geogram

No. 12 DECEMBER/1979
DECEMBRE

an informal branch newsletter
un bulletin interne d'information

FROM THE DIRECTOR GENERAL

This is a time of change: changes in government, in the economic climate of the country, in the civil service, particularly in the perception of the public towards the civil servant, and, within the Geological Survey, in management and organization. John Wheeler has now left Ottawa, and after a grueling time in the French Alps, both from a geological and gastronomic point of view, he is back in Vancouver renewing his acquaintance with the Cordillera. We certainly miss him in Ottawa as a colleague and a friend, but we'll have a lot to do with him yet. His encyclopedic knowledge of Canadian geology must be tapped, particularly in planning for a new edition of "Geology and Economic Minerals of Canada". John Fyles is now in place as his successor, and we've revived the honourable title of Chief Geologist for him. We are discovering that his five years away from us were not wasted, and he comes back more canny than ever with sound ideas on how to deal with some of the more tricky government managerial problems we must face. He is enjoying his first overall look at our program as he visits the Divisions.

We all recognize that times are difficult, budgets shrinking, auditors baying at our gates (or snapping at our heels) and endless systems of management (that were probably known to the Sumerians) masquerading under new names are being thrust upon us. In spite of this, our day to day doings continue. I was immensely encouraged and pleased that the Branch did so well in the United Appeal this year. I think we exceeded our quota by some 26% and I should like to congratulate all of you on this achievement, not the least the organizers and canvassers.

One of the invisible battles that is going on within our Department at present, of which you are probably entirely unaware, is the question of functional versus line management. For some 10 years now, there has been a belief that the display of programs by function could be separated from management, and great ingenuity has been expended over the years in obfuscating the real role of, for instance, the Geological Survey by resolutely not calling a spade a spade. The onslaught by the Auditor General and the Comptroller General and the Lambert Commission, however, may have carried an unexpected benefit. Because of the complexity of some of the systems that are now being introduced, it is beginning to be recognized that the easiest way to describe an organization's activities is by saying what each unit in that organization does. This is particularly true of a decentralized Branch like the Geological Survey where, until now, we've had to operate in no less than three Programs. This meant that we could not transfer funds from one Program to another without considerable difficulty, even though some Divisions were operating in two or even three of the Programs at the same time. I hope that this is all changing, and that the Survey will approach the future better identified and its Program better described by recognizing that a Geological Survey is a worthwhile activity in its own right. This, in fact, is the way the public has seen us for over 130 years, and, who knows, our name might even be reinstated in the Parliamentary Estimates Volume within a year or two.

One final word: I don't wish to repeat regrets and comments that are being made widely, but I feel I must record my own shock and sorrow at the death of Bob Douglas. He was a close personal friend, as well as a person I admired deeply. From the point of view of the Survey, we have lost someone irreplaceable and unique.

NOTE DU DIRECTEUR GÉNÉRAL

Nous vivons une époque de changements: le gouvernement, la situation économique du pays, la Fonction publique (en particulier l'attitude du public envers les fontionnaires), la gestion et l'organisation de la Commission géologique du Canada, tous ces domaines subissent des transformations. M. John Wheeler a quitté son poste d'Ottawa, et, après un épuisant séjour dans les Alpes françaises, des points de vue géologique et gatronomique, est retourné à Vancouver pour approfondir ses connaissances sur les montagnes Rocheuses. Evidemment, nous avons perdu un collègue et un ami, mais nous devons rester en communcation avec lui pour ses vastes connaissances de la géologie canadienne, notamment pour la planification de la nouvelle édition de "Géologie et ressources minérales du Canada". Il a cédé son poste à M. John Fyles, pour qui nous avons rétabli le titre honorifique de géologue en chef. Pendant son absence de cinq ans, M. Fyles semble ne pas avoir perdu son temps; il nous revient plus circonspect que jamais, avec d'excellentes idées sur la manière de traiter certains problèmes délicats de gestion au sein d'un organisme gouvernemental. Il fait actuellement la tournée des divisions afin de se familiariser avec le programme.

Nous savons tous que les temps sont durs. On nous impose des restrictions budgétaires et d'interminables méthodes de gestion (dont certaines sont probablement vieilles comme la terre mais dont seuls les noms changent) et enfin, les vérificateurs sont à nos trousses, quant ils ne nous mettent pas carrément le couteau sur la gorge. En dépit de tout cela, nous poursuivons notre travail quotidien. J'ai été grandement encouragé et ravi par l'étonnante participation de la Direction à la campagne Centraide de cette année. Je crois que nous avons augmenté nos contributions d'environ 26% et je tiens à vous en remercier tous, spécialement les organisateurs et les solliciteurs bénévoles.

L'un des conflits internes qui secoue actuellement le Ministère et dont vous êtes probablement tout à fait inconscients, est celui des services fonctionnels et organiques. Voilà près de 10 ans que les gestionnaires croient inutile d'identifier les programmes par leurs fonctions, et ils n'ont réussi pendant tout ce temps qu'à semer la confusion, au sujet du rôle véritable de la Commission géologique, par exemple, en refusant d'appeler les choses par leur nom. Les critiques du vérificateur général, du contrôleur général et de la Commission Lambert ont peut-être eu, toutefois, un effet bénéfique imprévu. A cause de la complexité de certains systèmes en vigueur actuellement, on commence à reconnaître que la façon la plus simple de décrire l'activité d'un organisme est de dire ce que fait chaque service. Cette constatation s'applique particulièrement dans le cas d'une direction aussi décentralisée que la Commission géologique qui, jusqu'à présent, a dû répartir ses énergies entre trois programmes au moins. Les transferts de fonds d'un programme à l'autre étaient donc très difficiles à réaliser, même si certaines divisions participaient à deux ou même trois programmes à la fois. J'espère que cela est en train de changer et que, en reconnaissant son importance réelle, on pourra un jour mieux identifier la Commission et mieux définir son programme. D'ailleurs, le public la considère comme un programme unique depuis plus de 130 ans; qui sait, le nom de Commission géologique du Canada pourrait même être rétabli dans le Budget des dépenses d'ici un an ou deux.

En dernier, sans vouloir répéter des propos si souvent entendus, je tiens à dire combien la mort de M. Bob Douglas m'a peiné et bouleversé. Il était un ami intime, et je l'admirais profondément. La Commission a perdu en lui quelqu'un d'unique et d'irremplaçable.

Energy, Mines and Resources Canada

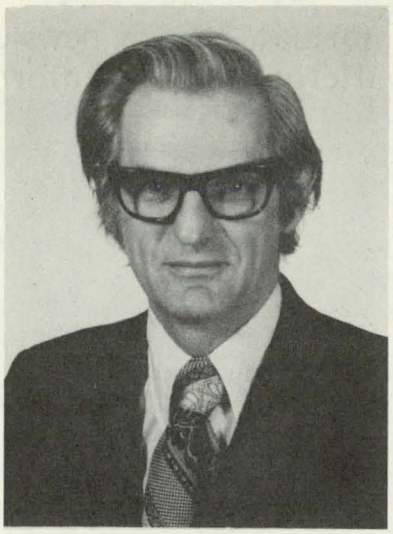
Énergie, Mines et Ressources Canada

R.J.W. DOUGLAS

1920 - 1979

The Survey suffered a great loss with the sudden death of Bob Douglas on November 1, less than two months after he had undergone what seemed to be successful open-heart surgery. Bob, Ottawa Valley-born, was a graduate of Queen's and Columbia (B.Sc.1942, Ph.D. 1950) and had been an officer of the Survey since 1945. His worldwide reputation as a structural geologist was based on his fieldwork in the Foothills and Rocky Mountains of Alberta and Mackenzie District and there are many on the Survey staff, in industry, and in academic life who spent one or more summers with Bob and whose careers are a continuing reflection of his ability to enthuse and to communicate. The 1950s and 1960s were times of rapid advances in the reconnaissance mapping of Canada with the advent of light helicopters, and in 1957 Bob Douglas directed "Operation Mackenzie" which resulted in the mapping of about 260 000 km^2 of southwestern Mackenzie designed to provide basic geological information especially as an aid to assessing the oil and gas possibilities of the region. The results of this work have been of great value and are the basis for much current work in the area.

In April 1964 he was appointed Chief of the Regional Geology Division, a position he held until April 1967 when a reorganization of the Survey



permitted him officially to return to "the bench" although by late 1965 he had been seconded to a special project, to organize and edit the 5th edition of "Geology and Economic Minerals of Canada". The 1:5 000 000 Geological Map of Canada more than any other of the folio of maps that accompany this report bears his imprint. At the time of his death he was co-ordinator of the 1:1 000 000 Geological Atlas of Canada; five sheets of this 60 sheet atlas have been published and several others are in an advanced state of preparation. Few if any Canadian geologists have the broad comprehension that Bob had of the geology of Canada, both Precambrian and Phanerozoic, needed to synthesize the results of the work of hundreds of colleagues and predecessors.

He was honoured by election to the Royal Society of Canada (1959), the award of the Miller Medal of that society (1965) and of the Logan Medal of the Geological Association of Canada (1976).

The talents and dedication that Bob Douglas brought to the Geological Survey will be very difficult to replace; the results of those talents and that dedication will be long remembered.

-R.G.B.

Au bureau de cartographie de la commission nous le connaissions tous. Un scientifique, c'est ce qui'il était à nos yeux. Son savoir nous paraissait sans borne et nous en avons abusé souvent car sa gentillesse nous était familière. Il pouvait écouter et comprendre ses semblables à différents niveaux, ce qui est la marque des grands êtres humains. La cartographie a perdu un ami et un conseiller de choix, mais son nom reste parmi nous sur de nombreuses cartes.

-P.C.J.D.

STAFF NEWS

Director General's Office

AWARD OF PROFESSIONAL INSTITUTE GOLD MEDAL TO D.J. McLAREN

The Professional Institute of the Public Service have awarded their biennial Gold Medal for work in the field of pure or applied science to Digby McLaren. The award recognizes an outstanding professional career that included the development of a research program at ISPG related to Canada's needs in petroleum geology and since 1973 responsibility for the direction of the GSC, one of Canada's largest scientific organizations. In the latter role he has been not merely concerned with maintaining the Survey's traditional and established roles but he has inspired new thrusts, notably in advances in the methodology of oil and gas appraisals, a contribution that is specifically mentioned in the citation that accompanied the medal.

