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AN INFORMAL BRANCH NEWSLETTER
UN BULLETIN INTERNE D'INFORMATION

FROM THE DEPUTY DIRECTOR GENERAL

Two recent reviews, the Report of the Canadian Geoscience Council for 1974, and a review by G.V. Middleton of the GSC Report of Activities, Paper 75-1A, in the August 1975 issue of Geoscience Canada have questioned the dominance of government earth science in Canada and, in the latter case, reflected upon the purpose of the GSC and its relative position in the spectrum of geological activities in Canada. Clearly, a need has evolved for the GSC to make the rationale of its scientific program more widely known. It is especially important to have our program properly understood by the Canadian Geoscience Council, the umbrella group representing Canadian earth science societies, which is currently examining the status, quality, level of effort, and level of support of the earth sciences in Canada.

One way of making our program better understood to the Canadian Geoscience Council is to have a committee from the Council periodically visit the GSC and examine its program. On the whole, we feel that we have a well-founded program, undertaken by thoroughly competent scientists – one that we are not afraid to defend. At the same time we recognize that our program may have weaknesses and areas that could be improved. We may well benefit by a look from outside, not only from suggestions on how our program may be improved, but also by making the Canadian Geoscience Council aware of our current constraints.

Accordingly, we have suggested to the Canadian Geoscience Council that an ad hoc advisory committee be established. This committee of about 5 or more people, reporting to the Assistant Deputy Minister, Science and Technology, and representing the major programs, institutions, and geographical areas, would meet with GSC once a year. Negotiations are currently underway to determine the composition of the committee and to establish its terms of reference. In view of the fact that the GSC program is large and complex we are suggesting that there be a cyclical review of three major, overlapping areas, dealing with one topic over a three year period. The first would be a review of the program structure with an explanation of typical projects as they relate to the mission of the Branch. The second would be a critical review of published and unpublished output of the Branch in regard to its relevance to the Departmental mission. The third review would be of the effectiveness of the operations and techniques employed by the GSC, which would be undertaken only after the committee had studied the program and its output.

It might be desirable also to set up sub-committees to examine more closely one or more particular areas of specialization within the Branch. In addition, the committee would be invited to monitor the selection of research agreements made by the Branch, for the most part, with members of Canadian universities.

The proposal to form an ad hoc advisory committee has been warmly received by the Canadian Geoscience Council. Final plans will be discussed at a meeting between the GSC and CGC in December.

We consider that the committee will provide a healthy forum for critique, similar in many ways to the role of visiting committees that advise several earth science departments in Canadian universities. We should not be apprehensive about this committee for the better our program is understood the less we have to fear from our critics. Indeed, had we not decided to invite examination of our program, government earth science and GSC, in particular, would be regarded even more suspiciously than at present.

NOTE DU SOUS-DIRECTEUR GENERAL

Deux études récentes, soit le rapport de 1974 du Conseil canadien des sciences de la Terre et une étude faite par G.V. Middleton relativement au Rapport des activités de la CGC, Etude 75-1A, publiées dans l'édition du mois d'août 1975 de Géoscience Canada, ont mis en question la domination du gouvernement sur les sciences de la Terre au Canada. M. Middleton, entre autre, réfléchit sur l'objectif de la CGC et sur sa situation par rapport à l'éventail des activités géologiques au Canada. Le temps est venu pour la CGC de faire mieux connaître la raison d'être de son programme scientifique. Il est particulièrement important que le Conseil canadien des sciences de la Terre comprenne bien notre programme; ce groupe d'encadrement représentant les sociétés canadiennes des sciences de la Terre examine présentement la situation et la qualité des sciences de la Terre au Canada ainsi que les efforts et l'aide qui y sont apportés.

L'un des moyens de mieux faire comprendre notre programme au Conseil canadien des sciences de la Terre est de permettre à un comité dudit conseil de visiter périodiquement la CGC et d'étudier son programme. Dans l'ensemble, nous croyons posséder un programme bien fondé, élaboré par des scientifiques parfaitement compétents; un programme dont nous sommes fier. Nous reconnaissons toutefois qu'il peut montrer certaines faiblesses et que des améliorations peuvent y être apportées. Nous ne pouvons que bénéficier des observations de personnes étrangères au programme, non seulement en accueillant leurs suggestions, mais également en faisant prendre conscience au Conseil canadien des sciences de la Terre de nos contraintes actuelles.

En conséquence, nous avons proposé au Conseil l'établissement d'un comité consultatif spécial. Ce comité d'environ 5 personnes ou plus, responsable au sous-ministre adjoint, Science et Technologie, et représentant les grands programmes, les institutions et les régions géographiques, rencontrerait la CGC une fois par année. Des négociations sont présentement en cours afin de déterminer la composition du comité et de définir ses responsabilités. Etant donné que le programme de la CGC est vaste et complexe, nous proposons qu'il y ait une étude périodique de trois domaines majeurs qui se chevauchent, traitant d'un sujet unique pendant une période de trois ans. Le premier comporterait une étude de la structure du programme ainsi qu'une explication des projets qui se rapportent particulièrement à la mission de la Direction. Le second consisterait à évaluer la pertinence des travaux publiés ou non de la Direction en ce qui concerne la mission du ministère. Le troisième serait une étude de l'efficacité des opérations et des techniques en usage à la CGC; cette étude ne serait entreprise que lorsque le comité aurait étudié le programme et son efficacité.

Il serait peut-être également souhaitable de former des sous-comités qui examineraient de plus près l'un ou plusieurs domaines particuliers de spécialisation au sein de la Direction. En outre, le comité serait invité à contrôler le choix des conventions de recherche intervenues, pour la plupart, entre la Direction et des universitaires canadiens.

Le Conseil canadien des sciences de la Terre a accueilli chaleureusement le projet de formation d'un comité consultatif spécial. Les plans définitifs en seront discutés lors d'une réunion entre la CGC et le Conseil, en décembre.

Nous estimons que le comité aura un rôle stimulant de critique, semblable en bien des points au rôle des comités visiteurs qui conseillent plusieurs départements des sciences de la Terre dans les universités canadiennes. Nous ne devons pas craindre ce comité parce que mieux notre programme sera compris, moins nous aurons à redouter les critiques. A vrai dire, si nous n'avions pas demandé que notre programme soit étudié, les activités gouvernementales dans le domaine des sciences de la Terre et celles de la CGC, en particulier, seraient considérées avec plus de méfiance encore qu'elles ne le sont présentement.

Energy, Mines and Resources Canada

Énergie, Mines et Ressources Canada

STAFF NEWS

DUNCAN WHITMORE 1917-1975

The sudden death of Duncan Whitmore on the 6th of October came as a great shock to all his friends and colleagues in the Geological Survey of Canada.

Duncan was born in London, England in 1917 and moved to Canada with his parents. He was educated at Ottawa schools, took his B.A. in geology and mineralogy at Queen's University and went on to Princeton where he took his Ph.D. in 1943 in economic geology and petrology.

He worked as a student assistant with GSC field parties. Most of his early professional career was in the mining industry where he had wide experience in many parts of Canada. He worked at Sudbury and Steep Rock, was mine surveyor at the Sullivan Mine, geologist at the Con Mine at Yellowknife, did exploration geology along the Alaska Highway and Canol Road and did extensive field work in the Mackenzie Mountains. He worked as an exploration geologist in Saskatchewan, northwestern Ontario, northern British Columbia, Alaska and Yukon. By the time he joined the GSC in 1958, he was an economic geologist of considerable experience, experience that was put to good use with the Survey's growing interest in studies of mineral deposits.

In recent years he has been actively concerned with the mineral data bank which provides an invaluable information base for the Mineral Deposits Section.

Duncan was married to Ann Ellsworth Collins, the daughter of W.H. Collins, a former Director of the Geological Survey.

ATLANTIC GEOSCIENCE CENTRE DARTMOUTH, NOVA SCOTIA

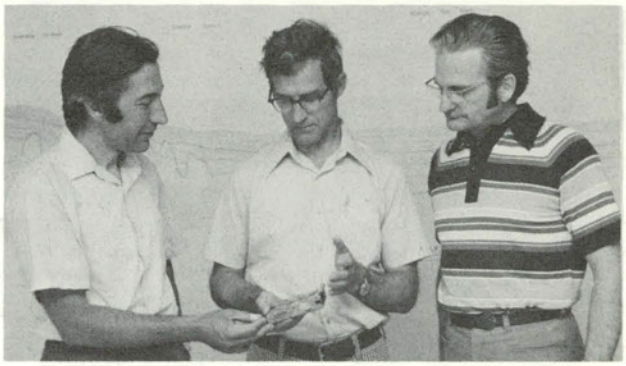
Michael Avery has recently joined the Eastern Petroleum Geology group of AGC as a technician. Mike, who was previously employed with the Resource Management and Conservation Branch (RMCB) will be working with coal petrologist Peter Hacquebard in the same building as RMCB.

Jonathan Bujak joined the Eastern Petroleum Geology group of AGC as a research scientist in August 1975. Jon, who comes to us from Mobil Oil and Robertson Research, will undertake palynological studies of the Mesozoic-Cenozoic rocks of offshore eastern Canada.

David Umpleby joined the Eastern Petroleum Geology group of AGC in August from Gulf Oil Canada. David, a petroleum geologist, will concentrate his research on the Labrador Shelf.

