

FROZEN GROUND



The News Bulletin of the International Permafrost Association

Number 23, December 1999



International Permafrost Association

The International Permafrost Association, founded in 1983, has as its objectives fostering the dissemination of knowledge concerning permafrost and promoting cooperation among persons and national or international organizations engaged in scientific investigation and engineering work on permafrost. Membership is through adhering national or multinational organizations or as individuals in countries where no Adhering Body exists. The IPA is governed by its officers and a Council consisting of representatives from 23 Adhering Bodies having interests in some aspect of theoretical, basic and applied frozen ground research, including permafrost, seasonal frost, artificial freezing and periglacial phenomena. Committees, Working Groups, and Task Forces organize and coordinate research activities and special projects.

The IPA became an Affiliated Organization of the International Union of Geological Sciences in July 1989. The Association's primary responsibilities are convening International Permafrost Conferences and accomplishing special projects such as preparing maps, bibliographies, and glossaries. The first Conference was held in West Lafayette, Indiana, USA, 1963; the second in Yakutsk, Siberia, 1973; the third in Edmonton, Canada, 1978; the fourth in Fairbanks, Alaska, 1983; the fifth in Trondheim, Norway, 1988; the sixth in Beijing, China, 1993; and the seventh in Yellowknife, Canada, 1998. Plans are being made to hold the eighth in Switzerland in 2003. Field excursions are an integral part of each Conference, and are organized by the host country.

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Permafrost Engineering

Cryosols

Coastal and Offshore Permafrost

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Cover: Blockstream in basalt near Sani Pass, Lesotho highlands 2900 m a.s.l. in Southern Africa. This 1.2 km long blockstream is the largest found to date in the highlands. It was visited during the 1999 INQUA post-conference excursion organized by the Southern African Permafrost Group (see page 8). A study on its palaeoenvironmental significance as a periglacial mass wasting feature will appear in the INQUA conference proceedings. Photograph by Jan Boelhouwers, Department of Earth Sciences, University of the Western Cape, South Africa.

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Frozen Ground, the News Bulletin of the International Permafrost Association, is currently published annually.

The IPA is a non-governmental association of national organizations representing 23 countries or groups of countries. The success of the bulletin depends upon the willingness of IPA participants to supply information for publication. News items from any IPA participant or others are very welcome, as are interesting photographs. To submit news items or photos please contact:

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This issue of *Frozen Ground* was compiled by Jerry Brown, Hugh M. French and Hanne H. Christiansen. Production is courtesy of the Institute of Geography, University of Copenhagen. Copies of *Frozen Ground* are available from national contacts.

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Executive Committee Report

Since the Yellowknife conference there has been a change in the operational style of the Association, with an enlarged Executive Committee and a change from a Secretary General to an International Secretariat. An International Advisory Committee has also been appointed, and the financial situation of the Association has been assessed in the light of these administrative changes. The last 18 months has also seen activities by the Working Groups and Task Forces established in Yellowknife. These are reported upon elsewhere in this issue of *Frozen Ground*.

The new IPA Secretariat is now formally located in Denmark and is operated by Dr. Hanne H. Christiansen. The Commission for Scientific Research in Greenland and the Institute of Geography, University of Copenhagen, are jointly funding the Secretariat for the first year, and we are hopeful that this support will continue in the future. The Secretariat is housed in the Institute of Geography, University of Copenhagen.

The first meeting of the new Executive Committee took place in Copenhagen, Denmark, April 26-27, 1999. It was agreed that the Secretary should be a member of the Standing Committee for Data, Information and Communication. The Secretary will also be responsible for the collection of reports and news, and, in association with the President, will oversee the editing and production of *Frozen Ground*. Because of its important role within the Association, the Executive Committee wishes to retain the style and format of previous issues as far as possible. However, budgetary constraints will limit *Frozen Ground* to publication only once a year. In 1999, publication was partially supported by Danish sources.

The annual income of the Association is approximately \$12000.00 (US). Nearly all adhering bodies are paying dues at their respective levels. It is anticipated that approximately 80% of annual revenues will be allocated each year. The funding of Working Groups, Task Forces and the Standing Committee will be for specific purposes, including covering communication. Support for the Secretariat, production of *Frozen Ground* and travel support for young scientists for the 2003 International Permafrost Conference are given high priority. Working Groups, Task Forces and the Standing Committees are requested to seek funding from international or regional funding sources in the first instance. In response to requests from various working parties, approximately \$4000 was allocated in 1999.

Vice-President Wilfried Haeberli reported upon plans for the 2003 conference; a steering committee has been formulated with representatives from the Swiss Academy of Sciences, the Federal Institute for Technology (ETH), and the Swiss Coordinating group on Permafrost. An International Advisory Committee has been appointed to liaise with the Swiss Organizing Committee for the next international conference. Its role will be to provide a 'corporate memory', to ensure that there is continuity and uniformity to the international permafrost

conferences.

Following information supplied by Jerry Brown, the Executive Committee approved plans for the development of an International Permafrost Monitoring Network Service (IPMNS) as part of the Global Terrestrial Network - Permafrost (GTNet-P). The aim is to develop a network of reporting sites in conjunction with the Global Climate Observatory System (GCOS). It was decided to hold an open Executive Committee meeting in 2001, either in association with the First European Permafrost Conference, in Rome, March 2001, or at the Fifth International Association of Geomorphology Conference, in Tokyo, August 2001. An IPA-sponsored visit to Mongolia is being considered in context with the IAG meeting, and collaborative links between China, Mongolia, Kazakstan and Russia are being encouraged. The next formal meeting of the IPA Council will take place in 2003 at the VIII-ICOP in Switzerland.

Following the Executive meeting, President French met briefly with the Dean of the Faculty of Science, Henrik Jeppesen, the Head of the Department of Geography, Bjarne H. Jakobsen, and the Vice-Chair of the Commission for Scientific Research in Greenland, Hans Ammendrup, to thank them for their support for the establishment of the IPA Secretariat in Denmark. Members of the Executive Committee also met with the Danish national IPA contact, Sven Berthelsen, President of the Danish Society for Arctic Technology.

The Executive Committee records with great sadness the passing of several distinguished colleagues during the past year. These include G. Hank Johnston (Canada), Anders Rapp (Sweden), Alfred Jahn (Poland) and Troy L. Péwé (USA).

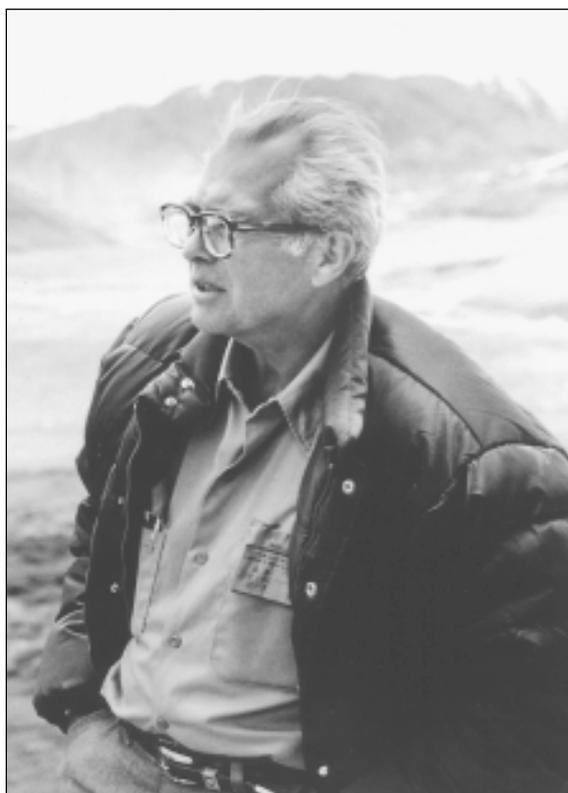
Troy L. Péwé - Memorium

It is with great sadness that we must record the passing of Troy L. Péwé, one of the leading figures behind the founding of the International Permafrost Association. He was the first Vice President, 1983-1988, and the second President, 1988-1993.

Troy Péwé died in Tempe, Arizona, October 21, 1999, with his wife Mary-Jean and members of the immediate family in close attendance. He was 81 years old. Those who knew Troy will remember his determination to live life to the full, in spite of several health-related problems over the last 10 years. He was active until the end. As recently as September 1999, Troy Péwé traveled to Fairbanks, Alaska, to participate in the dedication of the permafrost reserve, named in his honor, where he conducted seminal studies on permafrost and loess over several decades.

The author of over 300 scientific reports and numerous monographs, Troy Péwé had a distinguished scientific career, which spanned five decades. He undertook field investigations in nearly all of the permafrost regions of the world. He was a recognized international authority on permafrost. He was Chair of the U.S. Planning Committees for the Second, Third and Fourth International Conferences on Permafrost, the fourth being held in Fairbanks, Alaska, in 1983, at which over 1000 persons participated. He was recognized with numerous honors and awards, the most notable being the most recent - the 1999 Distinguished Career Award from the Quaternary Geology and Geomorphology Division of The Geological Society of America. His vision and leadership in the early years of the International Permafrost Association cannot be forgotten.

Hugh French



Photograph mid 1980's, Tibet, China.



Troy Péwé and Hugh French pose beside the 10 ton marble boulder containing the dedication plaque for the Reserve at Gold Hill, Fairbanks, Alaska. September 18, 1999.

The Troy L. Péwé Climate Change Permafrost Reserve

On September 18, 1999, an area of 25.5 acres in the immediate vicinity of Fairbanks, Alaska, was formally dedicated as the Troy L. Péwé Climate Change Permafrost Reserve. The reserve is located on the Parks Highway, approximately 10 minutes drive from the campus of the University of Alaska Fairbanks. A 10-ton marble boulder carries a plaque with the following dedication:

"At this site, called Gold Hill, the United States Smelting, refining and Mining Company mined 126,000 ounces of gold worth 4.4 million dollars from gravel under the loess from 1951 to 1957. In 1989, 15.5 acres were purchased by the University of Alaska through an appropriation from the Alaska Legislature, to be set aside as a permanent scientific site. Professor Troy L. Péwé, Head of Geology Department, School of Mines, from 1958 to 1965, and Senator Bettye Fahrenkamp were the motivation forces behind this acquisition. Research at this site since 1947 by Professor Péwé and his associates traced back the geological and climatic history of the site to about three million years ago, as laid down in the frozen layers of windblown "loess" dust, ash layers from volcanic eruptions, and ancient tree trunks and animal remains exposed in 200-foot-high silt cliffs created by gold mining. Several major episodes of global climate warming are recorded, with times of major permafrost thawing and great erosion of loess, alternating with major periods of loess deposition and permafrost formation. This makes it one of the richest sites for the study of past climates in Alaska. It is now preserved for future generations of researchers."

Report of Working Parties

The IPA Council at Yellowknife approved the formation or continuation of the one Standing Committee, six Working Groups (two of which are new) and three Task Forces; collectively referred to as Working Parties. Task Forces are intended to be short-term activities resulting in assessments or recommendations on specific subjects. The following reports cover the period since the 1998 permafrost conference and discuss future plans.

Additional details on the Working Parties guidelines and international liaison were reported in *Frozen Ground 22*. Results of Working Groups for the period 1994-1998 were reported in the abstract volume of the Yellowknife conference and periodically on the IPA web site. Reports were reviewed and edited by Jerry Brown, Member, IPA Executive Committee (jerrybrown@igc.org).

Standing Committee

Data, Information, and Communications

Objectives are to initiate and implement IPA strategies for data, archiving, information product development, and communication within and beyond the permafrost community. Core membership includes J. Branson (UK), M. Burgess (Canada), D. Vonder Mühll (Switzerland), and J. Brown (USA) liaison for Executive Committee and the Global Terrestrial Network-Permafrost (GTNet-P). Representatives from China, Russia and several Working Groups will be added during 2000.

Committee activities this past year involved representing IPA at international meetings, and maintaining the web site and Global Geocryological Database (GGD) activities.

Following distribution of the Circumpolar Active-Layer Permafrost System (CAPS), Version 1.0 CD-ROM by National Snow and Ice Data Center (NSIDC) to all attendees of the Yellowknife Conference, an additional 200 copies were ordered in January 1999 to respond to continued requests for the CD. Several additional GGD data sets were received and these and other new ones will be made available electronically from NSIDC. The complete CAPS is now available on the Global Terrestrial Observatory System (GTOS) web site: www.fao.org/gtos. The IPA map is available on line: ftp://ftp.ngdc.noaa.gov/Snow_Ice/Permafrost/IPA_map/. A short note was published in *Eos* (December 29, 1998) describing CAPS and the statistics for the IPA map units. The map has been prepared as a raster file for use by GCM modelers and is available from NSIDC.

Since Yellowknife members have attended a number of meetings. Informal discussions were held during the American Geophysical Union (AGU) Fall 1998 Conference among Barry, Brown, Burgess, F. Nelson and several others on the development of the permafrost monitoring network (see Monitoring report).

The activities of the committee were presented at the 1998 AGU session honoring Art Lachenbruch; the Asso-

ciation of American Geographers, 95th Annual Meeting, Honolulu, March 1999; the International Conference on Monitoring of the Cryosphere in Pushchino, Russia, April 1999, the IUGG General Assembly in Birmingham, UK, July 1999, and the XVth International INQUA Congress in Durban, South Africa.

During the April 1999 conference in Pushchino, Barry presented a plenary presentation on "Status and Recent Advances in Cryospheric Databases" co-authored with several Russian contributors: Burgess presented a report on Canadian monitoring activities, and Brown assisted by Vladimir Romanovsky and Russian colleagues conducted a panel and roundtable on the IPA/Global Climate Observatory System (GCOS) GTNet-P.

Following a meeting in Southampton in January 1999 among Branson, Clark and Brown, Branson redesigned and updated the IPA web site. In July 1999, Branson, Barry, Brown and Sharon Smith representing Burgess met during the IUGG/GTOS meetings in Birmingham, UK, and discussed additional web site developments including GTNet-P linkages. An informal meeting to discuss Committee and monitoring activities was convened at the AGU meeting in December 1999. The Geological Survey of Canada has established a web page on permafrost research and data in Canada: <http://sts.gsc.nrcan.gc.ca/permafrost/>

Clark and Brown met with the Southern Hemisphere Working Group during the INQUA Congress in August. Procedures to input Southern Hemisphere site information and data to GGD were discussed as were web linkages. Members of the Committee are in contact with the Permafrost and Climate in Europe (PACE) project concerning data transfer to GGD.

