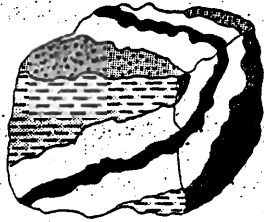


THE GANGUE



Newsletter of the Mineral Deposits Division

Geological Association of Canada

No. 11 October 1981

CHAIRMAN'S MESSAGE: Agenda of MDD Activities

Your Division is maintaining a full schedule of activities. New symposia, trips and publications are now in the planning stages, and several of these are detailed in this issue of The Gangeue.

Field Trips: Three trips are set for this month. All have been enthusiastically received, so it seems we should do more of this type of activity. A trip in New Brunswick and Nova Scotia will include deposits of the lithophile elements Sn, W, U and Mo. A MDD/CIM jointly sponsored Yukon trip will visit Mactung, Cantung and Tom. The southern B.C. gold deposits trip will include Carolin, Bralorne and Northair.

Symposia: Winnipeg '82 will feature a symposium on predictive methods in metallogeny sponsored by the MDD. Most of the provinces have contributed to a travel fund for invited specialists from overseas, which should assure the international stature and success of the symposium. For Victoria '83 a MDD - sponsored symposium on gold deposits of western Canada is being organized by Andre Panteleyev. The MDD and CIM are co-sponsoring a symposium and field excursions on Yukon mineral deposits slated for September 1983.

Workshop: A workshop on gold deposit models, co-sponsored by the MDD and Calgary MEG and organized by R.W. Hutchinson and University of Western Ontario staff, will be held at Banff in February of 1983.

As can be seen from the above items, your Division is alive and kicking. This and the following issues of The Gangeue will provide details of these meetings.

V.F. Hollister

PUBLICATIONS: Monograph Series on Mineral Deposits Geology

Mention of this forthcoming monograph series has been made from time to time in The Gangeue and at various MDD meetings, and perhaps it would be appropriate to give a more complete report on the status of this endeavour now that it is underway.

First, a word on the aims of this publication. As stated in the proposal approved by GAC Council last winter, the field of ore-deposits geology is suffering severely in the absence of a good up-to-date reference which could serve as (1) a reliable text-book for advanced undergraduate and early graduate students (more advanced research needs are satisfied by specialized journals, symposia, etc.), and (2) a respected reference for professionals (e.g., exploration geologists) in need of a thorough review of modern concepts in ore-deposits geology. The pedagogical need has become critical as the latest widely recommended texts (e.g., Stanton's "Ore Petrology", 1972) slip inevitably into obsolescence. At the same time, many professionals, notably exploration geologists, have expressed increasing concern over the lack of an informative modern reference which they could use to brief themselves in areas of ore-deposits geology neglected from time to time in attending to other duties.

In spite of these recognized needs for a text on ore-deposits geology, it has become increasingly obvious that a classic, formal text-book of the Stanton-type is unlikely to ever come on the market again. The problems include the obvious limitations of a single (or even double) author, and the lengthy period of time between the writing and the eventual publication of the bound text while obsolescence marches relentlessly onward.

The solution to this problem appears to be a multi-authored soft-cover booklet series of monographs in which each individually bound monograph would correspond to the usual chapters of a text-book on ore-petrology. The principal advantages of this approach are:

- 1) the simultaneous preparation of booklets by recognized experts;
- 2) reviews by a competent editorial board;
- 3) reduced time "in press" by preparation in a soft-cover, three-ring binder format; and
- 4) the ability to revise individual monographs as needed in future years without tossing out the entire set.

In the period 1978-81, support for this project was sought and received from the Mineral Exploration Research Institute (MERI), from the Canadian Geological Foundation, and from MDD, GAC, and their Robinson Fund Committee. Initiating grants were received from l'Ecole Polytechnique

and McGill University via MERI; my sabbatical at the Geological Survey of Canada (1980-81) was supported by a grant from MERI, supplemented of course by the kind hospitality of the Survey; the Canadian Geological Foundation approved a grant of \$7,500 in 1980 and has now approved an additional \$7,500 in 1981 for preparation of the manuscripts; and the Robinson Committee has provided \$10,000 (an additional \$5,000 if necessary) for preparation costs (principally drafting, typing, photocopying, telephone, and the like), and will advance an important loan for publication costs when that stage is reached. It is hoped that advanced sales based on publicity and circulation of an early monograph will help reduce the considerable initial investment from the Robinson fund. The retail price will be well within reasonable reach for students and should eventually result in good returns for the future activities of GAC and MDD. The latter have assumed the role of principal sponsors, with MERI as co-sponsor. Sponsorship for the publication of a French edition is being sought (contributions, aid for translation, and suggestions are welcome).