Atlantic Geoscience Centre, Dartmouth

Gerry Reinson left AGC to return to ISPG in Calgary in September. He has taken a position as Clastic Sedimentary Petrologist in which he should have an opportunity to contribute significantly to a better understanding of the processes of deposition and diagenesis of ancient sediments. It was with a good deal of regret that AGC had to part with the services and research contributions made by Gerry to the Centre. It is hoped that Gerry will be able to continue some aspects of his recent marine sediment studies on an opportunity basis. Any opportunity to do so will be welcomed by all of his colleagues at AGC who hold Gerry in high esteem as a scientist and a friend.

Mike Keen visited China with a delegation from the Canadian Government on Scientific Exchange from November 6 to December 3.

The Gilbert H. Cady Award was presented to Peter Hacquebard on November 5, 1979 to acknowledge his exceptional achievements in coal geology. The award is presented biennally by the Geological Society of America (GSA) for meritorious work in coal geology of North America. Peter has directed studies of coal petrology, palynology, and the evaluation of deposits for the GSC in Sydney (1948-1959) in Ottawa (1959-1973), and Calgary (1973-1975). In 1975 he returned to Nova Scotia to work on coal petrology as well as to advise the provincial Department of Mines on coal. Peter's efforts have led to important extension of old fields in Nova Scotia to introduction of a coalification curve for the Maritime Provinces, and the demonstration of vitrinite rank to be a significant guide to regional oil and gas occurrences in eastern and Rocky Mountain provinces of Canada.

Geological Information Division

Some time ago Tara Naraynsingh left the warm waters of Trinidad and has most recently found herself in charge of our Map Library. With Tara we also welcome Dianne Finnerty who is assisting Eleanor Smith as acquisitions clerk in the Library.

John Playford and Gaetan Lamarche recently left the GSC for greener pastures and Gord Currie, formerly with CLAS, is a welcomed addition to Laurier Touchette's Publications office.

Retirement lured two long-time GID employees from us - Ed Rail and Peter Harker. Ed joined the department in 1966 having previously been employed with the Canadian Corps of Commissionaires after serving overseas in the Second World War. He kept law and order in the publications storeroom. We have been reassured that Ed is enjoying his retirment, secure with the knowledge that Bruce Murphy is now at the helm.

Stephanie and Peter Harker admire GSC momentos (above) as countless friends and colleagues gather to bid adieu (below).

Peter Harker joined the GSC in 1948, a graduate of the British Army and the University of Cambridge. During the winter's of 1949 and 1950 he attended the University of Michigan where he completed his Ph.D. with a thesis on the Mississippian and Permian rocks of the Canadian Rockies. For the next decade he continued his stratigraphic and paleontological studies first in the Rockies and later as a member of Bob Douglas' Operation Mackenzie. In 1959 he joined the staff of the Chief Scientific Editor thus beginning his association with the management side of the Survey, an association that ended on June 30, 1979 with his retirement from the position of Director, Geological Information Division.

Wilson Hall was filled with past and present colleagues of Peter's on June 22. Dr. C.H. Smith our senior ADM presented the Government of Canada's long service certificate and in the course of his remarks commented "Peter's devotion to the work of other members of the Survey, and the Department, and the reciprocal respect and admiration that he has generated, are, in my mind, the mark of the man". Gifts from Earth Physics Branch and from ISPG were also presented as was an elegant, illuminated scroll from the GSC. Dr. McLaren, our Director General, who has known Peter Harker from Cambridge days recalled the humorous and serious aspects of Peter's career and then presented him with an antique silver tray engraved with the GSC crest. Digby McLaren's remarks were a perfect foil for Peter's response and when proceedings were brought to a close all agreed that it had been a "fine entertainment".

Economic Geology Division

A visiting Scientist from the Norwegian Geological Survey, Dr. A. Bjørlykke, will be hosted by the Mineral Deposits Geology Section (Economic Geology Division) for a year beginning October 1979. Born in Norway, Dr. Bjørlykke is a graduate of Trondheim University (Ph.D., 1967) having completed his thesis on the geology of "Lead deposits in the Gjøvik area" of Norway. He joined the G.S.N. as a Scientist Assistant immediately upon graduation, became a State Geologist in 1971, and finally a Senior State Geologist in 1976. For the last three years Dr. Bjørlykke has been the head of the Ore Deposits Section of G.S.N. During the years 1969-74 he was first a member, and then the leader (1972-74) of a group of geophysicists and geochemists engaged in exploring for lead deposits in Eocambrian sandstones of Norway.

Dr. Bjørlykke's main research interest is the geology of lead-zinc deposits in arenites and carbonates. He will be carrying out studies in selected deposits in North America during his year with us.

During the past year, mathematicians in the Survey have had the opportunity to compare notes with two guest scientists.

Norman H. Gray of the University of Connecticut was spending his sabbatical leave for the 1979 spring semester with the Geomathematics Section. Norman originally obtained his Ph.D. (1971) at McGill University dealing with

the thermal histories of small intrusions from petrologic information. He now teaches petrology and mineralogy and conducts research in the mathematical modelling of geological processes. During his stay in Ottawa he was working on twin-width distribution in polysynthetically twinned feldspars and the statistical testing of structural hypotheses by comparing least-squares small and great circle fit to orientation data. Norman has interacted extensively with geomathematicians working on problems of quantitative mineral resource estimation. In May he lectured to GSC staff on the origin of columnar jointing.

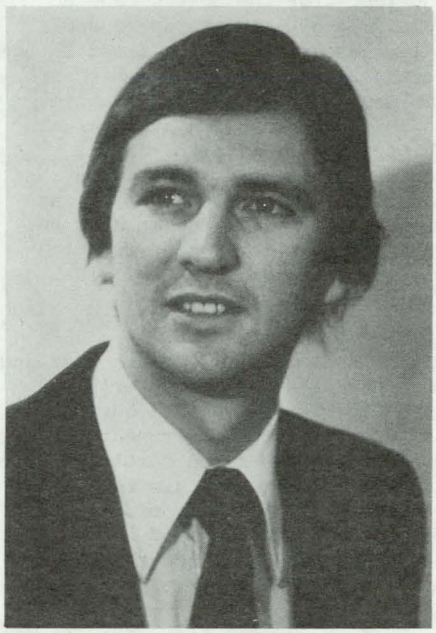
Carolyn B. Hudson joined the Geomathematics Section as a resident visitor in August. She will return to the University of South Carolina in March 1980 to work for a Ph.D. degree in mathematical geology. Carolyn holds a B.Sc. (1967) in mathematics from the University of North Carolina at Chapel Hill, and master's degrees in forest biometry (Duke University, 1969) and geology (University of South Carolina, 1979). In 1972 she published a paper on pandiagonal magic squares of order 6t±1 in Mathematics Magazine. In Ottawa Carolyn is working with Frits Agterberg on problems of quantitative biostratigraphic correlation. The purpose of this project is the development of computer-based mathematical theory and analysis of geological information required for the practical application of automated correlation techniques.

Helmut Geldsetzer and Andy Okulitch of the Correlations and Standards Subdivision in Ottawa have transferred to ISPG in Calgary.

Central Laboratories and Administrative Services

Harris Lapp retired on December 27, 1978 after completing 35 1/2 years in the Federal Civil Service. Before coming to the GSC to work as Administrative Officer to CLAS and Economic Geology Divisions in 1969, Harris was a financial officer for the CRTC under Pierre Juneau (1968), a hospital administrator for the Department of National Health and Welfare (1959) and worked in the Departments of Agriculture (1945) and Finance (1943).

Although he retired December '78, Harris was on an extension as a term casual until May 31, 1979. Since his retirement Harris has received several job offers from outside the Government service, however for the time being, he would like to remain in Ottawa to persue his hobbies of woodworking, researching the family history, and music.



Yvon Claude

Appointed Branch Administrative Officer, October 15, 1979.

Institute of Sedimentary and Petroleum Geology, Calgary

Hugh McLean (Storesman), Gary Brown (palaeontology technician) and Kim Evis (Energy Subdivision Secretary) have left the ISPG for employment in the private sector. Hopefully we will still get to see them at the annual ski event this winter The Sample and Core Room is now maintained by Pierre Meilleur; Nancy Long replaces Kim Evis as secretary to the Energy Subdivision. She hails from the Department of Indian and Northern Affairs. Maria Varalta and Jean Spirritts joined the Typing Office this fall.

Pat Michael will be taking on the responsibilities of scanning electron microscope technician as soon as the instrument arrives. Bernie Then replaces Russ Warren as the Instrument Shop Technologist, keeping the ISPG plant in running order under Cliff Jermy. Susan d'entremont joins our group of technicians in the geochemistry laboratory of the Energy Subdivision.

Joanne Drake has left the accounting office to start a day-care centre.

Gulam Jamro has transferred to the Department of the Environment in Burlington, Ontario where he continues as a PS1.

Valery Chipper moves from the Typing Office to the Library where she will learn the quirks and quarks of the library trade as the new Acquisitions Clerk replacing Pamela van Duffelin. Lynn Machan replaced Catherine Findlay some months ago as editorial assistant Cathy left for an editorial position with the Alberta Government.

Post-doctoral fellows come and go at a great rate in a large research institution and are soon only remembered by those with whom they were closely associated. Not so with Ravi Tipnis who came to us three years ago from the University of Alberta and so now has more seniority that most scientists in this city of transients. Ravi's interest in Early Paleozoic conodonts has brought him into direct working contact with most of our scientists and he has produced an enormous number of papers alone and with a variety of co-authors on the biostratigraphy of the northwest and the Arctic, all of them over an ISPG byline. He leaves us now for a tour of duty at Ohio State University; we shall all miss a very productive scientist and a very pleasant colleague. We wish him and his family well in the years ahead and we envy the students who will now be in contact with his quiet enthusiasm which we enjoyed for so long.

Terrain Sciences Division

Andy Casey became the Division's Administrative Officer. Andy originally began his career in the Departmental Administrative Trainee Program and went on to the Computer Science Centre. Andy is replacing Yvon Claude who is now the Branch Administrative Officer.

Mary Asselstine left the Sedimentology and Mineral Tracing Section in November. Among her many duties during her three years here, Mary handled the section's data base management needs and organized the logistics for several field projects. She left to seek work in earth or environmental sciences in Toronto. We wish Mary all the best for the future.

Joanne Cox left the Division in June 1979 and is now working in Legal Services of this Department.