As a follow up project to the NSIDC NSF-supported GGD Pilot Project, David Gilichinsky and colleagues prepared soil temperature records for 145 Russian stations. The activity is coordinated under the data exchange agreements of Working Group VIII of the U.S.-Russia Agreement on Cooperation in the Field of Protection of the Environment. The data are scheduled for release in 2000.

Barry was appointed co-chair of the World Climate Research Programmeme (WCRP)-Climate and Cryosphere (CLIC) project. The report of the first CLIC meeting in Utrecht, July 1998 is available from WCRP. Revision of the draft CLIC Science and Implementation Plan continues following the second Task Group meeting held in Grenoble in August 1999. Following review in November 1999 the plan will be submitted to the Joint Scientific Committee of the WCRP in March 2000. Information on CLIC is available on the ACSYS/CLIC Project Office web site hosted at the Norsk Polar Institute in Tromsø, Norway (www.npolar.no/acsys/CLIC/clicindex.html).

Roger Barry (rbarry@kryos.colorado.edu)

Working Groups

Global Change and Permafrost

Objectives are to facilitate analysis of changes in permafrost and its distribution induced by climate change, and to promote knowledge about the impact of these changes on natural systems and human activities. A subgroup coordinates Circumpolar Active Layer Monitoring (CALM) network.

Members and guests of the WG held a business meeting in San Francisco at the AGU conference in December, 1998. Countries represented and participants included Canada (4), Czech Republic (1), Germany (3), Russia (2), and USA (10). Consensus was achieved that the WG should support five major initiatives in its activities:

- Play a substantive role in the activities of the Intergovernmental Panel on Climate Change (IPCC);
- Continue support for the CALM network;
- Develop criteria for standardized borehole measurements;
- Continue development of a spatial perspective on permafrost and global change;
- Advocate for permafrost in global change awareness;

Progress has been achieved in each of these topical areas as follows.

IPCC, Third Assessment Report (TAR): O.A. Anisimov is a Co-ordinating Lead Author and F.E. Nelson is a Lead Author for Chapter 16, "Arctic and Antarctic". Both participated in the Lead Authors Meeting for the TAR in Geneva, Switzerland (January 1999) and in a meeting for Chapter 16 in Cambridge, UK in June 1999. An initial draft of the chapter was submitted in March 1999; and a first-order draft of the TAR was completed in late July and is currently in review by experts from across the spectrum of disciplines concerned with climatic change and its impacts. A number of WG members contributed to the material on permafrost in Chapter 16, including M. Burgess, C. Burn, V. Cermak, C. Harris, K. Hinkel, T. Osterkamp, A. Pavlov, V. Romanovsky, and T. Zhang. Although permafrost is treated in several of the regional chapters, primary attention is given to it in Chapter 16. IPCC Lead Authors met in December, 1999, in Canberra, Australia, and a second-order draft is scheduled for the first half of 2000. Input from the Working Group and other interested parties will again be solicited. Results of activities and publications of other Working Parties and IPA Adhering Members can serve as input to the TAR review process. For the Second Assessment published in 1996, the IPA prepared a draft assessment of permafrost-dominated changes, this appeared in *Frozen Ground* 15, June 1994.

CALM Network: WG members continue their involvement in the CALM Programme, coordinated through a grant to Ken Hinkel at the University of Cincinnati. Activities include continuation of annual data collection, archiving and posting data on the CALM web site, further development of sampling designs at pilot sites in

Northern Alaska, and participation in the meeting on Cryosphere Monitoring in Pushchino, Russia (April 1999). A new collaborative project between the University of Delaware (F. Nelson, O. Anisimov) and the University of Colorado (T. Zhang, R. Barry), concerned with stochastic variability of the active layer, has begun with support from the U.S. NSF. The project includes funding for field investigations into spatial variability at several sites in Eurasia. V. Romanovsky and G. Clow have instituted several new sites in northern and western Alaska to monitor the active layer and ground temperatures.

GCOS Permafrost Network: The WG is supporting activities of the IPA Executive Committee to develop and implement the Global Terrestrial Network for Permafrost (GTNet-P; see Long-Term Permafrost Observations).

Future Working Group plans include a formal meeting during the annual cryosphere conference in Pushchino, Russia, May 2000. Topics for discussion include review of the goals developed at the Yellowknife and San Francisco meetings in 1998, the IPCC report, and the status of the GTNet-P. A paper detailing the scope, goals, and methods of the CALM programme is currently in development by Brown, Hinkel, Nelson and others. A second paper on spatial modeling and analysis in geocryological research is planned, and input will be sought from a wide array of sources.

F. E. Nelson (fnelson@udel.edu)

Periglacial Processes and Environments

Objectives are to evaluate different methodologies and techniques for monitoring periglacial processes, and to publish a manual of recommended techniques.

The WG agreed at the 1993 Permafrost Conference in Beijing to produce a handbook on recommended methods to measure periglacial processes. The proposal received additional support at the IPA Council meetings in Berlin (1995) and Bologna (1997). In Yellowknife, it was decided that the single main objective of the WG should be the production of the handbook, and that this handbook should be available at the permafrost conference in Switzerland in 2003.

The handbook is intended as a field handbook to be used during the conduct of periglacial research, and suggests certain standardisation measurement techniques so that studies undertaken at different locations in both northern and southern polar areas, and at high altitude, produce comparable results. It is not intended to be a textbook on periglacial techniques. The WG is now in the process of contacting lead authors and contributing authors. The production of the first draft of the individual sections is planned during the year 2000.

In connection with the Fifth International Conference on Geomorphology, Tokyo, 2001, a special session on periglacial geomorphology and a field trip to the Japanese mountains are planned. Liaison with the IGU Commission on Climate Change and Periglacial Processes

(CCPP; chaired by Jef Vandenberghe) will continue. The IGU newsletter was distributed via e-mail to all interested readers.

A website has been set up for the IGU Periglacial Commission and the IPA Working Group on Periglacial Processes and Environments. The page includes details of periglacial meetings and a developing, global list of email and/or postal addresses of periglacial scientists at <http://www.cpes.susx.ac.uk/igu>.

Anyone wishing to receive electronic copies of the Circular of the IGU Commission on Climatic Change and Periglacial Environments and the IPA Working Group on Periglacial Processes and Environments who has not already notified their national representative should send their name, electronic and postal address to: j.b.murton@sussex.ac.uk.

Ole Humlum (oleh@unis.no) and Norikazu Matsuoka (matsuoka@atm.geo.tsukuba.ac.jp)

Permafrost Engineering

Objectives are to collect information on the practices and procedures of permafrost engineering in various regions of the world, and to facilitate communications between permafrost scientists.

An ad hoc meeting of the WG was held on August 19, 1999, in Lincoln, NH, on the occasion of the 10th International Cold Regions Engineering Conference. Members present were Branko Ladanyi, Kaare Flaate, Arne Instanes and Rupert Tart. The meeting dealt mainly with the organization of future conferences and the possibilities of publishing the WG contributions. Specifically, the WG members are encouraged to attend the International Workshop on Permafrost Engineering in Longyearbyen, and to publish the material they promised at the Yellowknife WG meeting.

In the past year, L. N. Khroustalev developed a detailed proposal for a project entitled "Effect of climatic warming on infrastructure stability in permafrost regions"

The objective is to develop a method for design of engineering structures in permafrost regions affected by global warming. The final output will include a manual for selection of global warming scenarios for engineering applications, and a database of climate and soil characteristics for different parts of the Earth's permafrost regions. The proposal was circulated by e-mail among WG members. The approach was presented in Tromsø in April as an invited contribution at the IASC workshop on global change.

The following books are in progress:

A new book, entitled *Permafrost Engineering* (Managing Editors, L.N. Khroustalev and E.D. Ershov) will be published in Russian in October 1999. The editors are seeking sponsorship for publishing the book in English.

A second edition of the book: *An Introduction to Frozen Ground Engineering* by O.B. Andersland and B. Ladanyi,

is in preparation.

Since the Yellowknife Conference, two Cold Regions Engineering Conferences were organized by the Technical Council on Cold Regions Engineering (TCCRE) of the American Society of Civil Engineers (ASCE):

The Ninth International Conference on Cold Regions Engineering was held in, Duluth, Minnesota, September 28-30, 1998. The conference theme, "Cold Regions Impacts on Civil Works", dealt with new technologies and methods, and successes and failures in practice (see Frozen Ground 22).

The Tenth International Conference on Cold Regions Engineering, held at Lincoln, NH, August 16-19, 1999, coincided with the 20th anniversary of the TCCRE. The conference theme "Putting Research into Practice" consisted of 26 concurrent sessions in which 86 papers were presented. Several IPA WG members presented papers (Instanes, Ladanyi, Tart, Vinson).

The annual Pushchino, Russia, conference was held April 20-23, 1999. The theme of the meeting was "Monitoring of the Cryosphere". Of great interest for permafrost engineering was the section on "Monitoring of Northern Natural Technogenic Geosystems" consisting of 35 reports.

The International Workshop on Permafrost Engineering, to be held in Longyearbyen, Svalbard, June 18-21, 2000, is sponsored by the Nordic Council of Ministers, within the Nordic Arctic Research Programme 1998-2002, and co-sponsored by the IPA. The main themes of the Workshop are: Management of infrastructure development and preservation and environmental management in connection with planning, constructing, operating and maintaining human activities in the Arctic. Contact Prof. K. Senneset (kaare.senneset@bygg.ntnu.no).

A scientific conference on The Environmental Conditions and the Prospects of a Sustainable Development of the Northern Pacific Area at the Turn of the Millennium, is planned for Magadan, Russia, March 21-24, 2000. Contact WG Member, G. Perlshtein at svj@online.magadan.su

Branko Ladanyi (bladanyi@mail.polymtl.ca)

Cryosol Working Group

Objectives are to establish interactions between geocryology and soil science, prepare a Cryosol monograph and global Cryosol classification and circumpolar soil database, and organise the Third International Conference on Cryopedology in Denmark in 2001.

Members of the working group met three times during the past year – in Denmark, Russia and Finland. The meeting in Copenhagen was held on March 19, 1999, following a Circumpolar Soil Database Meeting. Seven members of the working group, from Russia, Germany, Denmark, the USA and Canada discussed:

(i) Plans for the Third International Conference on

Cryopedology, August 20–24, 2001, Copenhagen, Denmark, and the post-conference field trip on August 25–31. The themes of this conference are: cryogenic processes; genesis of Cryosols; soil ecology, carbon storage and cycling; Cryosols and the hydrogeochemical cycle; and the response of Cryosols to anthropogenic impact and global change.

(ii) Finalizing the contents of the Cryosol book and scheduling the completion and review of the papers. The aim is to have the monograph available at the August 2001 conference.

(iii) Coordination of the acquisition of soil temperature data (additional discussions were held at the Pushchino conference in April 1999 – Sergey Goryachkin represented the working group at this conference).

It was agreed that the circumpolar soil database would be completed for the 2001 conference, and that the CWG would continue cooperating with, and providing data for, CALM, and co-operate with the European Soil Bureau (ESB), the Nordic countries soil database project, and ITEX. The CWG has been invited to organize an international symposium for the IUSS conference in Bangkok in 2002.

A number of CWG members participated in the International Conference on Monitoring of the Cryosphere in Pushchino in April 1999. The CWG organized a special session, “Monitoring of Soils in Cold Regions.” This special session and the CWG meetings included ten oral papers and four posters, all by Russian authors except for the papers from Germany and Canada. The presentations concerned carbon fluxes and their spatial and temporal dynamics, soil temperatures and the difference in their dynamics in relation to ecotones and stages of post-anthropogenic succession, and some characteristics of the solid phase of the soil.

The CWG met in Finland in August during the International Excursion on Frost-Affected Soils in Finnish Lapland. Seven members of the CWG, representing Finland, Russia, Germany, the United States and Canada, were present. They discussed the problem presented by the fact that the Pergelic soil temperature regime classification was not included in the 1998 US Soil Taxonomy. As a result all areas with perennially frozen soils were excluded. Thus, most of the world’s permafrost areas cannot be classified into any of the new soil temperature regime classes. It was decided, in order to establish soil temperature limits for permafrost-affected soils, that the working group will assemble available soil temperature data for these soils. These data should include information about the site from which the temperature data was collected. Assembly of the soil temperature data and development of site data will begin in Fall 1999.

Problems with the FAO/ISSS World Reference Base of Soil Resources (WRB) classification of perennially frozen organic soils were also discussed. Members felt that the exclusion of perennially frozen organic soils from the WRB Cryosolic major soil group is a contradiction of

the WRB concept that its classification should be an umbrella over other soil classifications and should reflect the concepts of these classifications.

Since both major classifications of permafrost-affected soils (US and Canada) include the perennially frozen organic soils in either the Gelisol (US) or Cryosol (Canada) orders, it was felt that the WRB classification should also reflect this approach.

Other working group activities included participation in: (a) The 9th International Tundra Experiment (ITEX) meeting in Michigan, USA January 5–9, 1999: The three CWG members present developed a list of information required to determine the minimal soil data needed to characterise, describe and sample soils according to accepted methods and standards. These data will provide information about nutrient status, pH and other chemical and physical properties necessary to study soil vegetation relationships on the ITEX vegetation plots. The CWG will continue to co-operate with ITEX.

(b) The International Excursion on Frost-Affected Soils in Finnish Lapland: This eight-day excursion, August 24–31, 1999, was organised by M-L. Raisanen and G. Broll as part of the CWG activities, and was held immediately after the Nordic Symposium on Changes in Permafrost and Periglacial Environment (organised by M. Seppala). Seven CWG members attended the symposium. The main objective of the excursion was to examine cryoturbated non-permafrost soils, especially Podzols, under various vegetation types at various elevations. It was interesting to observe the amount of cryoturbation even though none of the soils contained permafrost within the 2-m control section.

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Coastal and Offshore Permafrost

The objective is to encourage interactive investigations on the subjects of onshore, transitional and offshore permafrost and hydrates.

In recent years field work has been carried out in Laptev Sea, the coast of West Siberia, and along the Canadian Beaufort Sea.

