

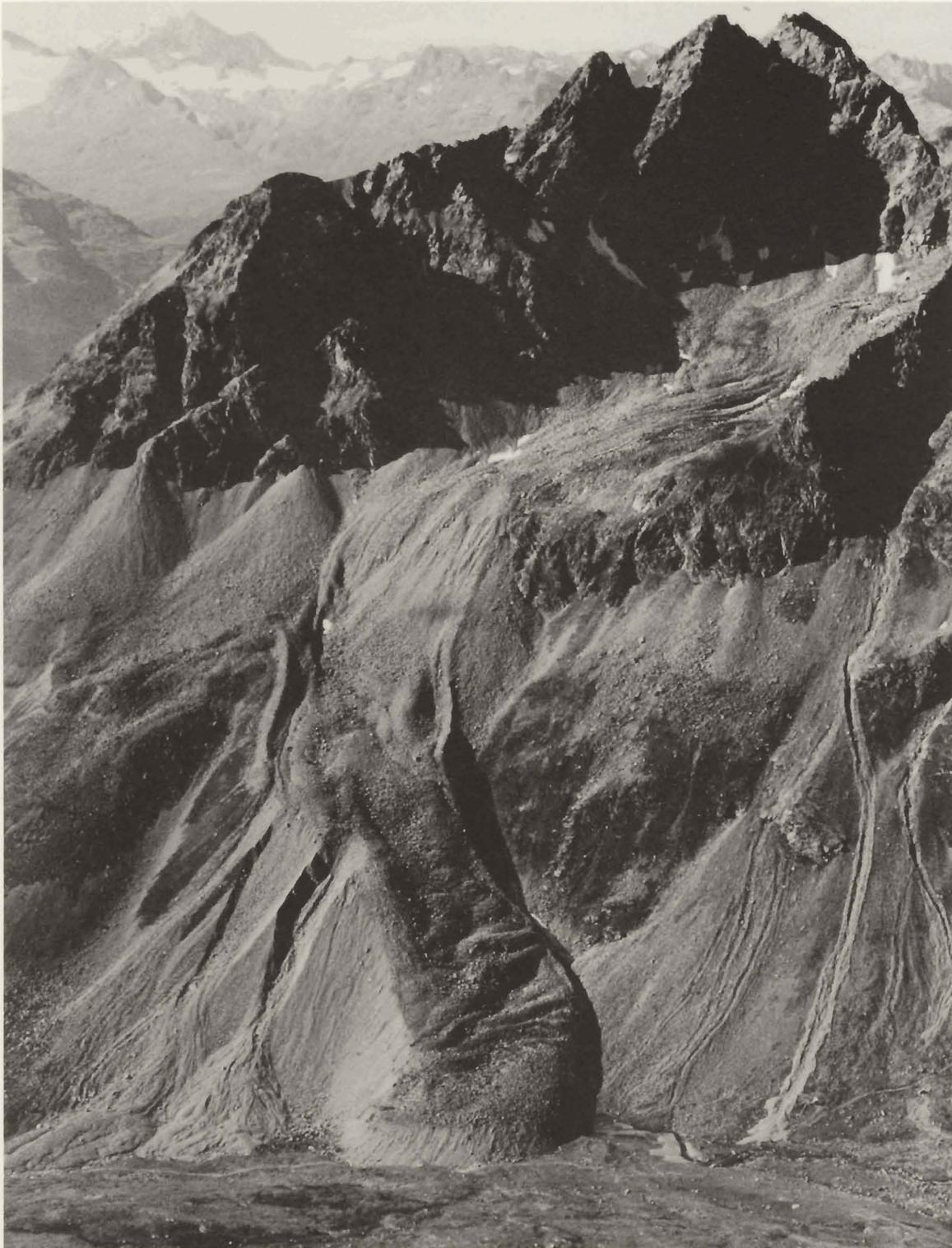


# *Frozen Ground*

Number 10

The News Bulletin of the International Permafrost Association

December 1991



# 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.

## Officers of the International Permafrost Association

### President

Dr. T.L. Péwé  
Department of Geology  
Arizona State University  
Tempe, AZ 85287-1404  
USA  
Tel: (602) 965-2883  
Telex: 156-1085 ASA UT  
Fax: (602) 965-8102

### Vice President

Dr. V.P. Melnikov  
Scientific Council on Earth Cryology  
USSR Academy of Sciences  
Fersman Street, 11  
17312 Moscow  
USSR  
Tel: (095) 124 54 22  
Telex: 411 700(2181) Permafrost  
Fax: 292 6511(2181) Permafrost

### Vice-President

Professor Cheng Guodong  
Lanzhou Institute of Glaciology  
and Geocryology  
Academia Sinica  
Lanzhou  
China  
Tel: 26726-385  
Telex: 72008 IGCAS CN  
Fax: 86-931-485241

### Secretary General

Dr. J. Ross Mackay  
Department of Geography  
#217 1984 West Mall  
University of British Columbia  
Vancouver, BC V6T 1Z2  
Canada  
Tel: (604) 822-2257 or 2663  
Fax: (604) 822-6150

## Adhering Member Countries

Argentina	France	Poland
Belgium	Germany	Sweden
Canada	Italy	Switzerland
China, People's Republic	Japan	United Kingdom
Denmark	Netherlands	USA
Finland	Norway	USSR

### Cover Photograph:

*Northeastern slope of Piz Albana (3100 m a.s.l.) from Piz Nair (upper Engadin, Swiss Alps): a 1-km-long rock glacier is creeping down to 2300 m a.s.l. in the Valley "Suvretta da S. Murezzan." Its front has crossed the river Ova da Suvretta and its orographic right lateral slope was affected by recent debris flows. The image illustrates the neighborhood and interrelation of three most typical phenomena in Alpine permafrost areas: debris cones, permafrost creep and debris flows. Photograph taken by W. Haeblerli, 6 September 1990.*

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**The Chinese Organizing Committee for the Sixth Conference has extended Abstract Submission Deadline to February 15, 1992 (see page 7 for details)**

*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. 11 is the end of April 1992. 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 23 or Chairman, IPA Editorial Committee, P.O. Box 9200, Arlington, Virginia 22219-0200, U.S.A.

Issue No.10 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.

## PRESIDENT'S COLUMN

Two meetings of the IPA Executive Committee and one day-long meeting of the Council took place in Beijing, China, in August just prior to the XIII Congress of the International Union for Quaternary Research (INQUA). The Congress was very successful, included 30 field excursions, and was attended by about 1000 participants representing many countries. The three largest groups were from China, U.S.S.R. and U.S.A. The IPA Council meeting, formal and informal contacts with Chinese scientists and engineers, and participation in INQUA activities, including field excursions, were very critical to planning, understanding, and supporting the VI International Conference on Permafrost and associated field excursions to be held in Beijing in July 1993.

Participants in the INQUA Congress, whether on their first trip to China or returning after earlier trips, could not help but be impressed with the continued eager cooperation of the Chinese with foreign associates, and also the continued increase in physical growth of the country—new roads, hotels, local housing, and industry.

Professor Cheng Guodong, Chairman of the Organizing Committee for the permafrost conference, and his staff have been working vigorously in planning for the 1993 conference. Excellent facilities for congresses in Beijing are available, and the Organizing Committee is planning to use accommodations and facilities that are less expensive and more suitable for a meeting of 500 rather than larger conferences. To allow careful planning for this important congress, the first IPA conference in Asia, it is necessary for potential participants to return participation forms and abstracts of papers by 15 February 1992 (see back cover).

The Organizing Committee has arranged interesting and important visits to cultural sites for which China is so well known. These events are scheduled so that participants can visit the Great Wall, Forbidden City, Peking Man Site and others as well as participating in the plenary and paper sessions. The three permafrost excursions are unique to China and have already drawn large numbers of applications. I urge you to sign up soon. It has been a pleasure for my wife and me to have worked in the three excursion areas: Tian Shan Mountains, northeast China, and Tibet, and I highly recommend all of these excursions to examine the scientific and engineering aspects of permafrost and periglacial features there.

In connection with the excursion to Tibet, it has been my privilege to participate in two working field investigations in the high plateau, 1980 and 1991. Our 1991 trip

from Lanzhou by bus to Golmud, Lhasa, and the Nepal border in August permitted me and officials from the Lanzhou Institute of Glaciology and Geocryology to gain further background information relating to the planning of the 1993 Permafrost Conference trip—Tibet, from Lanzhou to Lhasa.

The Qinghai–Xizang (Tibet) Plateau rises to more than 4500 m elevation. The climate is cold; mean annual temperatures are  $-3^{\circ}$  to  $-5^{\circ}\text{C}$  and summer temperatures range from  $15^{\circ}\text{C}$  to the 20s. The Qinghai–Xizang Highway is paved and reminiscent of the earlier days of the Alaska Highway. The road crosses the Kunlun Range, the high plains around the source of the Yangtze River and the Tanggula Range (at 5231 m/17,162 ft). The high mountain zone contains spectacular glaciers above 5000–6000 m and most of the plateau is underlain by permafrost. Permafrost conditions and engineering problems will be demonstrated throughout the area.

In the Kunlun Pass area (4780 m elevation) of the northern plateau, pingos exist in lacustrine sediments and the highway is adjacent to a large pingo (4680 m elevation). This pingo was  $14 \times 45 \times 18$  m high in 1975. At that time, its top was removed using explosives and groundwater created a lake in the cavity. The lake was 20 m in diameter and drained in 1981 exposing the pingo ice in the walls. It has been a dry pingo since 1989 and is easily available for examination by Conference participants.

Troy L. Péwé, President, IPA



Troy L. Péwé and Nat Rutter, immediate past president of INQUA, in front of large pingo of lacustrine sediments, Kunlun Pass, Tibet. (T.L. Péwé photograph No. PK 29,844, 15 August 1991.)

## SUMMARY OF IPA COUNCIL MEETING

The Sixth Council Meeting, International Permafrost Association, was held in Beijing, China, on 31 July 1992, from 0930 to 1700 hours. Present were: T.L. Péwé (USA), G.D. Cheng (China), J.R. Mackay (Canada), members of the Executive Committee, and the following Council Members: P. Haesaerts (Belgium), H.M. French (Canada), Shi Yafeng (China), L. King (Germany), F. Dramis (Italy), E. Derbyshire (United Kingdom).

