



# *Frozen Ground*

Number 13

The News Bulletin of the International Permafrost Association

June 1993



# International Permafrost Association

The International Permafrost Association was founded in 1983 and has as its objectives fostering the dissemination of knowledge concerning permafrost and promoting cooperation among persons and national or international organizations engaged in scientific investigations and engineering work on permafrost. Membership is through adhering national organizations. The IPA is governed by a Council consisting of representatives from 18 countries having interests in some aspects of theoretical, basic and applied frozen ground research (includes permafrost, seasonal frost, artificial freezing and periglacial phenomena). Working Groups organize and coordinate research activities. The IPA became an Affiliated Organization of the International Union of Geological Sciences in July 1989. The Association's primary responsibility is the convening of the international permafrost conferences. The first conference was held in the U.S. in 1963; the second in Yakutsk, Siberia, 1973; the third in Edmonton, Canada, 1978; the fourth in Fairbanks, Alaska, 1983; and the fifth in Trondheim, Norway, 1988. The sixth conference is planned for China in 1993. Field excursions are an integral part of each Conference, and are organized by the host country.

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Argentina  
Belgium  
Canada  
China  
Denmark  
Finland

France  
Germany  
Italy  
Japan  
Netherlands  
Norway

Poland  
Russia  
Sweden  
Switzerland  
United Kingdom  
USA

### Cover Photograph:

*Head of a partial carcass of an extinct bison, *Bison priscus*, discovered August 1951 in frozen silt of the Goldstream Formation (Wisconsin) during placer gold mining operations on Dome Creek, 25 kilometers north of Fairbanks, Alaska. A radiocarbon date of 31,400 (+2040 or -1815) years was obtained on a piece of the hide by the radiocarbon laboratory of the Geological Survey of Sweden (ST 1721). The light-colored substance on the hide is vivianite, an iron phosphate mineral (photograph no. PK 1758B, by T.L. Péwé, 3 September 1951). See Guest Report, p. 5.*

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*Frozen Ground*, the News Bulletin of the International Permafrost Association (IPA), is published semi-annually. The IPA is a non-governmental association of national organizations representing 18 countries. The success of the bulletin is entirely dependent upon the willingness of IPA participants to supply information for publication. Copy date for issue No. 14 is the end of October 1993. Please ensure that working group and member country reports are submitted in good time for publication. News items for inclusion in the *Miscellaneous* section are also very welcome from any IPA participant, as are interesting photographs for the cover (please furnish 8"×10" black and white glossy prints). For copies of *Frozen Ground* and submission of news items or photos please contact the appropriate individual listed on page 24 or Chairman, IPA Editorial Committee, P.O. Box 9200, Arlington, Virginia 22219-0200, USA.

Issue No.13 of *Frozen Ground* was compiled by Jerry Brown. Production is courtesy of the Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, USA.

## PRESIDENT'S COLUMN

It has been 10 years since the official founding of the International Permafrost Association in 1983 at the Fourth International Conference on Permafrost held at Fairbanks, Alaska. But it has been 20 years since the idea for an international organization was advanced by P.I. Melnikov at the Second International Conference on Permafrost held at Yakutsk, USSR, in 1973.

Our international activities started with the first International Conference on Permafrost held at Lafayette, Indiana, USA, in 1963. It has been my privilege to participate in all of the conferences to date and serve as vice-president of IPA, 1983–1988, and president, 1988–1993. Ross Mackay has been our founding, hard-working, and guiding Secretary General for the pioneer 10 years. Ross and I extend our heartfelt thanks to the other members of the Executive Committee who guided the Association through these early years: P.I. Melnikov, President, 1983–1988; Kaare Flaate, Vice-President, 1983–1988; and Cheng Guodong and V.P. Melnikov, Vice Presidents, 1988–1993. For the last 5 years, personnel of the Standing Committees, Working Groups and National Adhering Bodies have greatly aided in the development of our active organization.

Perhaps it would be well to review progress of the IPA in this report, especially of the last 5 years. Four of the 18 Adhering Member Countries (Canada, China, USA, USSR) were charter members, and the others joined in the last 10 years. Application for membership is pending for a group of countries representing southern Africa, and three other countries are currently considering membership. Our constitution and bylaws were formalized in 1988 and revised in 1993 (see p. 11).

With a firm foundation laid, IPA underwent an extensive maturing and expansion. The Executive Committee and members of the Council have met every year: 1988 (Oslo), 1989 (Yamburg, Siberia, USSR), 1990 (Quebec City), 1991 (Beijing), 1992 (Washington, D.C.) and 1993 (Beijing). In 1989 IPA was approved as an Affiliated Organization of the International Union of Geological Sciences (IUGS), one of the largest and most active non-governmental scientific organizations in the world.

The establishment and functioning of Standing Committees and Working Groups during the last 5 years probably has been the most important action of the IPA to date. The Finance Committee (H.M. French) recommended revision of our dues structure, and despite international financial difficulties, the organization is

functioning well. Our major source of revenue is dues; 13 countries are currently contributing.

The Editorial Committee (J. Brown) has been exceedingly active editing and preparing for publication the papers for the VI Permafrost Conference in Beijing; initiating and preparing the permafrost map of the northern hemisphere; and establishing and having published the semi-annual IPA News Bulletin *Frozen Ground*. The "Circumarctic Permafrost Map and Ground Ice Conditions" at a scale of 1:10,000,000 is an ambitious undertaking by a committee from Canada, Russia, and USA (J. Brown, Chairman). The base map was prepared by the U.S. Geological Survey, which will print and publish the multi-colored map, the first at this scale and with an international legend. The 24-page IPA News Bulletin, *Frozen Ground*, has been well-received worldwide since its initiation in 1990 when it grew from the original IPA newsletter. Publication production is courtesy of the Cold Regions Research and Engineering Laboratory, Hanover, N.H., USA, and 1600 copies are printed and distributed.

The Advisory Committee on Working Groups (C.W. Lovell) is undertaking to formalize "operational procedures" for the Working Groups and reviews proposals for new Working Groups. This is the oversight committee for these important activities of IPA. As with similar organizations, the Working Groups of IPA constitute the heart of the "action center." Six groups were organized in July 1988 and one in 1992, and one is pending. They are: Present Global Change and Permafrost; Mountain Permafrost; Terminology; Data and Information; Foundations; Periglacial Environments; Seasonal Freezing and Thawing in Permafrost Areas; and Cryosols (pending). The Groups are responsible for conducting symposia and field conferences, and for publication of such activities and papers during inter-conference periods. It is a pleasure to report that the Working Groups have been exceedingly active since their inception with field symposia on various subjects in Switzerland, Russia, United States, Canada, Sweden, Netherlands, France, and others; and publication of symposium results as well as bibliographies and multilingual glossaries. We look forward to many additional activities over the next five years.

The future of IPA looks bright. Best wishes for success to the new Executive Committee taking over at the Conference in Beijing in July.

Troy L. Péwé, President, IPA

## REPORTS OF IPA STANDING COMMITTEES AND WORKING GROUPS

Complete reports for all Committees and Working Groups will be available at the IPA Council Meeting in Beijing in July 1993 and summaries will be published in the December 1993 issue of *Frozen Ground*.