A number of coastal reports were presented at the 1999 Pushchino conference related to problems of sea-land interactions. They included the formation and evolution of offshore permafrost. An ad hoc meeting of the Working Group included informal presentations in preparation for the Fall 1999 workshop (see below). Representatives from the German and several Russian organizations, the Geological Survey of Canada, and the University of Alaska participated. The May 2000 Pushchino International Conference will include a special session dealing with problems of sea-land interactions and, offshore and coastal permafrost formation and evolution.

The Fifth Workshop on Russian-German Cooperation on the Laptev Sea was held in St. Petersburg, 26-29

November 1999. It was organized by J. Thiede (Director, AWI, Bremerhaven, and GEOMAR, Kiel) and I. Frolov (Director, State Research Center, Arctic and Antarctic Institute, St. Petersburg), and sponsored by the German and Russian Ministries for Science and Technology. Themes included: on- and off-shore permafrost and their feedbacks and evolution; terrestrial/marine interactions in the coastal zone; short- and long-term environmental changes in the central Siberian Arctic.

Recent field studies and reports suggest that sediment yield to the Arctic shelf resulting from erosion of ice-rich coastlines may produce quantities of sediments equal or greater than input from river discharge.

A workshop was held in Woods Hole, Massachusetts, November 2-4, 1999, to document regional rates of transgression and regression as a function of ice content of permafrost, near-shore bathymetry, sediment transport and deposition, and sea level changes. Workshop objectives and accomplishments included: (1) development of a common classification system for coastal mapping in high-latitudes for the purpose of estimating coastal change sensitivity and erosion potential; (2) identification and description of techniques presently used for coastal mapping and erosion measurements in high-latitude environments; and (3) development of estimates of erosion rates for representative circum-Arctic coastlines. Approximately 45 participants attended from Russia, USA, Canada, and Europe, including a number of students. The workshop was organized under the auspices of the Working Group's Coastal Erosion Subgroup and sponsored by the U.S. NSF as part of its Russian-American Initiative on Shelf-Land Environments in the Arctic (RAISE). Workshop abstracts can be obtained on email from the host organizer, Jerry Brown (jerrybrown@igc.org). Members of the Working Group met informally at the Woods Hole workshop.

A Coastal Erosion Subgroup meeting hosted by AWI, was held in Potsdam in June and attended by Felix Are, Misha Grigoriev, Hans Hubberten, Erk Reimnitz, Volker Rachold, and Steven Solomon (Chair).

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and Hans Hubberten (hubbert@awi-potsdam.de)

Southern Hemisphere Permafrost and Periglacial Environments

The objectives are to create a scientific platform to simulate interaction between permafrost and periglacial researchers in the Southern Hemisphere, and to synthesize permafrost and periglacial data and information, including existing IPA initiatives in the region.

The Working Group organized IPA participation in the XV INQUA Congress, in Durban, South Africa, August 1999. The Working Group and members of the Southern African Adhering Body organized a poster session, a workshop, business meeting and post-conference excursion.

The poster session on Southern Hemisphere permafrost and periglacial research included reviews of periglacial research in continental and maritime Antarctica, Patagonia and the Andes, New Zealand, Tasmania and Southern Africa. Other presentations highlighted Antarctic permafrost and valley asymmetry, maritime Antarctic frost environments, Southern African block-streams, stone-banked lobes and scree and regional and global data and monitoring systems.

A combined workshop and business meeting chaired by Jan Boelhouwers and Kevin Hall included Ian Meiklejohn (RSA), Eric Colhoun (Australia), Dario Trombotto (Argentina), Jim Bockheim (USA), Stefan Grab (RSA), Warren Dickinson (NZ), Paul Augustinus (NZ), Jerry Brown (IPA/USA), Yoshihiko Kariya (Japan), Francesco Dramis (Italy) and several participants from the UK. Participants reviewed current activities in their respective regions. Limited funding, perceptions of low relevance, and lack of continuity in data collection with respect to periglacial/permafrost research in the Southern Hemisphere were highlighted. Opportunities for climatic change research can be used to raise the profile of permafrost/periglacial research as is the case with PACE in Europe.

The regional networks of the SHWG appear to be a practical way of dealing with the problems of communication; each region has its own representative who can disseminate the information and thus helps overcome language barriers.

Mechanisms and schedules for the compilation of a SH bibliography, permafrost map inventory and research directory were reviewed. It was suggested to have a SHWG representative on the IPA Data Committee to oversee SH data and facilitate CD production for the next International Permafrost Conference.

Mike Clark met with the co-chairs to discuss methods for compiling these inventories and development of a SH web site. The SHWG committed to contribute towards the activities of the GTNet-P and its active layer and borehole monitoring.

The desirability of Australia/New Zealand membership in the IPA was discussed with Eric Colhoun and Paul Augustinus. Colhoun described procedures for obtaining access to Australian Antarctic research sites. Application procedures for IPA involvement in the Scientific Committee on Antarctic Research (SCAR) and its Geo-logy Working Group were discussed. The next meeting of the WG is proposed for the 2001 meeting in Japan.

A post-conference excursion to examine the Quaternary periglacial landforms of the Lesotho highlands was organized by the Southern African Permafrost Group. Leaders were Ian Meiklejohn, Paul Sumner, Stefan Grab, Jan Boelhouwers and Kevin Hall. During four days, 27 delegates from 13 countries debated the Quaternary landscape evolution of the highlands. The aim was to outline the problems pertaining to Quaternary



Participants in the INQUA periglacial excursion

periglacial issues in Southern Africa. Day one travel was by vans and four-wheel drive vehicles from Durban through the spectacular scenery of the southern African highlands where delegates were lodged in a mountain chalet at the edge of the main Escarpment. The next two days were spent visiting sites which are central to debates on Quaternary glaciation and periglacialiation of the region. Northern Hemisphere delegates from glacial geomorphological background found a resemblance to the flood basalt landscapes of the Faroe Islands and Iceland, while Southern Hemisphere delegates recognized similarities in geological framework with other Gondwana remnants. Issues on valley asymmetry, nivation hollows and cryoplanation benches were debated. One field day centered around a periglacial blockstream about 1.5 km long (cover photograph).

The lack of unequivocal indicators for Quaternary glaciation necessitates reliance on sediment evidence for which a temporal framework has yet to be established. Field trip guidebooks are available from Ian Meiklejohn (kim@scientia.up.ac.za).

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Kevin Hall (hall@unbc.ca)

Task Forces

Rock Glacier Dynamics and Permafrost Creep

The objectives are to establish the basis for and initiate numerical modelling concerning flow of ice/rock mixtures on slope. The activities are jointly organized by IPA and the International Commission on Snow and Ice.

During a two-year period (1999/2000), attempts will be made to define the presently available experience on, and to make recommendations for, numerical modelling of rock glacier flow. This effort will include an overview of recent and ongoing studies that provide quantitative information from drilling, geophysical soundings, geodetic and photogrammetric monitoring, and measurements and datalogging of surface conditions. Advanced concepts of thermo-mechanically coupled flow under permafrost conditions will be brought together with the rapidly growing evidence from sophisticated modern field experiments. Two fundamentally important aspects of rock glaciers will be of particular interest: (1) the ground thermal conditions (permafrost) that allow for the formation and/or the long-term preservation of sub-

surface ice; and (2) the composition of the ice/rock-mixtures, i.e., the amount and distribution of ice existing below the surface and enabling the sustained motion. The main topics will be dealt with by the following experts:

Composition: Matsuoka (rocks) and Elconin (ice)

Thermal conditions: Humlum (surface), Vonder Mühl (boreholes)

Geometry/kinematics: Kääb, Kaufmann (photogrammetry, geodesy)

Rheology: Ladanyi (lowlands) and Springman (mountains)

During fall/winter (1999-2000), state-of-the-art reports will be made available on the Internet for open review and feed-back. At the same time, recommendations will be prepared for numerical modelling of the complex system of creeping ice/rock-mixtures. A workshop is planned in conjunction with the Mapping/Modelling Task Force and the PACE project to complete the study, review the texts and prepare a final product at the 1st European Permafrost Conference, Rome, March 2001.

Contacts are being maintained with the International Workshop on Debris-covered Glaciers, to be held at the University of Washington, Seattle, Washington, U.S.A., 13-15 September 2000 (M. Nakawo, Institute for Hydrospheric-Atmospheric Sciences, Nagoya University 464-8601, Japan, Fax:81-52-789-3436, E-mail: nakawo@ihas.nagoya-u.ac.jp).

Wilfried Haerberli (haerberli@geo.unizh.ch) and
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Mapping and Distribution Modelling of Mountain Permafrost

The objective is to develop systematic strategies for mapping and modelling the distribution of mountain permafrost at different scales. The Task Force builds on the accomplishments of the earlier Working Group on Mountain Permafrost.

Mapping and distribution modelling of permafrost in the mountains and high plateaus are research activities of high interest, because of their linkages to climate change and hazard assessment. An e-mail list of interested colleagues was established to facilitate communication and is maintained from Oslo with a current list of about 50 addresses. Participation is open to all interested persons.

In Europe, mapping and modelling permafrost distribution is carried out in several countries, partly within the EU-funded project PACE (Permafrost and Climate in Europe). The mapping of permafrost in the Asian and Eurasian mountains are providing small-scale maps of permafrost distribution of mountain ranges, eg. for the Tien Shan (S. Marchenko, Kazakstan). Based on the IPA-sponsored visit of N. Sharkhuu (Mongolia) to Kazakstan in June 1999, a formal programme of cooperation between Mongolia and Kazakstan was developed on permafrost mapping and ground temperature monitoring,

including the CALM sites in both countries. An IPA-sponsored visit to Mongolia is under consideration in connection with the International Conference on Geomorphology to be held in Japan in 2001.

The principal aim of the Task Force is to define the state-of-the-art for mapping and modelling of permafrost in mountains and high elevations. Major challenges in this context are to evaluate existing models in different mountainous regions, the value of combining different approaches (empirical vs. physical models) at various spatial scales, and the application of geographical information technology. Preparation of a comprehensive document is essential for defining and coordinating further requirements and activities within mountain permafrost research. Bernd Etzelmüller and Martin Hoelzle (ETH/Zurich) will prepare an outline of the document during this year. It will be distributed for comments.

A joint mountain permafrost symposium is planned between the two Task Forces (*Mapping and Distribution Modelling of Mountain Permafrost* and *Rock Glacier Dynamics and Permafrost Creep*) and the PACE project at the 1st European Permafrost Conference, Rome, March 2001. Central topics at this conference will include temperature analyses of boreholes, geophysical soundings of permafrost, modelling of permafrost distribution, geotechnical hazards and modelling of permafrost creep. We will discuss progress and further steps in developing and testing permafrost distribution models at different scales.

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Isotope/Geochemistry of Permafrost

Objectives are to promote the application of isotope geochemical methods in permafrost research, to identify the main gaps in knowledge for successful application of isotopic methods in permafrost studies, and to develop an internationally accepted protocol for a WG. No formal report of this TF is available. There is close cooperation between the TF members with the isotope subproject of IGCP project 415 Glaciation and Reorganization of Asia's Drainage (GRAND), which held meetings during the INQUA Congress and at the Geological Society of America meeting in Denver in October 1999.

Related Working Parties Activities

Permafrost And Climate in Europe (PACE)

European Commission Environment and Climate Research Programmeme (DG XII) Contract ENV4-CT97-0492

"Climate change, mountain permafrost degradation and geotechnical hazard".

The three-year PACE project, initiated in December 1977, is co-ordinated at the University of Cardiff (UK), and includes partners from the Universities of Oslo (Norway), Stockholm (Sweden), Giessen (Germany), Zürich (Switzerland), ETH-Zürich (Switzerland), Roma 3 (Italy) and Complutense, Madrid (Spain). The PACE programmeme was briefly described in *Frozen Ground* 21 (Dec. 1997 p. 3-4). Full details, including participants, field sites, and progress in the six work packages, can be obtained from the PACE web site <http://www.cf.ac.uk/uwc/earth/pace/>.

A major aim is to establish a network of monitored boreholes in permafrost along a north-south transect through the mountains of Europe, from Svalbard in the north to the Sierra Nevada in the south. Long-term monitoring of mountain permafrost temperatures will provide a significant contribution to the Global Climate Observing System (GCOS) Global Terrestrial Network - Permafrost (GTNet-P). In addition, changes in active-layer thickness will be reported to the CALM programmeme. To date, deep permafrost boreholes (at least 100 m) have been drilled and instrumented at Janssonhaugen, Svalbard, Norway (May 1998), the Stelvio Pass, Italian Alps (May/June 1998) and at Juvvasshøe, Jotunheimen, Norway (August 1999). Shallow (10 - 20m) boreholes have also been instrumented at Janssonhaugen and Juvvasshøe, adjacent to the deep holes, to investigate in detail the near-surface thermal regimes. Additional shallow holes have been drilled and instrumented on Schilthorn in Switzerland (October 1998) and the Valetta Peak, Sierra Nevada, Spain (September 1999). Remaining deep boreholes at Tarfala (Sweden) and in Switzerland will be drilled in 2000. The first year's geothermal data from Janssonhaugen were presented at the International Glaciological Society (IGS), meeting in Zürich, Switzerland in August 1999 (Isaksen *et al.* in press).

Research is also focused on prediction of spatial changes in mountain permafrost distribution resulting from Global Climate Change, and relating these to potential increases in slope hazards associated with thawing of frozen ground. Geophysical surveys offer the possibility of mapping and characterisation of discontinuous mountain permafrost. Methodological improvement and application of methods rarely used in the difficult terrain of mountain permafrost has been the major task of the PACE Geophysics Work Package. Within these categories, ground penetrating radar (GPR) in winter and in summer, spontaneous potential SP, two-dimensional resistivity imaging (tomography), two-dimensional refraction seismics, EM-31 measurements and radiometry have been tested and continue to be developed. Results were reviewed by Vonder Mühl *et al.* (in press) at the Zürich IGS meeting. Surveys have been undertaken at the Stelvio Pass (Italy), Schilthorn and the Zermatt areas (Switzerland), in the Sierra Nevada (Spain), in Tarfala (Sweden) as well as in Jotunheimen

and Svalbard (Norway). In Jotunheimen, the transition from permafrost to no-permafrost was detected by applying EM-31, DC resistivity tomography, refraction seismics and BTS measurements.

