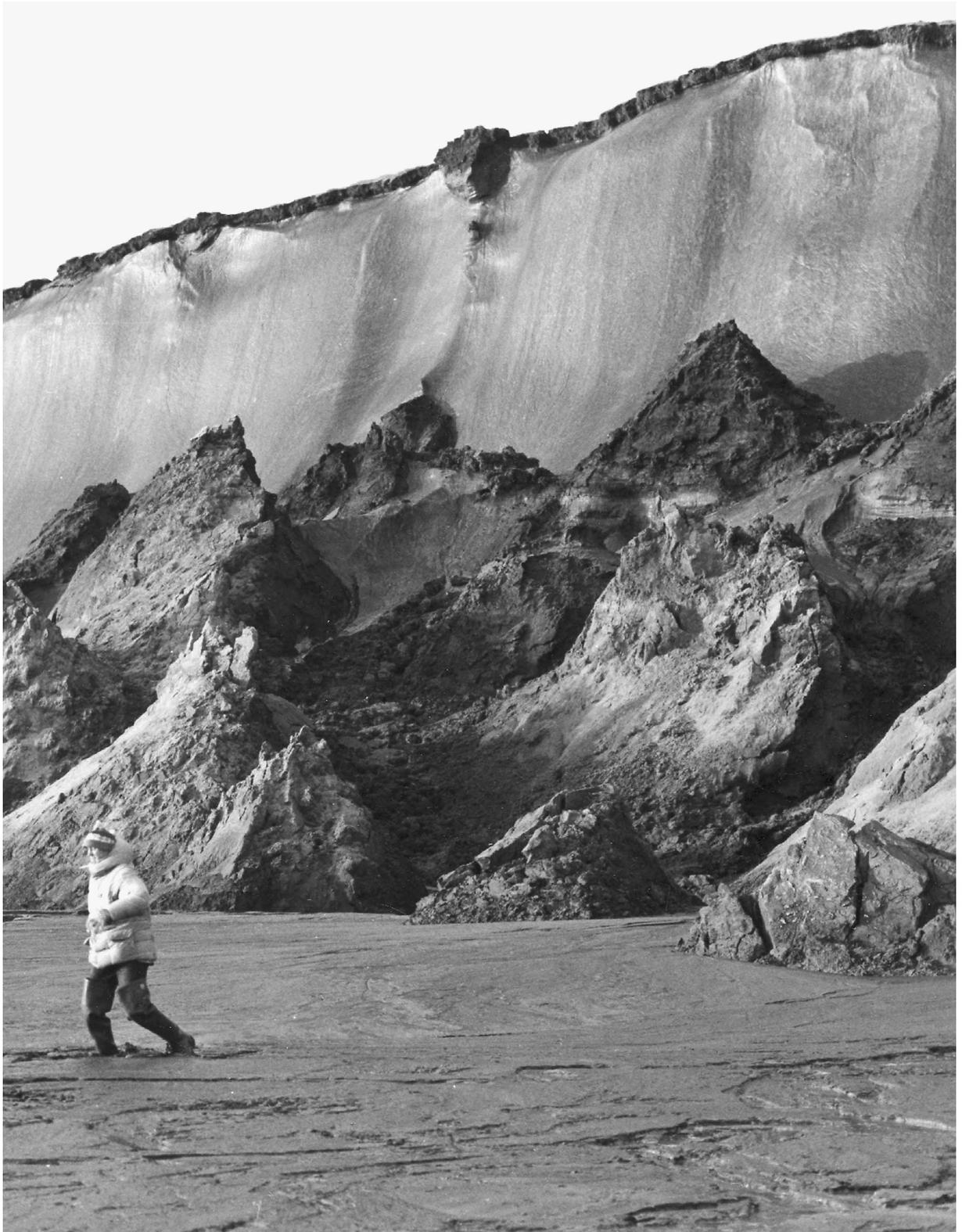


FROZEN GROUND



The News Bulletin of the International Permafrost Association

Number 24, December 2000



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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Vice Presidents

Dr. Felix E. Are, Russia

Professor Wilfried Haerberli, Switzerland

Members

Dr. Jerry Brown, U.S.A.

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Data, Information and Communication

Working Groups

Global Change and Permafrost

Periglacial Processes and Environments

Permafrost Engineering

Cryosols

Coastal and Offshore Permafrost

Southern Hemisphere Permafrost and Periglacial Environments

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Cover: Siberian Ground-Ice Complex: Ice-rich cliff along the coast of Bolshoy Lyakhovsky Island, Dmitry Laptev Strait near the mouth of the Zimovie River. Cliff height is 30 m. Ice-content is approximately 80%, with a coastal retreat rate of about 4.5 m/year. There are many mammoth bones in the sediments of this section. This location represents a key site to be employed in the Arctic Coastal Dynamics program (see ACD discussion in Working Group report). Photograph by Mikhail Grigoriev, Permafrost Institute, Yakutsk, Russia, August, 1998.

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International Permafrost Association
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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 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

Four of the six members of the Executive Committee met in Russia, 12-15 May 2000, during the annual Pushchino conference (Hugh French, Wilfried Haerberli, Felix Are, and Jerry Brown). The production and distribution of *Frozen Ground*, the annual budget and payment of dues by Council members, requests for financial support by Working Parties, and the operation of the IPA Secretariat were reviewed. Updates on IPA-sponsored meetings for 2001 in Rome, Copenhagen, Tokyo and Mongolia were presented (see Forthcoming Meetings). Planning activities with the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC) were approved. Members discussed with Vladimir Melnikov and others Russians participation in the Eighth International Conference on Permafrost (VIII ICOP) in 2003. It was agreed to initiate the reserve fund to support VIII ICOP attendance and produce a first announcement (see enclosed).

The IPA Secretariat (Hanne H. Christiansen) continued to provide liaison among Executive Committee members, with members of IPA Adhering Bodies, and the production of *Frozen Ground*. Dr. Christiansen's work in producing the last issue of *Frozen Ground* was noted with gratitude. Solicitation of funding for the Secretariat in Copenhagen continues.

Details of the following meetings that took place in 2000 are presented throughout this issue:

January

- Canadian GCOS workshop on Permafrost, Glaciers and Ice Caps, Ottawa, Canada.

February

- Arctic Cumulative Impact Assessment (ACIA), Washington DC, USA.

March

- Cryosol Working Group, Oslo, Norway.

April

- International Arctic Science Committee (IASC), Cambridge, UK.
- XXV General Assembly, European Geophysical Society, Nice, France.

May

- The Executive Committee and Annual Pushchino Conference, Russia.
- SCAR meeting Regional Sensitivity to Climate Change in the Antarctic (RiSCC), Johannesburg, South Africa.

June

- International Workshop on Permafrost Engineering; Longyearbyen, Svalbard.
- International Workshop on Permafrost Monitoring and Databases, Fairbanks, Alaska, USA.

July

- The Second International Conference on Contaminants in Freezing Ground, Cambridge, UK.

August

- 31st International Geological Congress, Rio de Janeiro, Brazil.
- Intergovernmental Panel on Climate Change, Lisbon, Portugal.

September

- Fourth British Periglacial Workshop, St. Andrews, Scotland, UK.
- International Workshop on Debris-covered Glaciers, Seattle, Washington, USA.
- Fourth International Symposium on Permafrost Engineering, Lanzhou, China.
- International Symposium on Ground Freezing and Frost Action in Soils, Louvain-la-Neuve, Belgium.

October

- Russian-German Laptev Sea Conference, St. Petersburg, Russia.
- Arctic Coastal Dynamics Workshop, Potsdam, Germany.
- Climate and Cryosphere (CLIC) workshop, Kiel, Germany.

November

- Russian-American Initiative on Shelf-Land Environments (RAISE) meeting, Seattle, Washington.

December

- Land Ocean Interactions in the Russian Arctic (LOIRA) Conference, Moscow, Russia.

Highlights 2001

Many of the IPA Working Groups and Task Forces plan to meet during the following conferences:

- First European Permafrost Conference, March, Rome, Italy.
- Fifth International Association of Geomorphology, August, Tokyo, Japan.
- Third International Conference on Cryopedology, August, Copenhagen, Denmark.
- International Symposium on Mountain and Arid Land Permafrost, September, Ulaanbaator, Mongolia.

The Executive Committee notes, with deep regret, the recent passing of a long-time periglacial colleague Professor Anna Dylikowa (University of Lodz, Poland).

Pushchino Conference - May 2000

The International Conference on Rhythms of Natural Processes in the Earth Cryosphere was held in Pushchino, 12-15 May 2000. The conference was attended by over 200 persons from all parts of Russia together with approximately 15 non-Russian participants from United States, Canada, Germany, and Kazakhstan. The sponsors of this annual conference were: the Scientific Council on Earth Cryology; the Institute of the Earth Cryosphere, Siberian Division, RAS; the Institute for Basic Biological Problems, RAS; the Institute of Permafrost and Development of Natural Resources of the Cryolithozone, Siberian Division, RAS; the Russian Foundation for Basic Research; and the International Permafrost Association. The Scientific Council on Earth Cryology, Russian Academy of Sciences, presided over by V.P. Melnikov, held its annual Assembly in Pushchino, May 15, 2000.

After the initial presentation of a number of plenary reports, the conference was organised around five concurrent 'sections', in which formal verbal presentations and a number of related poster sessions were made. The formal sections were entitled: Rhythms, cycles and trends in the evolution of the Earth and its components (2 sessions); Physico-chemical aspects of rhythmic processes in the Earth cryosphere; The influence of the land-sea interaction on the Arctic cryosphere; Topical problems of most recent facts from studies of the Earth cryosphere (2 sessions); and Effects of rhythms, cycles and trends toward changes in the Earth cryosphere on the stability of engineering structures. There was also a special section honouring the late Russian pedologist O.V. Makseev and entitled Reflections on the rhythmicity of natural processes in cryosols. At the end of the conference, there was a joint plenary session with the Russian glaciological community, which began its annual meeting in the days immediately following. Several roundtable discussions were convened to review progress on CALM, borehole thermometry and coastal erosion. Informal meetings of several IPA Working Groups were held including Global Change, Cryosols and Coastal and Offshore Permafrost.

The Chairman of the Organising Committee was

IPA Past Vice-President Vladimir Melnikov, Director of the Institute of Earth Cryosphere at Tyumen, Siberia. Vice-Chairman was Academician V.A. Shuvalov, Director of the Institute for Basic Biological Problems at Pushchino. Other members of the committee included Dr R. M. Kamensky, Director of the Institute of Permafrost and Development of Natural Resources (Yakutsk), Dr D. Gilichinsky (Institute for Basic Biological Problems) and Dr A. V. Pavlov (Institute of the Earth Cryosphere). An Editorial-Publishing Committee was chaired by Professor V. N. Konischchev (Moscow State University). The IPA was represented at the conference by President Hugh French, Vice-Presidents Wilfried Haeberli and Felix Are, and Executive Committee member Jerry Brown. Space does not permit a detailed assessment of the scientific results presented at the conference.

The organisers plan to publish a number of the approved papers in the Russian journal *Earth Cryosphere*. However, a 330-page abstract volume (information below) contains summaries, in both Russian and English, of the more than 130 papers and posters that were presented. This extremely useful volume provides a timely snap-shot of the broad range of Russian permafrost research, its practitioners, and its organisational structure, and hints at the extent of permafrost knowledge within Russia. The conference was highly successful and included a number of social events. All participants were well looked after and accommodation was in a hotel within easy walking distance of the conference facilities. For non-Russians, attendance at the annual Pushchino meeting is highly recommended since it is one of the most efficient ways to appreciate the scope of Russian permafrost research.

Publication: Consolidated Scientific Council on Earth Cryology. ABSTRACTS. Rhythms of Natural Processes in the Earth Cryosphere. 12-15 May, 2000. Russian Academy of Sciences, Pushchino. (330 pages: 1-200 in Russian; 201-330 in English).

Report by Hugh French, IPA President, University of Ottawa, Canada.



Participants at the Pushchino Conference, 12-15 May 2000.

Report of Working Parties

The IPA Council at the 1998 VII ICOP in Yellowknife approved the formation or continuation of one Standing Committee, six Working Groups (WG) and three Task Forces (TF); collectively referred to as Working Parties (WP). Task Forces are intended to be short-term activities resulting in assessments or recommendations on specific subjects. The following reports cover activities over the past 12 months. Several WP meetings took place during international conferences and workshops. A number of meetings are planned in 2001 in conjunction with the conferences, symposia and workshops including Rome, Moscow, Copenhagen, Tokyo and Mongolia (see Forthcoming Meetings). These meetings will provide the venues for formal and informal WP discussions on present activities and future plans.

Following these Working Parties' reports, the status of several international programmes are presented including the Global Terrestrial Network for Permafrost (GTN-P), PACE and Climate and Cryosphere (CLIC). Additional details on the guidelines for Working Parties and international liaison were reported in *Frozen Ground* Number 22.

Reports reviewed and edited by Jerry Brown, Member, IPA Executive Committee.

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Standing Committee

Data, Information, and Communications

The objectives of the SCDIC are to initiate and implement IPA strategies for data, archiving, information product development, and communication within and beyond the permafrost community. Mike Clark (UK) and Roger Barry (USA) are co-chairs of the newly established permanent Committee. Core membership in addition to the co-chairs includes Julia Branson (UK), Margo Burgess (Canada), Daniel Vonder Mühll (Switzerland), and Jerry Brown (USA) liaison for Executive Committee and GTN-P. Representatives from China, Russia and several Working Groups are in the process of being named.

Although there were no formal meetings of the SCDIC, several informal discussions took place in April in Cambridge during the IASC Arctic Summit Week, the Pushchino conference in May, and amongst several members and participants at the borehole GTN-P workshop in Fairbanks in June.

Clark, Brown, Charles Harris, and Branson met in Cambridge in April to review activities of the Committee. Several changes in the IPA web site, hosted by the University of Southampton, were discussed and subsequently implemented by Branson. Future plans for the next version of the CAPS CD were reviewed including both content and structure. No decision was

reached then or in subsequent discussions with Barry and Zhang at NSIDC, since funding sources have not been identified. New and updated data sets and metadata will continue to be available via the Global Geocryological Database (GGD) hosted in Boulder by the NSIDC/WDC-A for Glaciology. Charles Harris reported on the data policy for the PACE project and following publication of initial results in Permafrost and Periglacial Processes for the Rome 2001 conference, these data sets will be submitted to GGD.

The annual conference of the Russian Scientific Council on Earth Cryology in Pushchino in May 2000 provided numerous opportunities to review data activities of several projects. These included roundtables, group and individual discussions and meetings related to data management for CALM and the borehole inventory (GTN-P). Several plenary papers reviewed relevant data activities: (1) Status and Recent Advances in Cryospheric Databases by Barry, and (2) Status Report on Circumpolar Permafrost Projects by Brown. Barry and David Gilichinsky reviewed progress on the digitisation of Russian soil temperature data. A Russian map product including the distribution and data of some 130 stations with soil temperature data and superposed on the IPA map is planned for GGD access. The data compilation is coordinated under the data exchange agreement of Working Group VIII of the U.S.-Russia Agreement on Cooperation in the Field of Protection of the Environment.

A new digital version of the IPA permafrost map was produced at the NSIDC and results published in *Polar Geography* by Tingjun Zhang, et al. This version converts the Arc Info files to an Equal Area Scalable Earth (EASE) Grid format at 12.5° by 12.5° resolution, and combines with it a global land cover classification and digital elevations. The new map files are available from the NSIDC. In addition, former Committee member Alan Heginbottom is in the process of revising and updating the unpublished manuscript that describes the IPA map compilation and national contributions. Reviews of the English legend of the Geocryological Map of Russia and the Neighbouring Republics were prepared and published by Brown and Heginbottom. The map and English legend are available from (map@freezingground.org).

The Geological Survey of Canada (GSC), under the supervision of Margo Burgess, has established an informative web page on its permafrost research and data: <http://sts.gsc.nrcan.gc.ca/permafrost/>. Interactive maps of the national permafrost database have also been web-enabled as part of a National Arctic Geoscience Databases project. These maps will next be actively linked to the permafrost temperature database (GSC Open File currently in press) and ultimately to a permafrost thickness database. The GSC permafrost web site hosts the GTN-P borehole monitoring

web page at: <http://sts.gsc.nrcan.gc.ca/gtnp/index.html>, including an inventory of the candidate boreholes and metadata forms (see following report on GTN-P).

The SCDIC is pleased to acknowledge that the proceedings volumes of the VII ICOP are now available on CD-ROM from Laval University. (See Publications). An update of the Cumulative Index to Permafrost Conference Proceedings (1958-1983) is being considered by its senior author Alan Heginbottom. A web-accessible bibliography of the nearly 50 reports and papers covering research at Illisarvik, the experimental drained lake on Richards Island in Canada's western Arctic, is available at: <http://www.nwtresearch.com/illisarvik>. The bibliography was compiled by Chris Burn (Carleton), Margo Burgess (GSC), and Ross Mackay (UBC), and is hosted by the Aurora Research Institute, Aurora College, N.W.T.

The Russian-English Glossary of Geocryology and Related Scientific Field compiled by V.N. Konishchev, G. E. Rozenbaum and N.N. Romanovsky was published by Moscow University Press and is available for purchase from the senior author (konishchev@geogr.msu.ru). Robert VanEverdingen, former chair of the Terminology Working Group, is exploring ways to reverse the file to an English-Russian version so that terms are easily searchable in both languages. In support of the Coastal Erosion Subgroup, the Russian Permafrost Map Bibliography and Index, as reported by Irina Stretatskaya in the VII ICOP proceedings, is being expanded at Moscow State University to cover coastal literature. Part of this effort was already underway through an INTAS project.

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Working Groups

Global Change and Permafrost

The 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 the CALM network. F.E. Nelson (USA) and Oleg Anisimov (Russia) are the co-chairs.

CALM Network: WG members continue their involvement in the Circumpolar Active Layer Monitoring Programme, coordinated through a U.S. National Science Foundation 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, and further analysis of the sampling designs. Several members of the WG attended the annual conference in Pushchino in May

2000. A roundtable discussion, chaired by Hinkel, was held to discuss progress and plans for the network. An agreement was reached to begin preparation of regional reports as a first step toward an international synthesis of sites. As an example, Hinkel prepared and posted the draft Arctic Alaskan report and plots of the Russian grids on the CALM web site for review.

Intergovernmental Panel on Climate Change, Third Assessment Report (TAR): Anisimov is a Coordinating Lead Author and Nelson is a Lead Author for Chapter 16, Arctic and Antarctic. Both participated in the TAR Lead Authors Meeting in Canberra, Australia (December 1999) and Lisbon, Portugal (August 2000). Scientific experts and government scientists concerned with climatic change and its impacts have reviewed the first- and second-order drafts of the TAR, and a final version is being readied. Although permafrost is treated in several of the regional chapters, primary attention is given to it in Chapter 16. Publication of the final document is expected early in 2001.

Global Terrestrial Network-Permafrost: In addition to CALM, the WG is supporting network development and implementation of the GTN-P. A number of the members attended the June 2000 workshop on monitoring in Fairbanks (see the following GTN-P report for details).

Spatial Perspective: A position paper on spatial modelling and analysis in geocryological research is in the developmental stage. A paper treating the zonation of hazard potential in the circum-Arctic permafrost regions under several climate-change scenarios was prepared. An increasing number of papers are appearing that document thermokarst development in the warm discontinuous zone.

Future WG plans include meeting during the Rome conference. The IPCC draft, the international paper detailing the scope and initial results of the CALM programme, several regional reports and development of the Southern Hemisphere GTN-P/CALM will be discussed with SHWG and RiSCC (see SHWG report). An early 2002 CALM workshop completing the results of the first five-year programme is planned.