President Péwé welcomed Council members and noted that there was not a quorum so that any vote that required a quorum would be conducted by mail ballot. The tentative agenda, which had been previously circulated to all Adhering Bodies, was modified slightly and approved. The draft minutes of the fourth and fifth Council Meetings, held at Quebec City, Canada, on 4 and 5 June 1990, were approved, subject to one spelling error. The following summarizes major agenda items.

**Membership:** Péwé and Mackay reviewed the membership, which is now 18 countries. There have been no replies to two letters written to Mongolia enquiring about interest in IPA. K.J. Hall, from South Africa, has written to IPA asking about the possibility of several countries from Africa (e.g. Swaziland, Lesotho, Zimbabwe, South Africa) joining IPA as a Southern Africa Association. The suggestion met with support but since the Constitution refers to Adhering National Bodies, a slight modification of the Constitution would be required in order for an association composed of several countries to join IPA.

The following reports of Standing Committees and Working Groups were given:

**Advisory Committee on Working Groups:** The report by C.W. Lovell (Chairman) to form a new working group on "Seasonal Freezing and Thawing of Permafrost Areas" was discussed. The vote—7 in favor, none opposed—will be put on a mail ballot.

**Finance Committee:** (see following modified financial report).

**Editorial Committee:** There was a lengthy discussion on the procedures for the review of conference

papers from China, the U.S.S.R., and other countries. The preparation of a Circumarctic Permafrost Map was strongly supported. The Executive Committee was requested to work with J. Brown on a proposal for IUGS funding. During discussion of the Finance Committee report agreement was unanimous on the usefulness, continuation, and widespread distribution of *Frozen Ground*. Council requested that J. Brown serve as the IPA liaison with the newly formed Soil Cryopedology Group, which will hold the First International Conference in Moscow in November 1992 (see details in following report).

**Mountain Permafrost:** F. Dramis reported on the activities of the working group and the workshop to be held at Interlaken, Switzerland, 16–20 September 1991, including field trips to the French Alps and to the Swiss, Italian, and Austrian Alps. A business meeting will be held at Interlaken to discuss future activities of the working group. Workshop papers are planned for publication in *Permafrost and Periglacial Processes* (see details in following report).

**Foundations:** (see *Frozen Ground* Number 9, p. 6–7).

**Present Global Change and Permafrost:** Work continues on a bibliography to appear as an Open File Report, Geological Survey of Canada, and on the monograph "Global Change and Permafrost" to be published as a special issue of *Permafrost and Periglacial Processes* in 1993 and copies made available to Conference participants.

**Data and Information:** Appreciation was expressed for the contribution of the Chairman (M.J. Clark) and the Geo Data Institute, University of Southampton, U.K., towards the publication of *Frozen Ground* Number 8 (see additional information in following report).

**Periglacial Environments:** There were brief discussions about the forthcoming sessions and publications (see following report for details).

**Terminology:** There was discussion on the publication of the multi-lingual index of the main terms in the NRCC glossary. H.M. French agreed to explore the possibility of publishing the index in *Permafrost and Periglacial Processes*. T.L. Péwé, H.M. French and

J.R. Mackay noted that they had been contacted by Professors V.N. Konishchev and N.N. Romanovskiy of Moscow State University regarding the preparation and publication of a Russian-English Glossary of Permafrost Terms. The proposal is an ambitious one and would require financial help. H.M. French agreed to try to obtain further information, including the relationship of the proposed project to the Terminology Working Group.

**International Affiliations:** ICSU (International Council of Scientific Unions) asked IPA to help review the activities of IGBP (International Geosphere-Biosphere Programme). The review is in progress with short reports to be prepared by early September, under the direction of J. Brown and H.M. French.

**Nominating Committee:** The President appointed a nominating committee in June 1990. The three members are: F. Dramis (Italy, Chairman), J.A. Heginbottom (Canada) and Madame Zhou Youwu (China). The President reviewed the nominating procedure as given in Bylaw No. 2 of the Constitution. The nominating committee has been asked to prepare a list of nominees for the next Council Meeting in August 1992, Washington, D.C.

**VI International Conference on Permafrost:** G.D. Cheng reviewed the status of the Conference. More than 1000 copies of the announcement have been distributed and upward of 120 positive replies were received. Approximately 60% of those who responded chose the Qinghai-Tibet Plateau tour. There were numerous positive suggestions as to the best ways of ensuring a widespread distribution of the First Bulletin.

G.D. Cheng suggested that some of the Working Groups (e.g. Mountain Permafrost, Foundations, Present Global Change and Permafrost) participate in the sessions by organizing panels, discussions, and special sessions as suggested by Chinese Organizing Committee (COC). Council members responded positively to the suggestion. Mention was also made of a Symposium to be organized by A.E. Corte.

The venue of the VI Conference is under investigation by the COC. Council expressed the view that, if possible, accommodation be such that participants both with and without access to hard currency could be housed either in the same complex or, if not in the same complex, at least close enough to each other to permit personal contacts. Funding issues, registration costs, etc. were among numerous topics upon which there were wide ranging discussions.

**Future Meetings:** The next Executive Committee and Council Meetings are planned for early August 1992 at Washington, D.C., U.S.A., just prior to the International Geographical Congress.

**VII International Permafrost Conference:** H.M. French re-affirmed Canada's interest in hosting the VII conference in 1998, provisionally at Yellowknife, N.W.T., Canada. French stated that a decision will likely be taken late in 1991.

Report based on draft minutes by  
J. Ross Mackay,  
IPA Secretary General.

Participants in the Council Meeting of International Permafrost Association, July 31-August 1, 1991, Beijing, China.

Left to right: Cheng Guodong, Vice President, China; Francesco Dramis, Representative, Italy; Shi Yafeng, Representative, China; J. Ross Mackay, Secretary-General, Canada; Troy L. Péwé, President, U.S.A.; E. Derbyshire, Proxy Representative, U.K.; Lorenz King, Representative, Germany; Hugh French, Representative, Canada; Qui Guoqing, Representative, China. Not in photograph: P. Haesaerts, Proxy Representative, Belgium. (Péwé photograph No. PK 29,766, July 31, 1991.)



## IPA STANDING COMMITTEES AND WORKING GROUPS

### Finance Committee

The following Financial Report was submitted at the 31 July 1991 IPA Council meeting.

A new unit dues structure was approved at the IPA Council meeting in June 1990. The aim of this new dues structure is to ensure financial self-sufficiency of the IPA in 1993. At that time, the National Research Council of Canada will cease to support the operation of the Secretariat, currently in Canada.

The initial dues structure, established at the time of formation of the IPA, was

Canada, U.S.A., U.S.S.R.	\$1000
China	\$500

(all figures reported in U.S. dollars unless otherwise indicated).

Since then, Denmark and Italy have each contributed dues (\$250 each).

For 1991, under the new dues structure, dues have been received to date from Canada (12 units-\$3000), Germany (2 units-\$500), and U.K. (2 units-\$500). It was agreed that the U.S.A. and the U.S.S.R. would each adhere with 12 units (i.e. \$3000) and China with 6 units (i.e. \$1500). In addition, the IPA has been informed that the following countries will contribute dues in 1991 as follows: Italy-3 units, France-2 units, Denmark, Belgium and Poland-1 unit each.

Major expenses in 1990 were:

Printing of <i>Frozen Ground</i> No. 7	\$2132 (Can.)
Executive expenses, Quebec City	\$941 (Can.)
President's expenses	\$1000
Global Change Working Group	\$450

Expenses for *Frozen Ground* No. 8 and 9 were not charged against the IPA. Expenses for the Secretariat (\$5500 Can.) were met by the National Research Council of Canada.

The current bank balance of the IPA, representing the balance of past dues and accrued interest, is \$10,955 (Can.).

Recommendation: The Finance Committee recommends that all members arrange for annual dues to be paid regularly so that long-term financial planning of the IPA is possible.

The IPA is still in a critical funding situation until annual dues are regularly received. Based on current and previous expenditures, the financial requirements of the IPA are probably between \$12,000 and \$15,000 annually. This includes Secretariat expenses (\$5000 to \$6000), *Frozen Ground* (\$2000), Executive expenses (\$2000), and Working Groups (\$2000 to \$4000).

If the U.S.A., U.S.S.R., Canada and China pay dues at their designated levels, and if modest dues are paid by a number of other members, total revenues will approximate current expenditures. If the IPA is to undertake major projects, however, additional funds must be generated. Possible sources include:

Advertising in *Frozen Ground*

Instituting a small cost for *Frozen Ground* from individuals in some countries

Soliciting funds from appropriate national and/or international agencies for IPA projects (e.g. permafrost map)

Imposing a surcharge upon registration at international permafrost conferences

Selling publications (e.g. proceedings volumes of international conferences).

Recommendation: The Finance Committee recommends that, in order to support all the activities of the IPA, additional sources of revenue must continue to be investigated.

Report by  
Hugh M. French, Chairman

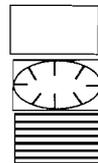
# PROVISIONAL LEGEND

## Circumarctic Map of Permafrost and Ground Ice Conditions

### Permafrost and Ground Ice

Distribution of permafrost and content of pore ice and segregation ice in upper 10–20 m of ground

Permafrost extent (% of area)	Ground ice content (visible, % vol.)			
	High (>20)	Medium (10–20)	Low (<10)	Nil (0)
Continuous (90–100)	Ch	Cm	Cl	Cn
Discontinuous (50–90)	Dh	Dm	Dl	Dn
Sporadic (10–50)	Sh	Sm	Sl	Sn
Island (0–10)	Ih	Im	Ii	In
None (0)	U			



G Glaciers and ice caps  
 R Relict permafrost  
 R<sub>s</sub> Subsea permafrost

### Ground Ice Bodies

General distribution of known occurrences of large bodies of ground ice  
 (surface icings not included)

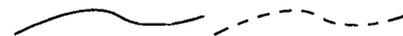
	Sparse	Abundant
Ice wedges		
Massive ice bodies		
Pingos		

### Temperature (°C) and Thickness of Permafrost (m)

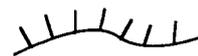
Range of typical mean annual ground temperatures at base of layer of annual fluctuations	–2° to –4°
Mean annual ground temperature	–7°
Thickness of permafrost	
Measured or interpolated	• 100
Extrapolated or calculated	● 120
Depth to top (numerator) and bottom (denominator) of relict permafrost	■ $\frac{120}{170}$
Depth to top (numerator) and bottom (denominator) of subsea permafrost	◆ $\frac{20}{60}$

### Boundaries

Boundaries of permafrost and ground ice units (defined, gradational)



Relict permafrost



Tree line (northern limit)



## Editorial Committee

Over the past 15 months considerable progress has been made in organizing the circumarctic permafrost map project. Through a series of reciprocal visits and correspondence permafrost mapping specialists in Canada, U.S.A. and U.S.S.R. have developed a common international legend and prepared test maps of regions within each of the three countries. This provisional legend (opposite) was agreed upon in Anchorage, Alaska, in September 1991 at a series of meetings attended by Heginbottom (Canada), E.S. Melnikov and Solomatina (U.S.S.R.) and Ferrians and Brown and others (U.S.A.). The final map scale will most likely be 1:10,000,000. The following schedule is proposed:

November 1991—Base maps prepared and distributed among principals in the U.S.A., Canada, and the U.S.S.R. Submit abstracts for VI International Conference on Permafrost, the 27th International Geographical Congress and several other workshops and conferences.

