



Newsletter for the Canadian Antarctic Research Network

Bulletin pour le réseau canadien de recherches antarctiques

Good-bye, CARP...Hello, CCAR!

*Peter Suedfeld
Chair, CARP*

This is my last column as Chairman of the CARP Executive Committee, as both CARP and the Executive Committee have now been disbanded. I don't think it necessary to review in detail what CARP has accomplished in its five years of existence; I have done that in previous issues. Suffice it to say that we have facilitated the access of Canadians, both as individual researchers and as a nation, to Antarctica; established Canada as a committed and permanent participant in Antarctic scientific affairs; helped Antarctic scientists from other countries gain experience in the Canadian Arctic, thus furthering bipolar research activities; and brought into existence coherent organization and a central depository of information that can help Canadians interested in Antarctic work.

None of this could have been accomplished without the help of dedicated people, who devoted time, energy, and thought to move the program forward. Among these, I am particularly grateful to Warwick Vincent, the Co-Chairman of CARP and Chairman of the newly established CCAR (see articles elsewhere in this issue) and the other members of the Executive Committee; the Canadian Polar Commission, especially Whit Fraser, Gerry Lock (who was the first Canadian representative to SCAR), and the various members of the CPC International Affairs Committee; Olav Loken, who has been a member of the Executive Committee, our liaison with the Commission, and our Environmental Officer; Dennis Stossel, our representative on logistics and operations, as well as our graphic and photographic artist; Albert Haller, the CPC staff member who has been handling Antarctic and CARP affairs; and Fred Roots, a never-failing source of wisdom, inside knowledge, and good advice.

Building on what has already been done, and holding full membership in SCAR with representation on all subsidiary bodies including the Working Groups, Canadian Antarctic and bipolar research should move ahead rapidly. All of us are certainly determined to help it do so.

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Message from the CCAR Chair

July 1998 will mark an important new step in the evolution of Canadian polar science. At the 25th meeting of the Scientific Committee for Antarctic Research (SCAR), to be held in Concepcion, Chile, Canada will formally present its application for full membership in SCAR. In preparation for this event, the Canadian Polar Commission has established a national Antarctic committee, called the Canadian Committee for Antarctic Research (CCAR). It is a privilege for me to chair this committee in its first two-year term, and to work alongside other members of the CCAR team (see p. 8) towards developing a stronger role for Canada in Antarctic research and in high-latitude science in general.

Canada and Antarctica have a natural, longstanding association. Many geographic place names in the Antarctic region bear testimony to Canadian science and exploration earlier this century: for example, the Canada Glacier, Mount Falconer, Roots Heights (Rootshorga), and the Wright Valley. Canada has recently emerged as one of the most commercially active nations in Antarctica (polar tourist expeditions and cruises, aviation, krill fishing, clothing, and cold regions services and technology). Canada's northern communities share a strong and natural affinity for the south polar environment (see the article by the Circumpolar Ambassador on p. 3) and have a particular interest in the question of global environmental change; the Environmental Protocol to the Antarctic Treaty, signed by Canada in 1991 and now in force, places special priority on this aspect of Antarctic research. In applying for full SCAR membership, Canada has much to offer in the international stewardship and understanding of both polar regions (see the article on RADARSAT on p. 4), and also much to gain in terms of new opportunities for the transfer of high-latitude knowledge and expertise.

Our application for SCAR membership is the culmination of effort by many individuals to help put Canada "on the map" in polar science and technology. On behalf of CCAR, I especially thank the Canadian Polar Commission for their active support and encouragement over the last five years; Peter Suedfeld for his many accomplishments as Chair of the Canadian Antarctic Research Program, the precursor to CCAR; and Olav Loken, now Secretary of CCAR, for his excellent, professional input to all phases of this process, most notably his leadership of Canada's SCAR application.

Full SCAR membership has the potential to open the door to a new era of Canadian high-latitude science, and the CCAR team is committed to working closely with other polar research groups in Canada and abroad toward realizing that potential.

