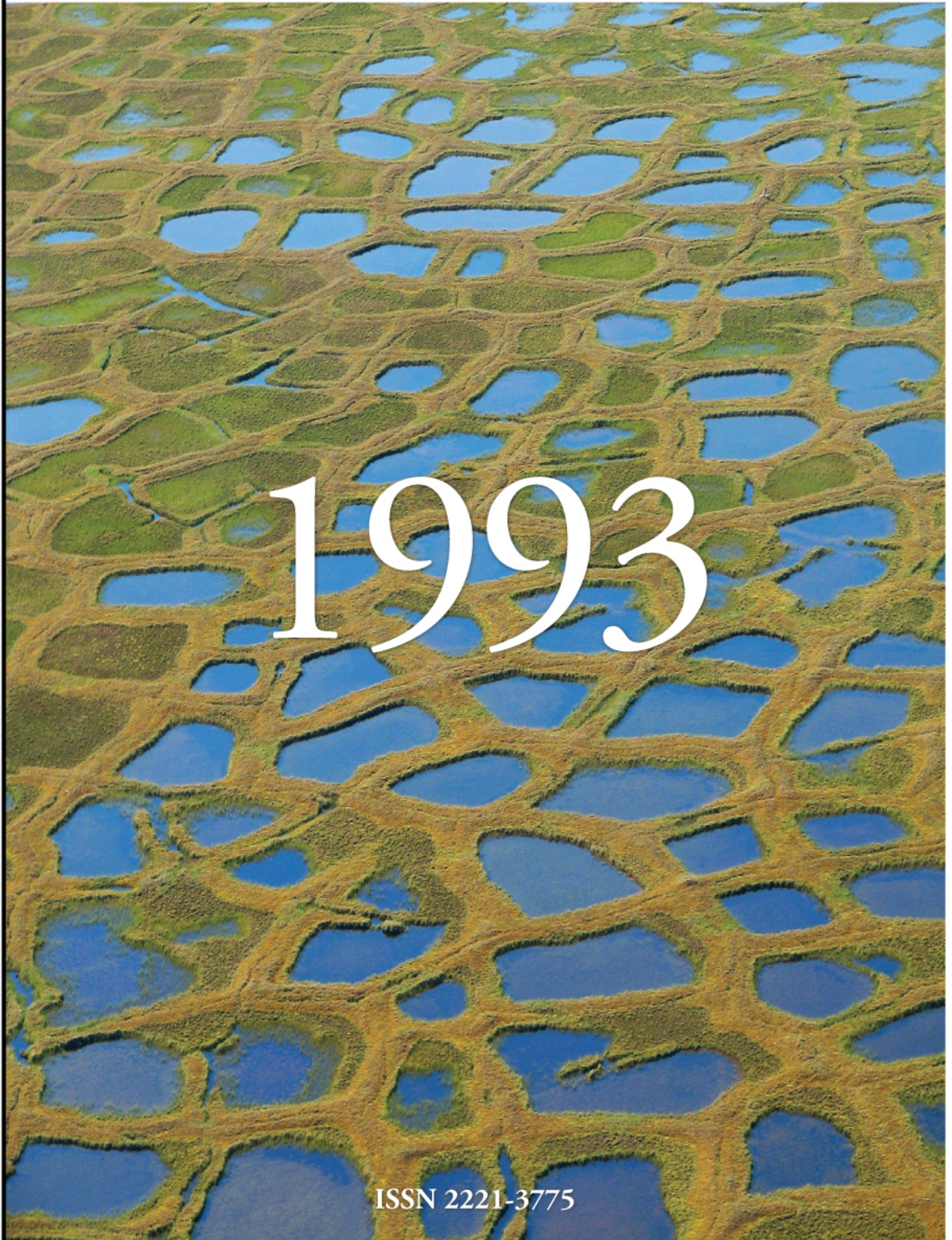


COUNTRY REPORTS



Reports from the Adhering Bodies of the International Permafrost Association



1993

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1 Canada

Report from June 1993

Permafrost Geoscience in Canadian Universities

The state of permafrost research in Canadian universities is intimately linked to industrial interest in northern regions. There was substantial activity from the late 1960s to the early 1980s, but now there are relatively few continuing programs. In part this stems from declining support for university research. For example, in January 1993 the Geological Survey eliminated its University Research Agreements program, which sponsored a small but significant portion of the field effort in permafrost, and substantially reduced, after a decade, its proportion of the support for Canada-France pipeline-ground freezing experiments at Caen, Normandy. The age structure of the professorate is also a factor, with some senior colleagues participating less in fieldwork. Projected budgets suggest that automatic replacement of retiring faculty is unlikely in the mid-1990s.

Nevertheless, we have the example of Professor J. Ross Mackay (UBC), who remains our most productive scientist, and has spent more time in the field since his "retirement" (1980) than many will in their entire lives. The award of the 1991 Logan Medal signifies the substance and leadership of his research. His most recent work on thermal contraction cracking provides a remarkable synthesis of detailed field observations and the theory of crack propagation in solids.