During the year 1980-81, I was principally pre-occupied with the final approvals of the project, with solicitations of authors and associate editors, and with the initial coordination of the writing now in progress. My duties as editor of manuscripts are expected to begin with a fury this autumn and to proceed rather exhaustingly throughout 1982. Six Associate Editors have kindly agreed to examine the manuscripts and submit them to critical review prior to acceptance.

The individual monograph format also permits one more flexibility which we will put to good use. Since it is unrealistic to expect all authors to meet a common deadline, we have decided on two publication periods: Part I will go to press whenever one-half of the manuscripts have been completed (ETA mid-1982), and Part II should go to press within the following 12 months. The format of each monograph will follow closely that of Geoscience Canada, a publication familiar to all. The costs of publication and the task of setting up this layout are predictable, and we believe the readers will find this presentation quite acceptable as well. The series will be marketed as two three-ring binders (Parts I and II), each containing nine monographs of some 20-40 pages each, for a grand total of approximately 600 pages.

The titles of the series, their invited authors, and the editorial board are given in the table below. Some questions have arisen concerning the scope of the titles, noting especially that certain ore-types are neglected. I personally have two responses to this: that the present list represents the core of currently recognized ore-types and thus forms a sufficiently ambitious undertaking for the moment; and secondly, that the individual monograph format would allow for later additions once we see how successful this first endeavour has been.

Composition of the Monograph Series on Mineral Deposits Geology:

| Titles | Authors | Editorial Board |
|--|--------------------------|---|
| 1. Magmatic Oxide Ores | .Cameron | Series Editor: Brown |
| 2. Magmatic Sulfide Ores | .Naldrett | |
| 3. Granitic Pegmatites | .Cerny | Assoc. Editors: Hutchinson Langford Naldrett Sangster Soregaroli Wilson |
| 4. Vein Deposits: | | |
| a. Caldera Au, Ag... | .Barton-Bethke | |
| b. Granite Assoc. Sn, W... | .Strong | |
| c. Cobalt | .Thorpe-Jambor | |
| 5. Porphyry Ores | .Hodder | |
| 6. Ores Assoc. with Alkaline Rk Compl. | .Watkinson-Sage | |
| 7. Submarine Exhalative Deposits: | | |
| Volc.-Assoc. Massive Sulfides | .Scott-Spooner | |
| 8. Submarine Exhalative Deposits: | | |
| Sediment-Hosted Pb-Zn | .Large | |
| 9. Sedimentary Iron Deposits | .Button-Holland | |
| 10. Carbonate-hosted Pb-Zn | .Sangster | |
| 11. Stratiform Copper | .Brown-Kirkham | |
| 12. Sandstone Uranium and Related Dep. | .Rose | |
| 13. Conglomerate Au-U | .Pretorius | |
| 14. Metamorphism and Ores | .Vokes-Strong-Jolly | |
| 15. Supergene Alteration | .Darling | |
| 16. Laterites | .Golightly | |
| 17. Vein-type Uranium | .Dahlkamp | |
| 18. Precambrian Gold | .Hodgson-Roberts-Kerrich | |

Meanwhile I would like to underline the calibre of the authors who have so enthusiastically responded to the call for the 18 monographs listed here. In fact, I think it worth noting in concluding this short report that not one author and not one sponsor asked to contribute to this undertaking has declined. Rather, the response has been consistently very favourable, and this attitude will no doubt serve as a great source of encouragement to us all in the considerable work that still lies ahead. The comments and suggestion of MDD members would be particularly welcome throughout this period since obviously so many of you are in a position to offer suggestions, time and/or aid which could improve our final product. In the meantime, many thanks for the many expressions of encouragement, and sincerest appreciation to our sponsors

and all involved in this project.