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Periglacial Processes and Environments

The objectives are to evaluate different methodologies and techniques for monitoring periglacial processes, and to publish a manual of techniques. Ole Humlum (University of Copenhagen, Denmark; currently at UNIS, Norway) and Norikazu Matsuoka (University of Tsukuba, Japan) are the WG co-chairs.

The WG is still in the process of contacting lead authors and contributing authors for preparation of the manual. Draft examples of contributions have been

prepared by the editors and circulated to a number of potential authors. Based on their response, a first draft compilation of the manual will be attempted prior to the Rome permafrost conference.

A periglacial workshop was held 6-7 September 2000 at the University of St. Andrews, Scotland. The workshop was organised by J. Murton (University of Sussex) on behalf of the Cryostratigraphy Research Group of the Quaternary Research Association (UK), the IPA British National Committee, the IPA Working Group on Periglacial Processes and Environments, and the IGU Commission on Climatic Change and Periglacial Environments. The workshop covered four main themes: 1: Modelling and monitoring of cryogenic processes, 2: Palaeoenvironmental reconstruction, 3: Mapping and monitoring of permafrost and periglacial features and 4: Interactions between permafrost and glaciers. The Workshop was attended by about 30 persons and preceded a three-day field meeting organised by the Quaternary Research Association (UK) to the Banffshire coast and Buchan, north-east Scotland, where glacial and periglacial features were presented and discussed.

An International Commission on Snow and Ice-sponsored International Workshop on Debris-Covered Glaciers was organized 13-16 September 2000 at the University of Washington, Seattle, Washington, USA by M. Nakawo, C. F. Raymond and A. Fountain. The background for this workshop is the potential contribution of debris-covered glaciers to variations in the global sea level and their relation to rock glaciers, thereby highlighting fundamental issues relating to debris transport and terrain-surface, energy balance in high-relief, cold-climate regions. With these issues in mind, the workshop was organised around five themes: 1: Distribution and setting of debris-covered glaciers, 2: Mass and energy balances of debris covers, 3: Debris origin and transport processes in debris-covered and rock glaciers, 4: Supra-glacial lakes, formation and outburst, and 5: Climatic variations and the response of debris-covered and rock glaciers. About 60 persons attended this workshop, which included a field trip to the debris-covered terminus of the Emmons Glacier in the White River Valley on the northeast side of Mt. Rainier. Further information is available on <http://snowman.ihas.nagoya-u.ac.jp/Research/DebrisWS/index.html>.

The International Association of Geomorphologists (IAG) will convene its fifth conference at Chuo University, Tokyo, Japan, 23-28 August, 2001. The WG is co-organising two sessions on 'Glacial and periglacial geomorphology' and 'Glaciation and periglaciation on Asian high mountains' during the main conference and a post-conference field trip on permafrost and periglacial geomorphology in Japan. The conference will be followed by an IPA-sponsored symposium in Mongolia. Members of

the WG plan to meet during the IAG conference.

Liaison with the IGU Commission on Climate Change and Periglacial Processes (CCPP; chair: Jef Vandenberghe) continues. A website has been set up by Julian Murton for the IGU Commission and our WG and includes details of periglacial meetings and a developing, global list of e-mail and/or postal addresses of periglacial scientists. See: <http://www.cpes.susx.ac.uk/igu>. The IGU newsletter will be available via e-mail, as usual. The IGU Commission will be continued for a second term of four years, which will enable the Commission to carry out planned activities. This, however, will be the last one in a series of commissions that have undertaken activities on periglacial research in IGU since 1949 in the traditional sense. Dr. Julian Murton has taken over as secretary of the Commission after Dr. Charles Harris, who has served for several years.

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Permafrost Engineering

The objectives are to collect information on the practices and procedures of permafrost engineering in various regions of the world, and to facilitate communications with permafrost scientists. Branko Ladanyi (Canada) and Lev Khrustalev (Russia) are the co-chairs of this reorganised WG.

Members of the WG participated in several international and national meetings in Svalbard, Russia, and the United States.

The International Workshop on Permafrost Engineering was held at The University Courses on Svalbard (UNIS) in Longyearbyen Svalbard, 18-21 June, 2000, sponsored by the Nordic Council of Ministers, within the Nordic Arctic Research Programme 1998-2002. The WG was represented by Kaare Flaate, Don Hayley, Arne Instanes, Lev Khrustalev, Truls Mølmann, Georgi Perlshtein, Seppo Saarelainen, Dave Sego, and Rupert Tart.

The following papers presented at the Svalbard workshop by WG members reflect some of the activities of the WG:

Lev Khrustalev: Allowance for climate change in designing foundations on permafrost ground.

Branko Ladanyi: Performance of field tests in permafrost and their use in design (presented by Kaare Senneset).

Rupert Tart: Practical resolutions of permafrost engineering issues along the Trans Alaska Pipeline.

Don Hayley: Road construction on permafrost-some technical and environmental issues.

Truls Mølmann: Access road over the Høganæs glacier to Svea Central Coal field.

Seppo Saarelainen, Heikki Onninen: Long-term settle-

ment of a road built on permafrost at Kilpisjarvi, Northern Finland.

Dave Sego: Enlarged base (belled) piles in ice or ice-rich permafrost.

Georgi Perlshtein: Features of the tailings management in the permafrost regions.

Fabrice Caline, Arne Instanes: Modelling permafrost temperature response to short-term (annual) and long-term (50 years) variations in meteorological data.

Maria Markova, Marina Leibman and Arne Instanes: Oil spills on permafrost-Russian experience and remediation techniques.

A meeting of the Working Group was held on 21 June, 2000. The participants concluded that the future goals of the WG are:

- To continue the research on the theme “Effect of climatic changes on infrastructure stability in permafrost regions.” This theme would include research on the development of new geotechnical systems that minimise the introduction of heat into permafrost.
- To develop modern programmes of permafrost engineering training for students.
- To collect information on the practices and procedures of permafrost engineering in various regions of the world, and to facilitate communications with permafrost scientists.

Results of the above activities are proposed for presentation at the VIII ICOP in 2003.

Branko Ladanyi, attended the “Workshop to Develop a Strategic Plan for Cold Regions Engineering Research in the New Millennium”, Anchorage, Alaska, 19-21 June 2000, under the sponsorship of the National Science Foundation (NSF), Alaska Science and Technology Foundation (ASTF), and the American Society of Civil Engineers (ASCE). The resulting report is intended to guide research efforts in the cold regions engineering community and direct federal and state agencies to fund research proposals which relate to the research needs identified in the report.

The Workshop was preceded on 18 June 2000, by the meetings of the ASCE Technical Council on Cold Regions Engineering (TCCRE) committees. The Frozen Ground Committee recently completed the ASCE Standard on “Design and Construction of Frost-Protected Shallow Foundations (FPSF)”; available from the American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400, USA. The Committee on Structures and Foundations discussed the next three-year plan and the organisation of the next ASCE Speciality Conference, to be held in Anchorage, Alaska, in 2002, with the topic: “Remediation and Repair of Structures and Foundations”.

The International Symposium on Ground Freezing and Frost Action in Soils was held at the Université Catholique de Louvain, Louvain-la-Neuve, Belgium, 11-13 September 2000. The Symposium was jointly organised by the 9th International Symposium on Ground Freezing (ISGF-2000) and the 4th International Symposium on Frost in Geotechnical Engi-



Participants in the International Workshop on Permafrost Engineering, Svalbard, June 2000. Sitting in the front row from left: Tone Larsen, Dave Sego and Truls Mølmann. Standing from left: Kaare Senneset (his back to the front), Bucky Tart, Ramesh Joshi, Carl Lenngren, Marina Leibman, Lukas Arenson, Arkadiy Gerasimov, Georgi Perlshtein, Kaare Flaate, Sverre Barlindhaug, Lev Khrustalev and Don Hayley. Photograph taken by Sarah Springman.

neering (FROST2000); the latter of which is a part of the ISSMGE Technical Committee activities, TC 23 and TC 8. The main topics were: Heat and mass transfer, Frost susceptibility and frost heave, Mechanical properties, Environmental soil freezing, Engineering design, and Case histories. A total of 59 papers were presented.

Khrustalev and Jerry Brown attended the organisational meeting of the Arctic Climate Impact Assessment (ACIA), in January 2000 in Washington DC. Their input focused on impacts of permafrost degradation on engineered structures and coastal regions under a warming climate. Khrustalev reported on the rise of the annual air temperature in Yakutsk and according to this trend, tables of safety factors for housing buildings have been compiled. Brown reported on concerns for increased coastal erosion rates and their impacts on local communities and development.

Russian WG members attended the annual conference of geocryologists held in Pushchino, 12-15 May 2000. As reported elsewhere in *Frozen Ground*, the theme of conference was Rhythms of Natural Processes in the Earth Cryosphere. Ladanyi attended the GeoDenver2000 meeting in August and presented a report on a field testing method for clays and warm frozen soils. He and Prof. Andersland are preparing the second edition of their book on 'Frozen Ground Engineering', which will be published by ASCE next year. The book 'Permafrost Engineering' (Managing Editors, L.N. Khrustalev and E.D. Ershov) was published in Russian in 1999.

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Cryosol Working Group

The 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 to be held in Denmark in 2001. Charles Tarnocai (Canada) and Sergey Goryachkin (Russia) are the cochair.

Members of the working group met twice during the past year; in Norway and in Russia.

The meeting in Oslo, Norway, was held on 15 March 2000, following the International Circumpolar Soil Database Meeting. Five members of the working group, from Norway, Germany, Russia, Denmark and Canada, attended. Those attending this meeting agreed to produce an expanded circumpolar database through cooperation between the IPA and IUSS Cryosol Working Groups, the EU Soil Bureau, and other interested groups and agencies. An interim database will be presented at the Third International

Conference on Cryopedology to be held in Copenhagen, Denmark, 20-24 August 2001. This cooperative project will combine the expertise and data of the participating countries to generate an expanded Circumpolar Soil Database. The plan for the project is as follows:

- The agreement between the EU Soil Bureau, Agriculture and Agri-Food Canada (ECORC) and the USDA (Natural Resources Conservation Service) was finalised in June 2000.
- The EU Soil Bureau will provide the Eurasian Soil Database to the chairs of the CWG.
- The CWG will review the Eurasian Soil Database and the CWG-generated Circumpolar Soil Database and will recommend revisions and minimum data sets.
- The GIS group in Ottawa, Canada will develop the first draft of the new Circumpolar Soil Database. Tarnocai will coordinate this work.
- This database will be reviewed during the International Circumpolar Soil Database meeting in March 2001 and the necessary revisions will be made.
- This revised database will then be presented at the Third International Conference on Cryopedology.

The agenda for the Conference and the programme for the post-conference field excursion in northern Finland were finalised. The themes of the Conference are cryogenic processes, genesis of Cryosols, soil ecology, carbon storage and cycling, and the response of Cryosols to anthropogenic impact and global change. The topics for the field excursion will be permafrost-affected soils (Organic Cryosols), seasonally frozen soils (e.g., cryoturbated Podzols) and landscapes of the European Subarctic. The discussions during this excursion will focus on pedogenesis, soil classification, soil ecology, soil temperatures in the discontinuous permafrost zone in view of global change, and land use in the European Subarctic (reindeer grazing and erosion).

The contents of the Cryosol monograph were reviewed and changes were made in the arrangement of papers in the various chapters. All papers have been completed and the reviews are scheduled for completion by the end of this year.

The meeting in Russia was held on 14 May 2000 in Pushchino during the International Conference on Rhythms of Natural Processes in the Earth Cryosphere. Five members of CWG from Russia and USA attended. They were informed of the results of the CWG meeting in Oslo; they expressed full support for the decisions in Oslo.

The guide for soil description for CALM and ITEX programmes was discussed among CWG members and other specialists involved in CALM project. Some improvements for the guide were recommended and

it was decided to translate the text into Russian for all Russian CALM people. The active participation of cryopedologists in the CALM programme and in all CALM meetings was also recommended.

The future of CWG in IPA was discussed. According to the rules of IPA this is the last five-year term for the Working Group under the title Cryosols. Changes in the focus of studies and name are under discussion. The general direction towards more ecologically oriented studies of cryosols was agreed. This will be discussed among all CWG members at future meetings of the WG.

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Coastal and Offshore Permafrost

The objective is to encourage the interaction of investigations on the subjects of onshore, transitional and offshore permafrost and hydrates. Hans Hubberten (Germany) and Nikolai Romanovskii (Russia) are cochairs of this new WG. Steve Solomon (Canada) chairs the Coastal Erosion Subgroup.

During the International Pushchino Conference on Rhythms of Natural Processes in the Earth Cryosphere, a special session dealing with the influence of the Land-Ocean interaction on the Arctic Cryosphere was cochaired by N.N. Romanovskii and H.-W. Hubberten. Twelve papers and one plenary lecture were presented during this session.

Within the framework of the Russian-German Cooperation in Polar and Marine Sciences, the Otto Schmidt Laboratory for Polar and Marine Sciences (OSL) has recently been established at the Arctic and Antarctic Research Institute (AARI) in St. Petersburg. Several fellowships for Russian teams consisting of a principal investigator and two students or post-graduate scientists were granted. Their topics relate to the COP WG objectives and include investigation of evolution in the past and recent state of terrestrial and offshore permafrost, land-ocean interactions, coastal processes, and others.

In the framework of the joint Russian-USA programme Russian-American Initiative on Shelf-Land Environments in the Arctic (RAISE), a new project titled Dynamics of Gas Hydrates and Permafrost in the Eurasian and North American Arctic Land-Shelf System was funded by the U.S. NSF.

Several field projects and cruises were active along the Russian and North American coasts in summer 2000. A joint Russian-German expedition (Expedition LENA 2000) studied permafrost and coastal processes in the Lena Delta region, and the adjacent land areas between the Olenyok and Anabar rivers and the east coast of the Taymyr Peninsula. Two expeditions on board the R/V Ivan Petrov (VNIIOkeangeologia, St.

Petersburg) in the Kara and Perchora Seas included the investigation of coastal processes. The R/V Nikolay Kolomeitsev (Pacific Oceanographic Institute, Vladivostok) occupied 114 biogeochemical stations in the Laptev, East-Siberian and Chukchi seas. In the Canadian and U.S Beaufort Seas coastal studies included erosion, tidal and storm surge measurements.

The Sixth Workshop on Russian-German Cooperation on the Laptev Sea System was held in St. Petersburg, 12-14 October 2000, organised by J. Thiede (Director, AWI, Bremerhaven) 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. Topics included: (1) On-shore and offshore permafrost: feedback's and evolution; (2) Effects of environmental changes; (3) Terrestrial/marine interactions in coastal zones; (4) Short- and long-term environmental changes in the central Siberian Arctic.

The Coastal Erosion Subgroup of the COP followed up on the 1999 Woods Hole Workshop report. Brown and Hubberten attended the IASC Arctic Summit Week in Cambridge, UK, in April, made several presentations on the Arctic Coastal Dynamics (ACD) initiative to IASC and the Arctic Ocean Sciences Board. The IASC Council approved a joint IASC-IPA activity and a workshop on Arctic Coastal Dynamics. A roundtable was convened at the Pushchino conference in May to review progress on the ACD recommendations and discuss summer 2000 field plans. The IASC-funded workshop was convened in Potsdam in October to develop an International Science and Implementation Plan for ACD. An exploratory workshop proposal from the AWI-Potsdam was developed for a European based programme. The Subgroup is coordinating planning with IASC-LOIRA, IGBP-LOICZ, AOSB, and other international organisations and programmes with interests in the evolution of the arctic coast. The Woods Hole Workshop report and the ACD science plan available on line at the ACD web site: <http://www.awi-potsdam.de/www-pot/geoacd.html>.

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Southern Hemisphere Permafrost and Periglacial Environments

The objectives are to create a scientific platform to stimulate interaction between permafrost and periglacial researchers in the Southern Hemisphere, and to synthesise permafrost and periglacial data and information, including existing IPA initiatives in the region. Jan Boelhouwers (South Africa) and Kevin

Hall (Canada) are the cochairs of this new WG.

Following its first business meeting at the INQUA Congress in August 1999, WG members began compiling regional bibliographies on periglacial and permafrost research. A series of reviews on periglacial and permafrost research was compiled and are currently in the review process for publication in the *South African Journal of Science*. It is the intention to make the reviews available as downloadable files on the internet. The reviews cover Antarctica (J. Bockheim and K. Hall), maritime and sub-Antarctic (K. Hall), New Zealand (P. Augustinus), Patagonia (D. Trombottto), NW Argentina (A. Ahumada), Tasmania (E. Colhoun) and Southern Africa (J. Boelhouwers and I. Meiklejohn).

Several activities were undertaken to formalise an IPA working relationship with the Scientific Committee for Antarctic Research (SCAR). Following discussions at the Arctic Summit Week in Cambridge, UK, between Jerry Brown and David Walton (British Antarctic Survey), IPA President French wrote SCAR President Rutford suggesting several steps towards developing IPA-SCAR connections. One of these involved Jan Boelhouwers representing IPA in May 2000 at a SCAR Biology workshop on its newly approved programme Regional Sensitivity to Climate Change in Antarctic Terrestrial Ecosystems (RiSCC). As an outcome, RiSCC has agreed to include the GTN-P active layer/permafrost monitoring approach within its science and implementation plans. RiSCC aims to, inter alia, bring together existing ground thermal records and support adjustment of existing and new monitoring protocols for ground thermal monitoring as proposed by the IPA/GTN-P guidelines. The active layer monitoring protocol for the Antarctic will need to consider differing sampling approaches from those applicable in the Northern Hemisphere. Various international programmes focus on, or have a substantial interest in, the geomorphological responses to climate change in the Antarctic. Jan Boelhouwers is undertaking a planning effort to coordinate these studies into a single activity, which would systematically address the science issues. The status will be discussed during the Rome meeting.

Activities for South America are reported by Dario Trombottto in the Argentine report. Membership of Australia and/or New Zealand in the IPA is still under discussion.

The next business meeting of the working group, which will review its progress on the bibliographies and permafrost map inventory, will take place during the IAG conference in Tokyo, 2001. Discussions are planned during the Rome meeting.

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Participants in the field trip of the 'South American Periglacial Group' to the tropical highlands of the Itatiaia, SE Brazil, August 2000. Standing from left: The driver, Jerry Brown, Celia Brown, May C. Modenesi-Gauttieri, Silvio Hiruma. Sitting in the front Dario Trombottto.

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 slopes. Wilfried Haeberli (Switzerland) is the TF chair assisted by Bernard Hallet (USA). The activities are jointly organised by IPA and the International Commission on Snow and Ice.

During the First European Permafrost Conference in Rome in March 2001, the Task Force will conduct a dedicated session to present and review the final product of its work. To date, chapter outlines and key references have been compiled for the topics by the corresponding lead authors:

- Thermal conditions by Humlum (surface) and Vonder Mühll (boreholes).
- Composition by Matsuoka (rocks) and Elconin (ice).
- Geometry/kinematics by Kaeab and Kaufmann (photogrammetry, geodesy).
- Rheology by Ladanyi (lowlands) and Springman (mountains).

As a next step, extended abstracts will be written for the topics, stating clearly where we stand, what the main gaps are and what needs to be done. In some areas such as geometry and flow fields, a great deal is already known and the methodology is far advanced. In others like rheology, we are at the very beginning, experience fascinating surprises and must delineate the many open questions and possible research directions. The literature compilation should be presented together with the extended abstracts and the Task Force authors should make a recommendation on how to further proceed. One possibility for a continuation beyond Rome would be the establishment of a working group concerned with permafrost creep on

slopes. Such a working group could produce a valuable volume for the 2003 conference. It may, however, also be concluded and recommended in Rome to end the Task Force activity with the existing summaries and bibliographies, an evaluation of the situation, and a proposal for future activities. The proposed time schedule for this final stage of the Task Force activity is as follows:

- Agreement by the authors of outlines and key references in view of the other chapters and new developments.
- Place the outlines on the web for outside contacts, comments and additions.
- Prepare written extended abstracts concerning each of the subheadings in the respective chapter before the end of the year. Each will contain systematic statements about (a) what is the problem, (b) what is being done, (c) what are the main results so far, and (d) what constitutes the main challenge for the future.
- Conduct internal review by TF members in January 2001.
- Place the texts on the web for open external review (February/March 2001).
- Present and discuss reports and final edit at the Rome Conference. Reach a decision about continuation and/or publication.
- Complete in summer 2001 a short report and/or plan for final publication.