The largest group of scientists are at the Ottawa-Carleton Centre for Geoscience Studies. The Carleton contingent is based upon the long-term interests of Peter Williams and Michael Smith in the geotechnical properties of freezing ground. M.W. Smith and Dan Riseborough have maintained interests in the modeling of permafrost temperatures, resulting recently in the development of a stochastic approach to simulation of the effects of climatic change on permafrost. Chris Burn came to the Geography Department from UBC in July 1992, and continues diverse studies of near-surface permafrost in Yukon and the Mackenzie Delta. Fred Michel has been Chair of the Earth Sciences Department at Carleton since 1990, maintaining his interests in the geochemistry of ground ice. At the University of Ottawa, Marie-Anne Geurts, Bernard Lauriol. Peter Johnson and Claude Duguay of the Geography Department represent strong interest in the geomorphology and Quaternary

of Yukon Territory. Duguay, a recent appointment, has interests in permafrost mapping using satellite data. Hugh French is now Dean of Science; Julian Murton, his most recent Ph.D. candidate (January 1993), presented ideas on the origin of sedimentary structures in thawing terrain of the western Arctic coastlands.

The two other principal groups in Canadian universities are at McMaster and Laval. Ming-ko Woo and Wayne Rouse (McMaster) continue long-term investigations of the hydrology and energy balance of permafrost terrain. Modeling of active-layer hydrology by Zhaojun Xia and Ming-ko Woo, integrated with field studies in the High Arctic, is one of the most stimulating recent contributions from Canadian permafrost science. W.R. Rouse and Richard Bello's (York) work in the Hudson Bay Lowlands led to recognition of the importance of mesoscale climate influences on permafrost conditions. At Université Laval, Quebec, Michel Allard, Serge Payette, Louise Filion and others at the Centre d'études nordiques conduct geomorphological, ecological and geophysical investigations in northern Quebec. The group has an extensive program on the east coast of Hudson Bay and in Ungava, areas that are relatively poorly known but which present a fascinating, dynamic Holocene thermal history associated with coastal emergence and fluctuations in treeline. Collaborative research on impacts to permafrost of recently constructed airstrips, with Laurel Goodrich (National Research Council) and Jean Pilon (Geological Survey of Canada), is an example of the numerous links this group shares with other geoscientists and engineers. An important monitoring service is provided by the network of 11 automatic weather stations in northern Quebec, which also gather ground temperature data.

A long record of permafrost temperatures and extensive data on local variation are available in the Schefferville area, where the Schefferville Digital Transect is coordinated by Hardy Granberg (Université de Sherbrooke). Extensive microclimate-ground temperature studies are conducted at the site, one of those selected for the CRYSYS satellite monitoring program. This program also aims to monitor changes in permafrost conditions on the Fosheim Peninsula, Ellesmere Island, the focus of hydrologic (Ming-ko Woo and Kathy Young, McMaster), geomorphologic (Antoni Lewkowicz, University of Toronto) and ground ice (Wayne Pollard, McGill University) studies, in anticipation of substantial climate change. The nearby Axel Heiberg research station hosts groundwater investigations by Michael English (Wilfrid Laurier). W.H. Pollard and Xiaogang Hu (McGill) recently initiated investigations of icings in

northern Yukon.

In the Cordillera, research is concentrated at UBC where, in addition to J.R. Mackay, Wayne Savigny has been involved with studies of slope stability along the Norman Wells to Zama oil pipeline. At the University of Calgary, promising techniques for mapping permafrost in the discontinuous zone from satellite images have been developed by Stephen Franklin and Derek Peddle. Stuart Harris maintains a program on the extent and temperature structure of alpine permafrost in various parts of the Cordillera, that is combined with studies of nearsurface hydrology and the development of palsas in Yukon. The hydrogeochemical studies are in association with Roy Krouse.

A more substantive review of current issues in Canadian permafrost research by C.R. Burn and M.W. Smith will be published in *Progress in Physical Geography*, 17 (3), as part of a special volume contributing to the Third International Geomorphology Conference, McMaster University, 23-29 August 1993.

Prepared by Chris Burn
Carleton University

Report from December 1993

Canada to Host 1998 International Permafrost Conference.

As expected, Canada's invitation to the IPA to hold the Seventh International Conference on Permafrost in Yellowknife, NWT, Canada, in 1998 was accepted by the IPA Council. This decision was publicly announced at the closing ceremony of the Sixth International Conference in Beijing on 9 July. The invitation, from Pierre Peron, President of the National Research Council of Canada, was issued in January 1992, and had received unanimous acceptance in principle from the IPA Council at its meeting in Washington, DC, in August 1992. The invitation was accepted unanimously at the Council meeting of 5 July 1993. Support for the conference will come from the Geological Survey of Canada, the National Research Council of Canada, the Science Institute of the Northwest Territories, and the Cold Regions Division of the Canadian Geotechnical Society.

Canadian National Committee for the IPA.