*Warwick F. Vincent
Chair, CCAR*

Message du président du CCRA

Juillet 1998 marquera une nouvelle étape importante de l'évolution de la science polaire au Canada. En effet, à la 25^e assemblée du Comité scientifique pour les recherches antarctiques (CSRA) qui se tiendra à Concepción, au Chili, le Canada présentera officiellement sa demande d'adhésion comme membre à part entière du CSRA. Dans cette optique, la Commission canadienne des affaires polaires a créé un comité national de l'Antarctique appelé Comité canadien de recherches Antarctiques (CCRA). Je m'estime privilégié d'avoir été chargé de présider ce comité durant son premier mandat de deux ans et de travailler avec les autres membres de l'équipe du CCRA (voir p. 8) pour raffermir le rôle du Canada dans la recherche antarctique et la science des hautes latitudes en général.

Un lien naturel unit depuis longtemps le Canada et l'Antarctique. Les noms de nombreux lieux géographiques, dans la région de l'Antarctique, rappellent les travaux scientifiques et d'exploration menés par des Canadiens au début du siècle. Exemples: le glacier Canada, Mount Falconer, Roots Heights (Rootshorga), Wright Valley.

Dernièrement, le Canada s'est distingué comme l'un des principaux pays qui exercent une activité commerciale en Antarctique (expéditions touristiques et croisières en milieu polaire, aviation, pêche au krill, vêtement, services et technologie aux régions froides). Les collectivités nordiques du Canada ont une forte affinité naturelle avec l'environnement polaire du sud (voir l'article de l'ambassade aux affaires circumpolaires à la p. 3), et elles s'intéressent vivement à la question du changement environnemental planétaire. Le Protocole au Traité sur l'Antarctique pour la protection de l'environnement signé par le Canada en 1991, qui est maintenant en vigueur, accorde la priorité à (cet aspect) de la recherche antarctique. En demandant à devenir membre à part entière du CSRA, le Canada fait valoir son énorme potentiel pour la gestion internationale et la compréhension des deux régions polaires (voir l'article sur RADARSAT à la p. 4). Cette adhésion peut aussi lui apporter de nombreux avantages en matière de débouchés et de transfert de connaissances et d'une expertise propres aux hautes latitudes.

Notre demande d'adhésion est l'aboutissement des efforts de nombreuses personnes qui ont aidé à bâtir la réputation du Canada en tant que spécialiste en science et technologie polaires. Au nom du CCRA, je tiens à remercier: la Commission canadienne des affaires polaires pour son soutien des cinq dernières années; Peter Suedfeld pour ses multiples réalisations en tant que président du Programme canadien de recherches antarctiques (précurseur du CCRA); et Olav Loken, secrétaire du CCRA, pour son excellente intervention professionnelle à toutes les étapes de ce processus, et surtout pour son leadership dans la demande d'adhésion.

En tant que membre à part entière du CSRA, le Canada pourrait entamer une nouvelle ère de la science des hautes latitudes, et l'équipe du CCRA désire collaborer étroitement avec les autres groupes du Canada et de l'étranger qui se consacrent à la recherche polaire, afin d'exploiter ce potentiel.

*Warwick F. Vincent
Président, CCRA*

Message from the Circumpolar Ambassador

To the Canadian Antarctic Research Network:

It gives me great pleasure to send greetings to everyone involved in the Canadian Antarctic Research Network (CARN), and to acknowledge the establishment of the Canadian Committee for Antarctic Research (CCAR). I am sure that the presence of CCAR, and its activities in representing Canada's scientific interests in Antarctica, together with our expected full membership in the Scientific Committee for Antarctic Research, will be another important step not only in bringing together and strengthening our scientific activities in Antarctica, but also in strengthening and rounding out Canada's role as a polar nation and a full player in world science.

It has often been said, and in fact it is formally stated in the Antarctic Treaty, that Antarctica is "a continent devoted to peace and science". And now, with the Protocol for Environmental Protection in force, peace and science are most strongly assured through vigorous protection of the Antarctic environment and ecosystems. As a non-scientist but a diplomat charged by the Government of Canada with ensuring that Canadian actions uphold the Treaty and preserve the region for peace and science, I am very aware that the effectiveness of Canada's role in Antarctica depends upon the contributions of Canadian science. Thus CARN and CCAR are important, not only for what they can do to promote and co-ordinate the activities of Canadian scientists in Antarctica and facilitate south polar and bi-polar science in Canada, but because they can also make a positive contribution to Canada's international relations, and, if I may say so, to the view that Canadians have of themselves on the world stage.

