Frozen Ground

Number 9 | The News Bulletin of the International Permafrost Association | June1991

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. 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. 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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Cover Photograph:

Water released from a depth of about 22 meters in a pulsating pingo, Tuktoyaktuk Peninsula, Northwest Territories, Canada. (Photograph from J. Ross Mackay; see Géographie Physique et Quaternaire, Volume 33, p. 3–61, 1979 for details.)

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International Permafrost Association

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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. 10 is the end of October 1991. 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 20 or Chairman, IPA Editorial Committee, P.O. Box 9200, Arlington, Virginia 22219-0200, U.S.A.

Issue No. 9 of *Frozen Ground* was compiled by Jerry Brown. Production is courtesy of the Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, U.S.A.

Erratum:
No. 8, p. 21: Price of the Proceedings of the Symposium on the Arctic and Global Change is $25, not $75 as printed.

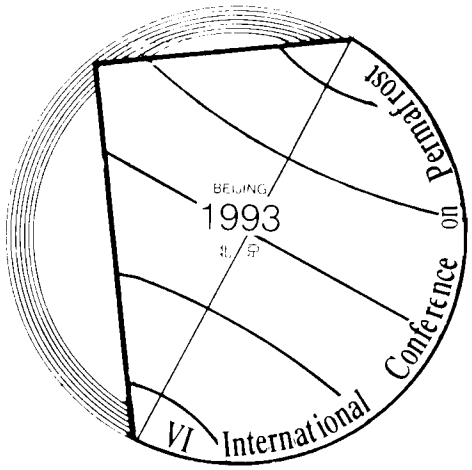
PRESIDENT'S COLUMN

This column is not by the President of IPA, but about the President of IPA. Troy L. Péwé was given special recognition by the University of Alaska on May 4, 1991, when he received an honorary degree of Doctor of Science. Such an award is the highest tribute a university can convey to a distinguished individual, and in his case recognized "his major contribution to the understanding of Alaska geology and...his international leadership in permafrost research." Dr. Péwé first began work in Alaska in 1946 with the U.S. Geological Survey. From 1954 through 1965 he was professor and then head of the University of Alaska's Department of Geology. Upon leaving Alaska, he became Chairman of the Department of Geology at Arizona State University, where he is now professor emeritus and Director of the University's Museum of Geology.

In addition to the honors bestowed upon him by the University, the State of Alaska's legislature gave him an official certificate recognizing his years of dedication to the University of Alaska and its students, as well as his numerous accomplishments associated with permafrost research in Alaska and world wide.

Congratulations and best wishes to IPA President Péwé from your colleagues in the International Permafrost Association. We look forward to seeing you at the Sixth International Conference on Permafrost.

Jerry Brown, Chairman
Editorial Committee



The circle symbolizes the globe. The North Pole, the South Pole, and the highest pole of the earth—the Qinghai–Tibet Plateau—are connected by a right triangle. The six half-circles on the left side symbolize the six International Conferences on Permafrost.

IPA STANDING COMMITTEES AND WORKING GROUPS

Editorial Committee

As indicated in News Bulletins No. 7 and 8, the main activity of the Committee has been to organize the steps necessary to prepare the circumpolar permafrost map for the 1993 Conference. Numerous discussions and several visits among U.S., Canadian and Soviet specialists continued during the first half of 1991. Several prototype legends and maps have been developed and exchanged. Visits of Soviet specialists to North America in summer 1991 and ensuing discussions should resolve questions on the legend. Compilation of permafrost attributes will commence in Fall 1991 and a final schedule and responsibilities will be resolved then. The plan to have a preliminary map available for review during the August 1992 IPA Council and IGU meetings in Washington, D.C., is our goal.

The Committee awaits further details from the Chinese organizers before beginning organization of the paper review process for the 1993 Conference. All countries, scientists and engineers intending to participate in the July 1993 Conference are urged to submit their abstracts by the 1 December 1991 deadline.

The Editorial Committee would like to formally express its gratitude on behalf of the IPA to Mike Clark, GeoData Institute, University of Southampton, U.K., for assistance in preparing issues 7 and 8.

Report by
Jerry Brown, Chairman
Editorial Committee

Terminology

Several major accomplishments were achieved. The translation of the NRCC Glossary of Permafrost and Related Ground Ice Terms into Russian has been completed by Nikolai Romanovskij and a limited number of copies are being circulated for review in North America.

The multilingual translation of the NRCC Glossary is proceeding under the direction of the Working Group Chairman. The following is a sample of the five-language index using the first seven "main" terms from the Glossary. Comments should be sent to Robert O. van Everdingen, 2712 Chalice Road NW, Calgary, T2L 1C8 Canada.

Report by
Robert O. van Everdingen, Chairman
Terminology Working Group

MULTILINGUAL INDEX FOR THE PERMAFROST GLOSSARY

ENGLISH	FRANÇAIS	DEUTSCH	ESPAÑOL	РУССКИЙ
active layer	couche active/mollisol	Auftauboden/Mollisol	capa activa	деятельный слой
active layer, relict	couche active relique/ paléomollisol	Auftauboden, reliktisch/ Paläomollisol	paleo-capa activa	деятельный слой, реликтовый
active-layer failure	décollement dans la couche active/ rupture de mollisol	Auftauboden-Rutschung	ruptura o deslizamiento de la capa activa	смещение грунтов деятельного слоя
adfreeze/ adfreezing	géli-adhérence/ congélation adhérente	Anfrieren	congelamiento adherente	сцерзаться/ смерзание
alas/alass	alass	Alas/Alass	alass	алас
beaded stream/ beaded drainage	cours d'eau en chapelet	Perlschnurent-wässerung	drenaje en cuentas de rosario	четковидный водоток
block field	champ de blocs	Felsenmeer	campo de bloques	каменное (глыбовое) поле

Periglacial Environments (IPA) and Commission on Frost Action Environments (IGU)

The Working Group and Commission operate as a joint organization to promote meetings, field excursions, discussion sessions and research initiatives, and to provide a source of information on periglacial research. The primary aim is to study, in both field and laboratory, the dynamics of the processes associated with frost action, and the nature of the landforms and sediments which result. A subsidiary aim is to continue paleogeographic reconstruction of the cold environments of the Quaternary, based on continued refinement of diagnostic criteria for, and climatic implications of, present day permafrost.

Recent Meetings

Workshop on Cold Regions Mechanical Weathering, April 29–May 1, 1991, Caen, France. Organized by K. Hall, South Africa, and J.-P. Lautridou, Centre de Géomorphologie du CNRS, Caen. The workshop, jointly sponsored by the IGU Commission on Frost Action Environments and the IPA Working Group on Periglacial Environments, consisted of two days of papers followed by a tour of the impressive experimental facilities for studying frost phenomena in soils, as well as in rocks, at the Centre de Géomorphologie and a field trip to examine sections on the Contentin Peninsula, Normandy. The 49 participants from 13 countries included geographers, geologists and engineers, showing that interest in frost action remains cross-disciplinary. The 19 papers presented were grouped under headings of 1) Paleoperiglacial mechanical weathering, 2) Frost shattering experiments, 3) Gelifraction mechanisms, 4) Models of frost shattering, and 5) Frost shattering at high altitude or high latitude.

