, especially where mineralization has not yet been well defined, which may lead to an improvement in the current situation.

In contrast to Indonesia and the Philippines some countries within SE Asia, such as Myanmar and Laos, still favor joint ventures through state-owned enterprises. The Myanmar government does this through international bids for properties based on the Myanmar Mining Law of September 6, 1994. Three bids have been called to date, the most recent in October 1997. According to this law, the government should receive 50% of the total share of a joint venture. Similarly, in order to attract exploration funds into the non-tin sector, the government of Malaysia introduced in 1990 a block system whereby properties, already identified as prospective for gold, are tendered to companies in joint venture with the State Economic Development Corporation (SEDC). The government continues to make improvements, the latest being the implementation of the Mineral Development Act in August 1994.

In recent years mounting pressure by local communities, local governments and non-governmental groups concerning environment protection and the rights and interests of the local people has led governments, in particular Indonesia and the Philippines, to reconsider their current regulatory systems.

RECENT EXPLORATION TRENDS AND COMPANY ACTIVITY

Recent Exploration Trends

Expenditure-related mineral exploration budgets declined significantly worldwide in 1998 from an estimated peak of 5.1 billion US\$ in 1997 following the dramatic downward trend in

both copper and gold prices (Metals Economics Group, 1998). Accompanying these exploration cutbacks, 1998 and 1999 have been marked by several companies, including majors such as BHP and Rio Tinto, restructuring their exploration departments, closing regional offices, and focusing exploration funds. A trend towards acquisition of promising properties through stock-market transactions rather than grassroots exploration has also been noted (Metals Economics Group, 1998).

The SE Asian region has been no exception, rather it has also had to contend with the Bre-X scandal and an across the board weakening in currencies associated with the Asian financial crisis. According to the Metals Economics Group (September, 1998), the Pacific/SE Asia region showed the largest percentage drop in exploration for 1998. A significant proportion of this reduction reflects the strong presence that junior companies have had in this region and the increasingly difficult time they are facing in financing their exploration programs.

Recent Company Activity

Although Indonesia has experienced localized social unrest throughout most of 1998-99, it remains one of the most, if not the most, attractive countries for mineral exploration in the SE Asian region. According to the Metals Economics Group (September, 1998), 73% of exploration expenditure in the SE Asian region was allocated to Indonesia (Figure 2). The largest exploration program and expenditure in 1998 was by Freeport-McMoRan in Irian Jaya (US\$ 36.4 million). Interestingly, the figures also indicate that the proportion of funds allocated to exploration in Indonesia from within the Pacific/Southeast Asia region has decreased only slightly in 1998 compared with 1997 and 1996 levels, i.e. 53% of regional exploration funds in 1998 as compared with 55.2% in 1997 and 55.7% in 1996. In a recent corporate survey of SE Asia by the author, companies currently

active in the region gave Indonesia the highest metallogenic ranking for copper and gold and the highest ranking in terms of favorable investment criteria (including mineral policy, political, financial, monetary, operational, environmental, social/cultural factors). The recognized high metallogenic potential and workable minerals policy coupled with the weak currency would appear to outweigh the negative aspects that continue to plague this country. Indonesia ranked 7th in the world's top twenty gold producing countries in 1997 with 101.4 t, a 10% rise over 1996 derived predominantly from increased production at the Grasberg, Minahasa (Mesel deposit) and Kelian mines (Mining Journal, 1998).

The Philippines is considered one of the most prospective countries in the SE Asian region for both copper and gold. However, hindered by the prolonged delay in granting FTAA applications and the confusion arising from the introduction of IPRA, the Philippines could only attract a relatively small 12% of total SE Asian exploration expenditure in 1998 (Metals Economics Group, 1998). The largest exploration expenditures for 1998 were reported by Climax Mining and WMC. The Philippines ranked 14th in the world's top twenty gold producing countries in 1997, and managed to increase total output by 6% compared with 1996 (Mining Journal, 1998).

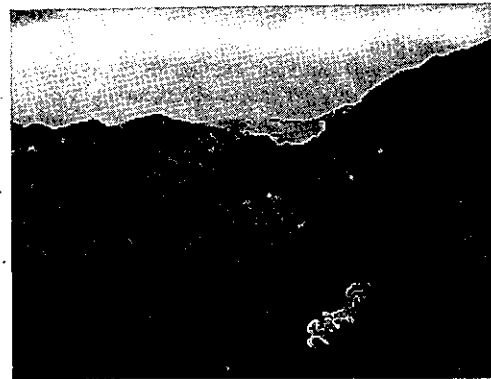
Several junior mining companies are continuing to explore in Malaysia and have taken advantage of the governments block system mentioned above, predominantly in the Kelantan, Pahang and Terengganu States of Peninsular Malaysia, the north area in the vicinity of the Mamut Copper Mine and Semporna Peninsula in southeast Sabah, and the Bau, Serian and Lundu areas of Sarawak. Specific Resources Sdn. Bhd., a subsidiary of the Canadian junior Avocet Ventures Inc., has proven this system to be a success with the opening of the Penjom Gold Mine in late December 1996 in Pahang State. The deposit is a low

1999 Mineralium Deposita Best Paper Award

The 1999 *Mineralium Deposita* Best Paper Award¹ goes to Stein H.J., Sundblad K., Markey R.J., Morgan J.W. and Motuza G.² for their paper *Re-Os ages for Archean molybdenite and pyrite, Kuittila-Kivisuo, Finland and Proterozoic molybdenite, Kabeliai, Lithuania: testing the chronometer in a metamorphic and metasomatic setting (Mineralium Deposita 33/4: 329-345)*

Citation

Using improved ¹⁸⁷Re decay constant, improved laboratory methodology and negative thermal ion mass spectrometry, the authors have determined accurate and precise Re-Os ages for Archean and Proterozoic molybdenites. This advance is important for ore geology since the Re-Os method can be used directly to date an ore mineral, thereby providing information about the timing and duration of ore-forming processes. The authors have combined these new techniques with excellent geological observation, mineralogical determinations and U-Pb zircon dating in a geological *tour-de-force* which will have fundamental consequences for the science.



Dr. H. J. Stein in the Never-Summer-Mts

¹The *Mineralium Deposita* Best Paper Award is made by Council on the nomination of the *Mineralium Deposita* Editorial Board, for the best paper published in *Mineralium Deposita* in the preceding 2 years. Since *Mineralium Deposita* is a leading mineral deposits journal, the award reflects a substantial contribution to the science. The award consists of a citation and an invitation to the lead author to the SGA Biennial Meeting to receive the citation.

²H.J. Stein, R.J. Markey and J.W. Morgan are currently members of the AIRIE group, Department of Earth Resources, Colorado State University. K. Sundblad is currently at Trondheim Technical University and G. Motuza is at the Geological Survey of Lithuania. The study was initiated at the United States Geological Survey and the University of Stockholm.

sulphidation epithermal gold system. Zambia Sdn. Bhd. has also applied for a mining lease for their Bukit Mantri epithermal gold deposit discovered on the Semporna Peninsula (Geological Survey Department, 1998). Gold output increased in 1997 by 58.6% to 4,488 kg from 2,830 kg in the previous year, 3,556 kg coming from primary ore deposits (Geological Survey Department, 1998). The Mamut Copper Mine, located in northern Sabah, is the only significant copper producer in Malaysia having been mined for over 20 years. Reserves will reportedly be depleted by the year 2000. The porphyry copper deposit initially contained 179 Mt @ 0.48% Cu (Taylor and van Leeuwen, 1980) and has also continued to produce significant by-product gold.

In Myanmar, several foreign companies in joint venture with the government mining enterprises have been exploring the government tendered blocks but with only limited success, and given the fall in metal prices, several companies have requested permission from the government to suspend activities. Before withdrawing from Kyaukpahthoe property, Newmont Mineral Exploration did however succeed in identifying a small resource of 3.7 Mt @ 2.6 g/t of Au. An indication that projects can be brought to fruition is Indochina Goldfield Ltd's Monywa Copper Mine which is now producing LME grade copper cathode at a rate of approximately 25,000 t/year.

Very little gold or copper exploration has taken place in Thailand. Nonetheless several junior companies, including Kingsgate Consolidated NL, Omax Resources Co., and Menzies Gold NL, have gained special prospecting licenses and are exploring areas prospective for gold in the lower northern provinces.

In 1990, following a preliminary visit in 1989, CRA Exploration (now Rio Tinto) was the first major company to seriously look at Laos. A literature review and field visits led to an application in early 1991 and 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 continuing on the Khanong and adjacent Thengkharn prospects. Other major companies to explore Laos were Newmont entering in 1991, signing an agreement with the government covering activities in the provinces of Vientiane and Sayaboury, and Normandy Anglo Asia in 1992. ♦

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Summary: In this book some of the major granite provinces of Russia are covered, e.g., Kola-Karelia, Urals, Northern Caucasus, Transbaikalia, Kuznetsk Alatau, Tuva, Sakha-Yakutia, Yana-Kolyma, as well as those of adjoining regions, such as the Pamirs of Tajikistan, the Tien Shan of Kyrgyzstan, for Kazakhstan the Kokchetav massif and Central Kazakhstan, and Mongolia. The paleo-geodynamic setting of the granite series is outlined for each province. Geological, geophysical, petrological, geochemical, and isotopic features of ore-bearing granitoids and associated mineralizations (W, Mo, Sn, Cu, Au; Ta, Nb, Li, Rb, Cs, Be, REEs, Bi, Zr) are given. The classification principles of genetic and economic features of the granite-related ore deposits are discussed. The location and distribution controls of these deposits are illustrated by an original schematic map. A brief description for more than one hundred major granite-related ore deposits of the former Soviet Union is given, including economic data on ore resources, mining production, uses, and applications. A larger part of the papers deals with various aspects of the evolution of granite-related ore-producing magmatic systems, as well as the anatomy and magmatic-hydrothermal mechanisms of ore deposition. A technique for 3-d modeling of ore-bearing granitoid bodies down to a depth of 10 to 15 km is presented. Current data on geochemistry and isotopes (Sm-Nd, Rb-Sr) are given which help to clarify the role of crustal and mantle components in the formation of rare metal ore deposits, along with new experimental information on K, F, Cl, and other chemical parameters controlling the ore potential of silicic melt systems. New experimental data are presented on permeability of granitic rocks and on physico-chemical controls in the development of major types of metasomatic alteration. This volume provides a first and hitherto unavailable overview of the geology and metallogeny of granite-related rare-metal deposits of Russia and adjacent countries. It is of interest to the mining community and all geoscientists, especially economic geologists, petrologists, and mineralogists.