Alex C. Brown, Editor
Monograph Series on Mineral Deposits Geology

Dept. de Genie Mineral
Ecole Polytechnique/Univ. de Montreal
C.P. 6079, Sta. "A"
MONTREAL, Quebec H3C 3A7
Tel: (514) 344-4743

DUNCAN R. DERRY MEDAL: Call for Nominations

We all look forward to the third award of the Duncan R. Derry Medal provisionally scheduled for the next Annual Meeting to be held in Winnipeg in May 1982. The current Selection Committee reminds MDD members that Medal nominations may be made at any time but the names and supporting information of candidates for the 1982 award must be received by the Chairman of the Selection Committee before JANUARY 31st, 1982.

The membership is urged, therefore, to familiarize themselves with the guidelines for nomination (reproduced below) and actively support and nominate worthy candidates. All nominations should include an introduction to the candidate, a summary of the candidate's accomplishments in economic geology, a curriculum vitae and any other information or attachments that will supplement and enhance the presentation.

Good candidates deserve good nomination presentations. The Duncan R. Derry Medal is a successful and prestigious award - as exemplified by the two fine scientists honoured to date. This standard can be maintained only with an active list of worthy candidates.

START TODAY. You don't have to wait until January to contact possible supporters and nominate the candidate of your choice. NOW IS THE BEST TIME TO ACT.

Please read the following guidelines:-

1. The medal may be awarded annually to an outstanding economic geologist who has made major contributions to the science of economic geology in Canada. Nominees should preferably be members of GAC, and preferably but not necessarily, members of the Mineral Deposits Division (MDD).
2. Nominations for the medal are to be made by three members of MDD, either jointly or by independent submissions. Nominations must be supported by relevant data, such as a curriculum vitae or a letter outlining the nominee's accomplishments, et cetera.
3. Candidates should be recognized for their skill and stature as professional economic geologists, and also by their public contributions to the science. It is acknowledged that publication is the prime but not the only method of spreading scientific information in any discipline.
4. Unsuccessful nominees will be automatically submitted for review in the subsequent two years, and will then be dropped unless renominated.
5. Nominations for the medal may be proposed at any time, but to be considered for a particular year, they must be received by the Vice-Chairman of MDD no later than January 31st. Nominations for 1982 should be sent to J.A. Coope, Newmont Exploration of Canada Limited, P.O. Box 105 Commerce Court West, Toronto, Ontario, M5L 1E3.

CONFERENCE REPORTS: Calgary '81 Symposium 'New Exploration Guides for Kuroko-type Massive Sulphide Deposits': Text of George Mannard's Summary and Review

A Critical Appraisal of the Applicability of Recently Developed Data and Theories to the Search for Volcanogenic Massive Sulphide Deposits

Introduction

The volcanogenic massive sulphide deposits have always fascinated economic geologists. The literature is full of lyrical phrases describing the fineness of their laminations, the beauty of their breccias, the symmetry of their zoning. At their best, they represent truly remarkable concentrations of base and precious metals. This characteristic makes Kuroko-type deposits attractive to the miner, as well as to the geologist, although this has not always been so. Prior to the 1930's many massive sulphide deposits could not be exploited profitably because of inability to separate the intergrown copper, lead and zinc minerals. The development of a differential flotation technique by Asarco and others solved this problem, and the volcanogenic massive sulphide deposits have been an attractive exploration target ever since. You will note that throughout this presentation, I will use the terms "Kuroko-type" and "volcanogenic massive sulphide" interchangeably. I have never accepted that there is any substantial difference between the miocene Kuroko deposits and their older cousins in the Archean.

Compared to most other types of mineral deposits, many of the volcanogenic massive sulphide deposits have a high metal content and a large number of potential products - copper, lead, zinc, cadmium, tin, precious metals, iron and sulphuric acid. These properties give them a relatively high unit value. Mining and milling of small quantities of ore can yield large profits - a highly desirable characteristic in these times of increasing energy and labour costs. A high-grade massive sulphide deposit, which lies in such a way that it can be mined by the open pit method, can yield a remarkably high return on investment.