One of the great strengths of Canada's activities in Antarctica and our not insignificant influence in Antarctic affairs has been that the presence and actions of Canadians in the region have not been due to government policy or political ambitions, but to the enthusiasm, interest, and competence--often based on knowledge and expertise gained in the North--of individual Canadians. This has been true since Canadian naturalist Hugh Evans was a member of the very first overwintering party on the Antarctic continent in 1899-1900. And it is true, no less today, for CARN and CCAR. Indeed, our challenge is to get policy and government support to match our scientific enthusiasm and our conviction that Canadian activities in Antarctica are in the national interest.

It is often said that one of the most distinctive differences between the Antarctic and the Arctic regions is that there are no indigenous peoples in Antarctica, while the Arctic has

been home to a variety of indigenous peoples, with distinctive cultures and civilizations, for more than 10,000 years. It is those who do not have a home in the Arctic who make much of these differences. As an indigenous northerner, an Inuk who as a little girl knew much more about different kinds of seals than about cars, I can feel genuinely that Antarctica, its ecosystems, its polar environment, and its demonstration to the world of international co-operation is a natural part of my personal background and value systems. And I am sincerely convinced that activities in Antarctica are natural and important for Canada as a polar country; they do not detract from but aid our ability to understand and address issues in the Arctic. As Ambassador for Circumpolar Affairs, I am committed personally to helping make both polar regions part of the background and value-systems of all Canadians. I am grateful that the Canadian government has given me the task and the opportunity to promote, internationally, the practices of co-operation, respect for the environment and search for knowledge that have been well developed, and proven, in both the Arctic and the Antarctic. In this task, CARN and CCAR are partners in ensuring that Canada plays a role in helping the polar regions be places of peace and science.

Mary May Simon

Ambassador for Circumpolar Affairs

Some Recent Canadian Contributions to Antarctic and Bipolar Science

(Names of Canadian co-authors are underlined, except where all are Canadian.)

James, T.S. and E. R. Ivins. 1998. "Predictions of Antarctic crustal motions driven by present-day ice sheet evolution and by isostatic memory of the Last Glacial Maximum." *Journ. of Geophys. Research* 103, B3:49935017.

Quesada, A. & Vincent, W.F. 1997. "Strategies of adaptation by Antarctic cyanobacteria to ultraviolet radiation." *Eur. J. Phycol.* 32: 335342.

Tang, E.P.Y., Vincent, W.F., de la Noüe, J., Lessard, P., & Proulx, D. 1998. "Polar cyanobacteria versus green algae for the tertiary treatment of wastewaters in cool climates." *Journal of Applied Phycology* 9: 371381.

Vincent, W.F. 1997. "Polar desert ecosystems in a changing climate: a NorthSouth perspective." In Lyons, W.B., Howard Williams, C. & Hawes, I. (Eds). *Ecosystem Processes in Antarctic Icefree Landscapes*. A.A. Balkema Publishers, Rotterdam, pp. 314.

Early Ice-Motion Results from the RADARSAT Antarctic Mapping Mission (AMM)

Some new results from the RADARSAT Antarctic Mapping Mission (see also CARN Newsletters #4 and #5) have shown that the early excitement over the high-quality imagery generated during this mission was warranted. While the major effort in this NASA/CSA initiative is directed toward high-resolution image maps of the complete Antarctic continent, (see http://polestar.mps.ohiostate.edu/amm_web/begin.html), here in Canada work is being done at the Canada Centre for Remote Sensing (CCRS) on mapping ice motion. This is being done using what is called *interferometric analysis* of pairs of images.

In Antarctica, most of the continent does not experience any surface snow or ice melt. Therefore, there was a possibility that pixel backscatter from the firm and upper ice layers would not change much during the AMM even if there were changes in the surface snow cover. This means that small pixel movements can be estimated as long as the terrain is viewed twice with exactly the same viewing angles. In radar jargon it was hoped that there would be the necessary "coherence" from sequential passes over the same site for interferometric analysis.