### Editorial Committee

The Committee completed review and processing of the papers for the Sixth International Conference. Camera-ready forms were distributed in October and authors prepared and submitted their final camera-ready manuscripts directly to the Chinese Organizing Committee. The Russian papers were delivered to and reviewed by the Chair, Editorial Committee, and final copy forwarded to China. Dr. Nikolai Grave's efforts in supervising the preparation of these final copies are greatly appreciated, as are the efforts of Zhu Yuanlin and Cheng Guodong and their associates in China, in preparing the publication.

A total of 189 papers from 18 countries will appear in the pre-conference proceedings volume as follows:

- 67 China
- 40 Russia
- 29 United States
- 26 Canada
- 6 Germany
- 4 Switzerland
- 3 Poland
- 2 Belgium, Italy, Japan
- 1 Finland, France, Mongolia, Netherlands, Norway, Romania, South Africa, United Kingdom

The December issue of *Frozen Ground* was printed and distributed in January 1993.

The IPA Circumarctic Permafrost and Ground Ice Map is nearing completion. The four senior authors (Brown, Ferrians, Heginbottom and E.S. Melnikov) met at the U.S. Geological Survey, Reston, Virginia, in February 1993 to agree on revisions. Since then, input for mountain permafrost has been received from Akerman for the Nordic countries and from Dramis, King and Gorbunov for Europe and central Asia. The map will be available for review in Beijing. Printing and distribution to all attendees of the conference is planned for the end of 1993.

The permafrost bibliography was reviewed and comments made, together with the Data and Information Working Group. Over 3000 bibliographic citations are contained in the new bibliography (1988–1992), which appears for the Conference as a Glaciological Data Report (GD 26) and is available for non-conference attendees for \$10.00 from CIRES/WDC-A, Campus Box 449, University of Colorado, Boulder, Colorado 80309.

Submitted by  
Jerry Brown

### Terminology Working Group

The Working Group has prepared a multi-language (English/French/German/Italian/Russian/Spanish) index of permafrost and related terms, based primarily on the 1988 NRCC *Glossary of Permafrost and Related Ground-Ice Terms*. Copies of the current draft of the index can be obtained from the Chairman for \$6.00 (U.S) per language section. A paper on the development of the index, prepared by the Chairman, was accepted for publication at the Sixth International Con-

ference on Permafrost. The current drafts of the individual language sections of the multi-language index will be printed for display at the Conference. Following the Conference, activities will include incorporation of new terms into the index where necessary, correction of errors, addition of other languages (e.g. Scandinavian and Polish), and inclusion of definitions.

Submitted by  
Robert O. van Everdingen



*Hundreds of fossil bones were washed out of this mammoth “cemetery” in the lower course of the Indigirka River in 1982. The Achchagyy-Allaikha site, which is about 12,500 years old, evidences the last millennia of woolly mammoth existence. The jet from the powerful motorized water pump borrowed from the Yakutsk Fire Service revealed the cryogenic structure of bone-bearing slope deposits. However, this is not the best way to excavate a fossil mammal locality, as most of the small bones are lost, and many are damaged.*



## GUEST REPORT

### **Permafrost and Fossil Mammals as a Focus for Interdisciplinary Arctic Research**

Permafrost provides excellent preservation of mammal fossils. The famous Beryozovka Mammoth from Kolyma, the Dima Baby Mammoth of the Magadan Region, the Blue Babe Bison of Alaska—their frozen carcasses, buried in permafrost, are unique evidence of the Pleistocene biota and environment. Less is known about how fossil mammals can be helpful in understanding permafrost history and dynamics.

In 1966, the first Early Pleistocene mammal fauna (Olyorian) was discovered in northeastern Siberia. Numerous ice-wedge casts in fossil-bearing horizons clearly indicated that permafrost had existed for at least 1 million years. Cryogenic structures in the Olyorian sediments were later studied by permafrost experts in great detail. Some fossil bones of mammals that became extinct more than half a million years ago, such as giant moose and archaic musk-oxen, still had preserved soft organic matter inside them. It was interpreted as a poorly mineralized and altered bone marrow, which suggested that there had been no radical degradation of permafrost since the Olyorian times.

Much more ancient evidence of permafrost was discovered a few years later. The Kutuyakh sediments in the Lower Kolyma Valley presented a fossil peat bog that had been heavily frost-cracked and contained ice wedges which were later replaced by ice wedge casts. According to small mammal fossils (voles and lemmings), this frozen bog existed during Late Pliocene times. Correlation of paleontological records with the paleomagnetic evidence from this section produced an estimate of the minimum age of permafrost of 2.5 million years. Paleoecological implications of fossil mammals, insects and plants from the Kutuyakh featured lowland tundra environment. This is the earliest evidence so far of permafrost documented by a broad set of paleontological data. The underlying sediments of Early Pliocene age (Begunov) also contain some structures which could be related to frost cracking, but that requires further research.

Pliocene and Early Pleistocene sediments contain only ice wedge casts, not the ice wedges themselves. An important problem in permafrost history is: What are

the oldest ice wedges preserved in the Arctic? It is clear that since that time no single climate warming event has been sufficient to destroy the entire permafrost system by deep thawing. Determining the age and thickness of frozen sediments with very high ice content is also important for many practical purposes, such as Arctic construction, mining, etc. Recent paleontological discoveries can probably help to solve this problem.

Fossil soil and peat horizons marking important warming of climate have recently been found in one of the bluffs along the Khomus-Yuryakh River (Indigirka-Kolyma Lowland). The peat contains ice wedges while only ice-wedge casts have been found beneath it. This is probably the earliest preserved ground ice, and fortunately there are two rich mammal-bearing horizons below and above the peat. According to the evolutionary level of collared lemmings, both horizons are considered to be middle Pleistocene. It is remarkable that the upper bone member contained fossils with the soft tissues preserved, which confirms that this member has never been thawed. The locality looks very promising as a contributor to the history of the Arctic, but due to the current situation in Russia further research there lacks necessary funding.

Finally, the extinction of mammoth fauna at the end of the Pleistocene is closely related to the permafrost history. There is convincing evidence that the intense development of thermokarst and the appearance of millions of lakes on the lowlands was one of the main reasons for Arctic ecosystem restructuring and the extinction of some large mammals.

These examples clearly demonstrate that close cooperation between paleontologists and permafrost scientists, including side-by-side field research, can be of mutual benefit to both fields of Arctic science.

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## NEWS FROM MEMBER COUNTRIES

### Canada

#### **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, Québec, 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





## United States

**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 data base on past active layer measurements in Arctic Alaska is being compiled and several 1000- × 1000-m grids have been established and used to monitor active layer thicknesses. Several cooperative sites have been established in Russia at Parisento, Gydan Peninsula (A. Pavlov) 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 CO<sub>2</sub> 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 2½ 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.** AYSPPS 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 AYSPPS, P.O. Box 202761, Anchorage, Alaska 99520-2761, USA, or Dr. John Kimble, phone: (402) 437-5363.