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Mapping and Distribution Modelling of Mountain Permafrost

The objective of the TF is to develop systematic strategies for mapping and modelling distribution of mountain permafrost at different scales. The Task Force builds on the accomplishments of the former Working Group on Mountain Permafrost. Bernd Etzelmüller (Norway) and Martin Hoelzle (Switzerland) are the co-chairs.

Mountain permafrost mapping and distribution modelling is a research field of high interest because of its linkage to climate change and hazard assessment. The Task Force has an e-mail list of interested colleagues and is maintained from Oslo. Participation is open to all interested persons, and presently has about 50 colleagues on the list.

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). This includes new 100-m boreholes in Switzerland (Schilthorn and Zermatt area) and in the Sierra Nevada, Spain. Within PACE, long 2D-resistivity tomography profiles were carried out in the Scandinavian mountains with promising

results. In the Swiss Alps several different permafrost distribution models were developed within and outside the PACE project and evaluated with the help of geophysical methods, such as BTS and geophysical soundings. Future modelling activities will be concentrated mainly in areas where boreholes are now available in mountain permafrost environments. At these borehole sites the distribution models could be well tested and/or calibrated and coupled to climate models.

Within the PACE project, the computer model PERMEBAL, simulating thermal conditions at depth and based on an energy balance approach, is developed by C. Mittaz at the Department of Geography, University of Zürich, Switzerland. The model consists of two principal modules, an energy balance module and a thermal-offset module. The energy balance module simulates ground surface temperatures with the help of suitable parameterisations for all important energy fluxes and uses simple meteorological data, digital elevation models and information on surface characteristics as input. The thermal-offset module will link these ground surface temperatures to thermal conditions at depth. So far, the model PERMEBAL is mainly applied to an area of 16 km² around the Piz Corvatsch (Engadine, Switzerland). The model calculations are verified independently by carrying out energy balance measurements at a permafrost site in the investigated area. Furthermore the model can be compared with the existing permafrost distribution models PERMAKART and PERMA-MAP and with BTS-measurements. In the future, the model will be adapted to changed environmental conditions and thus will compute various effects from climate change scenarios on permafrost distribution.

The mapping of permafrost in the Asian and Eurasian mountains has been intensified. Results will be discussed at a symposium on mapping and monitoring of arid mountain permafrost in Mongolia in September 2001. The mapping of permafrost in the Tien Shan and Pamir is performed in two directions. One of them is similar to the traditional approach based on the separation of mountain ranges on the belts with different types of permafrost distribution. Sometimes this approach by Marchenko implies the distinctions in altitudinal boundaries of permafrost at the northern and southern macro-slopes. Determination of the boundaries used the following premises: the difference in altitudes of glaciers lobes positioned on northern and southern slopes in the Transili Alatau Range (N. Tien Shan) is 200-250 m; the difference in altitudes of the snow line between northern and southern slopes is constant at about 200-220 m; and the difference of 1.5-2° C in ground temperature between southern and northern slopes at the depth 15-20 m is measured at the altitude 3300 m a.s.l.

Using these criteria, the Map of Permafrost Distri-

bution in Central Northern Tien Shan was compiled at the scale of 1:200,000. However, this approach does not take into account islands of permafrost within the belts and therefore is acceptable only for small-scale mapping. In Kazakhstan the Map of Permafrost, Glaciers and Periglacial Phenomena Distribution in the Bolshaya and Malaya Almatinka River Basins has been compiled based on GIS technology. The system includes topographical, geological, geomorphologic and vegetation layers. Results of the field work during the last 25 years and surface analyses based on DEM are used. These maps were first presented in the framework of Permafrost Monitoring and Database Workshop in Fairbanks June 2000.

Permafrost distribution in the Southern Hemisphere and particularly the Antarctic has been identified as an issue within the Southern Hemisphere Working Group and RiSCC. Members of the SHWG are currently compiling an inventory of permafrost maps. Key research sites under the RiSCC programme by SCAR will incorporate active layer and permafrost monitoring and geomorphological mapping. Mapping in the Sub-Antarctic has started on Marion and Heard Island. Coordination between these activities and this TF will be discussed at the planned workshop in Rome.

Andean permafrost and rock glaciers of the Central Andes continue to be monitored by Trombotto. Two mini-dataloggers will be installed at the "Morenas Coloradas" rock glacier, in order to study the climatic behaviour of the active layer between 3560 and 4000 m asl. at depths to 2 m. The "Inventory of Glaciers of the Mendoza Basin" (original title: "Inventario de Glaciares de la Cuenca del Río Mendoza" by Corte and Espizúa, 1981) contains detailed information on the areas of interest with respect to mapping permafrost. At present, Dr. Ana-Lía Ahumada of the Institute of Quaternary Geology and Paleoclimate (Tucumán) is carrying out an inventory of rock glaciers in the northwest of Argentina (see more information in Argentine report).

Stuart Harris, University of Calgary, reports that he plans to initiate a major permafrost mapping project using GIS-based satellite imagery and field observations in Jasper National Park. The project builds on prior studies at Plateau Mountain as reported in Builetyn Peryglacjalny #39.

A session will be dedicated to the TF activities at the First European Conference on Permafrost in Rome. During this session we will have the opportunity to discuss future activities and recommendations within this field of research. A discussion paper will be prepared by Martin Hoelzle and Bernd Etzelmüller within this year and made available to those interested in the Task Force activities.

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Isotope/Geochemistry of Permafrost

The objectives are to promote 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. Rein Vaikmae (Estonia) is the TF chair.

Several informal discussions were held amongst Rein Vaikmae, Hans Hubberten, Yuri Vasilchuk, and Jerry Brown in May during meetings in St. Petersburg and Pushchino. At the Pushchino conference Vasilchuk presented the manuscript and English Table of Contents for the new comprehensive textbook 'Principles of Isotopic Geocryology and Glaciology' by Vasilchuk and V. A. Kotlyakov. (See Publications) Vaikmae is supervising the preparation of a bibliography on isotope-geochemistry of permafrost. Cooperation continues between the TF and the isotope subproject of IGCP project 415 Glaciation and Reorganisation of Asia's Drainage (GRAND).

Vaikmae, Hubberten and Vasilchuk expect to meet in early 2001 to develop future TF plans.

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Related Working Parties Activities

The Global Terrestrial Network for Permafrost (GTN-P)

Active layer and permafrost thermal state, the basic GTN-P measurements, were identified by the Global Climate Observatory System (GCOS) in 1997 as two key cryospheric variables for monitoring. In the Northern Hemisphere the active layer observations are part of the Circumpolar Active-Layer Monitoring (CALM) network, with plans to extend the network to the Southern Hemisphere under the programme Regional Sensitivity to Climate Change in Antarctic Terrestrial Ecosystems (RiSCC) and other programmes. Over 300 boreholes sites involving temperature measurements by 14 countries have been identified as potential GTN-P sites. The majority of the boreholes are between 10 and 125 m deep.

Considerable progress has been made in organising and implementing the GTN-P since the last report in *Frozen Ground* (No. 23, pages 11-12). A letter from Secretary General Obasi of the World Meteorological Organisation (WMO) was sent in September 2000 to ministers of over 20 countries with permafrost programmes and interests. The letter requested active participation in the GTN-P and should provide added incentives and justification by national and international programmes to support the GTN-P. The Secretary General requested that permafrost observations be included in each country's report on systematic observations to the Conference of Parties to the United

Nations Framework Convention on Climate Change (UNFCCC) in November 2001. A summary of the GTN-P programme, recent activities and future steps are reported in the Geological Survey of Canada (GSC) Current Research report series: Burgess, M.M., Smith, S.L., Brown, J., Romanovsky, V. and Hinkel, K. 2000. Global Terrestrial Network for Permafrost (GTNet-P): Permafrost monitoring contributing to global climate observations; Geological Survey of Canada, Current Research 2000-E14; 8 p. (online; <http://www.nrcan.gc.ca/gsc/bookstore>).

National and international workshops and meetings, in addition to the PACE activities (see following report), were held in Ottawa in January, Pushchino in May and Fairbanks in June 2000:

National Permafrost/Glaciers/Ice Caps Monitoring Networks Workshop: The Geological Survey of Canada convened this workshop in Ottawa, 28-29 January 2000. Approximately 50 participants attended, with more than half representing the Canadian permafrost community (government, academia and private sector). The workshop was sponsored by the federal Climate Change Action Fund to provide input to the development of Canada's Global Climate Observations System (GCOS) Plan for the Cryosphere. The workshop focused on the requirements for coordinated national networks to observe the climate change signal, assess its regional variability, and evaluate its impacts in permafrost regions. The results are considered an important contribution to the development of the GTN-P.

Workshop sessions and discussions covered: (1) an overview of international and national GCOS programmes, (2) current monitoring activities, (3) climate and process modelling needs, (4) monitoring technology and techniques, and (5) network requirements. Although many regional and local monitoring activities are underway, there currently is no coordinated national permafrost programme. Discussions on network requirements addressed a range of issues: (1) management and coordination, (2) membership and site selection, (3) data quality control, (4) data reporting, (5) data access and exchange, (6) data archiving, (7) expertise and capacity, (8) instrumentation, and (9) priorities, needs, and funding requirements.

The final report of the Canadian permafrost monitoring workshop will be released as a GSC Open File and includes summaries of the presentations, group discussion and recommendations. The final report is also available for review on the GSC's permafrost web site: <http://sts.gcs.nrcan.gc.ca/permafrost/>. For further information contact Margo Burgess.

International Conference on Rhythms of Natural Processes in the Earth Cryosphere: Several roundtable discussions and reports related to GTN-P took place at the Pushchino conference in May. The roundtable and subsequent discussions on the CALM

programme were led by K. Hinkel, F. Nelson, A. Pavlov and D. Gilichinsky. Plans for regional CALM synthesis papers and a synthesis workshop in 2002 were developed. The roundtable on Thermometry in Permafrost Boreholes was led by H. Pollack, V. Balobaev, and V. Romanovsky, and reviewed principles and procedures for these observations. Several paper and poster sessions also presented reports on soil temperatures and active layer dynamics, ground temperature variations and trends, palaeo-reconstruction of permafrost regimes, and current programmes including heat flow from deep boreholes (H. Pollack) and the PACE programme (C. Harris).

Workshop on International Permafrost Monitoring and Database Management: The workshop was organised by Vlad Romanovsky and sponsored by and held at the International Arctic Research Center, University of Alaska, Fairbanks, Alaska, 11-14 June 2000. Twenty-five, invited specialists from Canada, China, Japan, Kazakhstan, Mongolia, Russia, Switzerland, and the United States participated. The workshop built on current IPA activities to develop the GTN-P. Each country and project reported on the status of boreholes, past results, plans for future monitoring, equipment employed, and availability of data. Although emphasis was on borehole observations, an overview of the initial results and analyses of the CALM programme was presented by K. Hinkel; including plans for regional synthesis papers.

The workshop participants selected a Borehole Quality Control Group with initial membership consisting of Margo Burgess, Gary Clow, Vladimir Romanovsky, Alexandre Vasiliev, Daniel Vonder Mühll, and Li Shuxun. The Group will report to the IPA ad hoc Steering Committee established by the IPA Council in 1998. The new Group's responsibilities are to prepare:

- (1) Technical guidelines for site selection, ground surveys, drilling, installations, and measurements similar to those prepared for PACE (include technogenic sites).
- (2) Information on equipment to be used (specifications and vendors can be added to CALM web).
- (3) Specific data formats and methods for reporting.
- (4) Reviews of metadata nominations and recommend borehole selection and identify gaps in the network.
- (5) Designate sites according to the GHOST strategy (see discussion below).

Three categories of boreholes were identified:

- (1) Active sites: those boreholes from which periodic measurements are currently obtained.
- (2) Nominated sites: those boreholes that have been identified and are potentially available for future measurements. If observations are not possible or no data is provided over the next 2-3 years, they would be removed from the GTN-P inventory of sites.

(3) Potential sites: these are known boreholes reported in the literature, but have not yet been nominated (for example sites in China, Greenland, Russia and Alaska).

Efforts should be made to reactivate boreholes dating back to the mid 1900s. Providing metadata forms are available, the GSC will code the existing borehole sites according to categories 1 and 2. The GSC will prepare a new index map of borehole sites. Category 3 sites will be added to the database as metadata information become available. Candidate sites will be assigned to one of the five levels of the Global Hierarchical Observing Strategy (GHOST): 1. Large transects along environmental gradients (such as IGBP transects, PACE boreholes, and permafrost transects as illustrated on the IPA map). 2. Extensive and high-resolution, process-oriented studies of shallow permafrost thermal state, energy fluxes and surface controls (such as observed at LTER sites). 3. Regional observations of borehole temperatures at intermediate depths (depth of zero amplitude and below) and regular time intervals. 4. Representativeness of measured permafrost temperatures by mapping permafrost distribution and coupling with ground thermal conditions using spatial modelling and geophysical prospecting. 5. Global coverage based on combination of in-situ measurements, remote sensing and GCMs/RCMs. Final site selection will emphasise representative regional and global coverage while taking maximum advantage of existing facilities.

Metadata forms are required for all boreholes. The inventory of sites and metadata are being incorporated into the GTN-P web site hosted by the Geological Survey of Canada (GSC) (<http://sts.gsc.nrcan.gc.ca/gtnp/>). Summary data will be available on the web site. Final archiving of data will be through the National Snow and Ice Data Center and the WDC-A for Glaciology, Boulder, Colorado, as part of the IPA's Global Geocryological Database (GGD). The first five-year summary report, consisting of a series of regional reports, is planned for the year 2004, with a draft presented and reviewed at the Eighth International Conference on Permafrost in Switzerland in 2003.

In the concluding session of the workshop, the moderator (Jerry Brown) led a discussion on how to portray to the public and other non-specialists the responses of permafrost to contemporary warming; particularly changes in distribution and stability. The popular presentation for changes in permafrost distribution in the Northern Hemisphere is the movement northward in continental regions of lines on maps denoting change in extent of permafrost zonation (isolated, sporadic, discontinuous, and continuous). In mountains and high elevations, the concept of permafrost shrinkage is employed with upward elevational movement of the permafrost boundaries. Variations in temperatures and thicknesses of perma-

frost due to vegetation, organic and snow covers, bedrock and slope and aspect are not usually considered in these regional or global projections or models.

These projections do not include the dynamics of permafrost change and assume sufficient time has elapsed for permafrost distribution to equilibrate with the new climatic conditions. Yet significant changes in the physical and thermal characteristics of permafrost may take place during the transition to the new equilibrium. An assessment of these changes in the permafrost environment over time periods of 50 to 100 years is important to evaluate the environmental and socio-economic impacts of climate warming. A variety of alternative cartographic strategies and modelling approaches, based on suitability for different spatial scale, warming scenarios and levels of data detail, are required to portray not only changes in permafrost distribution but also sensitivity and relative stability.

The discussion identified several types and degrees of sensitivity and stability: 1) thermal stability (colder permafrost temperature is more stable, warmer is less stable, in that a small increase in temperature could lead to thaw in the latter case) and 2) ground surface stability (thaw sensitivity in terms of melting of ground ice). The first depends on climate change and will be site specific (the same climate change can result in different permafrost temperature changes depending on surface and ground conditions). The second will occur only if and when permafrost starts to thaw (including significant increase in the active layer thickness). Here the ice content, topography, vegetation and surface disturbances will be extremely important.

There was consensus that a decadal time series of permafrost temperatures is desirable for assessing contemporary warming scenarios and trends. The IPCC Third Assessment Report, future Arctic Climate Impact Assessment (ACIA) reports, and programmes such as CLIC (see following report) and the Study of Environmental Arctic Change (SEARCH) should reflect these workshop discussions. A report of the Fairbanks workshop is in preparation and will be made available on web sites.

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Permafrost and Climate in Europe (PACE)

The scientific objectives and research structure of the EU PACE project were summarised in the last edition of *Frozen Ground* (No. 23, pages 10-11). Considerable progress has been made during 2000 in all aspects of the programme. Of particular importance was the drilling of the final PACE monitoring boreholes at Tarfala, Sweden (University of Stockholm), Schilthorn, Switzerland (ETH-Zurich and University of Zurich), Stockhorn Plateau, Switzerland (University of Giessen, Germany) and Valeta Peak, Sierra Nevada, Spain (University Complutense Madrid and University of Barcelona). The PACE transect of monitored boreholes is now complete, extending from Svalbard through Scandinavia and the Alps to the Spanish Sierra Nevada. A summary of all borehole sites is given in the Table. Thermal and related data from the PACE boreholes will be available through the GTN-P web site in Ottawa, and ultimately archived in Boulder as part of the GGD.

Geophysical investigations were completed at the Tarfala borehole station by the Swiss ETH-Zurich group. In addition, the group established a permanent array of electrodes at Schilthorn to allow repeated resistivity measurements on a long-term basis, thus allowing the effects of seasonal thermal changes to be detected. The Norwegian group at Oslo University has continued their development of GIS-based mapping and modelling of permafrost distribution and permafrost-related process variables, while at the University of Zurich, data from micrometeorological stations at selected PACE boreholes are used to develop advanced energy flux-based numerical modelling of mountain permafrost distribution. Process studies at the Universities of Cardiff and Dundee, UK,

have been concerned with scaled centrifuge modelling of thawing slopes. At Cardiff University gelifluction, mudflow and shallow active-layer detachment slides have been modelled, while at Dundee, modelling and element testing of frozen jointed bedrock slopes has demonstrated a clear temperature-dependence of slope stability where ice-filled joints are present.

A key deliverable of the PACE project is a set of new protocols designed to aid engineers and planners in assessing potential permafrost hazard associated with degradation in a warming environment. Meetings were held between the PACE team and engineers from construction, cable car, and railway companies in March 2000 at ETH-Zurich and in August 2000 at Andermatt, Switzerland, to discuss current practices and an appropriate format for the PACE protocols. It is anticipated that the report will be published through the European Commission in 2001.

At the PACE coordination meetings held in March and October, detailed arrangements were put in place for the 1st European Permafrost Conference, Rome, 2001. The organising committee is chaired by Dr. Charles Harris (Cardiff University), and the local organising committee by Prof. Francesco Dramis (Third University of Rome). A special volume of *Permafrost and Periglacial Processes* will be published for the meeting containing papers prepared by PACE partners reporting results from each of the PACE Work Packages.

PACE is funded by the European Union Environment and Climate Research Programme under Contract ENV4-CT97-0492.

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Metadata details of deep bedrock boreholes comprising the PACE monitored borehole network.