Mapping of permafrost distribution within PACE sites will test numerical modelling currently under development within the programme. A PACE GIS-based mapping system is being coordinated by the University of Oslo, and will also be used as part of a new hazard assessment methodology under development within the programme. Permafrost energy flux measurements are in progress at automatic meteorological stations established in Svalbard and Jotunheimen (Norway), Murtèl-Corvatsch and Schilthorn (Switzerland), Stelvio Pass and Foscagno (Italy) and the Sierra Nevada (Spain). Numerical modelling of mountain permafrost based on energy balance calculations and digital terrain models to provide altitude/aspect inputs is being directed by the University of Zürich (Mittaz *et al.* in press).

Thawing mountain permafrost may pose major potential geotechnical hazards in the high mountains of Europe (see for instance King and Kalisch, 1998). Slope instability processes including slow soil movements (solifluction) and rapid failures such as shallow landslides, mudflows, debris flows and rock falls, may become significant problems where permafrost is ice-rich. Laboratory experiments at the Cardiff University Geotechnical Centrifuge Centre aim to model processes of thaw-related instability and identify trigger levels and movement mechanisms. Scaled centrifuge tests at 10 and 20 gravities have to date investigated processes of gelifluction (see Davies *et al.* in press) and thaw-related mudflow. In addition, direct shear tests are underway at the University of Dundee to investigate thermal influences on strength characteristics of ice-filled rock joints (Davies *et al.* in press). Field investigations of geotechnical hazards associated with mountain permafrost have been undertaken during 1999 in the Valtellina region, Italy, and the Valetta Peak, Sierra Nevada, Spain.

The PACE project provides not only a research programme in which seven European countries are participating, but has fostered genuine international collaboration. Research teams with specific expertise have participated in fieldwork in other countries, and common data collection and analysis methodologies have been developed. The Spring 1999 co-ordination meeting in Svalbard was hosted by UNIS, and included two days of research presentations followed by a two-day field excursion by snowmobile. The autumn coordination meeting, in Giessen, Germany, allowed detailed research reports to be discussed, and planning for the next phase of this European permafrost monitoring programme to be accomplished.

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Long-Term Permafrost Observations

The IPA Council resolution in June 1998 endorsed the development of a permafrost monitoring network (GT Net-P). The proposed network would function under the joint auspices of the IPA and the Global Climate Observatory System (GCOS)/ Global Terrestrial Observatory System (GTOS) programmes of the WMO, FAO, UNEP, UNESCO, and ICSU. A number of supportive activities to implement the resolution were accomplished since the Yellowknife conference. To facilitate IPA planning of the network, the Executive Committee appointed an ad-hoc steering committee with members Jerry Brown (chair), Wilfried Haeberli, Roger Barry, Margo Burgess, and Fritz Nelson.

The GTNet-P network consists of two sets of observations: Active layer properties and permafrost temperatures and is initially divided into three sub-networks: CALM, PACE and the new network of Global Boreholes.

The Circumpolar Active Layer Monitoring (CALM) network is already in place, with plans to expand it for more comprehensive coverage into both hemispheres. CALM observes active layer thickness at 80 or more sites and soil temperature and moisture at some sites. The CALM web site at the University of Cincinnati maintains a summary of annual measurements and many of the initial data sets. The Permafrost and Climate in Europe (PACE) programme represents the first well-organized international programme for boreholes in the permafrost regions.

Starting in Fall 1998, IPA conducted an informal survey of individuals and organizations having existing boreholes that are available for future measurements. This initial survey revealed that at least several hundred locations throughout both hemispheres are candidate sites for future long-term observations of permafrost temperatures and related climatic variables. The complete list of boreholes and related network information

was placed on the CALM web site. Table 1 contains a summary by country, depth class, and co-location with PACE and CALM sites.

Based on the survey a draft plan for implementing the network was prepared and submitted to GCOS.

Components of the plan included the Circumpolar Active Layer Monitoring (CALM) network; the PACE programme, and the results of the boreholes inventory. The Global Climate Observing System Steering Committee (GCOS/SC), at its February 9-12, 1999, meeting in Geneva, formally approved the formation of the Global Terrestrial Network-Permafrost (GTNet-P). The IPA has overall responsibilities for development and management of the GTNet-P.

In order to review progress to date and explain GTNet-P, several meetings were held in Pushchino, Russia, 20-23 April 1999, as part of the International Conference on Monitoring the Cryosphere. These sessions and roundtables were lead by A. Pavlov, V. Balobaev, M. Burgess, V. Romanovsky, and J. Brown. Additional boreholes in Russia were identified. A metadata format was reviewed and revised. Boreholes associated with engineered structures, but in relatively undisturbed sites, are to be included. At its 26-27 April meeting in Copenhagen, the IPA Executive Committee approved the continued development of the GTNet-P, in close collaboration with IPA working parties.

An international meeting of GCOS/GTOS Terrestrial Observation Panel for Climate was held in Birmingham, UK in July 1999 during the International Union of Geodesy and Geophysics (IUGG) general assembly. Jerry Brown and Sharon Smith, Geological Survey of Canada (GSC), represented the GTNet-P and presented the following plan of activities:

- Complete initial borehole survey and maintain metadata inventory on web.
- Prepare periodic data reports (GSC Open File Reports).
- Standardize field measurements and equipment.
- Representatives meet annually at AGU and/or Pushchino meetings.
- Prepare synthesis report for VIII ICOP (Switzerland, 2003)
- Report to GCOS/GTOS.

Several national activities are underway to facilitate the development of GTNet-P. In Canada a series of GTOS workshops are being held to identify programmes for cryosphere monitoring. The Geological Survey of Canada's new permafrost web site will host the on-line GTNet-P borehole metadata and data. All information will be archived as part of the GGD in the WDC, in Boulder, USA. Several programmes are observing borehole temperatures in central and northern Alaska. A detailed five-year GTNet-P proposal was prepared at the University of Alaska to facilitate the standardization and acquisition of international field measurements on an annual basis, provide for exchange and centralization of the

data including maintenance of the GSC/GTNet-P web location, and preparation of periodic review reports. Sources of funding are being solicited. Plans for the forthcoming year (2000) include identification of representative borehole sites, compilation of metadata and summary of existing data. The metadata form for nominating borehole sites is available on several sites by email (see back cover).

During the past year, liaison was established with the International Heat Flow Commission (IHFC) of the International Association of Seismology and Physics of the Earth's Interior (IASPEI). The IHFC has had a long-standing programme of measuring and analyzing earth temperatures for climate change from deep boreholes throughout the world. It is currently extending these observations to permafrost regions. Additional collaboration among IPA, GTNet-P and IHFC will be developed.

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Country	CALM sites	Boreholes			
		Surface 0-10 m	Shallow 10-25 m	Intermediate 25-125 m	Deep > 125m
Austria - Russia	1				
Canada	20	9 (1)	36 (2)	14	3
China	2		3 (1)	12	1
Denmark - Greenland	3				
Germany - Russia	2				
Germany - Switzerland				1P	
Italy	3	1 (1)	1P	1P	
Italy - Antarctica		3			
Japan - Russia			5	2	
Kazakhstan	1		3 (1)		1
Mongolia		1	3	6	
Norway				1P	
Norway - Svalbard				1P	
Poland - Svalbard	1				
Russia	21		22 (9)	11	
Spain				1P	
Sweden	1			1P	
Sweden - Svalbard	1	2 (1)			
Switzerland	1		1P	6 (1) [2P]	
US - Alaska	25	4	1	22 (8)	21 (6)
US - Antarctica			1		1
US - Greenland					1

Table 1. Summary of Active Layer (CALM) and Permafrost Borehole Sites by Country (compiled by Jerry Brown, March 1999). P=PACE borehole; ()= number of boreholes associated with CALM sites.

News from Members

Austria

In Austria permafrost research continues to focus on the dynamics and selected characteristics of active rock glaciers. Viktor Kaufmann (Graz University of Technology) has recently established geodetic/photogrammetric monitoring of velocity and vertical changes of rock glacier surfaces by different methodological approaches at three sites in the Hohe Tauern Range (Central Alps). Especially in the case of the Doesen rock glacier (which was presented at the 7th International Conference on Permafrost in Yellowknife) a lot of quantitative information is now available providing data for discussion of rheology kinematics in connection with the IPA Task Force on rock glacier dynamics.

Karl Krainer (University of Innsbruck) has started several activities in the Hohe Tauern range as well as in the Tyrolean Alps. His working group emphasizes sedimentological and hydrological investigations (water and ground temperature, discharge, hydrochemical characteristics and tracing experiments in order to understand runoff systems). Furthermore, surface velocity measurements using GPS techniques are carried out in some of the study areas.

Setting up a permafrost monitoring network in the Austrian Alps is a very important task for the near future. A first initiative has been taken by Hans Stoetter (University of Innsbruck). His project started with collecting data on different climatic parameters (especially snow cover) and establishing a meta-database of permafrost relevant information available from the Austrian and nearby Italian Alps (Southern Tyrol). In addition, temperature dataloggers were installed in permafrost areas of the Tyrolean Alps. Similar work in the Hohe Tauern Range has been done by Gerhard Lieb (University of Graz, Institute of Geography). Some of these study sites are localized in permafrost areas outside rock glaciers and will contribute to the CALM network by the year 2000.

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Canada

Following an offer made by Don Hayley (Chair, CNC/IPA) to the IPA Council at the time of the VII-ICOP (Yellowknife), the Organizing Committee prepared a Post-Conference Report. The purpose of the report was to document, for future organizing committees, the notification procedures, scheduling deadlines, paper submission and review procedures, the conference format, and the relevant associated conference administrative and financial details. This report (20 copies) was submitted to the IPA Executive Committee in July 1999.

The report includes a conference summary and a collection of individual reports prepared by the respective Subcommittee Chairmen. General recommendations include: (1) the conference venue should be one that can provide the opportunity for delegates to experience local

permafrost conditions, (2) the technical programme should provide ample opportunity for informal discussions, should limit the number of concurrent sessions, and the report recommends an increase in poster presentations, (3) the IPA Working Groups should be tasked with soliciting papers and organizing specialty sessions in their areas of interest, and (4) the IPA needs to adopt a more organized approach to travel assistance for attendance at conferences, paying special attention to worthy delegates from countries with devalued currencies.

The Technical Programme Committee Report indicates that 440 abstracts were initially submitted to the Organizing Committee and that 277 papers were eventually received. Of these, 146 (52%) were accepted outright or with minor revisions, 69 (25%) required major revisions and re-review, and 62 (22%) were not accepted. Of the 188 papers published in the Proceedings volume, 30% were from Russia, 22% from Canada, 16% from USA, 9% from China, and 5% from Switzerland. Of the 60 extended abstracts published in the Programme and Abstracts volume, 36% were from Russia, 16% from USA, and 15% from China. A total of 31 Associate Review Editors, all but 2 from within Canada, handled the review process and a total of 198 individuals from a number of countries are listed as having acted as referees. Detailed recommendations concerning the paper review and publication procedures are given.

Following submission of this report, the Organizing Committee was allowed to stand down. The new membership of the Canadian National Committee for the International Permafrost Association (CNC/IPA) was formally announced in the Fall of 1999. The following have been appointed until December 31, 2003: Professor Michel Allard (Département de Géographie, Université Laval) - Chair, Mrs Margo Burgess (Geological Survey of Canada, Ottawa) - Secretary, Professor Richard Fortier (Département de géologie et de génie géologique, Université Laval) - member; Mr Alan Hanna (AGRA Earth and Environmental Limited, Calgary) - member; Mr Don Hayley (EBA Engineering, Edmonton) - member; Dr Brian Moorman (Earth Science Programme, University of Calgary) - member; Dr Steve Solomon (Geological Survey of Canada-Atlantic) - member; Mr Peter Vician (Government of the Northwest Territories, Yellowknife) - member. The new CNC/IPA will hold its first meeting in Ottawa at the end of January 2000. This will coincide with a workshop to define the requirements of a National Permafrost/Glaciers/Ice Caps Monitoring Network. The latter is being organized by the Geological Survey of Canada with funding support from Canada's Climate Change Action Fund (CCAF) and Environment Canada.

At the Fall 1999 Canadian Geotechnical Society Annual meeting in Regina, the Cold Regions Division presented The R. J. E. Brown Award, for '...outstanding contributions to permafrost science and engineering', to J. Alan Hegnbottom, now retired from the Geological Sur-

vey of Canada, for his contribution to the work of the CNC/IPA, from 1984 until 1998.

The Canadian permafrost community was saddened by the death of George Henry (Hank) Johnston, age 71, in late August 1999. An internationally known permafrost engineer and author of the standard reference text 'Permafrost: Engineering Design and Construction', Hank began a distinguished career in 1953 with the Division of Building Research, National Research Council of Canada (NRCC). Hank retired from the NRCC in 1993.

Current permafrost activities in Canada will be reported in the next issue of *Frozen Ground*.

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Denmark

At Disko Island, central W Greenland, research on rock glacier dynamics and surface climate is being continued by Ole Humlum, University of Copenhagen and the University Courses on Svalbard (UNIS). DGPS surveying of three active rock glaciers was carried out this year.

Surface climate investigations were extended, using various types of miniature dataloggers to measure surface and active layer temperatures. Automatic measurements of precipitation close to the rock glacier initiation line have been initiated. The timing of surface movements is experimentally recorded by means of vibration-sensitive dataloggers. Sampling of ice from rock glaciers, for isotopic analysis, has been continued and extended. The headwall weathering rate, and the rock glacier role as a transport agent in high-relief arctic regions, are being investigated. Five active rock glaciers located in various meteorological settings in Disko Island are now included in this general monitoring programme. In Mellemfjord (W Disko) and at the Arctic Station (S Disko), two automatic meteorological stations (including measurement of active layer temperatures) have been in operation since 1993 and 1991.

Bo Elberling and co-workers (Institute of Geography, University of Copenhagen) are studying the environmental impact resulting from oxidizing sulfidic mine tailings in the High Arctic. During the last three years fieldwork was carried out at the zinc-producing Nanisivik Mine in Canada together with freezer experiments on oxygen diffusion and consumption in frozen sulfidic waste material. The work is funded by the Environmental Department, Ministry of Environment and Energy, Denmark. As part of the study, cold-tolerant sulfide-oxidizing bacteria have been identified in natural and waste material from the Nanisivik area. Biological catalysis is responsible for about 1/3 of the observed oxidation, and bacteria are found to be active at temperatures as low as 4°C. High oxygen uptake rates and heavy metal release from well-drained tailings are observed during summer months, and snow accumulation during autumn and winter is considered responsi-

ble for reduced but surprisingly high pollution rates throughout most of the year. The project ends in 1999.