Current Exploration Situation

In the glaciated regions of the world, most outcropping volcanogenic massive sulphide deposits have been discovered. In unglaciated areas, discovery has been delayed by difficulty in recognizing the surface expression of deeply weathered sulphides. This problem is now being resolved and several deposits have been found recently in Australia and Southern Africa. It seems likely that within the next ten years, all outcropping deposits will have been found, as well as a large proportion of those which lie within 100 metres of the surface and are readily detectable by geophysical methods.

All of this means that, in the very near future, we will be called upon to explore at depth, where our main weapons will be geological projection and rock geochemistry. Recent discoveries by Dowa, deep in the Hokuroko basin, and Falconbridge, at 4500' in the Noranda camp, show that we already have some measure of capability. As the search becomes more and more difficult and costly, the exploration geologist will come under increasing pressure to provide reliable guidance for deep exploration drilling, in situations where drilling costs \$100 to \$150 per metre, or say, \$200,000 per hole; he will need parameters to help him recognize prospective geological environments, and to aid him to locate specific targets within the complex mineralized systems once they have been found. Who will provide these parameters? In order to answer this question it is necessary to review the development of current theories concerning the volcanogenic massive sulphides and to discuss the "state of the art" of geoscience research on these deposits.

Historical Review

Prior to the 1950's there was no widespread understanding of the origin and nature of volcanogenic massive sulphide deposits. During the 1940's or even earlier, isolated individual geologists in Scandinavia, Central Europe, Japan, Canada, and Australia began to question the dogma of Lindgren hydrothermalism. It is my contention (disputed by some) that most of these dissidents were field-oriented geologists employed by mining organizations. In the early 1950's the ideas of those pioneers began to be expressed in what was then considered to be a novel approach to exploration: granitic plutons were disregarded, structure was relegated to a secondary role, and the emphasis was placed upon volcanic stratigraphy. Success followed in such areas as Noranda, Bathurst, and ultimately, Timmins. The new movement spread to the government surveys and the universities, where it found convincing advocates. Slowly, the attention of the research community began to focus on the volcanogenic massive sulphide deposits.

Their first problem was to convince themselves that the minerals found in the volcanogenic massive sulphides could indeed form under sea-floor conditions, and that the massive sulphides were truly coeval with the enclosing rocks. Once this had been accomplished, investigations were aimed at elucidating the temperatures and pressures which prevailed during deposition, and the source and nature of the mineralizing fluids. As researchers moved more and more deeply into the physical chemistry of the ore-forming processes, they moved farther and farther away from the application of their findings to the solution of practical exploration problems. A community of laboratory geologists developed. Many of these scientists had little field experience, and it is not surprising that they became alienated from the exploration geologists.

Today, as we approach the period in which our ability to find deeply hidden Kuroko-type deposits will depend increasingly on close collaboration between exploration geologists and the research sector, it is obvious that we must close the gap which hinders effective communication between these two communities. The problem has been recognized by several organizations, and efforts are being made to solve it. Symposia such as the one we are attending today can make a strong contribution in this direction.

The Current Situation - What is Needed?

Until recently, much of the academic research devoted to the volcanogenic massive sulphides has been too introverted and curiosity-oriented to be of much use in exploration. This rather bald statement is supported by two very recent publications. In a talk delivered at the prospectors and developers convention in March, R.W. Hutchinson of University of Western Ontario described the situation very effectively, as follows:

"For decades, since its initial distinction as a sub-discipline within geological science, economic or mineral deposits geology has been self-centred, introspective and consequently perhaps, too narrow. Detailed studies of ore deposits dealing with their size and grade, mineral economics, mineralogy, textures, structural control, geothermometry, geobarometry, major and minor element content, isotopic geochemistry, etc., have been the rule. Unquestionably, all these have contributed to the knowledge of ore deposits and their significance is in no sense here discounted. Yet it is no longer adequate to investigate the many parameters of an ore deposit itself. Geological technology must be broadened in order to relate the orebody in proper perspective to its surrounding geological setting or environment. Ore must be treated as simply another, albeit economically unique, rock type. Its lithological setting, whether igneous, sedimentary or metamorphic rocks must be considered. Its stratigraphic relationships to its host rocks, both locally and regionally, must be evaluated. The tectonic environment under which both ore and host rocks were formed, and possibly deformed, must be interpreted. In short, a broader, geologically comprehensive or metallogenic approach to ore deposits geology must supplement the earlier, narrower, detailed studies".