Ray Ivany has recently joined the Environmental Marine Geology group of AGC as a technician. Ray, a chemical technology graduate of the Nova Scotia Eastern Institute of Technology, will be working in the organic geochemistry laboratory.

Sedley Barss has been elected vice-president of the American Association of Stratigraphic Palynologists. It is a much deserved testimonial to a long-time employee of GSC. Sedley joined the Survey in February 1949 in Sydney, Nova Scotia, as a petrology technician with the Fuels and Stratigraphic Geology Division. In 1953 he began to work on the identification of samples which led to his widely-recognized expertise in Carboniferous palynology. Sedley transferred to GSC headquarters in Ottawa in 1959, at the time the current Booth Street complex opened. On the strength of his self-made scientific and administrative reputation, Sedley transferred to the newly formed Eastern Petroleum Geology group in 1971.



Sedley Barss is presented with a polished jasper conglomerate paper weight bearing the GSC crest and a 25-year pin by Dr. Bosko Loncarevic (left) and Mr. Pat Purcell (right).

CENTRAL LABORATORIES AND ADMINISTRATIVE SERVICES DIVISION

New arrivals to Secretarial Services are typists Kathy Gareau and Sylvie Lavallée.

Doug McCuaig left the Branch Registry in August for a position at the Privy Council Office.

A position in Branch Registry was recently filled by Mrs. Heather Mulder. Heather previously worked with other branches of the Department.

In September a second position within Branch Registry was filled by Mike Foster.

GEOLOGICAL INFORMATION DIVISION

Richard Fix joined the Division in September as Leona Mahoney's editorial assistant.
Paul Rowe is replacing Mike Thompson who resigned his position in the library in September.
John Wright has left to accept a teaching position at Fisher Park High School and Mike Kiel has joined the staff as a term employee.
Darlene Knickle is acting as Division Secretary during the absence of Lorna Nadon who is on French language training.

INSTITUTE of SEDIMENTARY and PETROLEUM GEOLOGY CALGARY, ALBERTA

Reink Lakeman, who received his Ph.D. in 1952 from the University of Amsterdam, has joined the Energy Subdivision as Senior Petroleum Geologist and is now participating in the task of increasing the accuracy of hydrocarbon resource assessment. He was previously employed with the British Petroleum Corp. in Canada and abroad.

J.R. (Ross) McLean, formerly with the Saskatchewan Research Council, has joined the Southern Mainland Section. Ross received his Ph.D. from the University of Saskatchewan in 1970. He will be doing stratigraphical and sedimentological research, mainly Lower Cretaceous, of the Foothills.

A.R. Cameron, of the Geology of Coal Section, has one year's leave of absence to teach Coal Utilization at Southern Illinois University.

Colin Gange-Harris has left his position as technician for the Geology of Coal Section to join Birtley Engineering. Maria Tomica transferred from the Paleontology Subdivision to take over as coal technician. She has had many years of experience in the field of coal exploration in Czechoslovakia.

Foon Der transferred from his position with the Geology of Petroleum Section to join the National Energy Board, Reserves Division, as a Reserves Geologist.

R.R. (Bob) Barefoot has resigned his position as head of the inorganic chemistry laboratory after 8½ years with the Survey. He is now with A.A. Detectametal Laboratories Ltd. and Diachem Ltd.

Helen Johnson resigned from the Paleontology Subdivision in July. Her position as senior palynology laboratory technician has been taken over by Shirley Pickering. Elsie O'Keefe has joined the staff as junior palynology laboratory technician.

After 7 years as Supervisor of the typing pool, Laura Fiddes left to take a position in the administration of Agriculture Canada. Irene Garner, former secretary to the heads of the Paleontology and Regional Geology Subdivisions, has been promoted to fill the position vacated by Mrs. Fiddes.

Irene Brookwell resigned from her position in the typing pool. She is now teaching music at Mount Royal College, Calgary. Joan McIntyre has joined the staff of the typing pool.

Merle Beaver, formerly a draftsman at Union Oil Company of Canada Limited, has joined the staff of the Cartographic Unit and Susan Gill resigned her position as draftsman.

Brenda Case has transferred from her position as mail and registry clerk at the Institute to become a gas tax claims clerk with Customs and Excise Division of Revenue Canada.

Andreena Woolf is now secretary to the Chief, Resources and Processing, Coal, Energy Development Sector, having transferred from the Publications and Air Photo Distribution Unit.

Dona Moncrieff has resigned her position as geological technician. She is now working toward a B.Sc. degree in geology at the University of Calgary.

TERRAIN SCIENCES DIVISION

W.E. Podolak joined the permanent staff in August after having worked with the Division as a term-casual. Wilf received his B.Sc. from Brock University and is now supervisor of our Sedimentology and Mineral Tracing laboratories.

R.D. Thomas joined the permanent staff of Regional Projects Section in September. Roger received his M.Sc. from McGill University and he has acquired extensive experience in Quaternary field mapping in various parts of Canada through summer employment with the Division.

REGIONAL and ECONOMIC GEOLOGY DIVISION

Members of the division have heard numerous rumours over the years about being moved from 601 Booth. However it took almost no time for the latest rumour to evolve into fact as the Precambrian Subdivision was hurriedly moved to new quarters on the third floor of 588 Booth (the old headquarters building next to the tower). Many of the offices are large and more luxurious than the ones vacated, but some geologists have to share quarters.

Fred Chandler has transferred from the Precambrian Subdivision to Correlations and Standards Subdivision where he will be primarily concerned with red beds.

Janet MacManus who was assisting Terry Gordon for the summer is now a staff geologist with the Correlation and Standards Subdivision.

Pat Scrivens has moved upstairs to the Divisional office from the Central Registry.

Jim Franklin joined the Mineral Deposits Section as a Regional Metallogenist, southwestern Shield. Jim received his B.Sc. and M.Sc. in geology at Carleton University and his Ph.D. at University of Western Ontario (1970). His Ph.D. research project was on the metallogeny of the Thunder Bay area. Concurrent with his academic training, Jim worked several summers with the GSC and as geological assistant on field parties

of International Nickel, Geophysical Engineering, and Hollinger Consolidated Gold Mines Ltd. In 1969, Jim was appointed Associate Professor at Lakehead University, specializing in economic geology and remained in this position until joining the Survey in June 1975. During this time he carried out metallogenic studies in the Sturgeon Lake area, Ontario as part of the University of Toronto Superior Geotraverse. Jim is a member of several earth science associations and he brings a wealth of experience to the Section and the Survey.

RESOURCE GEOPHYSICS and GEOCHEMISTRY DIVISION

Maryann Blondin joined the Geochemistry Section in September, coming from E. M. R. General Administration Services (Headquarters Records Group). Her duties in the Geochemistry Section will include the establishment of a filing system to contain geochemical information relating to the Uranium Reconnaissance Program, and general typing, filing, etc. for the Section.

Margaret Scott came to the Radiation Methods Section on 25th September to work on section files. Her first job is to establish a filing system for geophysical information resulting from the Uranium Reconnaissance Program. In addition she will handle the general clerical duties of the section.

S. B. (Bruce) Ballantyne joined the Geochemistry Section of R. G. G. in January 1974. He formerly worked for the Ontario Ministry of Natural Resources and after graduating from the University of Guelph in 1972, with a degree in Earth Sciences, he was self-employed working throughout northwestern Ontario. Since joining the section, Bruce has been involved with geochemical surveys in the Slave Province and in northern Saskatchewan and is presently conducting geochemical orientation surveys in southeastern British Columbia as part of the Uranium Reconnaissance Program.

PERSONNEL

Our new staffing clerk is Diane Tremblay, replacing Carol Emond who left in August.

Doug Janny, Dennis Saucier and John Brydon have joined Personnel recently; Doug is a staffing officer, Dennis is the statistics and leave clerk, and John is our job description writer.

We welcome Penny Benson as our new classification officer. Penny is a graduate of Carleton University and came from the Department of External Affairs.

* *

OF GENERAL INTEREST

GSC Party Discovers Copper Mineralization in Northwest Territories

A discovery by Gordon Eisbacher's field party of what seemed to be a significant area of copper mineralization in the Redstone River area caused some excitement during the summer. The first information received in Ottawa was a telecopier message on the 11th of August from Dick Campbell in the Vancouver office, giving a brief description of the discovery and an index map. The mineralization was in the Copper Cap and Redstone River formations and as these formations had not hitherto been reported in the area, and as they were known to contain copper mineralization elsewhere, the new find was considered to be of potential economic interest and it was important that there be some form of controlled release to the public in order to avoid a staking rush that might result from unauthorized leaks of information.

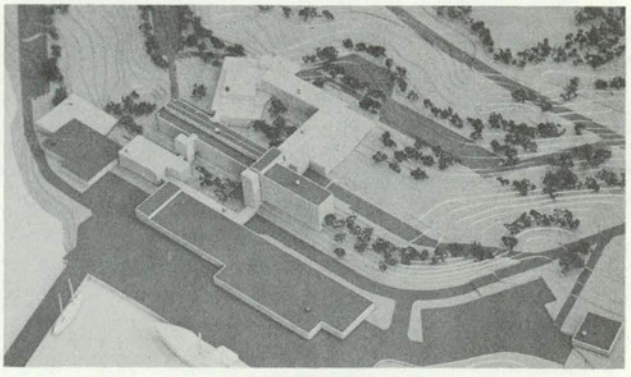
A somewhat non-commital announcement card was sent to our mailing list involving the printing and addressing of some 5000 cards. The cards stated that copies of an Open File giving a description of the occurrence and index map would be available in the four offices of the Geological Survey and in the offices of the Resident Geologists at Whitehorse and Yellowknife on the 26th of August.