Consequently, the decision was taken prior to the AMM to try to acquire some data suitable for tests of interferometry. RADARSAT was manoeuvred to acquire imagery looking toward the South Pole for a total of 30 days during September and early October 1997. As RADARSAT is in a 24-day repeat orbit, there was the opportunity during the last six days to repeat exactly the coverage of the first six days, thereby generating many pairs of images with which this type of interferometric analysis is possible. This was done, and the early results from an examination of five pairs of images supported the contention that useful information can be obtained from this type of analysis. CCRS is now concentrating on developing the methodology for ice-motion extraction, and in applying the technique in two areas in western Antarctica.

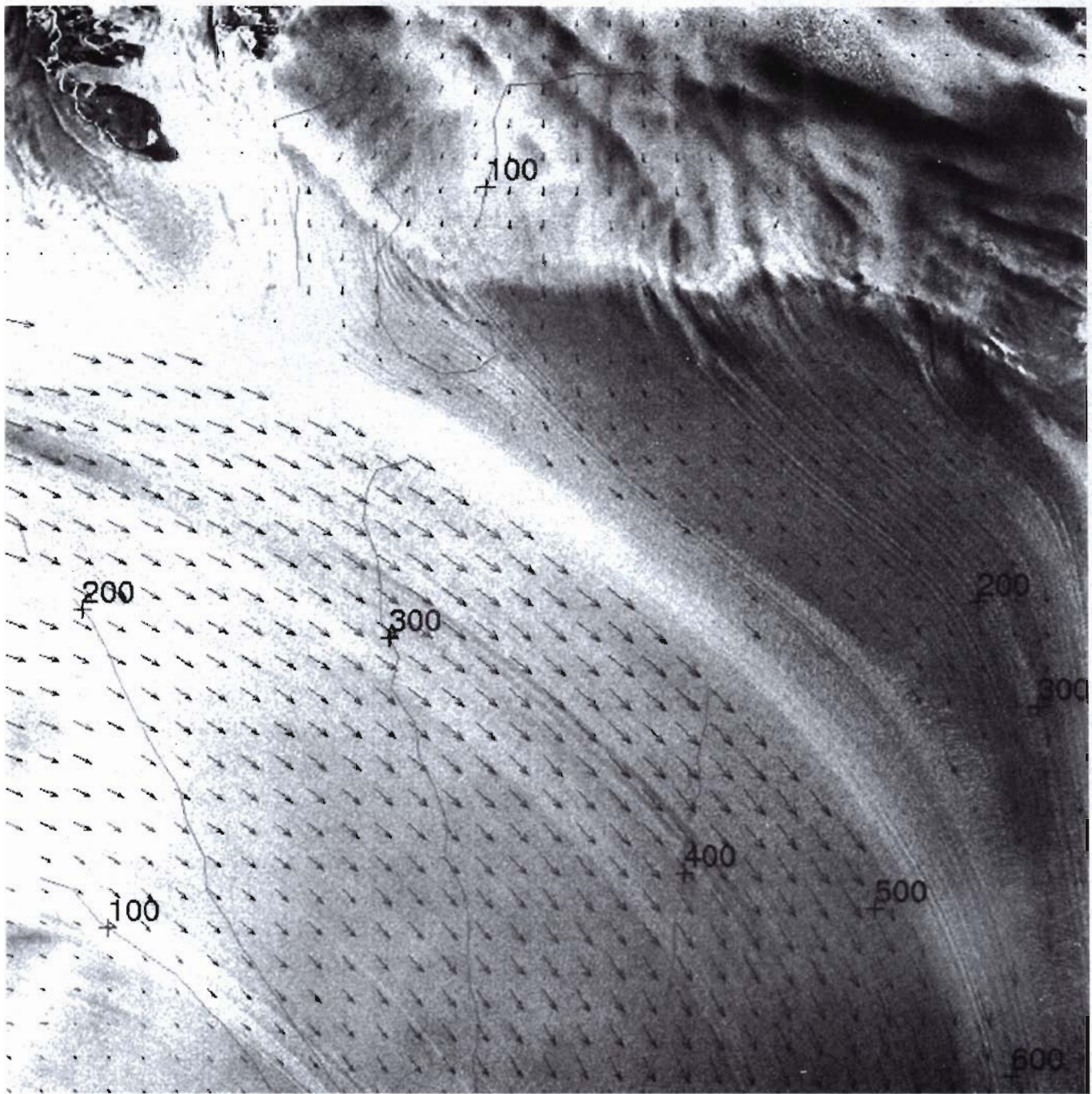
The first area includes two large glaciers, the Recovery and Slessor Glaciers, and the ice stream flowing through the Filchner Ice Shelf originating from the Slessor Glacier. RADARSAT images from September 24 and 24 days later on October 18 were