The AYSPPS 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: pfc1p@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 (MN/ROAD), 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 1993/94 (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.

## MISCELLANEOUS

### FROST '93

Arvind Phukan, School of Engineering, University of Alaska-Anchorage in association with the International Society for Soil Mechanics and Foundation Engineering (ISSMFE) Technical Committee TC8 (Frost); ASCE Technical Council on Cold Regions Engineering (TCCRE); and the IPA Working Group on Seasonal Freezing and Thawing in Permafrost Areas organized the Second International Symposium on "Frost in Geotechnical Engineering," 28 June-1 July 1993 in Anchorage Alaska. The Symposium is divided into three main sessions:

Session I: Theory pertaining to prediction of frost penetration and thermal degradation of frozen layer.

Session II: Application related to design and construction of various structures against frost.

Session III: Case histories illustrating experiences in projects where frost action caused significant damages and application of remedial measures against frost action.

The Conference proceedings, available from A.A. Balkema Publishers, The Netherlands, contains papers accepted for presentation at the symposium. Approximately 30 papers are included, representing contributions from nine countries (Belgium, Canada, Finland, Japan, Poland, Sweden, Switzerland, Russia and United States of America).

### Southern Hemisphere Report

The Southern African Permafrost Group held its first meeting at the University of the Western Cape from 5-9 April 1993. The group voted to apply for membership in IPA. The officers are: President-Dr. Kevin J. Hall; President elect-Mr. Jan Boelhouwers, Department of Earth Sciences, University of the Western Cape, Private Bag X17, Bellville 7535, South Africa; Secretary-Dr. Patricia Hanvey, Department of Geography, University of the Witwatersrand, 1 Jan Smuts Avenue, Johannesburg 2050, South Africa.

About 15 participants joined in a one-day paper session followed by a three-day excursion. The excursion examined recent work on the interpretation of fossil debris covers and visited sites of active frost action in the Western Cape mountains. At the meeting, a bibliography of periglacial studies of southern Africa was released. The second meeting of our group will be held in the Drakensberg mountains. Further information is available from Mr. J. Boelhouwers, Department of Earth Sciences, University of the Western Cape, Private Bag X17, Bellville 7535, South Africa.

During the austral summer 1992/93 Kevin Hall and Ian Meiklejohn (University of Natal, South Africa) worked at the southern end of Alexander Island in Antarctica on various aspects of weathering (mechanical and chemical) and undertook studies of the periglacial features found in that area. Extensive areas of cryoplanation terraces were found, as too were a peculiar form of patterned ground comprising contraction cracks in bedrock edged by sorted material. Stefan Grab, of the same university, has started a detailed study of periglacial phenomena in the Drakensberg mountains of South Africa, giving particular attention to thufurs.

Professor Jane Soons of the University of Canterbury (New Zealand) reported that information pertaining to periglacial studies in New Zealand is well summarized in the review paper published in *Permafrost and Periglacial Processes* (1990, vol. 1, p. 145-159).

Submitted by Kevin Hall  
University of Natal

### Spain

A Spanish group consisting of 28 scientists representing permafrost and periglacial processes has applied for membership in the International Permafrost Association.

The group has elected the following officers: President-David Palacios, Vice-President-Juan Martin, Secretary-Antonio Gómez Ortiz.

### International Union of Geological Sciences

The International Union of Geological Sciences has formed the new Commission on Geoscience for Environmental Planning (COGEOENVIRONMENT). A Working Group on Geo-Indicators chaired by A.R. Berger, Calgary, Canada, is being organized. The aim of the working group is to establish an international

checklist of "geological" indicators needed to assess the health and integrity of natural environments. A representative of the permafrost community has been invited to participate and this topic will be discussed at the IPA Council meeting in Beijing.



# INTERNATIONAL PERMAFROST ASSOCIATION CONSTITUTION AND BYLAWS

Adopted 5 August 1987—Revised 1 December 1992

## Preamble and Definitions

During the Fourth International Conference on Permafrost held in Fairbanks, Alaska, in July 1983, the International Permafrost Association (IPA) was founded. The founding countries were: Canada, The People's Republic of China, U.S.A., and U.S.S.R. The founding of the IPA and the election of its officers was announced at the closing Plenary session, a set of principles was distributed to the delegates, and other countries with an interest in permafrost were invited to become members of the IPA.

The organizations referred to in the Constitution and Bylaws are defined as follows:

(a) *Council* is the governing body of the Association.

(b) *Adhering Body* is a representative organization or committee designated to represent in the Council of the Association the interests in permafrost of scientists and engineers of a country, or in special circumstances, a grouping of countries.

## Constitution

### 1. *Objective*

The objective of the International Permafrost Association (hereafter called the Association) is:

To foster the dissemination of knowledge concerning permafrost and promote cooperation among persons and national or international organizations engaged in scientific investigations or engineering work on permafrost.

### 2. *Activities*

The Association will accomplish this objective by:

- (i) holding an International Conference on Permafrost approximately every five years
- (ii) holding Council meetings at the time of International Conference and, if required, at suitable times and locations between conferences
- (iii) cooperating with other national and international organizations whose aims are complementary to those of the Association
- (iv) exchanging information through its Adhering Bodies
- (v) promoting cooperative activity and the development of knowledge concerning permafrost.

### 3. *Membership*

Membership in the Association is through Adhering Bodies. There shall be only one Adhering Body per country or grouping of countries. National or multi-national organizations wishing to join the Association must submit to the Secretary-General documentation showing the existence of a bona fide Adhering Body, its mailing address and names of its officers. Membership in the Association must have the approval of two-thirds of the full Council. The Council has the right to terminate the membership of any Adhering Body by a two-thirds majority vote of the full Council.

In countries where no Adhering Body exists, an individual may apply directly to the Association to take part in Association activities.



#### 4. *Adhering Bodies*

An Adhering Body is free to establish its articles of association and its organization in accordance with its requirements.

An Adhering Body shall at all times keep the Secretary-General informed about its address, the names of its officers and of its representatives to Council.

#### 5. *Officers of the Association (Executive Committee)*

The Officers of the International Permafrost Association are:

- (i) The President
- (ii) Two Vice-Presidents
- (iii) The Secretary-General

Either the President or one of the Vice-Presidents must be from the country hosting the next International Permafrost Conference.

The President and Vice-Presidents shall be nominated in accordance with the rules stated in the Bylaws and shall be elected by the Council. The President and Vice-Presidents shall be from different countries.

The officers of the Association shall serve from the end of one International Conference on Permafrost to the end of the next Conference. The President and Vice-Presidents shall not serve more than one term in the same office. The term of the Secretary-General may be renewed.

The President shall represent the Association and shall perform the duties pertaining to that office, as well as those entrusted to him by the Constitution and Bylaws or by the Council. The President shall be responsible, in collaboration with the Secretary-General, for the conduct of the affairs of the Association.

In the event of the resignation or death of the President, one of the Vice-Presidents will assume the office for the unexpired term of office.