The overriding impression of the presentations and the discussions that followed them is that much remains to be discovered about weathering, both mechanical and chemical, in cold regions. Many processes can be active, including freezing and thawing of water, thermal contraction and expansion, hydration, and salt weathering. Moreover, the significance of each of these is dependent on the frequency and magnitude of external variables and the internal characteristics of the rock. Particularly promising research trends include: 1) more detailed and more complete recordings of temperature and moisture in the field, both in and out of rock samples; 2) more care in field studies in distinguishing between the breakdown of rocks due to frost and the dislodgement of previously fractured rock fragments from rock faces, 3) more precise laboratory experiments to clarify how the freezing process actually induces weathering as a function of rock type and external variables, and 4) more interaction between theoretical analyses, laboratory studies and field observations. The greatest challenge is to apply the sophisticated techniques that allow control in laboratory experiments to the collection of comparable field data.

Abstracts were available at the meeting and can be obtained from Centre de Géomorphologie. A special issue of *Permafrost and Periglacial Processes* on Cryogenic Weathering is being planned as a proceedings volume.

Report by
Toni Lewkowicz, University of Toronto
Bernard Hallet, University of Washington

Periglacial Environments in Relation to Climatic Evolution, May 3–6, 1991, Maastrich-Amsterdam, The Netherlands. Organized by the Free University, Amsterdam. Three days of excursions focused especially on aeolian and fluvial paleoenvironments in relation to climatic evolution, climatically induced changes in fluvial systems, transitional fluvial-aeolian environments, and different aeolian environments. The formation and preservation of specific periglacial phenomena (wedges, cryoturbations, ground ice) were demonstrated. The one-day paper session was introduced by guest speaker Prof. J. Oerlemans ("On the Meteorological Conditions Near Ice Sheet Margins") and consisted of 23 lectures and posters from all continents on four themes: periglacial environmental process, periglacial slope and planation development, periglacial sedimentary structures, and periglacial environments and processes around the last glacial maximum. The diversified experience of the participants resulted in fruitful discussions both in the field and during the paper session, and it may be concluded that progress has been made in the understanding of past and present changes in periglacial environments as a function of climate. Proceedings of the contributions and specific topics from the excursions are planned for publication in *Permafrost and Periglacial Processes* and in *Geologie en Mijnbouw*.

Report by
J. Vanderberghe, Symposium Coordinator

Future Meetings and Field Trips

Permafrost and Periglacial Environments in Mountain Areas, September 16–20, 1991, Hotel Mattenhof, Interlaken, Switzerland. Convened by W. Haeberli, Zurich, Switzerland. This is to be a joint conference with the IPA Working Group on Mountain Permafrost. Topics will include distribution of mountain permafrost, mapping periglacial landforms in mountain areas, permafrost creep on steep slopes, rock glaciers, permafrost–glacier relationships, mountain permafrost and climatic change, natural hazards, effects of tourism, and construction in mountain permafrost. Details and registration forms from W. Haeberli, Head, Section of Glaciology, Laboratory of Hydraulics, Hydrology and Glaciology, ETH-Zentrum, CH-8092 Zurich, Switzerland.

Alberta Rocky Mountains Field Trip, July 27–31, 1992. Organized by S. Harris, Calgary, Alberta, Canada. This is a joint field trip of IGCP Project 297 and the IPA Working Group/IGU Commission to view rock glaciers, patterned ground, thermokarst, slope processes, and glaciers. Details are available from Dr. S. Harris, Department of Geography, University of Calgary, Calgary, Alberta T2N 1N4, Canada.

Pre-IGU Congress Field Trip to Colorado, August 1–9, 1992, INSTAAR Mountain Research Station, Indian Peaks, Colorado. Organized by Colin Thorn, Illinois. Point of arrival/departure: Stapleton International Airport, Denver, Colorado. Accommodations: Mountain Research Station, Institute of Arctic and Alpine Research, University of Colorado. Program: strenuous day-long hikes to elevations of 3750 m. Good boots and rain gear needed. Weather sunny and hot, with afternoon thunderstorms.

Day 1: Arrive.
Day 2: Patterned ground and solifluction, Niwot Ridge. Leader: James B. Benedict.
Day 3: Patterned ground and solifluction, plus archaeological (paleo-Indian) site used in lichenometric studies, Albion–Kiowa Saddle. Leader: James B. Benedict.
Day 4: Periglacial geomorphology and hydrology of Green Lakes Valley. Leader: Nel Caine.
Day 5: Excursion to Rocky Mountain National Park: alpine tundra, panoramic views.
Day 6: Arapaho Col and Arapaho Cirque: periglacial geomorphology. Leader: James B. Benedict.
Day 7: White Rocks: patterned ground due to desiccation. Day includes free time in Boulder. Leader: Colin Thorn.
Day 8: Niwot Ridge to D1 weather station: soils, nivation, aeolian activity, vegetation, activity of pocket gophers. Leaders: Colin Thorn and Scott Burns.
Day 9: Depart.

Cost $400 U.S., deposit $100. Further details from Dr. Colin Thorn, Department of Geography, University of Illinois, 220 Davenport Hall, 607 South Matthews Street, Urbana, Illinois 61801, U.S.A.

IPA Periglacial Working Group/IGU Periglacial Commission Paper Session, August 9–14, 1992. To be held during IGU Congress, Washington, D.C., U.S.A. Organizer: Dr. Colin Thorn (address above). Session One, Periglacial Geomorphology, will be open to anyone to make a presentation on any aspect of periglacial geomorphology. Session Two, Predicting Periglacial Phenomena, will focus upon all aspects of modeling periglacial phenomena. Abstracts should be sent to Colin Thorn by July 1, 1991. You will be informed during July if your paper has been accepted. The abstract plus $100 deposit must then be submitted to the IGU Congress by October 9, 1991. Further details in IGU prospectus.

Post-IGU Congress Field Trip to Appalachians, August 14–18, 1992. The route extends northeastward through the Piedmont province in Maryland, Pennsylvania, and West Virginia.

Day 1: Block fields and block streams, including Hickory Run boulder field.
Day 2: Ridge and Valley Province, central Pennsylvania: patterned ground, grezes litees and colluvial soils.
Day 3: Maryland and West Virginia, Allegheny Front and Appalachian Plateau Province: sorted patterned ground, cryoplanation and soils.
Day 4: Transect of Ridge and Valley Province, Shenandoah National Park, and elective visit to Luray Caverns.

Cost $550 U.S., deposit $100.
Further details and booking forms from Dr. G.M. Clark, Department of Geological Sciences, The University of Tennessee, Knoxville, Tennessce 37996-1410, U.S.A.

Future Circulars

Please send notices, news items, etc. to the Secretary, Dr. Charles Harris. Interested persons not currently on the list of corresponding members, but who wish to participate in the activities of the Joint IGU Commis-

sion on Frost Action Environments and IPA Working Group on Periglacial Environments, please also contact the secretary. President: Dr. Jean-Pierre Lautridou, Directeur, Centre de Géomorphologie du CNRS, Rue des Tilleuls, 14000 Caen, France. Secretary: Dr. Charles Harris, Department of Geology, University of Wales, College of Cardiff, P.O. Box 914, Cardiff CF1 3YE, U.K.

Foundations and Construction in Permafrost

The Working Group co-organized the International Symposium on Foundations and Climate Changes in the Arctic, Norilsk, U.S.S.R., May 28–31, 1991. Members present included Academician P.I. Melnikov (Chairman, U.S.S.R.), Kaare Flaate (Secretary, Norway), and Rupert Tart (U.S. member). Numerous Soviets included in the activities of the Working Group were present, including N.A. Grave, S. S. Vyalov, L.N. Khrustalev, I.K. Rasstegaev, R.M. Kamensky and K.F. Voytkovsky, among others.