combined to create the illustration (right) of part of this area. The 100-km by 100-km background image shows radar backscatter while the arrows show ice motion in the Slessor Glacier as it flows into the Filchner Ice Shelf. We believe the grounding line is close to the left edge of the image, and the acceleration in ice motion as it enters the floating ice shelf is apparent. Velocities in the more southerly (upper) part of the glacier change from around 250 m/year as the ice enters the area covered by the image to around 600 m/year as it leaves in the floating ice at the bottom right corner. The feature running across the upper part of the image appears to be the "ice wall" referred to in the Sir Vivian Fuchs book on the TransAntarctic Expedition carried out as part of the International Geophysical Year (IGY). His 1957 journey of scientific endeavour, and danger, crossed through the area covered by this imagery and would certainly have benefited from RADARSAT imagery!

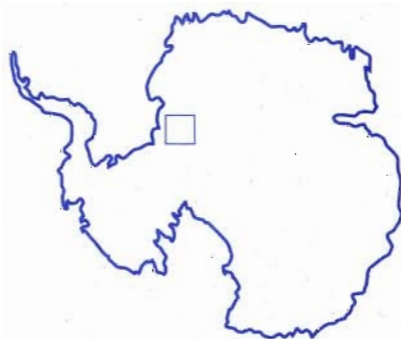
The second area of study is close to Byrd Station in the central Western Antarctic ice shelf. In this work we will co-operate with Dr. Bob Bindshadler of NASA's Goddard Space Flight Center who has used GPS technology to make ice-motion estimates in an area close to the "source" of one of the ice streams eventually feeding into the Ross Ice Shelf. This area will be more challenging; the velocities are much smaller, more variable, and there are fewer zero velocity "reference" areas, like exposed mountains or *nunataks*, which we can use to help calibrate the results. However, we will be able to quantify the accuracy of the results and project how well this technique will work for very large area mapping.

It is hoped that this data-set will make a significant contribution to our knowledge of ice movement in Antarctica, and that similar results can be obtained in a few years when again RADARSAT revisits Antarctica. NASA, with support from NSF and CSA, has issued a Research Opportunity to solicit proposals for scientific investigations in support of the U.S. Antarctic Program. There is the possibility for Canadian researchers to acquire some RADARSAT imagery through this program. (see <http://www.hq.nasa.gov/office/ese/nra98oes03/index.html>)

*Laurence Gray
Head, Satellite Geomapping Section,
Canada Centre for Remote Sensing*



RADARSAT image of Slessor Glacier, 79° 50' S, 28° 30' W, middle left, flowing into Filchner Ice Shelf.
 (Figures show approximate velocities in m/yr.)



approximate location

The Environmental Protocol Now in Force: What Does It Mean?

The Protocol on Environmental Protection to the Antarctic Treaty embodies a new environmental philosophy for the Antarctic. Signed by 31 countries, including Canada, in October 1991, the Protocol is based on the concept that environmental protection should take precedence over scientific, economic, or other human activity in the region. The Protocol states that all activities must:

- avoid or limit adverse environmental impacts;
- allow for prior assessment of environmental consequences;
- incorporate regular and effective environmental monitoring; and
- accord priority to scientific research that will both safeguard the Antarctic and contribute to understanding of the global environment.

Contained in the Protocol's 24 articles and five annexes are a range of provisions covering such areas as the preparation of environmental assessments and information on environmental risks; prohibition of activities related to mineral resources; establishment of procedures for response to environmental emergencies; strict rules for the conservation of flora and fauna; detailed guidelines on waste management; and categories and management procedures for different types of protected areas.