March 1992—Complete initial compilation according to current legend and circulate among principals in U.S.A., Canada and the U.S.S.R. Present poster at the Arctic and Vegetation Workshops, Boulder, Colorado.

April 1992—Conduct review meeting in Ottawa or Washington, D.C., of U.S.A., Canada and U.S.S.R. principals

May 1992—Distribute draft map to other IPA countries and request input for August meetings in Washington, D.C.

August 1992—Present, review and revise at IPA Council meetings held in conjunction with the International Geographical Congress. Prepare final layout. Complete and review conference paper for VI Conference.

Fall 1992/Winter 1993—Prepare and review final compilation.

Spring 1993—Print.

July 1993—Present and distribute map to Conference participants in Beijing.

Planning for review of Conference papers continues. Initial reviews will take place prior to the August 1992 meeting of the Editorial Committee and Council in Washington, D.C. At that time, all manuscripts will be given final consideration and the authors notified soon thereafter of acceptance and/or necessary modifications. Professional organizations, individuals and members of IPA Working Groups will be asked to assist in the review process and to participate if available in the IPA review sessions in August.

The Chinese Organizing Committee agreed to extend the deadline for abstracts until **February 15, 1992**. However, in order to facilitate processing, remaining abstracts should be air mailed or express mailed to IPA Editorial Committee, P.O. Box 9200, Arlington, VA 22219-0200, U.S.A. Authors will be notified promptly of their receipt and provided with instructions for preparation and submission of the manuscript. Deadline for submission of manuscript remains **June 1, 1992**. Three copies of all non-Chinese and non-Soviet manuscripts are to be sent to the address listed above. The review of all manuscripts will be completed by September 1992.

Finally, through the cooperation of IPA Adhering Members and Working Groups adequate materials are being received to produce two issues of *Frozen Ground* per year.

Report by  
Jerry Brown, Chairman

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## Terminology

The Terminology Working Group was organized in Fall 1988, after the V International Permafrost Conference, to develop a set of internationally accepted permafrost terms for use in both engineering and science, with equivalents in various languages, and to disseminate and encourage the use of such terminology.

### Current membership:

Robert O. van Everdingen, Chairman, Arctic Institute of North America, Calgary, Alberta, Canada

Roger G. Barry, University of Colorado, Boulder, Colorado, U.S.A.

Arturo E. Corte, Instituto Argentino de Nivología y Glaciología, Mendoza, Argentina

Oscar J. Ferrians, Jr., U.S. Geological Survey, Anchorage, Alaska, U.S.A.

Johannes Karte, Deutsche Forschungsgemeinschaft, Bonn, Germany

Branko Ladanyi, École Polytechnique, Montréal, Québec, Canada

Qui Guoqing, Institute of Glaciology and Geocryology, Lanzhou, People's Republic of China

Nikolai N. Romanovskiy, Moscow State University, Moscow, U.S.S.R.

Matti Seppälä, University of Helsinki, Helsinki, Finland

**Progress since 1990:** The report includes the addition of Spanish equivalents for 22 secondary terms in the NRCC Glossary. These were produced by Arturo Corte and co-workers, and have been incorporated into the multi-lingual (English/French/German/Russian/Spanish) index. The German translation of primary and secondary terms in the Glossary was received in September and is being incorporated in the Glossary index. Suggestions for modification of 48 of the French terms in the NRCC Glossary have been received from the Commission Française pour l'Étude des Phénomènes Périglaciaires. The modified terms have been incorporated in the Glossary index.

In the U.S.S.R., translation of the NRCC Glossary has been completed, and a copy of the translation is being used to incorporate Russian equivalents into the Glossary index. A number of the terms in the Russian translation of the Glossary were provided with additional

comments, because they are used in a slightly different sense in the Soviet Union. It has been suggested that the additional comments should be translated into English, for possible inclusion in a future (Russian/English) edition of the Glossary.

Oscar Ferrians is continuing to review the definitions in the English version of the NRCC Glossary to select terms that need further consideration for refinement or redefinition.

Matti Seppälä has proposed five Swedish and Finnish terms for eventual inclusion in the international glossary: aapa mire, flark, palsa mire, puonu, and puonikko. He has also suggested that the meaning of palsa should be limited to the original definition.

The first product of the combined efforts of the Terminology Working Group will be a multi-lingual index of the main and secondary terms in the NRCC Glossary. A sample of the index was published in *Frozen Ground* (No. 9, June 1991), for comment. Suggestions on where, when and in what form the index should be published will be welcomed.

Report by Robert O. van Everdingen,  
Chairman

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## Mountain Permafrost

The International Working Group on Mountain Permafrost organized, in collaboration with the Working Group on Periglacial Environments, an International Workshop on Permafrost and Periglacial Environments in Mountain Areas. The meeting was held in Interlaken, Switzerland, 16–20 September 1991. The meeting was organized by W. Haeberli and staff of VAW, Department of Glaciology, Swiss Federal Institute of Technology, Zurich, with the Glacier Commission and the Geomorphological Society of the Swiss Academy of Sciences as co-sponsors.

The primary aim was to bring together researchers from different parts of the world and working on different aspects of mountain permafrost, allowing them to exchange their opinions and experiences on some major topics.

The Workshop officially opened on 16 September and was divided into the following sessions:

- *Prospecting for Mountain Permafrost and Mapping of Associated Phenomena* (Chair: M. Evin, A.P. Gorbunov and L. King)
- *Distribution of Mountain Permafrost and Climate* (Chair: Cheng Guodong and F. Dramis)

- *Processes and Landforms in the Periglacial Mountain Belt as Related to Seasonally and Perennially Frozen Ground* (Chair: J.P. Lautridou and Y. Sollid)
- *Permafrost Creep on Slopes and Rock Glaciers* (Chair: D. Barsch and G. Shroder)
- *Relations and Interactions Between Mountain Permafrost, Glaciers, Snow and Water* (Chair: S.A. Harris)
- *Construction, Environmental Problems and Natural Hazards in Periglacial Mountain Belts* (Chair: W. Haeberli and I. Rastegayev).

Approximately 50 people from more than 13 countries attended the conference and about 40 papers on current research were presented. At the end of each session time was devoted to general discussion and to the review of draft situation reports prepared by Working Group members and corresponding members. Situation reports and selected papers are planned to be included in a future issue of *Permafrost and Periglacial Processes*.

In addition to presentations and discussions, a very interesting mid-workshop field trip was organized by

W. Haerberli and G.-L. Amigier, to the Jungfrauoch. Moreover, a pre-workshop excursion to the Southern Alps–Wallis Alps, organized by M. Evin, W. Haerberli and G. Tenthorey, and a post-workshop trip to the Eastern Swiss Alps–Italian Alps, organized by W. Haerberli, M. Hoelzle, F. Keller, C. Smiraglia, D. Von-

der Müll and S. Wagner, were also held. All were very interesting from both scientific and aesthetic points of view; of particular importance were the instrumented experimental monitoring sites.

Report by Francesco Dramis,  
Chairman

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## Permafrost Data and Information

The Working Group is currently pursuing several activities to improve awareness of and access to permafrost data and information:

- Development of a prototype inventory of data on permafrost, the active layer, and related climate–terrain variables. This will build initially on the expertise within the group, but input is invited from any IPA members holding significant records or data sets of this type, or archives of which they may be aware. Currently, the Arctic Environmental Data Directory of the USGS lists only one such data set collected by T. Osterkamp.

Individuals with such information are invited to communicate with Dr. R.G. Barry, WDC-A, Glaciology. The descriptions should, if possible, include: Data specifications (content, format, spatial coverage, record length[s], frequency of observation); form of data storage (media); ownership; availability (contact person). As a related effort, an inventory of permafrost maps is being prepared. J.A. Heginbottom has compiled descriptions of various medium- and large-scale maps and translated the legends into English, where

necessary. He is also compiling an updated index for the international permafrost conferences. Circulation of these is anticipated at the 1993 Conference in Beijing.

- Identification of selected data sets that are in a computerized format suitable for transferral to WDC-A for Glaciology. The Data Center may be able to produce a sampler diskette of such records as a demonstration product and for international exchange.
- Identification of “historical” records that may merit a data rescue effort to ensure their security and preservation. NOAA has a new focus in this area which may permit WDC-A for Glaciology to expand its efforts.
- An abstract on the planned 15-year permafrost bibliography has been submitted by A. Brennan and C. Hanson of WDC-A for Glaciology to the next Polar Libraries Colloquy (May 1992, Columbus, Ohio).

Report by R.G. Barry,  
Secretary

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## Periglacial Environments

Recent meetings of the Working Group include the workshop in Caen (see *Frozen Ground* No. 9, p. 4), the joint meeting with the Working Group on Mountain Permafrost in Interlaken (see p. 8, this issue) and a business meeting in Amsterdam, May 5, 1991.

Future plans include:

*1992:* A joint meeting in Alberta with IGCP 297, and pre- and post-IGU Congress field trips in the U.S. (see Calendar, this issue). During the IGU Congress, two paper sessions with the IGU Periglacial Commission (C. Thorn, organizer), and a joint business meeting of the Working Group and the IGU Commission.

*1993:* IPA Conference in China. A Working Group symposium is under discussion entitled “Permafrost and Landscape Evolution, Past and Present Day.”

*1994:* A meeting on periglacial structures in the region of Leipzig, organized by L. Eissman, will convene in Summer 1994. A joint meeting will be held of the Working Group and of the IGU Frost Action Commission in France, September 1994, with a field trip on Grèzes litées and a Symposium on the Movement of Slope Debris in Past and Present Periglacial Environments, Especially in High Altitude.

