FROZEN GROUND

The News Bulletin of the International Permafrost Association

Number 19, June 1996

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 multi-national 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 22 adhering bodies having interests in some aspect of theoretical, basic and applied frozen ground research, including permafrost, seasonal frost, artificial freezing and periglacial phenomena. Working groups 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, in 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. The seventh is planned for Yellowknife, Canada, in 1998. Field excursions are an integral part of each conference, and are organized by the host country.

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Cover: Needle ice on horizontal ground near Curitiba, Brazil. The lens cap in the lower left is 6 cm in diameter. (Photograph No. PK 19,444 by Troy L. Péwé, July 17, 1975.) See the back cover for another needle ice photograph and the inside of the back cover for more information on the photographs and on needle ice in general.

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THE NEWS BULLETIN OF THE
INTERNATIONAL PERMAFROST ASSOCIATION
NUMBER 19 • JUNE 1996

Frozen Ground, the News Bulletin of the International Permafrost Association, is published semi-annually. The IPA is a non-governmental association of national organizations representing 22 countries or groups of countries. The success of the bulletin depends upon the willingness of IPA participants to supply information for publication. Submission deadlines are 1 May and 1 November. Please ensure that working group and member country reports are submitted in good time for publication. News items are also very welcome from any IPA participant or others, as are interesting photographs for the cover (please furnish 8"×10" glossy prints). To submit news items or photos please contact the appropriate individual listed on page 35, or the Secretary General.

Frozen Ground is compiled by Jerry Brown with the assistance of Alan Heginbottom of the Editorial Committee. Production is courtesy of the Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, USA. Copies of *Frozen Ground* are available in Canada from Alan Heginbottom, Geological Survey of Canada, 601 Booth Street, Ottawa K1A 0E8; in Russia from the Consolidated Scientific Council on Earth Cryology, Vavilov Str. 30/6, 117982 Moscow; in the United States from Jerry Brown, P.O. Box 9200, Arlington, Virginia 22219-0200; and elsewhere from Council members.

Executive Committee Report

The cover photographs demonstrate one extreme in the freezing processes that occur at the atmosphere/ground interface. The life cycle of needle ice spans a matter of hours. At the other end of the time spectrum is permafrost occurrence in the dry valleys of Antarctica, possibly preserved for tens of millions of years. Seasonal frost dominates vast regions of the populated Northern Hemisphere. These diverse conditions and related processes and effects define many of the IPA's spatial, temporal, and thematic interests.

Over the past three decades, the six international permafrost conferences have provided a major arena in which to explore the many-faceted scientific and engineering aspects of permafrost and seasonally frozen soils. The seventh conference takes place in less than two years in Yellowknife, Northwest Territories, Canada. Although it will reflect many of the same interests as previous conferences, changing times require new approaches as to how we organize, report and synthesize our expanding knowledge.

Over the next two years the Executive Committee and the working groups will be preparing for their participation in the Yellowknife conference. Working groups will be completing their ongoing activities as reported in previous issues of *Frozen Ground*, organizing special conference sessions, and proposing new working groups and activities. The Executive Committee, at its meeting in Lanzhou this August, will consider suggestions to increase its membership from four to seven or eight, thus expanding representation within the IPA and with other organizations. Other restructuring may include creating a standing committee to ensure continuation of the IPA data and information functions.

Since the last permafrost conference in China, we have seen a dramatic increase in the number of national and international meetings and an even more dramatic change in technologies for disseminating information. By the end of 1996 there will have been three major national permafrost meetings (two in Russia and one in China) and several major international conferences; similar numbers are scheduled for 1997 and 1998. Electronic mail, CD-ROMs and other digital technologies are providing new methods for communicating and transferring knowledge. The initial IPA WWW site effort has met with success. If our readership and membership agree, we may expand the information on the site and thus reduce the frequency of publication of the print version of *Frozen Ground* to a single issue each year. The new permafrost map, the multilanguage glossary, and initial products from the Global Geocryological Database (GGD) will be available soon in digital and paper forms.

At the same time we recognize the need for continuing traditional means of communication and cooperation. This year IPA plans to formalize its affiliation with a number of international organizations. We are now an affiliate of the Arctic Data Directory organized under the leadership of the Global Resource Information Database and the International Arctic Science Committee. We plan to officially affiliate with the International Geographical Union during its Congress in the Hague in August. Similar discussions for cooperation or affiliation are ongoing with the International Association of Geomorphologists, the International Society of Soil Mechanics and Foundation Engineers, and the International Symposium on Ground Freezing. There are several joint activities with the International Society of Soil Science. To demonstrate these involvements and linkages with other international scientific and engineering organizations, IPA officers and working group members will participate over the next several months in conferences in Columbus (Ohio), the Hague, Harbin, Beijing, Lanzhou, Fairbanks, Victoria and Wyoming (see page 33 for the complete titles and dates of these meetings). This expanded issue of *Frozen Ground* presents information from IPA members and working groups for the benefit of those attending these important conferences.

Results of these and many other activities will be reported on at the Yellowknife conference. The IPA Executive Committee encourages its members, international organizations and individuals to participate in the 7th International Conference on Permafrost.

IPA Web site:
http://www.geodata.soton.ac.uk/ipa

7th International Conference on Permafrost Web site:
http://www.emr.ca/gsc/permaf_e.html (English)
http://www.emr.ca/gsc/permaf_f.html (French)

News from Members

Recent reports (*Frozen Ground* No. 17 and No. 18) can be accessed through the IPA WWW home page: http://www.geodata.soton.ac.uk/ipa

Argentina

A proposal for global change research with the following objectives was prepared and submitted to the Inter-American Institute for Global Research (IAI) :

- Search for evidence of global change in Andean permafrost
- Study the structure and composition of cryogenic mesoforms
- Identify regional and bihemispherical palaeoclimatic evidence of permafrost.
- Investigate the relation between cryogenic subsoils and discharge of mountain rivers

It is proposed that two boreholes near Mendoza and two in the Andes on the Chile-Bolivia border be cored and instrumented. The exact sites will be chosen on the basis of accessibility within the area of permafrost. The drillholes will be at least 20 m deep and instrumented with thermistor cables. The cores will be described and the ice content/moisture content noted and measured. Standard instrumentation used in North America will ensure that the results are obtained by comparable methods in both hemispheres. Each site will be equipped with an automatic weather station and data loggers capable of operating for one to two years. The data will become part of the IPA Global Geocryological Database (GGD), and sites will be integrated into the proposed Global Terrestrial Observing System (GTOS) cryosphere measurement program and the Circumpolar Active Layer Monitoring (CALM) program. If successful, the proposal will enable us to expand the network for monitoring mountain permafrost temperatures to both North and South America.

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Canada

From time to time, the Canadian Organizing Committee for the 7th International Conference on Permafrost (June 1998) will use this column in Frozen Ground *to present background information on the conference program and on the conference site, the City of Yellowknife, NWT. This is the first of these reports.*

Yellowknife—the site of the 7th International Conference on Permafrost—is a bustling city of 17,000 situated on the shores of Great Slave Lake, in the southern part of the Northwest Territories of Canada. At latitude 62°28′ north, it is about 960 km (600 miles) north of Edmonton (the site of the 3rd International Conference on Permafrost in 1978) and 440 km (275 miles) south of the Arctic Circle. The highway from Edmonton, opened through to Yellowknife in 1960, crosses the Mackenzie River at Fort Providence by means of a ferry in summer and an ice-bridge in winter. The road is open year round except for periods of a few weeks at the time of break-up and freeze-up of the river ice cover each spring and fall. The road distance from Edmonton is 1530 km (950 miles).

Yellowknife is located in an area that is typical of the Precambrian Canadian Shield. The local topography is generally flat, with many rock outcrops and small hills throughout the area. The region is dotted with innumerable lakes, and much of the land surface is covered with muskeg (peatland). Trees are small and predominantly spruce and pine, with birch and poplar stands found in valleys and on the occasional sand plains.