At Zackenberg, NE Greenland, a snow fence manipulation project was started in 1998 by Bjarne H. Jakobsen, Bo Elberling and Hanne H. Christiansen, (Institute of Geography, University of Copenhagen). In the 1999 summer the first data was collected since the manipulation started. The effect of the snow fence was reduced because of largely increased natural snow precipitation during the 1998-1999 winter. Data on active layer soil water and gas was collected in cooperation with Ron Sletten (University of Washington, USA) and Birgit Hagedorn (Alfred Wegener Institute, Germany). Geoelectrical soundings were made in the Zackenberg area as preparation for a coring programme in 2000.

On the Faroe Islands a new project called LINK (Linking land and sea at the Faroe Islands: Mapping and Understanding North Atlantic Changes) was funded by the North Atlantic programme of the Danish Research Councils for the period 1999-2001. One part of this project is monitoring periglacial processes in combination with modern mountain climate. The first mountain meteorological station in these islands was established during the autumn of 1999. This included a shallow (12 m) borehole with temperature monitoring. The MAAT at the highest mountain tops is about 0-1°C, so pockets of permafrost could occur. This part of the LINK project is carried out by Ole Humlum and Hanne H. Christiansen (Institute of Geography, University of Copenhagen) and Lis Mortensen (Museum for Natural History, Torshavn Faroe Islands).

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Finland

A Symposium on Changes in Permafrost and Periglacial Environment at Kevo, northernmost Finland took place 20-24 August 1999. It was organised by Matti Seppälä and Martti Eerola of the National Committee of Permafrost Research and Technics in Finland. There were 23 participants from 8 different countries. The paper and poster sessions had 15 presentations of both scientific and technical aspects of permafrost.

Thawing and formation of new permafrost was demonstrated to have taken place recently. Daily excursions were run in Finnish Lapland and northern Norway. No separate proceedings will be published, but the papers will be submitted to different journals.

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Germany

H. L. Jessberger (Ruhr University, Bochum) with a team of geotechnical engineers, continues to apply artificial ground freezing for tunnelling in Germany and abroad. This technology has been used for the subway line U5 in downtown Berlin, where the subsoil is dominated by Holocene sand with a high water table. Freeze pipes,

placed in microtunnels, produce a frozen soil ring at least 2 m thick. For high capacity railroad tunnels and road tunnels of 3.5 to 6.5 km length in the Netherlands, artificial ground freezing was used for the construction of traverse galleries between the two parallel main tunnel tubes. The traverse galleries of up to 26 per tunnel are constructed in very difficult subsoil conditions (fine to medium sand or very soft organic clays with high water content and with about 400 kN water pressure). The relevant tunnels cross the Rotterdam Harbour (Botlek railroad tunnel), the Westerschelde (Westerschelde Tunnel at Vlissingen) and the Groene Hardt. In Boston (USA), Rome and Naples (Italy) several major ground freezing applications are in design state.

Permafrost aggradation and degradation during the last 200 000 years was simulated numerically for two sections across Northern Germany (Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover) as part of a multinational EU-project. Calculations are based on a detailed climate curve for this time period provided by Jeff Boulton, University of Edinburgh and on detailed knowledge of the geological subsurface conditions. Calculations suggest up to eight periods of permafrost development with maximum permafrost thickness varying between 40 - 150m. The roles of rivers and lakes in preventing permafrost development, talik-formation was included in this modelling effort. Special attention was paid to likely permafrost degradation scenarios in front of the Scandinavian ice shield at the time of its maximum advance into Northern Germany during the Weichselian stage.

The Potsdam Research Unit of the Alfred Wegener Institute for Polar and Marine Research (Hans Hubberten) coordinates the multidisciplinary terrestrial portion of the joint German-Russian project "Laptev Sea System 2000". As part of this research project, an expedition to the Lena Delta region took place in July and August 1998. The expedition group was divided into three teams:

Team 1 focused on modern processes in permafrost-affected soils and used a biological station of the Lena Delta Reserve on the Samoylov Island in the central part of the Lena Delta. Instruments were installed at 4 measuring sites during 1998 fieldwork. Ongoing multidisciplinary studies focus on the seasonal variability of modern processes in tundra soils. The main scientific objectives were: 1 Study of the energy and water balances of the active layer and the upper part of permafrost; 2 Quantification of the climatic, pedogenic and soil microbial parameters which control the production, oxidation and emission rates of trace gases in soils; 3 Measurement of the carbon flux balances (CO_2 , CH_4) at differing tundra sites within the study area.

Team 2 focused on modern and ancient sedimentation in the Lena Delta and worked aboard the vessel *Dunay*. The main scientific goals were: 1 Sedimentation history reconstruction of the Lena Delta; 2 Understanding the

influence of global, regional and local climatic variability on sedimentation in the Lena Delta; 3 Modern and ancient sediment budget of the Lena Delta.

Team 3 focused on climate signals in ice-rich permafrost deposits and worked at the key section of the Late Pleistocene Ice Complex, Mamontovy Khayata, on the Bykovsky Peninsula. Their multidisciplinary research programme includes: 1 Complex cryolithological studies; 2 Ground ice research, especially on ice wedges of differing ages using various isotope and hydrochemical analyses; 3 Systematic paleontological research (mammal bones, insect fossils, rodents, plant remains, seeds); 4 Extensive sampling for radiocarbon and OSL dating; 5 Study of modern geocryological processes. The second expedition, started in April 1999, consisted of 7 field groups. They studied the processes listed above for a full seasonal cycle, from spring to late autumn. Sediment coring from the ice cover on lakes and lagoons in the spring, and an extensive coastal process investigation in the Lena Delta and Laptev Sea in summer comprise an investigation of the environmental history of the Lena Delta. Paleoclimatic signals in ice-rich permafrost are investigated on the Bolshoy Lyakhovsky Island and extend the sample base created in 1998. In addition, projects emphasising hydrologic and thermal dynamics of the active layer, silicate weathering and the carbon cycle in high Arctic soils are ongoing. Automated sites were installed in 1998 close to Ny-Ålesund, Spitsbergen and at Zackenberg, NE Greenland, with water, gas and soil sampling.

To identify sedimentary and permafrost structures within the Lena Delta, sampling of sedimentary sequences by shallow coring and through natural exposures, ground penetrating radar, and shallow seismic studies, have all been carried out.

Mineralogy and geochemistry of the sediments show details about the processes controlling the late Quaternary conditions of accumulation and deposition. The geophysical methods of sub-bottom profiling were two-fold: (1) ARAMAC impulse radar system proved to be a viable technique for mapping subsurface structures on land. The 100 MHz radar signal penetrated the permafrost down to 30 m maximum and indicated wedges and ice layers. Drilling was used to determine the geologic composition. (2) A sediment echo sounder was used as high-frequency pulse source for seismic surveying of sediments of Lake Nikolay in the western Lena Delta. It was possible to characterise the geometry of basin fills and changes in lake sedimentation as well as to identify the permafrost table below talik zones.

The research group of the Geographical Institute, University of Giessen, continued its studies in the EU-project PACE. In summer 1999 extensive field checks were carried out concerning periglacial and natural hazard features originating in permafrost areas in the Mattertal valley. At the new Grächen-Seetalhorn test site geomorphological mapping of periglacial features and

microclimatological measurements in the coarse blocky debris flow are being carried out. Correlation between slope processes and permafrost distribution were analysed using GIS.

Slope processes were surveyed by geomorphologic mapping, permafrost distribution was investigated by modelling (PERMAKART (F. Keller) and PERMAMAP (M. Hoelzle)) and BTS-mapping. The results of the geomorphologic mapping show many different periglacial forms and processes in the Gornergrat area such as rock glaciers, solifluction, rockfall and debris flows. By combining the results of the permafrost models and those of the BTS-measurements the calculation of a realistic permafrost distribution was carried out. The results of the GIS-analysis indicate a dependency of solifluction forms upon permafrost. The activity of rock glaciers seems closely connected to the occurrence of perennially frozen ground. Modelling of rockfall- and debris flow-trigger zones show that both processes can occur in permafrost as well as in non-permafrost areas.

Alpine permafrost is also studied in the Zugspitz summit area (highest peak in Germany) as part of the EU-project PACE by M. Gude (Department of Geography, Jena). Permafrost thermal conditions are monitored by temperatures measurements in surface and bedrock sites. Based on model PERMAKART and PERMAMAP the distribution of permafrost in the area is evaluated.

Monitoring and model results are aimed at improving risk assessment and management related to thawing permafrost and slope instability in the area.

The occurrence and ecological implications of sporadic permafrost in blocky scree slopes of non-alpine mountains in central Europe (altitudes less than 1000 m asl.) is subject of a joint research programme by Martin Gude/Roland Mäusbacher (Department of Geography, Jena) in co-operation with Roland Molenda (Department of Zoology, Jena) and other biologists. The main aim is to understand the thermal regime and the stability of these permafrost sites by means of field monitoring and modelling approaches.

Ground temperatures have been monitored in several block scree slopes in Germany and France for more than four years. Investigations on snow hydrologic processes and related sediment transport in the permafrost area of Swedish Lapland (Kärkevagge, Abisko area) are being continued by Martin Gude in co-operation with Dieter Scherer (Department of Geography, Basel, Switzerland) and Christer Jonasson (Abisko Scientific Research Station) in the framework of MOSAIC (Modelling of Snowmelt and its Consequences). A field measurement campaign was undertaken in 1998 and the next field research is planned for 2000.

In the Austdalur drainage basin (23 km²), located in the mountains of the Icelandic Eastern Fjords (Austfirðir), A. Beylich, Halle University, has started studies of recent gravitational and fluvial mass transfer in a subarctic-oceanic periglacial environment free of permafrost, but

with Pleistocene glaciations and a steep, alpine relief. Annually, fluvial sediment transport in the main channels clearly dominates over slope processes. Aquatic slope denudation (slope and rill wash) is the most important slope process, followed by geochemical denudation, avalanches, rock- and boulder falls, creep, debris slides/debris flows, and deflation. The intensity of recent processes is low.

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Italy

During 1999 the following activities were performed by the IPA Italian Adhering Body. In the EU PACE project:

- Monitoring of the thermal regime of the bedrock down to 100 m depth in the Stelvio Pass borehole (Italian Alps; 3,000 m asl.) and of the active layer at La Foppa rock glacier;

- Chemical, physical and crystallographic analyses of the ground ice collected from the Foscagno rock glacier borehole;

- Development of a new spatial model of alpine permafrost distribution, based on DTM and climatic parameters (air temperature and snow cover);

- Analysis of the relationships between vegetational ecosystems and permafrost occurrence.

In 1999 a new three-year research project 'Permafrost and Climate Change in Antarctica' (PCCA) (F. Dramis) has been approved within the PRNA (National Research Project on Antarctica). The main topics are:

- Analysis and monitoring of the surface energy balance and the active layer thermal regime in different environmental conditions with particular reference to vegetational ecosystems and gas flux changes;

- Reconstruction of palaeoclimatic conditions from the analysis of ground ice occurring in deglaciated areas.

In this framework, international cooperation programmes have been started with the Antarctic Institute of Argentina (Jorge Strelin) and the University of Ottawa (Hugh French); cooperation agreements are in progress with research institutions of the UK, Brazil and South Africa.

Investigations on present-day and Quaternary periglacial landforms and processes are in progress in the Alps and the Apennines.

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Kazakhstan

The Kazakhstan Alpine Permafrost Laboratory took part in the International Archaeological expedition in the Altai Mountains (Buchtarma Valley). It investigated permafrost in burial mounds and permafrost in natural conditions. The low limit of the sporadic permafrost belt at approximately 1100 m asl. (49°20'N and 86°22'E) has

been determined.

The laboratory carried out monitoring of the thermal regime of alpine permafrost, of seasonally frozen ground and dynamics of solifluction processes, kurums and the Gorodetsky rock glacier in the Northern Tien Shan. A manuscript about fossil debris flows near Almaty was prepared for publication.

The cooperation programme of permafrost investigation between Mongolia and Kazakhstan will be initiated in 1999, and continue until 2001. During 1998-1999 about 20 articles on topics of cryogenic processes have been published. Modelling of alpine permafrost distribution in connection with climate change continues in the Tien Shan Mountains.

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Mongolia

Detailed permafrost maps of Mongolia at the scale of 1:1 500000, and of the Selenge River Basin at the scale of 1: 500000 will be compiled by N. Sharkhuu in a new scientific project on Mongolian permafrost, running from 1999 to 2001. Likewise a map of seasonal freezing and thawing at the scale of 1:1 500 000 will be prepared by D. Tumurbaatar. The compilation of these maps will be carried out on the basis of analyses of data on Mongolian permafrost investigations obtained during the last 20 years. The maps will show distribution, thickness, temperature, ice content and composition of permafrost, cryogenic processes and phenomena and depths of seasonal freezing and thawing of ground. Legends for the maps will be prepared in both Mongolian and English.

Monitoring of permafrost temperature (for GTNet-P) and active layer (for CALM) at several sites of the Khentei and Khubsugul mountain regions, Mongolia, have been conducted by N. Sharkhuu since 1996. At these sites ground temperatures in boreholes were measured 10-25 years ago. In 1999 N. Sharkhuu installed frost tubes in two holes to a depth of 2.5 and 2.0 m for CALM at sites of the Terkh and Chuluut valleys in the Khangai mountain region. Besides, at the Argalant site of the Khentei mountain region, he drilled a borehole to a depth of 12 m and equipped it with a thermistor cable and a frost tube. At present, there are 10 active boreholes for CALM and GTNet-P in Mongolia. These are: Baganuur (15 m and 21 m deep), Nalaikh (5 m and 50 m deep), and Argalant (12 m deep) all in the Khentei mountain region, Burenkhan (50 m deep) and Ardag (15 m and 25 m deep) in the Khubsugul mountain region, and Terkh and Chuluut surface boreholes in the Khangai mountain region. Next year it is planned to install soil temperature dataloggers in some of the boreholes for CALM.