There was considerable interest in the file on the day of release. More than 50 callers took copies from the Vancouver office and there were a number of callers in Ottawa, several of whom had come from Toronto. There were also a large number of mail and telephone requests for the information.

By all reports the release went off smoothly and we understand that much of the area has since been staked.

Bedford Institute of Oceanography

The Bedford Institute of Oceanography of which the Atlantic Geoscience Centre is a part, will be open to the public on November 20, 21 and 22, 1975. People are busy at the Institute preparing what they hope will be a first class show.



An 18 million dollar, 5 year expansion program is planned for the Bedford Institute of Oceanography. The new facilities (the lighter coloured buildings in this architect's view of the expanded site) will be used by both government and industry. (BIO photograph)

A Polar Bear in Camp

On August 19, 1975 a young polar bear entered the camp of a GSC field party which was led by R. B. Taylor of Terrain Sciences Division. The episode ended with two people being mauled by the animal and the bear dead.

Have you ever sat listening to "bear stories" and wondered what you would do if it happened to you?

At 0230 hours on August 19, 1975 a young male polar bear, which had been tagged by Canadian Wildlife Services on July 9 at Brentford Bay southeast of Bellot Strait, Boothia Peninsula, wandered into our camp at Cunningham Inlet, northern Somerset Island. Before reaching the circle of tents he punctured two pneumatic boats on the beach. Two students sharing one of the five Logan sleeping tents were awakened by the barking of a ten-week old dog that was tied up next to their tent. Upon realizing there was a bear, not a fox, attacking the dog they ran to the kitchen tent where a rifle was kept. The first student made it but the second, John Legault, was attacked as he emerged from the tent. Jim Savelle and I woke to John's yells; Jim took the rifle in our tent and I ran for the spare rifle in the Parcoll to back him up. When I stepped outside with the rifle, however, I found the bear had left John and was coming straight for me. In my haste to load the rifle the bolt did not pick up a cartridge from the clip, and I was left with an empty rifle chamber. The bear attacked and had dragged me about 60 feet away from the Parcoll when Jim Savelle took aim with the second rifle and fatally shot the bear through the base of the neck. I have no doubt that Jim saved my life.

John and I both were severely lacerated on the head and shoulders but the other members of the party, Brian Bornhold, Jim Savelle, Sue Costaschuk, Roland Wahlgren, Ross Cameron, and Olaf Niemann, administered first aid immediately and sent out a distress call over the radio. Decca Monitor at Tuktoyaktuk, N.W.T. picked up our radio call, informed Ministry of Transport at Resolute Bay, and within an hour Polar Shelf personnel had airlifted us to the nursing station in Resolute Bay. Most of the injuries were taken care of there by the resident nurse and Dr. Braganza from the ice breaker Louis St. Laurent. Final closing of the wounds took place later that day in Frobisher Bay General Hospital.

To top it all off, another bear was wandering towards camp two days later but fortunately the Twin Otter aircraft was just arriving and was able to chase the bear away from camp.

Everyone who has dealt with bears in the field will have their own solutions to the problem but a few basic comments may be useful: Firearms training for GSC staff and students could be given, e.g. similar to an R.C.M.P. course given two years ago, either prior to the field season or in the field. More than one rifle is needed in each camp in case of (1) malfunction, (2) the camp personnel split up during their daily chores, and (3) the one rifle is inaccessible, as in our case when it was held onto by the person being attacked. However, bear hazards are by no means limited to camp and some convenient form of protection is needed for the working geologist on traverse away from base.

At least one continuously monitored radio frequency should be available on all radio sets supplied to field parties.

A dog tied up near camp appears to be the only satisfactory warning system against bears at night when the camp is asleep.

R.B. Taylor

REG Field Season

The field program for the year is now over and almost everyone has reported fantastic weather conditions. North central British Columbia was an exception as the weather was lousy for the last half of the season. Tony Frith started and ended the season in the Hackett River area with a snowstorm, but the intervening weather was phenomenal. Bob Baragar reported about 6 good days of weather between snow and rain squalls, cold and fog on Victoria Island. Between the storms, John Foster was able to take a few hurried sun shots at sixty paleomagnetic sample sites. One squall cleared away the clouds about midnight and John climbed Mt. Ragarab to arrive at the site about one A.M. just as thick clouds once more blocked the sun.

Lloyd Davison's camp on Milliken Lake, northern Saskatchewan, was twice visited by clever black bears who picked only those days when there was no rifle in camp. The party is still amazed at the way one bruin picked all the eggs out of the egg cartons and ate them without leaving a single egg shell behind.

Gary Delaney (a summer student from Brock University) was the unfortunate victim of a serious boating accident of Island Lake, Manitoba while with Richard Herd's field party. Gary was out alone in a Canova boat when the motor unexpectedly speeded up and threw him into the water. The boat made several crazy circles in the water and on the third or fourth pass Gary was no longer able to duck out of the way and was struck on the head by the motor. The crazy antics of the boat attracted Chief Mason and his wife who were out for a paddle and they saved Gary's life by getting him into their canoe and thence to medical attention. Gary was flown to hospital in Winnipeg and later returned to Ottawa for recuperation. The accident left Dick Herd without an experienced assistant and he was kept extremely busy with helicopter work. A few days later Fred Chandler arrived to provide Dick with some most welcome support. Fred stayed for about two weeks while Gary regained his strength before returning to the field. This accident, one of several mishaps with Canova boats emphasizes that their usefulness is extremely limited by their operating characteristics with a light load; in particular with only one person.

Colin MacGregor has preparations well in hand for the annual meeting of the GSC palynologists that is to take place in Ottawa, November 19 and 20.

Bill Poole has returned from a brief cruise with Dick Haworth on the northeast Newfoundland Shelf, simply fascinated by the methods of mapping geology beneath a continuous, thick, fluid overburden. Much to the dismay of many, Bill is pleased to report he was neither seasick nor did he fall overboard.

The Holleford Crater

Some members of the Geological Survey will remember the time in the middle 1950's when they were asked by C. S. Beals, Director of the Dominion Observatory, to work on materials from Holleford Crater, Portland Township, Ontario. This circular depression was discovered during a search of aerial photographs for circular structures that might be meteorite impact in origin. Geophysical and diamond drilling programs revealed a buried crater-shaped structure 1.5 miles in diameter and 800 feet deep. Underlain by shattered Precambrian rocks, the crater was filled by an inlier of Paleozoic fossiliferous sedimentary rocks that dip gently towards the centre. The Precambrian rocks are highly fragmented and exhibit shock effects attributed to the impact of a meteorite 300 feet in diameter and travelling at 35 000 m.p.h. B.A. Liberty, formerly of the Survey, studied the stratigraphy and fossil record of the Paleozoic rocks and K.R. Dawson reported on the petrology of the underlying breccia. Other members of the Survey visited the site or were consulted regarding other aspects of the study.

The Ontario Heritage Foundation, Ministry of Culture and Recreation, erected a bronze plaque April 17th on the site. The unveiling ceremony which took place in Miller Hall, Kingston, was co-sponsored by the Department of Geological Sciences, Queen's University, and the Earth Physics Branch, Department of Energy, Mines and Resources. The guests were bussed to the site at Holleford and on their return were entertained at a reception.

The group standing in front of the plaque include from left to right: R.A. Price, M.R. Dence, William J. Nuttall, MPP, K. Whitham, J.G. Tanner and Winston Cousins, Reeve of Portland Township.

The chairman, Michael Dence, Earth Physics Branch, read a message from Hon. Donald S. Macdonald expressing his pleasure in the interest Canadians take in their natural environment. R.A. Price, Head, Department of Geological Sciences, Queen's, spoke on behalf of the University. J.G. Tanner, Director of the Gravity and Geodynamics Division, Earth Physics Branch outlined the research done on the site, identified many of the individuals involved and expressed appreciation for the assistance received from the local residents. K. Whitham unveiled the plaque in the absence of C.S. Beals who was unable to participate because of an unfortunate accident. He concluded his remarks, "It is obvious from our presence here today that not only was the meteorite impact theory for Holleford correct, but that it is a concept which has gained general scientific acceptance. The residents of the Holleford area can justifiably consider themselves special in that there are very few people in this world who know with some certainty what their land looked like 450 million years ago. Indeed, they can compare the lunar surface with the pleasant countryside here, and contemplate what changes can be wrought by the inexorable forces which shape our physical environment".

Viking Site

A new National Park in northern Newfoundland was officially opened by the Prime Minister on June 27, 1975. This is the L'Anse aux Meadows National Historic Park where Norse settlers constructed sod houses, smelted bog iron and built a sauna bath about 1000 years ago. The Geological Survey has contributed to a recently completed resource inventory of the Park. The bedrock geology was mapped by L.M. Cumming as a part of a detailed biophysical survey, conducted in co-operation with the Forest Management Institute (DOE), the Canadian Forest Service (DOE) and Parks Canada (DNA). The geological setting of the Park is near the ancient margin of the North American continent where, due to interaction of plate edges, continental-margin flysch deposits and Ordovician pillow lava became thrust over a platform carbonate sequence whereby a spectacular mélange zone was formed, which contains large ultramafic exotic blocks.