The seminar was organized by Norilsk Mining and Metallurgical Works; Siberian Branch, U.S.S.R. Academy of Sciences; the International Permafrost Association; and Norilsk Construction Engineering Center of the U.S.S.R. Academy of Engineering. The Organizing Committee consisted of:

P.I. Melnikov, Chairman, U.S.S.R. Academy of Sciences, Moscow
V.M. Karavayev, Chairman, Norilsktroy Association Board, Norilsk
I.K. Rasstegaev, Corresponding Member/Scientific Secretary, U.S.S.R. Academy of Engineering, Norilsk
N.A. Grave, Scientific Secretary, U.S.S.R. National Committee on Permafrost, Moscow

Norilsk is the largest city in the world which is founded on permafrost. This seminar was the first ever held in Norilsk, which has been a closed city since the 1930s. The Soviets, particularly Dr. Rasstegaev, Mr. Karavayev, and the others from Norilsk, went to extraordinary efforts to be open about their facilities and their technology. Tours included visits to Taimyr-

Group photographs of participants in the international seminar on foundations, structures, and environment in the cryolithic zone under forecasted global climate warming and soil temperature increase in the next 30 to 50 years. Above: Foreign visitors include Tart and Collins, U.S.; Harris, Lagarec and Joshe, Canada; Flaate, Norway; Svensson, Sweden; Hong and Go, Korea. Rasstegaev, Voytkovsky and Melnikov are among Soviets in the front row. Facing page: Group of visitors in the Taimyrsky Mine.

sky Mine, Nadeshda Smelter, and a construction site where piles were being installed in permafrost.

Permafrost specialists from the U.S.S.R., Canada, U.S.A., Norway, Sweden and Korea were present. Twenty presentations were given, including 14 by Soviets. About 50 people attended, nine of whom were foreign.

Of primary concern were development of an international consensus on the significance of the impacts of global warming on permafrost structures and determination of what new technologies are necessary to address these impacts.

The technical information can be grouped into the following categories:

- Predictions of global warming and ground temperatures
- Relative significance of global warming
- Engineering methods to mitigate the effects of global warming

Academician Melnikov started the seminar with a proposal that an international permafrost institute be established where world-renowned specialists could work together to address permafrost problems. The first major task of the institute would be further research into the impacts of global warming on permafrost foundations.

Prediction of climatic warming was addressed by V.V. Romanovsky, A.A. Velichko, A.V. Pavlov, S.A. Harris, D. Lagarec and others. The general consensus was that there is a potential for global warming.

Prediction of the rate and amount of ground temperature change was discussed by A.V. Pavlov, S.A. Harris and several others. The consensus was that no model is currently available to reliably relate global warming to specific ground temperature variations.

L.N. Khrustalev proposed statistical and reliability methods for use in addressing global warming impacts on foundations so that the relative effects of climatic warming could be compared to other influences.

V.H. Grebenets, I.K.Rasstegaev, R. Tart, I.I. Mazoor, K.F. Voytkovsky and others presented examples of projects where other influences, particularly those of man, were much more significant than the influence of global warming.

Finally, methods of engineering for global warming were presented. G.M. Dolguikh introduced 1000-m-long thermosyphon systems. I.K. Rasstegaev discussed ventilation of Norilsk basements. R.G. Tart and others discussed mechanical refrigeration systems.

No formal conclusions were reached. It is anticipated that the IPA Working Group will hold future discussions in China in 1993 if no other appropriate forums develop before then.

Report by
Rupert G. Tart, Jr.
Golder Associates Inc., Anchorage, Alaska

NEWS FROM MEMBER COUNTRIES

CHINA

Chinese–Soviet Joint Investigations

Joint investigations on alpine permafrost in Central Asia were begun in 1991 by the Lanzhou Institute of Glaciology and Geocryology, Academia Sinica, and the Permafrost Institute of the Siberian Branch, U.S.S.R. Academy of Science. The participants include A.P. Gorbunov, E.D. Ermolin, S.H. Titkov and others from the Soviet Union and Qiu Guoqing, Zeng Zonggong, Wang Shujiun, Zhao Lin and Jin Huijun from China. The 1991 work, focused on the Zailiiski Alatau of the Soviet Union, Mounts Tianger and Western Bogeda in China, includes observations, drilling, electrical sounding and excavations.

A result of the 1991 investigations is improved understanding of periglacial phenomena: e.g., the perennial ice-cored frost mound at the Chinese Tianshan Glaciological Station, and palsa, ploughing stone and polygons in Western Bogeda. A group of polygonal cracks filled with humic soil was dated at 4656±93 B.P. in the eastern Zailiiski Alatau. At the Chinese Tianshan Glaciological Station the finding of buried humic soil horizons indicated thickening of the permafrost, with the sediment aggrading since 4301 ±96 B.P.

By comparative investigation it is known that the formative conditions of permafrost vary between the Zailiiski Alatau and Mt. Tianger areas. In the former, precipitation is concentrated in the cold season, forming a thick snow cover unfavorable for ground freezing; in the latter, however, winter snowfall is low, freezing penetrates the ground to a considerable depth, and the snowfall in summer is favorable for the preservation of frozen ground. At a similar latitude the lower limit of alpine permafrost is higher for the Zailiiski Alatau, and at similar elevation the permafrost is thicker and colder on Mt. Tianger. Under the comprehensive effect of several factors (e.g. earthquakes, rockfalls, precipitation, glaciation and freezing), many "near-glacier" large and fast-moving rock glaciers are developed in the Zailiiski Alatau, while on Tianger there are only a few "near slope," smaller and slowly moving rock glaciers. Sporadic permafrost was found in coarse-blocked sediment in the shadows of trees and under moss cover on the north-facing slopes of the Zailiiski Alatau at elevations as low as 1850 m. As a result of the 1991 joint work, the first issue of *Alpine Permafrost Studies in Central Asia* will be published in early summer of 1992.

In accord with an agreement between the State Key Laboratory of Frozen Soil Engineering (National Frozen Soil Engineering Laboratory), the Lanzhou Institute of Glaciology and Geocryology (LIGG), the Chinese Academy of Sciences, and the Department of Geology, Moscow State University (MSU), U.S.S.R., a joint research programme was started in 1990 in the fields of physics and mechanics of frozen soils. Last year two experts, Dr. IU.P. Lebedenko and Dr. L.T. Roman, came to LIGG, and Associate Professor Xu Xiaozu went to MSU. Researchers from both sides worked together and conducted many interesting and significant tests.

In the State Key Laboratory in China experiments on water and solute migration in frozen soils in an open system and under temperature gradients were carried out successfully. Compared with tests carried out by the Department of Geology, MSU in 1973, the sample sizes were about 20 times larger than the earlier ones and the temperature gradients used were 20 to 50 times lower. Gas hydrate was artificially synthesized and its unfrozen water content determined by the nuclear magnetic resonance (NMR) technique. Using scanning microscope techniques, it was found that ice accumulates at the outer side of a model-test frozen silt wall under confining pressure acting on the inner side of the wall. Roman and Zhu Yuanlin found that the creep test data fit Roman's long-term strength model very well.

In the Laboratory of the Department of Geology, MSU, Xu Xiaozu and Dr. Chuvilin studied the interface conditions of frozen soils using an electronic microscope. They found that the shape of unfrozen water surrounding frozen soil particles was basically divided into three types—smooth, winding and overflowing—and was dependent on factors such as soil type, temperature, solute type and solution concentration.

International joint research is considered very helpful in the development of permafrost studies, and it is hoped that the IPA will also organize similar joint research on some important subjects in this field.