Inez Kettles has returned from graduate work at the University of Illinois and has replaced Mary. Her M.Sc. thesis on the stratigraphy of south-central Illinois will be published in the "Circular" series of the Illinois Geological Survey.

Jeanne Grainger transferred to Terrain Sciences Division in July 1979 from the Personnel Office of this Branch and is now working for our Secretarial and Clerical Services Unit. Welcome.

Wes Blake attended a commemorative dinner in Ottawa on November 2nd to celebrate the 100th anniversary of the birth of Arctic explorer Vilhjalmur Stefansson. This gala event, hosted by the National Museum of Natural Sciences, was the third in a series; previous dinners had been held in Moscow on October 30th, under the auspices of the Geographical Society of the USSR, and at Dartmouth College, Hanover, New Hampshire, on October 31st. Stefansson served as an Arctic consultant at Dartmouth for a number of years, and it is there that his world-renowned polar library is housed. Wes noted that the Canadian Arctic Expedition of 1913-1918 made a number of important contributions in his field of Quaternary geology, including the only known discovery of a mammoth tusk in the entire Arctic Archipelago.

Resource Geophysics and Geochemistry Division

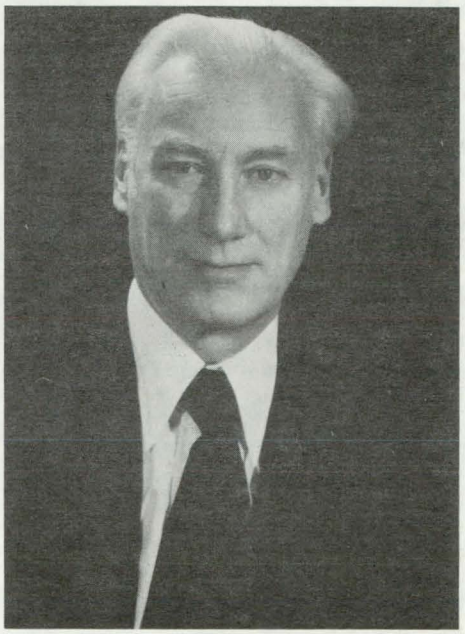
Peter Annan left to join Barringer Research Ltd., Rexdale, Ontario. Peter joined the GSC on October 1, 1974, and was involved in several electromagnetic projects from low frequency natural fields to radio frequency sounding. His major contributions were made in the use of radar waves to probing of the ground for engineering purposes and soil moisture determinations. The radar pulse method has been applied to structural mapping in permafrost terrain, crack and lithological mapping in potash mines, water table and bedrock mapping in coarse grained soils, fresh water ice thickness, and subbottom structure beneath lakes and rivers. When Peter departed, he was working on borehole radar for the Radwaste Project. Peter's interests in electromagnetic probing vary from one end of the frequency spectrum to the other. Best of luck for a bright future, Peter.

On Tuesday, October 23, Regional Projects Section of Terrain Sciences Division welcomed back John G. Fyles, former head of the Division, who was recently appointed Chief Geologist of the Geological Survey of Canada. The informal buffet luncheon showed the considerable culinary and organizational talents of, chiefly, Sylvia Edlund, Lynda Dredge, and Doug Grant.

Nelson Gadd offered remarks of welcome and congratulations to Dr. Fyles and included a brief review of the development of Pleistocene geology within the Geological Survey and the important role that Dr. Fyles had played in furthering that development.

John Fyles expressed genuine pleasure at returning to the Geological Survey among colleagues and friends and to a post where geology will be the basic theme of his endeavours.

-N.R. Gadd
Terrain Sciences



John Fyles

Chief Geologist
Géologue en chef

OF GENERAL INTEREST

Mesozoic and Cenozoic Microplate Tectonics of Western North America

The Penrose Conference on microplate tectonics was held from October 7-12, 1979, in the pleasant surroundings of the Islander Lopez, in the San Juan Islands of northwestern Washington. Convenors were Myrl E. Beck, Western Washington University, Allan Cox, Stanford University, and David L. Jones, U.S. Geological Survey, Menlo Park. Fifty-four delegates, including ten students, attended the meeting. Only four were from Canada - Ted Irving and Patrick Morel, Earth Physics Branch in Ottawa, and Chris Yorath and Jim Monger, Cordilleran Geology Division from Pat Bay and Vancouver, respectively.

In spite of the somewhat exotic title, the meeting was very down-to-earth and presented an excellent review of current thoughts on the tectonics of the western Cordillera. Much of the meeting consisted of reviewing data and introducing new evidence bearing on the concept that the Cordilleran eugeosyncline, from Alaska to southern California, is a collage of terranes that originally were isolated and subsequently were brought together along the western margin of North America.

-J.W.H. Monger
Cordilleran Geology Division

The '79 Grenville Club Field Trip took its participants to La Malbaie area on September 29-30. Jehan Rondot of the Quebec Department of Natural Resources guided the group through the metasediments of Charlevoix County believed to represent a sequence of thin continental deposits on a paleocontinent called Quebecia. Some of the outcrops showed faulting, shatter cones and dykes containing mylolisthenite related to the Charlevoix impact crater.

Participants represented the Quebec Department of Natural Resources, University of Quebec in Montreal and Chicoutimi, University of Laval, McGill University, State University of New York in Stoney Brook and the Geological Survey of Canada.

-Mariette Henderson
Economic Geology Division

Bob Howie's daughter, Cindy, has been awarded the Geological Wives Association scholarship for 1979/80. Cindy is presently enrolled at Queen's University and plans to pursue a career in Occupational Therapy. Congratulations to Cindy and Bob and Marion Howie. Bob is with Eastern Petroleum Geology at AGC.

CCSS Symposium

I. Trondheim, Norway

IGCP Project 60 (Correlation of Caledonian Stratabound Sulphides) held a Symposium in Trondheim, Norway, September 10-12, preceded by field trips to eight Norwegian and Swedish deposits. The Symposium was orchestrated by Prof. F.M. Vokes, International Leader of the Project and the author attended in his capacity as Canadian National Representative. Eighty participants registered for the Symposium and about half of these attended the field excursion. A 120-page guidebook was provided for the latter.

Deposits visited were the Bleikvassli and Mofjellet (highly deformed and metamorphosed Pb-Zn deposits in mica schist (meta-shales)); the Rana magnetite-hematite iron mine; the Laisvall sandstone-hosted Pb-Zn deposit; the Stekenjokk, Joma, Lokken, and Høidal volcanic-hosted massive sulphide deposits.

The Bleikvassli (4.8% Zn, 2.5% Pb, 0.15% Cu) and Mofjellet (3.6% Zn, 0.8% Pb, 0.3% Cu) are low-sulphide (i.e. not massive sulphide) deposits enclosed in mica schists and gneisses with minor amphibolites. Both deposits consisted of many lenses and layers of this low-grade material and the general impression the author came away with was that they likely represent a variety of shale-hosted deposits. Although originally considered to be of Caledonian (Lower Paleozoic) age, recent dating (as yet unpublished) indicates a Precambrian (possibly Grenville) age.

The Rana iron mines (4 deposits are currently under development, the largest of which is 180 million tonnes of open-pit ore) are associated with a dolomitic marble enclosed in garnet and mica schists. Again, there is controversy over the age of these rocks, originally considered Lower Paleozoic but now possibly Precambrian.

The famous Laisvall mine in Sweden was the highlight of the trip for the author. The deposit, hosted in clean quartzitic sandstones of Eocambrian age, contained original reserves of 80 million tonnes and is currently being mined at 1.4 million tonnes of 4% combined Pb-Zn per year. The ore consists almost entirely of galena as an intergranular matrix to the sandstone. The ore is strongly zoned laterally with the Pb-rich ore containing almost no sphalerite and vice versa in a small sphalerite ore-body. The contact between the two is very sharp and can be easily accommodated within a single photograph. Sedimentary features such as crossbedding and convolute bedding are readily recognizable even in the highest-grade ore. In summary, a deposit that must be seen to be appreciated.

The remaining deposits are, in my opinion, fairly standard small volcanogenic massive sulphide deposits which would hold few surprises for most geologists familiar with Canadian equivalents. In spite of age correlations, the Norwegian-Swedish ores are not similar to, for example, the Bathurst deposits. Host rocks in the Scandinavian deposits contain a much higher proportion of mafic volcanics and are considerably poorer in lead than the Bathurst deposits. The former are, moreover, low-grade. The largest Norwegian deposit of this type (Lokken) averages 2% Cu and 1.8% Zn whereas Stekenjokk, in the Swedish Caledonides, runs about 1.4% Cu and 3% Zn.

Symposium papers, which dealt mainly with descriptions of Scandinavian Caledonian sulphide deposits, will be published as a unit, probably in the Geological Survey of Norway's Norges Geologiske Undersökelse (NGU).

II. Finland

Following the CCSS Symposium, I visited three Outokumpu Oy deposits in Finland, namely Vihanti, Pyhasalmi, and Outokumpu-Vuonos. The first two of these are described in the recent Fennoscandian issue of Economic Geology (vol. 75, no. 5) and appear to be fairly normal Cu-Zn-Pb massive sulphide deposits associated with minor felsic volcanic rocks within a thick sequence of monotonous mica schists. One interesting feature of the Vihanti mine, not recognized in previous studies, is the occurrence of a distinctive uranium-apatite horizon just above the ore. As for the Outokumpu-Vuonos deposits, Cu-Zn (Co-Ni) deposits associated with serpentinized ultramafics, meta-chert, and black schist, all enclosed in the usual mica schist, I would agree with recent authors (e.g. Peltola, Econ. Geol., vol. 73, no. 4) that the deposits are an unusual type of exhalative Cu-Zn massive sulphide associated with an ultramafic body (possibly, but not proven, extrusive). The relatively high Ni-Co content of the ore may be due to its association with these ultramafics. One interesting feature, not mentioned in Peltola's paper, but touched on in an earlier publication (Geol. Sur. Finland, Bull. 271, 1975) is the occurrence of a cordierite-anthophyllite rock in the mines. Upon questioning by myself and J. Steward (BP Minerals, Toronto), mine geologists admitted that this distinctive rock occurred only in the Outokumpu-Vuonos mine area and only between the serpentinite and the adjacent orebody. If the cordierite-anthophyllite represents a metamorphosed alteration zone, then, for the first time, perhaps stratigraphic tops may be determined in this area. By this criteria, both orebodies are upside down and the proper stratigraphic mine sequence would be (from bottom to top) serpentinite-carbonate-chert (plus ore)-black schist.