PACE boreholes and test sites		Janssonhaugen Svalbard Norway	Tarfala Lapland Sweden	Juvvasshøe Jotunheimen Norway	Schilthorn Bern Oberland Switzerland	Passo Stelvio Lombardia Italy	Murtel-Corvatsch Oberengadin Switzerland	Stockhornplateau Wallis Switzerland	Pico/Corral del Velela Sierra Nevada Spain
Site Description	Latitude Longitude Elevation a.s.l. Topography MAAT	78° 10' 45" N 16° 28' 15" E 275 m Hill -8°C (estimated)	67° 55' N 18° 38' E 1540 m Ridge -7°C (estimated)	61° 40' 32" N 08° 22' 04" E 1894 m Plateau -4°C (estimated)	46° 33' 34" N 07° 50' 10" E 2900 m Slope	46° 30' 59" N 10° 28' 35" E 3000 m Summit -3,7°C (Sep 98-Sep 99)	46° 26' N 09° 49' 30" E 2670 m Rock glacier	45° 59' 17" N 07° 40' 31" E 3410 m Plateau on crest -5,5°C (estimated)	37° 03' 24" N 03° 22' 05" W 3371 / 3106 m Ridge/Rock glacier
1 st borehole	Drilling date Depth Chain length Thermistor depths	30.04.-02.05.1998 102 m (vertical) 100 m PACE standard	24.-26.03.2000 100 m (vertical) 100 m PACE standard	01.-04.08.1999 129 m (vertical) 100 + 129 m PACE standard	August 2000 101 m (vertical) 100 m PACE standard	1998 100.3 m (vertical) 100 24 (0,02 - 100 m)	May / June 1987 62 m (vertical) 58 m 52 (0,6 - 58 m)	31.07.2000 100,7 m (vertical) 100 m PACE standard	September 2000 100 m (vertical) 100 m PACE standard
2 nd borehole	Drilling date Depth Chain length Thermistor depths	02.05.1998 15 m (vertical) 15 m PACE standard	26.03.2000 15 m (vertical) 15 m PACE standard	04.08.1999 20 m (vertical) 15 m PACE standard	14.10.1998 14 m (vertical) 13,7 m PACE standard			02.08.2000 31 m (vertical) 17 m PACE standard	September 2000 15 - 20 m
Meteostation	Installation date Sensors	May 2000 Air temperature Relative humidity Wind speed Wind direction	April 2000 Air temperature Relative humidity	September 1999 Air temperature Relative humidity Net radiation Snow depth Wind speed Wind direction	October 1998 Air temperature Relative humidity Net radiation Snow depth Wind speed Wind direction	18.09.1998 Air temperature Relative humidity Net radiation Snow depth Wind speed Wind direction	1997 Air temperature Relative humidity Net radiation Snow depth Wind speed Wind direction		September 1998 Air temperature Relative humidity Net radiation Snow depth Wind speed Wind direction
Responsible Partner	Institute Team leader	University of Oslo Prof. J.-L. Sollid	University of Stockholm Prof. P. Holmlund	University of Oslo Prof. J.-L. Sollid	VAW-ETH Zürich Dr. D. Vonder Mühll	3 rd University of Rome Prof. F. Dramis	University of Zürich Prof. W. Haeberli	University of Giessen Prof. L. King	University Complutense, Madrid Dr. D. Palacios

Climate and the Cryosphere

The Science and Coordination Plan for Climate and the Cryosphere (CLIC), prepared by the Task Group for CLIC (under co-Chairs Ian Allison and Roger Barry), was presented by Roger Barry to the XXI Session of the Joint Scientific Committee (JSC) for the World Climate Research Programme in Tokyo in March 2000. The JSC endorsed the project which will be developed under the guidance of the Arctic Climate System (ACSYS)/CLIC Scientific Steering Group (SSG) through 2003 and thereafter under a CLIC SSG. The recently appointed Director of the International ACSYS/CLIC Project Office (IACPO) at the Norwegian Polar institute in Tromsø is Dr. Chad Dick. The CLIC Science and Coordination Plan is available at: <http://www.npolar.no/acsys/CLIC/clicindex.htm>

Its scientific objectives include: study of the energy

and water balance in regions with frozen ground; interactions of seasonally frozen ground with the climate system; and the representation of cryospheric processes in climate models. The use of cryospheric indicators for climate change detection and monitoring is also an important element of the project. Careful coordination of its activities with the ongoing work of other international programmes and scientific associations and national projects is planned to ensure that identified gaps are addressed, thus avoiding any duplication of ongoing efforts.

The first session of the newly formed ACSYS/CLIC Scientific Steering Group met in Kiel, Germany, 23-27 October 2000. The group discussed strategies for developing a CLIC Implementation Plan and initial priorities. The SSG Chair is Dr. Howard Cattle, UK with Ian Allison, Australia and Roger Barry, USA, as co-vice Chairs.

Roger Barry (rbarry@kryos.colorado.edu)

News from Members

Argentina

For the first time a course on geocryology in South America: 'Periglacial Phenomena, Determination and Application' was held thanks to support of the Foundation 'Miguel Lillo' and the National University of Tucumán, NW Argentina. It was a one week post-graduate course, held in the month of June in San Miguel de Tucumán, by Dr. Dario Trombotto and Dr. Ana-Lía Ahumada with participants from different parts of Argentina.

Several members of the Argentine Association on Permafrost (AAP) participated in the 31st International Geological Congress 2000 in Rio de Janeiro, Brazil, particularly in the session 'Modern and Ancient Sedimentary Environments Related to Glaciation'. Dario Trombotto was the convenor of this session, and the idea was to convene a South American meeting of the different experts on cold climate environments. In the two sessions 'Modern and Ancient Sedimentary Environments Related to Glaciation', the following South American posters were presented:

Periglacial sedimentary structures, Central Andes, Argentina, by A.-L. Ahumada.

Periglacial phenomena in the northwest of Argentina, by A.-L. Ahumada.

Study of rock glacier ice, by L. Arena & G.M. Caranti.

Review of permafrost measurements obtained eastward of the Antarctic Peninsula, by E. Borzotta, J. Venencia & M. Mamani.

Freezing index and frequency in Patagonia and in the piedmont cordillera region, by E. Buk.

The permafrost on Seymour Island (Antarctica): temperatures and geophysical soundings, by E. Buk.

Preliminary studies of Middle Pleistocene loess in the piedmont of Mendoza, Argentina at 33° S, by D. Trombotto & M. C. Regairaz.

South American Geocryological Inventory, by D. Trombotto.

Abstracts from these posters can be found on the Congress CD-ROM. A pre-Congress field trip with the participation of Jerry Brown and Dario Trombotto to the Itatiaia Mountains, Serra da Mantiqueira, reaching almost 2800 m asl., was organised by the South American periglacial group together with Dr. May C. Modenesi-Gauttieri, Geological Institute of São Paulo, Brazil. Several possible periglacial deposits were observed in southeast Brazil. A small working group was created and possible joint projects between Argentina and Brazil were discussed in order to be able to analyse cryogenic indicators in the future.

The geocryology of Mendoza was presented to the Argentine Working Group on Quaternary Research (Cadincua - INQUA) at the field workshop in Mendoza in November.

At present Dr. Ana-Lía Ahumada, Institute of Quaternary Geology and Palaeoclimate, is carrying out an inventory of rock glaciers in the northwest of Argen-

tina. Knowing the distribution of cryogenic phenomena in this area may contribute to a better understanding of climate changes. Together with Dr. Lucía Arena, Department of Mathematics, Astronomy and Physics, National University of Córdoba, ice from the rock glacier 'Morenas Coloradas' of the 'Cordón del Plata' is being analysed, and the correlation of micromechanical characteristics and the natural conditions of ice from a sedimentary environment are studied.

E. Borzotta has estimated the heat flow and the geothermal gradient based on magnetotelluric soundings on Seymour and Ross Islands. These data were used in conjunction with MAAT to estimate permafrost thickness under equilibrium condition.

María Camacho, University of Jujuy, is studying the sedimentology of the 'Laguna de Pozuelos' in northwest Argentina and has identified two humid stages: the Minchin Phase of 27 ka and Tauca Phase of 12 ka.

Bernard Francou (Quito, Ecuador) continues monitoring a rock glacier in the 'Cerro Caquella' area, Bolivia. He is working particularly on Andean permafrost degradation caused by climatic changes. At the same time he is preparing a borehole drilling to a large depth at 'Cerro Illimani' (Bolivia, 6450 m asl.) and at 'Cerro Chimborazo' (Ecuador, 6310 m asl.).

Trombotto and Regairaz, Mendoza, continue their studies of the loess profile at Las Carreras Valley at the foot of the 'Cordón del Plata', an eastern range of the Andes, at 2200 m asl. in Mendoza. The sedimentary characteristics of the analysed material correspond to an Andean loess. The studies of this loess therefore would be the first Argentine example. The loess was dated using TL technique to be 234 +/- 18 ka old, which assigns it to the Middle Pleistocene and to a period rarely mentioned for South America and the Southern Hemisphere. This profile constitutes a key element for the Quaternary stratigraphy in South America.

The Dr. Ricardo Villalba research group (Masiokas and others) from Department of Dendrochronology and Environmental History, at the Institute IANIGLA (Conicet), Mendoza, is working on the project PATAGON-1000. The study 'Latitudinal differences in glacier fluctuations across Patagonia: A dendrogeomorphological approach to characterise climate variability in the southern Andes during the past 1000 years' is conducted in collaboration with the Geocryology Unit (Trombotto) of the same institute. The major goal is to characterise the natural climatic variability in this region, with particular emphasis on long-term variability.

Dario Trombotto. (dtrombot@lab.cricyt.edu.ar)

Canada

This report highlights a number of current Canadian permafrost activities. The last two years have seen an increase in permafrost research activities in Canada, in part attributable to a new federal programme for science, impact and adaptation research related to climate change. This new Climate Change Action Fund programme is supporting a number of projects with strong partnerships between government, academia and the private sector. A few of these projects are described below.

A surge in resource exploration and development activities in the western Arctic is occurring, placing significant demands on permafrost science and engineering for infrastructure design and management, and for adaptation to climate change impacts. These increased activities and needs, as well as the concurrent interests for construction of gas pipelines, will present both challenges and opportunities for the Canadian permafrost community. In this era of new information technology, the web is presenting opportunities for dissemination and management of permafrost data. Two Canadian examples are presented in this report: an Illisarvik bibliography and a national ground temperature database.

The Government of Canada established the Climate Change Action Fund (CCAF) in 1998, in order to engage Canadians in partnerships that will lead to a deeper understanding of the climate change issue, as well as to take early and meaningful actions to reduce greenhouse gas emissions and adapt to the impacts of climate change. One component of this fund is directed towards Science, Impacts and Adaptation projects. This component of CCAF has funded several projects where permafrost is central or integral to the study. Further information on the CCAF programme can be found at <http://www.climatechange.gc.ca/english/html/fund/index.html>.

The Geological Survey of Canada convened a National Permafrost/Glaciers/Ice Caps Monitoring Networks Workshop in Ottawa, January 28-29, 2000. The workshop was attended by some 50 participants, more than half of whom represented the permafrost community (government, academia and private sector). Sponsored by the federal Climate Change Action Fund to provide input to the development of Canada's Global Climate Observations System (GCOS) Plan for the Cryosphere, the workshop focused on the requirements for coordinated national networks to observe the climate change signal, assess its regional variability, and evaluate its impacts in permafrost. For more details on the workshop see the section on the Global Terrestrial Network for Permafrost (GTN-P) in this issue of *Frozen Ground*. The final report of the Canadian permafrost monitoring workshop will be available on the GSC's permafrost web site: [\[sts.nrcan.gc.ca/permafrost/\]\(http://sts.nrcan.gc.ca/permafrost/\) and released as a GSC Open File.](http://</p></div><div data-bbox=)

In a collaborative programme between Germany's BGR and Centre d'études nordiques of Université Laval, twenty holes were drilled through the permafrost in July 2000 near Umiujaq in Nunavik (the Inuit territory of northern Québec) in order to obtain cores and to install geophysical instrumentation in the permafrost. The aims of the project include: to observe the cryostratigraphy in permafrost that aggraded in marine sediments following land emergence; to obtain samples of ice and trapped gases for chemical and isotopic analysis; to obtain temperature data that provide three dimensional temperature fields in permafrost and obtain groundwater pressure measurements at the base of permafrost in order to calibrate heat and mass transfer models of permafrost growth and regime; to provide open access holes for determination of geophysical properties; and to interpret and model the process of formation of palsas and permafrost mounds. As the recent emergence of these marine sediments is a possible analogue for early glacial emergence of marine sediments in other Arctic regions, this study will provide some potential explanations of permafrost characteristics and features now found in sea bottom conditions.

Three sites were drilled and instrumented: a (mineral) palsa consisting of a circular mound 50 m in diameter and 3 m high; a permafrost mound 14 m high that probably formed when permafrost invaded a spur between two pre-existing gullies; a 2.5 m high sandy mound. Preliminary results of the project will be presented at the 1st European Permafrost Conference in Rome.

A new National Park is being established on Bylot Island and northern Baffin Island in the eastern Canadian Arctic. In conjunction with this activity the University of Calgary (Brian Moorman) continues to study the glacier-permafrost interactions in the area. Moorman's team from the University of Calgary is examining the linkages between glacial and permafrost hydrological systems, the burial and preservation of glacier ice, and the stability of permafrost under changing environmental conditions. To accomplish these goals a number of new techniques have been utilised including: combining differential GPS and ground-penetrating radar surveys to create 3-D maps of glacier thickness, englacial and subglacial drainage systems, and buried ice. Current research includes developing electrical resistivity imaging techniques for mapping the 3-D thermal structure of the ground and the distribution of massive ice. To assist in the development of new geophysical applications and permafrost modelling, a low-temperature experimental facility has been constructed at the University of Calgary to enable numerical and physical modelling of field conditions. The facility includes a walk-in

freezer, currently housing a scale model (1.5 m x 3 m x 2 m) of permafrost, massive ground ice, and a buried pipeline. Two pumping constant-temperature baths enable precise control of the pipe temperature and the thermal field surrounding it. The facility also has an automated control and monitoring system that enables experimentation under controlled dynamic conditions. Currently, a number of experiments are being undertaken in the facility to test the scalability of geophysical techniques.

An Internet bibliography of the nearly 50 reports and papers that have been published covering research at Illisarvik is available at <http://www.nwtresearch.com/illisarvik>. Illisarvik is the experimental drained lake on Richards Island in Canada's western Arctic. The experiment was conceived by Ross Mackay and began in collaboration with the Geological Survey of Canada and the (then) Earth Physics Branch in 1978. Research at Illisarvik is continuing. The bibliography lists the full citation and abstract of all these articles. The bibliography was compiled by Margo Burgess (GSC), Ross Mackay (UBC) and Chris Burn (Carleton), and is hosted by the Aurora Research Institute, Aurora College, N.W.T.

The Geological Survey of Canada (GSC) has published a ground temperature database for northern Canada (Smith, S. and Burgess, M., 2000. 'Ground temperature database for northern Canada, Geological Survey of Canada Open File no. 3954') which provides a baseline summary compilation of data acquired over the last 30 years. This national database includes publicly available information from published and unpublished sources for 656 sites, 526 of which are in the permafrost region. The majority of sites are abandoned and currently inactive. Information on site characteristics such as air temperature, snow cover and vegetation, which influence the ground temperature regime has also been compiled. The entire database is presented digitally as an Excel spreadsheet. A series of maps and graphs illustrate site distribution, near-surface ground temperatures, and other attributes of the database.

Funding from the Federal Government's Climate Change Action Fund has been received to increase data accessibility and web enable the national ground temperature and permafrost thickness databases. The web-based version of these databases is currently under development by Sharon Smith and Margo Burgess, and Phase I of the project is available at http://sts.gsc.nrcan.gc.ca/tsdweb/geoserv_new.asp/.

Upon completion of the project by March 2001 access to the database will be provided through the GSC Permafrost Web Site (<http://sts.gsc.nrcan.gc.ca/permafrost/>).

High Arctic Permafrost Observatories are maintained by the Geological Survey of Canada. Ground temperatures to depths of 60 m have been measured

since 1978 on a regular basis at five borehole sites at Canadian Forces Station Alert, Nunavut (82.5°N, 62.4°W) with the ongoing collaboration of the Department of National Defence. These are the most northerly permafrost monitoring sites in the world and the 22-year data set is one of the longest records of permafrost temperatures in Canada. Funding was obtained in 2000 from the Federal Government's Climate Change Action Fund to undertake an analysis incorporating the last decade of observations and to service and upgrade site instrumentation. In summer 2000, ground temperature cables were connected to data loggers and air and ground surface temperature sensors were installed at three sites. Preliminary analysis indicates that air temperatures have generally increased since 1986 and this has been accompanied by an observed rise in permafrost temperatures in the upper 15 m. Snow cover is generally thin to absent in this area but exhibits high spatial variability and this may be an important factor influencing the response of shallow permafrost temperatures to changes in air temperature. Data were also recovered in summer 2000 from data loggers at two other High Arctic sites near Eureka and on Loughheed Island. The record of permafrost temperatures to depths of 60 m from 1991 to 1997 is now available for analysis.

A study of the impacts of climate change on the Beaufort Sea coast is currently underway by Steve Solomon. The Geological Survey of Canada, with funding from the Panel on Energy Research and Development and the Climate Change Action Fund has been examining the effects of changes in environmental forcing on rates of coastal erosion. Examination of historical data has revealed decadal scale cycles in storm events, which cause storm surges and wave induced erosion. Ice chart data over 30 years reveals a trend towards increased open water periods, especially during the past decade. During the last field season, a late summer storm resulted in a storm surge of 2.2 m (a return period of about 10 years). The surge was especially interesting in light of the abundance of ice in the region. Despite the construction of new shore protection at Tuktoyaktuk, flooding and localised severe erosion took place. At nearby Tuktoyaktuk Island, a thermoerosional notch 2 m high and 10-15 m deep was cut at the base of the cliffs over the 24 hours of the storm. The data from the storm and other field measurements and mapping will be synthesized in a report on the sensitivity of the Beaufort Sea coast to climate change, scheduled for completion in April 2001.

The Second International Conference on Contaminants in Freezing Ground, Cambridge U.K., July 2000, was jointly organised by Carleton University's Geotechnical Science Laboratories and Cambridge University's Scott Polar Research Institute (See United Kingdom report for details).

The Inuvik Gas Pipeline Project received the Profes-

sional Award of Merit for 2000 by the Association of Professional Engineers of Northwest Territories (NAPEGG). The recipients were Inuvik Gas Ltd, Nixon Geotech Ltd, Comeau and Associates, Asher Engineering and North of 60 Ltd. The 150 mm diameter gas line provides natural gas to the town of Inuvik at rates of up to 3 million standard cubic feet per day, over a distance of 50 km from two wells at Ikhil, due north of Inuvik, NWT. The gas is used for electricity production, and domestic heating. Innovative engineering approaches were used to complete the design for slopes, ice wedges, backfill thaw settlement and occasional warm gas flow at the north end of the line.

EBA Engineering Consultants Ltd. of Edmonton AB received an Award of Excellence from the Consulting Engineers of Alberta for their design and construction management of a frozen core dam at Ekati Diamond Mine, northeast of Yellowknife NWT. The 10 m high dam was constructed to contain surplus water from storage of processed kimberlite. The dam has a core of frozen gravel on a permafrost foundation that must remain frozen considering natural climatic variability and the risk of a progressive warming trend. A large number of delegates to the 7th International Conference on Permafrost, Yellowknife, 1998, visited the Ekati Mine and the dam just before diamond production began.

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China

The three former geo-science institutes of the Chinese Academy of Sciences (CAS) at Lanzhou, i.e., Lanzhou Institute of Glaciology and Geocryology, Lanzhou Institute of Desert, and Lanzhou Institute of Plateau Atmospheric Science, have been reorganised into a new institute in June, 1999, which is called the Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI), CAS. The major research areas of the new institute are glaciology, geocryology, cold regions engineering, desert and desertification, hydrology and land resources in cold and arid regions, plateau atmospheric science, and ecology and agriculture in cold and arid regions. Director of the new institute is Academician Cheng Guodong.