(Hutchinson, 1981)

A similar set of conclusions can be drawn from the preliminary analysis of responses to a questionnaire circulated by the society of economic geologist, as reported by J.J. Eidel at the

1980 G.S.A. meeting (Eidel, 1980). Of the 250 respondents, 65% represent the mining industry, and 30% the academic community. The questionnaire, which was quite detailed, essentially asked, "what do we need the most?" The requests were overwhelmingly for empirical data. Among the items considered most needed were: alteration and zoning studies of the tops, bottoms, and lateral extensions of ore deposits (with emphasis on field studies and mapping), multi-disciplinary field studies of ore districts, and several other similar items. At the end of the long list, relegated to the category of "additional subjects", were such items as high altitude imagery, fluid inclusion studies, geochronology and petrophysics.

These two sources are sending us a strong and uniform message as to the type of research which is needed. I can add little to their statements, except for a few pragmatic suggestions about the constraints which should be kept in mind when the results of the research are converted into new guides for use in the search for volcanogenic massive sulphide deposit. Geological criteria are needed for the selection of generally favourable large areas which are the starting points for regional reconnaissance, for the identification of prospective stratigraphic units within these areas, and for the recognition of mineralized systems within these units. Once a mineralized system has been recognized, it must be relatable to a conceptual model which the exploration geologist can utilize to direct his efforts towards finding the maximum concentrations of metals.

To be most useful, exploration guides should be applicable in geological terranes which may exhibit wide ranges of age, structural deformation and metamorphism. Ideally, a guide should be broadly applicable, rather than being specific to a single district. Even more ideally, the guide should involve techniques which can be applied at reasonable expense. Methods involving highly sophisticated analytical or interpretive techniques, which can be applied by only one lab or individual, quickly result in frustrating bottlenecks if they become widely applied.

Having made all of these generalizations, it is appropriate now to examine the exploration guides put forward in this symposium.

Appraisal of Exploration Guides

Appraisal of the "new exploration guides" presented in this symposium was difficult, as only the abstracts were available at the time of writing. Having been exposed to the full texts of the papers today, I have made some amendments, mostly minor.

1. The first exploration guides presented derive from the failed rift hypothesis put forward by Cathles, Dudas, and Lenagh. The authors direct our attention to longitudinally rifted volcanic belts. This is exactly the sort of guide which, if valid, can be useful in the selection of broad areas for reconnaissance. Carried further, it can help us take a second step by confining exploration to the part of the stratigraphic assemblage which was deposited at the time of rifting. Together, these ideas constitute a useable sequence of guides. They are new, in the sense of being applied specifically to Kuroko-type deposits. Similar guides have been in use for at least a few years in the search for buried Keeweenaw-type and Zambian-type copper deposits and carbonatites.
2. Although Takahashi and Sato disagree with Guber and Ohmoto concerning the water depth during deposition of the Kuroko ores (1000m. vs. 2000m.), both sets of authors direct our attention to the dacitic cauldrons which appear to localize Kuroko deposits. Takahashi focuses particularly on the periphery of a single major cauldron, whereas Guber recognizes several smaller ones. Location of such cauldrons by stratigraphic and structural studies, supplemented by geophysical observations, is obviously an important step in the investigation of a volcanic basin. Similar guides have been used successfully in older terranes such as the Noranda district; they are of limited use in highly deformed volcanic belts. Gruber's excellent illustrations of lithologic distributions document the history of the basin. They would have been more effective if they had also shown the distribution of the known orebodies, so that we could have kept our eye on the ball as the picture unfolded. Takahashi and Sato also offer, but do not pursue, the intriguing suggestion that pre- and post-ore dacites may be distinguishable by having different H₂O and CaO contents. This difference, if established firmly and proven to be widely applicable, could also constitute a useful guideline.
3. Date, Watanable and Saeki have provided us with a detailed and quantitative three-dimensional picture of the alteration zones surrounding the Fukazawa deposit. They have also described the technique of preparing sets of "halo maps" for magnetic susceptibility and major element rock chemistry which can be most useful in local situations where adequate data are available. The applicability of these guides outside the Hokuroko basin is open to question.
4. The papers by Urabe, Scott and Hattori, Green and Ohmoto, and Kalogeropoulos and Scott, describe mineralogical chemical and isotopic signatures which are diagnostic of the presence of various kuroko-type ores. Most of these indicators are slightly to moderately more broadly distributed than the orebodies, and therefore can serve to enlarge the targets in situations where their spatial relationships to the orebodies are understood. Of the various indicators cited, some have been long recognized (e.g., chlorite chemistry) and others, such as oxygen isotope zoning, appear to be inconsistent and inadequately understood to be reliable guides at this time. However, used in combination, these indicators can be effective. Strong evidence is presented that at least some of them are valid in both Tertiary and Archean Terranes. Particularly promising is the evidence that ¹⁸O depletion persists in the post-ore rocks above certain deposits, and the suggestion that this form