The overburden of glacial, fluvial or lacustrine deposits is shallow in most areas, but there are exceptions. In one place, drilling indicated a thickness of more than 130 m. In other areas around the townsite, drilling has revealed several tens of meters of gravels and sands overlying thinly stratified lake clays. In the townsite area the most significant glacial deposit is sand, representing outwash reworked by the waters of Great Slave Lake when it stood at a higher level. In places, former strandlines at elevations up to 80 m above the present level of the lake indicate former lake levels.

Permafrost in and around Yellowknife is widespread but not continuous, and extends to depths of more than 50 m in some areas. It does not occur in the exposed bedrock but is found where the rock is covered by overburden. Its greatest extent is in muskeg areas supporting spruce and sedge vegetation, where the active layer is about 1 m thick, and with mean annual ground temperature of –1° to –2°C. Little information is available on ground ice. Massive ice some tens of centimetres thick and thin ice lenses are found in many pockets of silt and clay. Quite extensive exposures of ground ice can be seen from time to time in the open pits at Giant Mine. Thin ice layers have also been observed at depth in bedrock fissures. In most areas of dry or well-drained sand or gravel, permafrost is usually not of major significance. Where ice-rich, fine-grained soils are encountered, however, major engineering problems arise.

The city of Yellowknife is named for the Yellowknife Dene (Indians). The name Yellowknife first appeared in Samuel Hearne's journal of his travels from Churchill to the Arctic coast for the Hudson's Bay Company in 1771. Hearne named the people inhabiting this area the Yellow-

knife Indians because he found them using knives and utensils of pure copper. Archeological evidence indicates the area has been occupied for over 2000 years. Peter Pond opened a fur trading post at Yellowknife Bay in 1786, which remained active until the 1820s.

Gold was first noted in the area in 1896, by miners on their way to the Klondike, but there was no staking rush because of the remoteness of the area. Hundreds of prospectors flooded into the area in the 1930s, however, following the discovery of pitchblende (uranium ore) at Great Bear Lake, and the gold at Yellowknife was rediscovered. By 1936, Yellowknife was a boom town, with two mine shafts being sunk. Commercial gold production began in September 1938, when a 72-pound (33-kg) gold brick was poured at the Con Mine. The gold mining industry continued to develop until, in 1942, there were six producing mines in the area, with an average annual production of about 100,000 fine ounces (3 tonnes). Gold mining is still a vital industry in the economy of Yellowknife. Also beginning in the 1930s was the era of the famed "bush pilots" who opened up the Canadian north to prospectors, miners and developers. Yellowknife was an early center of operations for bush planes; these were mainly float planes, at least in the early years. Air operations were centered on the Back Bay and Old Town areas, and a monument to the bush pilots was erected on The Rock in the Old Town in 1967. Along with the aircraft operations, Yellowknife developed into a center for support and expediting for prospectors and miners, a function which is still very important. The latest mineral target in the western part of the Canadian Shield is diamonds, with several good prospects under active exploration and development.

In 1967, Yellowknife was named the capital of the Northwest Territories. For many years the legislature met in the ballroom of the Explorer Hotel, which will be the main headquarters for the permafrost conference. Recently, a fine new Legislative Assembly Building has been erected across the road from the Explorer Hotel and near the NWT's principal museum, the Prince of Wales Heritage Centre.

Today Yellowknife is a thoroughly modern city, with all the facilities one would expect — museums, hotels, motels, restaurants, shops, banks, regular air service, etc. It is also a "small town" in the best sense of the idea, a town where people can and do know their neighbors. The permafrost conference is being planned to use space in the two main hotels in the town, plus other space as necessary. A local field excursion is being planned to provide all conference participants with an opportunity to see permafrost conditions in the city and its vicinity and how they affect the city's development. An accompanying persons program is being developed to make the best use of the facilities in Yellowknife and the hiking, fishing, picnicking and other opportunities in the surrounding wilderness area.

Other News

Branko Ladanyi, Professor of Civil Engineering at École Polytechique de Montréal, has received the 1995 Northern Science Award. The award is presented annually by the Minister of Indian Affairs and Northern Development to an individual who has made significant contributions to knowledge and understanding of the Canadian North.

The Cold Regions Division, Canadian Geotechnical Society, has a new executive, as of January 1996. The members are Elisabeth Hivon, EBA Engineering Consultants Ltd., Edmonton (chair); Kevin Biggar, Department of Civil Engineering, University of Alberta, Edmonton; Scott Dallimore, Terrain Sciences Division, Geological Survey of Canada, Ottawa; and Alan Hanna, AGRA Earth and Environmental Ltd., Calgary, Alberta.

Submitted by J. Alan Heginbottom
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China

The Project, Research on Changes in Cryosphere Dynamics in China (second stage) has begun. It includes the following subjects:

- Monitoring of cryosphere and information systems in China
- Cryosphere on the Qinghai-Tibet Plateau and a model of its response to global climate change (1:4,000,000), supported by GIS
- A model for predicting the engineering geocryological conditions along the Qinghai-Tibet highway (1:500,000), supported by GIS
- A model for predicting the response of cryosphere to climate change in the Urumqi River basin (1:50,000), supported by GIS
- Present processes of the active layer in the permafrost region of the Qinghai-Tibet Plateau
- Effect of climate change on the environmental engineering–geological conditions of permafrost

In addition, a 50-m-deep ground temperature measuring borehole was established in 1995 in the West Kunlun Mountains, and monitoring of the active layer on the Qinghai-Tibet Plateau and in Northeast China is planned to be carried out according to the method defined in the ITEX manual.

The International Symposium on Polar Ice and Snow and Global Change was held on 14–17 April 1996 at the

Lanzhou Institute of Glaciology and Geocryology. Sixty participants from China, France, Japan, Nepal and the United States attended this symposium. Fifty-six papers were presented and they will be published in a proceedings.

The first issue (vol. 1, 1995) of the journal *Cryosphere*, jointly compiled by the Chinese Society of Glaciology and Geocryology (CSGG) and the Lanzhou Institute of Glaciology and Geocryology (LIGG), was published (see p. 32 for contents). Two volumes of this journal will be published every year starting in 1996. Contact Zhu Yuanlin, Secretary-General of CSGG, to order this journal. The price is US $15.00.

Submitted by Zhu Yuanlin and Cheng Guodong
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Denmark

A long-term monitoring program called Zackenberg Basic was started in 1995 by the Danish Polar Center, in cooperation with scientists from the Institute of Geography, the Institute of Zoology and the Institute of Botany, University of Copenhagen. Zackenberg (74°28′N, 20°34′W) is located in the southern part of the world's largest national park, the National Park in North and East Greenland. Zackenberg Basic has as its primary goal the collection of data on a wide variety of physical and biological parameters from the High Arctic ecosystem. Part of Zackenberg Basic is the GeoBasis Programme, in which permafrost and periglacial processes are being monitored in a 600-km^2 water catchment area. The study area is located in the zone of continuous permafrost. A climate station is logging air temperature and humidity, precipitation, UV-A and UV-B, net radiation and soil temperature at 10 depths from 0 to 150 cm (in the active layer and upper permafrost) every hour and wind velocity and direction every 10 minutes. At a permanent hydrometric station at the main river, Zackenbergelven, water discharge and temperature, amount of suspended sediment in the water and its conductivity and pH are logged. Monitoring of the active layer and the top permafrost layers is also taking place along a transect from sea level to nearly 1000 m asl at four locations: 10 m, 35 m, 400 m and 800 m asl. A profile of small TinyTalk loggers, each with its own thermistor, logs temperature five times a day, and obtains the annual thickness and duration of the active layer. Photomonitoring of several periglacial landforms such as annual and perennial snowpatches and nivation niches, solifluction sheets and lobes, ice wedges, debris islands, rock glaciers, wind-abraded stones, avalanche features, talus slopes and free rock faces is carried out in combination with some measurement programs of the rate of ice wedge growth and solifluction movement. Parts of the program will be supplemented and extended in 1996.