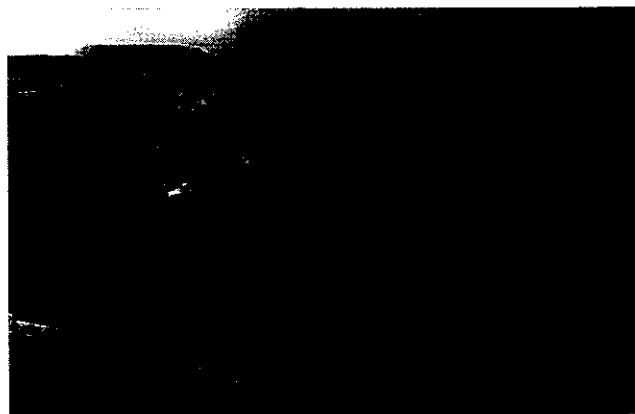
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An in-depth examination with lectures and labs of a spectrum of ore deposits presented by international experts from 5 countries. One day field trip to spectacular basalt outcrops. Instructors include Nicholas Arndt (Grenoble University, France), Yves Fouquet (IFREMER, France), Harold Gibson (Laurentian University, Canada), David Groves (University of Western Australia), Roger Hekinian (IFREMER, France), Peter Herzig (Freiberg University, Germany), Thierry Juteau (IUEM, France), Ross Large (University of Tasmania, Australia), Eric Marcoux (University of Orléans, France), Jean-Paul Milesi (BRGM, Orléans, France), Maryse Ohnenstetter (CNRS, Nancy, France), Steve Scott (University of Toronto, Canada, and IUEM, France) and Noel White (BHP, USA). Sponsored by SGA, CNRS, UBO, GEODE, GDR Métallogénie, Région Bretagne and Communauté Urbaine de Brest. Cost 600 FF.

CONTACT: Professor Thierry Juteau, IUEM, Place Nicolas Copernic, 29280 Plouzané, France. phone: +33 (0)298 49 87 11; fax: +33 (0)298 49 87 60; e-mail: juteau@univ-brest.fr

IGCP-373 FIELD CONFERENCE IN THE URALS: "THE ERODED URALS PALEOZOIC OCEAN TO CONTINENT TRANSITION ZONE: GRANITOIDS AND RELATED ORE DEPOSITS"

Ekaterinburg, Russia

18-30 July 2000

Jointly organized by:
Institute of Geology and Geochemistry (IGG), Ekaterinburg, Russia, IGCP-373 Project, Dr. R. Seltmann, Urals Branch, The Natural History Museum, London UK.

FIELD CONFERENCE TOPICS:

- *Petrology, mineralogy and geochemistry of ore-bearing granites.
- *Features of granites generated in different geodynamic environments.
- *Ore mineralization and wallrock alteration related to granite.

DURATION: 12 days (start and end in Ekaterinburg).

NUMBER OF PARTICIPANTS: 20-30 including local guides.



Pre-Registration Form for International IGCP-373 Field Conference

The eroded Urals Paleozoic ocean to continent transition zone: Granitoids and related ore deposits

Ekaterinburg, Russia: 18-30 July 2000

Name E-mail

I wish to attend. Please send me the Second Circular.

Organisation

Date:

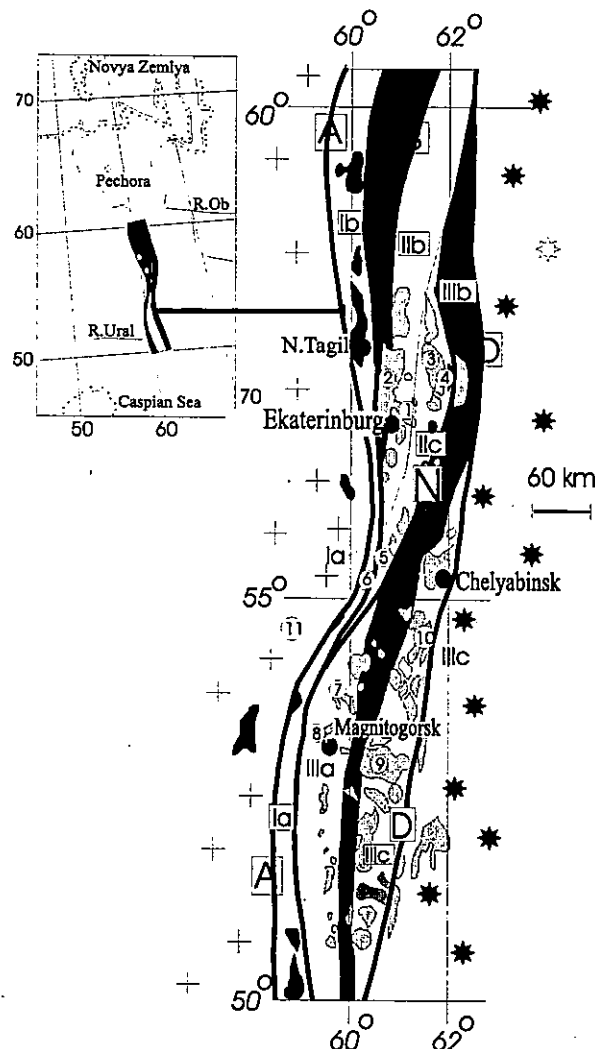
Address

Signature:

Phone

Fax

Send the completed form to both contact addresses reported on page 14.



Scheme of tectonic and magmatic subdivision of the Middle and South Urals (after Fershtater 1992).

I - suture sector; II, III - North-West (II) and South-East (III) island arc - continental sectors with island arc (IIa, IIIa), active continental margin (IIb, IIIb) and paleocontinental (IIc, IIId) zones. Main lineaments: Main Uralian Fault (A), Serov-Mauk Suture (B), Alapaevsk Suture (C), Chelyabinsk Fault (D).

ACCOMODATION in moderate hotels in Ekaterinburg, Magnitogorsk, and Miass.

LANGUAGE: English. At the field excursion a few contributions in Russian language will be simultaneously translated.

REGISTRATION FEE (all inclusive of 10-12 days from-to Ekaterinburg, e.g. accomodation, field transfers by jeeps and bus, catering, reference guidebook): approx. 600.- USD (depends on sponsor funds from IGCP, EUROPROBE, INTAS, GEODE, etc.).

IMPORTANT DATES

1/9/1999	Pre-registration	28/2/1999	Reviews of Abstracts
1/10/1999	Second Circular	31/3/2000	Registration and Payment, Definitive Abstracts
31/1/2000	Submission of Abstracts	18-30/7/2000	Field Conference

VISA: Participants need Russian visa. Formal invitation will be sent from the Organizing Committee to the applicants after registration. Further details on visa, travel and climate will be distributed in the 2nd Circular.

PRELIMINARY EXCURSION PROGRAM

Place and geological setting of excursion objects see enclosure.

Ekaterinburg area (5 days):

Subduction-related massifs and deposits

1- Shartash adamellite massif and Beresovsk gold deposits; 2 - Verkhisetsk batholith and small gold and skarn magnetite deposits; 3, 4 - collision-related Adui batholith; 3 - Shameika molybdenite deposit; 4 - Malyshevka beryl and emerald deposit, Bazhenovsk asbestos deposit.

Ilmeny area (3 days):

5 - granitoids, pegmatites and miaskites of Ilmeny Mineralogical National Park; 6 - Syrostan granitoid massif in the suture sector. Magnitogorsk area (3 days with final discussion); 7 - island arc Verkhneursk massif and Mo-Cu porphyry deposit; 8 - rift-related Magnitogorsk gabbro-granite massif and skarn magnetite deposit; 9 - collisional Dzhabyk batholith.

Reserve objects:

10 - Plast granitoid massif and related Kochkar gold deposit; 11 - Suroyam pyroxenite-syenite massif and related magnetite and apatite deposit.

Contact addresses

Vladimir Smirnov, Institute of Geology and Geochemistry (IGG)
Pochtovy per., 7, Ekaterinburg, 620151, Russia
Phone: +7(3432) 511785; Fax: +7(3432)515252
e-mail: smirnov@igg.uran.ru

Reimar Seltmann, Leader of IGCP-373

The Natural History Museum, Department of Mineralogy

Cromwell Road, London SW7 5BD, United Kingdom
Phone: +44(171) 938 9353; Fax: +44(171)938 9268
e-mail: rs@nhm.ac.uk

31ST INTERNATIONAL GEOLOGICAL CONGRESS

Rio de Janeiro, Brazil

SGA-COSPONSORED

August 6-17 2000

The 31st Session of the International Geological Congress - 31st IGC - will be held in Rio de Janeiro, Brazil, from August 6 to 17 of the year 2000, in cooperation with and under the scientific sponsorship of the International Union of Geological Sciences - IUGS. The 31st IGC is co-hosted by the Brazilian Geological Society, the Brazilian Ministry of Mines and Energy, Brazilian Ministry of Science and Technology, the Geological Survey of Brazil, Petrobras, the National Department of Mineral Production and important Brazilian government agencies, universities and scientific institutions. Industrial organizations and other South American countries will also be involved in the organization of the Congress. The meeting is designed to create a forum for a broad debate of the most significant advances in the geological sciences and to promote a discussion of the theme: Geology and Sustainable Development: Challenges for the Third Millennium.