of alteration can survive metamorphism intense enough to obscure mineralogical alteration patterns.

5. Similarly, the paper by Doe, Fehn, Farrell and Sato offers the hope that widespread halos defined by element concentrations and isotope compositions of lead and strontium at the Fukazawa deposit may be broadly applicable as guides. Rubidium is also mentioned as having potential. The authors conclude that further work will be needed to establish the validity of these guides.
6. I must confess that I am incapable of judging the merit of Cathles' paper on the use of hydrothermal circulation models in exploration. My instinctive feeling is that the approach involves too many basic assumptions which may be unjustified in our present state of knowledge.
7. The paper by Campbell et al, describes one of the least proven, but potentially most exciting guidelines mentioned in this symposium. If preliminary findings that rare earth element geochemistry can distinguish productive from barren acid volcanics can be substantiated, a powerful exploration weapon will be added to our armoury. Again, a great deal of work will be needed to confirm the validity of the method.

Summary and Conclusions

In order to provide future supplies of raw materials which will enable our descendants to enjoy a standard of living at least equal to our own, an increasing pressure will be exerted on those who are at the leading edge of the search for resources. For mineral deposits researchers, this will require a shift of emphasis towards identifying and elucidating the factors controlling mineralization, and developing a better understanding of those peripheral effects of mineralization which can constitute evidence that ore may be found nearby.

The papers presented in this symposium are evidence of a welcome new trend, in which mineral deposits research has shifted away from "science for the sake of science" towards "science in the service of mankind".

This symposium has given us a veritable feast of exploration guidelines, some proven, others whose validity remains to be confirmed. Equally important is the demonstration of what can be achieved by international collaboration in attacking geological problems. As a member of the exploration industry, I can assure you that your guidelines will be put to good use.

G.W. Mannard

REFERENCES

- Eidel, J. James and SEG Research Committee (1980); Preliminary results of the SEG research questionnaire; What we need the most (abstract). Geol. Soc. of America, 1980 Ann. Mtg. Atlanta.
- Hutchinson, R.W. (1981); Exploration technology: the geological challenge; Can. Min. Jour., April, 1981, pp. 31-43.

GEOLOGY DIVISION CIM-SEG URANIUM SYMPOSIUM, Saskatoon, Saskatchewan, Sept. 10-12, 1981

This concise and well-documented conference was the best the reviewer has attended in recent years, and a major credit to the organizers Gerry Pollock, Bill Petruk, Chris Healy, Geoff Burill, Tom Sibbald and Len Homeniuk.

The twenty-three papers constituted an excellent update and review of the geology of the Athabasca uranium deposits and their regional setting. Many papers, in particular the Asamera and Can.Oxy-Inco papers, provided new descriptive information not available elsewhere. The Can.Oxy paper provided several incisive observations which challenge some of the more rigid geological concepts currently in vogue. The descriptive papers from Saskatchewan were supplemented by papers on geologically similar areas elsewhere in Canada and in Australia, as well as by more theoretical papers on solution chemistry and alteration mineralogy. Evidence regarding whether the deposits resulted from "supergene" or "hypogene" processes remains as contradictory as it was when Hans Knipping presented his classic description of the Rabbit Lake deposit in 1974.

Pre and post symposium field trips were reportedly well organized and informative. The core display (Sept. 13), with associated posters, maps, plans and sections, provided a highly satisfactory conclusion to the Symposium.