Prepared by
Cheng Guodong

FRANCE

The Arctic Studies Centre
(Centre d'Etudes Arctiques)
The Arctic Studies Centre, founded in 1957 by its Director, Professor Jean Malaurie, at the "Ecole des Hautes Etudes en Sciences Sociales" (EHESS), is the only French organization offering a multidisciplinary program of Arctic research. In 1980, the Centre became a CNRS–EHESS Associated Unity in the framework of the "Centre National de la Recherche Scientifique" (CNRS).

The Centre coordinates work dealing with Arctic research of 12 laboratories at the University and at the CNRS (Besançon, Bordeaux, Caen, Grenoble, Lille, Meudon, Paris). Forty advanced investigators are involved in research programs concerning the earth, life and social sciences:

- Earth sciences research is mainly directed toward geomorphology (M.-F. André, T. Brossard, B. Vliet-Lanoë), topoclimatology (D. Joly, C. Kergomard), and the study of microfaults along the Fram Strait (C. Lepvrier).
- Life sciences research principally concerns human chronobiology.
- Social sciences studies deal with anthropogeography, ethno-geomorphology and problems linked with development.

A scientific club, founded in 1983, promotes links between French researchers and industrialists. The club meets from two to four times a year, allowing 50 people to exchange ideas and knowledge, under the chairmanship of a banker, about different topics such as oil and gas prospects, ice properties, human chronobiology, ozone layer holes, circumpolar Native educative programs, etc.

The Centre houses the French Permafrost Association, a member of the International Permafrost Association. The Committee heading the French association comprises J. Aguirre-Puente, A.M. Cames- Pintaux, J.P. Lautridou and J. Malaurie.

One-hundred-thirty-six scientific Arctic expeditions have been carried out since 1957. Sixty-four of them have been mounted from the "Charcot" French Research Station in Svalbard and have dealt with botany, climatology, geology, geomorphology, glaciology, remote sensing, etc.

The Arctic Studies Centre has organized 14 international conferences (one every two years), such as the first international meeting on Arctic oil and gas (1973), an international congress on problems raised by frost action (rocks and artificial building materials) (1975), and another on North Pole problems (1983).

The Centre has provided for publication of some 70 books. In addition to five conference proceedings, the Centre publishes the annual multidisciplinary scientific journal *Inter-Nord* (18 issues since 1957, with print runs of 1200 copies), which presents papers in French and English written by international specialists on earth, life and social sciences as well as on Arctic technology. Fifty-three theses have been submitted since the creation of the Centre.

The Centre's library, holding nearly 40,000 documents—books, reprints and periodicals, of which 200 concern Arctic serials—is the only one in France covering all fields related to the Arctic regions.

Submitted by
Prof. A.M. Cames-Pintaux, Secrétaire Général

on behalf of

Professor Jean Malaurie, Director
Association Française du Pergelisol
Centre d'Etudes Arctiques du CNRS

GERMANY

The 1991 German geoscientific expedition to northern Spitsbergen will take place from May 15 to August 21, 1991. It is supported mainly by the Deutsche Forschungsgemeinschaft (DFG). As in 1990, some 45 geographers, geologists and biologists will visit the Liefdefjorden area and conduct research under the general topic "Land–Sea Sediment Transport in Polar Geosystems." Permafrost-related topics are mainly treated by L. King, Giessen (glacial geomorphology and ground ice), H. Liedtke, Bochum (periglacial geomorphology), and G. Stäblein, Bremen (permafrost mapping). The complete list of working groups was published in *Frozen Ground, No. 8*. Some working groups intend to continue their permafrost-related research on Svalbard in 1992.

On the engineering side, and with respect to artificial ground freezing, investigation of the properties of frozen soil continued at several university institutes. Deep shafts in frozen ground are under construction;

the shaft of Rheinberg especially deserves mention. Artificial ground freezing also is used frequently in tunneling. For a major project the main problems are the drilling of roughly 100-meter-long horizontal freeze pipes and the increase of water content needed to achieve the required strength of the frozen ground above the water level.

Another field of research for engineers is investigation of the frost susceptibility of mineral layers within the sealing systems of landfills. In central Europe this problem is serious, especially in the construction phase, when the mineral lining system is not covered.

Prepared by
Prof. Dr. Lorenz King

POLAND

The Commission on Permafrost Problems at the Committee on Polar Research of the Polish Academy of Sciences continues its activities in Poland. In 1990 a long-term permafrost research program was continued in two areas of western Spitsbergen. In the Hornsund Fiord, at the Research Station of the Polish Academy of Sciences, measurements of the ground thermal conditions and dynamics of the permafrost active layer were conducted in conjunction with studies of the hydrometeorology of the area (M. Pulina, J. Pereyma, J. Klementowski, K. Migala). Similar studies were conducted in the Bellsund Fiord (K. Pekala), with particular attention being paid to conditions of the permafrost environment (soils, ecosystem). Different studies, based at the Research Station of Stockholm University in Tarfal's Valley, were carried out in the mountain massif of Kebnekajse, Swedish Lapland, in a discontinuous permafrost area. Measurements of soil movement begun in 1982 were completed, with the data providing a clearer estimation of the dynamics of the frost creep process (A. Jahn).

Members of the Commission traditionally meet in Lublin, supported by the University, which is very active in polar matters. This past year's seminar was devoted to periglacial problems. A book entitled *Polar Session, Periglacial Phenomena of Western Spitsbergen* (Institute of Earth Sciences, M. Curie–Sklodowska University, Lublin, 1990) was published as a result of this meeting. It contains 29 reports and two color maps and summarizes Commission activities.

Members of the Commission of Permafrost Problems:

Prof. A. Jahn	Geographical Institute University of Wroclaw
Prof. Kazimierz Pekala Prof. Marian Harasimiuk	Institute of Earth Sciences of M. Curie–Sklodowska University ul. Akademicka 19 20-033, Lublin
Prof. Zdzislaw Czeppe	Institute of Geography Jagiellonian University ul. Grodzka 64 31-044 Kraków
Prof. Andrzej Karczewski Prof. Andrzej Kostrzewski Prof. Stefan Kozarski	Quaternary Research Institute, A. Mickiewicz University, ul. Fredry 10 61-701, Poznan
Prof. Leszek Lindner	Institute of Geology Warsaw University al. Zwirki i Wigury 93 02-089 Warsaw
Prof. Marian Pulina	Faculty of Earth Sciences University of Silesia ul. Mielczarskiego 60 41-200 Sosnowiec
Prof. Jan Szupryczynski	Institute of Geography Polish Academy of Sciences ul. Kopernika 19 87-100 Torun
Prof. Gabriel Wójcik	Institute of Geography M. Copernicus University ul. Fredry 8 87-100 Torun
Dr. Jan Gozdzik	Institute of Geography University of Lódz al. Kosciuszki 21 90-418 Lódz

Prepared by
Prof. A. Jahn

U.S.S.R.

A seminar on "Rational Methods of Land Use in the Cryolithozone" was held in Yakutsk, June 1990, at the Permafrost Institute of the Siberian Branch of the U.S.S.R. Academy of Sciences. About 150 specialists from the Academy of Sciences, Gosstroi of the U.S.S.R. and the RSFSR, Moscow State University, and other agencies were present. The impact of global climate changes on large reservoirs, linear constructions, agricultural activity and landscapes in the cryolithozone was discussed.

A conference on "Geotechnical and Geocryological Problems" was held in Chita (eastern Siberia) in October 1990. Foundations and basements on permafrost and properties of frozen and frost-susceptible soil were discussed.