III. Germany

As part of a Germany-Canada scientist exchange agreement, I spent ten days in the company of BGR (West German Geological Survey) geologists examining the Meggen, Rammelsberg, and Maubach deposits. The first two are well-known Middle Devonian shale-hosted deposits, the third a Laisvall-type sandstone-lead deposit in the Triassic. The first two deposits, regardless of the fact that they are in similar host rocks of almost identical age and only 165 km apart, are quite different in many aspects. Meggen is a single layer of massive pyritic ore (10% Zn, 1.3% Pb) with little or no banding, surrounded by a sulphide-free barite zone. The ore contains little or no intercalations of host shale. Rammelsberg, in contrast, is strongly banded, contains shale interbeds, is a low-pyrite ore (9% Fe), and higher grade (19% Zn, 9% Pb, 1% Cu). Barite occurs mixed with lead-zinc in the top portion of the orebody as well as in a completely separate barite body well into the hangingwall of the sulphide body. An apparent stringer zone of chalcopyrite-quartz occurs beneath the deposit.

The Maubach deposit, which ceased being mined in the 1950's contains galena occurring as a matrix to clean quartzitic sandstones and pebble conglomerate in a manner very similar to Laisvall (Sweden) and Yava (Canada). Average grade for about 12 million tonnes mined was 2.5% Pb, 0.8% Zn, 0.2% Cu.

-D.F. Sangster
Economic Geology
Division

North Pole Geology Under the Sea Ice at LOREX 79

During April and May 1979, several members of GSC participated in a major EMR polar expedition to investigate the nature and origin of the Lomonosov Ridge near the North Pole. This ridge, equivalent in relief and size to a major mountain range, rises almost 3000 m above the floor of the Arctic Ocean and extends about 1700 km between northern Canada and U.S.S.R.

According to some theorists, the ridge is an ancient sliver of the Eurasian continent that was shifted to its present position by rifting and sea floor spreading processes within the last 60 million years. Others suggest the ridge stands as mute and relict evidence of former upheavals and buckling of the oceanic crust possibly with outpourings of volcanic rocks. Clearly the formation of such an extensive feature has played a major role in the evolution of the Arctic Ocean basin, and a proper understanding of the timing and mechanics of its emplacement is bound to improve our understanding of the continental margins surrounding the Arctic Ocean including the rocks and resources of Arctic Canada.

The ocean sediments may provide a record of the influence of this major ridge on deep sea sedimentation processes. This seabed record could lead also to insights about ancient oceanographic conditions and the history of ice cover on the Arctic Ocean.

The overall scientific program called LOREX 79 was conceived and developed by the Earth Physics branch, EMR, with Hans Weber taking the lead role in planning and in serving as the expedition's chief scientist. The Polar Continental Shelf Project supported the program magnificently with transport, food, shelter, fuel and Arctic expertise. The Canadian Armed Forces ultimately mobilized a squadron of Hercules aircraft to deliver fuel and shelter materials onto the sea ice in an impressive manner using their low altitude parachute extraction system that ejects freight just above ground level.

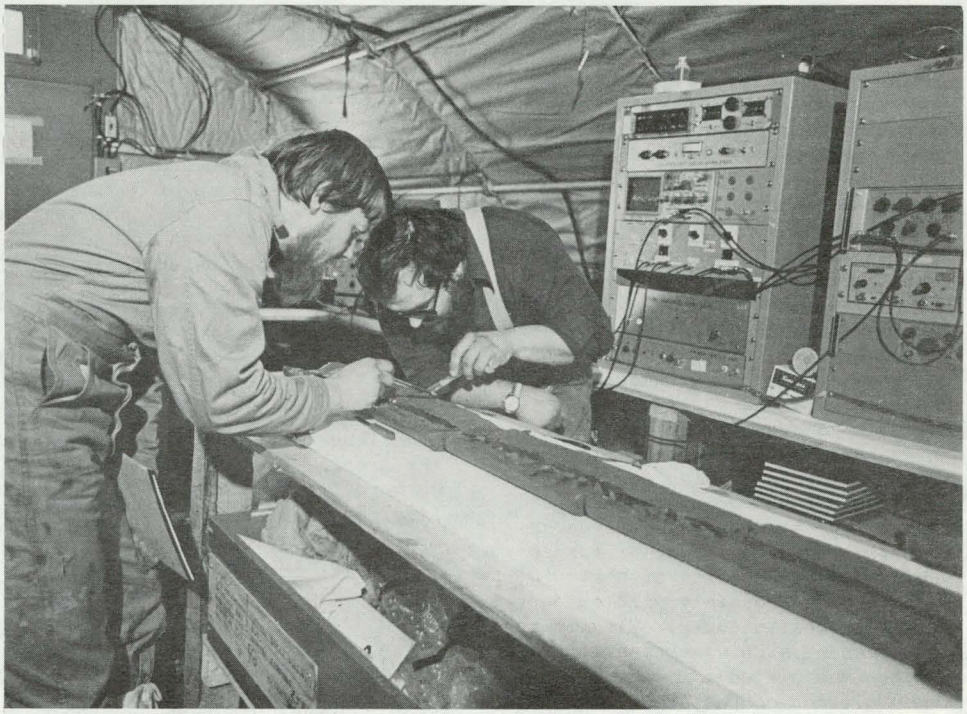
At an early stage in the planning, and following our initial experience with marine geology in the Arctic Ocean at AIDJEX in 1975, we were invited to take responsibility for the investigation of the surficial characteristics of the Lomonosov Ridge. Brian Bornhold carried out much of the interim planning and Steve Blasco took charge of the actual field project. We all managed to participate on the ice, ably assisted by Fred Jodrey, Robbie Burns, Ray Jubb and Bob Murphy. Our success in the midst of Arctic rigours, equipment breakdowns, and low levels of manpower owes much to Steve Blasco's dynamic leadership and the thorough support we received at the Atlantic Geoscience Centre in preparing for this venture.

The marine geology investigation operated round the clock as a five-point program: 1) coring and sampling of bottom sediments, 2) photography of the ocean floor with deep sea cameras (provided by Bedford Institute of Oceanography's Photographic Unit), 3) echo sounding to measure the depth of water and to record the layering in near surface sediments up to 75 m below the seabed, 4) seismic reflection profiling to determine the stratigraphy and structure of the unconsolidated sediments up to 1100 m beneath the seabed, and 5) sound velocity measurement in the water column to calibrate depths to the seabed inferred by acoustic ranging in 3) and 4) above. With this program, we were in a position to describe the seabed morphology and to analyze the stratigraphy and structure of the surficial sediments that mantle the ridge and adjacent ocean basins. The cores and bottom photographs will enable us to document the composition and age of the sediments and to infer the history and nature of sedimentary processes within the Lomonosov Ridge environment.

Mike Lewis assembles a parcoll tent frame.

The primitive Nansen sled played a strong role in setting up the LOREX camp. Originally designed for Arctic expeditions in the last century, it is never quite displaced by the more advanced transport systems available to us today. (All photos courtesy of Photographic Uni, BIO).

Our light-weight hydraulic winch used for deep sea coring and photography also carried instruments to the bottom for the heat flow program of Earth Physics Branch and for underwater photography by National Geographic Society. The echo sounding and seismic reflection profiling equipment were adapted from geophysical survey systems that are used conventionally aboard marine research vessels. Special timing equipment was designed to adjust the triggering rate of these sounding systems to the slow and variable speeds of the drifting ice cover. Other specialized techniques were implemented to protect the equipment from severe cold, to "tune" the systems for deep water work, and to reduce the interfering effect of ice noises on the reflected sea bottom signals.



Brian Bornhold (left) and Steve Blasco (right) log cores. Electronic components of the airgun seismic profiling system are mounted on the bench in the background.

The geological activities complemented, and were co-ordinated with, the studies of several other programs covering the geophysics of the ridge, oceanography of the water column, and the navigation and position fixing of scientific observations. The Earth Physics Branch and its associates assessed the geophysics of the ridge by investigating its physical properties. With refraction seismology, the variations in the velocity of seismic waves were measured in the rocks of the ridge and the mantle below. Gravity and bathymetry surveys were conducted to reveal regional variations in the shape of the ridge and the contrast in the density of its rocks. By observing a time series of gradients in the magnetic field just below sea level, geophysicists hope to detect the presence of naturally-induced electrical currents in the earth and ocean and to infer variations in the electrical and magnetic properties of rocks in the vicinity of the ridge. From measurements of the flow of geothermal heat at the surface of the ocean floor, it will be possible to compare the thermal conductivity of ridge rocks with those beneath the adjacent ocean basins. Peter Hood and Tony Overton, from GSC, implemented respectively, aeromagnetic and intermediate-depth seismic reflection studies to provide additional information on the distribution of magnetic properties and seismic wave velocities in the Lomonosov Ridge area.

With receivers, computers and teletype machines from the Bedford Institute of Oceanography, satellite signals were tracked and processed to fix the position of the drifting ice camp within 100 m about every hour for the whole two-month period. These positions are the primary reference for locating all scientific observations. And by comparing the satellite transit positions with those determined by star observations using a levelled telescope (University of Minnesota), it may be possible to measure deflections of the vertical and thereby infer the gravitational attraction of nearby dense rocks in the ridge or adjacent ocean basins.

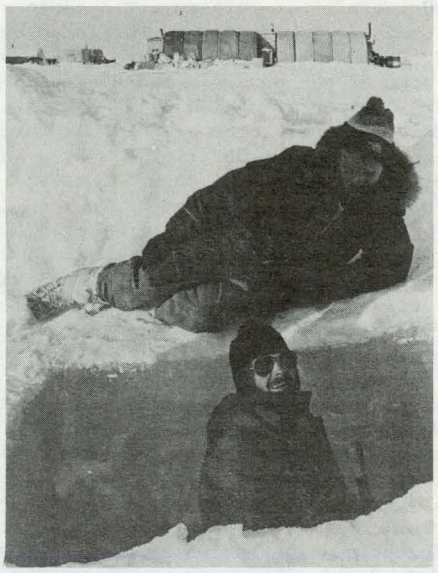
Investigations of the water column complemented the geophysical and geological studies and took advantage of the logistic resources of the LOREX program. Chemical oceanographers from Dalhousie University analyzed water samples to determine their composition and age. Ocean currents were measured in the upper 1500 m of the water column by personnel from McGill University and physical oceanographers from University of Washington moored current meters within 200 m of the bottom to survey water movements over the crest and past the base of the ridge. Experiments on the long distance propagation of sound in the ocean were conducted by Lamont-Doherty Geological Observatory between the LOREX site and the FRAM 1 site. FRAM was a multidisciplinary camp sponsored by the U.S. Office of Naval Research that operated concurrently with LOREX and was located approximately 700 km south of it towards the Atlantic Ocean.