Registration Fees

Participating members	Accompanying members	Students in 2000
US\$ 350	US\$ 150	US\$ 100

Scientific Program

The Scientific Program of the 31st IGC consists of Colloquia, Special Symposia, General Symposia, Short Courses, Workshops, and Field Trips.

SGA will run 3 Symposia: i) Pre-Atlantic Metallogeny of West Africa and Eastern South America (B. Lehmann); ii) Ore Deposits of the Central Andes (L. Fontboté); iii) Mineral Deposits Associated with Black Shales (J. Pasava); iv) Organics in Major Environmental Issues (J. Pasava -IGCP 429).

For a more detailed programme see SGA News N. 6 (pages 16-17).

Contact address

Secretariat Bureau - Casa Brazil 2000
31st INTERNATIONAL GEOLOGICAL CONGRESS
Av. Pasteur, 404 - Urca - Rio de Janeiro - RJ - Brazil
Cep 22.290-240 - Phone: +55 21 295 5847 - Fax: +55 21 295 8094
e-mail: 31igc@31igc.org - web site: <http://www.31igc.org>

IMPORTANT ANNOUNCEMENT FOR SGA CORPORATE MEMBERS

From the next issue of *SGA News* (N. 8, November 1999) Corporate Members will be offered the special opportunity to ADVERTISE FOR FREE ON *SGA News* FOR A SPACE OF 1/4 OF A PAGE!!!

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David Rickard retires from Editor of *Mineralium Deposita*



David Rickard (Cardiff), Editor of *Mineralium Deposita* since 1992, announced his retirement from the position at the end of 1999. Professor Bernd Lehmann (Clausthal) will join Professor Rich Goldfarb (Denver) as Editors of the journal - subject to the approval of the London Annual General Assembly.

Professor Rickard notes his delight that the Council has nominated Bernd Lehmann for the position. Bernd has been an associate editor for five years and has contributed much to the success of the journal. His expertise in founding and managing the SGA Web Site will stand him in particularly good stead as *Mineralium Deposita* enters into the new world of electronic publishing and manuscript handling. His strong German, French and South American connections will be important in maintaining the journal's international profile.

Rich Goldfarb has been co-editor for 3 years and has been particularly responsible for the journal finding increased favour in North America as well as enhancing industrial interest. Rich will continue to hold a steady hand on the tiller. The experience of the new team with the success of MD will ensure a steady transition and maintain the excellent product that SGA members deserve and expect.

The New Associate Editors of *Mineralium Deposita*

Five new Associate Editors have joined the Mineralium Deposita Editorial Board since January 1999, following a routine turn-over. Hereafter is reported a short professional profile for each one of them.

Julian Menuge obtained a BSc in Geology from Leicester University in 1979 and a PhD in Nd isotope studies of crustal evolution from Cambridge in 1982. Since 1982 he has been employed at University College Dublin, lecturing in Geology since 1989. His research interests include geochemical and isotopic studies of sediment provenance, crustal evolution and igneous petrogenesis. His current research activities include geochemical and isotopic studies of the rhyolite-hosted Fe oxide-REE-Au deposits of Missouri and the Carboniferous carbonate-hosted base Pb-Zn deposits of Ireland.

Alain Cheilletz is Professor at the Ecole Nationale Supérieure de Géologie at Vandoeuvre-les-Nancy, France and a researcher at the Centre de Recherches Pétrographiques at Géochimiques (CRPG) at Vandoeuvre-les-Nancy, research center from the Centre Nationale de la Recherche Scientifique (CNRS). Alain's current research areas are ore deposits geology and K-Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology. His main research projects comprise emerald and noble metals deposits genesis and a participation in the GéoFrance 3D project.

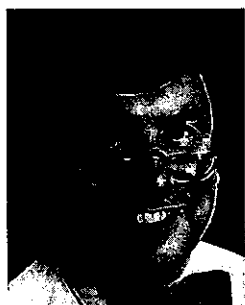
Ross Large is Professor of Geology and founding Director of National Key Centre for Ore Deposit and Exploration Studies (CODES), at the University of Tasmania. He graduated from the

University of Tasmania and took his PhD degree at the University of New England. He joined Geopeko as an Exploration Geologist at Tennant Creek in 1970 and stayed with that company until 1984. Ross is internationally recognised for his research on volcanic hosted massive sulfide deposits and Proterozoic ores of copper-gold and zinc-lead-silver. He has been the recipient of a number of major international awards and was most recently the Society of Economic Geologists (SEG) Distinguished Lecturer.

Hartwig Frimmel, a PhD graduate of the University of Vienna, has been with the University of Cape Town since 1989 and currently holds the position of Associate Professor in metamorphic geology at the Department of Geological Sciences there. His main scientific contributions are in the fields of the metamorphic/hydrothermal history of the auriferous Witwatersrand Basin, the geological evolution of Pan-African belts in southwestern Africa and the genesis of carbonate-hosted base metal sulphide deposits in these belts. He is a council member of the South African Geological Society and since 1995 Regional SGA Vice-president for South Africa.

Oskar Thalhammer is Associate Professor of Mineralogy and Petrology at the Institute of Geological Sciences, University of Leoben, Austria. He completed his undergraduate and graduate studies of Geology and Mineralogy at the Karl Franzens University, Graz, Austria. His main research interests are PGE-sulfide mineralisations in mafic-ultramafic rocks, mesothermal lode-gold deposits, magmatic and metamorphic petrology.

The Editorial Board of Mineralium Deposita



David Rickard (Cardiff, UK)



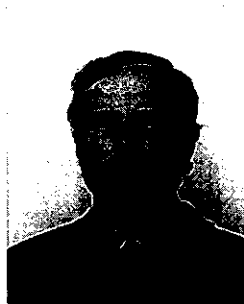
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Vera Walters (Cardiff, UK)



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A. Cheilietz (Nancy, France)



H. E. Frimmel (Rondebosch, South Africa)



J. Hedenquist (Tsukuba, Japan)



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P. Lattanzi (Cagliari, Italy)



B. Lehmann (Clausthal, Germany)



J. Menuge (Dublin, Ireland)



L. Miller (Juneau, Alaska, USA)



O. A. R. Thalhammer (Leoben, Austria)



J. L. Walshe (Canberra, Australia)

⇒⇒⇒FORTHCOMING EVENTS⇒⇒⇒

★ marks a new entry

1999**May 26-28**

GEOLOGICAL ASSOCIATION OF CANADA - MINERALOGICAL ASSOCIATION OF CANADA, JOINT ANNUAL MEETING, Sudbury, Ontario, Canada - Contact address: Dr. P. Copper, Department of Earth Sciences, Laurentian University, Sudbury, Ontario, Canada P3E 2C6; phone: +1 705 675 1151 (ext 2267); fax: +1 705 675 4898; e-mail: gacmac99@nickel.laurentian.ca

★ May 31-June 4

AMERICAN GEOPHYSICAL UNION (AGU) SPRING MEETING, Boston, Massachusetts, USA - Contact address: 2000 Florida Ave., N. W., Washington, DC 20009-1277; phone: +1 202 462 6900; e-mail: service@agu.org

★ June 3-5

ICADD-3: FROM THEORY TO PRACTICE, 3RD INTERNATIONAL CONFERENCE ON ANALYSIS OF DISCONTINUOUS DEFORMATION, Marriot's Mountain Resort, Vail, Colorado, USA - Contact address: Prof. B. Amadei, University of Colorado, Department of Civil Engineering, CB 428, Boulder, Colorado 80309-0428; phone: +1 303 492 7734; fax: +1 303 492 7317; e-mail: amadei@spot.colorado.edu; web-site: <http://www.tmn.com/-arma>

★ June 6-9

VAIL ROCKS 99, 37TH U.S. ROCK MECHANICS SYMPOSIUM, "ROCK MECHANICS FOR INDUSTRY", Marriot's Mountain Resort, Vail, Colorado, USA - Contact address: ExpoMasters, c/o Mark Cramer, 7632 E. Costilla Ave., Englewood, Colorado 80112, USA; phone: +1 303 771 2000; fax: +1 303 843 6212; e-mail: mcramer@expomasters.com

★ June 7-10

MODELS OF VOLCANIC-SEDIMENTARY ORE-FORMING SYSTEMS, St. Petersburg, Russia - Contact address: Margaret Finsen, Conference Dr. Mikhail P. Torokhov, VnllOkeangeologia, Angliiskiy Ave. 1, St. Petersburg, 190121, Russia; phone: +7 812 219 5064; fax: +7 812 114 14 70; e-mail: TOROKHOV@g-ocean.spb.su

June 13-24

XVIII CURSO DE POSTGRADO EN METALLOGENIA, Quito, Ecuador - Contact address: Dr. Jaime Jarrin, Universidad Central del Ecuador, Facultad de Ingenieria en Geologia, Minas y Petroleos, Instituto Superior de Postgrado, Casilla 17-21-1405, Quito, Ecuador; phone: +593 2 557 814; fax: +593 2 566 738/500 306; e-mail: iinvest@uio.telconet.net; web-site: <http://www.unige.ch/sciences/terre/mineral/quito99.html>

★ June 14-16

THE AUSTRALASIAN INSTITUTE OF MINING AND METALLURGY, PACRIM '99, Bali, Indonesia - Contact address: Miriam Way/Sally Forbes, Conventions Department, The Australasian Institute of Mining and Metallurgy, P.O. Box 660, Carlton South, Victoria, Australia 3053; phone: +61 3 9662 3166; fax: +61 3 9662 3662; e-mail: conference@ausimm.com.au

