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NEWSLETTER FOR THE

Canadian Antarctic Research Network

Inside

RADARSAT Reveals Antarctic Ice Dynamics

Laurence Gray, Naomi Short, Ken Jezek and Zhiyuan Zhao

Data collected by the Canadian satellite RADARSAT continues to enhance our knowledge of the Antarctic continent (see CARN newsletter #6 for background information). In particular, satellite radar interferometry, a technique whereby ice motion can be mapped, has turned out to be remarkably successful.

The Canada Centre for Remote Sensing (CCRS) has played an important role in analysing the RADARSAT Antarctic interferometric data sets, primarily because of the early demonstration that two-dimensional ice motion could be estimated using a technique now known as 'speckle tracking'. This technique correlates the radar speckle pattern in small chips in successive radar passes to determine chip displacement, and thereby the speed and the direction of ice movement (Gray *et al.*, 1998). While less accurate than the traditional approach dependent on interferometric phase, it has the advantage of no directional limitations and is successful over areas of very fast ice flow − greater than several hundred metres a year. Such speeds are common in Antarctica, particularly into and through the ice shelves that fringe the continent.

One of the CCRS study areas has been the Filchner Ice Shelf. This ice shelf forms the eastern arm of the Filchner-Ronne Ice Shelf in the Weddell Sea and is fed mainly by ice from East Antarctica, through the Slessor and Recovery Glaciers.

Figure 1 shows the surface velocity of a part of the Recovery Glacier and the Blackwall Ice Stream tributary, derived from speckle tracking. The Recovery Glacier accelerates through a constriction and over a relatively steep drop before entering the Filchner Ice Shelf, just beyond the bottom of the image. The ice speed is represented by the arrows and contours superimposed on the radar imagery. Speeds of 1000 m/a are achieved over the steep drop where the Recovery Glacier flows down into the ice shelf. Once floating, basal friction becomes negligible and the ice continues to gather speed and reaches velocities of over

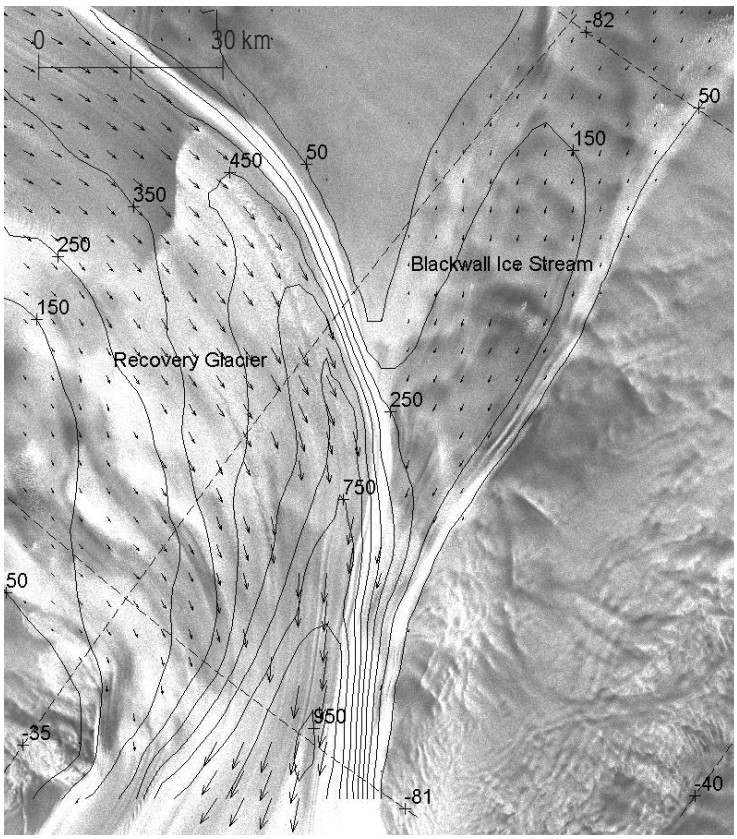

Figure 1
Ice velocity vectors and contours superimposed on a radar subscene from the larger area illustrated in Figure 2. The relatively slow flow of the Blackwall Ice Stream is seen in the upper right as it enters the fast flowing Recovery Glacier.Numbers on glaciers show ice movement in metres per year.

1200 m/a near the ice front. The previously unknown Blackwall Ice Stream can be seen in the upper right of the image. It has upstream speeds of around 100 m/a, increasing gradually to 200 m/a where it enters the Recovery Glacier. The surrounding ice motion is negligible, less than 30 m/a, which is the approximate error of the technique.

Comparisons of interferometric results with a map of balance velocities derived from accumulation rates published by Bamber (2000) show general agreement except in the Bailey Ice Stream area (for location see Figure 2). Here the interferometric velocities are lower than those required for equilibrium, *i.e.* more snow is falling than is being transported away each year. The conclusion is therefore that the Bailey Ice Stream has a positive mass balance and is currently experiencing thickening (Zhao, 2001).