Report by J.P. Lautridou,  
Chairman

## NEWS FROM MEMBER COUNTRIES

### ARGENTINA

The International Geological Correlation Programme, Project No. 297, "Geocryology of the Americas," will have its fourth meeting together with the VI International Conference on Permafrost, 5–9 July 1993, in Beijing, China. The aims of the project are clearly defined as: i) to identify present and past geocryogenic processes, ii) to correlate them across the Americas and the world, iii) to identify areas of future applications and nature conservation, and iv) to stimulate

training in geocryology. Dates for submission of abstracts, papers and registrations are the same as for the Permafrost Conference. For more information contact the organizer of the meeting in China: Cui Zhijiu, University of Beijing, China; or Project 297 leader Arturo E. Corte, P.O. Box 330, 5500 Mendoza, Argentina, Telex: 55438 CYTME AR; Fax: 54-61-380370.

Report by Arturo E. Corte

### CANADA

**Cold Regions Division, Canadian Geotechnical Society:** The 44th Annual Meeting of the Canadian Geotechnical Society was held in Calgary, 29 September to 2 October 1991. As usual, the Cold Regions Division sponsored a session on Cold Regions Engineering, in which eight papers were presented. The papers dealt with the distribution of saline permafrost in the N.W.T., the performance of frost heave and freeze-thaw tests in the laboratory, the dynamic response of piles in frozen soils, the performance of grouts for piles in permafrost, arctic offshore exploration structures, penetration testing for arctic soils, and the measurement of pore water pressures in freezing and thawing soils. In addition to this paper session, J.F. (Derick) Nixon, of Esso Resources Canada, Ltd., gave the R.M. Hardy Keynote Address on the topic of "Frost Heave Prediction." In his address, Nixon presented an overview of recent developments in the theory and practice of frost heave modeling.

The Geotechnical Society now includes a fifth Division, the Environmental Engineering Division, which has aroused considerable interest. This Division also sponsored a session at the recent conference, with 13 papers scheduled.

At the business meeting of the Cold Regions Division, concern was expressed about the low level of permafrost research activity in Canada. This reflects, in large measure, the current low level of petroleum and mineral exploration and development activities in Canada's arctic regions.

The 45th Canadian Geotechnical Conference, to be

held in Toronto, 26–28 October 1992, will include two sessions sponsored by the Cold Regions Division: one on Permafrost Terrain and the other on the North Warning System (see Calendar).

**Awards:** The 1991 *Roger J.E. Brown Award*, which was established in 1986 to honor the memory of the renowned Canadian permafrost scientist, was awarded to Dr. Don Hayley of EBA Engineering Consultants Ltd., Edmonton, for his services to permafrost engineering and science in Canada. Don Hayley was the founding president of the Cold Regions Division, Canadian Geotechnical Society. He is also former chairman of the Canadian Permafrost Subcommittee (now disbanded), and is currently a member of the Canadian National Committee for the IPA.

Dr. Branko Ladanyi, of École Polytechnique, Université de Montréal, was awarded the 1991 *Elbert F. Rice Memorial Lectureship* of the School of Engineering, University of Alaska, and the Technical Council on Cold Regions Engineering, American Society of Civil Engineers. The award was given to Branko Ladanyi "in recognition of his long-standing contribution to cold regions engineering."

**Permafrost Research at the Geological Survey of Canada:** The Geological Survey of Canada comprises one of the largest groups in Canada of scientists (as distinct from engineers) and technicians devoted primarily to permafrost research. Most of the work is carried out within the Terrain Dynamics Subdivision, Terrain Sciences Division, based in Ottawa. Other perma-

frost work is carried out in the Environmental Marine Geology Subdivision, Atlantic Geoscience Centre, in Dartmouth, Nova Scotia, and at the Centre Géoscientifique du Québec, in Québec City. Because of its implications for petroleum exploration, development and transportation in arctic regions, much of this research is undertaken with funding support from the Energy Research Program of the Government of Canada.

Work being done in Terrain Sciences Division comprises geothermal studies, geophysical research, and geological and geotechnical studies. The geothermal studies include basic research on heat and mass transfer processes in frozen ground, laboratory modeling of frozen ground, the routine measurement of deep ground temperatures in oil wells in the permafrost regions of Canada, and studies of gas hydrates. Geophysical research includes the development of geophysical systems (instruments, recording techniques, processing software) for the identification of ice-bonded soils and for the determination of ground ice conditions with soils. Techniques under development include high-resolution refraction seismic for both land and marine applications, seismic shear waves and ground-penetrating radar. Other research includes studies of the mechanical properties of frozen ground, of slope stability in permafrost terrain, of ground ice and its properties, of the performance of pipeline rights-of-way in permafrost regions, and the relationship of permafrost conditions to climate and to possible future climatic changes. Within Atlantic Geoscience Centre, studies have concentrated on the geotechnical properties of seabed materials and on elucidating the form, and the history of the multi-layered subsea permafrost bodies of the Beaufort Sea continental shelf.

A major multidisciplinary project to examine geotechnical and geological conditions in the shore zone of the Beaufort Sea in the Canadian western Arctic was recently completed. The project was a cooperative venture between Geological Survey of Canada, Gulf Can-

ada Resources, Esso Resources Canada, Ltd., Hill Geoscience Research, and the Inuvik Scientific Research Centre. The study comprised the drilling, coring and sampling of a line of six deep boreholes (depths of 30 to 100 m) extending from onshore on northern Richards Island out to a water depth of 12 m, 22 km offshore, plus three shallower holes (18 to 21 m depth) right at the coastline. The drilling was done in late winter of 1990, through the land-fast ice, using terrestrial drilling techniques and chilled drilling mud. Associated studies included 12 cone penetrometer tests, geothermal studies down-hole and other geological tests and observations. Results of the field and laboratory studies are still being analyzed.

In July 1991 a party of five scientists and technicians from Terrain Sciences Division visited the Yamal and Gydan peninsulas of northern West Siberia, U.S.S.R., for a cooperative study of geophysical and geotechnical methods used for the detection and mapping of ice-rich sediments in areas of oil/gas well sites and pipelines. The Soviet participants were from VSEGINGEO, U.S.S.R. Ministry of Geology. The techniques utilized comprised engineering geology, seismic and electrical profiling, georadar, and geothermal studies. The Soviet side provided drilling and sampling equipment, camp facilities, and all air and ground transportation. Accomplishments included the development of a new field technique for mapping shallow massive ice (5- to 20-m depth) using combined Soviet and Canadian technology, and exposure of both sides to the equipment and methods of the other. A series of reports is in progress, and joint presentations are being planned for the VI International Permafrost Conference, Beijing, 1993. The Soviet side is expected to visit Canada in March/April 1992, for combined field work in the Mackenzie Delta region.

Prepared by J.A. Heginbottom,  
Secretary, CNC/IPA  
Geological Survey of Canada

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## CHINA

The World Data Center-D for Glaciology and Geocryology is operated by, and co-located with, the Lanzhou Institute of Glaciology and Geocryology (LIGG), Chinese Academy of Sciences. The Center has extensive holdings in the areas of ice, snow and permafrost, as follows:

### Glaciology

1. Glacier inventory
2. Glaciological hydrology
3. Glaciological climatology

4. Ice core
5. Ice sheets in the polar regions
6. River, lake and sea ice
7. Ice chemistry
8. Ice physical parameters
9. Landsat MSS, TM, SPOT images and CCT data in typical glacial areas
10. Engineering parameters of ice

### Geocryology

1. Permafrost distribution

2. Permafrost temperature
3. Profile data of permafrost geology
4. Thermal and mechanical properties of frozen soils and the data from Low Temperature Laboratories
5. Ground ice
6. TM, SPOT images and aerial photographs in typical permafrost regions

#### Snow cover

1. Ground observation data
2. Snow chemistry
3. Snow avalanche and snowdrift
4. Snow physical parameters
5. Snow remote sensed data: AVHRR, SMMR, TM, SPOT  
Northern Hemisphere—winters and springs from 1966–1983 (CCT,  $\frac{1}{2}$  inch)  
Snow spectrum reflection data in different state (0.38- to 1.2- $\mu$ m; resolution: 10 mm, density: 1600/800,  $\frac{1}{2}$  inch)
6. Engineering parameters of snow

#### Data and publications available include:

- Glacier inventory of China
- Qilian Mountains (1 volume)
- Altayshan (1 volume)
- Pamir (1 volume)
- Inland water system on Qinghai-Xizang Plateau (the basin of Zhari Namco) (1 volume)
- Kunlun Mountains and Karakorum (5 volumes)

*Journal of Glaciology and Geocryology* (quarterly) (volumes 1–13)

Memoirs of Lanzhou Institute of Glaciology and Geocryology (5 volumes, 1980–1985)

Geocryology (numbers 1–6)

Annual Report of Tianshan Glacial Station (5 volumes, 1966–1983)

#### Maps

Map of Snow, Ice and Frozen Ground in China, 1:4,000,000

Glacier Map of Qomolangma Peak Area, 1:50,000

Batura Glacier Map, 1:60,000

Gonggashan Glacier Map, 1:50,000

Glacier Map of Tianshan Glacier No. 1, 1:10,000 and 1:5,000

Further information can be obtained from WDC-D for Glaciology and Geocryology, Lanzhou Institute of Glaciology and Geocryology, Chinese Academy of Sciences, Lanzhou 730000, China

Telephone: (0931) 26725, Ext. 251

Cable: Lanzhou 0393

Telex: 72008 IGGAS CN

Director: Professor Xie Zichu

Vice Directors: Professor Zeng Qunzhu and Professor Cheng Guodong

Personnel in Charge of Techniques: Associate Professor Feng Xuezhi

Executive Secretary: Assistant Professor Chen Xianzhang

## SWITZERLAND

On behalf of the IPA Working Groups on Mountain Permafrost and on Periglacial Environments, and with the Glacier Commission and the Geomorphological Society of the Swiss Academy of Sciences as co-sponsoring agencies, the Swiss Coordinating Group on Permafrost organized the International Workshop "Permafrost and Periglacial Environments in Mountain Areas" at Interlaken, Switzerland, 16–20 September 1991. Most of the ongoing research projects in the Swiss Alps were presented at this conference.