Internationally, joint projects were developed between the Permafrost Institute, the Institute of Northern Development of the Siberian Branch of the U.S.S.R. Academy of Sciences and the Institute VSEGINGEO of the Ministry of Geology and the Geological Survey of Canada, Ecole Polytechnique of Montreal and the Institute of Low Temperature Science, Hokkaido University. Installation of special stations in comparable regions of the U.S.S.R. and Canada is planned for 1991–1992 to test geophysical, geotechnical and specialized geocryological methods of studying permafrost zones and to monitor permafrost regimes.

Following the recommendation of the IPA Working Group "Foundations and Construction in Permafrost," an international seminar on the problem of the impact of the predicted climate warming on construction on permafrost was organized by the U.S.S.R. National Permafrost Committee in Norilsk (Central Siberia, Krasnoyarsky region) in May 1991 (see Working Group report).

Four Soviet scientists took part in the meeting "One Hundred Years of Polar Research " held at the Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, U.S.A., June 1990. The Soviet guests presented reports and warmly greeted Dr. A.Assur, in whose honor the meeting was held and who had for many years assisted with Soviet–American contacts in the field of geocryology.

Soviet scientists took part in final drafting of the report *Environmental Impacts and Socio-economical Consequences of Climatic Changes in Seasonal Snow Cover, Ice and Permafrost*, included in the General Report for the Second World Climate Conference in Geneva, Switzerland, November 1990.

Three books were published by the Permafrost Institute (Yakutsk) in 1990:

- *The Stabilization of Frozen Ground in the Basement of Buildings*, by L. Khrustalev and V. Nikiforov, Novosibirsk, Nauka.
- *Pile Foundations on Thawing Soil*, by V. Torgashev and P. Salnikov, Yakutsk.
- *Snow Cover and Seasonal Freezing of Soil in the Northern Tyan-Shan*, by I. Severski and E. Severski, Yakutsk.

Prepared by
N.A. Grave

The All-Union Research Institute of Hydrology and Engineering Geology

The All-Union Research Institute of Hydrology and Engineering Geology (VSEGINGEO), Ministry of Geology, located in the Noginsk District of the Moscow region, has a staff of about 100 undertaking the following programs on geocryology.

Complex geocryological and hydrogeologic study and mapping of the upper rock horizons of the Arctic permafrost zone, including nature conservation zoning and geological environment mapping: The technology consists of a complex of methods for obtaining geocryologic regional information necessary for rational placing of engineering objects, economical permafrost drilling, and working out measures for nature conservation. It includes the analysis and generalization of available regional information; complex hydrogeological and geocryological survey at any scale using aerial and satellite photography; high-frequency profiling and other geophysical methods; deep well observations, short-term monitoring of geocryologic processes and development of a system of applied programs and prediction of possible changes in the geocryological conditions under human impact. Use of geocryologic maps obtained for finding optimal routes of linear structures and optimal placing of settlements results in savings of 30% of building expenditures. The technology for compiling nature conservation maps (sensitivity maps) at different scales has been successfully used in oil and gas development areas in West Siberia.

Study and mapping of geocryological conditions when exploring placer deposits in permafrost zones: The technology obtains, rationally and economically, information on geocryological conditions needed for

deposit mining, including temperature, icing and geocryologic properties of ice-rich loose rocks, and possible cryogenic physical and geological processes.

Technology of control for thermodenudation processes under placer surface mining in the Arctic aimed at a higher efficiency for mining enterprise and environmental preservation: The technology was developed in northern Yakutia for control of thermodenudation processes on slopes (opencast flanks), especially those containing ice-rich rocks, making it possible to reduce the volume of the loose material from the flanks (slopes of open pits) and washing under placer deposits, and also to reduce effects in neighboring open-water reservoirs and channels.

Consulting on territory recultivation following placer deposit mining in permafrost: The methods allow the selection of the best variants for recultivation of mined territories containing ice-rich rocks.

Determining the reliability of landscape indication for engineering and geocryological conditions: This method permits determination of the reliability of landscape indicators for temperature, rock composition and properties and possible limits of their changeability based on mathematical analysis of geological conditions.

Predictions of cryogenic crack parameters in permafrost rocks: The CRACK program allows calculation of cryogenic crack formation, depth and width, for ground with a given composition and under given climatic conditions, including snow cover. The program can be used for predicting cryogenic cracks in soil plots, embankments, roadways and runways.

Accelerated high-frequency electric profiling equipment (HFEP): HFEP technology is a modified electric profiler (EP) and is based on the use of capacitance lines of 8 to 10 meters length. A 20- to 30-meter interval of depth is used. Geological problems solved with HFEP and EP methods are the same. HFEP technology is more effective as compared to EP when working in dry sands, gravels and stone streams for making measurements from frozen ground and snow cover surface. HFEP productivity is from three to four times higher and cost is three times lower than that of EP using alternating current.

Stationary investigations and predictions of freezing and thawing processes and thermal regime of rocks in permafrost zones: The technology allows observation of freezing and thawing processes and a change of temperature in permafrost zones in time and also prediction of these changes on the basis of data observed. It consists of a) studying cryogenic composition of seasonally thawed or seasonally frozen rock layers; b) instrumental observation of rock temperature, depth of thawing and surface deformation; c) calculation of seasonal thawing and freezing depth, considering surface covers such as snow, vegetation, asphalt, etc.; and d) prediction of rock temperature regime changes under given human impact on the surface. Its use is necessary for any type of building and agricultural land use in permafrost zones.

Prediction of stresses in the walls of cold underground gas lines, caused by cryogenic cracks and ground heaving: This method permits calculation of possible stresses in the walls of cold underground gas conduits caused by heaving and cracks in the ground, assuming the ground composition and properties, size and depth of gas line, and local climate characteristics such as temperature and snow cover thickness are known.

Laboratory investigations of frozen and thawed rock cryogenic properties: Rock cryogenic properties are studied with complex methods consisting of a) cryoscopic and adsorption–hygroscopic method of nonfreezing water determination; b) a simplified method of determining active specific surface of dispersive grounds and compacted rocks with rigid links; c) method of determining mass transfer coefficients in clayey, sandy and semi-hard rocks; d) relaxation methods of determining deformation and strength factors of frozen ground under tension and side compression; e) method of determining failure viscosity coefficient; and f) method of calculating permafrost thermal heave factors.

Prediction of geocryologic condition changes in permafrost zones under development: This technology allows prediction of rock temperature changes and cryogenic physical and geological processes development depending on a given local human impact. The technology consists of a complex of programs including prediction of snow cover thickness, rock surface temperature, annual average temperature, depth of freezing–thawing, thermokarst, heaving, erosion, cracking, solifluction and others. The technology has been used for nature-preserving aims in areas of oil and gas field development in the north of West Siberia.

Modified from a report by
S.E.Grechishchev, Head
Geocryology Department, VSEGINGEO

MISCELLANEOUS

Mongolian Permafrost

The Institute of Geography and Permafrost Studies, Mongolian Academy of Sciences in Ulaan Baatar, MPR, conducts research and teaches in the areas of geomorphology, soils geography, permafrost, ecology, socioeconomics, geography and cartography. It has soils and permafrost laboratories. Dr. S. Jigj, the Institute's Director, seeks joint projects with geographers, earth scientists, and ecologists, and with organizations willing to help publish several books on the geography and ecology of Mongolia. The Institute is interested in exchanging scientists for research and lecturing.

International Conference on Ground Ice and Cryomorphogenesis

The International Conference on Ground Ice and Cryomorphogenesis will be held at Anadyr, Chukotskiy Peninsula, August 18–25, 1991.