In addition to understanding the patterns of ice flow in Antarctica the volumes of ice being transported are important for discussions of mass balance. Where ice thickness and ice velocities are both known it is possible to estimate ice flux. Using a hydrostatic equilibrium model for the ice shelf (Vaughan *et al.,* 1995), ice shelf thickness was determined and used together with the interferometrically derived velocities to estimate flux close to the inputs and the output of the Filchner Ice Shelf. The Recovery and Slessor Glaciers were found to contribute 81% of the ice volume, the Support Force Glacier and Foundation Ice Stream both contribute 7%, and the remaining 5% comes from surface accumulation. The flux of 73.6 ± 11 km^3/a, downstream of the grounding line, cannot be considered significantly different from the value of 75.3 ± 12 km^3/a close to the ice shelf output (Gray *et al.,* 2001).

Grounding Lines from Radial Interferometry

One of the advantages of interferometry using phase over speckle tracking is that it can be used to detect ice bending at the grounding line when the two data acquisitions occur at different stages of the tidal cycle. The grounding line is the point beyond which a glacier flowing into a water body becomes floating. The position of this line is a function of the ice thickness and the level of the water into which the ice flows. Changes in ice volume and/or changes in sea level will cause the grounding line to migrate and so monitoring its position is a useful technique for monitoring change.

Figure 2 shows the Filchner Ice Shelf area with the grounding line determined from interferometry as a dotted black line. The solid black line is an estimate of the grounding line compiled by Vaughan *et al.* (1995) from a variety of

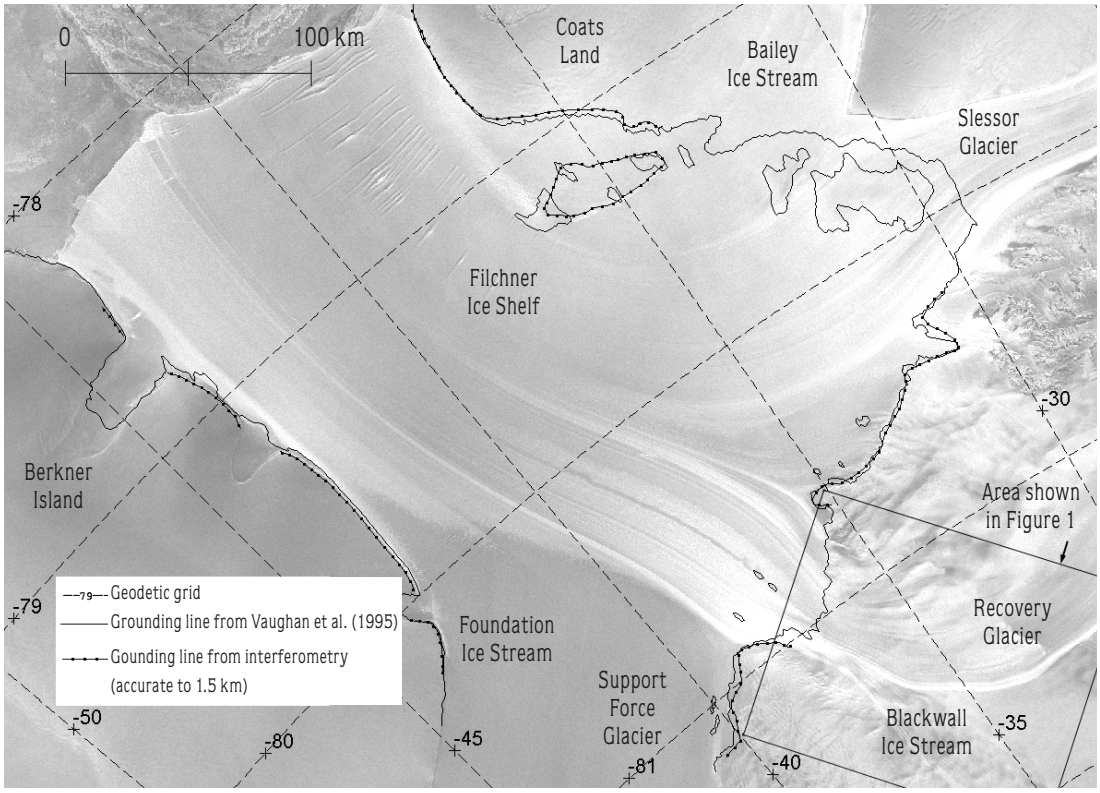

Figure 2
Section from the Antarctic Mosaic showing the Filchner Ice Shelf, its tributaries and grounding lines.

observations. These results differ most in the eastern section of the ice shelf, where the Bailey Ice Stream becomes floating and merges with flow from the Slessor Glacier. A single ice rise is clear from the interferometry results compared with multiple islands from the earlier map.

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Antarctic Permafrost

Kevin Hall

Literature pertaining to Antarctic permafrost and periglacial conditions, both present and past, is widely disseminated through a very wide range of journals and languages. Although permafrost and periglacial research has never had a high profile in national and international Antarctic science programs, there is nevertheless a substantial body of information. The International Permafrost Association Working Group on "Southern Hemisphere Permafrost and Periglacial Environments" seeks to collate and distribute this information. Material synthesised here is part of a larger work encompassing the Southern Hemisphere shortly to be published in the *South African Journal of Science* (Bockheim, J.G. and K.J. Hall [in press]).