To provide an opportunity for scientists and engineers to discuss and exchange their achievements and experience in cold regions engineering and to accelerate the great development of Western China, the Fourth International Symposium on Permafrost Engineering was held on 21-23 September 2000 at Lanzhou, China, organised and sponsored by the Chinese Society of Glaciology and Geocryology, CAREERI, Permafrost Institute of the Siberian Branch,

Russian Academy of Sciences, Heilongjiang Institute of Cold Ground Construction Science, Communication Department of Tibet, Communication Department of Qinghai Province, the First Survey and Design Institute of Highway, Ministry of Communication of China, Western Branch of Railway Science Institute, Ministry of Railway of China, the First Survey and Design Institute of Railway, Ministry of Railway of China, and Chang'an University. The proceedings are published in English. Please contact Prof. Zhu Yuanlin for information to purchase the proceedings.

The Qinghai-Tibet Railway is going to be built on the Qinghai-Tibet Plateau. The length of this railway is about 1100 km, among which about 560 km will be across permafrost terrain. Large-scale investigation and research dealing with the permafrost engineering problems of designing and constructing this railway will be started very soon. Experts and scientists from all over the world who are interested in the science and technology of permafrost engineering and other problems are welcome to take part in the scientific research programme for construction of this railway.

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Denmark

Investigations on bedrock weathering rates and rock glacier dynamics were continued on Disko Island (70°N), central West Greenland, by Ole Humlum, University of Copenhagen and the University Courses on Svalbard (UNIS). At sea level MAAT is about -6°C, and most of the study sites are within the zone of continuous permafrost. Precipitation and temperature (air, ground surface and within the active layer) are measured in headwalls, at rock glacier heads and at several locations along rock glacier flow lines by miniature data loggers. Geomorphic events and snow cover variations are daily monitored by two automatic cameras. Precipitation has been sampled on a daily basis at the Arctic Station (Qeqertarsuaq), southern Disko Island, since the early 1999 in order to calibrate the oxygen isotope signal obtained from ice within rock glaciers and other terrain elements.

In the Ammassalik area (65°N), SE Greenland, a similar programme on bedrock weathering rates and local meteorology was initiated during August 2000, also by Ole Humlum. An extension of this programme is planned for the coming year. At sea level, MAAT is close to 0°C, but the highest mountains (about 1000 m asl.) extend deep into the discontinuous permafrost zone. The study area is notorious for periodic very high winter wind velocities (Pitera's). The influence of wind on distribution of the snow cover and bedrock temperatures represents a main research topic. A study on Holocene aeolian deposits and the associated palaeowind regime at Ammassalik has been initi-

ated by Hanne H. Christiansen, University of Copenhagen, also in August 2000.

Bo Elberling and co-workers, Institute of Geography, University of Copenhagen, have initiated new environmental investigations of spreading of heavy metals (Zn, Pb and Cd) in aquatic environments in relation to Arctic mining. During the spring 2000, a fiord sampling programme was conducted in Strathcona Sound nearby Nanisivik Mine (Baffin Island, Canada) to obtain data for identifying possible sources of Zn, Cd and Pb in fiord sediment and to estimate potential impacts of the sources on the marine environment. In the summer detailed micro-scale oxygen profiles were performed in water-saturated/water-covered tailings deposited on land. This part of the project reveals that oxygen consumption takes place in the upper most few mm of tailings and that water-covered tailings is a promising remediation action compared to encapsulation. The project activities continue for the coming two years and are funded by the Danish Environmental Protection Agency, Ministry of Environment and Energy, Denmark as part of DANCEA.

At the Faroe Islands the LINK (Linking Land and Sea at the Faroe Islands: Mapping and Understanding North Atlantic Changes) project has extended the air and ground surface temperature and precipitation monitoring network of miniature data loggers in the mountains around Slættaratindur, the highest mountain (882 m asl.). A complete, successful year of automatic digital photographing has provided daily photographs showing snow cover distribution in the highest located cirque valley in the islands, during days without a cloud cover. The automatic, digital photographic monitoring has now been extended to include two web cameras operating at the mountain meteorological station at Sornfelli (740 m asl). These take photographs on an hourly basis of the mountain top and the surrounding landscape, providing snow cover depth, duration and distribution data. Online photographs and data from the meteorological station at Sornfelli can be seen at <http://www.metsupport.dk/data/sornfelli/>. The LINK project is carried out by Ole Humlum, Hanne H. Christiansen both University of Copenhagen, and by Lis Mortensen, the Geological Survey of the Faroe Islands. For more information on LINK see <http://www.geogr.ku.dk/link/>.

At Zackenberg (74°N) in NE Greenland the ZERO monitoring programme has now been in operation for five years. Included in the monitoring programme is now five summers of CALM data from two grids. In one of the CALM grids there is now also two years of daily automatic digital photographs obtained as part of a research project on active layer dynamics in permafrost soils by Hanne H. Christiansen.

At the Danish Meteorological Institute, Jens H.

Christensen recently completed numerical modelling studies of permafrost distribution in Russia's European North as part of the TUNDRA project. Good agreement is reported between modelled and observed distribution of permafrost zonation.

The Third International Conference on Cryogenic Soils - Dynamics and Challenges of Cryosols will take place in Copenhagen, Denmark, 20-24 August 2001. There will be a Post-Conference field trip to Finland August 25-31, 2001. The Conference is organised by the Working Groups on Cryosols of the International Permafrost Association and of the International Union of Soil Science. The second circular and registration form was sent in mid October 2000. The organisers from Denmark, USA, Canada, and Russia have invited scientists from different natural sciences to challenge and discuss their ideas about global change related to the functioning and climate interaction of soils, active layer-permafrost processes, soil-landscape systems and soil-plant systems in cold climates.

The following scientists are invited as key note speakers:

Luca Montanarella (Italy) - *soil database*.

Charles Tarnocai (Canada) - *soil data base, carbon storage*.

Sergey Goryachkin (Russia) - *soils and global change*.

Walter Oechel (USA) - *carbon cycling (CO₂)*.

Mark Williams (USA) - *carbon and nitrogen soil dynamics and global change*.

Lothar Beyer (Germany) - *chemical weathering and soil formation in cold soils*.

David Gilichinsky (Russia) - *cryosols and palaeoenvironments*.

Brigitte Van Vliet Lanöe (France) - *cryogenic processes*.

Bernd Etzelmüller (Norway) - *permafrost and global change*.

Torben R. Christensen (Sweden) - *carbon cycling (methane)*.

Phil Wookey (Sweden) - *soil ecology*.

Sven Jonasson (Denmark) - *soil-microbiology-plant interactions*.

Ole Humlum (Norway/Denmark) - *Arctic landscapes and their evidence of climate change*.

For further information on this meeting see <http://www.geogr.ku.dk/cryosols>.

Hanne H. Christiansen (hhc@geogr.ku.dk)

Germany

The Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Hannover, and the Centre d'études nordiques, Université Laval, Quebec, have started a joint-project to investigate the development of permafrost in emerged marine sediments east of Umiujaq, Nunavik, near the eastern shore of Hudson Bay (see also report by Canada). Six holes were drilled into a mineral palsa and geophysical equipment installed to

monitor the temperature field and water pressures at the palsa base for at least one year. The intention is to develop a fully consistent numerical model capable of simulating the full cycle of palsa growth and decay based on the observations. The area under investigation is considered as a modern analogue to conditions that prevailed during the last marine regression from the Laptev Sea shelf of Siberia.

During summer 2000 the Giessen PACE group successfully conducted drilling operations on Stockhorn-plateau (3410 m asl.), Mattertal, Switzerland. The two boreholes reached a depth of 101 m and 31 m, respectively. Preliminary temperature readings indicate a permafrost thickness of at least 150 m in this area. Investigations by Stephan Gruber demonstrated the influence of permafrost on landslide hazards in a GIS analysis that was carried out for a 485 km² basin in the Mattertal. The permafrost distribution proved to be a highly valuable factor in data-driven modelling of potential landslide hazards in the periglacial belt. A digital elevation model, extensive mapping from aerial photographs, satellite imagery and fieldwork formed the basis for this study. A local permafrost model was designed from calculated potential direct solar radiation totals in summer, terrain elevation and a map of vegetation abundance derived from a Landsat TM image. The satellite image was corrected for atmospheric and topographic effects using the ATCOR3 algorithm. An albedo map derived from the same corrected image has been incorporated into the radiation-based model in order to calculate net short-wave radiation. In the test area Grächen-Seetalhorn, Switzerland, Thomas Herz has started a programme to investigate the microclimatological conditions within a coarse-grained debris cover in the periglacial belt. First results of a one-year period of air temperature measurements indicate a temperature reduction from the surface to the base of the block cover especially in the snow free period. Future investigations will concentrate on the influence of a coarse boundary layer on energy exchange processes between near ground atmosphere and the lithosphere.

C. Kneisel, Trier, has investigated alpine permafrost in recently deglaciated glacier forefields in the Swiss Alps and in northern Sweden. Together with the Swiss colleagues C. Hauck and D. Vonder Mühl, permafrost occurrence below the timberline was confirmed by geoelectrical measurements in the Upper Engadine. Monitoring of ground temperature for a detailed characterisation of this sporadic permafrost site is maintained by C. Kneisel and T. Riedlinger, Trier.

The Russian-German LENA 2000 Expedition was carried out in the Lena Delta and along the coast of the Laptev Sea during the period 28 July to 27 August 2000. The investigations were conducted by four teams according to the following topics: (1) modern processes in permafrost-dominated soils including

trace gasses and water and energy balance; (2) coastal erosion and sediment accumulation and water level and temperature measurements; (3) the Ice Complex and its potential as a climate archive; and (4) palaeogeography of the western Lena Delta. The results of the 1998 expeditions to Siberia were published in 'Berichte zur Polarforschung 315', as a series of reports edited by Volker Rachold and Mikhail Grigoriev.

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Italy

The activity of the Italian IPA group by F. Dramis has focussed on two main topics that reflect the main financial resources for the scientific activities: a) Antarctic Research; b) the Italian activities within PACE.

In Antarctica, at Terra Nova Bay Station, the campaign 1999/2000 was performed with the cooperation of A. Lewkowicz (Ottawa University). The research was concentrated on the study of the net energy balance of the permafrost surfaces with different morphologic conditions and snow accumulations, on the impact of climate change on the salt concentrations within the active layer, and on the analysis of the relationships between climate and weathering of the bedrock in the ice-free areas of Northern Victoria Land. During the campaign, and thanks to the PNRA organisation, a 15.5 m deep borehole was drilled in the outcropping Harbour granite near the Station. The first temperature profiles were obtained. In the same campaign two CALM grids were established according to the CALM protocols, in proximity to the automatic monitoring stations of Boulder Clay and Simpson Crags. During the austral summer, with the cooperation of Argentine Antarctic Institute and CADIC, two field campaigns, one in Tierra del Fuego and one in James Ross Island (Antarctica), were performed. These campaigns are the first step of a three-year programme to analyse the relationships between active layer thickness, permafrost conditions and different kinds of vegetation in respect to the main climatic parameters. This approach was proposed to the SCAR-RiScc meeting in Madrid last year. It will be conducted along an ideal transect between Tierra del Fuego and Antarctica in cooperation with Argentina and UK. During this campaign a new 8 m deep borehole was drilled at Lachman Harbour (James Ross Island) in the outcropping sedimentary Tertiary rocks.

Monitoring of climatic parameters and borehole temperatures in the Stelvio Borehole (100.3 m deep) continues as part of the PACE activities. The first crystallographic and chemical analyses of the ice core from Foscano rock glacier have been completed. In

addition, 10 miniature data loggers have been placed within different vegetation types and landforms to monitor ground temperature at different depths and incoming radiation, and to understand the effect of the vegetation cover on the permafrost distribution in the Alps.

The Cryosphere Map of Lombardia was published. It is the first attempt in Italy to map the distribution of permafrost, rock glaciers and glaciers in a sector of the Italian Alps. Finally, the organisation of the First European Permafrost Conference in Rome (March 2001) was undertaken.

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Kazakhstan

The Kazakhstan Alpine Permafrost Laboratory continued monitoring of the thermal regime of permafrost, seasonally frozen ground and dynamics of solifluction processes, kurums and rock glaciers in the Northern Tien Shan near Almaty. During the summer 2000 the laboratory has investigated the geocryological conditions on the southern and eastern slopes of the Transili Alatau Range in the basin of Chong-Kemin River between 3000-3600 m asl. Also in the summer 2000 the laboratory carried out monitoring of the movement and investigations of the structure of the Gorodetsky rock glacier in the basin of the Bolshaya Almatinka River, Transili Alatau Range. The laboratory in 2000 investigated permafrost in burial mounds, in natural conditions and in cryogenic forms in the Altai Mountains, basin of Buhtarma River, where solifluction forms, ploughing blocks, thufurs, kurums and very large relict cryoplanation terraces exist. Studies of the Late and Middle Pleistocene glaciation also were performed here.

A book entitled 'Permafrost is the keeper of the antiquities' by A. Gorbunov, Z. Zamashev and E. Seversky was published in Russian, with an abstract in English. Staff of the Kazakhstan Alpine Permafrost Laboratory continue investigating climate, permafrost and ground ice evolution in the Tien Shan supported by the National Geographic Society of the United States of America.

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Mongolia

The Permafrost Laboratory of the Institute of Geography of the Mongolian Academy of Sciences prepared in 2000 a publication concerning seasonal freezing and thawing of ground in Mongolia. Also a preliminary map of Mongolia at a scale of 1:1,500,000, and a map of seasonal freezing and thawing are being compiled.

The Laboratory continues to carry out permafrost monitoring in selected areas of Mongolia. Also the Mongolian-Japanese joint expedition continues their permafrost investigations. Financial support from the USA and Japanese organisations enabled N. Sharkhuu to participate in the international permafrost-related meetings held in Alaska and Japan this year.

We are organising an International Permafrost Symposium on Mountain and Arid Land Permafrost in Ulaanbaatar, Mongolia, 2-6 September, 2001 and a post-symposium field trip on permafrost features, mapping, engineering and monitoring in the Khubsugul and Khangai mountain regions, Mongolia, 7-12 September, both in cooperation with the IPA. The provisional programme was distributed to the IPA, other organisations and individuals. (See Forthcoming Meetings for more details).

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Netherlands

The work on the EU-funded TUNDRA project on the north Russian Arctic Usa River, by Margriet Huisink, Vrije Universiteit Amsterdam, and Sandra van der Linden, Utrecht, continues towards its final stage at the beginning of 2001. Reports and scientific publications are in progress (see also *Frozen Ground* 23, 1999). In the framework of the palaeo-periglacial research at the Vrije Universiteit Amsterdam, the existence of former (until yet unknown) continuous permafrost in the middle of the last glacial could be detected (dated at 33-38,000 ¹⁴C years ago) in eastern Germany. The accompanying vegetation was reconstructed in great detail. A publication by Bos et al. is in press in the 'Journal of Quaternary Science'.

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Norway

Department of Physical Geography, University of Oslo (<http://www.geografi.uio.no/>) has continued its activities within the EU-PACE project. Further geophysical studies were carried out around the PACE borehole site at Juvvasshøe (61° 41' N, 8° 22' E, 1894 m asl.) in Jotunheimen, southern Norway, and in the Dovrefjell area. 2D resistivity tomography survey was performed along a profile, with the choice of site based on 530 BTS measurements in the area. During the summer 2000 the study of rock glaciers at Prins Karls Forland, Svalbard, was continued. At the Brøggerbreen rock glacier close to Ny Ålesund, Svalbard, 2D resistivity tomography was carried out. At Finse, southern Norway, measurements of ploughing boulder displacements were continued. The joint project between the University of Wales (Charles Harris),

University of Dundee (Michael Davis) and the University of Oslo (Johan Ludvig Sollid) to monitor solifluction processes continues. There are currently problems with handling displacement measurements using LVDTs mounted on frames due to the snow pressure.

Investigations on geomorphic activity, bedrock weathering rates and rock glacier dynamics were initiated around Longyearbyen (78°N) at Svalbard, by Ole Humlum (the University Courses on Svalbard, UNIS). At sea level MAAT is about -6°C, and most of the study sites are within the zone of continuous permafrost. Precipitation and temperature (air, ground surface and within the active layer) are measured on various terrain units by miniature data loggers, and geomorphic events and snow cover variations in the area are monitored daily by three automatic cameras. Precipitation has been sampled since 1999 in order to calibrate the oxygen isotope signal obtained from ice within rock glaciers and other terrain elements. Two CALM sites have been established close to Longyearbyen by Mette Oht (UNIS) at different altitudes, both equipped with data loggers measuring active layer temperatures. Investigations on ice wedge development, dynamics and oxygen isotope stratigraphy in nearby Adventdalen have been initiated by Jon W. Jeppesen (UNIS). In the Operafjellet area, investigations on the evolution of an ice cored rock glacier, the local meteorological environment, and the associated Holocene oxygen isotope stratigraphy are carried out by Sisse Korsgaard (UNIS).

At the Norwegian Geotechnical Institute (NGI), Arne Instanes is coordinating the research project 'Arctic oil spills on Russian permafrost soils' funded by the Norwegian Research Council and NGI. The purpose is to study transport, spreading and penetration of oil types on the surface and into soils and ice. Another project called 'Permafrost response to industrial and environmental loads' (<http://www.ngi.no/SIP/SIP7/index.html>) is also coordinated by Arne Instanes, and sponsored by the Norwegian Research Council and NGI for 1999-2003. The main 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 remediation of polluted areas. Numerical models and field and laboratory investigations will be used to reach this objective. The technologies developed will benefit Norwegian industry involved in industrial development on Svalbard and Northwest Russia.

Arne Instanes is also working with the Arctic Technology Programme at the University Courses on Svalbard (UNIS), where the purpose is to introduce students to technological and environmental prob-

lems that are relevant in the Arctic, including conducting field activities in Svalbard communities.

At the 1998 Yellowknife Permafrost Conference it was discussed that engineering should be more active within the IPA. Soon after the Conference the Norwegian Adhering Body started preparing a workshop on permafrost engineering to be held in Longyearbyen on the Svalbard archipelago. The International Workshop on Permafrost Engineering took place 18-21 June 2000, with 45 participants from 10 different countries. The workshop goals were to:

- Strengthen the cooperation and network building between the Nordic countries in the field of permafrost engineering.
- Strengthen the international network, in science as well as engineering, and to promote environmentally friendly solutions to permafrost engineering problems.
- To arrive at a set of conclusions and recommendations covering the workshop themes.

The workshop was sponsored by the Nordic Council of Ministers within the 'Nordic Arctic Research Programme 1998 - 2002' and organised by the Norwegian Geotechnical Institute (NGI), The University Courses on Svalbard (UNIS) and Department of Geotechnical Engineering at the Norwegian University of Science and Technology (NTNU).

An important part of the Nordic Arctic Research Programme is to stimulate young scientists to choose an Arctic research career. Only three or four of the workshop participants could be considered under the category 'young permafrost engineering scientists', and this demonstrates the importance of this IPA engineering initiative. Research opportunities have diminished with reduced interest in new resource development. This situation may change with the growing interest in development of Arctic regions such as Greenland, Northwest Russia, and renewed interest in Alaska and the Mackenzie Delta. The increased



Pingo in upper Eskerdalen on Svalbard. Photograph by Ole Humlum.

emphasis on alpine permafrost in densely populated areas of central Europe may inspire young scientists to a career within this field.

At the closing session it was summarized that the conclusions of the workshop should provide recommendations for the Permafrost Engineering Working Group in preparation for the 2003 Conference in Switzerland. The workshop highlighted the importance of environmental friendly solutions to engineering projects in permafrost regions, and again, the need for standardised methods for in-situ geotechnical testing of permafrost soil was brought forward.

Professor Kaare Senneset, chairman of the Organising Committee, contributed a tremendous effort into organising the workshop and especially his contribution in preparing the workshop proceedings with almost 30 papers must be mentioned.