The Norsemen settled on what is now a prominent raised beach. This and other geomorphological and Pleistocene features within the Park have been studied by D.R. Grant, R.J. Mott and M. Kuc, Terrain Sciences Division.

Exploration Geochemistry and the Environment

In view of the current revival of the "mercury scares" of the early 1970's, it is of some importance to assess the role which exploration geochemistry might play in environmental protection and contamination surveillance studies.

A considerable amount of surficial geochemical information published in the earth-science literature is relevant to the detection and resolution of contemporary environmental contamination problems. Unfortunately, with its geological emphasis and resource orientation, such information is often not readily accessible; or perhaps more specifically, it is not available in a technical form immediately useful to environmentalists as a source of natural background, or baseline data.

Much of the work being carried out in Canada, and for that matter, in most industrialized nations, on the toxicological effects of trace metals on fish, game birds, other wildlife and subsequently on man himself, has been restricted to regions where contamination has probably resulted from industrial or other urban related activities.

Examples of such studies are those presently being conducted jointly by Federal and Provincial environment agencies into the mercury contamination problems of the waterways of northwestern Quebec which drain to James Bay, and of the English River system in northwestern Ontario.

In both regions industrial activities centred around chemical or paper pulp production have been viewed with considerable suspicion as being major sources of mercury input into those waterways and to date little attention has been afforded to possible natural sources within the rocks of these regions.

Other research work has concentrated on air pollution, and subsequently, on water and soil contamination by heavy metals such as selenium, copper, nickel, arsenic, and mercury which may find origins in ore roasters and smelters in areas such as Trail, Yellowknife, Sudbury and Noranda.

In all cases, it has proved very difficult, if not impossible to accurately gauge the absolute degree and effects of rapidly increasing metal levels on environmentally sensitive materials, e.g., soils, which may already retain significant natural loadings. The main point to make here is that an estimate of the amounts of metals which were present in a drainage system before onset of pollution is difficult to make afterwards. It is possible by studying sediment cores from lakes to make such an estimate for those particular parts of a drainage basin--this objective has been achieved with a fair amount of certainty in the Great Lakes. But rivers and streams which may feed them are a different proposition altogether. No sediment cores are usually available to provide a historic record of metals input. Attention must eventually turn to tracing natural input of heavy metals into streams and rivers and subsequently into lakes by making full use of surficial geochemical information of the type which is usually sought by exploration geochemists.

Detailed studies of metal content of rocks, soils, sediments and waters may well provide entirely satisfactory means of assessing natural input even after the stream becomes polluted. It should be possible to infer from such detailed suites of geochemical data, what metal loadings are potentially available to the given stream system. Once this is known it becomes relatively easier to determine the extent of industrial contributions and to devise suitable abatement procedures.

The natural average background levels in drainage sediments and waters are not established so much by their content in economic orebodies, but rather by their presence in varying amounts in rocks of all types and, most importantly, in the common and widely distributed non-economic iron sulphides such as pyrite and pyrrhotite. In regions where there is little or no known mining activity there may well be extensive undiscovered economic mineralization. Because actual ore grade accumulations may be deeply buried, they will make relatively small direct contributions, by way of trace heavy metals, to the drainage systems of the regions under study. However, the science of exploration geochemistry has reached a degree of sophistication whereby such concealed mineralization may be detected by observing small shifts in metal contents of surficial materials such as soils, sediments, waters and rocks from within an encompassing drainage basin.

A fundamental assumption, on which reconnaissance level drainage sediment surveys are in part based, is that the presence of many types of mineralization, whether economic or non-economic in grade and size, are reflected by these increased metal abundance levels. Statistical treatment, often quite elaborate, of the data derived from sediment samples collected over a wide area may well reveal favourable host rocks which are distinguished by higher average contents of the metals of interest than found in similar rocks in adjacent areas.

Because these same areas would also represent regions of high natural background contamination, in the parlance of environmental scientists, it is apparent that reconnaissance surveys will provide useful information to exploration oriented and environment oriented scientists alike. However, the motivations for seeking such wisdom are quite different in each circumstance.

But once a problem of metal contamination of the natural environment becomes manifest, the scale on which an investigator must work is considerably narrower than is applicable to reconnaissance surveys.

In order to track down sources, dispersion paths, and to pin-point problem areas, very detailed surveys of all surficial materials are required. Information gathered on the second level (follow-up) of geochemical surveys, especially at a prospecting level, is particularly useful to this end.

The picture would not be complete without acknowledging the value of geochemical process research to both exploration and contamination surveys. Clearly, a knowledge of the natural controls imposed upon the dispersion of metals from their sources into drainage systems is essential for evaluating the importance of a measured metal anomaly in sediments or water.

Quite high metal levels may often be found in drainage sediments or soils; very exciting for an exploration geochemist, but not immediately useful to an environmentalist. The latter is more concerned with the availability of the given metal for its participation in biological mobilization and enrichment processes, than with absolute quantities, important though these may be.

In general, the sequence of physical events leading to the ultimate dispersion of metals from source to their eventual sinks, usually lake sediments, is simple. On the other hand the chemical fate of metal ions, originally derived from chemical weathering and mechanical disintegration of host rock is controlled by innumerable factors, all interacting, involving atmospheric precipitation, water movement, soil movement, changes in redox and acidity conditions, absorption-desorption processes, chemical complexation and precipitation and hydrolysis, uptake by and decay of vegetation and biochemical-bacterial interactions. Whether or not a specific load of freshly leached metal ions (groundwater or surface water) eventually reaches a lake system intact or widely dispersed, or if at all, depends on the relative interplay of these factors.

Because of the different physical and chemical properties of various metal ions and their complex compounds, each metal will behave somewhat differently with respect to the development and propagation of base metal dispersion trains in terms of each of the above mentioned factors

Of all of the realms of geochemistry, as defined so loosely above, the research level is ultimately the most important in that it provides the detail necessary for correct interpretation of field survey data on any scale.

Whereas the Geological Survey is well served by its geochemists in both reconnaissance and follow-up surveys, there is a tendency for allied research to fall behind those more extensive and currently more glamorous regional surveys in terms of both effort and manpower.

If the work of geochemists is to find even more relevance and application in the growing problems of environmental protection this apparent deficiency ought to be remedied. In the past few months the author of this commentary has received a large number of enquiries from government, industry and various interested "public-pressure" groups for information on natural levels of metals in surficial materials and ores.

It is obvious that interests on both sides of the snowballing mercury contamination problems are seeking the same information on natural sources and dispersion processes.

It would seem that the Geological Survey is a prime source for such advice and information, and perhaps the only source for much of it. Sometimes we can provide it, sometimes we cannot; but if the Geological Survey does not undertake to execute and interpret the results of such detailed geochemical studies who else can or will?

I. R. Jonasson

Geological Computer Applications - Discussion Group

Over the past few years the need for better communication in the field of Geological Computer Processing has grown with increased complexity and usage in this area. Concerned persons from various divisions within the GSC organized this Discussion Group with the aim of promoting internal communications about the various computer systems being used and developed.

In the past, geological data processing has been concerned mainly with scientific analysis of geological information, the general areas of data collection, verifications, storage, and retrieval having been largely neglected. With the trend in the Geological Survey towards resource evaluation, the need for flexible data accessing capabilities has been recognized. Towards this end individuals have developed various data management techniques within their own divisions. It is hoped that this Discussion Group will provide a forum for the exchange of experiences and problems and possibly prevent redundancy of effort.

The first meeting was held Friday, September 26 and Tuesday, September 30 when the purpose and organization of the discussion group was outlined by Don Proudfoot. This was followed by discussion of current projects within the divisions of the survey. Greg Lund, Dave Ellwood, and Mike Holroyd of RGG outlined the Geochemical Data Management System. Dwight Dods, also of RGG, presented the ADAM system for the handling of aeromagnetic information. Don Proudfoot and Guy Charron from TS presented the Mackenzie Valley Geotechnical Data Bank and Urban Geology Data Bank systems. From REG Bill Houston described the procedures used for handling field data. Felix Chung of the Geomathematics Section of REG mentioned his extensive library of advanced statistical and numerical analysis programs. The CANMINDEX and M-2 files of the Mineral Deposits Section were described by Don Picklyk of the Data Systems Group and Robert Laramée of REG.

It should be noted that the meeting originally was intended to take about 2 hours and ended up stretching over 2 days. This underscores the degree of GSC activity in this area and also the interest shown by the participants. One of the major points arising from the discussion was the importance of documentation of programs and systems.