Efforts continued to develop a system for long-term monitoring of alpine permafrost by photogrammetrically analyzing repeated aerial photography of several rock glaciers and by measuring borehole temperature and vertical/horizontal deformation. Monitoring of borehole temperatures at the Murtèl drill site reveals a pronounced warming trend as a consequence of the



Participants in the post-workshop field trip at the Ursina permafrost borehole near Pontresina/Engadin, Swiss Alps. Left to right: Dramis (Italy), Urdea (Romania), Pissart (Belgium), Haerberli (Switzerland), Ono (Japan), Cheng (China), Sørbel (Norway), Wagner (Switzerland), Sone (Japan), Keller (Switzerland), Rastegayev (U.S.S.R.), Hoelzle (Switzerland), Gorbunov (U.S.S.R.), and Vonder Mühl (Switzerland). (Photograph provided by W. Haerberli.)

late 1980s. At 10-m depth where the amplitude of annual temperature variations is reduced to about 0.3°C, the warming rate during the past four years was about 0.5 to 1°C per decade. Following detailed geophysical mapping and surface sounding (BTS, seismic refraction, DC resistivity, radar), two new permafrost boreholes into bedrock were installed, logged and equipped at the site Ursina above Pontresina/Engadin in connection with problems of avalanche protection and debris flow hazards. First results from borehole temperature and deformation measurements are now available from this site: mean annual permafrost temperatures are close to -0.6° and -1.7°C, permafrost thicknesses are about 35 and 40 m, and surface creep rates of the frozen sediments with up to about 80% ice by volume are 6 and 10 cm/year.

On the large rock glacier Suvretta at Piz Albana near St. Moritz/Engadin, new investigations started with

geophysical soundings (seismic refraction, DC resistivity) and tracer experiments in a small river passing underneath the rock glacier front. First attempts were also made to apply gravimetric and VLF-resistivity measurements to Alpine permafrost. With respect to the permafrost cores from the Murtèl drilling, methods of gas extraction are currently being tested (Paul Scherrer Institute, ETH Zurich), rock particles are being analyzed (Engineering Geology, ETH Zurich) and the special characteristics of the main shear horizon (fabric, isotopes) are being investigated (Laboratoire de Géomorphologie, Université Libre de Bruxelles).

In accordance with her Academy of Sciences, Switzerland has offered the IPA Council to host one of the forthcoming International Permafrost Conferences.

Prepared by Wilfred Haerberli

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## U.S.A.

The U.S. Committee for the IPA plans to meet during the August 1992 meeting of the IPA. The U.S. Committee on Permafrost, formerly under the Polar Research Board of the U.S. Academy of Sciences, is no longer active.

**ASCE News:** The Technical Council for Cold Regions Engineering (TCCRE) of the American Society of Civil Engineers (ASCE) met in Orlando, Florida, 24–26 October 1991. A four-paper session was held on Highways and Airfields in Cold Regions. The next

meeting of TCCRE is scheduled for 8–10 March 1992 in Long Beach, California. TCCRE/ASCE is considering the formation of a Standing Committee on Permafrost; a decision will be reached in 1992.

The next International Conference on Cold Regions Engineering is scheduled for March 1994 in Edmonton, Alberta, Canada, and the following Conference will be held in 1996 in Fairbanks, Alaska.

Report by C.W. Lovell,  
Chairman, USC/IPA

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## U.S.S.R.

**The Problem of Climate Change and Permafrost:** According to the activity of the WMO-UNEP Intergovernmental Panel on Climate Change, three projects within the limits of State scientific-technological programs were developed and financed for the U.S.S.R.:

1. Assessment of Impact of Global Climate Change on the Cryolithozone;
2. Monitoring of the Cryolithozone;
3. Cryosphere: Dynamics of the Coastal Area.

The basic investigations are carried out by the Permafrost Institute and Cryosphere Institute of the Siberian Branch of the U.S.S.R. Academy of Sciences, other institutions of the Academy, departments of the Moscow State University, VSEINGEO and other agencies. The research is guided under the leadership of Academician P.I. Melnikov.

*Project 1: Scientific analysis of contemporary cryolithozone in the U.S.S.R. and scenarios of its possible changes:* The changes of climate during the past 100 years in the permafrost area of the U.S.S.R. and the assessment of permafrost/surface temperature and thickness of the active layer are being studied. The emission of greenhouse gas from degrading frozen ground into the atmosphere at stations established in North Yakutia and the Magadan area. Estimates of methane release from gas hydrates should be undertaken.

*Project 2: The evolution of heat balance in permafrost by the natural and man-induced climate change within the limits of different blocks of lithosphere:* Special stations for systematic temperature measurements in

permafrost to the depth of 20–30 m are being established. One of those stations is situated near Yakutsk and is being managed by the U.S.S.R. Permafrost Institute and Japanese Institute of Low Temperature Science. Two stations in Yamal Peninsula (West Siberia) and at the Viljuii hydropower station (Yakutia) are under construction. Additional stations are proposed to be established in different areas of Siberia, the Far East and in China along meridians crossing the permafrost area.

*Project 3: History of permafrost during Pleistocene and Holocene:* Assessment of the contemporary changes of the landscapes in the region of the Novosibirsky Islands and adjacent coastal plains is in progress. Equal to this, the investigations to elaborate measures to protect structures and facilities from anticipated negative impacts of permafrost degradation have begun. The new types of foundations and methods to strengthen the basements from thawing are being developed. Experiments on test sites using artificial cooling for weak foundations are in progress.

Report by N.A. Grave,  
U.S.S.R. Academy of Sciences

**The Conference on Ground Ice and Cryomorphogenesis:** The Department of Geocryology of the Moscow State University and the Division of Complex Investigations of Chukotka, Northeastern Research Institute, Far Eastern Branch, U.S.S.R. Academy of Sciences co-organized the Conference on Ground Ice and Cryomorphogenesis under the direction of the Interdepartmental Lithological Committee, Section "Cryolithogenesis" and Scientific Council on Engineering Geology and Hydrogeology, U.S.S.R. Academy of Sciences.

The conference was held 19–24 August 1991, in Anadyr, Chukotka, U.S.S.R., and was attended by specialists from the U.S.S.R., the U.S.A. and Japan. Thirty-three Soviet participants, including E.D. Ershov, I.D. Danilov, A. Raukas, G.I. Dubikov, V.G. Kondratev, Y.P. Lebedenko, G.Z. Perlshtein, N.A. Shpolyanskaya, R. Vaikmaye, among others, represented 14 Soviet universities, academic institutions and ministries, as follows: Departments of Geocryology (Faculty of Geology) and Cryolithology (Faculty of Geography) of Moscow State University; Lvov State University; Permafrost Institute, Siberian Branch, U.S.S.R. Academy of Sciences, Yakutsk; Tianshan High Mountain Geocryological Laboratory of the Permafrost Institute; Northeastern Division of the Permafrost Institute, Magadan; the Division of Complex Investigations of Chukotka, Northeastern Research Institute, Far Eastern Branch,

U.S.S.R. Academy of Sciences; Institute of Geology, Estonian Academy of Sciences; Institute of Engineering Site Investigations, Moscow; Mining Institute, Siberian Branch, U.S.S.R. Academy of Sciences, Yakutsk; All-Union Research Institute of Hydrotechnics named after B.E. Vedeneev, St. Petersburg; NPO Site Investigations for Construction; Institute "Mosgiprotrans," Moscow.

The U.S. participants included Jerry Brown, Ray Kreig, James Rooney, Duane Miller, Max Brewer and Beez Hazen. Japanese participants were Masami Fuku, Institute of Low Temperature Science; and Shinji Saito, Nagoya City University.

Professor Edward Ershov, Head of the Department of Geocryology, MSU, was the Conference's Presiding Officer and Chairman of the Organizing Committee. Dr. M. Tishin, Head of the Geocryological Laboratory, Division of Complex Investigations of Chukotka, was Co-chairman of the Organizing Committee and the Conference host. Dr. N.I. Trush was Scientific Secretary of the Conference.

Twenty-three papers were presented, including six American and Japanese reports, in four categories:

- Theoretical and regional problems of ground ice formation and cryomorphogenesis
- Isotopic chemical composition of ground ice and host frozen soils
- History of ground ice formation and paleocryogenic phenomena
- Ground ice and industrial development of the permafrost zone

Present-day theoretical and practical problems of ground ice formation were discussed in papers by Danilov and Ershov. Classification of massive ice and problems related to the formation and genesis of massive ice in the northern part of Western Siberia and within the alpine permafrost zone of the Middle and Central Asia's mountains were addressed by Danilov, Shpolyanskaya and Ermolin. Problems related to the structural ice formation and to microstructure of frozen soils were discussed by Ershov, Lebedenko and Chuvilin. Isotopic-chemical composition of ground ice and glaciers were addressed by Vaikmaye, Fukuda, Dubikov, Kotov and Bragnik.

Vaikmaye presented results of comparative analysis of isotope composition of oxygen in ground ice and glaciers for paleoclimatic reconstructions. Fukuda addressed a paper on occurrence of ice-wedge ice and



Cape Rogoznyi outcrop of the Late Pleistocene frozen glaciomarine deposits with massive ice and syngenetic ice wedges, northern coast of the Onemen Bay, Anadyr, Chukotka, U.S.S.R. (Photograph by Igor D. Danilov, Moscow State University, August 23, 1991.)

its chemical composition in the Tertiary bedrock at Seymour Island, Antarctic Peninsula. Dubikov's primary concern was geochemistry of massive ice and frozen host soils. Raukas discussed the current state of the problem of the Pleistocene cryogenic periods and glacial formations. He proposed critical analysis of the most recent stratigraphic schemes compiled on the U.S.S.R. European part and also their correlation. Kotov, Bogutsky, Voloshin and others discussed paleocryogenic problems of ground ice formation in Chukotka and Western Ukraine.

Brown presented results of investigations of active layer and near-surface ground ice characteristics at Barrow, Alaska. Rooney presented results of engineering geological site investigations in the Copper River Basin, Alaska, which revealed patterns of ice distribution in frozen lacustrine and glacial marine deposits. Kreig presented results of test borings from mounds in the Little Tonsina River valley, Alaska. Airphoto analysis and borehole data suggest a frost heave mechanism for formation of the mounds within the Southern Copper River Basin. Climatic change and temperatures of permafrost in arctic Alaska were addressed by Brewer. Duane Miller presented examples of application of new technology in Arctic engineering.

Roujansky and Danilov discussed relationships between development of the permafrost zone in the Northern Eurasia in the Late Cenozoic and neotecton-

ics. They showed the role of different scale tectonic movements in the evolution of the permafrost zone, in particular, of its cryogenic topography.

The influence of ground ice on the industrial development of the Arctic and the permafrost zone of the Soviet Union was discussed by Krivonogova, Kondratev and several others.