All the data collected by the monitoring program are stored in a GIS related database, which is based on a digital terrain model of the Zackenberg area. This database is located at the Danish Polar Center. A ZERO newsletter and more information on the Zackenberg Basic monitoring program can be obtained in the report Zackenberg Ecological Research Operations, 1st Annual Report, 1995—Danish Polar Center, Ministry of Research and Technology, 64 p. Contact: oh@dpc.dk or hth@dpc.dk.

Hanne Hvidtfeldt Christiansen, Institute of Geography, University of Copenhagen, is the new IPA liaison for the Danish Society for Arctic Technology (SAT) and member of its board. She replaces Henrik Mai, who served in this capacity and as secretary of SAT for a number of years. Mads Bo Bojesen is the new secretary of SAT.

Submitted by Hanne Hvidtfeldt Christiansen
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Finland

The National Frost Committee of the Finnish Geotechnical Society is engaged in a national research project, "The foundation and pavement structures of roads." The goal is to develop a practical procedure for the frost design of roads in Finland. The program, intended to last six years, has just started and is based on national laboratory and field investigations. It is in contact with the U.S. Strategic Highway Research Program LTPP projects.

Submitted by Eero Slunga

France

The paleopermafrost modeling program continues with a drillhole in western France, undertaken by the participating agencies: CNRS, French Geological Survey, Laboratoire Central des Ponts et Chaussées, and the National Agency for Nuclear Wastes. Comparison with field evidence is underway in Normandy (CNRS, Caen) and in Aquitaine (Institut du Quaternaire, Bordeaux).

The paleopermafrost data will be published as a CLIMEX Map at the end of this year under the direction of Jean Dercourt, President of the Commission for the Geological Map of the World (CGMW). Efforts will be made to incorporate additional information from the European Group of Climate Modeling for the Last Glaciation.

At Caen (Centre de Géomorphologie, CNRS) experiments on thermal erosion of the river banks in cold regions (J. Aguirre-Puente and F. Costard) and on the cryoreptation (frost creep) process (C. Harris, Cardiff; J.P. Coutard, Caen) continue. A new program on the genesis of the cryo-

turbations has started (Cardiff, Caen). Field research on the periglacial slope processes (cryoreptation, debris flow) in the mountains is almost completed and publications are in press. The studies on the fossil periglacial deposits of Perigord and Quercy presented at the Symposium Grèzes Litées (September 1994) continue (collaboration Bordeaux, Périgueux, Caen). Michele Evin continues her work on rock glacier hydrology in the French Alps (Ubaye) with Italian colleagues.

The French Polar Institute plans to transform Kerguelen Island (Subantarctic) into a nature reserve.

The French Periglacial Association publishes reports of its activities. The President is Brigitte Van Vliet-Lanoe (Geosciences, Université de Rennes 1, 35042 Rennes Cedex, France), and the Secretary is Monique Forte (Départ. Géographie, Université Paris, Paris VII, 75251 Paris, France).

In May 1995, the Canada-France meeting at Caen, Sols Gelés, Processus Thermophysiques et Géomorphologiques, resulted in 28 communications and one volume of abstracts.

A meeting will be held in Paris 16–17 January 1997 in honor of Andre Cailleux, organized by the French Geological Society, the French Periglacial Group, and the French Geomorphological Group, with a special session on terrestrial and Mars periglacial. The organizer is Francois Costard, Centre de Géomorphologie, Caen (Tel: 33 31 45 5714; Fax: 33 31 45 5757).

Submitted by Jean-Pierre Lautridou
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GERMANY

The principal results of the Geoscientific Spitsbergen Expedition 1990–92 have now been published, mainly in *Zeitschrift für Geomorphologie,* N.F., Suppl.-Bd. 97, 1994. Several papers are of special interest to the permafrost community: patterned ground in the inner Woodfjord area (D. Thannheiser et al.), chemical weathering in high-arctic soils (W.D. Blümel et al.), recent fluvial sediment budgets in glacial and periglacial environments (D. Barsch et al.), the Late Quaternary glaciation history and landscape development (W.D. Blümel et al.), the glacial history (G. Furrer), glaciology and glacial gemorphology (L. King et al.), and evolution and age of shorelines along Woodfjord (H. Brückner et al.). Further work by this large group of polar geographers is focused on syntheses of the chronological results and studies on actual geomorphological processes in the permafrost environment of a catchment area at Liefdefiord, NW Spitsbergen. The development of a geoecological model for this catchment is planned. In addition, permafrost research is done by several geographical working groups, especially at the universities of Giessen, Heidelberg and Regensburg.

The Giessen group has done permafrost prospecting and mapping as well as investigation of mountain permafrost processes in the Zermatt area of Switzerland. This applied research is also focused on the formation and decay of permafrost connected with high mountain construction sites such as railways, cable car stations and buildings (cf. L. King, in *Z. Geomorphologie*, N.F., Suppl.-Bd. 104, 1996).

The Heidelberg group has published the results of a research project concerning the geomorphology and hydrology of the rock glaciers of the Andes of San Juan, Argentina (e.g. L. Schrott, *Z. Geomorphologie*, N.F., Suppl.-Bd. 104, 1996). The research group of R. Dikau and L. Schrott has moved to Bonn and will continue its studies there. Induced by three field campaigns in Spitsbergen (SPE 90–92), a special focus is the study of snowmelt processes and initiation conditions of slush streams (slushflows and slush torrents). A joint group led by D. Scherer (Dept. of Geography, Basel) and D. Barsch and M. Gude worked on this topic in a campaign in spring 1995 in Kärkevagge, Abisko Alps, Swedish Lapland (Modelling of Snowmelt and Its Consequences). The release of a high magnitude slush torrent was monitored with different measurement techniques. Snow cover temperatures were analyzed with a thermal imaging camera, energy fluxes at the snow surface were measured continuously at two sites, and meltwater movements in the snow cover were studied by dye tracer experiments. Accumulation of meltwater in the snow cover in the initiation area of the slush torrent was measured using pressure transducers. The slush torrent was documented on video and in photographs. The results of the studies on Spitsbergen and in Kärkevagge indicate that slush streams are released by a hydrostatic gradient in the saturated snow cover of valley floors. The initiation zone typically has a low gradient. Consequently, slush streams have to be carefully distinguished from avalanches. Further work will be focused on the modeling of meltwater production, movement, and accumulation, which condition the release of slush streams.

At the University of Regensburg, the working group on Periglacial Slope Deposits was established several years ago. The distribution, composition and formation of periglacial slope deposits, which occur throughout the formerly periglacial landscape of the Bavarian Forest, are studied. Major aims of the studies are 1) to unravel the layering of the periglacial slope deposits and their material composition by means of pedochemical and mineralogical characteristics, and 2) to identify the aeolian sediment component. A synthesis of the subdivision and the origin of the periglacial slope deposits in the Bavarian Forest is published in *Annals*

of Geomorphology (Völkel, 1995). Currently, slope sediments, soils and peats in the Bavarian Forest as evidence of climatically induced changes of the landscape during the transition from the Late Glacial to the Holocene are studied. The project is part of the DFG key program on the Change of the Geobiosphere During the Last 15000 Years: Continental Sediments as Witnesses of a Changing Environment and thereby incorporated in the core project Past Global Changes (PAGES) of the International Geosphere–Biosphere Program (IGBP). The aim of the project is to reconstruct the processes and the environmental conditions during the Late Glacial in an upland area in Germany from information preserved in slope sediments, soils and peats, and to outline the significance of the Late Glacial morphodynamics for the development of the post-glacial landscape. A more precise geostratigraphy concerning the morphodynamics of the Late Glacial by means of interstratifications (interbeddings) of slope deposits with peats and by means of absolutely dating the sediments by OSL (Optically Stimulated Luminescence) is planned. In the summers of 1994 and 1995 studies in northwestern Canada to examine the processes and forms in recently frozen ground allow conclusions concerning periglacial slope processes during the Pleistocene in Germany.