Natural Resources Canada (formerly Energy, Mines and Resources Canada), through the Geological Survey of Canada (GSC), has entered into a partnership with the National Research Council of Canada (NRCC) for

the support of the Canadian National Committee for the International Permafrost Association (CNC/IPA). NRCC will continue to be responsible for paying the annual dues for Canada. GSC, which has supported the CNC/IPA secretariat since its inception in 1985, henceforth will also be responsible for the operating costs of the CNC/IPA.

The CNC/IPA held its annual meeting in Saskatoon, Saskatchewan, 30 September 1993, directly following the Canadian Geotechnical Conference. As may be expected, the main item of business was the development of a structure of committees and individuals to organize the 1998 International Conference on Permafrost. The first meeting of the National Organizing Committee is being planned for April 1994. Alan Heginbottom, of the Terrain Sciences Division, GSC, and secretary of the CNC/IPA, was appointed as Secretary General for the conference and chairman of the National Organizing Committee. The conference will be held during the week of 27-31 July 1998, with field trips before and/or after the formal sessions.

In other business, the committee elected Don Hayley to be the new Chairman, CNCIPA, effective 1 January 1994; this appointment awaits ratification by the GSC. Mr. Hayley has been a member of the CNC since 1988. Before then, he served as Chairman of the Permafrost Subcommittee of the NRCC Associate Committee on Geotechnical Research, and was also the founding Chairman of the Cold Regions Geotechnology Division of the Geotechnical Society of Canada. He is vicepresident of EBA Engineering Consultants Ltd., in Edmonton, and a geotechnical engineer who has been involved in cold regions engineering research and practice for over 20 years. He has worked in many areas of the Canadian Arctic and Subarctic, in the Beaufort Sea, Alaska, and, most recently, the Russian Arctic.

In addition, the Committee heard reports from the Cold Regions Division of the Canadian Geotechnical Society, the Permafrost Committee of the Science Institute of the Northwest Territories, and the Canadian Polar Commission. Brief reports of progress were presented on IPA activities, particularly the Multilingual Glossary project of the Terminology Working Group, and the Circum-Arctic Permafrost Map project. Communications issues, both international and within Canada, were also discussed. The next meeting of the CNC/IPA will be held in association with the 47th Canadian Geotechnical Conference in Halifax, Nova Scotia, in September 1994.

Cold Regions Division, Canadian Geotechnical

The 46th Annual Meeting of the Canadian Geotechnical Society was held in Saskatoon, 27-29 September 1993. The Cold Regions Division sponsored a session on permafrost engineering, in which six papers were presented. The papers dealt with freeze-thaw treatment of oil sands tailings, creep of frozen soil, strength of silty permafrost, testing of frozen sand, and segregation potential. The 1993 *Roger J.E. Brown Award*, which was established in 1986 to honor the memory of the renowned Canadian permafrost scientist, was awarded to Branko Ladanyi, Département de génie civile, École polytechnique, Université de Montréal, for "services to permafrost studies in Canada." Don Hayley was also given a special award for "service to the Geotechnical Society," in recognition of his initiative and efforts in founding the Cold Regions Division of the Society.

The 47th Canadian Geotechnical Conference, to be held in Halifax, Nova Scotia, 21-23 September 1994, will include a session on "Piles in Permafrost." The conference will also include regular sessions for submitted papers. Abstracts of 500 words or fewer should be submitted by 30 November 1993 (see calendar).

Prepared by J.A. Heginbottom
Secretary, CNC/IPA

2 China

Report from June 1993

All arrangements for the Conference are well under way. (See inside back cover for schedule of sessions and routes of field trips.) A total of 189 papers are being published in the pre-conference proceedings volume. A total of 70 poster papers will be presented and 4000-word summaries published in the post-conference volume, along with reports of special sessions and other information.

The State Key Laboratory of Frozen Soil Engineering of the Lanzhou Institute of Glaciology and Geocryology was accepted by the Chinese Government at the end of 1992 and has been put into operation. New progress on frozen soil mechanics, heat and mass transfer, and engineering simulation has been accomplished in this laboratory.

Submitted by
Zhu Yuanlin

Report from December 1993

The main activities taking place in China were obviously the organization and conduct of the Sixth International Conference on Permafrost. Approximately 300 people from 22 countries participated in the Conference. Details of the Conference are contained elsewhere in this issue (*Frozen Ground* #14). The post-Conference volume of the proceedings is nearing completion and will be sent to all participants in early 1994. Copies of both volumes of the proceedings are available from the Lanzhou Institute of Glaciology and Geocryology. Two issues of the *Journal of Glaciology and Geocryology* contain special collections of Chinese papers accepted for the Conference (see p. 23).

The Chinese Organizing Committee thanked foreign participants for attending the Conference and excursions and hoped they enjoyed the meeting and visits.