A Canadian Armed Forces Hercules aircraft delivers about 15 tons of building materials on articulated sled pallets in early April. About 200 tons of supplies were ferried and delivered to the LOREX site by this LAPES (Low Altitude Parachute Extraction) system.

The Departmental Brass are briefed on progress at LOREX by Chief Scientist Hans Weber (second from left). Ken Whitham (Director General of Earth Physics Branch) stands at left talking to Hans Weber while John Keys (ADM, Science and Technology, EMR) and George Hobson (Director, Polar Continental Shelf Project) listen. Missing are Digby McLaren and Santa Claus!

Except for the aeromagnetics, all studies depended on the sea ice for support and transport. Living quarters for 30 people were established on strong ice, several years old, in three locations about 60 km apart once the six-month polar night waned in late March. The expedition depended entirely upon the rather important assumption that the average movement of ice in the Transpolar Drift Stream would carry the scientific party and their instruments across the Lomonosov Ridge in two months or less. Because of wind and current stress on its upper and lower surfaces, the Arctic ice canopy is nearly always in motion. Fortunately, in this assumption and in most other aspects of the experiment, we were successful.

By the end of the first month, the main LOREX camp was drifting onto the flanks of the ridge, at times with speeds up to 1 km/hour but usually about 1 km/day. And by the end of the second month, we had run down the quarry completely, passing within 37 km of the North Pole on May 17. We were euphoric. We, as marine geologists, had captured 40 short cores, 10 grab samples, 4 dredge hauls, 1100 bottom photographs, 1080 hours of echo sounding, 42 profiles of temperature and/or sound velocity, 14 plankton tows and 880 hours of airgun reflection profiling, all nicely distributed across the Lomonosov Ridge and into the adjacent Makarov and Fram ocean basins at 3900 and 4200 m depth respectively. With all this in hand, we began talking up an assault on the Alpha Ridge in the older western Arctic Ocean in the early 1980s! Even the prospect of shepherding home our 7 tons of freight scarcely dimmed the exhilarating sense of accomplishment at mastering the challenge of this unique Canadian polar expedition. LOREX 79 had come a long way in advancing the sophistication and scope of Arctic investigations since the Polar Continental Shelf Project initiated marine geology studies in the Canadian Arctic Archipelago two decades ago.



Robbie Burns (top) directs the excavation of ice from a hydrohole by Fred Jodrey (bottom). Hydroholes give access to the water for echo sounding transducers, seafloor cameras and sampling devices, etc.

Our preliminary results appeared in GSC's Current Research 79-1C. The first major exposure of all the LOREX results will occur next May in Toronto at the joint scientific meetings of the Canadian and American Geophysical Unions. Then, as new facts and ideas unfold, we shall perceive to what extent the theories of Arctic Ocean evolution are confirmed or modified and in which directions future research should go.

-C.F.M. Lewis
AGC

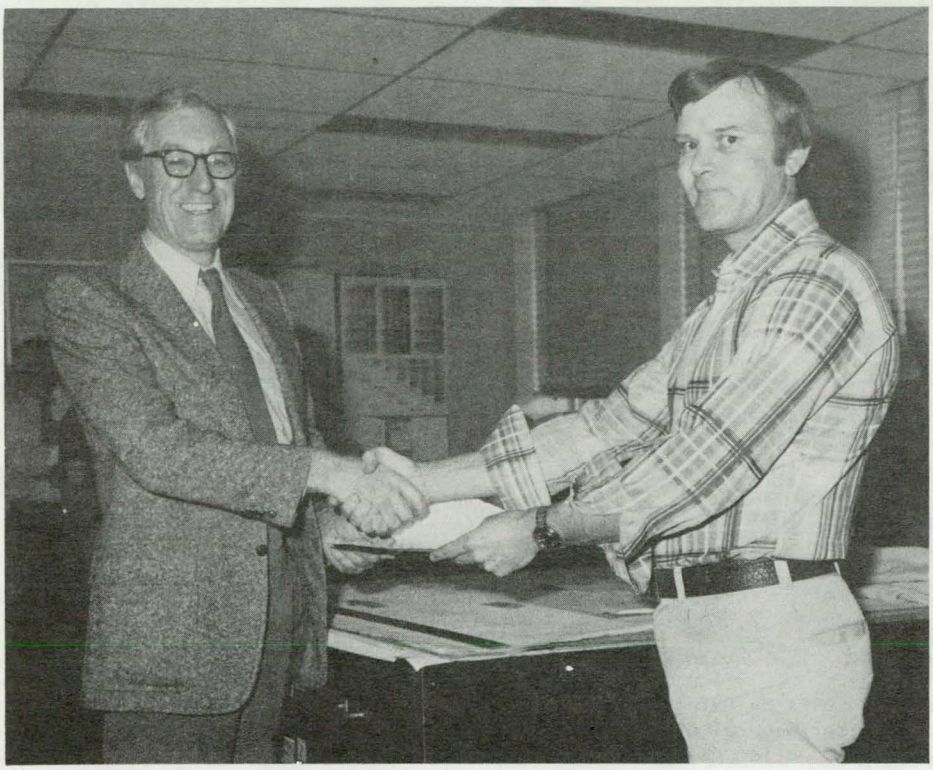
International Uranium Symposium on the Pine Creek Geosyncline

The Pine Creek Geosyncline Study Group of Australia organized an International Uranium Symposium on the Pine Creek Geosyncline that took place in Sydney, Australia, June 4-8, 1979.

Theoretical sessions, attended by almost 400 scientists from around the world, were complemented by field excursions to the Pine Creek Geosyncline. Attention was paid to Proterozoic unconformity-related uranium deposits, of which important representatives occur in Northern Territory of Australia near Darwin (e.g. Ranger I and III, Koongarra, Jabiluka I and II and Nabarlek) and in the Athabasca Basin region in Saskatchewan, Canada (e.g. Rabbit Lake, Key Lake, Cluff Lake, Collins Bay A and B and Midwest Lake deposits).

This well-organized symposium was sponsored by the Bureau of Mineral Resources, Geology and Geophysics and CSIRO Institute of Earth Resources in co-operation with the International Atomic Energy Agency, Vienna. During the symposium a meeting of a Working Party on studies of uranium provinces containing unconformity-related uranium deposits took place too. Canada was represented by the writer.

-V. Ruzicka
Economic Geology Division



Congratulations to John Ferguson of GID who recently received a Certificate of Merit and a sizeable cheque from the Suggestion Award Program. John's idea, by eliminating one stage in the production of maps resulting from the Uranium Reconnaissance Program, has resulted in a considerable saving and has a continuing value.

Canada-China Exchange

During October and November 1978, five Canadian geologists visited the People's Republic of China, as part of an exchange organized by Academia Sinica and the Geological Survey of Canada. The purpose of the visit was to examine Upper Permian and Lower Triassic successions and especially the Permian-Triassic boundary in South China. Included in the Canadian delegation were GSC geologists, Walter Nassichuk (Permian ammonoids), Tim Tozer (Triassic ammonoids), Jim Monger (tectonics), and Petro Canada geologists J. Utting (Permian palynomorphs) and G. Tsang (paleontogical technology).

To complete the exchange, five Chinese specialists in Permian and Triassic biostratigraphy and tectonics from the Nanking Institute of Geology and Paleontology and from the Institute of Geology, Peking, visited Canada during August and September 1979. The Chinese delegation was led by Wang Yigang (Triassic ammonoids) and included Rui Lin (Permian fusulinaceans), Ouyang Shu (Permian, Triassic palynology), Liao Zhuoting (Permian Brachiopods) and Zhou Zuoxia (tectonics). The Chinese delegation examined Carboniferous, Permian and Triassic sections across the Cordillera, from Vancouver Island to the eastern foothills of the Rockies and in the Maritimes. Jim Monger organized an extensive 10-day field trip between Campbell River and Calgary. He was assisted by W.R. Danner (University of British Columbia) and C.A. Ross (Western Washington University). Several excursions to the Rocky Mountains in southern Alberta and northeastern British Columbia were organized by Survey personnel, Walter Nassichuk, Tim Tozer, E.W. Bamber, D.W. Gibson, R.I. Thompson, L. Jackson, and by J. Utting (Petro Canada) and A. McGugan (University of Calgary). In eastern Canada field excursions initiated by J. Utting were made to lower Paleozoic rocks of the Hamilton and Niagara Falls areas of Ontario (led by G. Norris, University of Toronto), to the Gravenhurst region of Ontario (led by D.H. Collins, Royal Ontario Museum) and to the Quebec City area of Quebec (led by B. Granger and R. Trempe of SOQUIP). A trip to view Precambrian as well as Paleozoic and Triassic rocks in Nova Scotia was led by J.D. Keppie and P.S. Giles of the Nova Scotia Department of Mines and Energy.

The Chinese delegation visited the Vancouver, Calgary and Dartmouth offices of the Geological Survey of Canada and Petro Canada laboratories and offices in Calgary as well as universities and provincial mines departments in British Columbia, Alberta, Ontario, Quebec and Nova Scotia.

-W.W. Nassichuk
ISPG

Environmental Geology of the Deep Ocean

Beginning in 1980, a program of marine geological studies of the deep sea will commence. These studies are aimed at determining sedimentological and geochemical processes that take place in the upper 200 m of sediments in abyssal depths over 5000 m. The primary objectives will be to determine the sedimentation rates and stability and the geochemical processes that allow metals to be accumulated in these sediments or to be diffused out of the sediments into the overlying ocean water.