Although perhaps only 1% of Antarctica is ice-free, this still constitutes an area of ca. 150,000 km^2. Most of the ice-free areas and an undetermined part of the ice-covered areas are underlain by permafrost. This is a significant area. Three eco-climatic regions are discerned for continental Antarctica upon the basis that active layer thickness and the depth to ice-cemented permafrost are related to regional climate, proximity to glaciers and surface albedo. The three regions are: the Trans-Antarctic Mountains, including the McMurdo Dry Valleys (*ca.* 71°–87°S), Maritime East Antarctica (*ca.* 66°–71°S), and the Antarctic Peninsula with its offshore islands (*ca.* 61°–72°S).

The permafrost occurs in two forms: 'ice cemented' and 'dry'. The bulk is of the ice-cemented form, but the McMurdo Sound region has a substantial portion of dry permafrost. Much of the permafrost in the Antarctic interior is "dry" as it contains less than 5% moisture, a minimum value required to cement the coarse-textured Gelisols. Active layer calculations may have been overestimated as a result of this dry permafrost, but values tend to range between 15–20 cm along the polar plateau, increasing to 30–60 cm closer to the coastal area and up to 150 cm in the relatively mild Antarctic islands. Surface albedo has a significant impact on active layer thickness and can cause local variability. Compared to the Arctic, there is little information on permafrost thickness but, using the mean annual air temperature and a lag rate of 33 m/°C crude estimates can be obtained. These range from between 20 m and 180 m on King George and Seymour Islands through to nearly 1000 m in interior Antarctica; permafrost temperatures appear to range between −13°C and −24°C. Sub-sea permafrost has also been recorded.

There is extensive ground ice in Antarctica, mainly in the form of rock glaciers, ice-wedge polygons, buried glacial ice and ice-cored till. There are also occurrences of thermokarst, particularly in the Bunger Hills region. Pingos are about the only classic permafrost form not yet recorded from Antarctica. Rock glaciers are fairly widespread and some, in the South Shetland Islands, are estimated to have an average speed of 30 cm yr^{-1}. Rock glaciers with both a permafrost origin and a buried glacial ice (an ice-core) origin have been recognized. Protalus ramparts with an ice-cemented interior as well as "ice-cored talus aprons" are both identified. Human effects on permafrost are also documented. Runway construction causing active layer removal has resulted in the warming and melting of ice-cemented permafrost. Although a new active layer was established in only a few days, there nevertheless was surface subsidence. Land disturbance has also resulted in lowering of moisture content in ice-cemented permafrost plus replenishment has not been found to have taken place even in areas disturbed over 30 years ago.

The Antarctic glacial environment may remain fairly immune to small rises in temperature associated with global climatic change, but the exposed permafrost is potentially more sensitive. Active layer thickness is likely to increase

with an increase in seasonal air temperatures; moisture content may also increase. As a result of these active layer changes it can be expected that pedogenic and biotic responses will take place; increases in plant communities may well have a positive feedback to active layer/permafrost changes.

Among the suggestions for future work made by Bockheim and Hall, the following recommendations are pertinent to this brief discussion. These directions of research may be well suited to Canadian expertise:

1. Establish an observational network of active layer monitoring sites.
2. Develop a protocol for measuring active layer thickness.
3. Develop site-specific descriptions of the relation between active layer thickness, albedo and climatic parameters.
4. Investigate the short- and long-term variations in soil and rock temperatures as well as soil/rock moisture.
5. Measure permafrost thickness.

The full text and detailed references for observations, techniques and measurements can be found in Bockheim and Hall.

Reference

Bockheim, J.G., and K.J. Hall (in press): Permafrost, active layer dynamics and periglacial environment of continental Antarctica. *South African Journal of Science.*

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Canadian Arctic-Antarctic Exchange Program (CAAEP)

Bonni Hrycyk

The Canadian Arctic-Antarctic Exchange Program (CAAEP) has been given an infusion of moral and financial support from the Department of Foreign Affairs and International Trade (DFAIT).

DFAIT helped offset the logistics costs to support Antarctic partners working with Canadian colleagues in the High Arctic in 2000, and has provided some help to PCSP for pending costs for the 2001 field season.

"The lessons learned in Antarctica are very applicable to the Arctic", says Philippe Cousineau, Deputy Director of DFAIT's Aboriginal and Circumpolar Affairs Division. "This Program allows Canadians to establish valuable links with their colleagues from around the world, and for Canadians to share their expertise in polar research and consolidate partnerships and collaborations with their Antarctic counterparts."