A must for explorationists is the "CIM Geology Division Uranium Field Excursion Guidebook", which contains concise descriptions and maps of most of the deposits and is available from The Canadian Institute of Mining and Metallurgy, 400-1130 Sherbrooke Street, West, Montreal, Quebec, H3A 2M8, at \$10.00 for members or \$15.00 for non-members. The Symposium papers are being compiled in a volume which will be available shortly.

R.H. McMillan

FIELD TRIPS: Gold Deposits of Southern British Columbia

The departure date of a joint MDD-Cordilleran Section GAC field trip to Carolin, Bralorne and Northair mines has been moved ahead one day to Oct. 7. Late cancellations may allow a few additional participants: sent \$78.00 to R.S. Hewton, Riocanex Inc., #520-800 W. Pender St. Vancouver V6C 2V6, Tel.(604)685-1295. The bus will depart from Hotel Vancouver Oct. 7 at 06:45 sharp. Participants will visit Carolin mine first then overnight in Lillooet at the

Jay-Gee Motel. The tour will visit Bralorne Oct. 8 and overnight in Whistler, probably at the Highland Lodge. After a visit to Northair on the 9th, the tour will return to Vancouver in late afternoon. All participants must provide underground clothing, including hard hats, rubber boots and lamp belts. Accommodation and meals will be at participants expense.

Mineral Deposits in Granitoid Rocks of the Canadian Appalachians

The Mineral Deposits Division of the GAC is sponsoring a field trip on 'Mineral Deposits in Granitoid rocks of the Canadian Appalachians' on October 6, 7 and 8, 1981. The field trip will concentrate on the detailed geology and regional setting of the major antimony, tungsten-tin-molybdenum and uranium deposits in New Brunswick and Nova Scotia. In New Brunswick, recent developments at the Lake George antimony-tungsten and Mount Pleasant tungsten-molybdenum-tin deposits will be examined. In Nova Scotia, current development of the East Kemptville tin and Millet Brook uranium deposits will be investigated.

The trip will begin in Fredericton, New Brunswick, with initial evening discussions on Monday October 5, cross the Bay of Fundy on October 7, and end in the afternoon of Thursday, October 8, in Halifax, Nova Scotia.

Cost of the trip will be \$80 per person, with participants covering their own main meal and accommodation costs. Please send pre-payment to Dr. A. Ruitenburg, New Brunswick Department of Natural Resources, P.O. Box 1519, Sussex, New Brunswick, (Tel: (506)433-4317) by September 10, as registration is limited to thirty.

ANNOUNCEMENTS

9th International Geochemical Exploration Symposium, Saskatoon, Saskatchewan, May 12-14, 1982

Final Call for Papers

The Association of Exploration Geochemists is sponsoring the 9th IGES, for which the theme of the meeting is Geochemical Exploration for Energy Sources (uranium, hydrocarbon and geothermal), with a special session on litho-geochemistry (sponsored by the Mineral Deposits Division of the Geological Association of Canada). Papers and posters are invited also on all innovative aspects of geochemical exploration.

Please forward EXTENDED ABSTRACTS (1000 words) indicating whether you prefer a LECTURE or POSTER presentation, no later than 30 NOVEMBER, 1981 to:

9th IGES Organizing Committee,
Box 1971, SASKATOON, Saskatchewan S7K 3S5 Canada

(Please note the recent change of address) Registration forms will be mailed to all members in November.

Colin E. Dunn
9th IGES Program Chairman

Geoscience Forum, Yellowknife, N.W.T.

The ninth annual Geoscience Forum will be held in Yellowknife, Northwest Territories, Dec. 8, 9 and 10th. This meeting jointly sponsored by the Federal Government and the mining industry, brings together government geologists, university researchers, mineral exploration and mining people to talk about new ideas and discoveries in exploration, geology and mining development in the N.W.T.

The meeting is jointly hosted by the NWT Chamber of Mines (403-873-5281) and the Mining Section of the Department of Indian Affairs and Northern Development (403-920-8210).

Workshop on Gold Deposit Models, Calgary, Alberta, Feb. 14, 15, 16, 1983

The Mineral Deposits Division of the GAC, in conjunction with the Calgary MEG, are sponsoring a workshop on models or types of gold deposits to be held at Calgary on February 14 to 16, 1983. The workshop will be organized by the geologic staff of the University of Western Ontario, under the guidance of Dr. R.W. Hutchinson.