Five sessions will be held with the following themes:

- Theoretical and regional problems of ground ice formation
- Ground ice formation and cryomorphogenesis
- History of ground ice formation and paleocryogenic phenomena
- Isotopic–chemical composition of ground ice and frozen soils
- Ground ice and economic development of the North

The program includes post-conference field trips to:

- Icy complex near the mouth of Anadyr River
- Test sites of Anadyr permafrost station
- Industrial enterprises in Anadyr region
- Sea excursion along the Anadyr Bay coast

The organizers are: Professor E.D.Ershov/Dr. V.E. Roujansky, Department of Geocryology/ Faculty of Geology, Moscow State University, 119899, Moscow, U.S.S.R.

Sixth International Symposium on Ground Freezing

ISGF 91, to be held in Beijing, China, 10–12 September 1991, has five major objectives:

- to bring together those involved with any aspect of artificial ground freezing
- to foster the international exchange begun at previous symposia
- to provide a forum for discussion on theory, application and practice of AGF
- to relate theory more closely with practice
- to highlight areas where further research is needed

The technical sessions consist of:

Heat and Mass Transfer (thermal properties and measurement, frost action in earth materials, mathematical modeling, etc.).

Mechanical Properties (strength and deformation, stress–strain–time behavior changes in mechanical properties by freezing and thawing, standardization of test procedures, etc.)

Engineering Design (refrigeration or cryogenic systems, thermal analysis of frozen structures, structural design, etc.)

Case Histories (tunnels, shafts, inground storage, pipelines, foundations, open excavations, performance and instrumentation, observations, freezing pipe alignment, accidents and treatment, economic comparisons, etc.).

Contact for further information: ISGF 91, Central Coal Mining Research Institute, Hepingli, Beijing 100013, P.R. China, Telex: 22504 CCMRI CN, Fax: 4219234, Telephone: 4214931.

JOURNALS AND BOOKS

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Permafrost and Periglacial Processes

Volume 2, Issue No. 1
Devoted to papers from the southern hemisphere, which, up until now, has not seen extensive permafrost and periglacial research. The papers were all presented at the international meeting held in South Africa in September 1990 under the auspices of IGCP Project 297, Geocryology of the Americas, and constitute a useful state of the art summary of current knowledge of the cold conditions, both past and present, which characterize parts of two of the southern continents, excluding Antarctica.

Present-Day Periglacial Activity in the Natal Drakensberg, Southern Africa: A Review; J. Boelhouwers.

Periglacial Evidence from the Western Cape Mountains, South Africa: A Progress Report; J. Boelhouwers.

The Evidence for Cirque Glaciation in Lesotho; M.M. Marker.

Sedimentology and Genesis of Slope Deposits at Sonskyn, Eastern Cape Drakensberg, South Africa; P.M. Hanvey and C.A. Lewis.

Quaternary Fan and River Terrace Deposits in Glen Orchy, Barkley Pass Area, East Cape Drakensberg, South Africa; C.A. Lewis and P.M. Hanvey.

Cryoplanation Surfaces in the Central Andes at 35° South Latitude; S.A. Grosso and A. Corte.

Global Solar Radiation, Soil Temperatures and Permafrost in the Central Andes: A Progress Report; L. Schrott.

Volume 2, Issue No. 2
Caracterisation du Pergélisol de Buttes Cryogènes à l'Aide de Diagraphie Electriques au Nunavik, Québec; R. Fortier, R. Levesque, M.-K. Seguin and M. Allard.

Solifluction and the Role of Permafrost Creep, Eastern Melville Island, N.W.T., Canada; L.P. Bennett and H.M. French.

Thermal Gradients and Rock Weathering at Low Temperatures: Some Simulation Data; K. Hall and A. Hall.

Absence of Frost Sorting at an Experimental Site, Green Lakes Valley, Colorado Front Range, U.S.A.; J. Warburton.

Differential Frost Heave, Loadcasting and Convection; Converging Mechanisms: A Discussion of the Origin of Cryoturbations; B. van Vliet-Lanoe.

A Periglacial Stratified Slope Deposit in the Valley and Ridge Province of Central Pennsylvania, U.S.A.: Sedimentology, Stratigraphy and Geomorphic Evolution; T.W. Gardner, J.B. Ritter, C.A. Shuman, J.C. Bell, K.C. Sasowsky and N. Pinter.

The Holocene, 1st Issue 1991

The Holocene is the first journal dedicated to fundamental scientific research at the interface between the long Quaternary record and the natural and human-induced environmental processes operating at the Earth's surface today. *The Holocene* emphasizes environmental change over the last 10,000 years—the most recent geological epoch and the most relevant time span for understanding the future environments of the human species. The journal will reflect the wide range of important and exciting interdisciplinary research being carried out in this field, and its coverage will be world-wide.

The Holocene will encompass the following subjects:

- the geological, biological and archaeological evidence for recent environmental change
- paleoclimatic and related environmental changes on a time scale of decades, centuries and millennia, including directly observed changes
- interdisciplinary studies of environmental history and prehistory
- the use of modern analogues to elucidate the paleoenvironmental record
- techniques for reconstructing, dating, monitoring and modeling environmental change
- the nature, processes, mechanisms and causes of natural and human-induced environmental change
- the development of natural and cultural landscapes and ecosystems
- paleoenvironmental and historical perspectives on global environmental changes and their effects
- the prediction of future changes in the environment from the record of the past

Subscriptions available from Edward Arnold Journals, Hodder & Stoughton Publishers, Dunton Green, Sevenoaks, Kent TN13 2YA, United Kingdom, or Cambridge University Press, 40 West 20th Street, New York, New York 10011-4211.

Institutions $145.00; Individuals $57.00; Members $50.00

Drilling in the Permafrost

The book *Drilling in the Permafrost (Burenie Skvazhin v Merzlykh Porodakh)*, by B.B. Kudryashov and A.M. Yakovlev, originally published by Nedra Publishers, Moscow, 1983, has been translated by Amerind Publishing Co. Pvt. Ltd., New Delhi, 1990. It will be available as NTIS TT 87-001-101 from the National Technical Information Service, Springfield, Virginia 22161, U.S.A.

Heat Transfer

Heat Transfer with Freezing and Thawing, by V.J. Lunardini, 1991, Elsevier Science Publishers, P.O. Box 330, 1000 AH Amsterdam, The Netherlands. U.S. $151.50; DFl. 265.00.

Proceedings of the Third International Symposium on Cold Regions Heat Transfer

Approximately 65 delegates from the U.S., Japan, Europe, and the Soviet Union attended and presented papers on a wide range of cold regions thermal engineering and science topics. The overall purpose of the symposium was to bring together researchers and engineers from all over the world who are active in the area of cold regions heat transfer and thermal engineering. The symposium served as a forum for the exchange of ideas and experiences in cold regions heat transfer research, as a means to encourage cooperation and stimulation of future research, and as a way to allow international fellowships to occur and friendships to be made. The forum provided an environment for the review and dissemination of recent engineering, scientific, and technical information related to all aspects of heat transfer in cold climates.

The symposium covered all aspects of heat transfer and thermal engineering in cold climates. Five subject areas had been identified by the International Organizing Committee as high priority for state-of-the-art presentations. Internationally recognized authorities were invited to present state-of-the-art papers on these subject areas:

- *Phase Change in Porous Media*
  by Professor Raymond Viskania
  Department of Mechanical Engineering
  Purdue University, U.S.A.