In 1995, German–Russian cooperation on the project Late Quaternary Environmental History of the Taimyr/Severnaya-Zemlya Region continued. Its multidisciplinary program aims to provide information concerning the processes in the "permafrost–soil–hydrosphere–biosphere" system, and thus to understand the peculiarities and changes of these processes in the Late Quaternary. The results will also provide understanding of sedimentary and permafrost processes with respect to global change. Several German and Russian institutes are involved, namely the Alfred Wegener Institute for Polar and Marine Research, Potsdam; the Institute of Polar Ecology, Kiel; the Institute for Soil Science, Hamburg; the Arctic and Antarctic Research Institute and the Komarov Botanical Institute, St. Petersburg; and the Department of Geocryology, Moscow State University. From April to November 1995, a total of 30 Russian and German scientists carried out field work on the Taimyr Peninsula. In addition, a short expedition was undertaken to Severnaya Zemlya in order to plan field work in this area for 1996.

The objectives were as follows: 1) Paleoclimate reconstruction using bottom lake sediments: four ice-covered lakes were cored on the Taimyr Peninsula, with a maximum depth of recovered sediment of 23 meters (April to May). 2) Hydrological studies in the active layer, lakes and rivers: field work was carried out in the Levinson-Lessing catchment from snowmelt to the beginning of freeze-back (June to October). 3) Paleogeographical–geocryological investigations of permafrost sequences, mapping of permafrost landscapes, and studies of cryosols, including the decomposition of organic matter and microbiological processes in the eastern part of the Taimyr Lowland at Labaz Lake (July to August). A detailed summary of this German–Russian project will be published in Reports of Polar Research (contact H.-W. Hubberten, Alfred Wegener Institute for Polar and Marine Research, Telegrafenberg A43, 14473 Potsdam, Germany; E-mail: hubbert@awi-potsdam.de).

Submitted by Lorenz King

Japan

In January 1996, the Fourth Symposium on Joint Siberian Permafrost Studies Between Japan and Russia was held at Sapporo. At the meeting, attended by 60 participants, 30 papers were given dealing with the results of the previous summer's field program. In addition to papers, V.N. Konishchev, Moscow State University, visiting professor at the Institute of Low Temperature Science, presented a special report on the genesis and occurrence of the Edoma ice complex in Siberia. The proceedings of this meeting have been published and are available from the convener of the meeting, Masami Fukuda.

In summer 1996, three groups from Japan will conduct field studies in Siberia. The permafrost group, headed by M. Fukuda, will conduct field studies on the genesis of the Edoma ice complex on the New Siberian Islands with V.V. Kunistky and M.N. Grigoriev, Melnikov Permafrost Institute, Yakutsk. The biology group from Hokkaido University will conduct field work in the taiga and tundra regions of east Siberia, cooperating with the Yakutsk Biological Institute. A group from the Institute of Forest Research will also conduct joint field studies with the Yakutsk Biological Institute. Greenhouse gases over Siberia will be monitored by the Environmental Institute using charter aircraft to trace gas concentration in west and east Siberia.

A new group, IGBP-NES (Northern Eurasian Study), is being established in Japan. In November 1995, an international meeting on IGBP-NES was held in Tsukuba, Japan. During the meeting, a transect study related to the carbon budget in Siberia was discussed. Two transect lines were recommended, one along the Lena River and another along the Yenisey. Following this recommendation, the new group of IGBP–NES Japan is to establish a concrete action plan in 1997. The convener of IGBP–NES Japan is Gen Inoue, Institute of Environment; E-mail: inouegen@ nies.go.jp.

Submitted by Masami Fukuda
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KAZAKSTAN

The Laboratory of Geocryology of the International Center of Geoecology of Mountain Countries in Arid Regions (ICGM) carried out studies on monitoring of permafrost and the thermal regime of the active layer in northern Tien Shan. The laboratory continued to study cryogenic processes, movement of solifluction, rock glaciers, frost heave on the thufur area, and the mapping of permafrost and associated phenomena in the Zailiisky Alatau Range. In 1996 the monograph Geocryological Conditions of the Tien-Shan and Pamirs by A.P. Gorbunov, E.V. Seversky and S.N. Titkov was prepared for publication.

The Laboratory of Glaciology continues to work on the theme Monitoring and Forecast of Fluctuations of the Glacial Systems in the Mountains of Kazakstan. Year-round observations on winter and summer precipitation, accumulation and ablation of snow and ice, movement of ice, and the ice surface have continued on the experimental glacier Tuyuksu in the Zailiisky Alatau. Research at the Shumsky and Muravlev glaciers in Dzhungarsky Alatau resulted in a number of papers co-authored with the University of Wisconsin and showed the dynamics and mass exchange of the glaciers in connection with climate features for 25 years of observations.

The Laboratory of Snow Cover and Avalanches was renamed the Laboratory of Geoecological Problems of Mountain Territories. During the winter of 1995/96 observations on snow cover and avalanche activity were carried out. I.V. Seversky took part in the International Conference on Ecohydrology of High Mountain Areas in Kathmandu, Nepal, where he submitted a report, Distribution of Snow Cover in the Mountains of Central Asia. V.P. Blagoveshchensky presented a report, Estimation of Avalanche Risk, at the conference Mountains and Man held in Barnaul in March 1996.

In August 1996, ICGM intends to arrange an expedition to the Inylchek Glacier, Central Tien Shan, along the route of G. Mertzbacher, who reached this area more than 90 years ago. Scientists from Germany, Austria and Poland are expected to take part. Included will be observations on ecology, glaciology and geocryology in Central Tien Shan. The contact person is V. Popov. E-mail is the same for the Institute of Geography and ICGM.

Submitted by A.P. Gorbunov and
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MONGOLIA

The Mongolian National Permafrost Association is pleased to acknowledge its membership in the International Permafrost Association. Mongolian geocryologists express their appreciation to the IPA Council and its officers.

In 1995, geocryological field work was carried out on the Khan Khentei protected area, an area of more than 12,000 km^2 that embraces the Khentei Mountains. As a result of these and previous studies, maps at 1:500,000 of permafrost, seasonal freezing and thawing ground, and the distribution of cryogenic processes and phenomena have been prepared by N. Sharkhuu, D. Tumurbaatar and R. Lomborenchen. According to these maps, large parts of the territory are characterized by continuous permafrost with an average thickness between 50 and 200 m. Average depths of seasonal thaw are 1 to 3 m. There is widespread occurrence of surface icings and stone polygons. Permafrost aggradation associated with climatic change and hydrogeological conditions is observed at several sites.

As a result of geocryological and geothermal research by N. Sharkhuu in the Baganuur mining area in 1976, 1984, 1992-93, and 1995 (prior to and following mining) detailed changes in permafrost conditions have been observed. These results are presented in a chapter (in English) on permafrost and environmental analyses of the Baganuur project. The report includes a permafrost map of the Baganuur coal mining area at a scale of 1:25,000, and gives permafrost assessment, prediction and recommendations for monitoring.

Submitted by N. Sharkhuu

THE NETHERLANDS

The EC-sponsored EPECC project (European Palaeo Environments Climate and Circulation) has been completed. The Free University Amsterdam, the University of Amsterdam, the University of London and the University of Bonn participated. Palaeoclimatic reconstructions of western and central Europe have been done for a number of time slices within the last 130,000 years. Mean summer, winter and annual temperature patterns have been reconstructed. For the last glacial the main contribution for climatic reconstruction was provided by periglacial structures and phenomena, supplemented with information derived from botanical and beetle remains.