The Calgary MEG will reserve adequate hotel and meeting space, but the MDD will be responsible for pre-registration and for preparations for the workshop.

Short Course: Applied Ore Microscopy, University of Missouri

The course has been taught annually for the past 10 years to geologists and metallurgists from the United States, Canada, and Mexico, and will be given three times next year: 1) Dec. 7-11, 1981, 2) March 1-5, 1982, and 3) October 4-8, 1982 by the Department of Geology and Geophysics and the Mines and Metallurgy Continuing Education, University of Missouri-Rolla. The course consists of five days of lectures and laboratories and involves a wide variety of applications of the reflecting microscope to ores, exploration, beneficiation and other industrial problems. The course director and teacher is Dr. Richard D. Hagni. Maximum enrollment is 14. Registration fee for either of the first two-five week sessions will be \$650; the third will cost \$750. Further information on course content can be obtained from Richard D. Hagni, Department of Geology and Geophysics, University of Missouri-Rolla, Rolla, MO 65401, Tel. 314-341-4657.

Information on registration can be obtained from Frank F. Haston, director, Mines and Metallurgy Continuing Education, UMR, Rolla, MO 65401, Tel. 314-341-4204.

Third Circum-Pacific Energy and Mineral Resources Conference, August 22-28, 1982; Honolulu

The conference, to be held at the Hilton Hawaiian Village Waikiki, will be organized around the theme "Resources for the '80's" and will emphasize newly identified and significant energy and mineral resources of the Pacific, and developments in related methodology and technology. Abstract deadline is January 1, 1982. Submit 250 word or less abstracts to: Alan Mabra, ARCO International Oil and Gas Co., 515 Flower St., AP-4985, Los Angeles, CA 90071. For information brochure contact AAPG Convention Department, P.O. Box 979, Tulsa, Oklahoma 74101.

University of Ottawa, Public Lectures, Autumn 1981

- October 5, M. Frey, University of Basel
The step from diagenesis to metamorphism, Central Alps, Switzerland.
- October 19, M. Wadleigh, University of Ottawa
Strontium and its isotopes in Canadian rivers: Consequences for the exogenic cycle.
- October 26, R. Hesse, McGill University, Montreal
Early diagenesis of deep marine terrigenous sediments and the occurrence of gas hydrates.
- October 28, D. Tempelman-Kluit, Department of Indian and Northern Affairs, Whitehorse
Yukon tectonic elements and a collision model for the evolution of the Canadian Cordillera. National Lecture Tour, GAC. (Note: lecture in MacDonald Hall, Physics).
- November 2, R. Sabourin, University of Ottawa
Geostatistics as a tool to define ore reserve categories.
- November 9, J. Hea, Department of Energy, Mines and Resources
Geology and petroleum potential of Canada's frontier regions.
- November 16, J. Lafleur, University of Ottawa
Geology of the Round Lake Batholith area, Ontario.
- November 23, R.G. Garrett, Geological Survey of Canada
Sampling designs in geology.
- November 30, F. Frey, Massachusetts Institute of Technology
Mantle composition inferred from the study of ultramafic rocks.
- December 7, S. Hammer, Carleton University
Shear zones and diapirs in the Hercynian of western France.

All lectures are given at 11:45 a.m. in room D-103, Colonel By Hall, University of Ottawa. Enquiries at (603) 231-3480.

McMaster University: Geology Seminars

THURSDAY, October 8th, 1981

"The Hibernia Structure"

Dr. Ron McKenzie
Canadian Society of Petroleum
Geologists Distinguished Lecturer
Mobil Oil Canada, Ltd.
Calgary, Alberta

Coffee and doughnuts will be served at 3:30 p.m. in S.S.C.-123.

Dr. McKenzie's seminar will be presented at 4:00 p.m. in S.S.C.-163.

TUESDAY, October 6th, 1981

"History of CO₂"

Dr. E.T. Degens
C.I.M. Distinguished Lecturer
Geol. & Palaont. Institute
University of Hamburg
West Germany

Coffee and doughnuts will be served at 3:30 p.m. in S.S.C.-123.

Dr. Degens' seminar will be presented at 4:00 p.m. in S.S.C.-102.

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