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Poland

Studies of permafrost and periglacial phenomena in 2000 were carried out on scientific expeditions to Spitsbergen, Svalbard. These were continuations of programmes started in previous years. On Spitsbergen studies were carried out in the summer season of 2000 on Wedel Jarlsberg Land, Bellsund Fjord region, on Oscar II Land, Kaffioyra Plain and on Billefjord, Petunia Bukta. The research programme was conducted by teams from: Maria Curie Sklodowska University in Lublin (Bellsund Region), Nicolai Copernici University in Toru (Kaffioyra) and Adam Mickiewicz University in Pozna (Petunia Bukta). The investigations included dynamics of the permafrost and active layer, periglacial processes and deposits, and dynamics of glaciers.

The results of investigations carried out by the Polish Polar Center are presented every year at the polar symposium of the Polar Club of the Polish Geographical Society and the Polar Research Committee, as well as on polar sessions. The proceedings are published after each session and symposium (e.g. 26th International Polar Symposium 'The Polish Polar Research - The 25th Jubilee of the Polar Club of the Polish Geographical Society' Polish Polar Studies, ed. J.Repelewska-Pekalowa, Lublin 1999, 428 pages.). The next, 27th International Polar Symposium will be organised in the Nicolai Copernici University in Toru, 1-3 December, 2000.

The Polish periglacial community mentions with great sadness the passing of Professor Anna Dylikowa, University of Lodz.

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Russia

Vladimir P. Melnikov was elected Academician by the Russian Academy of Sciences.

The International Conference on Rhythms of Natural Processes in the Earth Cryosphere was held in Pushchino, 16-20 May 2000 (see details in introductory report). Highlights of several research topics and reports from institutes and university groups are presented in the following:

David Gilichinsky and his colleagues from the Soil Cryology Laboratory, Institute of Physicochemical & Biological Problems in Soil Science, Russian Academy of Sciences (Pushchino) and Department of Soil Biology, Faculty of Soil Science, Moscow State University have demonstrated that permafrost has allowed the prolonged survival of ancient microbial life at sub-zero temperatures. Permafrost is characterised as a unique physical-chemical complex, which due to the unfrozen water films, maintains life longer than any other known habitat. Viable cells have been isolated from cores up to 400-m deep in the Canadian Arctic and at the lowest ground temperatures (-25°C) in Antarctica. The oldest cells date back to 3 million years in north Siberia, and probably older in Antarctica. Upon thawing the microorganisms renew physiological activity and exposes ancient life to modern ecosystems. It is now possible for the first time to use actual viable organisms for the purposes of reconstructing a past environment.

Terrestrial permafrost, inhabited by cold-adapted microbes, can be considered as an extraterrestrial model. If life should be found to have existed during the early stages of the development of the Earth, then its traces may consist of primitive cryogenic forms within the extraterrestrial permafrost materials to be recovered from comets and Mars.

Permafrost sediments contains a tremendous mass of organic matter as well as viable methanogens which become activated and could produce additional methane in the event of permafrost thawing. Researchers at the Institute of Physicochemical and Biological Problems in Soil Science find that large quantities of carbon as methane (up to 40 ml/kg) and carbon dioxide (up to 20 ml/kg) are preserved in the permafrost. Methane occurs in discrete layers that are determined by the age and genesis of the deposits and by the type of cryogenesis. The fact that for at least several hundreds of thousands years methane has not diffused from the methane-rich layers into adjacent layers implies that there is negligible diffusion of methane in the permafrost under both present and past conditions. This reservoir of bound methane could be easily released during thermoabrasion of marine and riverbanks and summer thawing of landscapes and outcrops. The yield of ancient methane from thawing of frozen late-Pliocene sediments was

estimated to be as high as 40 mg methane/m² day; comparable with those from modern Arctic tundra landscapes.

Geocryologists at the Department of Geocryology, Geological Faculty, Moscow State University, under the leadership of Prof. E.D. Ershov continue to develop the concept of cyclicity of the cryolithozone during the Proterozoic-Phanerozoic on the basis of models of permafrost evolution. On the basis of physicochemical theory, Dr. V.G. Cheverev proposed recommendations for stabilisation and consolidation of cryogenic grouting.

Evidence was provided for the significance of intrasecular variations of temperature and atmospheric precipitation (mostly during the warm season) in the activation of cryogenic relief-forming processes in the zone of continuous permafrost. The activation of these processes is characterised by a definite cyclicity as shown by K.S. Voskresensky in his Doctoral Dissertation on Modern Relief-forming Processes on Plains of the Russian North, Faculty of Geography, MSU.

S.V. Gubin, Institute of Physicochemical and Biological Problems in Soil Science, in his Doctoral Dissertation, Late Pleistocene Soil forming on the Icy-loess Sediments of the Eurasian North-East, showed that these sediments contain buried soils formed in the relatively warm period 28,000-50,000 years ago. Among them the most-developed soil profiles were forest type soils formed 40,000-50,000 thousand years ago.

Field studies and new scientific generalisations by N.N. Romanovskii, MSU, and H. Hubberten (Alfred Wegener Institute, Germany) show the role of palaeo-reconstructions in the climate-sea-land system. The studies, conducted by investigators from the Moscow State University and the Institute of Earth Cryosphere, Russian Academy of Sciences, Siberian Division, are important for understanding the basic reasons for the activation of destructive cryogenic processes in the economically developing regions.

E.S. Melnikov and his colleagues from Institute of Earth Cryosphere, based on results of field work in different regions of Russia, confirmed the special role of geocryological mapping as a basis of permafrost monitoring. M.O. Leibman, based on long-term field studies on Yamal Peninsula, demonstrated the relationship of landslide development to summer temperature and precipitation of the current and preceding year.

Researchers from the Geocryological Department, Industrial and Research Institute for Engineering of Construction (Russian Federation State Committee for Construction) carried out comprehensive studies along the Pechora Sea coast (Varandey Peninsula, European North of Russia). The thickness of the sub-zero temperature zone is about 150 m, with the upper

30-50 m represented by frozen soils containing methane, and below supercooled saline sediments. The temperature of these sediments reaches down to -4.0°C, but their physical and physico-mechanical properties are similar to unfrozen sediments.

Results of the most recent studies are found in the following monographs (in Russian):

- L.S. Garagulya & E.D. Ershov, eds. (1999). *Geokriologicheskie opasnosti* (Geocryological Hazards).
- A.D. Frolov (1998). *Elektricheskie i uprugie svoystva merzlykh porod i' dov* (Electric and Elastic Properties of Frozen Deposits and Ices).
- L.N. Khrustalev, ed. (1999). *Inzhenernaya geokriologiya* (Engineering Geocryology).
- N.G. Moskalenko (1999). *Anthropogenic Dynamics of Vegetation on the Lowlands of the Russian Criolitozone*.

Director R.M. Kamensky, Permafrost Institute Yakutsk, reported that the basic topic of research at the Institute concerns the present state of permafrost and prediction of its future development. Investigations within this broad topic are conducted in five areas:

1. Spatial and temporal patterns of the distribution and evolution of permafrost, ice, frost-related features and processes;
2. Groundwater formation and regime;
3. Physical and chemical fields in permafrost, modelling and prediction;
4. Permafrost soil as a bearing and enclosing medium for engineering structures; and
5. Ecological consequences of anthropogenic impact on permafrost.

The Institute carried out and continues cooperative studies with scientists from Japan, USA, Germany, and France within the framework of GAME, GAME-GEWEX, GCOS/GTN-P international projects and bilateral agreements with the University of Hokkaido (Japan), National Institute of Polar Research (Japan), National Institute for Environmental Studies (Japan), Institute of Low Temperature Science (Japan), University of Alaska (USA), and Alfred Wegener Institute for Polar and Marine Research. Joint Russian-Japanese programmes include the study of the natural and post-disturbance (fire) evolution of permafrost landscapes in Central Yakutia, as well as monitoring of greenhouse gases in near-surface air, acid rain and snowcover contamination.

The joint Russian-German expedition (Laptev Sea – 2000 Project) in the Lena Delta, the Laptev Sea coast and shelf studied palaeoenvironmental conditions for ice-complex development and erosion of ice-rich coasts. In cooperation with the Geophysical Institute of the University of Alaska, a comparative study of geocryological conditions was undertaken along longitudinal transects (north-south) in East Siberia and Alaska. Air temperature variations in the last 100 years at Yakutsk and Fairbanks were analysed. Mem-

bers of the Kazakhstan Laboratory joined the Kazakhstan-French-Russian expedition to study freezing conditions in ancient burial mounds at the archaeological sites in the Altai and Dzhungaria. The Institute published the following monographs:

'Materials for Study of Unmelting Soil Frost in Siberia', written by the Russian Academician of the 19th century K.E. Baer. It is the collection of all data and information on permafrost available by 1840. It was written in 1842 and the manuscript was kept in the archives of the Russian Academy of Sciences.

Zhang R.V. (2000) 'Design, Construction and Operation of Small Hydraulic Structures in Permafrost Areas (Exemplified by Yakutia)', Permafrost Institute Press, Yakutsk, 158 pp.

Gorokhov A.N., Savvinov D.D., Fedorov A.N. (2000) 'Landscape Ecology of the Amga Watershed', Permafrost Institute Press, Yakutsk, 107 pp.

Karpov E.G., Baranovsky E.L. (1999) 'Permafrost Conditions in the Igarka Area, Northern Yenisey', Permafrost Institute Press, Yakutsk, 181 pp.

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Sweden

The main IPA-related research activities in Sweden during the past year are those under the PACE project and which are reported elsewhere (See PACE report).

Arctic and alpine geomorphological research in the Department of Physical Geography, Lund University, suffered a heavy loss by the recent death of Prof. Anders Rapp. No major projects have received funding during the last four years. Only minor activities continued through private funding initiatives, basic departmental funds and staff input. Prof. J.O. Mattsson has managed to continue editing 'Geografiska Annaler' from Lund. Active projects are present at Karkevagge: Through international cooperation and funding and good cooperation with the Abisko Research Station, P. Schlyter (now operating from Dep. of Physical Geography in Stockholm) has managed to continue a limited, but important activity of geomorphological monitoring in the Karkevagge valley. J. Åkerman is planning to revitalise participation from Lund with this project during 2000/2001.

Abisko: In cooperation with the Abisko Research Station Åkerman is maintaining the CALM sites along the east-west transect in the Abisko area. The ten active-layer sites have now been monitored since 1978 and annual data is presented within the CALM reporting system and the GGD.

Kapp Linne' area, Svalbard: Åkerman is maintaining a limited monitoring programme of active periglacial processes and their climatic significance. The active layer monitoring in Kapp Linne', started in

1972, is maintained within the CALM network. A single site visit a year and maintenance of the data loggers are conducted but without external funding. Several MSc projects of the Kapp Linne' area supervised by Åkerman are completed: Vegetation mapping by T. Josefsson and I. Martensson, and a Digital Elevation Model of the Kapp Linne' area with analyses of the vertical and horizontal distribution of vegetation and geomorphological forms and processes.

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Switzerland

The concept *Permafrost Monitoring Switzerland (PERMOS)* was approved by the Swiss Co-ordinating Group for Permafrost in November 1999 and ratified by the Glaciological Commission of the Swiss Academy of Sciences (SAS) in January 2000. During a pilot phase lasting from 2000 to 2003, the activities will be concentrated to circa 10 existing drillings, 10 permafrost distribution areas and a maximum of two aerial flights per year. Measurements are undertaken by eight institutes that actually set up the various sites. Meanwhile, efforts are under way to associate PERMOS under the umbrella of a federal department to ensure the long-term financing and maintenance of the network.

Mountain permafrost research is undertaken by various institutes, some of the projects with collaboration of two or more institutes are as follows:

The Institutes of Geography at the Universities of Lausanne (IGUL, Emmanuel Reynard, Christophe Lambiel) and Fribourg (IGUF, Michel Monbaron, Reynald Delaloye, Grégoire Devaud) are conducting several projects on the distribution and thermal conditions of discontinuous permafrost in the western part of Switzerland. In the partially frozen talus slope of the Lapires (Mont-Gelé, 2500 m asl.), measurements in the 20 m deep borehole drilled in autumn 1998 indicate permafrost with temperature close to the melting point (temperatures between -0.2°C and 0°C), an active layer of 3 m and a ZAA (zero annual amplitude) depth of only 4 m! At the Alpage de Mille (2200 – 2450 m asl.) analyses of spatial and temporal variability of BTS measurements are conducted in the vicinity of two inactive rock glaciers since 1996. Investigations on permafrost-glacier relationships in several sites indicate, beneath the high complexity of such terrain, the degradation, displacement and even the whole melting of pre-Little Ice Age frozen bodies, the possible post-Little Ice Age establishment of permafrost, and finally, in the forefield of the Grand-Aget glacier (2800 m asl.) a landslide affecting frozen material. Mapping of past, current and future distribution of permafrost and glaciers in the Mont-Gelé area is carried out. Geophysical survey (tomography, DC resis-

tivity soundings) and BTS measurements are performed in frozen terrain (rock glaciers, moraines, proglacial margins, screes) in the same area. Both institutes are also investigating the thermal evolution of perennially frozen ground at very low elevations (Creux du Van, Jura Range, 1200 m asl.) in collaboration with SFISAR, Davos (Veronica Stöckli, Marcia Phillips). Dendrochronological curves are compared with the thermal conditions of the ground.

The University of Bern (Group for Applied Geomorphology) has been investigating permafrost and periglacial phenomena in the small valley Furggentälti in the Gemmi region (2500 m. asl., Wallis, Switzerland) for many years. In 2000, the work concentrated on the new meteorological stations (radiation and energy balance, standard climate parameters) (Hans Kienholz, Severin Schwab, Dragan Mihajlovic). Furthermore, the annual BTS campaign was carried out last winter, combined with BTS measurements from more than 40, single-channel temperature data loggers. The two projects concerning the flow dynamics of the rock glacier in the Furggentälti (Dorothea Koelbing) and the spatial and temporal dynamics of the snow cover (Isabelle Kunz) are almost finished.

To improve understanding of the effects of disastrous flooding caused by high air temperature linked with heavy precipitation, a joint study between the Geological Laboratory of the EPFL (GEOLEP, Daniel Bayard) and the Institute of Terrestrial Ecology (ITÖ-ETHZ, Hannes Flühler, Manfred Stähli) is being conducted during the winter 2000/2001. This project called "Water infiltration in a partly frozen soil and ground water recharge in alpine catchments" combines physical and hydrogeological aspects to study water dynamics into a partly frozen soil in a mountainous area. Field experiments collecting meteorological data and soil physical data will serve as inputs for a numerical model. A one-dimensional heat- and water-balance model will be used for predicting the influence of the greenhouse effect on the studied system. Experiments will be carried out at various places in the southern Swiss Alps (region of the Valais), at the Hannigalp near Grächen (at 2100 m asl.) and near the Gd St Bernard pass (2500 m asl.) to characterise the hydrogeological processes for different climates and to investigate the influence of site orientation, altitude and soil texture on the frost depths and amount of percolated water. Tracer experiments will be used to quantify snow melt infiltration into frozen ground and to investigate the dependence of frozen soil infiltration on soil properties, surface characteristics and physical state at the onset of the snow melt.

The University of Zürich (Regula Frauenfelder, Wilfried Haerberli, Andi Käab, Martin Hoelzle) is involved in several projects related to mountain permafrost. Digital photogrammetry, geodesy, remote

sensing and geomorphology focus on improved process understanding of glacial and periglacial hazards. In the project "GIS-based Modelling of Creeping Mountain Permafrost" supported by the Foundation for the Promotion of Scientific Research at the University of Zürich, rock glaciers are of particular interest. Due to the fact that only the ice of a rock glacier matrix can melt, rock glacier topography is a cumulative expression of the entire rock glacier history and, thus, in a complex way, of the present and past environment. The decoding of present-day morphology and distribution of rock glaciers, and a better knowledge of the climatic controls on rock glaciers provide important information on past and present climate conditions. So far few investigations exist about regional variability of rock glacier development, i.e. what regional effects cause rock glacier abundance in contrast to scarce distribution of such a phenomenon. The project aims at closing this gap by applying two complementary approaches: (a) the development of a GIS-based model simulating alpine rock glacier distribution and (b) the evaluation of presently relict rock glaciers to reconstruct past distribution of permafrost limits. The synthesis of these two approaches should allow for assessing palaeoclimatic fluctuations in the time range of millennia.

The ETH-Mini-Poly project of the three institutes Geotechnics (Sarah Springman, Lukas Arenson), Geophysics (Hansruedi Maurer, Martin Musil) and VAW (Daniel Vonder Mühll) continued in its second year. After drilling four, 70 m deep boreholes through the Muragl rock glacier in 1999, two new cored drillings were undertaken this year on Murtèl-Corvatsch rock glacier. The boreholes are some 15 and 35 m upslope of the borehole 2/1987, and are 51 and 63 m deep. Undisturbed cores of frozen material for laboratory testing were taken and determination of *in situ* strength and stiffness using a pressuremeter (Cambridge InSitu) were performed. In addition, instruments for long-term monitoring of deformation and temperature were installed. The first results of the field measurements and some additional triaxial tests on artificially frozen samples, indicate that the thermo-mechanical behaviour of ice-rich permafrost soil close to 0°C strongly depends on micromechanical processes. Interaction between the air voids, the ice, the soil particles and the unfrozen water has to be taken into account while describing failure or creeping processes of such a system. Therefore, the stability of some currently frozen alpine slopes is thought to be extremely sensitive to climate change. First assumptions can be made, but in order to be able to predict the probability of slope failure, further laboratory investigations and numerical analyses are necessary.

Within the PACE project, the two Swiss partners (University of Zürich: Wilfried Haerberli, Martin Hoelzle, Catherine Mittaz; VAW-ETH Zürich: Daniel Vonder

Mühll, Christian Hauck) drilled two, 101 m deep boreholes (a vertical and an oblique one) at the north slope of Schilthorn. Further, geophysical field survey at various PACE drill sites (VAW) and energy balance measurements were undertaken during the past year. The latter allows improving the permafrost distribution models taking into account effects of snow and thermal offset.

During the last year, Marcia Phillips finished her PhD entitled 'Snow supporting structures in permafrost terrain' at the SFISAR, Davos.

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United Kingdom

The Second International Conference on Contaminants in Freezing Ground was held at Fitzwilliam College, Cambridge, United Kingdom, 2-5 July 2000. The Conference was organised by the Scott Polar Research Institute in collaboration with Geotechnical Science Laboratories of Carleton University, Ottawa, Canada. The primary theme was removing pollution in cold regions and especially that entering the ground from oil spills, military wastes, various sources of nuclear material and other contaminants. Delegates from 11 countries attended the Conference in Cambridge. A recurring topic was the restoration (decontamination) of lands damaged by oil and other spills using bacteria able to tolerate freezing conditions. The environmental conditions are such that conventional clean-up methods as practised in temperate lands often cannot be used. The proceedings of the Conference will include more than 20 reviewed papers, and various shorter items, which collectively illustrate the current rapid development of the associated science and technologies. The pre-publication price is US\$100. In addition to the approximately 200-page Proceedings, this price will include a membership in the Virtual Conference and, currently, a free copy of the proceedings of the first Conference (of which there is only a limited stock). As a member of the Virtual Conference, you will be able to join the international discussion and planning for the future. Enquiries should be directed to: conferencesecretariat@freezingground.org, or visit the web site <http://www.freezingground.org/vc/index.htm>.

The British National Adhering Body of the IPA held its Fourth Periglacial Workshop on 6-7 September 2000 at the University of St. Andrews, Scotland. The Workshop was organised by Julian Murton and Colin Ballantyne in association with the Cryostratigraphy Research Group of the Quaternary Research Association, the IPA Working Group on Periglacial Processes and Environments, and the IGU Commission on Climatic Change and Periglacial Environments. The Workshop had four themes.