During the 2000 Arctic field season, Polar Continental Shelf Project (PCSP), with DFAIT's help, supported two projects under the Canadian Arctic-Antarctic Exchange Program. Dr. Hugh French, University of Ottawa, hosted two Italian Antarctic colleagues in the study *Comparison of high latitude permafrost conditions on Ellesmere Island (Canada) and in the Northern Foothills (East Antarctica)*. Dr. French

and his University of Ottawa colleague Dr. Antoni Lewkowicz have already worked in Antarctica under sponsorship of their Italian colleagues. As well, British Antarctic Survey research scientist Dr. Elizabeth Morris continued work in the Canadian Arctic with Natural Resources Canada glaciologist Dr. Roy Koerner on *Bipolar studies of ice-sheet mass balance.*

2001 Field Season

PCSP received four proposals for fieldwork under the CAAEP this year and all were approved by both the Canadian Committee on Antarctic Research (CCAR) and PCSP's Scientific Screening Committee. PCSP and DFAIT are supporting the following projects this year:

- Dr. Wayne Pollard, McGill University is working with US and New Zealand colleagues on *Comparative massive ice, and ground ice landform studies* in the two polar regions. Dr. Pollard and his Antarctic colleagues have already benefitted, through this program, from one round of exchanges involving Antarctic researchers' work in the Arctic and Dr. Pollard's follow-up work (and that of one of his graduate students) in Antarctica.
- Follow-up collaboration between the British Antarctic Survey (Dr. E. Morris) and Natural Resources Canada on *Ice core studies in the two polar regions with a view to determining past climates.* This year's work will take place on the Agassiz Ice Cap, Ellesmere Island, and continue in the Antarctic in 2003 when Canadian scientists will participate in a British ice-coring project in Antarctica.
- Dr. Warwick Vincent, Université Laval (another past beneficiary of an exchange under this program with New Zealand colleagues) is working with Dr. Antonio Quesada, Univesidad Autonoma de Madrid, on *Microbial community structure and responses to UV radiation.* This summer the team will work on Ward Hunt Island (north of Ellesmere Island) with follow-up work in Antarctica planned for the next few Antarctic field seasons.
- Dr. Paul Hebert, University of Guelph, is collaborating with Dr. Ian Hogg, University of Waikato, New Zealand, on *Comparative polar marine invertebrate studies in the Arctic and Southern oceans.* Dr. Hebert has just completed work with Dr. Hogg at New Zealand's Scott Polar Base in Antarctica and hopes to host Dr. Hogg in the Arctic this summer.

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Canadian High School Students in Antarctica

"Students on Ice" is an Ottawa-based company organizing student-learning expeditions to Antarctica and the Arctic. In December 2000, founder and expedition leader Geoff Green led 95 high-school students, teachers and top polar scientists from across Canada on a two-week educational journey to Antarctica. A similar expedition will sail to the Arctic this summer. Fourteen-year-old Ashley Steuck from Leader, Saskatchewan relates her Antarctic experiences:

Antarctica is pristine, in the truest sense of the word. From December 27, 2000 – January 8, 2001, I and 43 other students from across Canada and 50 recognized scientists and expedition staff, went on a trip that we will all remember and cherish for the rest of our lives. After experiencing the seasickness that came with our crossing of the Drake Passage, we passed the Antarctic convergence. Soon, we were busy with landings each day along with lectures. During our outings, penguins of all types, seals, icebergs and glaciers often welcomed us. Luckily, we also met up with some humans at a few of the Antarctic research stations. The hands-on experience truly proved that Antarctica is the greatest classroom on Earth. While inside the ship, we were most likely to be found in our lecture hall a.k.a. "The Ritz". The scientists created a wonderful learning atmosphere in which we could learn, ask questions and be taught in a manner so unlike a classroom. I learned a very valuable

CANADIAN YOUTH STATEMENT ON ANTARCTICA

January 2001

General Statement

Antarctica is the most pristine continent, largely unaltered by human activity. The contrast of this region's environment to the rest of the world should encourage us to learn from our past mistakes. Surrounded by the Southern Ocean, it is a powerful, sensitive ecosystem playing a critical role in maintaining the stability of our planet's climate. Antarctica holds 70% of the earth's fresh-water supply, and is the summer home to one of the greatest concentrations of wildlife on the planet. Ice, hundreds of thousands of years old, has provided an important archive of many aspects of our planet's history. Research that has helped humanity understand climate change and ozone depletion illustrates the crucial importance of supporting science in this region. Cooperation and good will amongst countries working here is an example for how the world should collaborate in other international affairs. This approach must be strengthened.

Young Canadians with an Important Perspective

As the first youth expedition to Antarctica, we feel fortunate to have visited and experienced this special part of our planet. We are passionate, young ambassadors who came without a specific scientific or political objective. Visiting Antarctica has impacted us emotionally, artistically and intellectually. As future leaders with a new global perspective, we now feel a responsibility to express our insights, feelings and concerns about this continent. We hope our interest, motivation and open minds may provide others with new perspectives.

General Steps to Protect Antarctica

All countries must work together to uphold and strengthen the Antarctic Treaty System. Countries must accept full responsibility for any adverse environmental impact and a strong means of enforcing existing treaties must be established, such as establishing an international body with real judicial power. Specific attention must be paid to ensure that scientific work, tourism, fishing, whaling and other

amount of new knowledge that I constantly try to put in use. We also developed "Youth Statement for Antarctica" as a group and it will hopefully be presented at the Antarctic Treaty meeting in St. Petersburg, Russia later this year. A few of us have also started another project: "Initiative to Ratify the Antarctic Treaty Protocol in Canada".