- *Icing Phenomena and Frost Formation*
  by Professor Edward Lozowski
  Department of Geography
  University of Alberta, Canada

- *Micro-Macro Freezing of Biological Substances*
  by Professor Y. Hayashi
  Department of Mechanical Systems Engineering, Kanazawa University, Japan

- *Thermal Properties and the Nature of Freezing Soils*
  by Professor Peter J. Williams
  Geotechnical Science Laboratory
  Carleton University, Canada

- *Recent Studies on Combined Contact and Natural Convection Melting*
  by Professor T. Saltoh
  Department of Space and Aeronautical Engineering, Tohoku University, Japan

Cost: U.S. $50.00
Contact: Stephanie Faussett, Publications, Institute of Northern Engineering, University of Alaska Fairbanks, Fairbanks, Alaska 99775-0660, U.S.A.

Strength of Frozen Soils Under Variable Temperature

Strength of Frozen Soils Under Variable Temperature, by A.A. Konovalov, will be published in the third quarter of 1991 by Nauka Publishing House, Novosibirsk. The book contains characterization principles and evaluation procedures for temperature fields in frozen ground formed by seasonal and multiseasonal climatic fluctuations, by the influence of engineering structures, and by the action of cooling or heating systems. The formulas developed make it possible to calculate correction coefficients to be applied to the U.S.S.R. Construction Codes on Permafrost (SNIP). Rapid methods are presented for evaluating the strength properties of frozen soils and frost heaving forces.

Calendar of Recent and Forthcoming Meetings

1991

Sixth International Conference on Cold Regions: Cold Regions Engineering Technology for the 21st Century
26–28 February 1991
Contact: Devinder Sodhi, CRREL, 72 Lyme Road, Hanover, N.H., 03755-1290, U.S.A.
Phone: (603) 646-4100; Fax: (603) 646-4278.

Workshop on Cold Regions Mechanical Weathering
29 April–1 May 1991, Caen, France
Contact: J-P. Lautridou, Centre de Géomorphologie, CNRS, Rue de Tilleuls, Caen 14000, France.

Periglacial Environments in Relation to Climatic Evolution
3–6 May 1991, Amsterdam, The Netherlands
Contact: Prof. J. Vandenberghe, Institute of Earth Sciences, Free University, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands.

International Arctic Technology Conference
29–31 May 1991, Anchorage, Alaska, U.S.A.
Contact: Society of Petroleum Engineers, PO Box 833836, Richardson, Texas 75083-3836, U.S.A.
Telex: 730989 Spedal; Fax: (214) 669-0135.

International Seminar on Permafrost Problems
27–30 May 1991, Norilsk, U.S.S.R.
Contact: P.I. Melnikov, 11 Fersman St., U.S.S.R. National Permafrost Committee, 117312 Moscow, U.S.S.R.
Phone: 124 54 22; Fax: 292 6511 (2181) Permafrost;
Telex: 411 700 (2181) Permafrost

Sustainable Development in Circumpolar Regions Conference (postponed)
1–8 June 1991, Surgut, U.S.S.R.
Contact: Organising Committee, 625003, Tyumen, Box 2774, Surgut, Siberia, U.S.S.R.

Third International Symposium on Cold Regions Heat Transfer
12–14 June 1991, Fairbanks, Alaska, U.S.A.
Contact: Stephanie Faussett, Institute of Northern Engineering, University of Alaska, Fairbanks, Alaska 99775-0660, U.S.A.
Phone: (907) 474-6113; Fax: (907) 474-6087.

ISCORD 91, International Symposium on Cold Regions Development
16–21 June 1991, Edmonton, Alberta, Canada
Contact: ISCORD 91, PO Box 8330, Postal Station 'F', Edmonton, Alberta, Canada T6H 5X2.
Phone:(403) 450-5218; Fax: (403) 450-5198;
Telex: 0372147.

Tenth International Conference on Offshore Mechanics and Arctic Engineering
23–28 June 1991, Stavanger, Norway
Contact: Nirmalk Sinha, OMAE/ASME National Research Council of Canada, Ottawa, Ontario, Canada K1A 0R6.

XIII INQUA Congress—Man and Global Change During the Quaternary
2–9 August 1991, Beijing, China
Contact: Secretariat, XIII INQUA Congress, Chinese Academy of Sciences, 52 Sanlike, Beijing, 100864, China.
Phone: (86) 3062, (86) 8361,
Cable: BEIJING SISICADEMY
Fax: 8011095; Telex: 22474 ASCHOCH

First (1991) International Offshore and Polar Engineering Conference
11–16 August, 1991, Edinburgh, U.K.
Contact: ISOPE-91, P.O. Box 1107, Golden, Colorado 80402-1107
Phone: (303) 273-3673; Fax: (303) 420-3760

XX General Assembly IUGG
11–24 August 1991, Vienna, Austria
Contact: F. Nobilis, Hydrographisches Zentralburo, Marxergrasse 2, A-1030 Vienna, Austria.
Phone: +43 222 71100 Ext. 6944. Fax: +43 222 7139311.
and
Symposium on Water and Ice as Geophysical Agent
Contact: J. Klinger, University of Grenoble, CNRS, BP 96, 38402 St. Martin d'Hères, Cedex, France.

International Conference on Ground Ice and Cryomorphogenesis
18–25 August 1991, Anadyr, U.S.S.R.
Contact: E.D. Ershov, Department of Geocryology, Moscow State University, 119899 Moscow, U.S.S.R.
Fax: 7 095 939 0126; Telex: 411 483 MGU 54

Mountain Glaciology—Relation to Human Activities
26–30 August 1991, Lanzhou, China
Contact: Secretary-General, International Glaciology Society, Lensfield Road, Cambridge, CB2 1ER, United Kingdom.
Phone: 223-355974; Fax: 223-336543.

Symposium on the Physics and Chemistry of Ice
1–6 September 1991, Sapporo, Japan
Contact: Norikazu Maeno, Institute of Low Temperature Science, Hokkaido University, Sapporo 060, Japan.

ISGF 91—6th International Symposium on Ground Freezing
10–12 September 1991, Beijing, China
Contact: ISGF 91, Central Coal Mining Research Institute, Hepingli, Beijing 100013, China.
Phone: 421 4931; Fax: 421 9234; Telex: 22504 CCMRI CN.

International Permafrost Association: Permafrost and Periglacial Environments in Mountain Areas
16–20 September 1991, Interlaken, Switzerland
Contact: Laboratory of Hydraulics, Hydrology and Glaciology, Federal Technical Institute, Zurich, Switzerland.

Geotechnica—Trade Fair and Congress for Geosciences and Technology
18–21 September 1991, Cologne
Contact: C.C.M. Cologne Congress, PostFach 19 0180, D-5000 Koln 1.
Phone: (0221) 236413; Fax: (0221) 249447
Telex: 8881783 COHD

Periglacial Geomorphology Symposium
21–22 September 1991, Buffalo, New York, U.S.A.
Contact: Athol Abrahams, Department of Geology, SUNY, Buffalo, New York 14260, U.S.A.
Phone: (716) 636-2722; Fax: (716) 636-2329

Workshop on Canadian Arctic Global Change Research
24–25 October 1991, Ottawa, Ontario, Canada
Contact: Association of Canadian Universities for Northern Studies, 130 Albert Street, Suite 201, Ottawa, Ontario, K1P 5G4, Canada
Phone: (613) 238-3525; Fax: (613) 238-6012

First International Design for Extreme Environments Assembly
12-15 November 1991, Houston, Texas, U.S.A.
Contact: IDEAA ONE Program Office, University of Houston, 4800 Calhoun, Houston, Texas 77204-4431, U.S.A.
Phone: (713) 749-1181; Fax: (713) 747-6230

1992

Polartech '92: International Conference on Development and Commercial Utilisation of Polar Technologies in Polar Regions
22–25 January 1992, Montreal, Canada
Contact: Marianne Stenbaek, Centre for Northern Studies and Research, McGill University, Burnside Hall 720, 805 Sherbrooke St West, Montreal, H3A 2K6 Canada.
Phone: (514)398-6052; Fax: (514)398-8364;
Telex: 05-268510.