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NORWAY

In Svalbard there are several ongoing programs concerning rock glaciers. One project was started by the University of Oslo, Department of Physical Geography, in 1986 in the Ny-Ålesund area, with monitoring of surface movements of the Brøgger rock glacier. The movement is 3–5 cm/year. Another movement monitoring program of two rock glaciers in the Longyearbyen area was started in 1994 by the

UNIS (the University Courses on Svalbard). Preliminary results show a surface creep rate of 8–13 cm/year, with a mean surface temperature of –5° to –7°C. Both programs will be continued. This summer a new rock glacier program will be started by the same department on the northern part of Prins Kals Forland, Svalbard, to calculate volume, form and surface changes of selected rock glaciers through historical time. The program is supported by the Norwegian Research Institute.

Investigation of frost heave phenomena on the runway at Svalbard Lufthaven (LYR), Longyearbyen, was started two years ago by the University of Oslo, Department of Physical Geography, in cooperation with NP, UNIS and Luftfartsverket. High resolution elevation measurements are made several times a year, during thaw and freeze-up periods, to identify problem areas for more detailed studies.

The Norwegian Geotechnical Institute (NGI) in Oslo has continued its research at the Permafrost Station at Sveagruva, central western Spitsbergen. The station was established in 1978. Basic climate and near-surface ground temperature data are logged every hour year-round in addition to manual observations of snow height, thawing depth, and water content of topsoil.

In northern Spitsbergen, hot springs in Woodfjorden will be studied this summer by the Agricultural University of Norway, Department of Soil and Water Science.

A field course in Arctic Geomorphology for graduate and doctoral students will be conducted by the University of Oslo, Department of Physical Geography, in Ny-Ålesund, Svalbard, during the first two weeks of August. The course is part of the Norwegian Net university courses.

Kaare Semneset reports that the University Courses on Svalbard (UNIS) are attended by about 100 students, including foreign students from Sweden, Finland, Netherlands, Russia and the United States. Graduate and undergraduate courses for the 1996–97 academic year include arctic biology, geology, geophysics, and technology. The handbook of studies and application forms are available from UNIS, B.P. 156, N-9170 Longyearbyen, Norway. Tel: 47 79 02 3300; Fax: 47 79 02 3301; E-mail: studadm@unis.no. Their Web site contains updated information: http://www.unis.no.

On the mainland, permafrost research programs are running at Finse in Jotunheimen and at Dovre in southern Norway. A new program will be started in Varanger, northern Norway, this August. The program is run by the University of Oslo, Department of Physical Geography. At Finse a monitoring program of geomorphological features was started in 1995 as part of a Ph.D. study. In Jotunheimen and Dovre mapping of the permafrost thickness has been the main subject. Results are newly published in *Norsk Geografisk Tidsskrift*, vol. 50, no. 1. In Varanger the goal is to investigate the distribution pattern of permafrost for that area.

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POLAND

In 1995, research on permafrost and contemporaneous periglacial processes focused on the following regions: the Polish Antarctic Stations on King George Island; the western coast of Spitsbergen in the Recherche Fjord (Expedition of Maria Curie-Sklodowska University of Lublin); Kaffioyra Plateau (Expedition of Nicolai Copernici University of Torun) and the Polish Polar Station of Hornsund. Research also continued on slope processes in an area where discontinuous permafrost is present on the Kola Peninsula, with the cooperation of Maria Curie-Sklodowska University in Lublin and the Institute of Marine Biology in Murmansk.

In October 1995 the XXII Symposium of the Polar Club of the Polish Geographical Society took place. This was dedicated to Professor Alfred Jahn, eminent geomorphologist and polar scholar (who frequently represented Poland in the IPA), in celebration of his 80th birthday. To commemorate the occasion, a book was published entitled Unity of Arctic and Antarctic Natural Environment containing 20 papers (165 pages, published by the University of Wroclaw). Much of the authors' interests were in the abiotic and biotic elements of the periglacial environment.

In December 1995, a scientific polar session took place in Lublin. Its theme was Contemporaneous and Pleistocene Problems of the Periglacial Zone, and it was organized by the Department of Geomorphology of Maria Curie-Sklodowska University in Lublin and the Permafrost Committee of the Polish Academy of Sciences. This brought forth another publication in the series Geographical Expeditions to Spitsbergen (28 contributions, 240 pages, Maria Curie-Sklodowska University, Lublin).

The journal *Biuletyn Peryglacjalny*, published in Lódz (Societas Scientiarum Lodzensis) and edited by Professor Anna Dylik, made its reappearance. Members of the editing body are: R.O. van Everdingen, J.S. Goździk, G. Hoppe, A. Jahn, L. King, H. Klatkowa, V.N. Konishchev, K. Pękala, A. Pissart, R. Raynal, N.N. Romanovskii, A. Srodoń, and A.L. Washburn. The latest issue (no. 34) is in print, and the next (no. 35) is planned for late 1996. It includes the following problems: morphogenetic periglacial processes of the Quaternary (paleogeographical assessment); contemporary periglacial processes and the reaction of the periglacial environment to anthropogenic forces; problems of terminology, discussion concerning new terms and their correct usage, termi-

nological misuse etc.; and reviews of recent publications. *Biuletyn Peryglacjalny* is published in English (with a French summary) or in French (with a summary in English).

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Russia

During this past year the Russian Academy of Sciences restructured its permafrost organizations. The National Permafrost Committee and the Scientific Council on Earth Cryology were combined into the Consolidated Scientific Council on Earth Cryology. Its chair is Vladimir P. Melnikov. The officers and members of the new council are identified in the accompanying table.

The first annual meeting of the new council was in Pushchino during the International Conference on Fundamental Research of Earth Cryosphere in the Arctic and Subarctic. The conference was organized by the council and was attended by approximately 125 participants, including 10 foreign scientists and engineers. A total of 109 abstracts were published in Russian and English before the conference in a special volume (234 pages).

There were three plenary and three special sessions, two round tables, and a joint session of the IPA Cryosol Working Group and ISSS Cryosol Subcommission. Plenary subjects covered many aspects of geocryology, including paleogeography of the cryolithozone, prediction of permafrost evolution, modeling, monitoring, and interrelationships between components of onshore and offshore cryogenic geosystems. Many problems were discussed at the special sessions:

International Conference on Fundamental Research of Earth Cryosphere in the Arctic and Sub-Arctic (Results and Prospects)
Puschino, 23–26 April 1996

gas emission, gas hydrates, results of experimental and field studies of gas hydrates and greenhouse gas fluxes on land, lakes and shelves of different arctic regions, cryogenesis and soil formation processes, cryosol classification, and periglacial processes.

Members took part in round table discussions on new geocryological databases and a digital map of contemporary geocryological processes of Russia at a scale of 1:7,500,000 (Earth Cryosphere Institute), and prospects for geocryological investigations in the Russian Arctic and Subarctic.

Two draft projects were presented. The first was a program called The Arctic: The Environment and Its Stability, Mineral and Biological Resources, Climate, Hydrometeorological and Geocryological Prediction, by V.P. Melnikov, E.S. Melnikov and F.E. Are. This proposal is under the State Combined Scientific and Technical Program of Russia, entitled Combined Investigations Ocean and Seas; Arctic and Antarctic in 1996–2000. The second was Cryosphere of the Laptev Sea System, A Draft of Prospects for Russian–German cooperation in 1998–2000, by H.-W. Hubberten and N.N. Romanovskii.

Members of the Consolidated Scientific Council on Earth Cryology and Bureau of the Council and principal docu-

Participants in Pushchino conference, April 1996.