1. Modelling and monitoring of cryogenic processes. Keynote addresses were given by Charles Harris (Cardiff) on physical modelling in periglacial geomorphology, and Albert Pissart (Liège) on periglacial experiments and the origin of cryoturbations. Presentations were given by Colin Ballantyne (St. Andrews) and Ivar Bertling (Oslo) on ploughing boulders, Michael Davies (Dundee) on centrifuge modelling of rock slope stability, Norikazu Matsuoka (Tsukuba) on micro- and macrogelivation, Julian Murton (Sussex) on physical modelling of ice segregation in bedrock, and Samuel Etienne (Nantes) on biological weathering in periglacial environments.

2. Palaeoenvironmental reconstruction. The keynote address was by Colin Ballantyne on the Late Devensian periglacialiation of Scotland. Presentations were given by Hanne Christiansen (Copenhagen) on nivation in the Cairngorm Mountains of Scotland, and Stephanie de Villiers (Pretoria) on South African cryogenic palaeoenvironments.

3. Mapping and monitoring of permafrost and periglacial features. Presentations were given by Daniel Vonder Mühll (Zürich) on geophysical mapping of mountain permafrost, Nikolai Shiklomanov (Delaware) on the effects of climate variability on active-layer thickness in Alaska, Hanne Christiansen on monitoring of snow cover by automatic photography, and Martin Gude (Jena) on the microclimate of extra-alpine screes.

4. Interactions between permafrost and glaciers. The keynote paper was given by Bernd Eitzelmüller (Oslo) on the relation between glaciers and permafrost on Svalbard. Presentations were given by Ole Humlum (Svalbard) on the effect of supraglacial debris on glaciers in permafrost areas, Wishart Mitchell (Luton) on rock glaciers in the Indian Himalaya, Julian Murton on basal ice and the frozen deforming bed of the Laurentide Ice Sheet, and Colin Whiteman (Brighton) on melt-out till overlying Laurentide basal ice.

Nine posters were displayed on topics spanning the four themes. Roundtable discussions highlighted two key areas for future research: (1) the rheology of cold earth materials, and (2) the transient behaviour of cold-climate processes. Laboratory modelling, particularly by way of large geotechnical centrifuges such as those at Cardiff and Dundee, provides promise for advancing understanding of the rheological behaviour of, for example, ploughing boulders, downslope soil movements in areas of two-sided freezing, and subglacial deforming beds of permafrost.

Abstracts for the Workshop may be obtained by e-mail from Julian Murton (j.b.murton@sussex.ac.uk).

Charles Harris (harrisc@cardiff.ac.uk)

United States of America

Research programmes reported in prior issues of *Frozen Ground* continued and are briefly reviewed. In addition a number of workshops were conducted this year and reports on climate change impacts prepared.

The Frostfire project is attempting to develop and further refine our knowledge and modelling capability of fire effects, ecosystem impact, and vegetation recovery in the subarctic boreal forest by examining the impacts of an experimental forest fire. The goal of this project is to determine the impacts and interrelated effects of fire on ecosystem processes and their feedbacks to climate in the relatively small Caribou-Poker Creeks Research Watershed near Fairbanks, Alaska. On-going studies are related to fire science, nutrient dynamics, permafrost and vegetation responses and recovery, climatic influence and feedbacks, and hydrology. Intensive pre-burn surveys quantified fuel status of the soil organic layer and forest canopy throughout the experimental watershed. Data on climatic processes, vegetation distribution, streamflow quantities and chemistry, and permafrost and active layer temperatures were also collected. These data sets are currently being augmented with additional data on microclimate, soil nutrients, ground- and surface-water partitioning in streams, among other parameters. A Frostfire synthesis workshop was convened on 21-23 March 2000 to compile and compare results. Over fifty scientists participated with 43 separate oral or poster presentations. The abstracts of this meeting are available at: <http://www.uaf.edu/water/publications/ffabstrc.pdf>. Additional project synthesis activities took place at the Fire Conference 2000 in San Diego, California, November 2000 and in a special session at the Fall American Geophysical Union meeting in San Francisco, California, December 2000.

The NSF ATLAS (Arctic Transitions in the Land Atmosphere System) programme completed its third year of field research and analysis in examining the potential and actual changes occurring in the Alaskan Arctic in response to climatic warming. This research includes integrated analyses of permafrost dynamics, vegetation/climate interactions, trace gas flux measurements, hydrological process studies, and interdependence of snow distribution and ecological community evolution. Many of the active layer measurements under CALM and the shallow borehole, ground temperature measurements are conducted with ATLAS funding. Details of the research programme may be obtained at <http://www.laii.uaf.edu/atlas/atlas.html>. Summaries of the progress to date were presented in a special session at the Fall American Geophysical Union meeting in San Francisco, December 2000.

Dan Lawson and colleagues reported that the Cold Regions Research and Engineering Laboratory (CRREL)

conducts a number of permafrost projects in Alaska. Topics include: stable isotope variations in ground ice as a palaeoclimate indicator, ground water flow and contaminant migration in discontinuous permafrost, GPR and temperature measurements in boreholes, rates of degradation of permafrost and thermokarst formation on the Tanana Flats, and remediation of contaminated soils. Ron Sletten reported that the University of Washington continues a project in the Beacon and Victoria Valleys, Antarctica, investigating polygonized ground and its surface dynamics, and studies of buried ice obtained from co-ring in the Beacon Valley. The ice is on the order of at least several million years, thereby being some of the oldest continuous ice on Earth. Another project is investigating the migration of inorganic contaminants in the active layer and permafrost utilizing laboratory studies and a field site in Alaska. They are collaborating with the Danish scientists at Zackenberg on a study of soils and weathering processes.

The U.S. Geological Survey's Borehole Palaeothermometry programme continues to operate in Greenland and Antarctica. This project seeks to reconstruct surface temperatures in the polar regions for the last 40 kyr and to improve our understanding of the thermal conditions within the permafrost that underlies polar ice sheets. Field work began at Siple Dome, West Antarctica during November 2000; these measurements will continue for another two years. In addition, high-precision borehole temperature measurements from central Greenland and East Antarctica (Taylor Dome) are continuing to be analysed for climate changes during the Little Ice Age and Medieval Warm Period. Gary Clow (USGS) and Bruce Koci (University of Wisconsin) are developing the design for a 'rapid access' drill. This drill would be capable of drilling through 3.5 km of polar ice in a week. In-situ measurements or core samples could then be obtained from the underlying permafrost. In northern Alaska, the USGS (Clow) expanded its network of climate-monitoring stations to eight. This network is designed to monitor regional changes in air and active-layer temperatures during the next 10-20 years. All stations are co-located with deep boreholes and are part of the GTN-P network.

Tim Collett (USGS) reported that the USGS and the U.S. Department of Energy, in cooperation with industry, are assessing the occurrence, recoverability, and energy resource potential of permafrost-associated, natural gas hydrate accumulations in the Prudhoe Bay-Kuparuk River area of northern Alaska. Two known gas hydrate accumulations, Eileen and Tarn, are being evaluated. The initial phase of this study includes mapping the distribution of gas hydrates. In the second phase of the project, the USGS will propose drilling a test well to evaluate the production characteristics of these gas hydrate accumulations.

The NSF Arctic System Science Programme sponsored a workshop to document the current state of knowledge of arctic hydrology and identify and describe the gaps in knowledge that are most limiting to a better understanding of the Arctic water and energy balances. The workshop was held 18-20 September 2000 at the National Center for Ecological Analysis and Synthesis, Santa Barbara, California. The convenors of the workshop were Charles Vorosmarty (University of New Hampshire) and Larry Hinzman (University of Alaska-Fairbanks). Thirty-three scientists participated in this workshop and review. The research needs document is planned to be published by the Arctic Research Consortium of the U. S. (ARCUS) in early 2001. The Workshop on International Permafrost Monitoring and Database Management was sponsored and held at the International Arctic Research Center (IARC), University of Alaska, Fairbanks, Alaska, 11-14 June 2000. Twenty-five specialists from Canada, China, Japan, Kazakhstan, Mongolia, Russia, Switzerland, and the United States attended. The workshop builds on current activities of the IPA to develop the Global Terrestrial Network-Permafrost (GTN-P) of the WMO Global Climate Observing System (GCOS). Details are reported elsewhere in this issue of *Frozen Ground*.

A series of regional reports by the National Assessment Synthesis Team (NAST) of the U.S. Global Change Research Programme are currently being published. The report Potential Consequences of Climate and Change for Alaska discusses potential effects on permafrost. The NAST reports will be available on: www.gcrio.org/nationalassessment. A workshop organised by Orson Smith entitled 'The Warming World: Effects on the Alaska Infrastructure' was held at the University of Alaska-Anchorage 5-6 January 2000. The report is available at: <http://www.engr.uaa.alaska.edu/infrastructure/>. A Workshop on Cold Regions Engineering chaired by Ted Vinson was held at the University of Alaska-Anchorage in 19-21 June 2000 and attended by 126 participants including seven Canadians. The objective of the workshop was to identify and prioritise cold regions engineering research needs in the new millennium in North America.

Rupert (Bucky) Tart reported that the American Society of Civil Engineers (ASCE) held its annual Civil Engineering Conference and Exposition in Seattle, 18-21 October 2000. The Conference theme was 'Seattle 2000 - Passages to Century 21'. The ASCE's Technical Council on Cold Regions Engineering (TCCRE) was an active participant in the Conference given the proximity of the Conference to Alaska, the location of many of the nation's major cold regions projects. TCCRE sponsored six sessions at the Conference on the topics of: South Pole Station Redevelopment, Ground Freezing in Civil Engineering Projects, Global

Warming Effects of Civil Engineering Projects, Challenges of Civil Engineers Working in the Former Soviet Union, and Approaches to Difficult Problems in Cold Regions. The TCCRE Executive Committee and the following seven TCCRE Committees also met in Seattle: Programmes, Frozen Ground, Environment and Public Health, Foundations and Structures, Transportation and Infrastructure, Hydraulics and Hydrology, and Education. Topics discussed included developing programmes on cold regions pipelines for the ASCE 2001 annual convention to be held in Houston; revisions to existing TCCRE monographs and the completion of new monographs; and how TCCRE can participate in the VIII ICOP. The Speciality Conference will be held in Anchorage, Alaska, in 2002, with the theme 'Remediation and Repair of Structures and Foundations'.

Recognising that extreme environments are ever more important sources of freshwater, and that additional hydrologic research and data collection are needed in these areas, the American Water Resources Association (AWRA) sponsored a speciality conference on 'Water Resources in Extreme Environments' 1-3 May 2000, in Anchorage, Alaska. The convenors of the conference were Douglas L. Kane, Technical Chairman (University of Alaska Fairbanks) and James Thrall, Conference General Chair (Meridian Management, Inc.). Most of the world's population is concentrated in areas where freshwater resources may already be, or may soon become, inadequate to meet the demand for water. When this happens water must be imported from other areas or a dispersal of the population will occur. Source areas of additional freshwater are often in extreme environments such as mountains, plateaus, and polar regions. The proceedings bring together papers and posters presented at the conference and are available via <http://www.awra.org/proceedings/paper.html#extreme>.

A meeting of the U.S. and Russian scientists was held in Seattle in November under the Russian-American Initiative on Shelf-Land Environments (RAISE) programme. Field studies and modelling of coastal and subsea permafrost are included in the programme.

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OTHER NEWS

New Zealand

During the 1999/2000 summer, several New Zealand permafrost-related programs were undertaken in the Ross Sea region of Antarctica:

Jackie Aislabie (Landcare) is leading an ongoing programme into the effects of hydrocarbons on soil properties in the Ross Sea Region of Antarctica. Other researchers in the programme include Megan Balks (University of Waikato), Robert Gibb, Doug Shepard, Iain Campbell, and Graeme Claridge. The work involves monitoring a range of soil and climate parameters, at three sites of contrasting soils and climate, in collaboration with John Kimble and Ron Paetzold (USDA). Data have shown increased temperature and microbial activity at hydrocarbon-contaminated sites compared to controls. Megan Balks presented a paper at the Contaminants in Freezing Ground Conference in Cambridge, UK, in July and results of aspects of the programme have been presented at a number of other national and international conferences.

Paul Augustinus (University of Auckland) continued his high resolution ground penetrating radar study into the internal structure of Holocene raised beaches on the McMurdo Sound Coast. The mapping of permafrost types and active-layer depth using radar was a significant outcome of this work.

Warren Dickinson (Victoria University of Wellington) lead a programme that involves shallow permafrost drilling in the McMurdo Dry Valleys, Antarctica. This drilling project had its first field season starting in November 2000, and is based on new portable drilling techniques which allow shallow coring of permafrost-glacial sediments in remote areas. The primary aim of this project is to recover a climate record from Antarctic ground ice and soils which potentially hold detailed climate information and date back 15 million years. The cored material will not only be used to determine climate and climate history from geological and biochemical material, but will also provide stratigraphic information for ground penetrating radar studies and outcrop maps of glacial sediments. Ground ice from a high elevation site in the Dry Valleys was obtained during a pilot drilling project in 1996-1997. Chemical data from this ice suggests it originated from atmospheric water vapour and brine formed at the surface.

Iain Campbell lead a project which involved detailed examination of the soils at the Lake Hoare LTER site (McMurdo Dry Valleys) in November/December 1999. Soil moisture was measured gravimetrically on a daily basis at various sites, and diurnal soil moisture changes appear to be related to daily weather conditions. The first year of data from the three soil-climate sites established in January 1999 show marked changes in soil moisture content throughout the year and a close relationship with trends in soil temperature. Soil moisture values are very low over winter

months and peak for short periods following summer snowfalls.

Discussions were recently held in Christchurch on a proposal for a multinational (USA/NZ/Italy) Latitudinal Gradient Project to study ecosystem changes along the Transantarctic Mountains from 70°S to 86°S. Mapping and examination of periglacial and permafrost processes will form an integral part of this project. For details of the LGP project go to: <http://www.antarc-ticanz.govt.nz/Pages/Science/Lat-Project.msa>.

Paul Augustinus (p_augustinus@hotmail.com)

Portugal

The project ESTRELA - 'Geomorphological and biophysical processes and landscape units in Mediterranean mountains: the case study of Serra da Estrela (1999-2001) (PRAXIS/C/CTE/11153/1998)' started in October 1999 and is coordinated by António de Brum Ferreira (Centro de Estudos Geográficos, University of Lisbon). It is an interdisciplinary approach joining geomorphologists, climatologists and botanists. In the framework of the project several data loggers measuring air, soil and rock temperature were installed in the upper areas of the Estrela range. An assessment of the relationships between air, soil and rock temperatures and a better understanding of the present-day periglacial phenomena are expected outputs. A meteorological station was also installed in the top of the mountain at 1993 m asl. and is now fully operational. More details about the project can be found at http://www.ceg.ul.pt/proj_estrela.

From January to March 2000, Gonçalo Teles Vieira participated in the Spanish Antarctic Campaign in Livingston and Deception Islands (South Shetlands) in the framework of the project RADIANTAR-2001, coordinated by Miguel Ramos Saínz (Department of Physics, University of Alcalá de Henares, Spain). The research focused on detailed geomorphological mapping (with special emphasis on periglacial activity), meteorological data collection (automatic monitoring of air temperature, relative humidity, wind, soil temperatures and radiation budget) and drilling in the active layer and permafrost. Data from this and other campaigns are being integrated in a GIS for spatial analysis.

A report synthesising the results from the research on the Pleistocene glaciation of the Serra do Gerês (Northwest Portugal) was published in late 1999. Relict periglacial landforms and deposits and their relationship with glacial evidence were also analysed (Ferreira, A. B.; Vidal-Romani, J. R.; Zêzere, J. L.; Rodrigues, M. L. 1999 - 'A glaciação plistocénica da serra do Gerês'. *Vestígios geomorfológicos e Rn*° 37, 150p. - in Portuguese with English abstract)

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Romania

Since the last Romanian report, the activities of the Romanian geomorphologists involved in glacial and periglacial geomorphology and permafrost were focused on the Transylvanian Alps (Southern Carpathians).

A group of geographers from West University of Timisoara are involved in the research project 'The present-day morphodynamic processes of the alpine area of the Southern Carpathians, from sustainable development perspective' (project director, P. Urdea), financed by the National Council for University Research (CNCSIS) for the period 1999-2001 (Grant 15/63 CNCSIS).

In the Fagaras Mountains – the highest in Romania, and in the Retezat Mountains, monitoring and prediction of permafrost activity were continued by P. Urdea and his group from the Department of Geography, West University of Timisoara. Also, the sporadic-extrazonal permafrost, discovered at low altitude (1100 m asl.) at Detunata Mountain (Apuseni Mountains), was monitored by the method of temperature measurements of the spring situated at the base of the rock glacier.

P. Urdea and L. Dragut (Babes-Bolyai University of Cluj-Napoca) examined and mapped glacial and periglacial relief and relict permafrost indicators in the Surianu Mountains. M. Voiculescu (West University of Timisoara) completed and defended at the Bucharest University, the doctoral thesis 'The study of the geoecological potential and environment protection in the Fagaras Mountains'.

Glacial and periglacial relief and present-day geomorphic phenomena were studied by M. Mandrescu (Stefan cel Mare University of Suceava) during the summer of 2000 in the Maramures Mountains (Eastern Carpathians).

The Asociatia Geomorfologilor din Romania (Romanian Association of Geomorphologists), founded in 1990 and affiliated with the International Association of Geomorphology, was reorganised at the XVIII National Symposium of Geomorphology (25-30 September, 2000) and now has six different research fields including 'Glacial and Periglacial Geomorphology' coordinated by P. Urdea.

Petru Urdea (urdea@cbg.uvt.ro)

IGU Commission on Climatic Change and Periglacial Environments

The International Geographic Union (IGU) approved continuation of the Commission for the next four years. During the past term of the Commission (since 1996), the attention focused mainly on the effects of climatic changes in the most marginal zones of periglacial activity, with symposia and field studies in mountainous Portugal, Lesotho and South Korea. The

impact of climate warming on permafrost environments was also highlighted. During the second term of the Commission (2000-2004) these themes will be continued with special emphasis on processes occurring during climate warming in glaciated and non-glaciated periglacial regions during past and present times.

Periglacial research is impossible without the study of processes in environments with permafrost. Therefore, the existing direct link with the International Permafrost Association (IPA) through its Working Group on Periglacial Processes and Environments will be maintained (see the WG report in this issue for details of our joint activities). The formal affiliation between IGU and IPA is represented by this IGU Commission.

The IGU is reconsidering the philosophy of its structure with Commissions, Study Groups and Task Forces. In particular, Commissions will have the task to cover the fundamental field, methods and theories of geography, to enhance their further enduring scientific developments and to ensure the discipline's relevance to society. Study Groups will focus more on specific fields. Commissions will have a broader scope and task than at present (for instance, it will not be their specific tasks to organise research meetings). These new directions will have the consequence that we will not continue a Periglacial Commission with the current specific and limited objectives as has been the case for the last 50 years. Taking into account the general emphasis on 'environments' within the IGU, and the importance of 'cold regions' in many aspects, we propose to prepare for 2004 a new initiative of Commission to be established within the IGU.

In 2001 we will sponsor, together with the IPA WG, a symposium and session on glacial and periglacial research at the International Conference on Geomorphology in Japan and an excursion on alpine geomorphology. In 2002 we will participate in the IGU Regional Conference in South Africa with a symposium and an excursion to the Drakensberg region. Possibilities for a field meeting in Gaspésie (Canada) or Greenland are under investigation. The Commission will actively participate in the IPA Conference in Zurich 2003. A meeting during the INQUA Conference in Reno (USA) is also envisaged. The Commission intends to terminate its activities in 2004 with a symposium and excursion at the IGU Congress in Glasgow. Preparations are continuing for the compilation of a special publication on selected topics in periglacial research in which substantial progress has been made in the understanding of processes, forms and environmental conditions of those topics in recent years. It will appear as a special issue of *Progress in Physical Geography* in 2001. See our website for more information: <http://www.cpes.susx.ac.uk/igu>.