In November 1998 a joint Japanese - Mongolian group headed by Masami Fukuda, conducted a permafrost survey in the Khatagal (near Khubsugul lake) and Nalaikh

(near Ulaanbaator) areas for three weeks. During the survey, three boreholes were drilled to a depth of 5-8 m and geoelectrical soundings were carried out.

Data were collected on the Busnuur pingo near The Nalaikh area. This year a new group headed by Fujio Tsuchiya worked on a joint research programme on the study of permafrost degradation under influence of Mongolian forest fire. This programme lasts from 1999 to 2002. The main objective is to monitor the thermal gradient shift in permafrost after fire occurrence and the temperature gradient change near heat pipes as a counter measure of degradation, as well as to investigate the ecological impacts of forest fire and processes of regeneration. This summer permafrost surveys were conducted in the areas with forest fires of the Khentei mountain, Mongolia, for two weeks. During the survey heat pipes were installed in two surface boreholes (about 2 m deep) one with and one without permafrost.

Financial support from the IPA enabled N.Sharkhuu to visit the Kazakhstan high mountain permafrost laboratory in Almaty for two weeks in June 1999. Based on analyses of permafrost research materials from Mongolia and Kazakhstan and financial possibilities, geocryologists from both countries discussed and constituted a programme of joint Mongolian and Kazakhstan permafrost studies in the period 1999-2001. They will start to develop a joint programme for mapping and monitoring permafrost as part of CALM, and GTNet-P and the IPA Task Force of Mapping and Distribution Modelling of Mountain Permafrost. For permafrost modelling and mapping, the Burenkhan phosphorite area, Mongolia and the Big Almaty area, Kazakhstan were selected as permafrost conditions that have been studied and mapped previously.

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Netherlands

The Vrije Universiteit, Faculty of Earth Sciences, participates in the EC-funded TUNDRA-project and is studying fluvial processes in the Russian arctic Usa basin. In the summers of 1998 and 1999 fieldwork was conducted, and morphological and sedimentological data were collected, from field sites across the catchment, from the taiga to the treeless tundra, from the Ural Mountains to the tundra-lowlands. In each of these sites present and past fluvial processes of erosion, deposition and reworking were reconstructed by means of morphological mapping and sedimentological analysis. Extrapolation of these data into a larger area will be done by using satellite images, topographical maps and maps such as soil maps, vegetation maps and permafrost maps that will be provided by other members of the TUNDRA-project. For more information, contact huim@geo.vu.nl.

This research is carried out in close cooperation with the Utrecht University, Department of Physical Geography, which studies the hydrological charac-

teristics of the Usa River. A model is under construction, using data collected during the field work, which will describe present discharges and future changes in the hydrological regime under climate changes. The model uses monthly temperature and precipitation values and data from other partners in the TUNDRA-project, such as vegetation cover, topography and permafrost conditions. More information from s.vanderlinden@geog.uu.nl.

In a study of Tertiary Sirius Group diamictites from different localities in South Victoria Land, Antarctic, attention is paid to periglacial overprinting of the glacial structure of the sediments. This is done by checking thin sections for well-known periglacial microstructures.

During studies of glacial sediments emerging from underneath the glacier Sléttjökull, Iceland, it was found that permafrost exists underneath the snout. Sediments remain frozen for up to four years and so should be classified as permafrost. Freezing is caused by heat loss in winter from the thin glacier snout. Studies are being conducted together with J. Krüger, Institute of Geography, University of Copenhagen. More information on these two last projects from : J. van der Meer (j.j.m.meer@frw.uva.nl)

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Norway

Department of Physical Geography, University of Oslo (<http://www.geografi.uio.no/>) continues its activities within the EU-PACE project. The first deep PACE borehole (102 m) was drilled in May 1998 at Janssonhaugen (78°12' N, 16°28' E at 250 m asl.) on Svalbard. The first year of data collection from Janssonhaugen shows seasonally temperature variations down to a depth of 18.0 m, equivalent to the depth of zero annual amplitude. The depth of the active layer in the first summer was 1.55 m, with a maximum depth on 4 September. At both 0.2 m and 0.8 m there are high-frequency variations throughout the entire year. Below the permafrost table, high-frequency temperature variations diminish rapidly, as revealed from theory, and closely follow a sinusoidal curve at 5.0 m depth. The permafrost thickness is estimated to be approximately 220 m. Analyses reveals an increasing temperature gradient with depth. Using a heat conduction inversion model a palaeoclimatic reconstruction shows a warming of the surface temperature over the last 60-80 years. The temperature profile represents a regional signal on Svalbard, which shows an inflection associated with near surface warming of 1 ° to 2 °C in the last century.

In August 1999 a 129 m deep PACE borehole was drilled on Juvvasshøe (61°41' N, 8°22' E at 1894 m asl.), Jotunheimen, in southern Norway. The preliminary results indicate 250 to 300 m deep mountain permafrost, and a very low upper geothermal gradient, which probably reflects a pronounced surface warming in the last part of this century. The Norwegian Meteorological Insti-



Drilling the borehole at Janssonhangen, Svalbard 1998

tute will install a complete meteorological station close to the drill site. Juvvasshøe has a relatively gentle slope from 1700 down to 1300 m asl., where geophysical investigations such as 2D-resistivity soundings, seismic and electromagnetic measurements (EM31) were carried out along a 600 m long profile. This was done together with ETH/Zürich and Terradat/Cardiff. The result is a detailed picture of the transition from continuous to patchy permafrost situated about 1450 m asl., with an increasing active layer thickness.

In connection with the PACE project, mapping of mountain permafrost has been intensified using geophysical methods, and by establishing spatial models of permafrost distribution by means of GIS. Field efforts were concentrated on the mountain areas of Jotunheimen and Dovrefjell, where several hundred BTS-measurements have been carried out. Based on a topographical, spatial-distributed radiation model (SRAD), the radiation balance was calculated in both areas. This showed nearly identical relationships between altitude, potential radiation and BTS temperatures. The BTS temperatures are mainly controlled by altitude, whereas topographic effects, such as slopes aspect seem to be of minor importance, chiefly due to the maritime macroclimatic conditions.

A small-scale map of permafrost distribution in southern Norway has recently been established, based on temperature data provided by the Norwegian Meteorological Institute and a spatial regression model. In the areas of Dovrefjell and Jotunheimen empirical spatial models of large-scale permafrost distribution were established using GIS. Relationships between relief, radiation and partly snow were applied. These data will be incorporated into the PACE documentation.

Studies of periglacial processes are undertaken at Finse in southern Norway, where GIS methods have been used to analyse the relationship between the distribution of periglacial landforms and topographical parameters. For a number of years, slow slope movements (i.e. ploughing boulders, solifluction lobes and debris in general) were monitored using standard surveying techniques. Recently, DGPS has been employed for this pur-

pose, and a test of DGPS for continuous measurement of slope deformation has been performed. In the autumn 1998, a joint project with PACE, between University of Wales (Charles Harris), University of Dundee (Michael Davis) and the University of Oslo (Johan Ludvig Sollid) was started at Finse. The equipment used in the laboratory experiments on solifluction processes, performed by Harris and his co-workers, was installed at one of the Finse sites (Jomfrunut).

The Norwegian Geotechnical Institute, NGI (<http://www.ngi.no/>) has recently started a five year research programme "Permafrost response to environmental and industrial loads". The objective is to investigate how permafrost responds to different loads such as terrestrial pollution and industrial activity, and to establish reliable, effective and environmentally safe solutions for construction on permafrost and clean-up operations at contaminated sites. Existing numerical models will be used in the investigations to predict and estimate permafrost response and optimise the field and laboratory testing programme.

There will be a joint field and laboratory programme that aims at developing new methods for field investigations and, together with numerical analyses, gives input to the response analysis and model development. NGI's permafrost research station at Sveagruva, Spitsbergen (77°54'N, 16°41'E) will be used for the field investigations. In addition, NGI's existing field installations in Longyearbyen and several contaminated sites on Spitsbergen will be utilised. The Research Council of Norway finances the programme. For more information, see <http://www.ngi.no/SIP/SIP7.htm>, or contact the programme coordinator Arne Instanes (ai@ngi.no or arne.instanes@unis.no).

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Russia

The following report presents highlights of some current permafrost studies in Russia. The Federal research subprogramme 'Global Changes in Natural Environment and Climate' unites geocryologists from different regions of Russia. Participating researchers come from institutes of the Russian Academy of Sciences (RAS), e.g. Obukhov Institute of Atmospheric Physics of RAS, Institute of Geography of RAS; its Siberian Division (SD RAS), e.g. Institute of Atmospheric Optics of SD RAS, Institute of Earth Cryosphere of SD RAS; North-Eastern Centre of the Pacific Division of RAS; as well as from Moscow Lomonosov State University, St. Petersburg State University and other leading academic institutions of Russia. Also, very popular in Russia still is the multi-year subprogramme 'Comprehensive Studies of Oceans and Seas, Arctic and Antarctic'. It is implemented by the All-Russian Research Institute of Oceanology, United Institute of Permafrost and Use of Natural Resources of

the Cryolithozone of SD RAS, Institute of Earth Cryosphere, Polar Geophysical Institute of the Kola Research Centre of RAS, North-Eastern Research Centre of the Pacific Division of RAS, Moscow Lomonosov State University, as well as the Arctic Murmansk Engineering-Geological Expedition and other large-production organizations. Working over the lines of the above programmes, the Institute of Global Climate revealed 'Echoes of land climate of some Russian regions' to the warm stream El-Nino events that occur in the Pacific. The Institute of Computational Mathematics of RAS has developed a theory of the sensitivity of global atmospheric circulation to low-power permanent perturbations. Studies carried out at the Geography Faculty of Moscow State University and presented in the 1999 doctoral dissertation of K.S. Voskresensky entitled 'Modern Relief-Forming Processes on Plains of Russian North' have demonstrated the critical role in the relief-forming processes played by intrasecular changes in the temperature regime and the level of precipitation during the warm annual season. It has also been elucidated that cryogenic processes are characterized by cyclic development, whereas their energy is determined by the potential energy of the relief and a portion of the descending heat flux.

Field studies were performed in the Yugorsk Peninsula which yielded comprehensive (cryolithologic, chemical and isotopic) characteristics of massive ground ice. These field and laboratory studies were performed in collaboration with geologists from Göteborg University, Sweden, Institute of Earth Cryosphere of SD RAS, All-Russian Research Institute of Oceanic Geology, Shirshov Institute of Oceanology of RAS, and the Institute of Microbiology of RAS.

The reliability of identifying regions of perennially frozen deposits by electric and elastic properties of frozen deposits and ice (particularly ground ice) using technique reported in Frolov's monograph 'Electric and Elastic Properties of Frozen Deposits and Ice' (1999), as well as in Doctoral dissertations of I.A. Komarov, R.I. Gavriliev, and others, is being studied.

Field studies in the Laptev Sea basin support conclusions drawn by N. Romanovskii and H. Hubberten on the significance of paleo-reconstructions of interactions in the climate-land-sea system. In this context radically new geocryological modelling of the dynamics of the shelf and off-shore permafrost indicate four climatic and glacio-eustatic cycles (~ 420 000 years). This is based on the isotopic temperature curve derived from ice cores from the Vostok station in the Antarctic kindly provided by V.M. Kotlyakov.

Also of interest is geocryological modelling of the dynamics of the shelf and off-shore cryolithozone, its interaction with the zone of stability of gas hydrates and gas fields, and modelling of cryogenic phenomena. The above-mentioned studies are carried out by the joint effort of Russian scientists from Moscow State University,

P.I. Melnikov Permafrost Institute, St. Petersburg State University of Communications and German scientists: H. Hubberten, K. Siegert, V. Rachold, L. Schirmeister and others from the Potsdam Division of the Alfred Wegener Institute for Marine and Polar Studies. The annual meeting of geocryologists was held in Pushchino 20-23 April 1999, and for the first time the programme was shared with glaciologists. The theme of the international conference was "Monitoring of the Cryosphere" and consisted of a series of plenary, paper and poster sessions and several panel and round table discussions. The annual meeting of the Consolidated Scientific Council for Earth Cryology, presided over by Vladimir P. Melnikov, was held on the last day of the conference, and included a discussion of plans for the next conference in May 2000 on the theme "Rhythms of natural processes in the Earth Cryosphere".

New geocryological data are presented in more detail in the Russian-language journal "Kriosfera Zemli" (The Earth Cryosphere), and national and foreign specialists are invited to subscribe to it.

The English version of the 16-sheet Geocryological Map of Russia and Neighbouring Republics has recently been published. The English version of this very detailed map, important to industrial and government users as well as to permafrost scientists, is a project of Cambridge, Moscow State and Carleton Universities. Full details with map examples are given on the <http://www.freezingground.org/map> or may be obtained by writing to Collaborative Map Project c/o Geotechnical Science Laboratories, Carleton University, Ottawa, K1S 5B6, Canada.

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Southern Africa

Most activities of the members the Southern African Permafrost Group have been concentrated on the preparations associated with the INQUA Congress, Durban, from 3-15 August 1999, as reported elsewhere in this issue.

Ongoing research on Marion Island in the maritime sub-Antarctic by the Universities of the Western Cape and Pretoria focus on: (a) Ground climate monitoring in order to examine environmental controls on frost activity, (b) Experimental determination of sediment movement rates in response to soil frost activity, with particular emphasis on needle ice as a geomorphic agent, (c) Quantitative survey work on active and relict periglacial landforms, concentrating on active patterned ground, (d) Geomorphological mapping of glacial and periglacial landforms.

In addition Paul Sumner, with the assistance of Werner Nel, is working on rates of weathering and debris production on Marion Island.

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Spain

Forty-five experts from Spain and Portugal attended the fourth meeting of IPA-Spain, organised by the Instituto de Estudios Turolenses and the University of Zaragoza, 15-17 July, 1999, in Albarracín. The objective of the meeting was to discuss the characteristics of the cold-climate landforms and processes in the Mediterranean and sub-Atlantic environments of the Iberian Peninsula.

Lorenz King (University of Giessen, Germany) gave a keynote address on mountain permafrost in Europe, and Francesco Dramis (University of Roma) gave the closing speech on periglacialiation of the mountains of Italy. On July 16, a field trip to Sierra de Albarracín examined cold-climate landforms in Paleozoic quartzite mountains and Mesozoic calcareous ravines of the Iberian Range.

The fifth meeting of IPA-Spain will take place in 2001, in Santander.