3 Denmark

The Adhering Body is the Danish Society of Arctic Technology and its sister organization, the Greenland Technological Society. The Adhering Body acts as a source of information concerning International Permafrost Association activities for Danish and Greenlandic members of the societies. The societies' membership includes about 300 individuals and 40 companies and institutions. Within this framework the societies organize meetings and establish links with other organizations and companies concerned with cold climate regions. Besides the societies' initiatives in both countries, with meetings and the like, work is also carried out in consulting engineering companies, universities, and governmental institutions.

In January 1993 a group of consulting engineering companies in Denmark and Sweden prepared the first draft of a book entitled *Permafrost Studies for Hydro-Power*. The work, sponsored by the Nordic Industrial Foundation, covers the relationship of permafrost to: 1) hydraulic structures in general, 2) lakes, and 3) dams and embankments.

Long-term temperature data for rock in Greenland are still being collected at some stations. The data are kept in the Greenland Home Rule hydrological-climatological database, where considerable time series are now available. From this database and synoptic temperature data from Denmark's Meteorological Institute a new map has

been drawn of discontinuous and continuous permafrost distribution in Greenland. The map was shown at the poster session at the Beijing Conference, together with a display copy of the first draft of the book *Permafrost Studies for Hydro-Power*.

Submitted by Thorkild Thomsen

4 Germany

Many scientists of the German Permafrost Community are still absorbed in evaluation of the data from the German Geoscientific Spitzbergen Expeditions that took place between 1990 and 1992 with more than 45 participants. Two preliminary volumes containing results appeared in 1992 (Stuttgart) and 1993 (Basel). Several papers with detailed results and large-scale color maps have been finished recently and are being prepared for printing in spring 1994 in a volume of *Zeitschrift für Geomorphologie (Supplementband)*.

German permafrost studies are continuing mainly in the Alps (Germany, Switzerland) and in the Andes (Argentina). In addition, several German permafrost scientists have been active at international conferences and seminars, and some joined the post-conference excursions to the Qinghai-Tibet Plateau and to Urumqi-Xinjiang. At the "Joint Russian-American Seminar on Cryopedology and Global Change" in Pushchino in November 1992, several German papers presented results of microbiological, geochemical, pedological and paleopedological studies in Siberia and Antarctica. At the Sixth International Permafrost Conference in Beijing, German contributions mainly presented results of the Svalbard expeditions.

On the engineering side, and with respect to seasonal frost effects, German research is related to the frost susceptibility of mineral sealing layers for landfill lining systems. This problem is only relevant during the construction period. The 5th International Symposium on Ground Freezing will be held in Nancy, France, in October 1994. For further information please contact Prof. Michel Fremont, Chef du Service, Laboratoire central des Ponts et Chaussées, Scé. de Mathématiques, 58, Blvd. Lefèvre, 75732 Paris, Cedex 15, France.

Prepared by Lorenz King and H.J.L. Jessberger

5 Italy

The Italian Adhering Body of the International Permafrost Association is completing an inventory of rock glaciers both in the Alps and in the north central Apennines. The results of these studies are also an Italian contribution to the IPA permafrost map of the Northern Hemisphere. Large-scale geomorphological mapping is in progress in selected mountain areas (central and western Alps and Apennines) which have proved to be affected by permafrost. Very detailed studies have also been carried out for more than 40 rock glaciers, including ¹⁴C datings, BTS measurements, geoelectrical soundings and remote sensing.

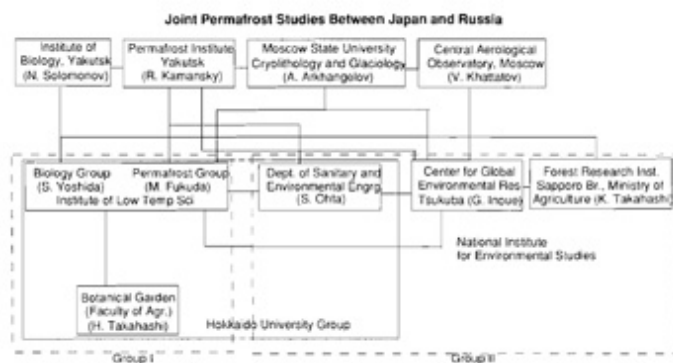
Research continued at two stations installed in the Valtellina area (central Alps) some five years ago to monitor creep phenomena in rock glaciers. A new research station has been established on an active rock glacier in the upper Valtellina catchment. In this area, located at about 2700 m a.s.l., meteorological instruments and more than 15 thermistors measuring ground temperature at different depths have been installed.

Research on permafrost and periglacial geomorphology is also in progress for the area surrounding the Italian research station in Antarctica (Terra Victoria). Finally, the ultimate Italian version of the permafrost glossary has been submitted to the IPA Working Group on Terminology for inclusion in the multilingual glossary.

Prepared by Francesco Dramis

6 Japan

As reported in *Frozen Ground* number 11, a joint Japanese-Russian permafrost program was agreed to in 1990. The following diagram shows the organization of the program. The joint permafrost studies began in summer 1992 with more than 23 scientists from two Japanese groups (Ministry of Education, Culture and Science and Japan Environmental Agency)



participating.