In closing, Antarctica is a phenomenal place. It deserves to be respected, appreciated and conserved. I hope to continue my studies and someday research and work in this pure continent. Everything I saw opened my eyes to things I would have never learned from a book. I will continue to keep in contact with many people from this expedition. It has truly changed my whole perception of the world. This place has taught me an abundance of knowledge and each day it affects the world and our lives. I won't forget this experience and I genuinely hope that more people receive the experience that is Antarctica.

For further information contact: Students On Ice, 1125 Bank St., Ottawa, ON K1S 3X4, Web site: www.studentsonice.com, tel.: (613) 236-9716.

human activities do not compromise the integrity of Antarctica and the Southern Ocean. Strong efforts are needed to educate both the general public and the private sector about current threats to the environment, including climate change, over fishing, and ozone depletion. These efforts should also identify solutions.

Education and Student Related Initiatives

In order to strengthen the environmental integrity of both polar regions, higher public awareness is essential. These efforts are particularly important for youth so that they understand early in life the consequences of damaging these regions. These initiatives can be carried out in a number of ways:

- Make it a priority to put multi-disciplinary polar curriculum in elementary and secondary schools.
- Support experiential programs like educational tours and co-op programs that provide real hands-on opportunities to learn.
- Deliver educational programs through the internet, TV, books and movies.
- Scientists and interested students should seek opportunities to give presentations in schools and the broader community.
- Support opportunities for students to participate in the activities of the CCAR, CPC and other Canadian polar committees.
- Youth should be actively involved in helping develop polar education initiatives, through direct participation in committees and other programs.

Canada's Role in Antarctica

Canadians have a long history of involvement in Antarctica through exploration, scientific research and commercial activity. Canada is an important polar nation and involvement in Antarctica can improve our understanding of our Arctic region. Canada should, therefore, strengthen its role in protecting and supporting activities in Antarctica. There are a number of actions Canada could take:

- Investigate the establishment of a Canadian research base that encourages strong international cooperation and minimizes environmental impact.
- Become a full member of the Antarctic Treaty.
- Take stronger leadership in protecting the ozone layer and preventing climate change, such as supporting alternative energy and other appropriate technologies, or using the tax system to encourage ethically and environmentally sound business.
- Set an example to all countries by implementing and enforcing all parts of the Antarctica Treaty System.
- Ratify the Antarctic Treaty System's Environmental Protocol.

Reports on SCAR Working Groups Meetings, Tokyo, July 2000

Working Group on Biology

Kathleen E. Conlan

About 30 scientists representing 19 member countries participated in the meeting to exchange information about recent developments within national programs, discuss issues of common concern, plan new research programs and provide advice on biological aspects of Antarctic activities. The Working Group made 15 recommendations on a wide range of issues to SCAR. Here are some highlights:

1. *SCAR restructuring* – The Working Group endorsed the spirit of the recommendations in the report of the ad hoc committee on SCAR Organization and Strategy and urged SCAR Delegates to actively involve the Working Groups in implementing changes.
2. *Subglacial Lakes* – The Working Group reviewed the report of the Cambridge workshop on Subglacial Lake Exploration. Several biological concerns arose, including prevention of contamination and sampling and laboratory methods for analysing samples. The WG urged strong biological input into planning of future activities, and supported the report recommendation.
3. *Diseases of Antarctic Wildlife* – The WG reviewed a report on human introduction of diseases to Antarctic wildlife. The direct link between human activities and wildlife diseases is not firmly established; it should be further investigated before changing Antarctic operating procedures.
4. *Antarctic fishing* – The Commission on Conservation of Antarctic Marine Living Resources (CCAMLR) is deeply concerned about the unregulated, unreported and illegal fishing, especially of Patagonian Toothfish. Krill harvesting is rising again, with considerable bycatch of marine birds.
5. *Ecology of the Antarctic Sea Ice Zone (EASIZ)* – This ongoing program will be completed in 2004. Results of the early phase of the program will appear shortly in *Polar Biology.* A final symposium on the program is planned. The German research ship Polarstern will conduct two Weddell Sea cruises in 2002, one to focus on the deep sea and the other on coastal regions.
6. *New Research Programs:*

- Evolution in the Antarctic (EVOLANTA) – The WG recommended this program, initiated at a 1999 workshop in Brazil, for approval by SCAR. The program focuses on past and present evolutionary processes in Antarctica.
- Regional Sensitivity to Climate Change in Antarctic Terrestrial Ecosystems (RISCC) – The aim is to understand the interactions between biodiversity, functioning and climate of Antarctic terrestrial and limnetic ecosystems, and to predict regional sensitivity to the impacts of climate change. If approved in 2000, the program will run until 2011.
- Victoria Land Transect – A study of the terrestrial and marine biocomplexity along the latitudinal environmental gradient of the Victoria Land Coastal Biome (from −72°S to −78°S in the western Ross Sea) as a global climate barometer. This is a US-NZ-Italian project, expected to begin in 2002 if funded.

7. *Over-winter research opportunities at McMurdo Station* – USAP is developing plans for winter access for researchers, primarily to the Dry Valleys LTER, but also enabling other science programs shorter over-winter stays than the current six months. The proposal is for regular access October to February, extended helicopter support in March, and two ship arrivals during the winter (March and August) period. This additional support would facilitate studies of overwintering strategies in Antarctic biota.
8. *Cooperation* – The Chilean representative expressed interest in expanding cooperation between Canada and Chile in polar science.
9. *SCAR VII Symposium on Antarctic Biology* – This biannual symposium will be held in Amsterdam from August 27 to September 1, 2001.