An active rock glacier has been discovered in the Sierra Nevada Mountains in southern Spain, as part of the EU-PACE project fieldwork. It is situated in Corral del Veleta (3100 m asl.), a cirque at the NE face of the Veleta Peak (3394 m). A shallow borehole was drilled in the rock glacier by members of the Spanish PACE group.



Participants at the Pushchino conference, April 1999

Pure ice appeared at 1.9 m depth. As the Veleta Peak is located at 37°N, this active rock glacier is the southernmost in Europe. The Spanish PACE group will carry out intensive research at this rock glacier in the next years to determine its origin, the climatic implications and the permafrost distribution in the area.

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Sweden

Else Kolstrup Physical Geography, Department of Earth Sciences, University of Uppsala, continues research on boundary constraints of geomorphological forms and processes in past and present periglacial environments. Faculty and NFR-funded projects involve a thesis study by Bo Westin on constraints of thermal contraction cracking and another by Frieda Zuidhoff on boundary constraints of palsas in Lappland. Dynamics of, and dating methods applicable to, Danish Weichselian coversand (aeolian) deposits are being investigated in cooperation with Göran Possnert (Uppsala) and Andrew Murray (Risö, Denmark). Also casts from thermal contraction cracks in Denmark are the subject of investigation.

Philip Wookey, Else Kolstrup and Göran Possnert continue the NFR-funded project 'Climate Change, Soil Organic Matter Lability and Decomposer Metabolism in High Latitude Soils in Northern Iceland'. Wookey is playing a strong role within the EU project Dynamic Response of the Forest-Tundra Ecotone to Environmental Change (DART), and is chairman of the International Tundra Experiment (ITEX).

Late December 1998 Prof. em Anders Rapp died and Swedish periglacial research has thereby lost a highly merited representative.

Else Kolstrup (Else.Kolstrup@natgeog.uu.se)

Switzerland

In the last year, the main issue of the Glaciological Commission of the Swiss Academy of Sciences (SAS) has been permafrost, in particular the concept of the Permafrost Monitoring Switzerland (PERMOS). It was agreed that the main part will comprise thermal monitoring in a number of shallow, 20 m deep boreholes. Various existing sites form the base, which will be enlarged continuously. In January 1999, a meeting held in Interlaken was dedicated to permafrost with presentations by Charles Harris (Permafrost and Climate in Europe - PACE), Markus Imhof (Permafrost in the Schilthorn region), Hansruedi Keusen (Geotechnical approaches for buildings in permafrost) and Daniel Vonder Mühl (Permafrost Monitoring Switzerland - PERMOS).

The International Glaciological Society (IGS) held a meeting in August 1999 in Zürich. Five talks were given in the permafrost session and several permafrost pos-

ters were presented. A field trip led by Wilfried Haerberli and Marcia Phillips took the participants to the Swiss Federal Institute for Snow and Avalanche Research (SFISAR, Davos) and various research sites in the Upper Engadin.

The results of the project 'Ice melt in high mountain areas' (Project W. Haerberli) within the National Research Programme (NRP) 31 on 'Climate Change and Natural W. Hazards', was published in spring 1999.



Borehole drilling operation in the Swiss Alps.

Within the Hydrological Atlas of Switzerland (HADES), the permafrost part was published in August 1999. It contains a Swiss map showing the permafrost distribution according to three different models, the location of over one hundred rock glaciers, three case studies (Murtèl-Corvatsch, Furggentälti and Val Réchy) and a comment in German, French, Italian and English. Meanwhile, projects performed through several institutes are going on:

The Institutes of Geography at Fribourg (IGUF, Michel Monbaron, Jean-Michel Gardaz, Reynard Delaloye) and Lausanne (IGUL, Emmanuel Reynard) are conducting research on the thermal evolution of permanently frozen ground at very low elevations (Creux du Van, Jura Range, 1200m asl.) and at the lower limit of the discon-

tinuous permafrost belt in the western Penninic Alps (Alpage de Mille, 2300m asl.; Mont-Gele/Lapires, 2500m asl.). A comparative study site of IGUL is situated in the more oceanic Diablerets region (2400m asl). Various methods such as direct current (DC) resistivity soundings and mapping, BTS measurements, and continuous temperature measurements at the ground surface are being used. In the Lapires talus slope, a 20 m borehole was drilled in autumn 1998.

The research project 'Snow-supporting structures in permafrost terrain' has been running for three years at the SFISAR, Davos (Patrik Thalparpan, Marcia Phillips). The influence of snow-supporting structures on ground temperature evolution, and the technical aspects of the construction of the structures in high alpine permafrost terrain are being investigated. Field measurements include the monitoring of borehole temperatures, snow distribution, temperatures of experimental snow-supporting structures, and slope stability. Results obtained from measurements and computer simulations indicate that heat is not conducted into or out of the ground through the steel components of the supporting structures. Ground temperature is, however, reduced slightly on a very local scale through artificial modification of snow cover distribution. Temperature measurements will be continued to verify these results over a longer period. Several types of structures and foundations have been tested for their suitability in steep, potentially unstable terrain. In addition, anchor pull-out tests were conducted and different types of grout and injection techniques were investigated in the field and in the laboratory. Guidelines for the construction of snow-supporting structures in permafrost have been established.

At the Department of Geography, University of Zürich (Wilfried Haerberli, Andi Kääb, Martin Hoelzle), various ongoing projects relate to creeping mountain permafrost. They combine photogrammetry, geodesy, geophysics, geomorphology and distribution modelling.

One project aims at developing remote sensing techniques for early recognition of glacial and periglacial hazards based on satellite imagery, aerial photography and digital terrain models.

On Muragl rock glacier, four 70m deep boreholes some 30m apart, were drilled within the ETH-Mini-Poly project of the three institutes of Geotechnics (Sarah Springman, Lukas Arenson), Geophysics (Hansruedi Maurer, Martin Musil) and VAW (Daniel Vonder Mühll). Sophisticated geophysical surveys included both surface as well as borehole-to-borehole investigations (seismics and radar). Some cores were saved and are being analysed. Borehole logging, vertical and horizontal deformation and temperatures provide the base to assess the geotechnical characteristics, and for long-term monitoring of the rock glacier.

As the PACE project is fully operative now, the main fieldwork at all field sites took place this year. The two Swiss partners (University of Zürich: Wilfried Haerberli,

Martin Hoelzle, Catherine Mittaz; VAW-ETH Zürich: Daniel Vonder Mühll, Christian Hauck) intensified their investigation at the Schilthorn site: geophysical surveys, a 14 m deep borehole to measure temperatures and a climate station to determine the energy balance are a first step to the deep drilling, which will be done in 2000.

VAW-ETH Zurich organised and participated in the geophysical fieldwork in Sierra Nevada (Spain), Svalbard, Tarfala (Sweden), Valtellina (Italy), Jotunheimen (Norway) and at various sites in the Swiss Alps. A whole range of different methods were used, such as refraction seismics, DC resistivity tomography and various electromagnetic methods in order to evaluate suitable techniques for the mapping of permafrost. First results were presented at the PACE meeting in Giessen, Germany in October 1999.

Possible new establishment of permafrost in glacier forefields is investigated at the Muragl glacier by the University of Trier, Germany (Christoph Kneisel), and in several glacier forefields in the Valais area by the University of Fribourg (Reynald Delaloye).

Three PhD theses were successfully completed during the last year: Markus Imhof (University of Berne) investigated the relationship between permafrost and snow especially in the Bernese Alps, including the Schilthorn area. Emmanuel Reynard (University of Lausanne) performed geomorphological and hydrological studies in the Montana area (Valais). Jean-Michel Gardaz (University of Fribourg) wrote his thesis about hydrology in permafrost.

Daniel Vonder Mühll
(vondermuehll@vaw.baum.ethz.ch)

United Kingdom

A project under the direction of Julian Murton (University of Sussex), with funding from The Leverhulme Trust and the Geological Society, is investigating 'The origin of deformed massive ice, Pleistocene Mackenzie Delta, Western Canadian Arctic'.

A second project, organised by Julian Murton and funded by the UK Natural Environmental Research Council, brings together expertise on ground ice, rock weathering and cryogenic experiments from the University of Sussex and the Centre de Géomorphologie, Caen, France to develop 'A pilot experiment on rock weathering in permafrost'. A new methodology for simulating the ground thermal regime of the active layer and the upperpart of permafrost (two-sided freezing) has been successfully developed and is being applied to a large block of chalk. Results to date indicate that frost heave occurs during both freeze and thaw cycles, and that ice segregation is causing rock cracking to take place at the base of the simulated active layer.

As part of the research project "Assessment of renewable ground and surface water resources and the impact of economic activity in The Ili River Basin, Republic of Kazakstan" funded by the INCO-COPERNICUS Fund

of the European Commission, Stephan Harrison (Centre for Quaternary Science, Coventry University) and David Passmore (Department of Geography, University of Newcastle-upon-Tyne) are investigating the geomorphological evolution of upland valleys in the Tian Shan mountains. Long-term monitoring of environmental systems in the Zailiisky Alatau mountains of the northern Tian Shan offers an unusually detailed record of late 19th and 20th century glacier fluctuations, rock glacier fluctuations, climate records and frequency of avalanche activity over the past 40 years. Research aims include (a) to establish temporal and spatial linkages between twentieth century climatic changes, glacier and rock glacier response and patterns of valley side and valley floor instability, and (b) to develop a model of climate change and associated geomorphic responses that may be integrated within environmental and economic management frameworks.

Scaled centrifuge modelling of thaw-related slope processes by Charles Harris and Brice Rea (Cardiff University) has made significant progress through 1999 (see PACE report, this issue), and a new three-year project entitled "Scaled centrifuge modelling of periglacial mass movement processes" commenced in October 1999. Funded by the UK Natural Environment Research Council, this project will study gelifluction processes and the transition to rapid mudflow/active layer detachment sliding, with particular emphasis on the role of constitutive soil properties. A second project, involving Anglo-Norwegian collaboration and funded by the British Council and the Norwegian Research Council has been initiated to monitor processes of gelifluction at a field site in Finse, Southern Norway. The research team includes Johan Ludvig Sollid and Ivar Berthling (University of Oslo), Charles Harris (University of Cardiff) and Michael Davies (University of Dundee). This monitoring is designed to provide field validation of the scaled centrifuge modelling programme.

Charles Harris (harrisc@cardiff.ac.uk)

United States of America

FROSTFIRE, a wildfire research project in the boreal forest near Fairbanks, Alaska, was ignited in Caribou Poker Creeks Research Watershed (CPCRW) in July 1999. The Bureau of Land Management, Alaska Fire Service, at the request of the University of Alaska Fairbanks conducted the 900-acre controlled burn.

Research groups from the U.S., Canada, and Japan are studying fire behaviour and effects on climate and boreal ecosystems. The fire burned about 90 percent of the black spruce in the 2,000-acre research area as it raced through stands of black spruce and feather moss, but moved more slowly and with less intensity in hardwoods and sphagnum moss. Background data on pre-fire conditions were collected over the last two years and now numerous investigations will focus upon fire impacts, permafrost degradation and vegetation recovery. A second

programme in CPCRW, the YuWEx (Yukon Water and Energy Experiment) project, is a collaborative research activity among several Japanese and U.S. scientists. Studies of interactive processes associated with hydrologic and climatic dynamics in the discontinuous permafrost area of the Yukon River uplands are underway to improve our understanding of land surface processes and potential impacts of climatic change in a region of discontinuous permafrost.

Permafrost research continues as part of the ATLAS programme (Arctic Transitions in the Land/Atmosphere System), a research programme sponsored by the National Science Foundation's ARCSS (Arctic System Science) programme. The goals of the research are to develop a more complete understanding of the responses of arctic ecosystems to a changing climate, to determine the geographical patterns and controls over climate-land surface exchanges (mass and energy), and to develop scenarios of future change in the Arctic system. This five-year programme includes numerous investigations of active layer dynamics and permafrost response to climatic change. The Circumpolar Active Layer Monitoring (CALM) network is part of ATLAS.

A second NSF programme 'Russian-American Initiative on Shelf-Land Environments in the Arctic (RAISE)' sponsored a 3-day workshop on Arctic Coastal Dynamics. Rates of erosion of ice-rich, land-based permafrost, the dynamics of subsea permafrost, and sedimentary processes along the coastlines were reviewed and available information synthesised.

In the Antarctic, a joint US-Russian team cored permafrost in Beacon Valley to study sand/ice wedge polygons, their initiation and growth, and their effect on land surface stability. This University of Washington led team recovered a 20-m core that may contain the earth's oldest preserved ice. Observations include physical, chemical and microbial characteristics of the core along with borehole ground temperatures. A NASA collaborator is modelling ground-ice dynamics as the Beacon Valley is considered to be one of the best terrestrial analogs for the study of Martian soils.

Gary Clow reports that the U.S. Geological Survey continues its borehole measurements in Greenland, Antarctica, and Alaska. The primary goals of the Survey Borehole Paleothermometry Programme are to reconstruct surface temperatures in the polar regions for the last 40 ka and to improve our understanding of the thermal conditions within the permafrost that underlies the polar ice sheets.

The ASCE Technical Council on Cold Regions (TCCRE) held its 10th International Conference on Cold Regions in Lincoln, New Hampshire, August 16-19, 1999. The conference, entitled Putting Research into Practice, was represented by Canada, Japan, Norway, Russia, Sweden, and the United States. Eighty-six papers were presented in 26 sessions. The technical and administrative committees of TCCRE met. Bucky Tart reported

on the Yellowknife conference and announced the forthcoming International Workshop on Permafrost Engineering in Svalbard and the permafrost conference in Switzerland. TCCRE expressed interest in developing engineering sessions for the 2003 conference. Ted Vinson reported on the ISCORD conference held in Tasmania. Bill Lovell, Jr., former U.S. representative to IPA, was presented the Hal Peyton Award, the prestigious ASCE cold regions engineering award.

Steve Grant and Giles Marion, CRREL, and Ron Sletten, University of Washington, organised a special session on unfrozen water for the American Geophysical Union Fall meeting in San Francisco, December 1999. The Cryosphere Specialty Group of the Association of American Geographers sponsored several sessions at the AAG annual meeting in Honolulu, Hawaii, in April 1999.