Several field trips included visits to various industrial enterprises in Anadyr region, including a power station and a dam, and some construction and engineering sites in Anadyr, and test sites of the Anadyr permafrost laboratory. One of the test sites called "Ozernoe" is used for agricultural research on tundra terrain. The 1700-m-long, 16-m-high earth dam and underlain by permafrost is kept frozen with a large number of thermopiles placed to depths of 16–35 m.

A boat trip from Anadyr city along the northern coast of the Onemen Bay to the Cape Rogoznyi allowed observation of different types of ground ice outcrops along the bluff. The Late Pleistocene frozen deposits with massive ice and syngenetic ice-wedges compose various geomorphological levels and are heterogeneous both in horizontal plan and in cross section.

The Conference coincided with dramatic events in the Soviet Union (August coup). The Soviet conferees expressed their sincere appreciation to the American and Japanese colleagues for their solidarity and support for the democratic process.

The Conference was a success thanks to support of its sponsors: Center of Youth's Initiative, Yakutsk; North-eastern Research Institute, Far Eastern Branch, U.S.S.R. Academy of Sciences, Magadan and Anadyr; Executive Committee of Soviet of People's Deputies of Chukotka, Anadyr.

The Conference provided an excellent opportunity for Soviet, American and Japanese participants to share their achievements and new ideas on permafrost science and cold regions engineering. The next meeting is proposed to be held in Lvov, Ukraine, U.S.S.R., and Tallinn, Estonia, in 1992.

Report by Vladislav E. Roujansky  
and Edward D. Ershov,  
Moscow State University

## MISCELLANEOUS

### 22nd Annual Geomorphology Symposium

Approximately 100 registrants participated in the 22nd Annual Geomorphology Symposium hosted this year by the Department of Geography at SUNY–Buffalo, and devoted to periglacial geomorphology. Seventeen speakers divided their attention almost equally between alpine and (sub)polar periglacial regimes. The alpine speakers distributed their attention across the U.S./Canadian Rockies, the Appalachians, the Andes, and the Scottish Highlands, while the (sub)polar group focused its attention primarily upon the Canadian archipelago with one Antarctic presentation. A poster session embraced a wide range of periglacial topics. A generous amount of time for informal discussion contributed greatly to a very successful meeting.

A number of issues emerged from a broad range of thematic papers. Among the more pervasive problems and emphases to be discussed were:

1. The need for both more field data on, and a more sophisticated conceptualization of, freeze–thaw weathering.
2. The fundamental controls on periglacial development imposed by lithology and previous glacial history in at least some periglacial environments.
3. The limitations imposed upon our understanding of contemporary periglacial process rates by

“Ph.D.” time (i.e., the three- to four-year period of monitoring normally reported).

4. Both the theoretical progress made in our understanding of frost sorting, as well as the value of still approaching it as a multiple working hypothesis, field issue.
5. The considerable terminological complexity concerning various types of ground ice, as well as the ongoing uncertainty with respect to origin in many instances.
6. The serious problem in continuing to overlook the role of chemical processes in cold environments.

In all the symposium revealed periglacial geomorphology to be in a vigorous state with a growing level of sophistication in both the investigation of new aspects of the discipline as well as in reconsideration of established concepts. The symposium volume, edited by the organizers John C. Dixon and Athol D. Abrahams, is to be published as *Periglacial Geomorphology* in June 1992 by John Wiley and Sons Ltd., and promises to be stimulating reading for anyone interested in periglacial geomorphology.

Report by Colin E. Thorn,  
University of Illinois–Urbana/Champaign

### Sixth International Symposium on Ground Freezing



ISGF 91 was held at the Fragrant Hill Hotel in Beijing, China, 10–12 September 1991. The meeting, hosted by the Central Coal Mining Research Institute, was chaired by Professor Yu Xiang. Approximately 100 specialists in ground freezing technology and practice attended, one-half of whom were from countries outside of China, including Belgium, Canada, England, Finland, France, Germany, Japan, Sweden, Switzerland, the U.S.A. and the U.S.S.R.

The conference included technical sessions on Heat and Mass Transfer, Mechanical Properties, Engineering Design and Case Histories. Recent advancements in the understanding of ice segregation and frost heave processes were presented. Also, some current studies of strength and creep of frozen soil were discussed. Practical methods for calculating and dimensioning artificial ground freezing projects were presented and

case histories including innovative technology and problems were also discussed. The first volume of the proceedings, *Ground Freezing 91*, has been published by A.A. Balkema (Yu Xiang and Wang Changsheng, Ed.), and includes 56 papers. Late papers and discussion summaries will be published in a second volume.

The conference was followed by a technical tour to Qufu to observe a shaft-sinking site. Cultural visits were also made to Shanghai and Xian and to Dunhuang in western China.

The International Organizing Committee (IOC) for the ISGF symposia also met to conduct business. It announced that the next ISGF will be held in Nancy, France, in 1994. Details will be published by the French National Committee.

Report by Edwin J. Chamberlain,  
Treasurer, IOC ISGF

## Commission on Global Continental Paleohydrology (GLOCOPH)

The INQUA International Council at its meeting in Beijing on 7 August 1991 accepted the proposal presented by delegates L. Starkel (Poland) and V. Baker (U.S.A.) and founded a Commission on Global Continental Paleohydrology. The officers of this new Commission are: President—L. Starkel, Polish Academy of Sciences; Vice-Presidents—V. Baker, University of Arizona, and K.J. Gregory, University of Southampton, U.K.; Secretary—J. Maizels, University of Aberdeen, U.K. The following are proposed for the new Commission:

Analysis of the nature of global hydrological changes (fluxes and storages) during the last 20 ka using a time resolution of  $10^2$ – $10^3$  years in all land areas with some emphasis on those holding the greatest human populations and the most water-sensitive areas. The objectives should include:

- Development of interrelated data bases employing existing data sets by defining a range of proxy indicators
- Quantification of changes in the water balance including precipitation, runoff, evaporation and various types of storage in major world zones
- Analysis of factors, including climate and human activity, controlling changes in the water balance
- Correlation of the results of existing models and development of global paleohydrological models based on paleohydrological explorations in the field
- Extension of the results to contribute to predictions of future hydrological changes.

To realize this extensive program we need a good internal structure for our Commission as well as an evaluation of the present state of the art by preparing an edited book entitled *Global Continental Paleohydrology* (edited by K.J. Gregory in cooperation with V. Baker and L. Starkel). In fact, this book is now under preparation and will include chapters providing the background and summarizing the state of research.

Internal structure of the GLOCOPH: The formation of the following subcommissions were proposed: polar and subpolar zone; temperate zone; arid zone; humid tropics; and high mountains (facultative). In each of these zonal commissions it will be necessary to identify some key river and lake basins.

Parallel with these subcommissions working groups for special problems were proposed: global water cycle changes and estimation of changes; database development for runoff and methods for its reconstruction; methods of reconstruction of changes in water storage (groundwater, permafrost, glaciers, lakes, etc); and interrelations between water cycle, biomass and the carbon cycle.

The new Commission welcomes comments and individuals to be associated with subcommissions and with working groups. Further information may be obtained from Professor K.J. Gregory, Department of Geography, University of Southampton, SO9 5NH, U.K.

Modified from report of L. Starkel,  
Polish Academy of Sciences

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## Southern Africa

While not an area one would readily associate with permafrost there is, nevertheless, a small group of people with a strong interest in the recent role of this phenomenon in the development of the local mountain landforms. As reported in *Frozen Ground* No. 8, a meeting of IGCP #297 was held in South Africa in 1990 during which a number of overseas visitors were taken to see several key sites. However, much detailed work remains to be done, not the least being to determine if, when and where permafrost actually existed

in the Drakensberg/Western Cape mountains and/or whether these mountains were glaciated. At the present time, studies regarding present-day, non-permafrost periglacial processes are taking place in both the Western Cape and the Drakensberg. Work undertaken outside of southern Africa includes weathering and periglacial studies in Antarctica and in Argentina.

Report by Kevin Hall,  
University of Natal, South Africa

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## Frost in Geotechnical Engineering

The first conference on Frost in Geotechnical Engineering was held in Finland in March 1989. The organizers are proposing a second conference in Alaska in either 1993 or 1994, possibly in conjunction with

the VI International Conference on Permafrost. For further information contact Dr. Arvind Phukan, School of Engineering, University of Alaska, 3221 Providence Avenue, Anchorage, Alaska 99504.

## JOURNALS AND BOOKS

# 冰川冻土

JOURNAL OF GLACIOLOGY AND GEOCRYOLOGY

### Journal of Glaciology and Geocryology (selected frozen ground titles)

#### Volume 13, No. 1

*Improvement of Saline Soils in the Seasonally Frozen Ground Regions*; Qiu Guoqing

*Changes of the Permafrost Environment in Great Xian Ridges After Disastrous Forest Fire*; Liang Linheng, Zhou Youwu, Wang Jiacheng and Gao Xinwang

*Hydraulic Conductivity of Unsaturated Soil and Its Changing Regularity in Saturated Soil After Freezing-Thawing Cycles*; Deng Yousheng and Xu Xiaozu

*Carbon Fixation and Glacial Epoch During Geological History*; Wang Ziming

*Soil Wedge and Ice Wedge Pseudomorphs and Their Paleoclimatic Implications*; Wang Baolai

*The Modern Climatic Undulation and the Change of Cold and Warm in Recent 250 Years in Balikun Basin*; Luo Geping and Yuan Yujiang

*Effect of Glacier-Permafrost on Isotopic Formation and Sampling Method of  $^{14}\text{C}$  Dating*; Gu Gongshu,

Chen Huiqin and Zhang Hongwei.