June 29-July 2

11TH INTERNATIONAL CONFERENCE OF THE GEOLOGICAL SOCIETY OF AFRICA, UNIVERSITY OF CAPE TOWN, SOUTH AFRICA - Contact address: Margaret Finsen, Conference Secretariat: GSA 11 Conference Secretariat, P O Box 6345, Roggebaai, 8012 South Africa; phone: +27 (21) 61-9550; fax: +27 (21) 61-9547; e-mail: geoconf@gsa11.co.za; web-site: <http://www.gsa11.co.za>

★ July 15-26

IGCP PROJECT 427 ORE FORMING PROCESSES IN DYNAMIC MAGMATIC SYSTEMS Field Conference 1999, Canada - Contact address: Sarah-Jane Barnes, Sciences de la Terre, Universite du Quebec, Chicoutimi, Canada, G7H 2B1; e-mail: Sarah-Jane_Barnes@uqac.quebec.ca

August 22-25**SGA-SPONSORED**

5TH, BIENNIAL SGA MEETING AND 10TH IAGOD QUADRIENNIAL SYMPOSIUM, London, U.K. - Contact address: Dr. C. J. Stanley, Dept. of Mineralogy, The Natural History Museum, Cromwell Rd., London, SW7 5BD, U.K.; fax: +44 171 938 9268; e-mail: cjs@nhm.ac.uk (see page 20 for details)

August 27-September 3

IGCP-373 FIELD CONFERENCE ON GEODYNAMICS AND MINERAL DEPOSITS IN UZBEKISTAN MURUNTAU, Kochbulak, Almalyk - Contact address: A. Kremenetsky, krem@sovam.com and R. Seltmann, seltm@gfz-potsdam.de

August 28-September 1

MIN WIEN 1999, ANNUAL MEETING OF THE GERMAN MINERALOGICAL SOCIETY (DMG) TOGETHER WITH THE HUNGARIAN GEOLOGICAL SOCIETY (MFT) AND THE AUSTRIAN MINERALOGICAL SOCIETY (OEMG), Wien, Austria - Contact address: MinWien 1999, Institute of Petrology, University of Vienna, Geozentrum, Althanstrasse 14, A-1090 Wien, Austria; phone: Secretary of the OC +43-1-31336-9174 (Mrs. I. Mayrhofer) or +43-1-31336-1821 (Mrs. R. Trischak), Speakers of the OC +43-1-31336-1853 (Dr. A. Beran) or +43-1-31336-9153 (Dr. F. Koller); fax: +43-1-31336-785 or 783; e-mail: Mineralogie@univie.ac.at; website: <http://www.univie.ac.at/Mineralogie/Oemg.htm>

September 4-13

SEG-SPONSORED FIELDTRIP: EPITHERMAL MINERALIZATION IN THE TERTIARY VOLCANIC BELT OF THE WESTERN CARPATHIANS, Hungary and Slovakia - Contact address: Dr. Jeffery W. Hedenquist c/o SEG, 5808 South Rapp St., Suite 209, Littleton, CO 80120, USA; fax: +1 303 797 0417; e-mail: SEGhungary@aol.com

September 7-20

GEOCHIM: TRAINING COURSE IN EXPLORATION AND ENVIRONMENTAL GEOCHEMISTRY, Prague/Dolni Roinka, Czech Republic - Contact address: GEOCHIM, Czech Geological Survey, Geologická 6, 150 00 Prague 5 - Barrandov, Czech Republic; phone: +420 2 581 7390; fax: +420 2 581 8748; e-mail: pasava@cgu.cz

September 12-16

SUDBURY '99, MINING AND THE ENVIRONMENT II. First announcement and call for papers - Contact address: Sudbury 99, Centre in Mining and Mineral Exploration Research CIMMER, Laurentian University, Sudbury, Ontario P3E 2C6 Canada; phone: +1 705 673 6572; fax: +1 705 673 6508; e-mail: cmosher@nickel.laurentian.ca or bevans@nickel.laurentian.ca

★ September 19 -24

INTERNATIONAL SYMPOSIUM "ABRAHAM GOTTLÖB WERNER (1749-1817) AND HIS TIMES", Freiberg University, Germany - Contact address: Dr. Peter Schmidt, Universitätsbibliothek Georgius Agricola; phone: +49 3731 39 3235; fax: +49 3731 39 3289; e-mail: pschmidt@ub.tu-freiberg.de

September 22-25

ENVIRONMENT 2000, Geosciences for Society, Halle (Saale), Germany - Contact address: Environment 2000, c/o Universitätszentrum für Umweltwissenschaften, Martin-Luther-Universität Halle, Moritzburggring 10, D-06 108 Halle (Saale), Germany; web-site: <http://www.gug.org>

★ October 4-6

ISAG 99, 4th International Symposium on Andean Geodynamics, Universität Göttingen, Germany - Contact address: Gerhard Wörner, Geochemische Institut, Goldschmidtstr. 1, 37077 Göttingen, Germany; e-mail: ISAG@gwdg.de or Etienne Jaillard, Institut Dolomieu, 15 Rue Maurice-Gignoux, 38031 Grenoble Cedex, France; e-mail: ejailard@ujf-grenoble.fr; web-site: <http://www.uni-geochem.gwdg.de/ISAG99>

★ October 4-8**SGA-COSPONSORED**

6th Annual Short Course on "Metallogeny: The Research and Industrial Perspective", Brest, France - Contact address: Professor Thierry Juteau, IUEM, Place Nicolas Copernic, 29280 Plouzane, France; phone: +33 298 49 87 11; fax: +33 298 49 87 60; e-mail: juteau@univ-brest.fr

★ October 20-22

APCOM'99, COMPUTER APPLICATIONS IN THE MINERAL INDUSTRIES Golden, Colorado, USA - Contact address: APCOM'99 Symposium, Office of Special Programs and Continuing Education, CSM Annex (Lower Level), 1600 Arapahoe, Colorado School of Mines, Golden, CO 80401, USA; phone: +1 303 273 3321; fax: +1 303 273 3314; e-mail: space@mines.edu; web-site: http://www.mines.edu/Outreach/Cont_Ed

★ October 25-28

SEG ANNUAL MEETING WITH THE GEOLOGICAL SOCIETY OF AMERICA (GSA), Denver, CO, USA - Contact address: Bill Atkinson, Department

of Geological Sciences, Campus Box 250, University of Colorado, Boulder Colorado; 80309-0250, USA; phone: +1 303 492 6103; fax: +1 303 492 2606; e-mail: atkinsow@stripe.colorado.edu

★ October 25-29

3RD INTERNATIONAL SYMPOSIUM, ENVIRONMENTAL GEOCHEMISTRY IN TROPICAL COUNTRIES, Nova Friburgo/RJ, Brazil - Contact address: Programa de Geoquímica da Universidade Federal Fluminense, Outeiro de São João Batista s/nº - Centro - Niterói - RJ - Brazil Cep: 24020-007; phone: +55 21 71 74 189; fax: +55 21 62 07 025; e-mail: isegtc@vm.uff.br

November 3-5

INTERNATIONAL SYMPOSIUM ON GEOCHEMICAL AND MINERALOGICAL TRACERS, Santiago, Chile - Contact address: International Symposium on Geochemical and Mineralogical Tracers in Mining Exploration, ORSTOM, Casilla 53390, Correo Central, Santiago 1, Chile; phone: +56 2 2363 464; fax: +56 2 2363 463; e-mail: orstom@netline.cl

★ November 15-20

INTERNATIONAL SYMPOSIUM ON LOW-TEMPERATURE MINERALIZATION (ISLTM), Guiyang, China - Contact address: Prof. Huang Zhilong, Prof. Hu Ruizhong, Prof. Zhang Zheru, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002, Guizhou province, China; phone: +86 851 5814757 ext. 403; fax: +86 851 5822982; e-mail: hzl@ms.gyg.ac.cn

★ December 13-17

AMERICAN GEOPHYSICAL UNION (AGU) FALL MEETING, San Francisco, California, USA - Contact address: 2000 Florida Ave., N. W., Washington, DC 20009-1277; phone: +1 202 462 6900; e-mail: service@agu.org

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(See page 2 for details concerning the format of the documents to be sent)

2000

★ February 21-24

5TH INTERNATIONAL CONFERENCE ON THE GEOLOGY OF THE ARAB WORLD, GAW-5, Cairo, Egypt - Contact address: Prof. El-Sayed A. Youssef, 5th International Conference on the Geology of the Arab World (GAW-5), Geology Department, Faculty of Science, Cairo University, Giza, Egypt; phone: +202 567 6887 and 567 6502; fax: +202 572 7556 and 572 8843; e-mail: eweida@main-scc.cairo.eun.eg

★ April 16-19

8TH INTERNATIONAL SYMPOSIUM ON EXPERIMENTAL MINERALOGY, PETROLOGY AND GEOCHEMISTRY, Bergamo, Italy - Contact address: EMPG VIII Organizing Committee, Università degli Studi di Milano, Dipartimento di Scienze della Terra, Via Botticelli, 23 20133, Milano, Italy; fax: +39 027 0638681; e-mail: empg@biko.terra.unimi.it; web-site: <http://imiucca.csi.unimi.it/~spoli/empg.html>

★ May 12-14

EUROPE'S MAJOR BASE METAL DEPOSITS: Galway, Ireland - Contact address: Leo Fuscuardi, Irish Association for Economic Geology, c/o Minorco Services Ireland, Ltd., Killoran, Moyne, Thurles Co., Tipperary, Ireland; phone: +353 504 45369; fax: +353 504 45344; e-mail: lfuscuardi@minorco.ie