Members of the Consolidated Scientific Council on Earth Cryology

President: Melnikov, Vladimir Pavlovich, Corresponding Member, RAS; Director, Earth Cryosphere Institute

Vice-Presidents:
Melnikov, Evgeny Sergeevich, Head, Moscow Branch, Earth Cryosphere Institute, SB/RAS
Romanovskii, Nikolai Nikitich, Vice President, IPA, Professor, Faculty of Geology, Moscow State University
Kamensky, Rostislav Mikhailovich, Director, Melnikov Permafrost Institute, SB/RAS

Science Secretary: vacant

Bureau members:
Balobaev, Veniamin Tikhonovich, Corresponding Member, Melnikov Permafrost Institute, SB/RAS
Gennadinik, Boris Isaakovich, Dr.Sci., Earth Cryosphere Institute, SB/RAS
Gilichinsky, David Abramovich, Candidate Science, Institute of Soil Science and Photosynthesis, RAS
Izrael, Yuri Antonievich, Academician, RAS
Konishchev, Vyacheslav Nikolaevich, Professor, Faculty of Geography, Moscow State University
Kotlyakov, Vladimir Mikhailovich, Academician, Institute of Geography, RAS
Minkin, Mark Abramovich, Director General, National Geocryological Foundation
Perlshtein, Georgi Zakharovich, Professor, Magadan Department, Melnikov Permafrost Institute, SB/RAS
Zalikhanov, Mikhail Chokkaevich, Academician, RAS

Council members:
Alekseev, V.R., Institute of Geography, SB/RAS
Anisimov, O.I., State Hydrological Institute
Are, F.E., Petersburg State University of Transport
Baulin, V.V., Production and Research Institute for Engineering Survey for Construction
Chistotinov, L.B., Igarka Research Laboratory, Melnikov Permafrost Institute, SB/RAS
Cybulsky, V.R., Institute for Problems of Northern Development, SB/RAS
Davidenko, N.M., Earth Cryosphere Institute, SB/RAS
Dubikov, G.I., Production and Research Institute for Engineering Survey for Construction
Duchkov, A.D., United Institute of Geology and Geophysics, SB/RAS
Ershov, E.D., Professor, Faculty of Geology, Moscow State University
Fotiev, S.M., Professor, Retired
Frolov, A.D., Russian State Humanitarian University
Gavrilova, M.K., Yakutian Academy of Sciences
Grave, N.A., Earth Cryosphere Institute, SB/RAS
Grechishchev, S.E., Earth Cryosphere Institute, SB/RAS
Ivanov, V.V., Arctic and Antarctic Research Institute
Ivanov, V.N., Aeroproekt
Khrustalev, L.N., Professor, Faculty of Geology, Moscow State University
Khurshudov, A.G., Nizhnevartovsk Institute of Nature Usage
Kochetkov, M.V., Geological Survey, Russian Federation
Krupinin, N.Ya., Nizhnevartovsk Committee for Nature Protection
Mas'kov, M.I., "Nordeco"
Minailov, G.P. Head, Tynda Research Station, Moscow Transport Construction Institute
Moskalenko, N.G., Earth Cryosphere Institute, SB/RAS
Oberman, N.G., Pechora Department for Geological Prospecting
Odisharia, G.E., All Russian Institute of Natural Gases
Orlov, V.O., Research Institute of Foundations and Underground Structures
Pavlov, A.V., All-Russia Research Institute for Hydrogeology and Engineering Geology
Polyakov, V.A., All-Russia Research Institute for Hydrogeology and Engineering Geology
Sadovsky, A.V., Research Institute of Foundations and Underground Structures
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Sergeev, D.O., Federal Center for Geoecological Systems, "Ecologia"
Sher, A.V., Institute for Evolutionary Morphology and Ecology of Animals and Plants, RAS
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Tseeva, A.N.,Yakutian Branch, Krasnoyarskstroyniiproekt
Velichko, A.A., Institute of Geography, RAS
Voitkovsky, K.F., Faculty of Geography, Moscow State University
Vtyurin, B.I., Professor,Retired
Vyalov, C.C., Moscow Engineering Construction Institute
Zimov, S.A., Institute of Geography, FEB/RAS
Zotikov, I.A., Institute of Geography, RAS
Zykov, Yu.D., Production and Research Institute for Engineering Survey for Construction

SB: Siberian Branch; FEB: Far East Branch; RAS: Russian Academy of Sciences

ments were announced. The council agreed to conduct the next annual international conference in the last 10 days of April 1997 and to invite foreign scientists. One special topic will be evidence and distribution of paleopermafrost. Information about the next conference will be available soon. The council supported the suggestion by V.M. Kotlyakov and V.P. Melnikov to publish the journal *Earth Cryology*. The publishers will be in Novosibirsk.

On 3–5 June 1996 the First Conference of Geocryologists of Russia was held at Moscow State University. It was organized and sponsored by 16 main geocryological institutions of Russia. The Chairperson of the Organizing Committee was E.D. Ershov, the Co-Chairs were V.V. Baulin and R.M. Kamensky, and the Scientific Secretary was N.I. Trush. The plenary session was devoted to development of the ideas of V.A. Kudryavtsev in geocryology, the main scientific problems in geocryology, and international cooperation at the Melnikov Permafrost Institute. Five sections discussed the problems of engineering geocryology (42 reports submitted), dynamic geocryology (28 reports), geocryological forecasting and geoecology (21 reports), regional and historical geocryology (45 reports), and the physical chemistry and mechanics of frozen soils (29 reports).

A total of 165 reports were published in three pre-confer-

ence volumes in Russian. The volumes are available from the Geocryological Department of the Faculty of Geology, MSU for $30. For more information contact: N.I.Trush, Faculty of Geology, Geocryological Department, Moscow State University, Vorobievy Gory, 119899 Moscow, Russia. Tel: 7 095 939 4919; Fax: 7 095 233 4084.

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Other News

Russian organizations and institutions are welcome to submit descriptions of their programs and activities.

The Institute of Soil Science and Photosynthesis has a new director: V.A. Shuvalov, Corresponding Member, Russian Academy of Sciences. The institute plans to host the next Earth Cryology Conference in Pushchino in April 1997. David Gilichinsky and colleagues continue to develop plans for the International Permafrost School.

The Earth Cryosphere Institute of the Siberian Branch of the Russian Academy of Sciences is located in Tyumen with a branch office in Moscow. The director is Vladimir P. Melnikov and the head of the Branch of Geocryological Prognosis and Informatics in Moscow is Evgeny S. Melnikov, who reports the following.

The ECI conducts both basic and applied investigations. Basic studies include:

- Theoretical, field and experimental investigations of the development of natural and technogenic geosystems and geocryological processes.
- Fundamentals of geocryological surveys, digital mapping, modeling and forecasting.
- Fundamentals of geological monitoring and assessment of impact on the onshore environment in the Arctic and Subarctic.
- Investigation of the distribution, properties, and geocryological processes of offshore permafrost deposits.
- Studies of the thermodynamics and physico-chemical mechanics of freezing soils, ice and materials (cryogenic water migration, ice lensing, heaving etc.).
- Studies of gas hydrate properties and distribution in the earth cryosphere.

Applied studies include, among other topics:

- Assessment of engineering and geocryological conditions in the oil- and gas-bearing arctic regions and recommendations for rational use of nature during technological impacts.
- Recommendations for development of oil and gas fields in connection with the distribution of cryogenic deposits on the shelf of the Russian sector of the Arctic Ocean, as well as the influence of subsea permafrost on linear structures.
- Interpretation of geological and geophysical data, results of three-dimensional seismic prospecting, and data on the dynamics of developed fields of hydrocarbons.
- Collection of geocryological raw data and metadata covering the regions with oil and gas field development in the Arctic and Subarctic.
- Compilation of digital geocryological and geoecological maps.
- Techniques for production of artificial ice and ice-compositional materials.
- Methods for estimating areas of thaw and settlement close to a cluster of wells.
- Technology for preventing local degradation of permafrost with foam shields.
- Technological production and application of efficient foam sorbents and peat filters.
- Geotechnical designs for preventing: (a) thermal cracking in frozen soils, embankments and dams, and frost crack interaction with pavements, chilled pipelines, cables, foundations, etc., (b) frost heaving and ice-lensing inside of soils, embankments, dams, roads, foundations, etc.