In the event of the resignation or death of one of the Vice-Presidents, or if one of the Vice-Presidents assumes the office of President, the Council will appoint a successor from among its members who will complete the term of office. The choice of the President will be made by the remaining members of the Executive Committee.

The Secretary-General shall be appointed by the Council and shall not represent an Adhering Body on the Council.

#### 6. *Council*

The Council shall consist of the officers and two representatives from each Adhering Body.

Each Adhering Body in good standing shall have a vote. If no official representative is able to attend a meeting of Council, his or her vote may be cast by an authorized deputy appointed by his or her Adhering Body.

The Council shall be presided over by the President of the Association or, in case of his or her incapacity or inability to attend, by one of the Vice-Presidents. In the event of an equal decision of votes, the President or acting President shall cast the deciding vote.

The Council shall meet in ordinary session at the call of the President normally every five years during an International Conference on Permafrost. The Council may meet in extraordinary sessions at the call of the President or at the request of a majority of the Adhering Bodies. The Council may make decisions by written communication on questions put to it through the Secretary-General with the approval of the President.



The Council may set up, by a simple majority vote, standing and ad hoc committees and working parties with whatever powers and terms of reference it may decide.

The Council shall determine, with the advice of the Secretary-General, the annual subscription fee to the Association. The Council shall approve the budget and authorize disbursement of funds.

#### *7. International Conference on Permafrost*

An International Conference on Permafrost shall be held approximately every fifth year in a country to be decided upon by the Council. The organization and financing arrangements of an International Conference are the responsibility of the Adhering Body of the host country. The Adhering Body shall follow the principles, rules and procedures for the Conference set out in the Bylaws and any additional procedures approved by the Council.

#### *8. Entry into Force of Constitution and Bylaws*

This Constitution and Bylaws shall come into force at the close of the session at which they receive the approval of at least two-thirds of the full Council.

#### *9. Amendments to Constitution and Bylaws*

Amendments to the Constitution and Bylaws must be proposed by an Adhering Body. Such amendments shall be submitted in writing to the Secretary-General early enough to have the proposal submitted to all Adhering Bodies at least six months prior to the Council meeting at which the amendment is to be placed on the agenda.

Adoption of an amendment will require an affirmative vote of at least two-thirds of the full Council.

Amendments to the Bylaws shall follow the same procedure except that a simple majority in favor of the amendments is required instead of two-thirds, as above.

#### *10. Non Profit Organization*

The International Permafrost Association shall be carried on without purpose of gain for its member countries and any profits or other accretions to the International Permafrost Association shall be used in promoting the objectives of the Association.

### **Bylaws**

#### *1. Council*

- (i) A quorum for a Council meeting shall be a simple majority of the Adhering Bodies, except if changes in the Constitution are to be made or a vote is to be held on the acceptance of an application for membership. In these cases, a quorum shall be two-thirds of the full Council.
- (ii) Any Adhering Body that will not be present for a vote requiring a two-thirds majority may submit its views and vote in advance by mail. In this case that Adhering Body will be regarded as being present for the purposes of the quorum for the vote.
- (iii) Voting shall in general be by a show of hands except for the election of the President, the place for the next International Conference on Permafrost or Council meeting, or for other matters specified at the time by the Chairman.
- (iv) Resolutions shall be made by a simple majority of those voting, except for resolutions altering the Constitution or on the acceptance of new Adhering Bodies, for which the assent of two-thirds of the Council is required.
- (v) Adhering Bodies wishing to have items placed on the agenda should submit them not less than six months before a Council meeting. Three months before the meeting the Secretary-General will send the complete Agenda to each Adhering Body. The Agenda for the ordinary meeting of Council shall generally include the following items:



- (a) Minutes of the previous meeting: matters arising
- (b) Acceptance of new Adhering Bodies
- (c) Business raised by President
- (d) Business raised by Adhering Bodies
- (e) Business from other sources
- (f) Financial statement for preceding period and draft budget for ensuing period
- (g) International Conference
- (h) Election of President
- (i) Election of Vice-Presidents
- (j) Appointment of Secretary-General
- (k) Review of activities and reports of committees
- (l) Items submitted after preparation of agenda, subject to agreement of Chairman
- (m) Any other business

## 2. *Nomination of Officers*

The Executive Committee shall appoint a nominating committee of three people from Council two years before a conference. The nominating committee shall submit the name of one individual for President and two for Vice-Presidents to the Secretary-General one year before the conference. The nominating committee shall ensure that the nominees are willing to serve if elected. The Secretary-General, upon receipt of the report of the nominating committee, shall so inform the Adhering Bodies. Additional nominations may be made by Adhering Bodies prior to the meeting of Council.

## 3. *Secretary-General*

The Secretary-General shall be responsible, under the general direction of the President, for the conduct of all correspondence and current business of the Association, for the preparation and distribution of the Agenda of the Council meetings and for the preparation and maintenance of minutes.

The Secretary-General shall send to each Adhering Body an annual account of the dues owing, and shall ensure that all contributions and dues paid to the Association are placed in a separate account and that a record is kept. The Secretary-General is responsible for keeping the accounts of the Association, for the preparation of the annual budget of receipts and expenditures, for payments on behalf of the Association up to the limit of the approved budget, and shall acknowledge all monies received. The Secretary-General shall prepare a summary of the accounts for each meeting of the Council and shall give any explanation required of expenses incurred.

## 4. *Conferences*

- (i) Invitations to act as host for an International Conference on Permafrost and the accompanying Council meeting shall be considered at the meeting of the Council at the time of the preceding International Conference.

The inviting country must provide assurance that no individual will be denied attendance on grounds of nationality, race, creed or political views. If an invitation is received from more than one Adhering Body the final selection shall be made by secret ballot.

Arrangements for the International Conference on Permafrost shall be the responsibility of the Organizing Committee of the host country, in consultation with the Executive Committee.

- (ii) Adhering Bodies or their affiliates are encouraged to organize technical meetings and conferences. These may be designated as co-sponsored by the International Permafrost Association if approved by the Council.

For further information contact:  
The Secretary General.



## PUBLICATIONS

### Ice on the Equator

This 386-page book documents the Quaternary record on Mount Kenya, including the geological background, environmental setting, use of multiple relative and absolute age-dating methods, glacial and periglacial chronology, paleosol genesis, glacial geology, paleoclimatology, paleoecology, prehistoric and historic environmental impact, and correlation with other tropical alpine areas and with the deep-sea record. A comprehensive discussion of the glacial chronology and new advances in the use of paleomagnetism and amino acid racemization for relative-age determination form an important part of the volume. The geochemistry of stratigraphically

important paleosols on Mount Kenya provides new and detailed information on paleoclimatic reconstruction. New methods for distinguishing tills from lahars are discussed, along with laboratory freezing experiments on mud polygons.

Please order from the publisher: Wm. Caxton Press, 12037 Highway 42, Ellison Bay, Wisconsin, USA, or from Professor W.C. Mahaney, York University, Atkinson College, Geomorphology and Pedology Laboratory, Department of Geography, 4700 Keele Street, North York, Ontario M3J 1P3, Canada. \$65.00 (U.S.), \$75.00 (Can.).