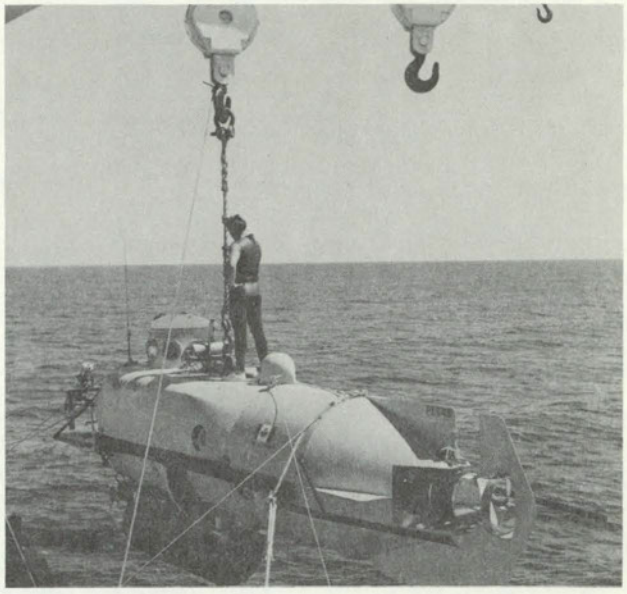
In future meetings, selected topics from the broad scope of geological computing applications will be presented and discussed in detail. It is hoped that these meetings will be held at least once a month with a new chairman being selected after each meeting. For further information contact Don Proudfoot, Bill Houston, or Dave Ellwood.

Mini-Submarines and the Marine Geologist

Mini-submarines, or submersibles, have been used by marine geologists to extend their range of direct observation of the ocean floor. As well as serving as an observational platform, with as many as 3 to 24 viewing ports, cameras and television equipment can be mounted externally to assist in exploring and recording the natural secrets of the sea bed. Many of these sights are fascinating encounters to both the naturalist and the explorer. In one venture in the waters of the high Arctic, a veritable cemetery of narwhals was discovered in which the profusion of tusks and bones presented a sepulchral appearance in the blue light that filtered downwards to the site through these partly frozen seas. On another dive to more than 1200 feet below sea level, patches of old bituminous (black organic) stains were observed on sandstone beds more than 100 million years old, which suggested that valuable hydrocarbon compounds were stored in the ancient rock and presented a potential energy source to be exploited by oil companies surveying and drilling in the area.

For more than two decades submersibles have been developed chiefly by European, American, and Canadian companies. Only ten years ago more than 40 such vessels, but fewer today, were in service over many parts of the world and were making dives to 20 000 feet. This does not include the spectacular descents of the BATHYSCAPE which was lowered into one of the deepest bottoms on the sea floor – a trench more than 7 miles below sea level, and sufficiently deep to contain the greatest mountains of Eurasia or the Americas. Of the thousands of deep dives to date, several were made off La Jolla, California in Cousteau's DIVING SAUCER in order to study the mass movement of sand along the Californian coast. Here scientists observed sand literally cascading thousands of feet down the face of a submarine canyon cut into the continental slope and shelf. More recently the ALVIN from Woods Hole Oceanographic Institute took part in a French-American underwater study of the Mid-Atlantic Ridge – a feature which is part of the longest mountain system in the world as it extends more than 40 000 miles around the earth. Here studies were made on the phenomena of drifting continents, spreading sea floors, and outpourings of modern basalts.

Many of the most fascinating dives however, are undertaken in shallow waters. All over the world's tropical waters such excursions have been made over the coral reefs – the largest single feature ever constructed by animals, including man. These reefs are studied by geologists in order to understand their structure, composition, and origin, and to apply this knowledge to the ancient reefs, some of which are now the repositories of vast stores of oil and gas. But some dives are made to appraise the damage in coastal waters created by the activities of man. A Perry mini-sub, the PC-8 from Miami, was used to examine the sea floor in Chedabucto Bay, Nova Scotia, where the oil tanker ARROW went aground on Cerberus Rock in February 1970. The tanker spilled most of her cargo, which contaminated more than 185 miles of Nova Scotian coastline. Eighteen months after the event geologists photographed the sea floor through the 40-inch diameter viewing port of PC-8, investigated the movement of sand on the sea bed, and collected bottom sediment samples with the use of a manipulating arm and container. Farther north in Chaleur Bay adjacent to the northwestern portion of the Gulf of St. Lawrence, geochemists and micropaleontologists used the PC-8 to observe industrial waste discharged from an offshore effluent pipe. Samples of sediment and micro-organisms were collected to determine the effects on the environment from industrial pollutants.



SHELF DIVER being lowered over the side from C. C. G. S. C. D. Howe, Bay of Fundy.

In shallower waters, many of the dives can be made with SCUBA divers. Because of this capability of man, it was only a matter of time before the activities of the diver and those of the submersible were married, so to speak, and the diver lock-out submersible was designed and built as a matter of course. The Perry Submarine Company of Miami introduced the SHELF DIVER for commercial and research work, and Hydrodynamics International of Vancouver (the builders of the PISCES class) followed with SDL-1 for military assignments to the Canadian Forces Base in Halifax. In a series of dives with SHELF DIVER in the Gulf of St. Lawrence and Bay of Fundy, Canadian Navy divers assisted geologists by carrying out some of the lock-out work, in which undisturbed samples of the sea bed had to be collected. Although this task has been performed routinely many times in the past, it still remains an amazing sight to see a diver emerge from his compressed atmosphere in the lock-out chamber, step through the lower part of the chamber and into the sea which is restrained from entering the submarine only by an invisible wall of compressed air, and then walk along the sea floor to carry out his assignments. Beyond the lights of the submarine he trails his life-support hose and walks into the darkness of the ocean, only vaguely lit by ambient light from the surface.

Soon the capabilities of the diver lock-out submersible will be linked to those of the undersea habitats, which are stationary units set on the sea floor (SUB LIMNOS in the Great Lakes), or they may be acrylic hulls suspended from the surface (SUB IGLOO in the Canadian Arctic). Installations such as wellhead, mining, and navigation equipment may have to be manned or monitored remotely from the sea bed in special habitats. With the continued world demand for energy, metals, and food, the subsea installations used in winning such resources may be serviced or linked to the submersible and diver system.

A so-called shirt-sleeve environment within the observational chamber of the submersible permits a wide variety of tasks to be accomplished in comfort and with ease. Animals are studied directly and may be collected with the aid of externally mounted dredges and manipulating claws. Rock-coring drills, powered from the same battery-driven system that drives the submersible, are used by geologists to collect samples of bedrock. Undisturbed samples of the sea floor are best collected from the lock-out submersible, but at depths greater than 150 feet gases must be added to the breathing mixture in the life-support system. Even so, a depth limit of 300 feet still exists for the normal professional SCUBA diver, although test dives have been made to 1200 feet and simulated dives in compression chambers to 2000 feet.

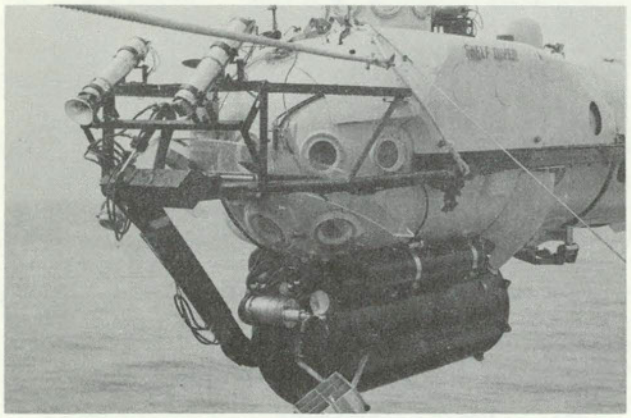
Elements of the ocean environment can be observed continuously by equipment installed in the submarine. Special sensors to measure the electrical conductivity of sea water can be fixed to the submarine chassis externally, and wires can be extended from the instrument, through the hull, to the recorder inside the submersible. This instrument indirectly gives the salinity of sea water, since water temperature also is recorded simultaneously. With these data, the extent and structure of the ocean water mass can be determined and applied to meteorological and fisheries studies as well as to investigations of ocean dynamics, such as the tremendous upwelling of deep ocean water, the vast oceanic eddies or gyres, and the great currents like the Gulf Stream.

Early in the 1960's the use of the submersible as a viewing platform was probably the most widespread purpose of these vessels. Over the Scotian Shelf, features were observed such as ledges of bedrock which were sampled and mapped for exploration purposes, conical holes in the sea-bottom muds which were later explained as due to escaping gas derived from ancient rocks beneath, mounds of boulders and sands which were dumped by colossal ice sheets that slowly migrated onto the continental shelf along the northern Atlantic seaboard as recently as 20 000 years ago, and old river systems which originated millions of years ago on land and filled with silt in their presently submerged locations and possibly contain economical deposits of placer gold. The submersible has been used to observe and to install ocean monitoring equipment on the sea floor, to study the massive but almost imperceptible movement of sand across the sea floor in the form of dunes or gigantic sand waves 30 feet high and perhaps 200 feet long, to observe the interaction of life on the bottom sediments and rocks, to investigate the occurrence of gravel deposits which are favourite sites for herring spawning, and to record all such phenomena with camera, and video tape.