On 27 January 1993, many of the scientists who participated in the previous year's work assembled at the Institute of Low Temperature Science and presented results of their initial studies. A total of 25 short papers related to trace gases, permafrost soils, geology, fauna and flora were published in March 1993 in *Proceedings of the First Symposium on Joint Siberian Permafrost Studies Between Japan and Russia in 1992* (M. Fukuda, Ed.).

Report based on preface of proceedings volume

7 Netherlands

Within the framework of regular Quaternary geological mapping and investigations the study of periglacial (and permafrost-related) phenomena in Weichselian sediments continues. These studies are pursued in particular by the Institute of Earth Sciences of the Free University (Amsterdam) and to some extent by the Geological Survey of The Netherlands and the Departments of Physical Geography of the Universities of Utrecht and Amsterdam.

A recent topic of interest is "cryogenic microfibrils and macrostructures and their palaeoenvironmental significance" (see A.S. Huyzer, 1993, Free University of Amsterdam, Thesis, 245 p.).

A major activity in (sub)Arctic regions has been the Greenland Ice Margin Experiment (GIMEX). These studies are carried out in the Sondre Stromfjord area in western Greenland. This multidisciplinary programme is on:

- * the mass balance of the (west) Greenland ice sheet and its sensitivity to climate change
- * the meteorology of the ablation zone of the ice sheet and the adjacent tundra area
- * the Holocene deglaciation history
- * the palaeoecology of the tundra margin
- * the sediment balance in the fjord region

The study of periglacial phenomena and permafrost temperature profiles forms an integral part of this research programme. In the summer of 1993 another expedition (about 15 participants) to the Sondre Stromfjord region will take place.

Prepared by Eduard A. Koster

8 Norway

Current activities in permafrost research relate to technical developments and are scaled to the size of the country and the actual problems. Some 30 people are involved to varying degrees.

Research on permafrost and periglacial processes takes place at the Polar Research Institute and in university departments. The level of activity is about the same as before and the work involves close cooperation with foreign colleagues. Construction activities at Svalbard have been reduced in recent years. Greater involvement of Norwegian-based oil companies is, however, foreseen for the Barents Sea region. It is important to be prepared for this development. As part of this, the Norwegian Institute of Technology is offering education and research opportunities in permafrost technology. This is made possible through close cooperation with Canadian and Russian colleagues.

Norway has terminated publication of the journal *Frost Action in Soils*. Membership in IPA has thus become even more important to us, and we appreciate the information we receive through IPA in general and *Frozen Ground* in particular.

Prepared by Kaare Flaate

9 Spain

At the Council meeting in 1993 in Beijing, China, the Spanish National Permafrost Committee became an official member of the International Permafrost Association. The committee currently consists of 28 scientists that are representative of Spanish research in the field of permafrost and geocryology. The members are from different universities and research institutes in Spain, e.g. Madrid, Barcelona, Zaragoza, Santander, Sevilla, LaLaguna (Tenerife), Alcalá, Jaca Huesca. The committee elected Professor David Palacios, Universidad Computense, Madrid, as its chairman. The IPA Committee plans to meet in June 1994 to establish its organization and plans.

Committee members are conducting permafrost studies in several Spanish mountain ranges (Pyrenees, Cordillera Cantabrica, Sistema Central, Sierra Nevada and Teide Volcano). Some Spanish teams are also working abroad, e.g. in the Mexican stratovolcanoes, the South American Andes, and Antarctica.

Prepared by Lorenz King
Regional Reporter, Europe

10 Switzerland

On 25 November 1992 about 30 scientists and members of the Swiss Coordinating Group on Permafrost of the Swiss Academy of Sciences met at the Laboratory of Hydraulics, Hydrology and Glaciology (VAW) of the Swiss Federal Institute of Technology, Zurich (ETHZ). Short reports were given on current permafrost research in polar and alpine areas.

M. Hoelzle (VAW) summarized results of D.C. resistivity soundings carried out on rock glaciers and ice-cored moraines of northwest Svalbard in cooperation with the Geographical Institute of the University of Oslo. K. Dettwiler and N. Ritter from the Geographical Institute, University of Basel, gave an outline of ongoing climatological and geocological permafrost investigations in Svalbard as part of the German/Norwegian/Swiss Liefdefjorden Expeditions 1990, 1991 and 1992. Concerning the Alps, O. Antonson (Paul Scherrer Institute, Villigen) discussed gas analyses on core samples from the Murtèl drilling, D. Vonder-Mühl (VAW) described gravimetric measurements on the Murtèl rock glacier, and W. Haeberli (VAW) presented time series of borehole temperatures from the same place.

Borehole deformation measurements in the permafrost of Pontresina-Schafberg were analyzed by S. Wagner (VAW), and F. Keller (VAW) illustrated snow-permafrost interactions from extensive field experiments in the Upper Engadin. The distribution pattern of permafrost in selected areas of the Western Alps is being investigated by a research group of the Geographical Institute of the University of Lausanne (P. Schoeneich). Attempts are being made to numerically model the influence of Ice Age glaciers and permafrost on ground temperatures and groundwater conditions in the Swiss Plateau (C. Speck, VAW). Hazards from debris flows starting in steeply inclined permafrost terrain above Randa, Valais, are being dealt with by M. Zimmermann (Geo 7, Bern).