### Proceedings of the Russian Academy of Sciences, Geographical Series

One of the major academic journals in geography—the *Proceedings of the Russian Academy of Sciences, Geographical Series*, published in Russian since 1951—will become available for foreign readers in an English version. It reflects new trends in world geography and economic transformations in Russia, such as:

- the contribution of geographers to the study of global environmental change and its driving forces, both natural and human
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- problems of human safety, especially in critical environmental zones and areas of ethnic and other social conflicts
- works on methodology and applications of the geographical sciences, including critical reviews of national and international meetings and publications
- insights into the development of geographic in-

formation systems, especially by combining GIS and space-time analysis.

The journal also provides an up-to-date analysis of regional situations all over Russia.

The *Geographical Series* of the *Proceedings of the Russian Academy of Sciences* will be useful not only for specialists on Russia, but for all those who strive to strengthen geographical thinking in human activities, to link the local and the global, and to integrate earth and social sciences to improve forecasting and management of our common future. This periodical is indispensable for the libraries of universities, geographical societies, and governmental agencies concerned with environmental problems, the management of population, and space economy.

The English version will appear quarterly in February, May, September and December. Since this is a translation from Russian the subscription price is expected to be \$350 per year (U.S.). Contact V.M. Kotlyakov, Fax: +7 095 230 2090.

### Memoirs of Lanzhou Institute of Glaciology and Geocryology

Issue No. 7 of this Chinese Academy of Sciences journal includes 15 papers on monitoring glaciers, climate, runoff changes and research in cold regions

hydrology in the Qilian Mountains. The journal is available from the Lanzhou Institute of Glaciology and Geocryology, Lanzhou, China.

# 冰川冻土

JOURNAL OF GLACIOLOGY AND GEOCRYOLOGY

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- Greenhouse Effect and Climate Change*; Li Peiji  
*Elastoplastic Calculation of Bottom Heave in an Artificially Frozen Shaft*; Ma Wei and Wu Ziwang  
*Frost Susceptibility of Powdered Calcium Carbonate*; Chen Xiaobai, A.E. Corte, Wang Yaqing and Shen Yu  
*Application of D.C. Electric Sounding for Permafrost Exploration Along the Xinjiang-Xizang Highway*; He Yixian  
*BZXJ, A Super Light-Weight Core Drill*; Zhu Guocai et al.  
*Some Advances in Periglacial Environment Studies*; Wang Baolai

### Volume 13, No. 4 (December 1991)

- Holocene Deglaciation in North Tianshan, USSR*; A.P. Melnikova and E.K. Bakov  
*Lake Transgression and Reasons During Glaciation Maximum on the North Margin of the Qinghai-Xizang Plateau*; Li Shuanke and Li Shijie  
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### Volume 14, No. 2 (June 1992)

- A Great Breakthrough in the Theory of Formation of Thick Layered Ground Ice*; Zhou Youwu and Huang Maohuan  
*Experimental Study on Conditions for Ice Formation of Saturated Sand in Freezing and Thawing Cycles*; Wang Jiacheng, Cheng Guodong, Zhang Hongding and Liu Jimin  
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*A Study on Local Circulation and Temperature in Alpine Glaciated Area*; Kang Xingcheng  
*Evolution of Quaternary Glaciers and Environment on the Eastern Side of the Geladandong Peak*; Deng Xiaofeng and Zhang Wenjing  
*An Extreme Heavy Debris Flow in Mt. Gongga*; Lu Ruren  
*The Preliminary Report on the Sino-USSR Joint Glaciological Expedition to the Mt. Xixabangma Region, 1991*; Su Zhen and A.B. Orlov

### Volume 14, No. 3 (September 1992)

- Determining Depth of Phase Change Front of Solid Water in Soil*; B.P. Chubylysku and B.B. Kudayph  
*Mathematical Modeling of Near-Shore Permafrost Thermal Regimes, Western Canadian Arctic*; Wang Baolai

*Constitutive Relations of Frozen Soil in Uniaxial Compression*; Zhu Yuanlin, Zhang Jiayi et al.  
*Effect of Tunnel Wall Rock Refreeze on Lining Stability*;  
Wu Qingbai and Wu Ziwang  
*Mountain Glacier Fluctuations and Climatic Change  
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## PERMAFROST AND PERIGLACIAL PROCESSES

### Permafrost and Periglacial Processes

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*Permafrost Research Sites in the Alps: Excursions of  
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#### Volume 3, Issue No. 4 (October–December 1992)

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*The Fractal Geometry of Thermal and Chemical Time  
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*Introduction—Periglacial Environments in Relation  
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*Weichselian Upper Pleniglacial Aeolian and Ice-Cored  
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*Implications in the Abisko Mountains, Swedish*

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*Investigations of Cryogenic Weathering in Europe and*

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*An Approach to Determine the Origin and Age of*

*Massive Ice Blockages in Two Arctic Caves*; B.

Lauriol and I.D. Clark

**Short communication**

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## Alaskan Field Guidebooks

Available from Alaska Division of Geological and Geophysical Surveys, 794 University Avenue, Suite 200, Fairbanks, Alaska 99709-3645.

*Elliott and Dalton Highways, Fox to Prudhoe Bay,*

*Alaska* (J. Brown and R.A. Kreig, Ed.), 1983. A

guidebook to permafrost and related features.

DGGB4, \$7.50.

*Prudhoe Bay, Alaska* (S.E. Rawlinson, Ed.), 1983. A

guidebook to permafrost and related features.

DGGB5, \$6.00.

*The Alaska Railroad Between Anchorage and Fair-*

*banks*, by T.C. Fuglestad, 1986. A guidebook to

permafrost and engineering problems. DGGB6,

\$7.50.

*Dalton Highway, Yukon River to Prudhoe Bay, Alaska*

(C.G. Mull and K.E. Adams, Ed.), 1989. A guide-

book to the bedrock geology of the eastern Koyukuk

Basin, Central Brooks Range, and Eastcentral Arctic

Slope. DGGB7, \$40.00.

The following provides citations and ordering information for publications of previous conferences on permafrost.