However, these vessels, highly versatile as they are, can be costly to purchase or hire, particularly when a tender ship is needed to support them. In nearshore waters the submersibles can be towed to the diving site and thus can eliminate the need of a mother ship, although a launch is usually standing by to render aid in case of emergencies, or to support the diving operation. Most mother ships lift the submersible out of the water by means of a crane. Ramps or elevators, however, can be lowered in order to receive the submarine while yet in the water. With the aid of a diver, a cable is hooked to the submarine and winched onto the ramp. The ramp is then raised to provide a deck-floor, which thus becomes an integral part of the ship. Such support is costly and will not be eliminated until the submarine can support itself without the means of a mother ship. To make this prospect possible it was necessary to give the submersible additional tasks so that her benefit to cost ratio would be higher. This was realized with the introduction of sonic and seismic surveys, as well as gravity and magnetic measurements, which conventionally are carried out at sea from surface vessels. Because surveys such as echo sounding are carried out while the vessel is underway, the results of the survey are topographic profiles of the sea floor in which plains, hills, valleys, and ridges are easily distinguishable. In the same sense, seismic profiling can be carried out to give a cross-sectional view of the geological formations and structures beneath the sea bed. At the same time, gravimetric and magnetic surveys can provide profiling and mapping data on large-scale structures of the earth's crust such as deep sedimentary basins, the roots of ancient mountains, the structure of the deep-sea trenches, and the relative locations of continental and oceanic crustal features with reference to problems on continental drift and sea floor spreading. Sometimes the sound signal from the echo sounder may penetrate a few tens of feet of recent sedimentary layers, but it generally takes the greater man-made shock of the seismic apparatus to produce the sound energy that will penetrate hundreds and thousands of feet of bedrock. Some of the records of these seismic refraction experiments reveal structures more than 20 miles deep. Seismic profiling however is much shallower and generally records sub-bottom depths to 20 000 feet.

Another sonic system, called side scan sonar, is now being used to survey the sea floor. This instrument is towed from a ship and sends sound signals obliquely to the bottom. The returning echoes (for it is really an echo sounder) give a bird's eye view of the sea floor for several hundred feet to each side of the ship's track. Because the vessel is underway, a continuous view of the sea floor is presented. One such survey in the Beaufort Sea showed the presence of furrows in the sea floor made by ice dragging the bottom. In an area of petroleum exploration, these

features indicate a potential hazard to drilling vessels and installations on the sea floor. Because of the unpredictable occurrence of ice scouring together with the impact of industrial activity on the environment and economy, it was imperative to obtain first-hand knowledge of these scour features. In the late summer of 1975, the submersible PISCES IV was used to examine these trench-like grooves, to core them, and to record their form on film and video tape.



The submersible SHELF DIVER in Gulf of St. Lawrence shows attached camera, manipulating arm, storage rack containing short cores, and numerous viewing ports. (Photo by J. R. Belanger, Atlantic Oceanographic Laboratory)

With the combined capability of the geophysical surveys, as well as drilling, bottom sampling, photography and television, an interesting and worthwhile survey package can now be put aboard the submersible on a potentially paying basis. All underway surveys can be carried on simultaneously and most important, all can use the same positioning system from fixed references on the sea bottom and nearby land stations. Such a scheme however will require a larger submarine than the mini-submersible, and it will demand more self-sufficiency in terms of life-support, power, and maintenance. Horton Maritime Exploration of Vancouver recently obtained the AUGUSTE PICCARD, which was used in Lake Geneva to take as many as 45 passengers on an underwater sight-seeing tour. Now she is being refitted to carry out seismic and echo sounding surveys in all waters including those beneath the ice in the central portion of the Canadian Arctic Archipelago and perhaps the Arctic Ocean itself. Special radio devices will be placed on the sea floor to serve as aids to navigation. The mini-submarine carries two or three people, and at times five as in the case of lock-out diving, and may have as much as 3 or 4 man-days of life support; but the AUGUSTE PICCARD may have two three-man crews using an 89 man-day life-support system.

The mini-sub has reached a level of advancement similar to that of the helicopter in the 1950's. Now with the necessity of continuous seismic and sonic profiling, new developments are taking place. The oil drilling rigs working over the continental shelf off the northeastern Atlantic and North Sea also are providing more impetus and demands for development of the mini-sub.

By the end of this decade more than 30 submersibles will be working in that area, and more will be needed in other parts of the world. They will be used to carry out site surveys and to monitor the security of the drilling rigs. The future for submersibles will be a demanding one and will require an understanding of working at great depths (2000 to 10 000 feet or greater) in the recovery of resources to be made from and beneath the sea bed. Meanwhile, the more extensive survey tasks may be assigned to the next generation of submersibles such as the AUGUSTE PICCARD class. They will carry out or assist in the underwater drilling of the sea floor, and some will serve as underway survey platforms to aid in the geological and geophysical mapping of the ocean floor and the rocks beneath it. As more of man's activities including industrial and urban expansion moves seaward, our ocean environment will continue to be observed and monitored by marine geologists in their mini-submarines.

B. R. Pelletier

CANMET MSL Technical Report 75-132

Why should the publication of a CANMET report be of interest to GEOGRAM readers? Mainly because of the involvement of GSC staff in a rather unique publication. Authored by Sydney Abbey (GSC), Archie Gillieson (recently retired from CANMET) and Guy Perrault (of Ecole Polytechnique) the report describes collaborative analysis of three Canadian rocks (two unusual syenites from the Bancroft area of Eastern Ontario and a gabbro from the slopes of Mont-Royal, in the heart of Montréal) for the purpose of establishing them as "reference samples".

Reference samples are samples of accurately known composition that can be used by analysts to calibrate instruments and to verify new analytical methods, and by geologists as controls in comparing analytical data emanating from different laboratories. Syd says his involvement in this type of work began with an enforced idleness in 1969, when he was recuperating from surgery. He spent it manipulating published data in order to arrive at "usable" concentration values for certain components of six reference samples issued by the U. S. Geological Survey. Later on, the involvement was extended to data on samples from many other countries, and finally to the collaborative operations on the three Canadian rocks.

The work was done as part of the Canadian Certified Reference Materials Project, a CANMET activity which also involves the GSC, several universities and private industry. The Project is an outgrowth of the Standards Committee of the then Canadian Association for Applied Spectroscopy, of which Hal Champ was a founding member. Compositional data was reported by some 50 laboratories all over the world, amounting to about 6000 individual determinations. From those figures, a set of usable values was derived for most of the major and

minor components of the three rocks, as well as for many trace elements. It is hoped that more data will be forthcoming, in order to extend the number of elements covered in a second report, to be published some day.

Naturally, GSC laboratories played a major rôle in contributing data. Among the participating analysts were Hal Champ, Gerry Lachance, Clare Meeds, Joy Sen Gupta, René Guillas, Bob Wanless, Linda Seymour, Jean-Louis Bouvier, Gower Bender, Vera Grushman, Ruth Robertson, Serge Courville, Diane Bellerive and Gisèle Bélanger.

On a bulletin board in the Analytical Chemistry wing of the 7th floor at 601 Booth St., there is a map of the world with coloured pins showing the locations of the participating laboratories, and the state of their contributions. Letterheads from all of them, along with other information are also on display. Readers are warned not to ask Syd about the display because, by his own admission, once he starts talking about it, he finds it hard to stop.

Geophysical Research in Permafrost

For the past few years, the Resource Geophysics and Geochemistry Division has been involved in research on the application of geophysical techniques to permafrost with a view to relating measured geophysical parameters to geotechnical properties of materials. Early work by Bill Scott and Jim Hunter led to the establishment of test sites in the Mackenzie Valley in areas with discontinuous, thin continuous, and ice-rich permafrost. These sites have since been used by industry as calibration areas for various airborne and ground electrical techniques and for seismic techniques.

From laboratory and field work, it has been established that substantial differences in seismic and electrical properties exist between frozen and unfrozen states for most overburden and rock materials found in permafrost areas. Combined geophysical methods have proved effective in delineating unfrozen and frozen zones and estimating type and ice content of frozen materials. Geophysical mapping of permafrost is now done in a routine manner along transportation routes in the western Arctic.

Recently, novel techniques have been developed in our division for application to specific permafrost problems. Hugh MacAulay of the Seismic Methods Section has been interpreting the 'front ends' of industry reflection data to map refracted waves from frozen ground beneath the sea floor in the Beaufort Sea; large areas of the continental shelf are underlain by permafrost, thought to be relict in nature. Bill Scott of the Electrical Methods Section has developed a marine DC resistivity unit for mapping frozen ground under lakes, rivers and shallow seas; geophysical companies have expressed interest in commercial exploitation of the system.

Peter Annan and Les Davis of the Electrical Methods Section have been developing pulse radar techniques to map the occurrence of ice bodies at shallow depths. Initial tests at the Tuktoyaktuk site were unsuccessful, and computer reflection enhancement techniques are being attempted.

Under the leadership of Len Collett, our co-ordinator for the Terrain Geophysics Program, plans have been formulated for next year's field season in the Arctic Islands. In co-operation with mapping groups in the Terrain Science Division, a variety of geophysical techniques will be applied to type areas along proposed pipeline routes. Since ground truth is essential, we will be working closely with the geotechnical drilling team.

J. A. Hunter

The Woes of Mud Flat Field Work

The Minas Basin Project, which is being conducted by the Environmental Marine Geology group of AGC, has been fraught with many logistical problems not least of which is the example cited below. Windsor Causeway Mud Flat located in the Avon Estuary of Nova Scotia has been the subject of much interest and conjecture. How fast is it accreting sediment? What is the mechanism causing sedimentation? How long will the accretion continue? These and other problems remain unsolved so far because of one outstanding impediment – access to the mud flat!

The flat can be sampled in one of three ways:

(1) On foot at low tide. Experience has shown that it takes an extremely fit individual approximately one hour to wade groin-deep through 300 yards of the soupy mire.