*Interpreting the Permafrost Thickness with Logging Curves*; Wang Xianlie

#### Volume 13, No. 2

*The Distributive Characteristics of Frozen Ground in the East of Qinghai-Xizang Plateau*; Wang Shaoling, Luo Xiangrui and Guo Pengfei

*Approach to Genesis and Era of Clayey Gravel in Guilin*; Kong Fanye, Zeng Huayan and Wu Shuimu

*Periglacial Periods and Pleistocene Environment in Western Mountains of Beijing, China*; Guo Xudong, Yan Fuhua and Jin Zengxin

*Explanation of Electrical DC Resistivity Sounding at the Headwaters of Urumqi River, Tianshan*; Zeng Zhonggong and Qiu Guoqing

*Buried Humus Soil and Syngenetic Permafrost Around the Daxigou Meteorological Station at the Source of the Urumqi River*; Zhao Ling and Qiu Guoqing



## PERMAFROST AND PERIGLACIAL PROCESSES

### Permafrost and Periglacial Processes

#### Volume 2, Issue No. 3

*Pentes, Granulometrie et Mobilité des Matériaux le Long d'un Talus d'Eboulis en Milieu Alpin*; Francou

*Alpine Permafrost Temperature Zonality, Northern Trans-Baikal Region, U.S.S.R.*; Romanovskii, Zaitev, Volchenko, Zagryazhan and Sergeev

*Observations of Aeolian Transport and Niveo-*

*Aeolian Deposition at Three Lowland Sites, Canadian Arctic Archipelago*; Lewkowicz and Young

*Ice-Wedge Casts of Wisconsin Age in Eastern Nebraska*; Wayne

*Localisation, Génèse et Fonte de Quelques Nalds du Nord du Yukon*; Lauriol, Cinq-Mars and Clark

**Volume 2, Issue No. 4**  
**(Special Issue, provisional contents)**

*Introduction*; Hall and Lauitridou.

*Model of Rate of Frost Shattering, Japan, Svalbard and Spitsbergen*; Matsuoka

*Frost Heave Mechanism of Welded Tukk Rock*; Akagawa and Fukuda

*Weathering by Segregation Ice Growth in Micro-cracks at Subzero Temperatures*; Hallett, Walders and Stubbs

*Rock Properties as Controls on Free Face Debris Fall Activity*; Douglas, Whalley and McGreevy

*Mechanical Weathering Associated with Seasonal Late-Lying and Perennial Snowpatches, Jotenheim, Norway*; Berrisford

*Frost Weathering of Rocks in the Presence of Salt*; Williams and Robinson

*Rock Moisture Data from Juneau Icefields*; Hall

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## **Engineering Geology of the Earth**

The book, *Engineering Geology of the Earth*, edited by W.R. Dearman, E.M. Sergeev and V.S. Shchakova 1989, Nauka Publishers, was first proposed by Academician Sergeev. Two of the 11 chapters are specifically devoted to permafrost and include sections by: V.T. Trofinov, K.A. Kondratyeva, E.D. Ershov, N.I. Trush, B.A. Savelyev, V.V. Bauten and N.A. Oberman. Other

chapters are devoted to loess, continental shelves, and mountain regions. For further information on availability of this and related International Association of Engineering Geology books, contact Secretary General, IAEG, c/o L.C.P.C., 58 Bd. Lefebvre, 75732 Paris cedex 15 France.

# **Polar Journals from Cambridge**

## **Polar and Glaciological Abstracts**

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## **Polar Record**

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**Subscription Information:** Volume 27 in 1991. Published in January, April, July and October: £48 for institutions; £32 for individuals; airmail £17 per year extra ISSN 0032 - 2474

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## Guidebooks

Guidebooks (1–6) prepared for the IV Conference on Permafrost held in Alaska are still available. Other related publications are still available and can be obtained from the Alaska Division of Geological and Geophysical Surveys, 794 University Avenue, Basement, Fairbanks, Alaska 99709-3645, Phone: 907-474-7147.

GB 1 *Guidebook to Permafrost and Quaternary Geology Along the Richardson and Glenn Highways Between Fairbanks and Anchorage, Alaska*, T.L. Péwé and R.D. Reger (Ed.), 1983, 263 p., scale 1:250,000, 1 sheet. \$7.50.

GB 2 *Guidebook to Permafrost and Related Features of the Colville River Delta*, H.J. Walker, 1983, 34 p. \$2.00.

GB 3 *Guidebook to Permafrost and Related Features of the Northern Yukon Territory and MacKenzie Delta, Canada*, H.M. French and J.A. Hegibottom (Ed.), 1983, 186 p. \$8.50.

GB 4 *Guidebook to Permafrost and Related Features Along the Elliott and Dalton Highways, Fox to Prudhoe Bay*, Jerry Brown and R.A. Kreig (Ed.), 1983, 230 p. \$7.50.

GB 5 *Guidebook to Permafrost and Related Features at Prudhoe Bay*, S.E. Rawlinson (Ed.), 1983, 150 p. \$6.

GB 6 *Guidebook to Permafrost and Engineering Problems Along the Alaska Railroad Between Anchorage and Fairbanks*, T.C. Fuglestad, 1986, 82 p., 2 sheets. \$7.50.

GB 7 *Bedrock Geology of the Eastern Koyukuk Basin, Central Brooks Range, and East-Central Arctic Slope Along the Dalton Highway, Yukon River to Prudhoe Bay, Alaska*, C.G. Mull and K.E. Adams (Ed.), 1928, 2 vol., 309 p., scale 1:125,000 and 1:2,851,200, 2 sheets. \$40.00.

## PERMAFROST AND PERIGLACIAL PROCESSES

### EDITOR-IN-CHIEF

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*Permafrost and Periglacial Processes* is an international journal dedicated to the rapid publication of scientific and technical papers concerned with earth surface cryogenic processes, landforms and sediments present in a variety of (Sub) Arctic, Antarctic and High Mountain environments. It provides an efficient vehicle of communication amongst those with an interest in the cold, non-glacial geosciences. The focus is on (1) original research based on geomorphological, hydrological, sedimentological, geotechnical and engineering aspects of these areas and (2) original research carried out upon relict features where the objective has been to reconstruct the nature of the processes and/or palaeoenvironments which gave rise to these features, as opposed to purely stratigraphical considerations. The journal also publishes short communications, reviews, discussions and book reviews. The high scientific standard, interdisciplinary character and worldwide representation of PPP are maintained by regional editorial support and a rigorous refereeing system.

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Volume 3 1992 Quarterly US\$165.00

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## Calendar of Recent and Forthcoming Meetings

1992

**Polartech '92: International Conference on Development and Commercial Utilisation of Polar Technologies in Polar Regions**

**21–24 January 1992, Montreal, Canada**

Contact: Polartech '92 Secretariat, Conference Office, McGill University, Sherbrooke St. W., Montreal, H3A 3C5 Canada.

Phone: (514) 398-3770; Fax: (514) 398-4854;

Telex: 05-268510.

**22nd Arctic Workshop**

**5–7 March 1992, Boulder, Colorado, U.S.A.**

Contact: John Andrews, INSTAAR, Campus Box 450, University of Colorado, Boulder, Colorado 80309-0450  
Phone: (303) 492-6631; Fax: (303) 492-6388

**Classification of Circumpolar Arctic Vegetation**

**5–9 March 1992, Boulder, Colorado, U.S.A.**

Contact: Marilyn Walker, INSTAAR, Campus Box 450, University of Colorado, Boulder, Colorado 80309-0450  
Phone: (303) 492-5276; Fax: (303) 492-6388

**Role of Global Change in the Arctic**

**21–26 April 1992, Reykjavik, Iceland**

Contact: International Arctic Science Committee, Secretariat, P.O. Box 158, 1330 Oslo Airport, Norway  
Phone: 47-2-123 650; Telex: 74745 POLAR N  
Fax: 47-2-122 635;

**14th Polar Libraries Colloquy—International Sharing of Polar Information Resources**

**3–8 May 1992, Columbus, Ohio, U.S.A.**

Contact: Lynn Lay, Byrd Polar Research Center, Ohio State University, Columbus, Ohio 43210  
Phone: (614) 292-6715; Fax: (614) 292-4697

**Second Circumpolar Symposium on Remote Sensing of Arctic Environments**

**4–6 May 1992, Tromsø, Norway**

Contact: Roald Amundsen Centre for Arctic Research, University of Tromsø, N-9000 Tromsø, Norway  
Phone: 47 83 45 240; Fax: 47 83 80 705

**Impacts of Climate Change on Resource Management of the North**

**12–14 May 1992, Whitehorse, Yukon Territories, Canada**

Contact: Al Malin Auska, Canadian Climate Centre, 4905 Dufferin St., Downsview, Ontario M3H 5T4, Canada  
Phone: (416) 739-4431; Fax: (416) 739-4380

**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, P.O. Box 1107, Golden, Colorado 80402-1107

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

**Permafrost and Periglacial Environments in Mountain Areas—International Workshop**

**1–3 August 1992**

Pre-Workshop Field Trip: Permafrost and Periglacial Landforms, Mountains of Southwest Alberta  
27–31 July 1992

Post-Workshop Field Trip: Periglacial Features in the Northern Rocky Mountains of the U.S.A.  
4–7 August 1992

Contact: S.A. Harris, Department of Geography, University of Calgary, Alberta T2N 1N4, Canada  
Phone: (403) 720-5584

**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.

**IPA Council Meetings**

**6–8 August 1992, Washington, D.C., U.S.A.**

(Other IPA committees and working groups to meet—locations to be announced in June 1992 News Bulletin)

**27th Congress of the International Geographical Union**

**9–14 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.

Phone: (202) 828-6688; Fax: (202) 775-6141  
Telex: 64194

**IGU Post-Congress Field Trip**

**14–18 August 1992, Central Appalachians, U.S.A.**

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 95616

**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.

**9th Symposium on Northern Research Basins**

**August 1992, Saskatoon, Saskatchewan, Canada**

Contact: Terry Prowse, National Hydrology Research Centre, 11 Innovation Boulevard, Saskatoon, Saskatchewan, S7N 3H5, Canada  
Phone: (306) 975-5737; Fax: (306) 975-5143

**International Conference on Arctic Margins (ICAM)  
2–4 September 1992, Anchorage, Alaska, U.S.A.**

Contact: Dennis Thurston or David Steffy, 1992 ICAM, Alaska Geological Society, P.O. Box 101288, Anchorage, Alaska 99510  
Phone: (907) 271-6545 (Thurston) or 6553 (Steffy)  
Fax: (907) 271-6805

**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

**23rd Annual Binghamton Geomorphology**

**Symposium: Geomorphic Systems**

**25–27 September 1992, Oxford, Ohio, U.S.A.**

Contact: William H. Renwilk, Department of Geography, Miami University, Oxford, Ohio 45056  
Phone: (512) 529-1362

**45th Canadian Geotechnical Conference**

**26–28 October 1992, Toronto, Ontario, Canada**

Contact: Dr. Balu Iyer, Ministry of Transportation of Ontario, 1201 Wilson Avenue, Room 315, Central Building, Downsview, Ontario, M3M 1J8, Canada  
Phone: (416) 235-3731; Fax: (416) 235-5240