## International Conferences on Permafrost

- Permafrost: International Conference Proceedings.* Washington, D.C.: National Academy of Sciences, 1966, National Research Council Publication 1287. Available on microfilm in the Cold Regions Science and Technology Bibliography, no. 25-3138, U.S. Library of Congress or NTIS.
- Permafrost: The North American Contribution to the Second International Conference, Yakutsk.* Washington, D.C.: National Academy of Sciences, 1973, \$50.00
- Permafrost: The USSR Contribution to the Second International Conference, Yakutsk.* Washington, D.C.: National Academy of Sciences, 1978, \$19.50.
- Proceedings of the Third International Conference on Permafrost.* Ottawa, Ontario: National Research Council of Canada, 2 vol., 1978, \$35.00.
- Permafrost: Fourth International Conference; Abstracts and Program.* Fairbanks, Alaska: University of Alaska, 1983. \$10.00
- Permafrost: Fourth International Conference, Final Proceedings.* Washington, D.C.: National Academy Press, 1984. \$32.50.
- Proceedings, Fifth International Conference on Permafrost. Trondheim, Norway.* Tapir Publishers, Volla-bakken, 7030 Trondheim, Norway. Vol. 1-3, \$240.00. Vol. 1-2, \$225.00, Vol. 3, 1988, \$15.00.
- Permafrost: A Bibliography, 1978-1982.* Glaciological Data Report GD-14. Boulder: World Data Center for Glaciology, University of Colorado, Box 449, Boulder, Colorado, 1983. \$5.00.
- Permafrost: A Bibliography, 1983-1987.* Glaciological Data Report GD-14. Boulder: World Data Center for Glaciology, University of Colorado, Box 449, Boulder, Colorado, 1988. \$5.00.
- Permafrost: A Bibliography, 1988-1992.* Glaciological Data Report GD-26. Boulder: World Data Center for Glaciology, University of Colorado, Box 449, Boulder, Colorado, 1993. \$10.00.
- A Cumulative Index to Permafrost Conference Proceedings, 1958-1983,* J.A. Heginbottom and M. Sinclair. Geological Survey of Canada, Open File Report 1135, 1985. Available from K.G. Campbell Corporation, Reproduction Department, 880 Wellington St., Bay 240, Ottawa, Ontario K1R 6K7, Canada. \$48.39.

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## ISOPE Publications

*International Journal of Offshore and Polar Engineering (IJOPE)* (J.S. Chung, J. Wardenier, H. Maeda, S. Remseth, Ed., with associate editors). Topics: offshore engineering, ocean engineering, offshore mechanics, polar (Arctic and Antarctic) engineering, materials and technology, and energy (Quarterly). Yearly subscription \$120 (U.S.). 1991 issues are available at \$100 (U.S.).

*Proceedings of the 1st (1990) Pacific/Asia Offshore Mechanics Symposium (PACOMS '90),* Seoul, Korea, 24-28 June 1990. 3 vol., 1260 p, \$150 per set (U.S.); \$70 single volume (U.S.). Vol. I: offshore technology, ..., polar technology, wave energy, 430 p. Vol. II: non-linear hydrodynamics, ..., Russian ice-structure interactions, 390 p. Vol. III: mechanics and applications, ..., fatigue, tubular structures, welding, ..., 440 p.

*Proceedings of the 1st (1990) European Offshore Mechanics Symposium (EUROMS-90),* Trondheim, Norway, 20-22 August 1990. \$80 (U.S.) Hydrodynamics, tubular joints, ..., TLP, and Russian ice-structure interactions.

*Proceedings of the 1st (1991) International Offshore and Polar Engineering Conference (ISOPE-91),* Edin-

burgh, U.K., 11-16 August 1991. 4 vol., 2190 p., \$320 (\$100 single volume). Vol. I: TLP, fixed and jacked-up structures, heavy lift, geotechnical engineering, reliability, subsea systems, floating production and marginal fields, wave energy and power, gas hydrates, ocean mining, special topics. Vol. II: computer technology, ROV, pipelines, risers, mooring and cables, international polar research, Antarctic mining, Antarctic structures and design, ice, structure and scour, Russian ice-structure interactions. Vol. III: ocean measurements, ocean waves, hydrodynamic forces and equations, motions and nonlinear dynamics, higher-order effects, vortex and oscillations. Vol. IV: decommissioning, impact/explosion, damage and repair, structural mechanics and analysis, buckling, materials, tubular structures, fatigue, fractures, corrosion, underwater welding, NDT, ...

*Proceedings of the 2nd (1992) International Offshore and Polar Engineering Conference (ISOPE-92),* San Francisco, California, 14-19 June 1992. 4 vol., 2899 p., \$340 (U.S.). Vol. I: 713 p., \$100. Vol. II: 824 p., \$100. Vol. III: 724 p., \$100. Vol. IV: 638 p., \$100.

Contact for ordering: ISOPE, P.O. Box 1107, Golden, Colorado 80402-1107. Fax: (303) 420-3760.

## International Symposia on Ground Freezing

*Proceedings of 1st International Symposium on Ground Freezing, Bochum, Germany, 1978* (H.L. Jessberger, Ed.), 2 vol., Bochum: Ruhr University (out of print). [Papers reprinted in *Engineering Geology*, vol. 13 (H.L. Jessberger, Ed.), and in *Developments in Geotechnical Engineering*, vol. 26 (H.L. Jessberger, Ed.), Elsevier.]

*Proceedings of 2nd International Symposium on Ground Freezing, Trondheim, Norway, 1980*, 2 vol., Norwegian Institute of Technology (out of print). [Papers reprinted in *Engineering Geology*, vol. 18 (P.E. Frivik, N. Janbu, R. Saetersdai and L.I. Finborud, Ed.), and *Geotechnical Engineering*, vol. 28 (P.E. Frivik, N. Janbu, R. Saetersdai and L.I. Finborud, Ed.), Elsevier.]

*Proceedings of 3rd International Symposium on Ground Freezing, Hanover, New Hampshire, 1982*. Hanover, N.H.: USA Cold Regions Research and Engineering

Laboratory, Special Report 82-16. Further papers collected and published in extra volume.

*Ground Freezing: Proceedings of 4th International Symposium on Ground Freezing, Sapporo, Japan, 1985*, vol. 1, A.A. Balkema.

*Ground Freezing 1985: Proceedings of 4th International Symposium on Ground Freezing, Sapporo, Japan, 1985*, vol. 2 (S. Kinoshita and M. Fukuda, Ed.). Hokkaido University Press.

*Ground Freezing '88: Proceedings of 5th International Symposium on Ground Freezing, Nottingham, England, 1988* (R.H. Jones and J.T. Holden, Ed.), 2 vol. A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands.

*Ground Freezing '91: Proceedings of 6th International Symposium on Ground Freezing, Beijing, China, 1991* (Yu X and Wang C, Ed.). A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands.

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## Heat Transfer Symposia

*Proceedings, International Symposium on Cold Regions Heat Transfer, 4–6 June 1987, Edmonton, Alberta, Canada* (K.C. Cheng, V.J. Lunardini and N. Seki, Ed.), 270 p.

*Proceedings, Second International Symposium on Cold Regions Heat Transfer, 28–30 June 1989, Sapporo,*

*Japan* (N. Seki, K.C. Cheng and V.J. Lunardini, Ed.), 314 p.

*Proceedings, Third International Symposium on Cold Regions Heat Transfer, 11–14 June 1991, University of Alaska* (J.P. Zarling and S.L. Faussett, Ed.), 572 p.



## RECENT AND FORTHCOMING MEETINGS

1993

### **3rd (1993) International Offshore and Polar Engineering Conference**

**6–11 June 1993, Singapore**

Contact: ISOPE, P.O. Box 1107, Golden, Colorado 80402-1107

Phone: (303) 273-3673; Fax (303) 420-3760

### **International Conference on Offshore Mechanics and Arctic Engineering**

**20–24 June 1993, Glasgow, Scotland**

Contact: S.K. Chakrabarti, c/o CBI Research, 1501 North Division St., Plainfield, Illinois 60544-9829

Phone: (815) 436-2912; Fax: (815) 436-8345

### **IGCP 253: Termination of the Pleistocene**

**26–28 June 1993, Manitoba, Canada**

(followed by field trip across the glaciated and flood-scoured Canadian Prairies/Rockies)

Contact: James T. Teller, Department of Geological Sciences, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada.