(2) By boat on the flooding tide. After negotiating the world famous tidal bore (much as a surf boater would) one has but a few minutes to complete a task that usually takes two or three times longer. With the tide rising 10 feet each hour, the likelihood of a mud-flat pedestrian becoming stranded mounts proportionately.

(3) By HOVERCRAFT or other similar vehicle. This is probably the only way to safely and successfully sample areas such as the Windsor Causeway Mud Flat.

At first I found it curious that a mud flat no more than 400 yards from the centre of the town of Windsor should be so imperfectly understood in 1975. But with the inherent dangers and discomforting methods available for the study of inter-tidal sediments, I well understand why this flat has defied study despite the 600 or so oceanographers in Nova Scotia.

Carl Amos

Logan Club, 1975 - 1976 Session

The officers for the 1975-76 session of the Logan Club are Gordon Gross, Chairman and Colin McGregor, Secretary. This year the executive is being aided in the arrangement of programs by representatives from the Ottawa based Divisions: T. Frisch for Regional and Economic Geology; R. B. Taylor for Terrain Sciences; V. R. Slaney for Resource Geophysics and Geochemistry; and A. G. Plant for Central Laboratories and Administrative Services. Suggestions for Logan Club speakers may be made to the Executive or to the Division representatives.

Logan Club speakers this year have been Prof. A. F. Wilson of the Dept. of Geology, University of Queensland, Brisbane, Australia, on September 23 and Lubomir Jansa from Atlantic Geoscience Centre on October 8.

Readers might be interested to know that it is 88 years since the first Logan Club meeting.

On the Ridge with GLORIA

One of the largest and in many ways most sophisticated towed oceanographic instruments is GLORIA – Geological Long Range Investigating Asdic. GLORIA is a side-scan sonar similar to units used in the Beaufort Sea to study iceberg scours or off Vancouver Island to locate sunken barges. With a range of 26 km in deep water, GLORIA is unique. She is operated on the Royal Research Ship *Discovery* and is part of a sophisticated installation for advanced geological surveys.

In July and August 1975 *Discovery* was on a major deep ocean expedition in the mid-Atlantic Ocean. One of the projects, in which AGC participated, was to return to the area of the Mid-Atlantic Ridge at 45°N, which was studied in the late sixties during many expeditions by the Bedford Institute of Oceanography.

With GLORIA we were able to view the morphology of the crestal mountains anew. The information GLORIA provides is an oblique shadow-view suitable for highlighting the trends of the topography. The general problem in the area is the unexplained mechanism of formation of the Median Valley. The specific problem that we were interested in was the question of transverse faulting. In particular, we wanted to know whether there were any fracture zones through the survey area of the crestal region between 45°N and 46°N.

During a 2500 line-km survey the area was covered with sufficient tracks to produce a complete photo mosaic. An examination of this mosaic led to the following preliminary conclusions:

(1) The topography is lineated in a direction subparallel to the Median Valley and there are no major fault- or fracture-zone displacements; (2) Block faulting is the main mechanism responsible for the rugged topography; (3) Around 45°45'N there is a shift in the orientation of trends from 015 to 030 degrees, and the northern portion trends more to the east; (4) Cross trends against the main grain of the country are possible at terminations of major blocks but they are not obvious on the mosaic and cannot be identified with certainty.

After eight years of service, GLORIA was retired at the end of the cruise to be replaced by Mark II in 1976. She has served British marine geoscientists since 1967 and was used on surveys in the Atlantic and Mediterranean Oceans in addition to the continental shelf around the U.K. GLORIA was a beautiful 'baby'; 10 m long, 1.75 m in diameter, she weighed 3.5 tons in air. She could be towed at speeds of up to 7 knots to a depth of 100 m. She was often temperamental and had, it seemed, a mind of her own. Those who had to babysit her throughout the cruise expressed their feelings by proposing variations on the name GLORIA. Samples:

Genuinely Lifelike Ocean Ridge Investigating Apparatus;
Gigantic Load of Rough Instrumental Antiquities;
Greatest Lump of Rubbish in Atlantic;

The last of these is a bit unkind.

When I left the ship, the arrangements for the disposal of the body had not been completed. A suggestion was made to donate her to Discovery's Captain Geoff Hall as a retirement present.

B.D. Loncarevic

A Celebration

During this summer's field work several officers of the Geological Survey conducted an intensive scientific program which attracted the attention not only of the mineral exploration industry but perhaps even more that of the various communities of the Pelly River Valley. The voices of Drs. Tempelman-Kluit, Blusson, Eisbacher, Fritz, and Mulligan, and their associated pilots and student researchers testified to the close radio network that connected their isolated fly camps with the vital supply centres of Ross River and Pelly Crossing. The main thrust of the program was directed towards examining, on detailed and regional scales, the relationship of lead, zinc, copper, barite and tungsten to the presumed stratigraphic and structural controls. Although the data still have to be processed and finalized it is clear that some of the conclusions will have a major impact on directing the search for mineral deposits.

To express their appreciation to the people of the region the officers hosted a bonfire and wiener roast to commemorate the establishment of the trading post of Ross River near the Kumquatly fishing grounds about 100 years ago.

Even the mayors of Ross River, Mayo and Braeburn attended this affair held on the banks of Lapie River near the traditional fishing grounds of Kumquatly. In an address to this gathering of "Yukoners" the mayor of Braeburn, Mr. J. Smith, emphasized the importance of the continuing role of the Geological Survey of Canada in the Yukon in the great tradition of Dawson, McConnell and the respected Hugh S. Bostock. The more than two hundred guests arrived by truck, helicopter, plane and riverboat taxing the abilities of the camp crew to the limit.

In the usual Yukon fashion the festivities, which continued beyond that day, reaffirmed the goodwill towards the Survey in this region.

G.H. Eisbacher
D.J. Tempelman-Kluit

Omo River Project, Ethiopia

The Geological Survey is currently hosting a group of seven members of the staff of the Geological Survey of Ethiopia. Six of the group are working with Tony Davidson, helping to prepare, as part of their training, the final report and maps for C.I.D.A.'s Omo River Project. Tony was team leader in Ethiopia for this bilateral aid project which started in September 1972 and has the dual aim of reconnaissance mapping and counterpart training. The seventh member, Getachew Shume, has been taking training here in cartographic methods, and works part-time with the Project. Some of the members are shown in the picture with Tony, taken in the Ottawa operations room.

Left to right: Miss Negist Hintsa, Muluneh Gelatta, Mengesha Teferra, Getachew Shume and Aberra Degeffu. Alemu Shiferaw and Alemayehu Walde Rufael are the other two members of the current Omo River Project team.

GSC Report of Activities

To meet the apparently ever-increasing demands of the Survey for the rapid release of information, it has been found necessary to put out a third volume to be called Report of Activities, Part C. This issue has already gone to press and will be released in November, bringing the total number of pages for the series this year to more than 1300. This is a large amount of text and preparing authors' submissions for publication requires a lot of work on the part of our scientific editors, technical editors, proofreaders and stenographic staff.

The picture shows our dedicated production crew around one of our "mag card" machines in Ottawa; from left to right they are Janet Gilliland, Richard Fix, Sharon Parnham and Leona Mahoney with Debbie Busby at the keyboard.

* *

MEETINGS AND VISITS

IUGG, Grenoble, 1975. Charlotte Keen and Bosko Loncarevic attended the General Assembly of the International Union of Geodesy and Geophysics in Grenoble from 25 August to 6 September, 1975. About 3000 scientists participated. As is often the case at large meetings, the scientific symposia were disappointing and few really new ideas were brought forth. Of particular interest to marine geophysicists, however, were the new results obtained with ocean-bottom seismometers by Russian, Japanese, and American scientists.

Don Barrett, Robin Falconer, Dave Heffler, and Ruth Jackson of AGC joined the *R/V Atlantis* of Woods Hole Oceanographic Institution for a joint cruise. Three site surveys for the International Program of Ocean Drilling were carried out from late August to mid-October. Sites 2 and 2A on the Hatteras abyssal plain in the Keathley magnetic lineation sequence and site 5 near the Mid-Atlantic Ridge at 22°N over anomaly 5 were surveyed in detail. AGC loaned equipment such as a 2000 in^3 air gun and receiving and recording equipment for expendable sonobuoys to Woods Hole Institute. Lamont-Doherty Geological Observatory also participated in the cruise. They supplied three ocean bottom seismometers, which were of particular interest to us because AGC plans to purchase and modify similar seismometers.

Analytical Chemistry Collaborates with Laurentian University

At the request of the Geology Department of Laurentian University, Jean-Louis Bouvier spent two days in Sudbury working on some problems they had met in their induction-furnace apparatus for determining total carbon in rocks. Laurentian also wished to set up apparatus for determining carbonate carbon in rocks, and for that purpose, Mrs. Lorraine Dupuis of Laurentian University spent a day in our laboratories to acquire the necessary knowledge. Later, Mr. Radi Telassie, a CIDA trainee from Ethiopia who is studying at Laurentian, also visited our labs to observe our X-ray fluorescence and atomic absorption methods.

J.D. (Jim) Aitken returned recently from the International Symposium on Correlation of the Precambrian, held in Moscow, USSR, September 1-6, under the auspices of the Soviet Academy of Sciences, IUGS, and UNESCO. A field excursion to the Bashkirian SSR provided an appreciation of the structure and Proterozoic stratigraphy of the southern Urals, and another to the Georgian SSR gave participants a quick look at the Caucasus Mountains and a long draught of splendid Georgian wines. He learned that, as of this year, the Soviets have 160 000 Ph.D. geologists and 11 000 (yes, eleven thousand, that's no misprint) field parties! The handwriting is on the wall, chums: learn Russian.