Preliminary pollen analysis by botanists from the University of Basel of organic matter found in the uppermost part of the Murtèl permafrost core appears to confirm that the ground ice within the active rock glacier indeed dates from the earlier part of the Holocene, as estimated earlier on the basis of thermal and flow considerations. Permafrost in starting zones of snow avalanches and corresponding problems relating to avalanche protection are being investigated by VAW and the Swiss Federal Institute for Snow and

Avalanche Research, Weissfluhjoch/Davos, in cooperation with federal and cantonal authorities. Attempts continue to build a network for monitoring the long-term evolution of permafrost in the Swiss Alps. Warming of Alpine permafrost since the late 1980s is observed in the Murtèl borehole and appears to have accelerated by a factor of about 5 to 10 as compared with reconstructed secular permafrost warming (about 1°C/century).

Thawing of frozen ground as inferred from high-precision rock glacier photogrammetry seems to have markedly accelerated also, in 1980-1990, as compared with 1970-1980. Computer simulations of changing permafrost distribution patterns and ground temperatures are developed at VAW within the framework of the Swiss National Research Program on Climate Change and Natural Catastrophes. Geographical Information Systems have found wide application for estimating permafrost occurrence on the basis of digital terrain information. Corresponding algorithms are presently being improved by using the growing data base from field evidence in combination with energy balance considerations.

Prepared by Wilfried Haeberli

11 United Kingdom

The British Adhering Body is organized through a committee comprising Charles Harris, Cardiff, Geology (Chairman); Michael Clark, Southampton, Geodata (Secretary); Edward Derbyshire, Royal Holloway, London, Geography; Peter Worsley, Reading, Sedimentology; Ronald Jones, Nottingham, Engineering; and Tony Mayer, NERC, Polar Sciences. The committee has continued in its function as a source of information concerning IPA activities and a means of distributing newsletters and circulars to British scientists. IPA dues are paid by the British Royal Society on behalf of the British Adhering Body of the IPA. A Geocryology Workshop is planned for 1994.

Prepared by Charles Harris

12 United States of America

Report from June 1993

U.S. Geological Survey.

Timothy S. Collett reports that since the mid-1980s the primary objective of the U.S. Geological Survey gas hydrate research project has been to assess the energy resource potential of gas hydrates in northern

Alaska. Most of the gas hydrate occurrences are geographically restricted to the area overlying the eastern part of the Kuparuk River oil field and the western part of the Prudhoe Bay oil field. Calculations indicate that the volume of gas within these mapped hydrates is approximately 1.0 to 1.2 trillion cubic meters, about twice the amount of recoverable natural gas in the Prudhoe Bay field. Most recently, research efforts have focused on utilizing available industry seismic data to assess the distribution of subsea gas hydrates and ice-bearing permafrost within the nearshore Alaskan continental shelf. These studies suggest that the onshore Prudhoe Bay-Kuparuk River gas hydrate accumulations may extend as much as 15 km into the near-offshore. This gas-hydrate-related research has also focused on the relation between permafrost-associated gas hydrates and global climate change. Under the present climate regime, the gas hydrates of the nearshore continental shelf may be the most vulnerable to change. Field work includes both onshore and offshore geochemical surveys in northern Alaska and the establishment of gas flux monitoring stations which enable us to directly measure the rate of gas flux from decomposing gas hydrates.

Gary Clow reports that the USGS is continuing its climatic studies in the Alaskan Arctic, where permafrost temperature analysis indicates a 2-4 K warming has occurred during the last 50-100 years. As part of this program, the USGS has established a "solid-earth" climate observatory at Fish Creek on the Arctic Coastal Plain. The permafrost is 270 meters thick at this site. The observatory consists of a 735-m-deep borehole and a cluster of three automated microclimate stations on the surface. The borehole, a large-diameter oil and gas exploration well drilled in 1977, has been retrofitted with a system to: a) reduce the thermal noise associated with vigorous fluid convection that normally occurs within this well, and b) provide direct measurement of subsurface temperature transients caused by past climatic changes. In addition to monitoring various fluxes at the Earth's surface, the nearby microclimate stations will establish the connection between air, active layer, and permafrost temperatures in each of the vegetation zones influencing the deep borehole. Data from this observatory are anticipated to reduce much of the ambiguity inherent in previous climate analyses of permafrost temperatures, providing a clearer view of past climatic changes on the Arctic Coastal Plain. The data will also be used to monitor future climatic changes in this region.