★ May 15-18

GEOLOGY AND ORE DEPOSITS 2000: The Great Basin and Beyond: A Geological Society of Nevada Symposium Reno/Sparks, Nevada, USA - Contact address: GSN Symposium Editor, P.O. Box 12021, Reno, NV 89510-2021, USA; phone: (775) 323-3500; Fax: (775) 323-3599; e-mail: gsn symp@nbnm.unr.edu; web-site: <http://www.seismo.unr.edu/GSN>

May 21-24

5TH INTERNATIONAL CONFERENCE ON ACID ROCK DRAINAGE: Denver, CO, USA - Contact address: ICARD SME, PO Box 625002, Littleton, CO 80162-5002; phone: 800 763 3132 and +1 303 973 9550; fax: +1 303 979 3461

August 6-17

31TH INTERNATIONAL GEOLOGICAL CONGRESS, Rio de Janeiro, Brazil - Contact address: Secretaria Executiva do 31º Congresso Geológico Internacional, Av. Pasteur, 404 - Anexo 31 IGC - Urca - Rio de Janeiro - RJ - CEP 22.290-240; phone: +55 21 295 5847; fax: +55 21 295 8094; e-mail: 31igc@cristal.cprm.gov.br; web-site: <http://www.cprm.gov.br/31igc.htm>

★ August 19-22

X CONGRESO PERUANO DE GEOLOGIA, Lima, Peru - Contact address: Soc. Geol. del Perú, Arnaldo Marquez 2277, Lima 11, Peru; fax +51 1 2612362; e-mail: sgp@inictel.gob.pe

September

GEOLOGY AND EXPLOITATION OF TIN DEPOSITS IN EUROPE FOR THE THIRD MILLENNIUM, Sokolov, Czech Republic - Contact address: Pavel Beran, Okresni muzeum a knihovna Sokolov, Zamecka ul. 1, 356 00 Sokolov, Czech Republic; fax: +420-16822217; e-mail: okmsokolov@mbox.vol.cz

★ September 25-29

ISECA-2000, INTERNATIONAL EARTH SCIENCES COLLOQUIUM ON THE AEGEAN REGION, Izmir, Turkey - Contact address: Dr. Ismet Ezgenç, Organizing Secretary, ISECA-2000, Department of Geological Engineering, Dokuz Eylül University, P.O. Box 37 (E.Ü.Ptt), 35100 Bornova, Izmir, Turkey; phone: +90 232 388 29 19; fax: +90 232 388 78 65; e-mail: iesc2000@izmir.eng.deu.edu.tr; web-site: <http://www.deu.edu.tr>

★ November 7-10

GOLD 2000, "Gold - a driving force for sustainable development in the new millennium", Harare, Zimbabwe - Organized by the IMM London, UK and the Geological Society of Zimbabwe. Contact address: Dr. R. P. Foster, University of Southampton, Southampton Oceanography Centre, Southampton SO14 3ZH, U.K.; e-mail: rpf@mail.soc.soton.ac.uk

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2002

August

11TH IAGOD SYMPOSIUM, South Africa - Contact address: Dr. Hammerbeck, Council for Geoscience, P.B. X112, Pretoria 0001, South Africa; phone: +27 12 841 1130; fax: +27 12 841 1140; e-mail: ehammerb@geoscience.org.za

GEODE - GRANTS FOR VISITS

To give this new programme a strong start, the GEODE Scientific Steering Committee wants to support short visits by active researchers and doctoral students to a research institution (e.g. University, Geological Survey) in another European country for laboratory and/or field work in order to build new research partnerships and facilitate new funding proposals for collaborative, multidisciplinary research. See the GEODE web-site

<http://www.gl.rhbnc.ac.uk/geode/>

for details of the Grants for Visits scheme and how to make an application.
The deadlines for applications are 1 June and 1 December 1999.

SOCIETY FOR GEOLOGY APPLIED TO MINERAL DEPOSITS

SGA Membership Application Form

I would like to become a member of the Society for Geology Applied to Mineral Deposits (SGA) and to receive my personal copy of *Mineralium Deposita*.

Surname/Corporation
 First name
 Title
 Mailing address

Phone Fax

E-mail

Date of birth..... Nationality.....

Degrees obtained from Universities or Colleges

Present position

Membership in other scientific societies

Are you a member of the Society of Economic Geologists? (If yes, no sponsors are necessary) ☐ Yes ☐ No

- ☐ DM 98,- (~65US\$) Regular Member
☐ DM 68,- Junior Member (up to 4 y after Ms. Sc., Ph.D.)*
☐ DM 38,- Student Member (up to Ph. D., max. 4 years)*
☐ DM 68,- Senior Member (after retirement)*
☐ DM 294,- Corporate Member (includes 3 copies of *Mineralium Deposita*)

*Certificate required

If the application is approved by the SGA Council, I authorize the "Society for Geology Applied to Mineral Deposits" to charge the above amount (please tick)

to my ☐ Visa ☐ Mastercard/Eurocard ☐ American Express

Card No.

Expiry date

Signature

Place and date

(If you do not intend to pay by credit card, an invoice will be issued after acceptance of your application)

Two SGA Sponsors (If you have difficulty in finding sponsors, please send this form to the Executive Secretary who will recommend sponsors)

Name, place, date, signature

SPONSOR 1

SPONSOR 2

Send the Membership Application Form to:

Dr. Jan Pasava
 SGA Executive Secretary
 Czech Geological Survey
 Klárov
 CZ-11800 Prague 1
 CZECH REPUBLIC

Tel.: +420 2 58 17 390
 Fax: +420 2 58 18 748
 e-mail: pasava@cgu.cz

Join the SGA now...



The Society of Geology Applied to Mineral Deposits was established in 1965 by an international group of economic geologists. Its Journal *Mineralium Deposita* is now recognized as a premier international mineral deposits journal.

GOALS

- The promotion of science of mineral deposit geology
- Personal contact of its members in order to exchange knowledge and experience
- Organization of scientific meetings, field trips, workshops. For these events, SGA members have reduced registration fees and in certain cases may apply for travel grants
- Cooperation with other scientific societies, especially with SEG and IAGOD.
- Publication of *Mineralium Deposita* and scientific volumes

MEMBERSHIP

Membership in SGA is open to all persons interested in economic geology, mineral resources, industrial minerals and environmental aspects related to mineral deposits. SGA is an international society with global membership in over 50 countries. Members have reduced registration fees in SGA-sponsored events and in certain cases are eligible for travel grants. Subsidies for publication of color plates in *Mineralium Deposita* also may be applied. Current membership fees are listed on the left-side column of this page.

MINERALIUM DEPOSITA

Editors: David Rickard (Cardiff, UK) and Richard Goldfarb (Denver, CO, USA).

Mineralium Deposita publishes papers on all aspects of the geology of mineral deposits. It includes new observations on metallic and non metallic minerals and mineral deposits, mineral deposit descriptions, experimental and applied inorganic, organic and isotope geochemistry as well as genetic and environmental aspects of mineral deposits. *Mineralium Deposita* is published bimonthly. Fast publication: *Mineralium Deposita* publishes *Mineral Deposita Letters* within 3 months and regular papers normally within 4 months after manuscript acceptance and usually 6-9 months after manuscript submission.

..and receive

MINERALIUM DEPOSITA & SGA NEWS!!!

Additional information in the
 SGA homepage on Internet:

<http://www.immr.tu-clausthal.de/sga.html>

Record participation expected at the SGA-IAGOD joint Meeting

From the Chairman of the Organizing Committee

Chris J. Stanley

*Department of Mineralogy, The Natural History Museum
Cromwell Road, LONDON, SW7 5BD, U.K*



This historic meeting in London, the 5th Biennial Meeting of the Society for Geology Applied to Mineral Deposits (SGA) and the 10th Quadrennial Symposium of the International Association on the Genesis of Ore Deposits (IAGOD), came about through a combination of somewhat unexpected circumstances. The Council of the SGA decided at their last Biennial Meeting in Turku, 1997, to accept a bid from the United Kingdom to host their next Biennial Meeting in London. A structure for the meeting and the membership of the Honorary Advisory and Organising Committees had already been determined by a core group from the Royal School of Mines of the Imperial College of Science, Technology and Medicine and the Natural History Museum.

Late in 1997, it became clear that Professor Ian Plimer, who had offered to host the 10th Quadrennial IAGOD symposium in Broken Hill, Australia, had time-consuming demands in the form of potentially ruinous legal battles after taking on the vociferous proponents and proselytisers of 'Creationism'. His laudable and heroic stance left him, however, insufficient time to organise this symposium. Hence, it was decided to ask the SGA if they would hold the London meeting as a joint meeting with IAGOD, a suggestion the Officers and Council of SGA kindly and readily agreed to.

In keeping with past SGA and IAGOD meetings the theme 'Mineral Deposits: Processes to Processing' was kept as broad as possible so that it would attract academics and mining company personnel alike. Few papers were received on technological advances in mineral processing and it was decided not to have a formal session on this aspect of the science. Peer review reduced the 450 abstracts submitted to about 358. These will be given as oral presentations (160) or posters (200) under the following session titles:

Plenary lectures - 4	Processes and scales of remobilisation in metamorphosed ore deposits - 21
Fluid inclusions and ore formation processes - 27	Metamorphogenesis and other fluid-related syn-metamorphic mineralising processes - 9
Applying thermodynamic models to understanding ore deposits - 5	Skarn deposits -worldwide contrasts and similarities - 5
Ore mineralogy and paragenesis - 18	Processes of formation and geology of industrial mineral deposits - 24
Organics in the formation of mineral deposits and remediation of mining sites - 19	Environmental aspects of mineral deposits - 14
Ore-bearing granitic systems: anatomy and magmatic-hydrothermal evolution - 41	Time-preferential ore deposits and palaeoenvironmental changes - 6
Volcanism and mineralisation: terrestrial and submarine - 40	Timing and duration of ore-forming processes: contributions from radiometric dating - 13
Ore-forming processes associated with alkaline rocks, carbonatites and kimberlites - 19	Geodynamics and ore deposit provinces - 19
Ore-forming processes associated with mafic and ultramafic rocks - 26	Open session - 20
Sediment-hosted mineral deposits - 28	

Even with the recent wave of mining industry redundancies, we confidently expect more than 500 registrants to take part. It is clear as I write that all the Short Courses will run except S1 and S4. Of the pre-meeting field excursions, A2 (Urals gold deposits), A3 (Wales), and A5 (Finland) are not viable. A1 (Urals VHMS) and A4 (Ireland) are fully booked. Post-meeting excursion B2 (Shetland) is withdrawn, B5 (Greece) is not viable, B1 (Cornwall), B4 (SW Iberia) and B6 are fully booked.