The sixth annex to the Protocol, now being prepared for the next Antarctic Treaty Consultative Meeting (ATCM) in May 1998, will address legal liability and enforcement. Giving teeth to the Protocol presents a twofold challenge. The legal challenge is to achieve wording for a significant new area of international law, where nations commit collectively to assess liability and support acts of enforcement in a region of the world where none has sovereign rights. The second challenge, conceptual and scientific, is to determine a means of assessing the impact of changes caused by human actions in the natural environment in an area where no one lives permanently or owns anything, and where both living and non-living resources have no established market value. It is likely that this pioneering legal exercise will be closely watched because of its possible applicability to legal regimes in other areas without national jurisdiction, such as the sea bed and outer space.

The Protocol may be opened for review, at the request of a Consultative Party, anytime after the year 2048. Since the Protocol was signed, ATCMs have been held annually as opposed to every second year. As well, a Transitional Environmental Working Group, representing all Treaty members, has been established to consider the operational and policy aspects of implementing the Protocol. Through this means, many of the activities in Antarctica have already been conducted in accordance with the Protocol. It is to be hoped that these actions will help the Committee for Environmental Protection, which will be established in 1998 as the main operational tool of the Protocol, to become a more practical and effective instrument.

Canada and the Environmental Protocol

Although Canada has yet to ratify the Protocol, its status as a non-consultative party will not affect its entry into force. As the Protocol is now an integral part of the Antarctic Treaty, Canada as an adherent to the Treaty, is bound by the Protocol. However, without ratification or domestic legislation to ensure that its citizens and institutions act in accordance with the Protocol, Canada may have a difficult time meeting its obligations under the Treaty. Canada has made known its intent to ratify, but progress on this front has been slow for two reasons: lacking a "champion" in Cabinet, the subject has a low profile in the ranking of issues demanding legislative attention, and, despite the absence of obvious policy obstacles, Canada's federal structure tends to complicate the adoption of appropriate legislation; for example:

- regulation of tourism is a provincial responsibility;
- new legislation would be required to prohibit mining or energy exploration;
- under present Canadian law, protection of the marine environment relates to fisheries resources, not protection of the ocean ecosystems;
- regulations governing transboundary movement of wastes is an area of mixed federal-provincial responsibility; and
- federal environmental assessment legislation applies to projects, not general activities.

It is important to note, however, that similar problems have been encountered by other countries, most notably those with a federal legislative structure, and have been dealt with successfully. In the domestic arena, as well as on the international scene, the Environmental Protocol requires a new examination and a clarification of environmental responsibilities and co-operation. Despite these complexities, Canada is now on its way toward ratification.

*E.F. Roots
April 1998*

Arctic-Antarctic Exchange Program

Year one of the Canadian Arctic-Antarctic Exchange Program has proved a success.

The program, which is designed to foster bi-polar scientific exchanges among Canadian Arctic research scientists and their Antarctic counterparts, is a joint initiative of Polar Continental Shelf Project (PCSP) and the Canadian Antarctic Research Program. During the summer of 1997, two Canadian-led field programs involving Antarctic participants were provided logistics support by PCSP to conduct work in the High Arctic.

One was led by **Dr. Donald McEwen**, University of Saskatchewan, who worked with U.S., Japanese, and Australian colleagues on polar atmospheric research programs. The other was led by **Dr. Wayne Pollard**, McGill University, who has since worked with his U.S. partners in Antarctica on programs linking polar desert systems to cold desert systems and potential life on Mars.

"Participation in PCSP's ArcticAntarctic exchange and the opportunity to do field research in the Antarctic...has exposed me to a different set of cold climate environments and processes; by studying these environments, I have gained a better understanding of systems operating in the Arctic," **Dr. Pollard** says of his recent experiences.

Dr. Pollard and his U.S. colleagues will again be receiving support through the exchange program in 1998 to continue their Arctic work at Expedition Fiord. Other 1998 program participants include **Dr. Warwick Vincent**, Université Laval, who will be conducting research on similarities and differences between microbial ecosystems in the two polar regions during the 1999-2000 season in collaboration with a scientist from New Zealand, and **Dr. Marianne Douglas**, University of Toronto, who will be working with two American colleagues on the limnology of perennially ice-covered lakes in the High Arctic, with comparative Antarctic research planned during the austral 1998-99 field season.