Oscar Ferrians, Jr. is compiling a new permafrost map of Alaska at a scale of 1:2,500,000, which shows the distribution, thickness, and general character of permafrost. This map will be an upgraded version of the 1:2,500,000-scale permafrost map prepared in 1962, published in 1965, and reprinted several times. Since 1962, considerable new data have become available, especially from borehole records along the 1280-km long trans-Alaska pipeline route, oil exploration and development work on the Arctic North Slope, water wells, and soil boring records from other developmental activities. The map units are subdivided primarily on the basis of topography, thermal characteristics of the soils and rocks, soil moisture, and vegetation. The range of thickness of the permafrost, the range of ground temperatures at the depth of zero annual amplitude, and estimates of the extent of permafrost are given for the map units.

National Science Foundation.

NSF, under the Global Change Research Program, initiated a program called Arctic System Science (ARCSS). One component, Land-Atmosphere-Ice Interactions (LAI), deals with the flux of trace gases and nutrients from tundra regions with emphasis on Arctic Alaska (FLUX). One project by K.R. Everett (Ohio State University), F.E. Nelson (Rutgers University) and J. Brown concentrates on spatial and temporal variations in the active layer. A database on past active layer measurements in Arctic Alaska is being compiled and several 1000- x 1000-m grids have been established and used to monitor active layer thicknesses. Several cooperative sites have been established in Russia at Parisent, Gydan Peninsula (A. Pavov) and Anadyr (A. Kotov). Additional Russian sites are planned on Yamal Peninsula (M. Liebman), Taimyr (T. Vlasova), Kolyma (D. Gilichinsky) and elsewhere. Quality of soil organic matter is being evaluated by C.L. Ping (University of Alaska) and the hydrology of the permafrost-dominated terrain by D. Kane and L. Hinzman (University of Alaska). A gas flux program by W. Oechel at San Diego State University is measuring CO₂ and methane fluxes from numerous tundra sites. Measurement of near-surface permafrost temperatures by T. Osterkamp (University of Alaska) continues. More information on the LAI program is available from the Arctic Research Consortium of the United States (ARCUS), 600 University Avenue, Suite B, Fairbanks, Alaska 99709.

Cold Regions Research and Engineering Laboratory.

Virgil Lunardini notes that, in support of global warming

research, CRREL will install a series of 200-m boreholes in the permafrost zones of Alaska. The holes will be cored to obtain a complete record of the subsurface physical properties. Temperature monitoring will be carried out for many years. The first two holes will be drilled on the North Slope during 1993.

CRREL will host the Fourth International Symposium on Thermal Engineering and Science for Cold Regions at Hanover, N.H., 28 September-1 October 1993. The conference will consist of single sessions run for 2 1/2 days with about 40 papers and four special lectures presented (contributions from Canada, China, Denmark, Finland, France, Germany, India, Netherlands, Russia, Switzerland, USA). A lecture on permafrost and global warming will be given and some eight permafrost papers are expected. Contact V. Lunardini, CRREL, 603-646-4326.

Alaska/Yukon Society of Professional Soil Scientists.

AYSPSS is organizing an international correlation meeting on permafrost-affected soils with the collaboration of USDA-Soil Conservation Service, Agriculture Canada and University of Alaska-Fairbanks. The meeting includes two weeks of mixed plenary sessions and field trips from Inuvik, NWT. to Fairbanks, Alaska, via the Dempster Highway and Dawson City, Yukon Territory, 18-30 July 1993. About 50 pedologists, geologists and climatologists from Canada, China, Croatia, Denmark, Germany, Hungary, Russia and the U.S. plan to participate in the meeting. The purposes of the meeting are 1) to review and compare the current classifications used for permafrost soils, 2) to discuss the land use management and ecological balance of permafrost soils, and 3) to focus on the effect of global climate change on permafrost soils. For further information contact AYSPPSS, P.O. Box 202761, Anchorage, Alaska 99520-276 1, USA, or Dr. John Kimble, phone: (402) 437-5363.

The AYSPPSS is also cosponsoring the Alaska Soil Geography Field Class offered by Dr. C.L. Ping, 14-24 June 1993. This year, the students and participants will travel to the North Slope along the Dalton Highway. The class will study the morphology and management interpretations. For details, contact C.L. Ping (phone: (907) 746-9462; E-mail: pfclp@alaska.bitnet).

National Research Council.

NRC's Committee on Frost Action, chaired by Tom Kinney, Fairbanks, Alaska, held its annual meeting 11

January 1993, and reviewed a range of on-going activities including the Minnesota Road Research Project (MNROAD), the Strategic Highway Research Program with its TDR measurements and asphalt test programs, and the status of several ground temperature and climate data bases.

The National Research Council and its Commission on Geosciences, Environment and Resources announced the appointment of Loren W. Setlow as Director of the Polar Research Board. The Polar Research Board represents the U.S. on the International Arctic Science Committee and maintains close liaison with the USC/IPA and the U.S. permafrost community.

ASCE Technical Council on Cold Regions Engineering.