We are particularly grateful to our Patron Organisations who made it possible for low rate registration for all students, support for students from abroad, and support for scientists from World Bank designated poorer countries:

Rio Tinto plc, BHP plc, Billiton plc, Minorco plc, Geological Society, London Metal Exchange, Society of Economic Geologists, Mineralogical Society of Great Britain and Ireland

As Chairman of the Organizing Committee, I am extremely grateful to all the co-editors involved in organizing the scientific sessions and in editing the extended abstracts for their patience, tolerance and dedication. I thank the Organizing Committee for their enthusiasm and hard work throughout this project. Helpful advice was forthcoming from the Honorary Advisory Committee and from SGA Council and IAGOD Councillors. ♦

see information on the next pages ➡



SGA - IAGOD

International Meeting

MINERAL DEPOSITS: PROCESSES TO PROCESSING

Science and technology applied to mineral formation and breakdown, mineral processing and environmental problems



SGA

SOCIETY FOR GEOLOGY APPLIED TO
MINERAL DEPOSITS
5th Biennial Meeting

IAGOD

INTERNATIONAL ASSOCIATION ON THE
GENESIS OF ORE DEPOSITS
10th Quadrennial Symposium

LONDON

22nd to 25th August 1999

Natural History Museum & Imperial College

ORGANIZING COMMITTEE

C. Stanley (NHM), A. Criddle (NHM), R. Herrington (NHM), B. Williamson (NHM), C. Stockley (NHM), F. Wall (NHM), T. Williams (NHM), J. Wilkinson (Imperial College), C. Halls (Imperial College), S. Mulshaw (Imperial College), J. Pasava (Prague, SGA), J. Aichler (Prague, IAGOD), R. Seltmann (Potsdam), D. Alderton (Royal Holloway), H. Colley (Oxford Brookes), A. Rankin (Kingston), I. McDonald (Greenwich), J. Naden (BGS), J. Richards (Edmonton), P. Scott (Camborne), R. Ixer (Birmingham), H. Prichard (Cardiff), E. Valsami-Jones (NHM), E. Stumpf (Leoben), P. Herzig (Freiburg)

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SPONSORS

Natural History Museum, Imperial College, British Geological Survey, University of Birmingham, Oxford Brookes University, University of Kingston, University of Wales, Camborne School of Mines, Royal Holloway College, University of Greenwich, Applied Mineralogy Group

INVITATION FROM THE ORGANIZING COMMITTEE

We invite all academic and professional economic geologists, geochemists, mineralogists and environmental scientists to come to this historic joint meeting of the SGA and IAGOD in London to discuss current research under the general theme: "Mineral Deposits: Processes to Processing".

The venue for the meeting is the main site of the Imperial College of Science, Technology and Medicine, home to the Royal School of Mines situated just to the south of Hyde Park in South Kensington, the cultural centre of London. 300 beds have been reserved in the recently upgraded student accommodation on campus and hotel accommodation is also available nearby. The nearby Natural History Museum with its recently redesigned Earth Galleries will be the location for a reception in the Rio Tinto atrium.

GENERAL INFORMATION

Travel to London

By air: London has five airports, Heathrow, Gatwick, City, Stansted and Luton. Busiest is Heathrow with excellent transport links by London Underground Piccadilly line to South Kensington (about £3-4) or by Airbus No 1 (£5 - ask for South Kensington). A taxi is about £35. Gatwick is further away and requires a train journey to Victoria Station (about £10) and a short ride on the District Line underground to South Kensington. Stansted and Luton are not so conveniently situated, while City airport caters mostly for business people.

By train: Direct rail links to London Waterloo through the Channel Tunnel from Paris and Brussels now exist. Waterloo to South Kensington is a short journey on the underground involving one change of line, or a £10 taxi ride. Other mainline stations serve trains picking up passengers from the ferries, notably Liverpool Street for trains from Harwich.

By bus: Scheduled coach services exist from Eastern and Central Europe and some Western European cities. The main terminus in London is Victoria Coach Station. This is only a few minutes from the underground and South Kensington is just two stops on the District Line.

By car: Although London is less congested with traffic at this time of year, parking is expensive. No car parking space has been booked at Imperial College.

Visas

Participants should check with the British Consulate or Embassy in their country as to whether they need a visa to enter the United Kingdom. If you

need a letter of invitation from the Organizing Committee, please ask for this as soon as possible.

Weather

London in late summer can be warm and dry with the risk of the occasional thunderstorm, but remember that we have a maritime climate which is rather less predictable than continental climates. Bring a raincoat and umbrella, just in case!

SCIENTIFIC PROGRAMME

Sessions

There will be three days of oral and poster presentations with parallel sessions. The opening half day will be devoted to three or four plenary lectures.

1. Fluid inclusions and ore formation processes (COFFI) (R. Bodnar, J. Naden, J. Wilkinson, A. Rankin)

1A. Applying thermodynamic models to understanding ore deposits (B. Yardley)

1B. Ore mineralogy and paragenesis (Commission on Ore Mineralogy; Paragenesis Commission) (A. Criddle & R. Hagni)

2. Organics in the formation of mineral deposits and remediation of mining sites (IGCP 429) (A. Gize, J. Pasava & A. Fleet)

3. Ore-bearing granitic systems: anatomy and magmatic-hydrothermal evolution (IGCP 373 and WGT) (R. Seltmann, C. Halls, & M. Stempok)

4. Volcanism and mineralization: terrestrial and submarine (R. Herrington & R. Hill)

5. Ore-forming processes associated with mafic, ultramafic and alkaline rocks, carbonatites, and kimberlites (IGCP 427, CODMUR) (H. Prichard, F. Wall, C. T. Williams, & I. McDonald)

6. Sediment-hosted mineral deposits (J. Wilkinson & D. Cooke)

7. Metamorphism and ore formation

7A. Processes and scales of remobilisation in metamorphosed ore deposits (N. Cook, B. Marshall & P. Spry - Working Group on Ores and Metamorphism)

7B. Metamorphogenesis and other fluid-related syn-metamorphic mineralising processes (N. Cook, B. Marshall & P. Spry - Working Group on Ores and Metamorphism)

7C. Skarn deposits - worldwide contrasts and similarities (L. Meinert, K. Sundblad & Khin Zaw - Working Group on Skarns)

8. Processes of formation and geology of industrial mineral deposits (COFAB) (P.Scott, S.H.B.Clark, & S.Akande)
 9. Environmental aspects of mineral deposits (E.Valsami-Jones)
 10. Timing of ore-forming processes, palaeoenvironmental change and geochronology (Commission on Manganese)
 -Time-preferential ore deposits and palaeoenvironmental changes (N.Beukes)
 -Timing and duration of ore processes - contributions through radiometric dating (H.Stein & J.Hannah)
 11. Geodynamics and ore deposit provinces (GEODE) (F.Neubauer & D.Blundell)
 12. Open session

Workshops and Short Courses

Co-ordinator: Dr D.H.M.Alderton E-mail: D.Alderton@rhbc.ac.uk

For pre-meeting and post meeting short courses and workshops please pre-register your interest with the co-ordinator above.

Pre-meeting

S1. Mineralogy of Russian Diamond Deposits (cancelled)

S2. Unconventional Platinum Group Minerals

Workshop Leader: Prof J.J.Jedwab, Université Libre de Bruxelles, Belgium [also involving A.Criddle, J.Spratt, & C.T.Williams, Natural History Museum]

1. Introductory lecture on unconventional PGMs and PGE-containing minerals, undefined compounds and associations. Including special detection techniques, types of compound and tentative classification, localities, typical deposits, origins, etc.; 2. Demonstration of Platinum Group compounds under the reflected light microscope; 3. Demonstration of Platinum Group elements with back scattered SEM or electron microprobe.

August 22nd. Minimum 10, maximum 30 participants. Cost £100.

S3. Quantitative Analysis of Hydrothermal Alteration: Applications in Mineral Exploration

Course leader: Dr Hans E Madeisky, HEMAC Exploration, Canada

Lithogeochemical exploration, like every other geochemical method, depends on recognizing element concentrations and distribution patterns which are significantly different from local background in order to identify prospective exploration targets. In order to separate the background variations in the geochemistry of unaltered rocks from the variations superimposed by later hydrothermal alteration, a new method of analyzing whole-rock geochemical data has been developed. It is an adaptation of a petrologic modelling technique originally designed to study mass transfer processes in igneous systems. The fractionation models used by that technique have been adapted for use in lithogeochemical exploration. By quantifying hydrothermal alteration, this method can identify lithogeochemical vectors which point to the core of a hydrothermal system and, if it exists, to mineralization. The method has been applied to deposits hosted in a variety of terranes, with metamorphic grades ranging from greenschist to upper amphibolite. Deposit types include volcanic- and sediment-hosted massive sulphide, volcanic-hosted epithermal gold, mesothermal vein, carbonate-hosted (Carlin type) gold, porphyry Cu-Au and Archaean shear zone hosted gold deposits.

August 22nd. Minimum 10 participants. Cost £150.