Symposium on Remote Sensing of Snow and Ice
17–22 May 1992, Boulder, Colorado, U.S.A.
Contact: Secretary-General, International Glaciological Society, Lensfield Road, Cambridge, CB2 1ER, U.K.
Phone: 223-355974; Fax: 223-336543.

Second (1992) International Offshore and Polar Engineering Conference
14–19 June 1992, San Francisco, California, U.S.A.
Contact: ISOPE-92, P.O. Box 1107, Golden, Colorado 80402-1107
Phone: (303) 273-3673; Fax: (303) 420-3760

International Geological Correlation Programme Project No. 297, Geocryology of the Americas
26–31 July 1992, Alberta, Canada
Contact: Arturo E. Corte, Chairman, C.C. 330-5500 Mendoza, Republica Argentina.

Alberta Rocky Mountains Field Trip
27–31 July 1992, Calgary, Alberta, Canada
Contact: S. Harris, Department of Geography, University of Calgary, Calgary, Alberta T2N 1N4, Canada

IGU Pre-Congress Field Trip
1–7 August 1992, Indian Peaks, Colorado, U.S.A.
Contact: Colin Thorn, Dept. of Geography, University of Illinois, 607 South Mathews 220, Urbana, Illinois 61808, U.S.A.

27th Congress of the International Geographical Union
9–19 August 1992, Washington, D.C., U.S.A.
Contact: Anthony R. de Sousa, Secretary-General, 27th International Geographical Congress, 1145 17th Street NW, Washington, D.C. 20036, U.S.A.

IGU Post-Congress Field Trip
14–18 August 1992, Central Appalachians
Contact: G. Michael Clark, Department of Geological Sciences, 306 G&G Building, University of Tennessee, Knoxville, Tennessee 37996-1410, U.S.A.
Phone: (615) 974-6006; Fax: (615) 974-2368

AMQUA 1992 Biennial Meeting
21–30 August 1992, Davis, California, U.S.A.
Contact: Bob Bettinger, University of California (Davis), Davis, California, U.S.A.

29th International Geological Congress
24 August–3 September 1992, Kyoto, Japan
Contact: Secretary General, ICG-92, PO Box 65, Tsukuba, Ibaraki, 305, Japan.
Phone: 81-298-54-3627, Fax: 81-298-54-3629.

POAC '91, 11th Conference on Port and Ocean Engineering Under Arctic Conditions
23–27 September, St. John's, Newfoundland, Canada
Contact: Derek B. Muggeridge, Director, Ocean Engineering Research, Faculty of Engineering and Applied Science, Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X5, Canada
Phone: (907) 737-8804; Fax: (907) 73704042; Telex: 016-4101

Symposium on Snow and Snow-Related Problems (part of an international forum on snow areas)
14–18 September 1992, Nagaoka, Japan
Contact: Secretary General, International Glaciological Society, Lensfield Road, Cambridge, CB2 1ER, United Kingdom
Phone: 223-355974; Fax: 223-336543.

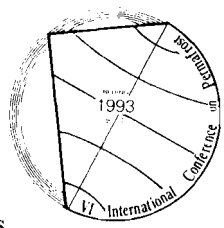
1993

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

International Cryosols Tour: Classification, Correlation, and Management of Permafrost Soils
Late July 1993, Northwest Canada and Alaska
Contact: John Kimble, USDA-SCS, Federal Building, Room 152, 100 Centennial Mall North, Lincoln, Nebraska 68508-3866, U.S.A.
Phone: (402) 437-5363; Fax: (402) 437-5336

Third International Conference on Geomorphology
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.

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



Important Dates

August 1, 1991 — First bulletin, call for papers
December 1, 1991 — Abstract deadline
February 1, 1992 — Notification to authors
June 1, 1992 — Deadline for paper submission
December 1, 1992 — Second bulletin
April 1, 1993 — Pre-registration deadline

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Sixth International Conference on Permafrost

5–9 July 1993, Beijing, China

Announcement

It is a great pleasure to the Organizing Committee to announce the Sixth International Conference on Permafrost, which will take place in Beijing, China, from 5 to 9 July 1993. The organizers extend a cordial invitation to attend the Conference.

The Sixth International Conference on Permafrost will be held under the auspices of the International Permafrost Association (IPA), which was founded in 1983, and the Chinese Society of Glaciology and Geocryology (CSGG), which is the Adhering National Body of the International Permafrost Association (IPA), and will be organized by the Lanzhou Institute of Glaciology and Geocryology (LIGG), Chinese Academy of Sciences, with the collaboration of the National Frozen Soil Engineering Laboratory of LIGG.

Conference Themes

The Conference themes are permafrost science and permafrost engineering, including:

Permafrost Science	***Permafrost Engineering***
Climatic change and permafrost	Site investigations and terrain evaluation
Regional permafrost	Geophysical exploration
Periglacial phenomena	Remote sensing and mapping
Physics and chemistry of frozen ground	Geotechnical problems
Heat transfer processes	Petroleum engineering
Hydrology	Mining engineering
Ecology	Municipal engineering
Prediction of natural hazards and environmental protection	Road construction
	Water conservation

Language

The official language of the Conference is English. No translation facilities will be provided.

Technical Excursions

A) Tour to Lhasa. Field trip starts from Lanzhou, crosses the Qinghai-Tibet Plateau, and ends in Lhasa. The duration of the excursion will be about 10 days and transport will be by coach.

B) Tour to the Tienshan Mountains. Field trip starts and ends in Ürümqi.The duration of the excursion will be about 7 days. Transport by train.

C) Tour to northeast China. Field trip starts and ends in Harbin. The duration of the excursion will be about 7 days. Transport by train.

Guidebooks will be provided for all excursions.

Programme for Accompanying Persons

Pre- and post-conference scenic tours to south and central China, and to east China, for those persons accompanying the conference participants are currently planned to offer them an opportunity to view and visit many places of interest. Details will be given in the First Bulletin.

Correspondence and Preliminary Questionnaire

All correspondence pertaining to the Conference should be addressed to:

Prof. Cheng Guodong
Lanzhou Institute of Glaciology and Geocryology
Chinese Academy of Sciences
Lanzhou 730000, China
Telex: 72008 IGGAS CN

Please complete, copy and send to Prof. Cheng Guodong:

Name _____

Title _____

Mailing address _____

_____

Affiliation _____

Telephone _____

Fax _____

Telex _____

The probability that I will attend the Conference is:

☐ almost definite ☐ likely ☐ poor

I intend to present ☐ a paper ☐ a poster contribution on the following theme(s):

☐ Permafrost science
☐ Permafrost engineering

I would like to join the following post-conference tours:

☐ Qinghai-Tibet Plateau
☐ Tienshan Mountains
☐ Northeast China

Number of accompanying persons:

Adults _____ Children _____

The accompanying person would like to join the following pre- and post-conference scenic tours:

	Pre-conference tour	Post-conference tour
South and central China		
East China		
Please send further information		

Important Dates: December 1, 1991—Abstract deadline.
June 1, 1992—Deadline for paper submission.