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Working Group on Geology

Wayne Pollard

The SCAR Working Group on Geology (WGG) chaired by Rudolph Trouw (Brazil) met at SCAR XXVI in Tokyo between July 10 and 14, 2000. Representatives from 17 member nations attended.

- Each country gave short national reports on previous and future work in Antarctica. A pattern of cutbacks, reduced funding, and increased international cooperation emerged from nearly all countries. This is a good time for Canadians who wish to get involved in Antarctic research to seek out foreign partners – but probably on a cost recovery basis.
- In discussing the report by the Ad Hoc Group on SCAR Organization and Strategy the WGG agreed with the intent to revise the organization of SCAR, but expressed concerns about the formation of Delegate-level committees and the proposed replacement of the current system of Working Groups.
- Reports of Groups of Specialists (GOS) and other groups included discussions about (a) the formation of a new GOS on Antarctic Subglacial Lakes, (b) plans for an informal group to bring together geologists, biologists, glaciologists and oceanographers to study ecosystems and environments across the latitudinal gradient of the Victoria Land Coastal Biome, (c) activities of ANTIME (Antarctic Ice Margin Evolution) which considers changes in Antarctic environmental history over the last 200,000 years, and (d) an initiative for research on the tectonic evolution of Antarctic Continental Blocks (Age, Growth and Evolution of Antarctica [AGEANT]) with its main focus on the Precambrian basement.

- WGG supported closer links with the International Permafrost Association's WG on Southern Hemisphere Permafrost and its proposed network of active layer monitoring sites.
- R. Powell (USA) drew members' attention to US concerns that private expeditions are collecting Antarctic meteorites to for subsequent sale in a lucrative market, as this would put the integrity of future meteorite collections for scientific research at risk. Provisions in the Environmental Protocol seek to prevent this from happening.
- H. Miller outlined the preparations for the 9th International Symposium on Antarctic Earth Sciences in Potsdam, Germany in 2003 and distributed copies of the first circular.

Finally, the Working Groups on Geology and Solid-Earth Geophysics combined to recommend the formation of a new, single Working Group on Geosciences, with a subcommittee structure designed to ensure representation of the wide range of expertise needed to deal with the full range of scientific problems in geosciences. The Working Group would consist of one representative of each SCAR nation and an alternative.

For further details contact: Prof. Wayne Pollard, McGill University, e-mail: pollard@felix.geog.mcgill.ca, tel.: (514) 398-4454.

Glaciology

Representatives from the 13 SCAR countries attending the Working Group on Glaciology presented national reports. Dr. Roy M. Koerner prepared Canada's report. Reports were then heard from a number of international programs and initiatives:

- Subglacial lakes in Antarctica
- ISMASS – mass balance studies of the Antarctic ice sheet
- PICE – coordinates deep ice core drilling in Antarctica and Greenland
- ITASE – ice-core paleoclimatic research
- ASPeCt – sea-ice program within SCAR-GLOCHANT
- BEDMAP – collates existing measures of Antarctic ice sheet thickness
- VELMAP – an analogue to BEDMAP, plans to collate all existing ice sheet velocity measurements to produce a map of ice flow
- RADARSAT – Antarctic mapping program generating new data on ice sheet
- GLASS – studying glaciology of South Shetland Islands
- WAIS – West Antarctic Ice Sheet program
- EPICA – European Project for Ice Coring in Antarctica
- FRISP – the Fundamental Research in Ice Shelf Processes (formerly Filchner-Ronne Ice Shelf Program)

The Working Group noted the wide range of scientific activity in glaciology, making particular reference to projects they felt deserved support. These were drafted as Recommendations to SCAR. The projects included:

- the development of the VELMAP program;
- the development of an implementation plan for the ISMASS program.

The WG also recommended that SCAR support the following meetings:

- the Seventh International Symposium on Antarctic Glaciology, which Italy proposed to host in 2003;

- a meeting on sea ice;
- a Paleoenvironments from Ice Cores program (PICE) workshop on the comparison of Antarctic ice core records for the last deglaciation, to be held in Denver, Colorado, in 2001.

The Working Group on Glaciology together with the Working Group on Physics and Chemistry of the Atmosphere hosted a one-day scientific workshop on "Antarctic Precipitation and Mass Balance". The Glaciology Working Group welcomed the inclusion of joint scientific workshops at SCAR meetings as it encourages the participation of a wider audience of scientists.

The WG reviewed the proposals in "Preparing SCAR for 21st century science in Antarctica" by the Ad Hoc group on SCAR Organization and Strategy. The WG formulated a Recommendation welcoming the review of SCAR structures, as well as suggesting amendments.

The SCAR Glaciology WG also recommends:

- The SCAR Executive consider establishing a new discipline-based Operating Group for coordinating studies in the physical and chemical Oceanography of the Southern Ocean.
- That SCAR provide funds to encourage younger scientists to participate in Antarctic research and in SCAR scientific operating groups.
- That the SCAR Executive consider holding an open cross-discipline scientific symposium every two years, aimed at defining major problems.