Digital maps have been prepared for the Nizhnevartovsk Oil Association, the Samotlor Oil Association, the Chernogor Oil Association, and the Belozer Oil Association, among others. Information presented on the maps includes rivers and reservoirs, forests, populated areas and their structure (residental blocks and streets), basic communication (roads, oil pipelines, electric power lines, etc.), and industrial objects (flares, well clusters, pumping stations, boilers). Eight doctors of science and 26 bachelors of science are working on 11 projects in the institute. Facilities include a radiospectrometer; a combined reflecting spectrometer; a mass spectrometer; spectral analyzers; chemical, soil mechanics, and physical properties laboratories; cold chambers; seismographs; ultrasonic translucent instruments; and computers. Geoinformation systems are developed using ARC/INFO. For more information, contact: The Earth Cryosphere Institute, Russian Academy of Sciences, Siberian Branch, P.O. Box 1230, 625000 Tyumen, Russia. Tel: 7 345 224 3649; Fax: 7 345 222 3380; E-mail: root@ikz.tyumen.su or The Earth Cryosphere Institute, Russian Academy of Sciences, Branch of Geocryological Prognosis and Informatics, Vavilov Str., 30/6, r.85, 117982 Moscow, Russia. Tel: 7 095 135 9871, 7 095 135 9828; Fax: 7 095 135 6582; E-mail: emelnikov@ glas.apc.org

Southern Africa

A five-year research program has been approved by the South African Committee for Antarctic Research on cryogenic landforms and processes on Marion Island, situated at 46°S, southeast of the African continent in the maritime Subantarctic. The project, led by Jan Boelhouwers and Ian Meiklejohn, aims to assess the environmental controls, active processes and resulting landforms of geomorphological phenomena on the island. The focus is on forms that have a high paleoclimatic indicator value, or have a high environmental impact. Jan Boelhouwers and Stefan Grab undertook their first visit to Marion Island in April and May 1996, during which ground climate and sediment movement monitoring sites were established.

Currently five members of the Southern African Permafrost Group (SAPG) are cooperating in a project under Ian Meiklejohn's leadership on mountain environments. One of the prime aims of the project is to use paleogeomorphic features to develop a Pleistocene climate history for the high mountains of southern Africa. In the context of mountain environmental research, Ian Meiklejohn will be working with Kevin Hall in British Columbia during July.

Two conferences of relevance to IPA members will take place in southern Africa over the next 15 months. First is the Southern African Association of Geomorphologists (SAAG) Biennial Conference in Cape Town, as announced in the last issue of *Frozen Ground*. The second is an International Conference on Environment and Development in Africa, 29 June to 4 July 1997, hosted by the University of Pretoria, the Society of South African Geographers, the International Geographical Union, and the African Association of Geographers. There will be a post-conference field workshop, hosted in conjunction with SAAG and the SAPG, to the Drakensberg Mountains. Interested parties are invited to contact the Conference Organizers, Department of Geography, University of Pretoria, 0002 Pretoria, South Africa; Tel: 27 12 420 4049; Fax: 27 12 420 3284; E-mail: kim@scientia.up.ac.za

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Switzerland

The Permafrost Coordinating Group of the Swiss Academy of Sciences met on 29 April 1996 at VAW-ETH in Zurich.

During the first part of the meeting, the new technology of miniature temperature data loggers was discussed. In fall 1994, the geomorphology group of the Geography Department at the University of Bern had developed such miniature data loggers with a programmable time interval and especially designed for alpine permafrost conditions. These miniature temperature data loggers open new possibilities for monitoring programs and other research projects. Bernhard Krummenacher (University of Bern) carried out a demonstration experiment, described the technical aspects involved, introduced the program for tuning the loggers, and showed first results from field measurements. Martin Hoelzle and This Wegmann (VAW–ETH Zurich) also reported first experiences and results obtained in the area of the Murtèl-Corvatsch rock glacier. The bottom temperature of the snow cover (BTS) was monitored continuously during the winter 1994/1995. Significant differences were observed on the rock glacier (ridge and furrow), in front of it, and beneath and outside a nearby ski run.

In a second part of the meeting, 14 presentations provided an overview of ongoing research projects in Switzerland. The University of Bern group (B. Krummenacher, K. Budmiger, B. Blank and D. Mihajlovic) reviewed their activities near the Gemmi Pass during the last 8 years: year-round temperature measurements in the soil and snow cover, solifluction observation and photogrammetric investigation of the Furggentälti rock glacier with displacement rates of up to 5 m/a. Using an automatic camera which takes a daily photograph, the pictures were rectified, registered and assembled in a video sequence which shows the melting pattern of the snow in springtime. The relation between permafrost occurrence and snow distribution patterns is being investigated by M. Imhof (Ph.D. dissertation).

Activities at the University of Lausanne (M. Phillips, E. Reynard and L. Wenker) consist of geomorphological mapping of periglacial environments using aerial photographs in combination with the BTS method. The distribution of mountain permafrost is being modeled using several programs, and the results compared with those from other alpine regions.

The distribution of permafrost is also being modeled at the University of Fribourg (M. Monbaron, R. Lugon, J.-M. Gardaz, S. Morand, R. Delaloye) using rock glaciers as an indicator of permafrost conditions. The inventory of rock glaciers obtained from aerial photographs and field visits includes more than 300 rock glaciers. In addition, meteorological, geophysical and runoff measurements have been performed over the past ten years.

F. Keller (ETH Zentrum) has compiled a new map modeling the permafrost distribution of Switzerland using the program PERMAKART. Glacierized areas (about 1300 km^2) and areas occupied by periglacial permafrost (roughly 2000 km^2) cover about 8% of the entire country.

Investigations of the reaction to construction activities at Jungfraujoch were presented by H.-R. Keusen (GEOTEST).

The group at VAW–ETH Zurich presented three different projects. Temperature and deformation measurements in the undisturbed part of Jungfraujoch have been completed by numerical finite element models to investigate the stability of rock walls with permafrost within a changing climate (T. Wegmann). Photogrammetric investigations of Gruben rock glacier were performed for the time interval 1970–1991. Elevation changes, surface velocities, strain rates and changes at the rock glacier front were presented (A. Kääb). In addition, first results from high-frequency georadar investigations on Murtèl-Corvatsch rock glacier and comparisons with the existing borehole information were reported (P. Huggenberger, D. Vonder Mühll).

Information about the small fragment of moss containing pollen which was encountered in the core during drilling through the Murtèl-Corvatsch rock glacier was discussed: the botanical (J.-N. Haas, University of Basel) and ^{14}C investigations (D. Wagenbach, University of Heidelberg) led to an age of about 2000 years BP, which corresponds well with the rough estimations concerning the Holocene evolution of the rock glacier (W. Haeberli, University of Zurich).

Chr. Döbeli (University of Basel) reported on ecological studies in the Liefdefjorden area (Spitsbergen), investigating temperatures, radiation, flowering time and nutrients at several test sites.

The meeting closed with an overview by W. Haeberli on permafrost monitoring programs in various mountain regions of the world.

In January, Wilfried Haeberli was appointed president of the section on Geography and Environment of the Swiss Academy of Sciences, and consequently stepped down as the leader of the Permafrost Coordinating Group. Daniel Vonder Mühll was appointed as the new leader of the group. In addition, two working groups were established, one to define standards with respect to large-scale, long-term experiments using miniature temperature data loggers in the Alps, and the other to compare and compile the various existing inventories on rock glaciers and permafrost sites.