### **4th Canadian Marine Geotechnical Conference**

**27–30 June 1993, St. Johns, Newfoundland, Canada**

Contact: Farrokh Poorooshasb, C-Core, Memorial University of Newfoundland, St. Johns, Newfoundland A1B 3X5, Canada

Phone: (709) 737-8371; Fax (709) 737-4706

### **Frost '93: International Symposium on Frost in Geotechnical Engineering**

**28 June–1 July 1993, Anchorage, Alaska**

Contact: Arvind Phukan, School of Engineering, University of Alaska, 3211 Providence Drive, Anchorage, Alaska 99508-8096

### **Sixth International Conference on Permafrost**

**5–9 July 1993, Beijing, China**

Contact: Cheng Guodong, Lanzhou Institute of Glaciology and Geocryology, Academia Sinica, Lanzhou, 730 000, China

Telex: 72008 IGGAS CN; Fax: 86-931-485241

### **4th Meeting–Geocryology of the Americas (IGCP Project 297)**

**5–9 July 1993, Beijing, China (during Sixth Conference)**

Contact: Arturo E. Corte, P.O. Box 330, 5500 Mendoza, Argentina

Fax: 54-61 380370; Telex: 55438 CYTME AR

### **Joint CSCE/ASCE Conference on Environmental Engineering**

**12–14 July 1993, Montreal, Quebec, Canada**

Contact: Raymond N. Young, Conference Chair, Geotechnical Research Centre, McGill University, 817 Sherbrooke St. West, Montreal, Quebec H3A 2K6, Canada  
Phone: (514) 398-06672

Fax: (514) 398-7361

### **Symposium on the Impacts of Climatic Change/Global Warming on Hydrology and Water Resources in Mountainous Regions and Cold Regions**

**Mid-July 1993, Lhasa, Tibet, China**

Contact: Chairman, Organizing Committee, Ming-Ko Woo, Department of Geography, McMaster University, Hamilton, Ontario L8S 4K1, Canada or Liu Changmin/Guobin Fu, Secretariat of Symposium, Department of Hydrology, Institute of Geography, CAS, Building 917, Datun Road, Beijing 100101, China

Phone: (861) 4231539

Fax: (861) 4231551

Telex: 222483 CAAMS

### **International Correlation Meeting on Permafrost-Affected Soils: Classification, Correlation, and Management of Permafrost-Affected Soils**

**18–30 July 1993, Northwest Canada and Alaska**

Contact: John Kimble, USDA-SCS, Federal Building, Room 152, 100 Centennial Mall North, Lincoln, Nebraska 68508-3866

Phone: (402) 437-5363; Fax: (402) 437-5336

### **ICG Pre-Conference Field Trip–Geomorphology and Permafrost of the Yukon and the Western Canadian Arctic**

**11–22 August 1993**

Contact: C.R. Burn, Department of Geography, Carleton University, Ottawa, Ontario K1S 5B6, Canada

### **Global Change and Terrestrial Arctic Ecosystems: An International Conference**

**21–26 August 1993, Oppdal, Norway**

Contact: Jarle Holten, NINA, Tungasletta 2, N-7005, Trondheim, Norway

Phone: 47 7 58 0500

Fax: 47 7 91 5433

E-Mail: jarle.holten@nina.no

**Third International Conference on Geomorphology**  
(including the Binghamton Symposium 25 August and IGU/IPA business meeting of Working Groups on Periglacial Environments and Frost Action Environments)  
**23–29 August 1993, Hamilton, Ontario, Canada**  
Contact: McMaster University, Hamilton, Ontario L8S 4K1, Canada  
Phone: (416) 546 9140 X 4535; Telex: 061-8347;  
Fax: (416) 546 0463

**44th Arctic Science Conference: Circumpolar Information Exchange**  
**15–18 September 1993, Whitehorse, Yukon, Canada**  
Contact: Arctic Science Conference, P.O. Box 31137, Whitehorse, Yukon Y1A 5P7, Canada  
Phone: (403) 667-4288  
Fax: (403) 633-6965

**4th Northern Regions Conference—People in the Arctic: Regional Rights and Regional Management**  
**27 September–3 October 1993, Tromsø, Norway**  
Contact: Charlotte Winsnes, Joint Secretariat, Post Box 190, 9001 Tromsø, Norway  
Phone: +47-83-80811  
Fax: +47-83-80618

**Fourth International Symposium on Thermal Engineering and Science for Cold Regions**  
**28 September–1 October 1993, Hanover, New Hampshire**  
Contact: Virgil Lunardini, USA Cold Regions Research and Engineering Laboratory, 72 Lyme Road, Hanover, New Hampshire 03755-1290  
Phone: (603) 646-4326; Fax: (603) 646-4640  
Telex: 710 366 1826

**International Symposium on the Ecological Effects of Arctic Airborne Contaminants**  
**4–8 October 1993, Reykjavik, Iceland**  
Contact: Debra Steward, Technical Resources Inc., 3202 Tower Oaks Boulevard, Rockville, Maryland 20852  
Phone: (301) 770-3153  
Fax: (301) 468-2245

**Thirty-Second Hanford Symposium on Health and the Environment—Regional Impacts of Global Climate Change: Assessing Change and Response at the Scales that Matter**  
**18–21 October 1993, Richland, Washington**  
Contact: Ray Baalman, Manager, Planning and Communications, MSIN: K1-50, Life Sciences Center, Battelle Pacific Northwest Laboratories, Richland, Washington  
Phone: (509) 375-3665  
Fax: (509) 375-3686

**The Second International Design for Extreme Environments Assembly: Growth and Environment—Challenging Extreme Frontiers**  
**23–28 October 1993, Montreal, Quebec, Canada**  
Contact: Centre for Northern Studies and Research, Burnside Hall, Suite 270, McGill University, 805 Sherbrooke St. West, Montreal, Quebec H3A 2K6, Canada  
Phone: (514) 398-6052  
Fax: (514) 398-8364  
Telex: 05-268510

**Fifth Canadian and Japanese Conference on Paving**  
**1993, Calgary, Alberta, Canada**

#### 1994

**Seventh International Specialty Conference: Cold Regions Engineering—A Global Perspective**  
**7–9 March 1994, Edmonton, Alberta, Canada**  
Contact: Daniel Smith, Department of Civil Engineering, University of Alberta, Edmonton, Alberta T6G 2G7, Canada

**Polar Tech '94**  
**22–25 March 1994, Luleå, Sweden**  
Contact: CENTEX, Lena Allheim Karbin, Luleå University of Technology, S-95187, Luleå, Sweden