As noted elsewhere, the Troy Péwé Climatic Change Permafrost Reserve, located in Fairbanks, Alaska, was dedicated on September 18, 1999.

Jerry Brown (jerrybrown@igc.org) and Larry Hinzman (ffldh@aurora.alaska.edu)

Other News

New Zealand

Members of the New Zealand group are currently undertaking a number of research projects in the Ross Sea sector of Antarctica. There is little active periglacial/permafrost research currently being undertaken in New Zealand itself although a number of relevant projects have recently been completed.

In Antarctica Warren Dickinson (Victoria University of Wellington) has an ongoing programme of drilling permafrost in the Dry Valleys area using ground ice to improve our understanding of paleoclimate and landscape history. Ground ice in the Sirius group tillite has been sampled from cores up to 9.5 m deep at Table Mtn. Stable isotopic data suggests that the ground ice accumulated from a combination of: (1) moisture diffusion from the surface and (2) brine seeping downward from the surface along thin films. Further research will involve validation of this model using ground ice from cores taken across a transect on surfaces of differing ages and elevations. Temperature probes will be deployed into the core holes to determine the stability of the ground ice and will record temperatures and relative humidity through the winter.

Peter Sheppard (IGNS), Megan Balks (University of Waikato), Jack Alasbie (Landcare) and Ron Paetzold (USDA) are continuing work on the effects of hydro-carbon spills on Antarctic soil ecosystems. It has been demonstrated that the right organisms are present to degrade fuel and oil spills in Antarctic soils, but they achieve it at a much lower rate than observed elsewhere. The reasons

for this contrast are being examined as is how these properties affect the functioning of the ecosystem. The main objective of the 1999/2000 season is to undertake maintenance and download data from a number of climate monitoring sites and to install temperature and moisture monitoring equipment at sites with oil contamination. Preliminary work will be undertaken to install equipment for a controlled spillage trial that is to be undertaken during the 2000/2001 summer.

Iain Campbell, Doug Sheppard, Megan Balks are involved with John Kimble and Ron Paetzold (USDA) in a project involving active layer/permafrost investigation at two locations in the McMurdo Sound region. Temperature probes have been inserted as well as humidity and moisture recorders in the active layer and non-ice cemented permafrost. At the coastal sites, ice-cemented permafrost was present at 35 and 65 cm respectively, whilst the inland Dry Valley site provided a contrast with no ice-cement present and dry permafrost present below 40 cm. It is intended that they will become permanent permafrost monitoring sites and that the range of sites can be extended.

Peter Sheppard is also involved in a project with Iain Campbell, Graeme Claridge and Ian Graham (IGNS) in which the sources of salts in ancient Antarctic Dry Valley soils and their stored climatic record are being investigated. Understanding of the sources of the salts, how to differentiate these sources, and the controls on intra-soil processes is needed if the climatic history is to be elucidated.

Paul Augustinus, Matt Watson, Scott Nichol (University of Auckland) and Ed Butler (Victoria University of Wellington) undertook ground penetrating radar surveys of raised beaches in the McMurdo Sound region. The subsurface imaging clearly displayed the subsurface stratigraphy and depth to bedrock at many sites, as well as indicating the depth to the active layer and discrimination between dry and ice permafrost. This work is being extended to other raised beaches along the Ross Sea coast over the 1999/2000 summer season.

In New Zealand, Alan Mark (University of Otago) is collaborating with Peter Kershaw (University of Alberta) on vegetation-environmental relationships in the alpine zone of Rock and Pillar Range, Central Otago, N.Z.

There will be a conference of the Australia-New Zealand Geomorphology Group, in Wanaka, in the central South Island of New Zealand, and at the foothills of the Southern Alps and close to some of New Zealand's best periglacial landscapes. Details of the conference have not yet been announced, but it is to follow the conference of the New Zealand Soil Science Society and is to run from Dec 6 to 10, 2000. Professor Michael Crozier, School of Earth Sciences, Victoria University of Wellington is the organiser and contact person for details of the meeting: michael.crozier@vuw.ac.nz.

Paul Augustinus (p_augustinus@hotmail.com)

Portugal

During 1999 Portuguese periglacial researchers continued studies mentioned in previous reports.

Maria Luísa Rodrigues presented a PhD thesis on the Quaternary deposits and present-day dynamics of the Limestone Massif of Estremadura. Among other issues, she analysed the significance of relict stratified slope deposits.

At the IPA-Spain meeting in Albarracín, António de Brum Ferreira, Maria Luísa Rodrigues and Gonçalo Teles Vieira presented a synthesis on the relict and present-day periglacial phenomena in Portugal. Gonçalo Teles Vieira participated in the IGU/IPA periglacial symposium in Lodz, Poland.

A small group is being organised in order to apply in the near future for membership in the IPA. The group includes researchers from the Universities of Lisbon (4), Coimbra (2) and Oporto (1).

Gonçalo Teles Vieira (gtvieira@ceg.ul.pt)

Romania

The main focus of activity during the past year was the monitoring of permafrost and related periglacial forms (BTS and summer temperature measurements of springs situated at the base of rock glaciers, talus cones and block fields) in the Fagaras, Retezat, Parang, Tarcu (Southern Carpathians), and Detunata Goala (Apuseni) Mountains, by a team of the West University of Timisoara, under the coordination of Petru Urdea.

For the next three years (1999-2001) the same team will work in the grant 15/63 'Study of the present-day morphodynamic processes in alpine zone of the Southern Carpathians (Transylvanian Alps) from the perspective of sustainable development of the mountain area', financed by the National Council of Scientific Research for Higher Education, of the National Education Ministry.

Petru Urdea (urdea@cbg.uvt.ro)

The 12th Northern Research Basins Workshop and Symposium was convened in Reykjavík, Kirkjubæjarklaustur and Höfn, Hornafjörður, Iceland Aug 23-27, 1999. Representatives from the U.S., Canada, Norway, Finland, Denmark, Sweden, Greenland, Japan, Germany, Great Britain, and Iceland met to discuss hydrologic problems and investigations currently ongoing throughout the circumpolar North. Permafrost hydrology was a recurrent theme throughout the meeting. The papers presented at the meeting have been compiled into a 400+ page proceedings that is available through Jónas Eliasson (jonase@verk.hi.is)

Forthcoming Meetings

2000

30th International Arctic Workshop, 16-18 March, Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado, USA.

<http://instaar.colorado.edu/AW2000/>

Scientific conference on **The Environmental Conditions and the Prospects of a Sustainable development of the Northern Pacific Area at the Turn of the Millennium**, 21-24 March, Magadan, Russia. G. Perlshtein at email: svj@online.magadan.su

International Arctic Science Committee, Arctic Week, 2-7 April, Cambridge, U.K., email: iasc@iasc.mo.

Ice and permafrost drilling in high mountains, symposium co-sponsored by the EU projects ALPCLIM and PACE, at the **European Geophysical Society, XXV General Assembly, Millennium Conference on Earth, Planetary and Solar System Sciences, Nice, France, 25-29 April**. Convenors: Wilfried Haeblerli and Dietmar Wagenbach. The symposium aims to review presently available knowledge and overviews ongoing research projects.

<http://www.copernicus.org/EGS/egsga/nice00/nice00.htm>

International Conference on Rhythms of Natural Processes in the Earth Cryosphere, 12-15 May, Pushchino, Russia. Russian Academy of Sciences, Scientific Council on the Earth Cryology, Moscow 117312, ul. Fersmana 11/2, kv. 68. Phone: 7-095-1324-5422, Fax: 7-095-135-6582, email: kriozem@glasnet.ru

The Tenth International Offshore and Polar Engineering Conference, ISOPE2000, Seattle, May 28- June 2. <http://www.isopec.org>

International Workshop on Permafrost Engineering, Longyearbyen, Svalbard, Norway, 18-21 June.

The workshop goals are to: Strengthen co-operation between the Nordic countries in the field of permafrost engineering, and to promote environmentally friendly solutions to permafrost engineering problems. Further information : Professor K. Senneset, Department of Geotechnical Engineering, NTNU, Høgskoleringen 7a, N-7491 Trondheim, Norway. Phone: 47 73 59 4602, Fax: 47 73 59 4609, email: kaare.senneset@bygg.ntnu.no

The Second International Conference on Contaminants in Freezing Ground, 2-5 July, Cambridge, U.K. <http://www.freezingground.org/conf2000>, or Conference Secretariat, c/o Geotechnical Science Laboratories, Carleton University, Ottawa, K1S 5B6, Canada.

31st International Geological Congress, 6-17 August Rio de Janeiro, Brazil. Secretariat: Phone: 55 21 295 5847, Fax: 55 21 295 8094, email: 31igc@cristal.cprim.gov.br

International Workshop on debris-covered glaciers, 13-15 September, Seattle, Washington, USA, sponsored by the International Commission on Snow and Ice.

M. Nakawo, Institute for Hydrospheric-Atmospheric Sciences, Nagoya University 464-8601 Japan. Fax: +81-52-789-3436, email: nakawo@ihas.nagoya-u.ac.jp

International Symposium on Ground Freezing (ISGF) and Frost Action in Soils, to be held in Brussels, 11-13 September. J.-F. Thimus, UCL, Génie Civil-Batiment Vinci, Place du Levant I, 1348 Louvain la Neuve, Phone: +10-47-21-12, Fax: +10-47-21-79.

The Fourth International Symposium on Permafrost Engineering Lanzhou, China 21-23 September. Secretariat address: Prof. Zhu Yuanlin, Lanzhou Institute of Glaciology and Geocryology, Chinese Academy of Sciences, Lanzhou, 730000, China. Phone: 86-931-8841490, Fax: 86-931-8885241, email: zhuyl@ns.lzb.ac.cn

British Periglacial Workshop, 6-7 September, University of St Andrews, Scotland. Dr. Julian Murton, email: J.B.Murton@sussex.ac.uk and Prof. Colin Ballantyne, email: ckb@st-andrews.ac.uk

2001

The First European Permafrost Conference, Rome, Italy, 26-30 March. For further information please see the inserted 1st Announcement.

The Third International Conference on Cryopedology, Copenhagen, 20-24 August. For further information please see the inserted Pre-Registration Form.

Fifth International Association of Geomorphology Conference, 23-28 August, Tokyo, Japan, organised by the Japanese Geomorphological Union (JGU). A five day post conference field trip to the alpine landforms of the Japanese Alps with N. Matsuoka (email: matsuoka@atm.geo.tsukuba.ac.jp) and others are proposed.

Further information and registration at <http://wwwsoc.nacsis.ac.jp/jgu/>

2003

VIII International Conference on Permafrost, 21-25 July, Zürich, Switzerland. Contact: Prof. W. Haeblerli: haeblerli@geo.unizh.ch

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December 1999

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Additional Member Report

China

The Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI), Chinese Academy of Sciences (CAS), is a new institute organised in June 1999 following the Knowledge Innovation Project of the CAS. The organisation was based on three former CAS institutes – the Lanzhou Institute of Glaciology and Geocryology, the Lanzhou Institute of Desert Research and the Lanzhou Institute of Plateau Atmospheric Sciences (or Research). The goals of the new organisation are disciplinary integration and scientific syntheses, while retaining the present unique and distinguished disciplines.

To optimise the disciplines, the new institute is composed of six divisions: Cryosphere and Global Change, Desert and Desertification, Plateau Atmospheric Physics, Frozen Soils and Cold Regions Engineering, Land-water Resources and Ecology and Agriculture. The first three divisions are based on a merger of the existing institutes and laboratories. The last three divisions were formed through a combination of research groups from the three former institutes and scientists and engineers from universities and local institutions.

The new organisation has a staff of 200 senior scientists, mid-level scientists and technicians. Fifty-five are leading scientists, engaged in research domestically and abroad, 131 are mid-level scientists and technicians and 14 are management or logistics personnel. Looking to the future, an emphasis has been placed on organising a younger staff; the average age is younger than 40 years and 60 % are younger than 45 years old. The new institute will retain 230 to 240 positions for graduate and postgraduate students (about 150-180 positions), and for visiting scholars and distinguished scientists (about 50 positions).

Major research activities will be focused on glaciology, cryopedology and cold regions engineering, desert and desertification, hydrology and land resources in cold and arid regions, and plateau atmospheric sciences. Restoration and rehabilitation ecology and regional agriculture will be a new field to be developed.

Major fields of research for the new institute will include climate, polar and mountain glaciers, ice cores and global change, freeze-thaw processes in the cold regions environment, the physics and mechanics of frozen soils in cold regions engineering, wind sand physics and desertification dynamics, desert environment evolution and global change, desertification and control, hydrological processes and water resources in cold and arid regions, water resources capacity and optimisation, environment and dynamics in plateau and adjacent regions, convective wind-storm and thunder-lighting physics, mechanisms of and the mitigation of the effects of meteorological disasters (droughts, hails, thunderstorms, sand-dust storms and snow hazards), ecological processes and their mechanisms in fragile and degraded ecosystems in cold and arid regions, restoration

and rehabilitation of highly efficient water-saving eco-agriculture, and the development of a strategy for sustainable eco-agriculture in cold and arid regions.

Cheng Guodong, Academician of the CAS, President of the Lanzhou Branch of the CAS, a former President of the International Permafrost Association and a 1965 graduate from the Beijing College of Geology, is the director of the CAREERI. His long-term studies of frozen soils on the Qinghai-Tibet Plateau contributed to the solution of the mechanism of ground ice formation, implemented the mapping of permafrost distribution, provided principles and methods for engineering construction in permafrost regions and contributed to several construction programmes on the Plateau.

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IPA web site with links to other permafrost-related sites:

<http://www.geodata.soton.ac.uk/ipa>

CAPS CD information:

<http://www-nsidc.colorado.edu/NSIDC/CATALOG/ENTRIES/G01175.html>

IPA Circum-Arctic Permafrost Map:

ftp://ftp.ngdc.noaa.gov/Snow_Ice/Permafrost/IPA_map/

On- line metadata for Global Georyological Database (GGD):

<http://www-nsidc.colorado.edu/NOAA/GGD/>

Cirumpoar Active Layer Monitoring:

<http://www.geography.uc.edu/~kenhinke/CALM>

Permafrost and Climate in Europe (PACE):

<http://www.cf.ac.uk/uwcc/earth/pace/>

Global Terrestrial Network on Permafrost (GTNet-P):

<http://sts.gsc.nrcan.gc.ca/permafrost/>