Two major cruises are planned. The first will take place in January and February on the DAWSON in conjunction with the geophysical experiment LADLE (Lesser Antilles Deep Lithospheric Experiment) to measure the nature of the lithospheric plates in the east central Atlantic Ocean north of Antilles. The marine geological studies will be aimed at sampling the uppermost soft sediments and extracting pore waters for analyses of trace element content. The second major cruise on board HUDSON is planned for June 1980 and will be on the Sohm Abyssal Plain. This operation will be multidisciplinary, including some shallow seismic surveys, precision box and piston coring of sediments, heat flow measurements, and ship-board geochemical analyses to determine the distribution of metals in pore water and sediments.

-AGC

Arts and Crafts Exhibit at ISPG

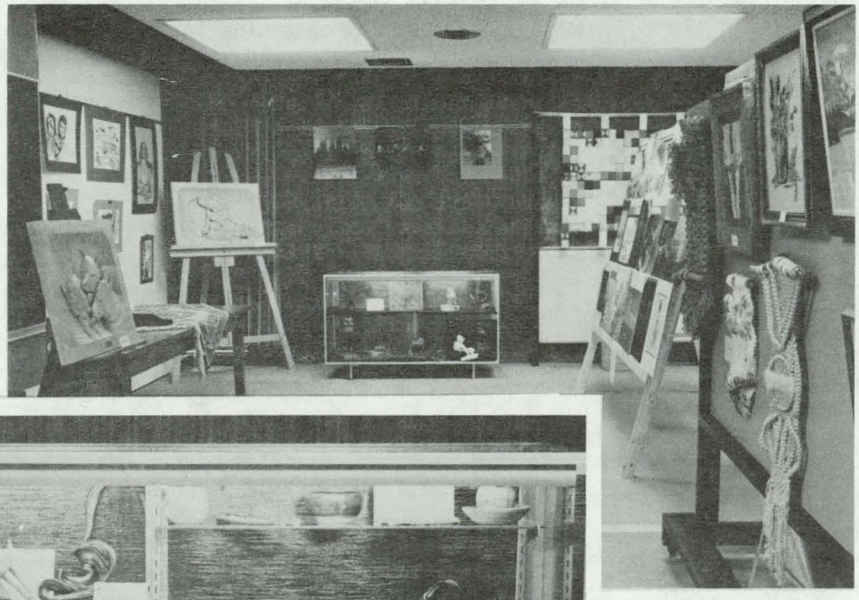
To prove that culture is alive, well and thriving in Calgary, a group of ISPG staff members held an art exhibit in the boardroom of the Institute June 4-8. More than a dozen people displayed entries ranging from pottery, weavings, wood and soapstone carvings, watercolours, oil paintings, woodcuts and prints, to Kirlian photographs, stained glass, tapestries, to mention a few. Besides being a lot of fun to put together exhibitors were pleased to see that their objets d'art sparked a good deal of interest from those who came to see them and that the show got a favourable response from people. The non-competitive nature of the exhibit should be mentioned: no prizes, mentions or awards were made. Participants cooperated together to present their work in the most harmonious way possible, while maintaining the individuality they expressed through their artwork.

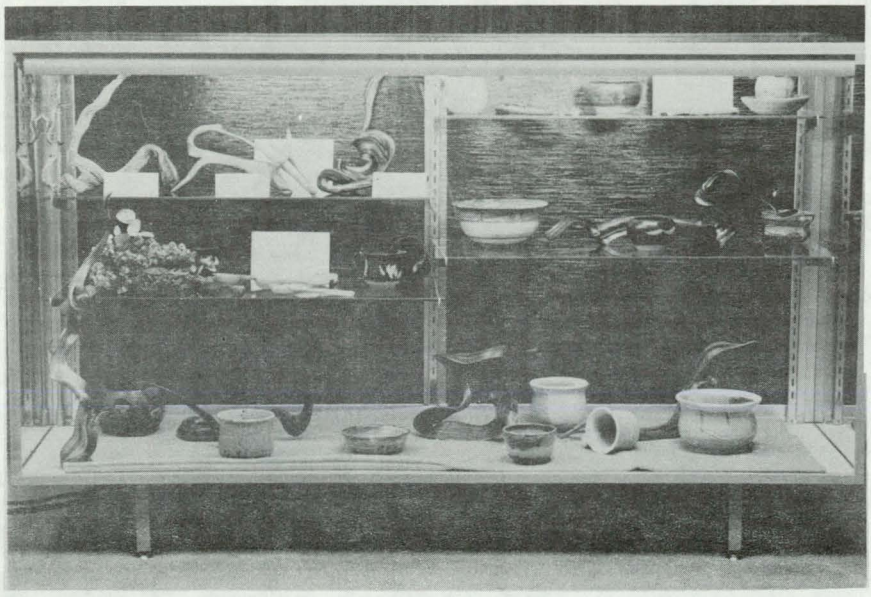
Elsie O'Keefe contributed a very tasteful and tangible series of decorated cakes which were given away each day in a draw and thoroughly enjoyed by those who won them.

Participants included (top photo from left to right): Karen Wallace, Bill Sharman, Nick Meijer-Drees (crouching), Hans Bielenstein, Glen Edwards, Margaret Solomon, Dianna Campbell, June Graff, Margaret McKenzie, Elsie O'Keefe, Lynn Machan, George Brydges and Brian Rutley (alias T.L. - front row centre).

Another exhibit is being organized for the summer of 1980; the energy is there to make this an annual event.

-L. Machan
ISPG





Bud Cumming (EGD) recently served as a judge of earth science exhibits at the 18th Canada-Wide Science Fair held at the University of Western Ontario. This event was sponsored by the Youth Science Foundation and the London District - Science and Technology Fair Incorporated.

Over 180 science projects were exhibited by 220 students. A number of outstanding prizes and awards were presented to winning young scientists.

This year Shell Canada sent three winning students to attend the International Youth Science Fortnight in Londón, England. Also, two all-expense trips were awarded to winners to visit Fort McMurray and the Syncrude Project to meet the scientists involved in research on tar sand development.

Bell Northern will bring a winner from each province to Ottawa for a week to tour their research facilities. Another prize, also in the form of a trip, will be to Cape Kennedy to visit NASA facilities.

The following randomly selected titles show the variety of scientific projects displayed:

Possible Hazards of Aluminum Wiring; Dietetical Analysis; Effects of Snow Fences on Drifting; Discos and Hearing Loss; In Search of a Cure for the Cold; Aerodynamics of Sailing; Robots of the Future; Penetration and Concentration of Lead in Soils; Effects of Microwave Radiation on Drosphila DNA; Hovercraft; How Long Can You Keep a Spider Over Winter?; The Artificial Arm; Fiber Optics; Robot Management; Acoustics of the Violin; Kirlian Photography; Too Much Salt a Time Bomb.

AWARDS

Recipients of 25 year awards of government service include the following ISPG staff members: Dennis Peatman, Bob Christie, Derek Pugh and Don Walters. Bernie Latour will be receiving his award for 35 years of service this year.

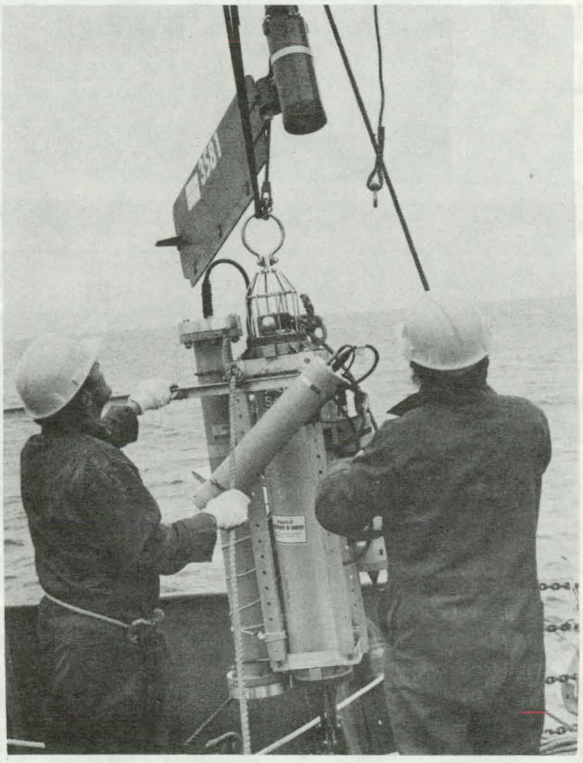
-ISPG

Monitoring Sedimentary Processes on the Continental Slope

Last summer, AGC's Charlie Schafer teamed up with Lionel Carter (a recent AGC Visiting Fellow who has since returned to his staff position at the New Zealand Oceanographic Institute in Wellington) on a HUDSON cruise to the continental slope off Newfoundland at latitude 49°30'N. Among the instrumentation packed on the ship before it departed from the Bedford Institute dock was a newly designed time-lapse camera and current meter system that was destined to be moored on the seabed below the axis of the Western Boundary Undercurrent (WBU). The WBU is a kind of "contour current" that flows southward along the slope at a depth of about 2800 to 3000 m. The use of a bottom-moored, self-contained instrument to measure the flow characteristics of the WBU and to simultaneously take a series of photographs of the adjacent sediment surface satisfied the objectives of a project that was initiated as the result of a growing international trend to learn more about the quantitative aspects of geologically-significant marine processes that are presently operating in deep ocean environments. An understanding of the relationship between bottom current speed, sediment transport, and the formation of bedforms is of particular interest to marine geologists at AGC because these factors appear to control the intensity of bioturbation by the macro and microbenthos. The degree of bioturbation and sediment mixing is, in turn, related to the ultimate paleoecologic resolution possible through quantitative analysis of the fossil record.

Bottom-moored monitoring instrumentation of the type employed by Schafer and Carter (see photo below) represents a cost-effective approach that can be used to obtain synoptic time series data on the nature of modern sedimentary processes that are active over large distances. Most systems of this type are designed to be deployed and recovered using research "ships of opportunity". In addition, the sampling pattern and frequency of these instruments can be specifically designed for a particular problem in contrast to a research ship that might only be able to maintain a rigid schedule of visits to the same location under ideal weather conditions. Similarly, the cost of keeping a research vessel on station for even a fraction of the minimum desired monitoring period is becoming increasingly prohibitive under the present mandate for restraint in, and reduction of, governmental expenditures.