S4. Genetic Mineralogy of Gold from Hydrothermal Deposits and Deposits in the Weathering Profile (cancelled)

S5. Introduction to Organic Processes Related to Ore Deposits

Course Leaders: J.Leventhal (USGS, Denver), A.Gize (University of Manchester)

The short course is divided into two 1/2 day sections.

The first section will be an introduction to organic processes in the Earth's crust, which will assume no prior knowledge of organic geochemistry. The processes covered will include transformations between the biosphere and the geosphere, and the different types of organic-metal interactions which occur. Special emphasis will be placed on soil organic matter (e.g. humic materials) and their metal interactions. The second section will be an advanced introduction to applications of organic geochemistry and petrology to ore deposit studies. Topics to be covered will include Mississippi Valley-type Pb-Zn, SEDEX-type, Carlin type Au, Kupferschiefer, and uranium deposits. Emphasis will be placed on their genesis, analytical methods, and their interpretation (chromatography, mass spectrometry, microscopy) and carbon-sulphur-iron relationships.

August 22nd. Minimum 25. Cost: section 1, £40; section 2, £50.

S6. Volcanic Hosted Massive Sulfide Deposits (VHMS)

Course Leaders: Prof Ross Large, Associate Prof Tony Crawford, Drs Jocelyn McPhie & Bruce Gemmell, Centre for Ore Deposit Research, University of Tasmania

1. Styles of Australian VHMS deposits, including Cu-rich types, Zn-Pb rich types and gold-rich types; 2. Examples discussed include Rosebery, Hellyer, Que River, Henty, Mt Lyell (Tasmania); Thalanga, Mt Chalmers, Mt Morgan (Queensland); Scuddles, Gossan Hill (Western Australia). Comparisons are made with other global VMS districts; 3. Tectonic environments and volcanic geochemistry; 4. Volcanic facies architecture of VHMS districts; 5. Alteration styles and geochemistry; 6. Genetic models and comparisons to current seafloor hydrothermal systems; 7. Mineral exploration case histories and key criteria.

2 day course 21-22 August. Minimum 10, maximum 40. Cost: £300.

S7. Fe-Oxide Cu-Au Deposits - (The Candelaria - Ernest Henry - Olympic Dam Family)

Course Leaders: Patrick J. Williams and Peter J. Pollard (Economic Geology Research Unit, James Cook University, Queensland, Australia)

Are you interested in the magmatic versus amagmatic debate for Fe oxide-Cu-Au deposits (e.g. Candelaria, Olympic Dam and Ernest Henry) and are you labouring under the misconception that the Cloncurry Cu-Au deposits such as Ernest Henry are hosted in banded iron formations? Are you unaware of evidence that Broken Hill-type deposits may have been transported to their current locations by the same sorts of hot high salinity-fluids that formed these distinctive Cu-Au deposits? This short course is for you if you are intrigued by any of these questions or would simply like to know more about the essential geology of the newly recognized class of Fe-rich Cu-Au deposits that is particularly well represented in Australian Proterozoic rocks. The course presenters have recent hands on research experience in several of Australia's very largest ore systems (e.g. Broken Hill, Cannington, Ernest Henry, Olympic Dam) and are also studying Fe-rich Cu-Au systems in younger rocks (e.g. Ertzberg-Grasberg complex, Irian Jaya). They will outline some major advances in understanding of Fe oxide-Cu-Au deposits that have occurred in the last few years including unpublished results of large industry-funded research projects in the Mount Isa - Cloncurry province that will be available for the first time in an international public forum.

August 22nd. Minimum 10, maximum 30. Cost £150.

During meeting

The role of deep lithospheric structure in the origin of large and superlarge ore deposits

Workshop leaders: J.Kutina, Pei Rongfu, D.V.Rundqvist and P.Laznicka

This will incorporate CTOD/IGCP-354 together with CTOD WG5 "Remote sensing methods for Tectonics and Ore Prospecting".

25th August (provisionally) All welcome. No charge to registrants for meeting.

Post meeting

S8. Proterozoic Sediment-Hosted ('SEDEX') Zinc-Lead-Silver Deposits

Course Leaders: Drs Peter McGoldrick, Stuart Bull, David Cooke, Prof Ross Large (Centre for Ore Deposit Research, University of Tasmania) and Dr Martin K. Neudert (School of Natural Resource Sciences, Queensland University of Technology)

26th August: 1. Introduction (McGoldrick); 2. Geology and zinc-lead-silver deposits of the Carpentaria Zinc Belt of northern Australia (Bull, Neudert & McGoldrick); 3. Detailed 3D sub-basin reconstruction of the area around HYC (Neudert); 4. Mount Isa Group sedimentology, setting, depositional /diagenetic/ alteration processes (Neudert).

27th August: 5. Geochemistry of metal transport in SEDEX deposits (Cooke); 6. Lithogeochemical and isotopic halos to northern Australian SEDEX' deposits (Large & McGoldrick); 7. SEDEX genetic models for HYC and Lady Loretta (Large and McGoldrick); 8. Diagenetic models for HYC and Mount Isa mineralisation (Neudert); 9. Geochemistry of metal transport in SEDEX deposits (Cooke); 10. Differences between Broken Hill type and SEDEX Zn-Pb deposits (Large and Cooke).

2 days: 26 -27 August. Minimum 15, maximum 40. Cost: £300 or single day at £180.

PRICES FOR ADVERTISING IN SGA NEWS

1	page	800 DM	(~440 US\$)
1/2	page	400 DM	(~220 US\$)
1/4	page	250 DM	(~140 US\$)
1/8	page	140 DM	(~80 US\$)

Before sending your advertisement contact *SGA News* (see address on page 2). Advertisement should be sent as attached files via e-mail or on a 3.5" diskette along with a hardcopy to SGA News (see page 2).

Credit card payments are welcome.

FIELD EXCURSIONS

Please pre-register an interest in taking part in any of the field excursions with the named organiser (underlined) by e-mail or fax. All excursions are offered on a first come, first served basis.

Pre-meeting**A1. Massive sulphide deposits of the Southern Urals (fully booked)**

10 - 19th August, 1999.

Start and end: Miass, Chelyabinsk district, Russia.

Leaders: Prof Viktor Zaykov, Institute of Mineralogy, Urals Branch, Russian Academy of Sciences, Miass, Chelyabinsk district, 456301 Russia [fax: +7 35135 50286; e-mail: zaykov@imin.uran.ru] or Dr Richard Herrington, Department of Mineralogy, Natural History Museum, Cromwell Road, London SW7 5BD [fax: +44 171 938 9268; e-mail: R.Herrington@nhm.ac.uk].

A2. Gold and massive sulfide deposits in the Middle Urals (not viable)**A3. Mineralisation in Wales (not viable)****A4. Zn-Pb-Ag deposits of Ireland (fully booked)**

August 18th-20th 1999

Leader: Dr Jamie Wilkinson [j.wilkinson@ic.ac.uk] and Dr Garth Earls

A5. Metallic and industrial mineral deposits of the northern Fennoscandian/Baltic Shield (not viable)**Post-meeting****B1. Metalliferous and industrial minerals in Cornwall, England (fully booked)**

Leaders: P.Scott, [pscott@csm.ex.ac.uk], R.Shail and C.Halls.

B2. Geology and mineralisation of the Shetland ophiolite (withdrawn)**B3. Scottish mineral deposits**

Leaders: Clive Rice [gmil18@abdn.ac.uk] (Aberdeen Univ.), Graham Smith (BGS).

Duration: 4 days. Cost/person: Estimate £320. Maximum/Minimum number: 18-12.

Start: 7.30am, 26th August, Imperial College, Exhibition Road, SW7.

End: Mid-evening, 29th August, Imperial College, Exhibition Road, SW7.

Thursday 26 August: Leave London 7.30am. Arrive for dinner Millcroft Hotel, Gairloch, N.W. Scotland. Friday 27 August: Loch Maree Group at Gairloch. Saturday 28 August: Leave Gairloch for Aberfeldy, Perthshire. Foss Baryte Mine. Sunday 29 August: AM. Cononish gold development near Tyndrum (if open); PM. Return to London.

The Proterozoic (c. 2by) Loch Maree Group at Gairloch is a varied group of metagreywackes and metabasalts which overlie Archaean gneiss and are, in turn, overlain by Torridonian sandstones (c. 1by). The group contains a subeconomic volcanogenic massive sulphide (Cu-Zn-Au) deposit, BIFs and Mn-rich sediments. The day will consist of a traverse across the Group examining the diverse rock types (Jones et al., 1987). The Foss baryte mine is the largest baryte producer in the UK and is a major supplier to the N. Sea Oil Industry. The mineralisation is of the SEDEX type and consists of a strongly deformed, high grade, baryte bed about 4m thick, hosted by the Neoproterozoic Ben Eagach Schist Formation. The baryte bed is associated with barium-enriched muscovite schist, quartz-celsian rock and also carries some sulphides. The open pit and underground operation will be visited (Coats et al., 1980). The Cononish gold-silver deposit is the most important precious metal deposit so far discovered in Scotland (Earls et al., 1992). The mineralisation (c. 500,000t @ 10g/t) occurs in the Eas Anie quartz vein and may be of Lower Devonian age. The vein is hosted by Neoproterozoic psammites and pelites. The precious metal phases comprise tellurides, electrum, native gold and silver and these correlate with sulphides which are mainly pyrite, chalcopyrite, sphalerite and galena. This visit depends on the underground workings being open.

B4. Geology of the main ore deposits of SW Iberia (fully booked)

Leaders: Fernando Tornos, [ftaige@iponet.es], Juan Locutura (ITGE, Spain) and Luis Martins (IGM, Portugal). Visits are organized in conjunction with the mining companies and research geologists.