TCCRE met in San Francisco, California, in February/March 1993. Council Officers for 1993/1994 (starting in October) are: Andrie Chen (Chair), Tom Krzewinski, Bernard Alkire, Bill Lovell, Lynda Barber and Eric Johnson. The Education Committee is updating the Educational Opportunity Inventory and plans to publish the report in 1994. The Committee will organize a workshop to gather input on undergraduate curriculum needs into the 1994 Edmonton Specialty Conference. The Design and Construction Committee anticipates publication of the *Monograph on Roadways and Airfields* and *Monograph on Arctic Foundations* by late 1993 or early 1994.

The Frozen Ground Committee plans to develop a short course entitled "Design and Freezing Capabilities of Thermosyphons" in 1994/95. The Publications Committee added a "forum" section to the *Journal of Cold Regions Engineering* to include book reviews, letters to the editor, listing of available publications, etc. The TCCRE created an ad hoc committee to explore future TCCRE contact with Russians regarding cold regions engineering opportunities.

The 1996 Cold Regions Specialty Conference is scheduled for August in Fairbanks, Alaska.

Report from December 1993

The United States is represented in the IPA by its US Committee for IPA under the National Research Council. Current membership includes C.W. Lovell (Chair), Bernard Hallet (Vice Chair), and members Roger Barry, George Gryc, Lewis Link, Rupert Tart, and John Zarling. Support for IPA annual dues is

provided directly to the Secretary General by the Association of American Geographers, American Society of Civil Engineers, American Society of Mechanical Engineers, and individuals and private companies. The June 1993 issue of *Frozen Ground* reported on many government and professional organizations' activities. The following supplements that report.

Keith Kvenvolden of the USGS in Menlo Park reports on recent results coming from the study of permafrost and gas hydrate as possible sources of methane. Permafrost has been suggested to be a high-latitude source of methane (a greenhouse gas) during global warming. To assess the magnitude of this source, an examination was conducted of the methane content of shallow cores (maximum depth 9.5 m) drilled in 1991 and 1992 at four sites near Fairbanks, Alaska, where discontinuous permafrost is common. The cores were composed mainly of frozen or thawed loess and peat, with some ice present in the frozen ground. Methane contents of frozen and thawed ground were compared. At all sites methane contents decrease toward the surface. Maximum methane contents at the sites were variable, ranging from 22.2 to 0.03 mg/kg. Results suggest that both frozen and thawed ground in permafrost regions can be a source of methane.

The idea that gas hydrate associated with relict permafrost of the Beaufort Sea continental shelf is a source of methane was tested. It was discovered that methane concentrations in water under the winter sea ice cover were 3 to 28 times greater than they are in late summer when ice is absent. These observations suggest that methane concentrates under the sea ice during winter and ventilates rapidly in late summer as the ice melts and retreats. The Arctic Ocean margin may be a seasonal, high-latitude, marine source of about 0.1 Tg/yr atmospheric methane. New field work is designed to expand these kinds of observations and to determine the sources of methane.

Submitted by Jerry Brown

13 South Africa

The Adhering Body is small, but active. Work has been undertaken in the Antarctic, the Drakensberg Mountains, and the mountains of the Western Cape. The first meeting of the "Southern African Permafrost Group" (SAPG) was held in April 1993 at the University of the Western Cape, and a field session was held in the mountains of that area. A Bibliography of Research on Periglacial Geomorphology in Southern Africa was compiled by Jan Boelhouwers. Papers on related

topics were presented at the International Permafrost Conference in Beijing, the International Association of Geomorphologists meeting in Hamilton, and the local SASQUA meeting in Kimberley. Cooperative work with colleagues in Caen, France, was initiated. An attempt is being made to interest the world community in the cryogenic questions of the Southern Hemisphere and to broaden the local membership of the SAPG, which includes: President: Kevin Hall (University of Natal); Secretary: Patricia Harvey (University of Witwatersrand); President-Elect: Jan Boelhouwers (University of the Western Cape).

Prepared by Kevin Hall

14 Russia

The annual meeting of the Council on Cryology was held in Pushchino, near Moscow, 20-24 April 1993 at the Institute of Soil and Photosynthesis of the Russian Academy of Sciences. At the plenary session eight papers were presented:

- * Development of the coastal area of the Arctic seas
- * Thermoabrasion of Arctic shores and decomposition of gas hydrates
- * Engineering-geocryological research in the central area of the Yamal Peninsula
- * Formation of the tundra soil cover in northeast Russia
- * Permafrost research in the Arctic territories to develop recommendations for survey and construction
- * Changes in the rate of thermoabrasion and thermodenudation in the coastal area of the Laptev Sea
- * Permafrost evolution and its monitoring by the contemporary global climate change
- * The dynamics of frozen shores in the shoal coastal area of the East Siberian Sea
- * International Circumpolar Permafrost Map (Russian part)

At the special sessions, about 70 papers on general and engineering geocryology (physics and chemistry of frozen soil, hydrology, linear construction, underground water, ecology, and environmental protection) were discussed.

An international seminar on "Protection of Construction Against Frost Heaving" was held in Chita, Siberia, 27-29 September 1993 at the Chita Department of the Permafrost Institute.

Prepared by Nikolai Grave