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International Union of Geological Sciences

International Union of Geological Sciences (IUGS), the parent organisation of the IPA, met in Rio de Janeiro in conjunction with the 31st International Geological Congress. The following new officers were elected:

President: Dr. E. F. J. de Mulder (the Netherlands)

Secretary General: Prof. Attilio Boriani (Italy) (re-elected)

Treasurer: Dr. Werner Janoschek (Austria)

Vice Presidents:

Dr. Tadashi Sato (Japan)

Dr. Peter Bobrowsky (Canada)

Councilors:

Dr. H. K. Gupta (India)

Dr. Jane Plant (United Kingdom)

Dr. J-P Cadet (France)

Dr. A. C. Riccardi (Argentina)

Under the sponsorship of the UNESCO/ COGEO-ENVIRONMENT programme, Drs. de Mulder and Bobrowsky along with Dr. Othon Leonardos (Brazil) organised and cochaired a Special Congress Symposium on Environmental Geosciences into the 21st Century. Jerry Brown presented the invited paper 'Permafrost in the 21st Century'. As reported elsewhere, Dario Trombotto organised several oral and poster sessions during the Congress.

The IUGS has developed a strategic plan to face new challenges for the future and President de Mulder set forth his goals to implement the plan. During the Congress; the then current President, Robin Brett, met with representatives of the affiliated organisations. Drs. Brown and Trombotto represented IPA. In order to promote interactions among the affiliated organisations, Brown suggested that the IUGS and appropriate affiliated organisations present reports at the forthcoming international permafrost conference in 2003. Additional information on the Congress and the IUGS can be found on the web site and in the current issues of Episodes: <http://www.31igc.org>.

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Global Mountain Biodiversity Assessment

The First International Conference on Global Mountain Biodiversity Assessment (GMBA) was held at Rigi Kaltbad in Switzerland, 7-10 September, 2000. Participants consisted of about 200 biologists, environmental scientists and geographers. A wide range of topics and papers were presented and discussed covering biodiversity in the mountainous regions of the world and the effects of human activities on the indigenous plant and animal population.

Permafrost and biodiversity were discussed by Stuart Harris. He reported that the vascular plant species in the mountains of southwestern Alberta,

Canada represent the effects of pronounced mixing of floras from the Arctic, Beringia, Circum-Atlantic, and the Cordillera during cold, non-glacial events, e.g. mid- and early-Wisconsin events, followed by annihilation of most of the local flora by ice during the Late Wisconsin glaciation. The present flora has recolonised the area from isolated nunataks, Beringia, and the south.

Additional meetings are planned and those in the tropical Andes show the most promise of involving permafrost problems. A workshop on the Global Observation Research Initiative in Alpine Environments (GLORIA) was convened during the Conference. More Information on GLORIA is available at: <http://www.pph.univie/ gloria/ gloria.html>

Stuart Harris (harriss@acs.ucalgary.ca)

The International Symposium on Ground Freezing and Frost Action in Soils 2000

The symposium was held in Louvain-la-Neuve (Belgium), 11-13 September 2000. This conference was a joint arrangement between the 9th International Symposium on Ground Freezing and the 4th International Symposium on Frost in Geotechnical Engineering. Six topics were developed: heat and mass transfer, frost susceptibility and frost heave, mechanical properties, environmental soil freezing, engineering design and case histories. More than 65 people from 15 countries have participated. 37 papers have been presented orally and also four keynote lectures by A. Instanes (Norway), A. Frolov (Russia), J.M. Konrad (Canada) and Ma Wei (China). The proceedings of the conference have been published by Balkema (The Netherlands).

Jean-François Thimus (www.gc.ucl.ac.be)

The Second International Conference on Contaminants in Freezing Ground

The Conference was held in Cambridge, 2-5 July, 2000, organised by the Scott Polar Research Institute and the Geotechnical Science Laboratories of Carleton University, Canada. Eleven countries were represented, with large groups from USA, Canada and Russia, and from Australia and New Zealand. Thirty-three papers were presented in plenary sessions, poster sessions or workshops and the Proceedings are being published as special issues of two refereed journals together with a supplementary volume (<http://www.freezing-ground.org>). Particularly noteworthy were the advances in bioremediation since the first Cambridge conference in 1997. The previously little-known behaviour of psychrotropic organisms (in permafrost they survive over extraordinary periods of

time) and their ability to break down contaminants in thawed ground is the subject of research and development which has already demonstrated the cost-effectiveness of the techniques. Other topics included current remediation practices generally, the role of remote sensing in detecting the extent and effects of contamination on terrain, and microscopic level examination of contaminant behaviour in soils. It is clear that contaminant remediation in freezing ground necessitates a full understanding of the permafrost and the seasonally-freezing layer.

The Conference was sponsored by INTAS (European Union), the European Research Office of the US Army, the Canadian Polar Commission, BP Amoco, Anglo-Siberian Oil Co. and a number of consulting companies. Following the invitation of the Premier of Tasmania to hold the Third Conference in Hobart, preparations are underway. It is expected this meeting, while covering both Polar regions will also examine problems of the cold regions of Asia.

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Publications

CD-ROM 7th International Permafrost Conference on Permafrost, Yellowknife

This CD-ROM contains all the 188 papers from the "Permafrost, Seventh International Conference, Proceedings, Yellowknife, Canada, A.G. Lewkowicz and M. Allard (editors), Universite Laval, Centre d'etudes nordiques, Collection Nordicana, No 57, 1276 p", and the extended abstracts that accompanied the poster presentations at the Conference. The format of these 60 abstracts is the same as in the volume entitled "Programs, Abstracts and IPA reports" that was distributed to participants at the Conference in Yellowknife. ISBN 2-920197-58-4. The CD-ROM price is US\$10, and it can be ordered from Centre d'etudes Nordiques, Universite Laval, Pavillon Abitibi-Price, Sainte-Foy, Quebec, G1K 7P4, Canada. Email contact: cen@cen.ulaval.ca.

Permafrost and Periglacial Processes

IPA members can subscribe to this journal and receive the four annual issues for a special personal annual rate of US\$80. Contact James Martin, John Wiley & Sons, Baffins Lane, Chichester, P019 1UD, UK. More information on this journal at <http://www.inter-science.wiley.com>.

Earth Cryosphere

This journal publishes original reports of theoretical and methodological nature on the problems of the Earth Cryosphere in four issues each year. Topics include frozen ground, snow and ice related to: new data on the structure of various parts of cryosphere and characteristics of cryogenic formations, their evolution, problems of cryogenesis, methods and results of modelling of cryospheric components, problems of the methodology of studies of the Earth and other planets' cryosphere. The journal also publishes reviews, critical articles, chronicles the most important scientific events, and advertisements. Papers in non Russian languages are accepted and published in Russian. Contact Dr. S.M. Fotiev, Journal Editor, for manuscript specifications and special subscription rates at : 11731, Moscow, ul. Fersman street 11, building 2, room 68. Consolidated Research Council on the Earth Cryology of the RAS. Phone number (095) 124-54-22. Fax: (095) 135-65-82. E-mail: kriozem@glasnet.ru.

Principles of Isotope Geocryology and Glaciology

Yurij K. Vasil'chuk and Vladimir M. Kotlyakov have published a comprehensive textbook called 'Princi-

ples of Isotope Geocryology and Glaciology'. The price of the book in hard cover is US\$60. It can be ordered from M.V. Lomonosov, Department of Cryolithology and Glaciology, 119899 Moscow, Moscow State University.

This textbook presents the main principles and applications of stable and radioactive isotopes to the study of glaciers and ground ice. It includes a variety of topics: the basic principles of stable and radioactive isotope study in the cryosphere, the preservation of ice records and measurement techniques. It describes the relationship of isotope fractionation and isotope composition with the temperature of precipitation for glaciers and ground ice and then uses these principles to explain cryospheric processes. It considers the records of ice cores from the Greenland and Antarctic ice sheets, ice caps of the Arctic Islands and a number of mountain glaciers. Reference cross-sections for ice-wedges and massive ice of Late Pleistocene and Holocene age throughout Siberia and North America are presented together with numerous diagrams and data tables. Modern research methods of radioactive isotope application for ground and glacier ice dating are discussed.

Cryogenic Formations in the Earth's Lithosphere

V.P. Melnikov and V.I. Spesivtsev have published this graphic version book, which has both a Russian and an English part. Novosibirsk: Scientific Publishing Center of the UIGGM, Siberian Branch of the RAS, Publishing House, Siberian Branch of the RAS; 2000. ISBN 5-7692-0267-X.

The book is based on materials collected during many years of field geocryological studies in various regions of Russia, including the shelf of the Arctic (Barents, Kara and Laptev) seas. The book considers extensive data on the cryogenic structure of sedimentary layers of the upper part of the lithosphere and discusses cryotic physico-geological processes and phenomena and their dependence on geological, geomorphological, cryogenic, climatic and other factors. Much attention is given to the cryogenic structure of the eluvium (its surface, deep and bottom parts) and also to distinctive features of the structure of the offshore shelf cryolithozone, including coastal areas and islands of the Laptev Sea. The price of the book is US\$60. It can be ordered from the Russian Federation, 625000 Tyumen, P.B. 1230, Earth Cryosphere Institute of Siberian Branch of Russian Academy of Sciences, tel/fax: (3452)-251153, e-mail: an@ikz.tmn.ru. Contact person Victor An, Scientific Secretary.

Forthcoming Meetings

2001

31st International Arctic Workshop

22-24 March, Department of Geosciences and Climate System Research Center, University of Massachusetts, Amherst, USA. Contact Information: Julie Brigham-Grette (brigham-grette@geo.umass.edu) or Ray Bradley (rbradley@geo.umass.edu).

1st European Permafrost Conference

26-28th March, Consiglio Nazionale delle Ricerche, Roma, Italy. The Conference is sponsored by: the International Permafrost Association, the IGU Commission on Climate Change and Periglacial Environments, and the European Commission. Over 175 abstract were received according to the following permafrost science and engineering topics:

- Permafrost thermal monitoring in the context of changing global climate.
- Rock glaciers.
- Distribution modelling of mountain permafrost.
- Past, present and future permafrost conditions in Europe.
- Coastal permafrost.
- Permafrost hazard assessment in the context of changing global climate.

An abstract volume will be available at the Conference. The Conference includes keynote papers, oral presentations and poster sessions. The IPA Executive Committee and a number of Working Parties will meet during the Conference to discuss their progress and plans. A post-conference field excursion features a geomorphological transect through the Apennines to view past periglacial features (stratified slope deposits, climatically-related terraces), palaeosols, Holocene evolution of rivers, travertine dams, large scale landslides, deep-seated gravitational slope deformations, active tectonics among other features. Conference details and registration form are available on the PACE site <http://www.cf.ac.uk/uwc/earth/pace/> or from Charles Harris (harrisc@cardiff.ac.uk) or from Francesco Dramis (dramis@uniroma3.it).

The Arctic Science Summit Week

22-29 April, Iqaluit, Canada. Organised by the International Arctic Science Committee (IASC), <http://www.iasc.no/>.

Conservation and Transformation of the Matter and Energy in the Earth Cryosphere

1 - 5 June 2001, Pushchino, Russia. Institute for Physical-Chemical and Biological Problems of Soil Science, Russian Academy of Sciences. Contact David Gilichinsky: gilichin@issp.serpukhov.su.

Second Russian Conference on Geocryology

6-8 June, Moscow State University, Vorob'evy Gory, Moscow, Russia. The conference will be devoted to the most recent projects in various fields of geocryology. Publication of the accepted papers that contain original research data is planned before the conference. The following topics will be included at the conference:

- Physics, chemistry and mechanics of frozen ground.
- Lithogenous Geocryology.
- Dynamic Geocryology.
- Regional and Historical Geocryology.
- Permafrost Engineering.

Additional information on this conference is available by e-mail from the Organising Committee at: Dr. Evgeny Chuvilin, chuvilin@geol.msu.ru, phone: +7(095) 939-19-27 Dr. (Mrs.) Nina Trush, cryology@geol.msu.ru, phone: +7(095) 939-49-19 Fax: +7(095) 939-49-65.

The 11th International Offshore and Polar Engineering Conference (ISOPE-2001)

17-22 June, Stavanger, Norway. For more information visit: <http://www.isopec.org>.

Third International Conference on Cryopedology

20-24 August, University of Copenhagen, Denmark. The Conference, entitled Dynamics and Challenges of Cryosols, focuses on a series of topical sessions and invited papers on cryosols including carbon storage and cycling, active layer dynamics, cryogenic processes, soil ecology, palaeosols, anthropogenic impacts, and databases. In addition to an abstract volume, a special issue of a scientific journal is planned. More details on this Conference in the Danish National report in this issue.

A post-Conference field trip to Finnish Lapland, 25-31 August, will focus on frost-affected soil. For further information and registration form contact the local organiser Bjarne Holm Jakobsen (bhj@geogr.ku.dk) or consult <http://www.geo-gr.ku.dk/cryosol>.

Fifth International Conference on Geomorphology

22-28 August, Chou University, Tokyo, Japan, convened by the International Association of Geomorphologists (IAG).

IPA is co-organising two sessions during the main conference and a post-conference field trip on permafrost and periglacial geomorphology. The sessions are a general session on "Glacial and periglacial geomorphology" and a symposia on "Glaciation and periglaciation on Asian high mountains". All scientists working with glaciers, permafrost and cold climate landforms on Asian mountains (Himalaya, Tibet, Tien Shan, coastal high mountains, and compari-

son with other areas, etc.) are welcome to talk in the symposia.

The post-conference field trip (B7, Alpine geomorphology in central Japan, 29 August-3 September, start and end in Tokyo) illustrates the geomorphological features of high mountains in central Japan. The provisional programme is as follows.

Days 1-3, Mt. Tateyama, Northern Japanese Alps. Topics include the distribution of mountain permafrost and inactive rock glaciers, interaction between an ice patch and permafrost, protalus rampart, the influence of volcanism on the Late Pleistocene glaciation, a large earthquake-triggered rock avalanche and neotectonics.

Days 4-5, divided into two parties. Party A (for hard walkers): Akaishi Mountains, Southern Japanese Alps. Topics include automated monitoring of periglacial slope processes (frost weathering, heave and solifluction), inactive and fossil rock glaciers, gravitational spreading and large rock avalanches. Party B (for normal walkers): Kamikouchi, Northern Japanese Alps. Topics include debris flows and interaction between geomorphological processes and vegetation dynamics along a mountain stream.

Day 6, Mt. Fuji. Topics include ice caves in lava flow deposits and permafrost distribution on a high volcano.

An option will be arranged for people attending the IPA-sponsored meeting in Mongolia. They will leave the field trip on Day 3 (31 August) and move by train to Osaka. Those who want this option, please contact N. Matsuoka. For more information see the ICG home page (http://wwwsoc.nacsis.ac.jp/jgu/icg_hopa/indexicg.html). Contact address:

Norikazu Matsuoka, Institute of Geoscience, University of Tsukuba, Ibaraki 305-8571, Japan, e-mail: matsuoka@atm.geo.tsukuba.ac.jp.

International Symposium on Mountain and Arid Land Permafrost, Mongolia

2-6 September, Ulaanbaatar, Mongolia. The objectives of the symposium and field trips are to provide an opportunity for researchers and engineers concerned with permafrost conditions in mountain and arid land regions to discuss and exchange their achievements and experiences, to observe permafrost conditions in Mongolia, and to discuss and plan future mapping, monitoring and other regional programmes in Asia. The Symposium and the two-day field trip is organised under the auspices of the International and Mongolian Permafrost Associations and the Institute of Geography, Mongolian Academy of Sciences (MAS) with the collaboration of a number of sponsors. The official language is English with approximately 20 oral presentations, roundtables and poster sessions

planned in the course of the three-day technical programme. An optional six-day field trip to north central Mongolia following the symposium is limited to 12 participants. A detailed programme, route maps and registration information have been mailed to many potential participants and are available via email from the Conference Secretary Dr. N. Batnasan at geodgv@magic-net.mn. Deadlines for pre-registration and abstract submission are April 1, 2001.

2002

11th International Conference on Cold Regions Engineering

'Cold Regions Impacts on Transportation and Infrastructure' May 20-22, 2002, Anchorage, Alaska, U.S.A. Submit paper abstracts by March 2, 2001 to: Kelly Merrill, CH2M Hill, Suite 601, 301 West Northern Lights Boulevard, Anchorage, Alaska 99503, U.S.A. Phone 1 907-276-6833; ext202; email: kmerrill@ch2m.com.

2003

8th International Conference on Permafrost

21-25 July 2003, University of Zürich, Switzerland: The first announcement for the conference has been issued by the Swiss Organizing Committee (enclosed in this issue). Conference topics will cover all major fields concerning the scientific, engineering and technical problems related to frozen ground. Special emphasis will be upon fields which require intensified research such as slope processes and natural hazards in mountain areas, effects of past and future climate change, and interactions between snow, surface ice, water, vegetation and permafrost. A programme of oral and poster presentations, IPA Council and working group meetings, and public presentations and evening events are planned. The conference centre at the University of Zurich is close to the centre of town and can easily be reached by international transportation. A half-day mid-week excursion will take conference participants through 'Zurich by Ice' and possibilities will exist to look at centrifuge modelling facilities. Short two-day field trips will provide an opportunity to visit sites of ongoing research in mountain permafrost of the Upper Engadin. Extended field trips will examine important European sites of Pleistocene permafrost as well as present-day permafrost in the Alps, in Scandinavia and in the Arctic (Svalbard).

The Conference Proceedings will be concentrated in one single volume. Submission of abstracts is scheduled for the end of the year 2001 and submission of papers for summer of 2002. An editorial board of

European specialists will be assisted by a system of international reviewers as nominated by the adhering bodies of the IPA. Attempts will be made to review regional contributions by an international as well as a regional reviewer. Primary responsibility for the Conference organisation is with Wilfried Haerberli, University of Zurich (scientific programme) and Sarah Springman, Federal Institute of Technology Zurich, (engineering programme). Kaare Flaate (Oslo) chairs the IPA Conference Advisory Committee.

A First Circular is planned for Spring 2001 and a second one for Autumn 2002. The circulars will contain detailed information about registration, hotel bookings, and field excursions. Consult the Conference web site for further information: <http://www.geo.unizh.ch/ICOP2003>, or contact the Conference organisers: Prof. Wilfried Haerberli (haeberli@geo.unizh.ch) or Prof. Sarah Springman (springman@igt.baug.ethz.ch).

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December 2000

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

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

CAPS CD-ROM:

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

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

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

Cirumpolar Active Layer Monitoring:

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

Permafrost and Climate in Europe (PACE):

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

Global Terrestrial Network on Permafrost (GTN-P):

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

Arctic Coastal Dynamics (ACD) Initiative:

<http://www.awi-potsdam.de/www-pot/geo/acd.html>

Periglacial Environments and Processes (IGU Commission and IPA Working Group):

<http://www.cpes.susx.ac.uk/igu>

Back Cover: *Alphorn concert at the front of Macun rock glacier, Engadine, Swiss Alps. First of August is the Swiss national holiday and Alphorn music is usually heard in many places during that day. This summer, however, a special celebration took place at Macun, because the region of the lakes and rock glaciers of Macun became part – and indeed constitutes the first enlargement since its establishment – of the Swiss National Park. Representatives of the federal and cantonal governments as well as of the community of Lavin were present at the ceremony. They spoke to several hundred guests at the very front of Macun rock glacier, which was first investigated by Dietrich Barsch in the late 1960s. In fact, the seismic refraction soundings and geodetic velocity measurements at this site had marked the beginning of modern research on Alpine permafrost. The traditional Swiss Mountain sound highlighted the ceremony of August 1st, 2000, and the rock glacier was friendly enough to refrain from throwing rocks at the participants. Photograph by Wilfried Haerberli.*