B5. Epithermal and porphyry mineralisation in the northern and southern Aegean (not viable)**B6. Au, Ag and Cu Deposits of Uzbekistan (IGCP 373 - Field Conference) (fully booked)**

Contact address for more detailed information: Dr Reimar Seltmann (Leader of IGCP-373), GeoForschungsZentrum Potsdam (GFZ), Telegrafenberg B223, D-14473 Potsdam, Germany; e-mail: seltm@gfz-potsdam.de; phone: +49 331 288-1433, fax: +49 331 288-1436; http://www.gfz-potsdam.de/pb4/pg3/igcp/welcome.html (further information about IGCP-373).

ABSTRACTS AND THE PROCEEDINGS VOLUME

Extended abstracts of the papers selected for presentation will be published as a Proceedings Volume which will be distributed to all those registered for the meeting and which is included in the registration fee.

DEADLINES

April 15th 1999 was the deadline for the return of final camera-ready Abstracts, payment of registration fees at lower rate and order for reprints. Abstracts will not go to the printer unless a registration fee has been paid.

Deadline for registration with full payment for Workshops/Short Courses and Field Excursions was also April 15th 1999. Limited registration for those courses and excursions designated viable will be possible after this date. Remember to register your interest with the Short Course co-ordinator and with individual field excursion leaders at the earliest opportunity.

SOCIAL PROGRAMME

Sunday 22nd August 19.00 - 22.00: Ice Breaker Party at Imperial College. Cost included in registration fee for participants and accompanying persons.

Monday 23rd August 19.00 - 22.30: Riverboat excursion with buffet and cash bar. A luxury river boat will leave Westminster pier and travel downstream past St Pauls Cathedral, Tower Bridge, Docklands, Greenwich, the Millennium Dome as far as the Thames Barrier before returning. Cost £25 (pre-paid as we need to know numbers in advance).

Tuesday 24th August 19.00 - 21.00: Reception in the Rio Tinto Atrium of the Earth Galleries of the Natural History Museum. A special opportunity to visit the newly opened exhibits at your leisure. Cost included in registration fee for participants and accompanying persons.

REGISTRATION

Venue: Imperial College of Science, Technology, and Medicine, Exhibition Road, South Kensington, LONDON, SW7 2BP, United Kingdom.

Contact telephone, fax, e-mail: Conference office for messages during the conference: +44 171 594 9494. Organizing Committee: +44 171 938 9353 +44 171 938 9268; cjs@nhm.ac.uk. Accommodation: +44 171 594 9507 +44 171 594 9504

OFFICIAL LANGUAGE

English

REGISTRATION FEES [for payment after April 15th]

SGA/AGOD/SEG/Geological Society of London/Mineralogical Society of Great Britain and Ireland members [as of August 1st 1998] **£125.**

SGA/AGOD/SEG/Geological Society of London/Mineralogical Society of Great Britain and Ireland student members [as of August 1st 1998] **£55.**

Non-members £180; Non-member students £80.

The registration fee includes the scientific programme, morning coffee and afternoon tea, abstracts volume, Ice Breaker Party, and Earth Galleries reception. There are separate fees for the Short Courses, Workshops, Field Excursions and the Riverboat excursion. Meals are not included in the registration fees. There are many places to eat in South Kensington. Boxed or packed lunches can be ordered using the registration form. These cost £4 each day. The registration fee for accompanying persons is £25 and they will be welcome to attend the Ice Breaker Party and reception in the Earth Galleries of the Natural History Museum.

Payment of fees

Please note: all payments must be made in Sterling (GBP) and be free of bank charges to the Conference Organisers. Please ensure that the participant's name is clearly attached and legible so that the payment is registered correctly. There are three methods of payment:

1. Bank/wire transfer to:

Account name: Natural History Museum

Bank: National Westminster Bank, 186 Brompton Road, London, SW3 1HH

Sort Code: 60-04-04; Account Number: 18129773

Please annotate with SGA-IAGOD and your family name.

2. Bank cheque or draft in sterling made out to 'Natural History Museum'

[Eurocheques not accepted]

3. Credit card payment by Visa, or Mastercard only.

Please fill in the authorization in the registration form

Cancellation

Cancellation must be made in writing to the Organizing Committee. A refund of 80% of the total amount paid will be made on cancellations before July 15th 1999. Unfortunately, it is not possible to offer refunds after this date. If a Short Course/Workshop or Field Excursion fails to run because it is not viable or for any other reason, full refunds will be given of the fees paid.

ACCOMMODATION

Accommodation is being handled separately by the Imperial College Vacation Accommodation Office. They will accept reservations for South Kensington campus Halls of Residence accommodation and also for local hotels.

Single rooms on campus are priced at £29.50 per night and twin rooms at £47 per night, both inclusive of full English breakfast and VAT. All rooms are fitted with hand washbasins and full bathroom facilities are shared with, on average, three other rooms. Imperial College Vacation Accommodation Office are also able to offer a selection of local hotels with a discount of 20-38% on standard rates. Please quote your attendance at SGA-IAGOD 1999 on all correspondence with the vacation accommodation office (see page 24).

INSURANCE

No travel insurance is being arranged for any of the conference or field excursion participants. All participants are reminded that they should organize their own personal insurance for all aspects of the conference and field

excursions including travel to and from the venues. The Organizing Committee, short course, workshop, and excursion leaders and anyone else connected with organizing and running the conference and field excursions

shall accept no responsibility whatsoever for any damage, loss, personal injury or death suffered by any participant during the conference and field excursions or in travel to and from the conference and field excursions.

The Final Circular will be issued only in electronic format to those who have registered. It can also be downloaded from the web-site reported below.

You can get complete information on the SGA-IAGOD joint Meeting

at the following internet address:

<http://www.nhm.ac.uk/mineralogy/course/sga.htm>

or from

Dr C. J. Stanley (SGA-IAGOD), Department of Mineralogy, The Natural History Museum, Cromwell Road, LONDON, SW7 5BD, U.K. - Fax: +44 (0)171 938 9268. E-mail: SGA.IAGOD@nhm.ac.uk

REGISTRATION FORM ♦ SGA-IAGOD MEETING (London 22-25/08/99)

Title First/Last Name

Address

E-mail

Fax Tel.

Registration fees

Member SGA/IAGOD/SEG/Geol.Soc./Min.Soc. £95 ☐ (after 15/04 £125 ☐)

Student SGA/IAGOD/SEG/Geol.Soc./Min.Soc. £25 ☐ (after 15/04 £55 ☐)

Non-member £150 ☐ (after 15/04 £180 ☐)

Student non-member £50 ☐ (after 15/04 £80 ☐)

Accompanying person £25 ☐

Lunch (a packed snack lunch at £4 per day not included in registration fee)

23 Aug ☐ 24 Aug ☐ 25 Aug ☐

Excursion on River Thames 23 August £25 ☐

Short courses and workshops [check with co-ordinator for availability]

S2 £100 ☐ S3 £150 ☐ S5 section 1 £40 ☐ S5 section 2 £50 ☐ S6 £300 ☐

S7 £150 ☐ S8 £300 ☐ (or single day option £180 ☐)

Field excursions [check with leader that excursion is not overbooked]

A1 - Urals £700 ☐ A4 - Ireland £180 ☐ B1 - Cornwall £220 ☐

B3 - Scotland £320 ☐ B4 - SW Iberia £300 ☐ B6 - Uzbekistan £650 ☐

Payment: Grand total

Cheque (in sterling) ☐ Mastercard ☐ Visa ☐ Bank transfer ☐

Card Number:

Expiry date (year/month): ____ / ____

Name as it appears on card

Signature Date

Also give billing address if different from above.

Send to: Dr C. J. Stanley, Dept. of Mineralogy, Natural History Museum, Cromwell Road, LONDON SW7 5BD, UK

ACCOMMODATION BOOKING FORM ♦ SGA-IAGOD MEETING (London 22-25/08/99)

I will be attending the SGA-IAGOD conference to be held at Imperial College August, 1999 and wish to book accommodation as follows:

Arrival date: Departure date:

No of nights: Room type:

Student Accommodation at Imperial College Single room £29.50 ☐
Twin room £47 ☐

Hotel	Single	Double/ Twin	Includes
Millenium (Gloucester)*	£145	£175	room only
Bailey's*	£125	£135	room only
Stakis London Metropole*	£117	£144	room only
Regency*	£109	£119	English B'fast
Holiday Inn*	£105	£125	room only
Harrington Hall*	£105	£105	room only
Rembrandt*	£104	£124	room only
Forum*	£99	£119	Cont. B'fast
Jury's Kensington*	£98	£98	Cont. B'fast
Swallow International*	£96	£106	Vitality B'fast
Stakis Hyde Park*	£95	£115	room only
Novotel Hammersmith*	£89	£89	room only
Kensington Moat House*	£88	£105	English B'fast
Paragon*	£85	£95	room only
Jarvis Embassy House*	£83	£93	Cont. B'fast
Cranley Gardens*	£72	£95	Cont. B'fast
Imperial College Guest Rooms*	£42	from £68	Cont. B'fast
Imperial College Apartments	prices on request		
Roland House Apartments	prices on request		

*=executive room rates available upon request

1st preference

2nd preference

3rd preference

A 50% deposit or credit card number with expiry date is required to secure a booking. Payment can be made by Switch, Visa, Mastercard, Eurocard and Sterling cheques (made payable to Imperial College). A charge will be made for late cancellations and non-arrivals.

Delegate's details

Name

Address

E-mail

Fax Tel.

Card Number:

Mastercard ☐ Visa ☐ Expiry date (year/month): ____ / ____

Send to: Vacation Accommodation Office, Imperial College of Science, Technology and Medicine, Watts Way, Prince's Gardens, LONDON SW7 1LU. Tel.: +44 (0)171 594 9507 or +44 (0)171 594 9511; Fax: +44 (0) 171 594 9504; E-mail: vacation.accommodation@ic.ac.uk