For further details contact: Steven Bigras, Executive Director, Canadian Polar Commission, e-mail: bigrass@polarcom.gc.ca, tel.: (613) 943-8606.

Working Group on Human Biology and Medicine

Peter Suedfeld

The SCAR Working Group on Human Biology and Medicine (WG HB&M) met in Tokyo in July 2000. Fourteen national Antarctic programs were represented. Three nations were represented by scientists who were born in Canada and/or are Canadian citizens: besides Canada, these were the United States (Lawrence A. Palinkas) and New Zealand (G. Daniel Steel).

The meeting discussed at length the report on restructuring of SCAR and its activities.

Some of the suggested changes were considered beneficial. Others would have the effect of (a) centralizing decision-making in two groups many of whose members are not scientists; (b) diverting funds and personnel from scientific activities to administration; and (c) disrupting the established and effective functioning of SCAR subsidiary groups.

The WG HB&M combines basic research with crucial contributions to the administration of national programs and COMNAP. Members are involved in personnel selection and training, and in the provision of medical and psychological countermeasures and treatments as needed on the ice. Thus, even if some subsidiary groups become unnecessary in the future, WG HB&M likely will continue with few changes.

Each national representative reported on developments since the last meeting. Telemedicine attracted considerable attention. The methodology is proliferating in Antarctic stations; the Italian Antarctic program is particularly active in this regard. The construction of the Concordia station (at Dome C), a joint French-Italian project and the first Antarctic station to be planned and built as an international enterprise, is of great interest. Applications from scientists of other countries to use the station for psychosocial

research and for studies in other disciplines will be considered. In private conversation it was clear that Canadian scientists would be very welcome. After the meeting, a Concordia Subcommittee was formed with members from Italy, France, Australia, and Canada.

A series of reports was presented on international research programs. A French-led project to develop a standard list of required medical equipment and supplies to be kept at stations is almost complete; the compilation of a handbook of subdromal "disturbances of adaptation" commonly found in Antarctica is almost finished; and data collection for a project on personnel selection, conducted by scientists from Norway, USA, Canada and the UK continue. The data collection phase and most of the data analysis for the Polar Psychology Project are complete. Major recent publications in Antarctic psychology and medicine include a special issue of the journal *Environment and Behavior* on international psychological research in Antarctica (edited by Peter Suedfeld, with Karine Weiss of France as co-editor).

New and planned research projects of interest include a study of cultural differences in adaptation to polar conditions (conducted in the stations of the US, Australia, Argentina, and China, under the leadership of L. Palinkas, USA): and a study of the families left behind by Antarctic crewmembers (G. Steel, NZ).

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Some Recent Canadian Contributions to Antarctic and Bipolar Science

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News in Brief

In mid-March of this year, the Canadian Polar Commission and CCAR arranged a **workshop on Subglacial Lakes and Deep Ice Exploration** in Ottawa. Fourteen Canadians active or interested in related research met with three leading experts on Lake Vostok exploration from outside Canada to explore shared interests and potential for future cooperation. The presentations and discussions were extremely stimulating and topics ranged from viruses to ice sheet dynamics, to biogeochemistry, to global change. It was clear that Canadian talent could contribute significantly to a future Antarctic Subglacial Lakes Deep Ice Exploration initiative. Before launching such an initiative in Antarctica, many technological and scientific challenges have to be overcome. **The Canadian Arctic and the Yukon offer a wide variety of analogous glacial environments for testing.** It was decided to form a Canadian group to facilitate exchange of information and ideas among Canadian scientists interested in exploring Deep Ice phenomena. The group will also facilitate contact with the international science community. For further information contact Prof. W. Pollard, e-mail: Pollard@felix.geog.McGill.ca or Prof. W. Vincent, e-mail: Warwick.Vincent@bio.ulaval.ca.

The workshop was generously supported by the Canadian Polar Commission and by a grant from the Going Global S&T Program of the Department of Foreign Affairs and International Trade. A report of the workshop will be published this summer. Copies can be obtained from the CPC/CCAR.

Cybercartographic Atlas of Antarctica Planned – Cybercartography is a new term for multimedia interactive web-based cartography. The term was introduced in 1997 and has been applied to a number of new products including the Atlas of Water and Sustainable Development in Latin America (www.atlaslationamerica.org). **Dr. Fraser Taylor, Director of the Geomatics and Cartographic Research Centre, Carleton University** and Canada's representative on the SCAR Working Group on Geodesy and Geographic Information, leads an effort to produce a similar atlas for Antarctica. In The Hague in September 2000 the project was noted by the Committee for Environmental Protection, which reported to the Antarctic Treaty Consultative Meeting that the Atlas "... could supplement and be of assistance to the various information and database presently used and assist CEP in its work".

The project has been further discussed with Dr. Mullins of the United States Geological Survey which currently has an on-line Atlas of Antarctic Research. Plans for the ongoing development of the Cybercartographic Atlas of Antarctica will be further developed at the Working Group meeting in Siena in July and a meeting to discuss the Atlas is planned for Puerto Madryn, Argentina in November 2001. For details contact: Prof. D.R.F. Taylor, e-mail: ftaylor@ccs.carleton.ca, tel.: 613-520-3979.