The technology of today's self-contained in situ marine instruments draws heavily upon space technology "spin offs" and, in fact, the proposed development and utilization of a more complex suite of bottom-moored instruments to study ocean bottom processes by the staff of one of our "well heeled" counterpart institutions in the United States is at a level of technology that is probably comparable to that required for the development of the hardware that was used to monitor and sample the moon's surface during the unmanned lander phase of the lunar exploration program. Although the AGC effort was modest compared to U.S. programs that have been proposed

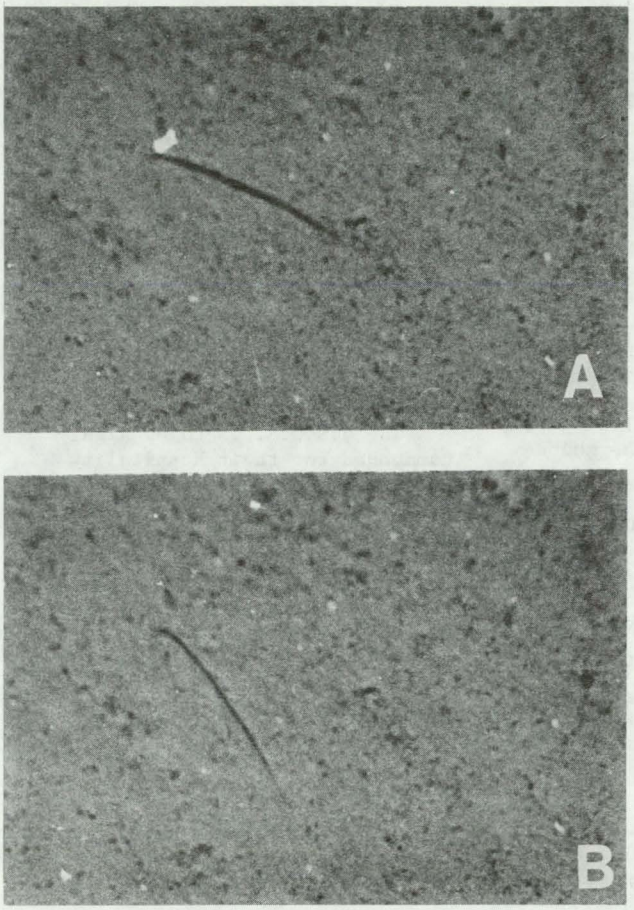


Technical staff guide current meter and time-lapse camera over the rail of CSS HUDSON.

for the next several years, the first results from the HUDSON cruise in July showed some interesting characteristics of the WBU over a 2.5 day period. The directional change of the current could be correlated with the movements of some stalk-like attached benthos (probably sea pens) that were in the field of view of the camera (see photo). Preliminary interpretation of the current meter record suggested that during the period of observation the current speed varied from zero to more than 18 cm sec^{-1} and apparently changed direction through a total arc of about 80°. This observation has implications for the transport and dispersal of natural and man-made substances in the deep ocean. In addition, these data provide input to a descriptive model that can be used to interpret the Holocene stratigraphic record of slope sediments.

The continued utilization of an in situ monitoring strategy over longer periods (i.e. years) should contribute substantially to our understanding of the coupling effects between bottom currents and marine sediments and may shed some light on the real time phase lag between variations in the characteristics of these deep-flowing currents and the climatic factors that control the general circulation pattern of the oceans.

-C. Schafer
AGC



Change in orientation of a sea pen-like form from a southeast position (A) at 6 a.m. on July 17th to a southwest orientation (B) at 2 p.m. on the same day. Throughout this period the speed of the WBU was steady at about 8 cm sec^{-1} (0.29 km hr^{-1}).

Canada-People's Republic of China Scientific Exchange Visits - Precambrian Stratigraphy

The Scientific Exchange Program between the State Bureau of Geology, People's Republic of China, and the Geological Survey of Canada, consisted of lengthy visits by three-man delegations from each country to the other.

The Canadian delegation (H.J. Hofmann of the University of Montreal, and Paul Hoffman and Jim Aitken of the Geological Survey of Canada) visited the People's Republic of China from August 15 to October 15, 1978. Because the Bureau of Geology is in the late stages of a major re-study of China's Middle and Upper Proterozoic rocks, the visit was essentially confined to the examination of strata of that age, plus the Precambrian-Cambrian boundary.

In the Peking region, and on the Liaotung Peninsula, 10 km-thick platform successions of the Sinian Suberathem, or "Sinian of North China type" were examined. The Proterozoic successions in these two regions are grossly similar, but difficult to correlate with one another. Each rests on Archaean basement, with basal beds as old as 1.7 Ga, and extends upward to beds approaching 0.8 Ga but predating the widespread glacial deposits. As in Canadian Proterozoic platform successions, opportunities for radiometric dating are few. No significant tectonic movements took place during the long span of deposition of the Sinian Suberathem.

At the Eastern Gorge of the Yangtze River, and also near Kunming, the Sinian System, or "Sinian of South China type" was examined. There, resting on well-dated igneous basement dated at about 0.8 Ga, are first, continental fluvial clastics and then tillite. Above the tillite are deep water shale, marl, and limestone, largely carbonaceous, bituminous and phosphatic, of the Toushantou Formation is mainly dolomite, it contains the lowest traces of metazoan life.

The Chinese geologists describe the sections of the gorge and near Kunming as demonstrating continuous deposition across the Precambrian-Cambrian boundary. The Canadian visitors were impressed by physical evidence for erosion at least one and probably two of the formational contacts; nevertheless, the Kunming area especially has promise as a Precambrian-Cambrian boundary stratotype at a level above the suspected disconformities.

In common with all other visiting delegations, the Canadians found their hosts well-prepared, well-organized, and hospitable beyond any previous experience.

The Chinese delegation (Xing Yusheng, Lu Zongbin, and Gao Zhenjia, all of the State Bureau of Geology) visited Canada from June 18 to August 30, 1979. They viewed the Precambrian of Canada geographically from Vancouver to St. John's and Waterton to Inuvik, and stratigraphically from the Archaean to the beds containing the earliest trilobite traces. Geologists of the GSC are too thinly spread to have been available all along the route; nearly half of the hosts and guides were non-Survey people who did a splendid job for the visitors.

The visiting trio were tireless observers and note-takers. They maintained a high level of interest up to - and including - the very last outcrop.

Chinese etiquette discourages expressions of disagreement; the visitors were delighted with our rocks, but largely kept their own counsel in regard to our interpretations. Their most often-repeated comment was that our cities were clean and our drivers law-abiding.

-J.D. Aitken
ISPG

Binational Field Trip in Southeastern Alaska

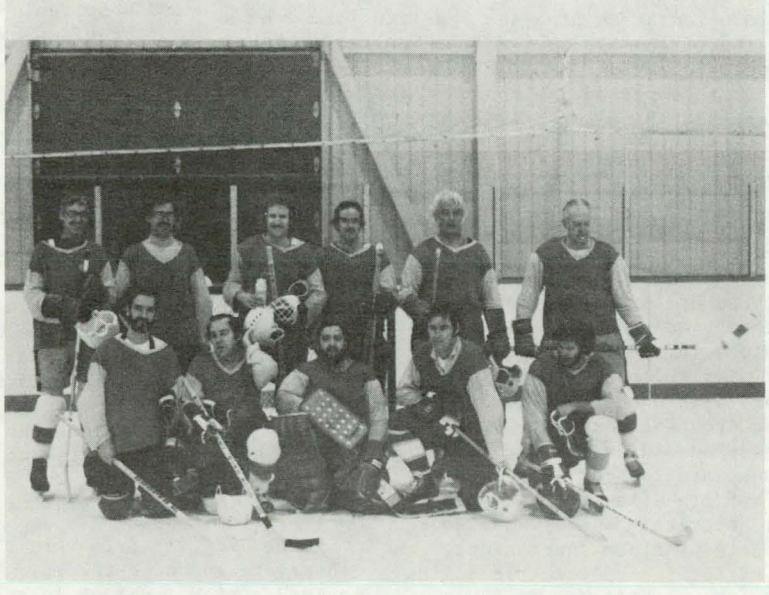
This truly memorable fall field trip (September 13-20, 1979) to look at the geology of mainly lower Paleozoic rocks in southeastern Alaska was masterminded by Dave Brew of the U.S.G.S., Alaska Branch. It was conducted from the U.S.G.S. research vessel DON J. MILLER II (D.J.M. II), an extremely well equipped 118-footer complete with spacious accommodation for work and relaxation. Five skiffs equipped with 25 h.p. outboard motors and handily winched on and off the vessel by a hydraulic crane were used to reach the shoreline. The field excursion was attended by members of the Cordilleran Division of GSC - Dick Campbell, Jan Muller, Jim Monger, Glen Woodsworth, Chris Yorath and Chris Dodds. The U.S.G.S. contingent included Dave Brew, Tom Ovenshine, Bob Loney, Henry Berg (alias Dr. "Zarembo"), (all of Menlo Park), Dick Mast (Denver), John Whetten (Seattle), and Anita Harris (Washington, D.C.).

Two GSC members (R.B.C. and C.J.D.) were impressed by striking similarities in the lithological packages of the Ordovician, Silurian and Devonian to rocks outcropping within the St. Elias Mountains to the northwest. This was a great leap forward in the comprehension of extensive areas of unfossiliferous rocks in that region. However, they were equally impressed by the almost total (relatively speaking) lack of pervasive deformation undergone by the Alaskan rocks when compared to their St. Elias counterparts.

The U.S.G.S. is to be highly commended for their hospitality and smooth organization of the trip. The kind of co-operation exemplified by the field excursion has long marked the relations between the Alaskan Branch of the U.S.G.S. and the Cordilleran Geology Division of the GSC with a great deal of benefit to both agencies.

-C.J. Dodds
Cordilleran Geology Division

SUPERSTARS '78-79



A hearty "congratulations" goes to Team 3 of the GSC Hockey League (Ottawa Division) which captured the 1978-79 season championship. The ice nearly melted with all the fast and fancy skatework but only egos suffered as the "no fighting, spearing, kicking or butt ending" law was strictly enforced. These proud smiles belong to (from left to right) back row: Tony Frith, Bob Skinner, Louis Renaud, Ron Christie, Frank Williams, and Murray Frarey. Front row: Jack Macrae, Norm Grenier, Ken Clark, Floyd Heney, and Wayne Goodfellow. Team members Ron Good and Ken Ford were absent for the photo session.