**Fourth (1994) International Offshore and Polar Engineering Conference (with Third Pacific/Asia Offshore Mechanics Symposium)**  
**10–15 April 1994, Osaka/Kobe, Japan**  
Contact: ISOPE, P.O. Box 1107, Golden, Colorado 80402-1107  
Phone: (303) 273-3673; Fax (303) 420-3760

**International Conference on Future Groundwater Resources at Risk**  
**13–16 June 1994, Helsinki, Finland**  
Contact: Ms. Tuulikki Suokko, FRG 94, National Board of Waters and the Environment, P.O. Box 250, SF-00100 Helsinki, Finland  
Phone: 90-402-8345  
Telex: 90-402-81  
Fax: +358-0-4028-345

**ISCORD 1994—International Symposium on Cold Region Development**  
**13–16 June 1994, Espoo, Finland**  
Contact: ISCORD '94 Symposium Secretariat, c/o Association of Finnish Civil Engineers RIL, Meritullinkatu 16 A 5, SF-00170 Helsinki, Finland  
Phone: +358 0 1356300  
Fax: +358 0 1357670

**4th International Conference on the Bearing Capacity  
of Roads and Airfields**

**July 1994, Minneapolis, Minnesota**

Contact: BCRA '94, Conference Services, 338 Nolte  
Center, University of Minnesota, Minneapolis, Minnesota  
55455-0139

Phone: (612) 625-9023; Fax (612) 626-1632

**Bipolar Information Initiatives: The Needs of Polar  
Research—15th Polar Libraries Colloquy**

**3–8 July 1994, Cambridge, United Kingdom**

Contact: William Mills, Scott Polar Research Institute,  
Cambridge CB2 1ER, U.K.

Phone: 0223-336557

Fax: 0223-336549

E-Mail: wjm13@uk.ac.cam.phx

**International Conference on the Arctic and  
North Pacific: Bridges of Science Between North  
America and the Russian Far East**

**25 August–2 September 1994, Anchorage, Alaska and  
Vladivostok, Russia**

Contact: Dr. Gunter Weller, Geophysical Institute, Uni-  
versity of Alaska, Fairbanks, Alaska 99775-0800

Fax: (907) 474-7290

E-Mail: gunter@dino.gi.alaska.edu

**Second International Conference on Arctic Margins  
(ICAM)**

**September 1994, Magadan, Russia**

Contact: Dennis Thurston, Anchorage, Alaska  
Phone: (907) 271-6545, 6010

**Symposium on Periglacial Slope Processes**

(will include IGU/IPA full meeting and a field trip  
to southwest France, Champaign and Lorraine)

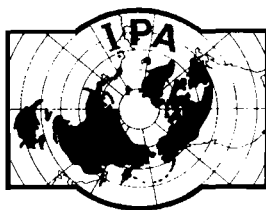
**1–6 September 1994, France**

Contact: Jean-Pierre Lautridou, Centre de Géomorpholo-  
gie du CNRS, Rue des Tilleuls, 14000 Caen, France

**International Conference on Offshore Mechanics and  
Arctic Engineering**

**Fall 1994, Houston, Texas**

**International Symposium on Ground Freezing  
1994, France**



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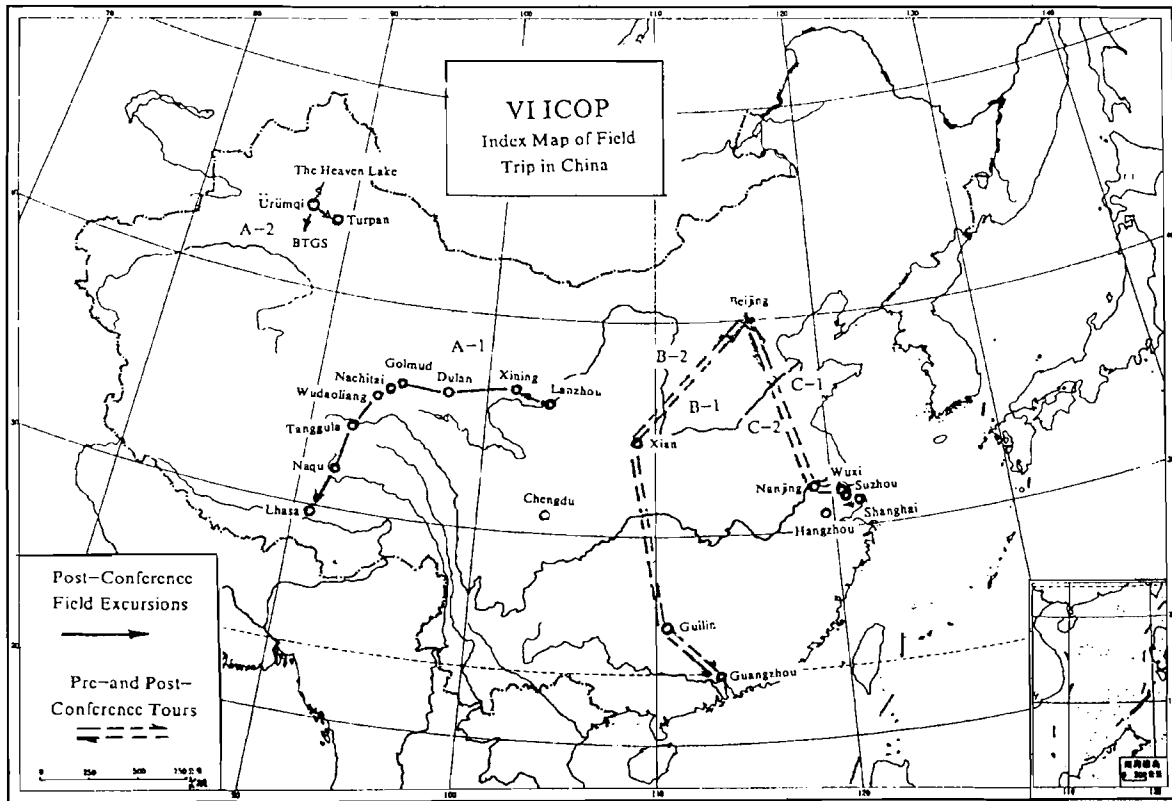
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# Additional Information for the Sixth International Conference on Permafrost 5–9 July 1993, Beijing, China



**Conference Calendar**

	Sunday July 4	Monday July 5	Tuesday July 6	Wednesday July 7	Thursday July 8	Friday July 9	
0800			Registration				
0900		Registration 0900–1800	Opening	Special Session B	Paper Sessions	Paper Sessions	
1000			Break	Break	Break	Break	
1100		Joint Meeting of IGCP/IPA/IGU	Special Session A	Special Session C	Paper Sessions	Paper Sessions	
1200							
1300				Lunch		New IPA Executive Committee Meeting	
1400		IPA Council Meeting	Poster Session	IPA Data Workshop	Paper Sessions	Paper Sessions	
1500				Break	Break	Break	Closing
1600				Paper Sessions	Paper Sessions	Paper Sessions	
1700	IPA Executive Committee Meeting	Meeting of Working Group Chairmen				IPA Council	
1800							
1900							
2000							
2100		Reception	Social Arrangements	Banquet	Social Arrangements		
2200							