Jim was impressed by the advance in material well-being of the Soviet people over what he saw only two years ago.

Danish Exchange

R.L. Christie returned in September from Denmark. Bob had participated in a one-year exchange arrangement between the GSC and the Greenland Geological Survey (Danish name: Grønlands Geologiske Underaøgelse); his GGU counterpart, David Bridgwater, spent the year in Ottawa and completed two field seasons in Labrador.

The project began with a field season in Peary Land, northern Greenland, in company with John S. Peel of the GGU and two young Danish assistants. At the close of field work, in August 1974, the Christie family – including Audrey and 3 children – met in Copenhagen and settled in the Bridgwater house for the winter.

What can one say in a few words about a stay in Denmark, except that it was wonderful? The cost of living may be high, but people seem to enjoy the life there! The children went to school in the international or English-speaking section of an alternative school, the Bernadotte School, while Bob worked at the downtown headquarters of the Survey. All travelled the 25 km between Hørsholm where the Bridgwaters live, and school or office by means of a fast, diesel-electric "coast train".

The Greenland Geological Survey is about the size of ISPG – and a rather friendly, "family" atmosphere prevails. The working languages are Danish or English; most of the staff converse freely in either. Serious attempts on the part of a visitor to speak Danish invariably caused great amusement (Danish sounds are not easy) but are met with sympathy and a good deal of patient help.

Visits were made, in the course of the year, to other parts of the Danish archipelago; the country is uniformly beautiful and the people everywhere are friendly. Stockholm, Sweden, and Oslo, Norway, were visited during other trips, enabling Bob and Audrey to meet many people concerned with Arctic affairs.

The year in Denmark was indeed a memorable one: to learn how things are done in Greenland, our giant, neighbouring Arctic Island; to begin to understand the social fabric of one of the Nordic countries; to learn some of a new language so closely related to our own; these are things that can only be obtained by "going there, being there"!

R.L. Christie

"Northern Hemisphere Glaciations Correlation"

The 1975 meeting of the Quaternary Glaciations in the Northern Hemisphere project (73/I/24) of the International Geological Correlation Programme, September 8-17, was hosted by United States with part of the field excursion taking place in Canada. Theme of the meeting was correlation of the last glaciation. About 40 people from 10 countries took part in the two days of symposium and eight days of field excursion. The technical session was held at Western Washington State College, Bellingham, Washington, four days of excursion were run in western and central Washington and four days in south-central and southwestern British Columbia. Bob Fulton, John Clague and John Armstrong were there from the GSC.

Twenty-seven papers, most of them dealing with some aspect of the stratigraphy of the past 150 000 years, were presented at the two-day technical session held in Bellingham. All will be prepared for publication in a session proceedings volume. There was little controversy over the timing of the last major ice advance and general agreement that middle Wisconsinan time was a period of general nonglacial deposition in many glaciated areas. There was also general agreement that the time of commencement of the last glaciation would vary depending on the criteria used to define the change from Interglacial to Glacial conditions but there was obvious lack of agreement on whether the major ice advance that took place before the last Pleistocene advance was pre or post Sangamon.

In 1976 the working group hopes to hold a similar session in southern Germany with excursions to the Alps and their forelands in Austria, Germany, Switzerland, and possibly France. Main emphasis again will be on the last glaciation with particular stress on the environment of the Alps during Würm and the identification and differentiation of oldest Würm and youngest Riss moraines. There will be no working group meeting in 1977 but possibly a symposium will be organized at the international INQUA conference. Dr. Velichko of the USSR Academy of Sciences has been asked to attempt to organize a working group meeting in the USSR in 1978 with the location and the subject to be left up to USSR scientists.

Dr. Dreimanis, Canadian leader, is planning to hold a meeting of the Canadian working group (about 12 people) this coming March in Ottawa. The Geological Survey is being asked to make arrangements for this meeting at which the future course of the Canadian group will be discussed.

Lubomir Jansa gave lectures from 5-10 October 1975 to: McMaster University in Hamilton, University of Toronto in Toronto, Queen's University in Kingston, McGill University in Montreal, Carleton University in Ottawa, and the Logan Club of GSC. Lubomir's talks encompassed the Mesozoic stratigraphy and sedimentology of the Atlantic continental margin of eastern Canada, the results of Deep Sea Drilling Program Leg 41 off Northwest Africa, and the Mesozoic development of the central North Atlantic Basin and its relation to plate tectonics and hydrocarbons.

Ray Cranston of the Environmental Marine Geology group of AGC is on educational leave at the University of Washington in Seattle, Wash. Ray is studying for a Ph.D. degree on the geochemistry of marine waters and sediments under the supervision of Dr. Roy Carpenter of the Department of Oceanography.

Felix Gradstein is participating as a micropaleontologist on JOIDES Leg 44, south of Bermuda. This is to be the last leg of the Deep Sea Drilling Project before IPOD, the International Phase of Ocean Drilling program, begins.

The annual meeting of the American Geophysical Union was attended by D.I. Ross of AGC. Dave found the most interesting session to be the symposium on Project Famous. The U.S. and France have carried detailed surveys of a portion of the Mid-Atlantic Ridge, such as that initiated by B.D. Loncarevic, a step further. It is only through projects of this type, complemented by deep drilling in the oceanic crust, that we can gain a proper understanding of the processes occurring during the genesis of oceanic crustal material.

Other highlights of the meeting were the general acceptance that hydrothermal circulation can be used to explain the scattering of heat flow measurements observed on mid-ocean ridges, a review of work being done concerning the problems of earthquake prediction, and the Frontiers of Geophysics Session which emphasized the increasing interest by geoscientists in paleoclimatology.

In general the main push in plate tectonics seems to be subsiding slightly and that efforts now are being directed towards assessment of available data in terms of these models and the global synthesis of data. New efforts are directed towards the support of the International Program on Ocean Drilling (IPOD) programs and the studies of plate margins and processes related to proposed drilling, or efforts in paleo-oceanography that have resulted directly from initial syntheses of Deep Sea Drilling Program (DSDP) data.

W.W. Nassichuk and E.W. Bamber participated in meetings of the 8th International Congress on Carboniferous Stratigraphy and Geology held in Moscow, September 8-13, 1975. Nassichuk, as Secretary-General of the International Commission on Stratigraphy, addressed the Subcommission on Carboniferous Stratigraphy and the Subcommission on Permian Stratigraphy on matters pertaining to international correlation and particularly the organization of systematic boundary Working Groups. As Vice-Chairman of the Subcommission on Permian Stratigraphy, Nassichuk also participated in symposia dealing with definition and subdivision of the Permian System.

Both scientists also participated in field excursions to examine Carboniferous stratotypes in the Ural Mountains in Bashkiria between the Russian Platform to the west and West Siberia Basin to the east, and the Donetz Basin, which is situated south of the Russian Platform and north of the Ukrainian Shield in the eastern Ukraine. Extensive collections of corals and ammonoids were assembled to facilitate the refinement of Carboniferous correlations between western and northern Canada and the Soviet Union.

GSC Ottawa Christmas Party

Sandy Lowdon has given us some preliminary information about the party. It will be held on Thursday, December 18th from noon to 8 p.m. at the same place as last year, Canadian Forces Golf Club. Tickets will be $5.50 per person, this includes smorgasboard lunch and live entertainment; they may be purchased from Division Admin. Officers.

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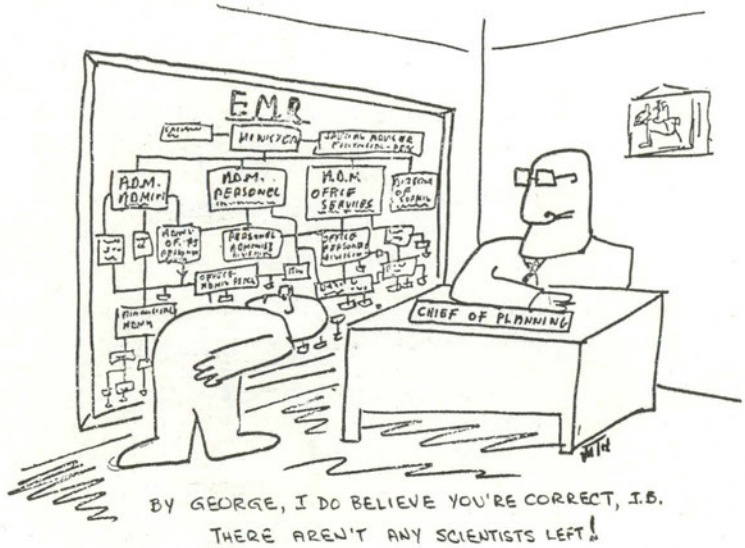

BY GEORGE, I DO BELIEVE YOU'RE CORRECT, I.B.
THERE AREN'T ANY SCIENTISTS LEFT!

Material for the next issue of Geogram should be sent to your Division Office or to Mary LaHam.
Les articles pour la prochaine parution de Geogram devront être dirigés au secretariat de votre Division ou à Mary LaHam.

Editor/ Rédacteur P. Harker

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