Geological Survey of Canada Display

This year's theme, "The Geological Survey and Fossil Fuel Exploration, 1842-1979", is devoted to GSC contributions to the search for coal, oil and gas in the years since Sir William Logan studied the sections at Joggins, Nova Scotia. The ideas came from Survey officers at ISPG and AGC who, in some cases, supplied catchy titles to accompany their brain waves. Our prize goes to Keith Williams whose titled "Canada's Great Barrier Reef" and dealt with just that, the great 350 million year old reef that extends through northern B.C., Alberta and the N.W.T. and is host to many valuable oil, gas and lead/zinc deposits.

The squiggles and blots of the geoscience geniuses were converted into attractive, understandable works of art by Lachie MacLachlan who pressed into service Bill Vermette, Brian Ortman, George Whitman, and Diane Wallace - the creative wonders of our Cartography Section. The exhibit attracted many favourable comments at the GAC/MAC meeting in Quebec last May and the CSPG/CSEG meeting in Calgary last June. It is currently on show at the University of Calgary. Next it moves to our Vancouver office, then to the University of Alberta in Edmonton and, finally, to the University of Saskatchewan Museum in April and May. "It is rather good, " the Director General was heard to say in an unguarded moment. "Probably the best and most colourful thing we've done yet!" If you would like to see it in the East drop us a line and maybe it can be arranged.

-ISPG

Penrose Conference on the Antler Orogeny

A Penrose conference on the Antler Orogeny, convened by Tor Nilsen and Jack Stewart of the U.S. Geological Survey, was held September 9 to 14, 1979 in Elko, Nevada. Of the fifty participants, including three students, 22 were from universities, 17 from the U.S. Geological Survey, five from the Geological Survey of Canada, five from industry, and one from the Nevada state survey. Canadian participants included H. Gabrielse, M.P. Cecile, H.P. Trettin, A.V. Okulitch, and the writer, of the Geological Survey of Canada. L.V. Hills of the University of Calgary, and W. Roberts of Cyprus Anvil Mining Corporation. Two days of field trips, one free afternoon, and a few night excursions to the local casinos provided a welcome change of pace from the indoor sessions.

The purpose of the meeting was to examine new data and recent developments in thinking on the mid-Paleozoic (Antler) orogeny in western and northern North America. It included regional summaries of the Antler orogeny with representation from the Canadian Arctic, Alaska, the Canadian Cordillera, western United States, and Mexico and Central America, and sessions on Antler age clastics, biogeography. and structure.

-S.P. Gordey
Cordilleran Geology Division

Mr. Fezziwig's Ball

Just as we go to press, the Ottawa chapter is preparing to hoot and holler all the way over to Carleton University Commons Lounge for the annual Christmas party. December 13 (fortunately not a Friday) is The Day and after a relaxing lunch, all shoes are sure to be kicked off for lots of dancing.

And speaking of Christmas, on behalf of the Geogram editor and the editorial advisors, I extend a heartfelt ***Merry Christmas*** to each and every GSC-er. I hope the season is filled with unending joy and inner happiness for all and that the new decade brings much-needed peace throughout the world.

-L. Firth
Co-ordinator

Geological Highlights of the Rideau Trail

Recently, a two part description of the geology along the Rideau Trail, written by Bob Stevens, was featured in the Spring and Summer issues (nos. 31 and 32) of the Rideau Trail Newsletter. Bob is in the geochronological section of the Precambrian Geology Division in Ottawa.

Rideau Trail is a walking trail extending from Ottawa to Kingston, Ontario. The trail starts in the Ottawa area on horizontally bedded Lower Paleozoic limestone, dolomite and sandstone of the Ottawa Lowland, crosses the more rugged topography of the Precambrian Shield, and ends in lowland area around Kingston where Lower Paleozoic sediments are also present.

These articles provided hikers with an excellent opportunity to better understand the geology of the Ottawa-Kingston area as well as enjoying nature, some exercise and the good eastern air.

A sincere "thank you" is extended to Gail Henderson in the Word Processing Centre and Karen Knudson of the Cartography Unit for typing this issue of Geogram. Their assistance is greatly appreciated.

THE GSC HAS RECENTLY PUBLISHED A FEW REPORTS OF SPECIAL INTEREST TO SOME GEOGRAM READERS. THE FOLLOWING ARE BRIEF REVIEWS ON EACH.

THE GEOCHEMISTRY OF GOLD AND ITS DEPOSITS (TOGETHER WITH A CHAPTER ON GEOCHEMICAL PROSPECTING)

GSC Bulletin 280 by R.W. BOYLE

Gold has captivated man for thousands of years, and references and books on the most noble of metals are legion. In the geological field the classic treatises on the metal are those by E. Cumenge and F. Robellaz (1898), J.H. Curle (1905), J.M. Maclaren (1908), W.R. Crane (1908), E.J. Dunn (1929), and W.H. Emmons (1937). A recent addition to the geology and geochemistry of gold is the Bulletin by Bob Boyle.

Dr. Boyle's bulletin comprises six chapters of which the first dealing with the history of gold and the last covering the production and uses of gold are the most interesting to the non-expert and layman. The chapter on the history of the metal traces its legendary discovery by Cadmus, the Phoenician to the present. The discovery of the great gold fields of the world are described briefly, including those in California, Australia, New Zealand, U.S.S.R., South Africa (Witwatersrand) and Canada.

The first attempt to mine gold in Canada is a story of ignorance and knavery perpetrated on Martin Frobisher by a London promoter Michall Lok and an unscrupulous alchemist, John Baptista Angello, who by 'coaxing nature' claimed high assays of the precious metal for a rock composed mainly of mica and pyrite on Kodlunarn Island in the Arctic. The mining endeavour came to nought after it was discovered that the ore was worthless, Lok was consigned to debtors prison, and Frobisher found himself in some disfavour with Queen Elizabeth who evidently had an investment in the venture.

The first authentic discovery of gold in Canada took place in the Touffe des Pins, a small tributary on the right bank of the Chaudière River about 85 kilometers southeast of Quebec. In the Canadian Shield, the geological province providing the main gold production of Canada, the intial discovery of gold was made at Eldorado, near Madoc, Hastings County, Ontario by Marcus Herbert Powell a part time prospector. In the Canadian Cordillera gold was probably first found on the Queen Charlotte Islands in 1857, followed later by the fabulous discoveries of the Cariboo (1859) and the Klondike (1896).

Extensive data and dicussion on the chemistry, mineralogy and geochemistry of gold comprise Chapter 2, and this is followed in Chapter 3 by the classification of metallogeny of gold deposits, the mineral and elemental associates of gold in its deposits, descriptions of typical gold deposits, and a discussion of the origin of endogene and supergene (placer) auriferous deposits. The

author concludes that the epigenetic vein, lode, stockwork and disseminated types of gold deposits appear to have originated mainly by metamorphic secretion processes, the source rocks of the gold and its associated elements being mainly the enclosing volcanic and/or sedimentary piles. Modern gold placers are of sedimentary origin, the gold being winnowed into pay streaks as the result of both chemical (accretion) and physical (gravity) processes operating during weathering and subsequent sedimentation. The auriferous quartz-pebble conglomerate deposits are considered by the author to have originated as placers, the gold and many of its associated elements having undergone radical chemical reworking during subsequent diagenetic and metamorphic events.

Chapter 4 of the Bulletin deals with the oxidation and secondary enrichment of auriferous deposits, and Chapter 5 comprises an extended discussion of the art of prospecting for gold deposits, including the classic methods and those based on geochemistry. The author concludes that practically all the geochemical methods of prospecting are applicable in the search for auriferous deposits. He states that the most effective methods are those based on the sampling of stream and lake sediments and soils, analyzing these materials directly or analyzing heavy mineral separates obtained from them. The most specific indicator (pathfinder) elements for gold are stated to be Ag, As, Sb and Te.

The last chapter covers the production and uses of gold. It is notable that the quartz-pebble conglomerate deposits provide the bulk of the world's production of gold, some 56 percent. The other deposits, mainly the vein and disseminated types, eluvial and alluvial placers, and the various polymetallic veins, lodes, massive bodies and stockworks (byproduct gold) now provide the remaining 44 percent of the production. The principal uses of gold are in industry (jewellery, dentistry, and electronics) and in monetary transactions (coins, bullion). In prospect the author perceives an industrial vista where gold will play an ever increasing role in the production of high speed computers, telecommunications, space vehicles, pharmaceuticals and a thousand other artifacts of future civilizations. He perceives also that man will lose none of his fascination for the metal that he has long admired for its natural beauty and enduring qualities.

An extensive bibliography comprising some 3000 references, covering all aspects of gold completes the bulletin. *($45.00)*

GEOPHYSICS AND GEOCHEMISTRY IN THE SEARCH FOR METALLIC ORES

Economic Geology Report 31; edited by PETER J. HOOD

This is an up-to-date comprehensive treatise describing recent advances in geophysical and geochemical techniques applied to the search for metallic ores. The 811-page volume contains 40 papers of which a number have been split into several parts and most of which have extensive bibliographies. The first three papers are overviews of economic geology, mining geophysics and geochemistry and these are followed by 22 review papers by internationally recognized experts in their fields covering in a systematic way recent advances in each of the major disciplines of geophysics and geochemistry. Fourteen of the remaining 15 papers are case histories from around the world describing the exploration sequence followed in discovering a given deposit; the majority of the case history papers were prepared by explorationists from major mining companies responsible for the discovery. The last paper is a review of recent developments in exploration geophysics and geochemistry in the People's Republic of China and appears to be the first such paper by Chinese authors published outside China since the People's Republic of China was founded in 1949. All of the papers were presented at the Exploration 77 Symposium held in Ottawa during October 1977, which was sponsored by the Canadian Geoscience Council. The treatise updates the material contained in the proceedings volume (GSC Economic Report 26) for the Canadian Centennial Conference on Mining and Groundwater Geophysics held at Niagara Falls in October 1967 with the addition of geochemical prospecting techniques. *($35.00)*

PACKHORSE TRACKS

GSC Open File 650 by H.S. BOSTOCK

This item presents the unedited recollections of a geologist's life in British Columbia and the Yukon from 1924 to 1954. The author retired from the GSC in 1966 as head of the Cordilleran Section and some years later at the urging of his many friends set down his memoirs in diary form. From his collection of many hundreds of photographs a selection was made to show activities, places, and people that have a place in the history of the Yukon. *($7.50)*

Material for the next issue of Geogram should be sent to your Division office or to Lorna Firth.

Les articles pour la prochaine parution de Geogram devront être dirigés au secretariat de votre Division ou à Lorna Firth.

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