Bonni Hrycyk
Director, PCSP

News in Brief

Last November, CARPEX sent a letter to the **Chair, House of Commons Standing Committee on Foreign Affairs and International Trade**, commenting on the Committee's report *Canada and the Circumpolar World: Meeting the Challenges of Cooperation into the Twenty-First Century*. The letter, copied to key departments, pointed out the lack of attention to Antarctic issues and why they ought to have been included. The Government of Canada response to the Standing Committee report was released April 29, 1998. You can find the report on the DFAIT Web site at: www.dfaite-maeci.gc.ca

Each year the **Canadian Centre for Foreign Policy Development (CCFPD)** selects a topic and seeks public input through its "National Forum". The 1998 topic, "Canada's Circumpolar Relations" will be discussed in a series of five meetings to be held at locations across Canada. A discussion paper has been prepared. For details see the CCFPD Web site at: www.cfp-pec.gc.ca

The Canadian company **Adventure Network International** completed its 13th Antarctic season this year. The only private air operator in Antarctica transported a total of 131 passengers to the interior, including two American university groups conducting scientific research. Expeditions consisted of: two Belgians, who completed the longest-ever manhaul journey

across Antarctica; three Australians, who successfully skied from Berkner Island to the South Pole; and an Icelandic team, who skied from Patriot Hills to the South Pole. In early December, the company experienced the first tragedy in its history when three skydivers died when their parachutes failed to open. Chilean authorities are to produce a report on the incident.

Two Antarctic researchers from Australia, **Dr. John Gibson** and **Dr. Kerrie Swadling**, are currently undertaking post-doctoral research at **Université Laval** for a two-year period in the laboratories of **Prof. Warwick Vincent** and **Prof. Reinhard Pienitz**. Dr. Gibson did his doctoral dissertation on the biogeochemical flux of carbon in the coastal Southern Ocean, and Dr. Swadling's research was on the biochemistry and ecology of Antarctic zooplankton. Dr. Gibson was deputy station leader of Australia's Davis Station in 1994. Both scientists have worked on lakes in the Vestfold Hills region in East Antarctica, and are currently working on the Global Change and High Latitude Lakes program at Centre d'études nordiques, with field work in subarctic Quebec and the Northwest Territories.

Dale Andersen recently started a doctoral program at the **Department of Geography, McGill University**, under **Prof. Wayne H. Pollard**. He will investigate the physical and biological aspects of perennial springs near Expedition Fiord, Axel Heiberg Island, N.W.T. The study will focus on the processes of mineralization and fossil formation in sub-freezing temperatures at what are believed to be the northernmost springs in the world. The project will attempt to identify the mechanisms that sustain them despite mean annual ground temperatures of approximately -20°C. As well, the study will seek to elucidate the physical and biological processes that may have occurred 23 billion years ago on Mars when mean annual temperatures were below freezing.

While at the Search for Extra-Terrestrial Intelligence (SETI) Institute, Mr. Andersen conducted field research aimed at understanding life in extreme environments. He has extensive Antarctic experience from nine field seasons in the McMurdo Dry Valleys area, and from the Bunger Hills as part of an U.S./U.S.S.R. expedition organized by the space programs of the two countries. He has also participated in exobiological fieldwork in eastern Siberia and in the Atacama Desert.

The First International Conference on **Mars Polar Science and Exploration** will be held in Houston, Texas, October 1992, 1998. It is sponsored by the **Geological Survey of Canada**, the International Glaciological Society, the Lunar and Planetary Institute, and NASA. **Dr. David Fisher**, a glaciologist with the GSC, is one of three conveners.

Dr. Curtis Suttle, a University of British Columbia oceanographer, is involved in studies of viruses in lakes in the Dry Valleys and Southern Ocean. He will spend six weeks on an NSF-sponsored cruise this fall.



Attendees at the Canadian Committee on Antarctic Research (CCAR) inaugural meeting in Quebec City, from left to right: Bonni Hrycyk, Albert Haller, Wayne Pollard, Kathleen Conlan, Warwick Vincent, Peter Suedfeld, Stephen de Mora, Marc-Adéland Tremblay, Olav Loken, Fred Roots.

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