Dr. Franz Tessensohn, senior geologist in the German Federal Geological Survey visited Ottawa in May and met with Steve Bigras, Executive Director, CPC, and with several CCAR members for informal discussions about possible **use of the German Gondwana Station by Canadian scientists.** The summer-only station on the coast of North Victoria Land, Antarctica is currently surplus to German needs. Under the German-Canadian Agreement on Cooperation in Science and Technology, it could be made available for Canadians wanting to use it as a base for scientific studies. For further details contact the CCAR Secretariat.

Prof. Peter Suedfeld, University of British Columbia participated in an international meeting in Rome to discuss possible research projects within the fields of human biology, medicine and social behaviour at **the new French-Italian Concordia station** in Antarctica. The first Antarctic station to be built as a multinational facility is currently under construction. Located about 950 km from the French Dumont d'Urville station at an altitude of more than 3000 m, it is expected to be ready by February 2003. **Dr. Suedfeld** was invited to join one of the research teams.

In a diplomatic note to the Canadian mission in Lima, the **Peruvian government** has expressed interest in developing cooperation between the two countries in polar research. The proposal, now being reviewed by the Department of Foreign Affairs and International Trade (DFAIT), suggests inter alia, joint research activities, exchange of personnel and participation in Antarctic and Arctic field programs, as well as bilateral technical cooperation including support for their Antarctic program. Anyone interested in participating in such cooperation should contact the Secretary, CCAR.

The International Polynya Symposium 2001 will be held in **Quebec City, September 9–13, 2001.** The objective is to improve our understanding of the role of Arctic and Antarctic polynyas in both local and global circulation patterns. See their web site for further information: www.fsg.ulaval.ca.ciroq/now/IPS2001.

Message from the Executive Director of the CPC

Steven C. Bigras

It has been an eventful and productive year for CCAR. A large Canadian contingent attended the July 26th SCAR/COMNAP meeting in Tokyo and participated in most of the SCAR Working Groups. CCAR submitted *Current Canadian Research Activities in the Antarctic, 1999–2000* to the SCAR membership, and presented a proposal to develop a Cyber-atlas of Antarctica to the Working Group on Geodesy and Geographical Information. A modified version of the proposal appeared as Information Paper #24 at the Special ATCM in The Hague in September.

CCAR members contributed to the development of the Educational Component for the Students on Ice Expedition to Antarctica, and six members and advisors participated as instructors in December and January. CCAR held an international workshop in Ottawa in March 2001 to review Canadian expertise on subglacial lakes and deep ice exploration. These are just a few of CCAR's accomplishment over the fiscal year 2000–2001.

On behalf of the Commission I would like to extend a special thanks to all the members of the CCAR for their commitment and hard work in dealing with Antarctic issues. Sincere thanks to Dr. Eddy Carmack, Research Scientist, Fisheries and Oceans Canada, Dr. Kathleen Conlan, Research Scientist, Canadian Museum of Nature, Prof. Wayne Pollard, Department of Geography, McGill University, and Prof. Peter Suedfeld, Department of Psychology, University of British Columbia. Special thanks also to the CCAR's special adviser, Dr. Fred Roots, Science Adviser Emeritus, Environment Canada for his support and guidance. I would also like to acknowledge and thank the Chairman of CCAR, Prof. Warwick Vincent, Department of Biology, Laval University, for his commitment and leadership, as well as the Secretary of CCAR, Dr. Olav H. Loken, Consultant, Ottawa, Ontario for his dedication and hard work.

After three years Prof. Warwick Vincent has decided to retire as Chair of CCAR to concentrate on his Arctic research projects. Dr. Vincent assumed chairmanship of CCAR at its creation in 1998, after he and Prof. Peter Suedfeld had co-chaired the Canadian Antarctic Research Program (which preceded CCAR) since 1994. His substantial contributions include starting the CARN Newsletter (1994), and facilitating exchanges of Canadian scientists and politicians to Antarctica. CCAR benefitted greatly from his enthusiasm, commitment, and effective leadership. On behalf of the CPC Board of Directors and the staff I would like to wish him all the best in his bipolar research endeavours, and to thank him for all the time and effort he has devoted to Antarctic and CCAR matters. Canada and CPC are fortunate in having had a scientist of his calibre and international recognition as the first chair of CCAR.

For the next three-year period, Prof. Wayne Pollard has agreed to assume the Chairmanship of CCAR. Returning, as committee members are, Dr. Kathleen Conlan, Dr. Eddy Carmack, Prof. Peter Suedfeld, and Dr. Olav H. Loken who will also remain as Secretary. Dr. Fred Roots will also remain as a special adviser.

We would also like to welcome Dr. Erik D. Blake Icefield Instruments Inc., Yukon as a new member of CCAR, and Prof. Kevin Hall, University of Northern British Columbia as a special adviser.

The Canadian Polar Commission looks forward to working with CCAR in the advancement of scientific knowledge and in the facilitation of Antarctic and bi-polar research.

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CARN Newsletter

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