**International Conference on Cryopedology**

**10–14 November 1992, Pushchno, Moscow Region, U.S.S.R.**

Contact: Secretariat, Institute of Soil Science and Photosynthesis, U.S.S.R. Academy of Sciences, Pushchno, Moscow Region, 142292, U.S.S.R.  
Phone: 7-095-923-35-58; Telex: 205128 SOIL SU

**1993**

**Symposium on Arctic Resources: The Challenge of Development**

**24–26 May 1993, Anchorage, Alaska**

Contact: Don Blasko, Bureau of Mines, 201 E 9th Avenue, Anchorage, Alaska 99501  
Phone: (907) 271-2455; Fax: (907) 271-3933

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

**5–9 July 1993, Beijing, China**

Contact: Arturo E. Corte, P.O. Box 330, 5500 Mendoza, Argentina  
Fax: 54-61 380370; Telex: 55438 CYTME AR

**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

**International Permafrost-Affected Soil Correlation Meeting: 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, U.S.A.  
Phone: (402) 437-5363; Fax: (402) 437-5336

**ICG Pre-Conference Field Trip–Geomorphology and Permafrost of Yukon and Western Canadian Arctic  
11–22 August 1993**

Contact: C.R. Burn, Department of Geography, University of British Columbia, Vancouver, British Columbia C6T 1W5, Canada

**Third International Conference on Geomorphology  
(including the Binghamton Symposium–25 August)**

**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

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## NATIONAL CONTACT ADDRESSES

### Argentina

Dr. Arturo E. Corte  
Laboratorio De Geociologia  
Acta Geociogenica  
Casilla de Correo 330  
5500 Mendoza, Argentina

### Belgium

Dr. Albert Pissart  
Université de Liège  
Géomorphologie et Géologie du Quaternaire  
7, Place du 20 Août  
4000 Liège, Belgium

### Canada

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Department of Geography and Geology  
University of Ottawa  
Ottawa, Ontario K1N 6N5, Canada

### China

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Lanzhou Institute of Glaciology and Geocryology  
Academia Sinica  
Lanzhou, 730 000 China

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Rosenvængets Allé 16  
DK-2100 Copenhagen Ø  
Denmark

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Dr. Matti Seppälä  
Department of Geography  
University of Helsinki  
Hallituskatu II  
SF-00100 Helsinki, Finland

### France

Dr. Jaime Aguirre-Puente  
Laboratoire d'Aérothermique du C.N.R.S.,  
4 Route des Gardes  
92190 Meudon, France

### Germany

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Geographisches Institut  
Justus Liebig-Universität  
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### Italy

Dr. Francesco Dramis  
Department of Geology  
Università di Camerino  
Viale Beati I  
62032 Camerino, Italy

### Japan

Dr. Masami Fukuda  
Institute of Low Temperature Science  
Hokkaido University  
N19 W8 Sapporo 060, Japan

### The Netherlands

Professor Eduard A. Koster  
Geographical Institute  
University of Utrecht  
P.O. Box 80.115  
3508TC Utrecht, The Netherlands

### Norway

Odd Gregersen  
Norwegian Geotechnical Institute  
PO Box 40 Tasen  
0801 Oslo 8, Norway

### Poland

Dr. Alfred Jahn  
Geographical Institute  
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pl Uniwersytecki 1  
50-137 Wrocław, Poland

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W. Haeblerli  
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Dr. H. Jonas Akerman  
Department of Physical Geography  
University of Lund  
Soelvegatan 13  
S-23362 Lund, Sweden

### United Kingdom

Dr. Charles Harris  
Department of Geology  
University of Wales, PO Box 914  
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### U.S.A.

C.W. Lovell  
School of Civil Engineering  
Purdue University  
West Lafayette, Indiana 47907

### U.S.S.R.

Academician P.I. Melnikov  
National Permafrost Committee  
U.S.S.R. Academy of Sciences  
Fersman Street 11  
117312 Moscow, U.S.S.R.

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Contacts: *Frozen Ground News Bulletin* (if different than above)

### Canada

Mr. J.A. Heginbottom  
Geological Survey of Canada  
601 Booth Street  
Ottawa, Ontario K1A 0E8, Canada

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Dr. Cheng Guodong  
Lanzhou Institute of Glaciology and Geocryology  
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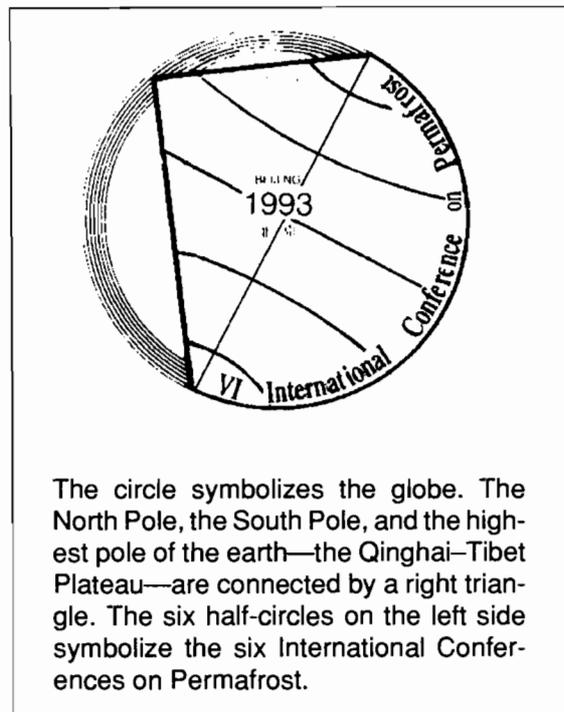
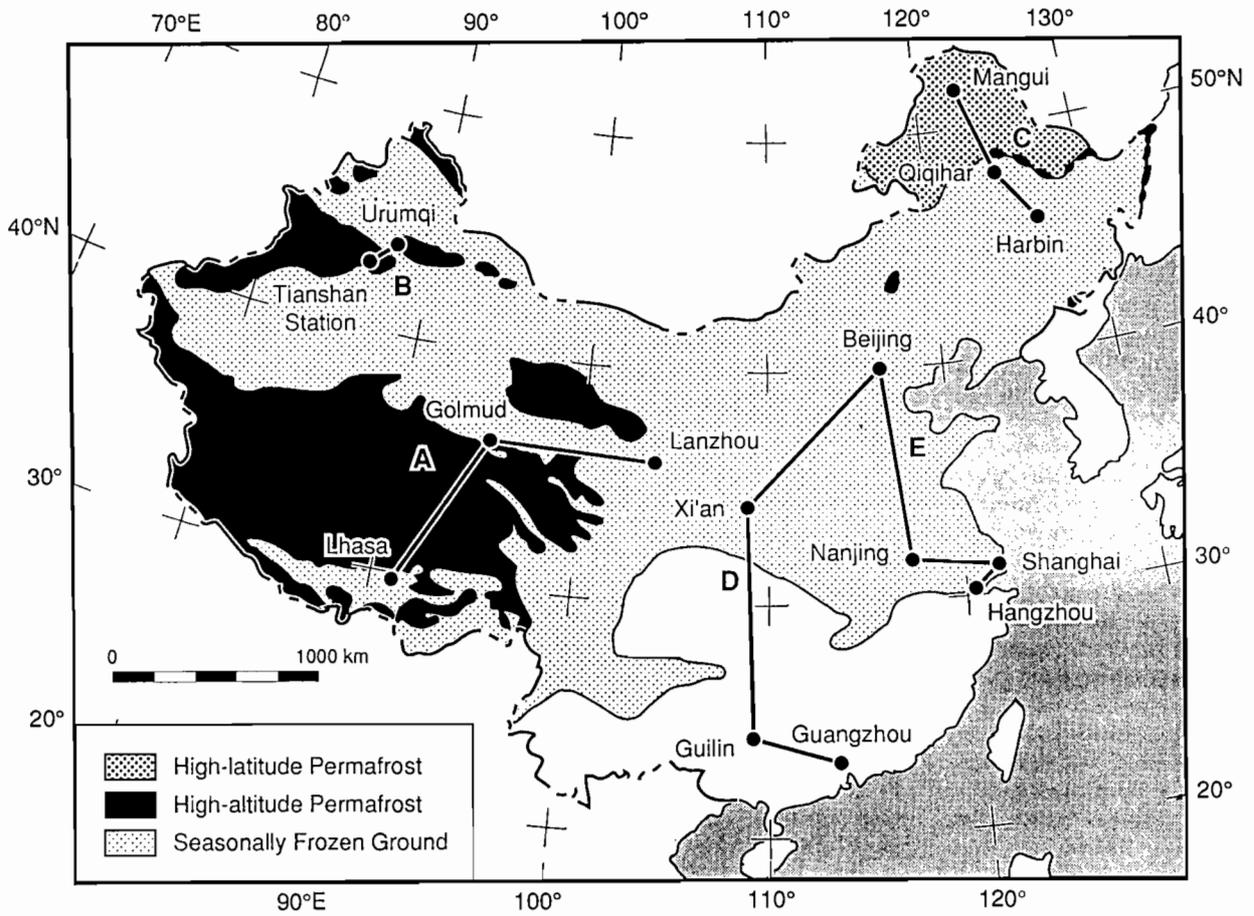
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# Sixth International Conference on Permafrost

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:

<i>Permafrost Science</i>	<i>Permafrost Engineering</i>
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 (see map)

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 12 days. Transport will be by train and bus.

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

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 are given in the First Bulletin.

## Abstract Deadline

Extended to February 15, 1992

## Correspondence and Preliminary Questionnaire

All correspondence pertaining to the Conference should be addressed to:

Prof. Cheng Guodong  
Secretariat for the Sixth International Conference on Permafrost  
Lanzhou Institute of Glaciology  
and Geocryology  
Chinese Academy of Sciences  
Lanzhou 730000, China  
Telex: 72008 IGGAS CN  
Fax: 86-931-485241

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I would like to join the following conference tours:

- A  Qinghai-Tibet Plateau/Lhasa  
B  Tianshan Mountains/Ürümqi  
C  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<br>tour      | Post-conference<br>tour     |
|--|-----------------------------|-----------------------------|
| D <input type="checkbox"/> South and central China           | <input type="checkbox"/> 1D | <input type="checkbox"/> 2D |
| E <input type="checkbox"/> East China                        | <input type="checkbox"/> 1E | <input type="checkbox"/> 2E |
| <input type="checkbox"/> Beijing (one day during conference) |                             |                             |