Submitted by D. Vonder Mühll and W. Haeberli
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United Kingdom

Members of the British National Adhering Body of the IPA have been involved in establishing a new Cryostratigraphy Research Group jointly with the Quaternary Research Association. The CRG was established to promote interdisciplinary research among Quaternary scientists and geomorphologists concerned with periglaciation. The CRG is a fixed-term research group of the QRA, and is affiliated with the British IPA body.

Cryostratigraphy seeks to classify permafrost sequences on the basis of their contained ground ice. Variation in the nature and distribution of ground ice allows identification of cryostratigraphic units whose interpretation and dating may allow reconstruction of past geocryological environments. The British Pleistocene is characterized by repeated growth and decay of permafrost, which caused the formation of distinctive landforms and structures, and disturbed superficial sediments and bedrock. The application of cryostratigraphy in Quaternary research requires integration of process studies in the modern permafrost zone with traditional Quaternary stratigraphic investigations.

The CRG will hold one or two meetings per year at key periglacial localities within Britain. During these meetings, leading periglacial scientists will be invited to present keynote talks. The first meeting will take place in West Wales, probably in autumn 1996. Details of meetings will be published in the Quaternary Newsletter and on the QRA Web site (http://www2.tcd.ie/pcoxon/qra.html). Enquiries should be directed to Julian Murton, Department of Earth Sciences, University of Wales, P.O. Box 914, Cardiff CF1 3YE, UK; Tel: 44 1222 87 4830; Fax: 44 1222 87 4326; E-mail: murton@cardiff.ac.uk

A Periglacial Workshop affiliated with Britain's National Adhering Body took place on 13 December 1995 at the University of Durham during the 1995 Annual Meeting of the British Sedimentological Research Group. The workshop, convened by Julian Murton (Cardiff), comprised ten talks and seven posters, and was attended by about 25 people. The objectives were to promote discussion of current research and provide opportunities for future collaboration.

The workshop opened with a talk by Colin Ballantyne (St. Andrews) on aeolian and niveo-aeolian deposits on Scottish mountains. Colin presented evidence for a general model of aeolian sedimentation commencing during the early Holocene. During the past few centuries the aeolian sediments on some mountains have been subject to extensive (niveo) aeolian reworking because of opening of the vegetation mat. Continuing the aeolian theme, Mark Bateman (Sheffield) discussed structures of possible periglacial origin within the Late Devensian coversand of north Lincolnshire. Some structures at Caistor morphologically resemble involutions, and their stratigraphic position suggested to Ko van Huissteden (Free University, Amsterdam) a similarity with Weichselian Late Pleniglacial sediments in the Netherlands. The third talk, by Geoff Duller (Aberystwyth), evaluated whether the luminescence dating of glacial and periglacial sediments

was fact or fantasy. Geoff reviewed experimental data testing the "full-bleach" assumption of the TL and OSL methods, and concluded that the degree of bleaching is highly variable.

The next two talks concerned periglacial rivers. David Bridgland (Durham) presented a climatic model for river terrace formation during the Middle and Upper Pleistocene in southern England. The model, based on stratigraphic observations, has aggradation of fluvial sediments, both at the beginning and end of periglacial conditions, and downcutting during the intervening periglacial episode. A debate ensued as to the effects of sea level change on fluvial activity. Following this, Ko van Huissteden presented cryostratigraphic and ^{14}C evidence for Weichselian floodplain aggradation in the Netherlands. In contrast to the Weichselian Early and Late Pleniglacial (OI stages 4 and 2), when continuous permafrost existed here, the Middle Pleniglacial (OI stage 3) was a time of alternating aggradation and degradation of permafrost. An important phase of degradation at approximately 38,000 years BP was associated with floodplain erosion.

Wishart Mitchell (Luton) presented results on studies of rock glaciers in the Himalayas. Based on reconnaissance mapping in the Lahul and Ladakh regions, he suggested that the rock glaciers have developed under drier conditions than those associated with glaciers in the high mountains. Other rock glaciers in the Indus valley and the upper part of Spiti are currently developing out of retreating valley cirque glaciers.

Nel Caine (visiting at Durham) discussed the hydrologic and geomorphic processes in a nivation hollow from the Colorado Front Range, USA. During a 14-year record of discharges from the basin, the yields of both clastic sediment and dissolved material have been low, with a denudation rate of only 0.005 mm/yr. The figure suggests that this part of the alpine landscape has hardly been modified during the Holocene. Infilling of hollows by clastic sediment is countered by geochemical denudation, and it is the latter which may therefore be important in maintaining the basin form.

Julia Branson (Southampton) reported on recent progress in the development of the Global Geocryological Database. The GGD will in time comprise linked data centers (in Boulder, Moscow, Lanzhou and Southampton) which are compiling data from regions of perennially and seasonally frozen ground. The objectives of the database are to advance studies of permafrost, cold regions engineering and environmental change.

David Evans (Glasgow) described buried glacier ice from Ellesmere Island, in the Canadian High Arctic, and considered its implications for the glacial geology and geomorphology of subpolar glaciers. Because the ice is buried by till or alluvium whose thickness may exceed that of the active layer, the ice may be preserved indefinitely under present climatic conditions. Thus glaciers readvancing over the buried ice may reactivate it, which may partly explain the occurrence of thick englacial debris bands.

The final talk, by Julian Murton (Cardiff), discussed the sediments and stratigraphy of thermokarst lake basins in the Mackenzie Delta area, western Canadian Arctic. Based on cryostratigraphic observations, three stages of deposition have been distinguished: 1) widespread thaw slumping transporting upland sediments into thermokarst lakes; 2) reduced slumping promoting reworking of sediment and suspension settling; and 3) lake drainage permitting gelifluction and accumulation of peat and aeolian sand. The ^{14}C dates from some stage 1 sediments suggest a progradation rate of approximately 4 cm/yr.

The following posters were displayed:

- Periglacial trimlines and the upper limit of Devensian glaciation, outer Hebrides (Colin Ballantyne, St. Andrews)
- Sediment transport by periglacial processes—The gravity fall model revisited (Julia Branson, Southampton)
- Relict rockglaciers in the British Isles (Stephan Harrison, Coventry)
- The Mis Tor Rockglacier, Dartmoor (Stephan Harrison, Coventry; Ed Anderson, Middlesex; and Vanessa Winchester, Oxford)
- Rock glaciers in the Himalaya (Wishart Mitchell, Luton)
- Near-surface brecciation of chalk, Isle of Thanet, Kent: A comparison with ice-rich bedrocks (Julian Murton, Cardiff)
- Cambering and gulls in unconsolidated Quaternary sediments in East Anglia, UK (Colin Whiteman, Brighton)

The workshop promoted enthusiastic discussion of periglacial research and demonstrated the important contribution that such work can make to Quaternary science. This was particularly well illustrated by the studies of periglacial aeolian and fluvial sedimentation. In addition, the workshop drew attention to at least three important topics that merit further research: 1) Anglo-Dutch optical dating studies of late Weichselian/Devensian sediments to improve cryostratigraphic correlations and palaeoenvironmental reconstructions, 2) comparative studies of mid-latitude Pleistocene river terraces to test models of terrace formation, and 3) collaboration between glacial and periglacial geologists in studies of glacially deformed massive ice in permafrost to interpret the origin of the ice.

Several participants expressed interest in the possibility of

future workshops and field meetings on a periglacial theme. Abstracts for the present workshop are available from the convenor.

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UNITED STATES

A series of permafrost-related projects have been funded as part of the National Science Foundation's Arctic System Science (ARCSS) program. Larry Hinzman, University of Alaska, solicited and submitted the following summaries.

Progress in developing climatic simulations of large areas in the Arctic is restricted by physical constraints of data collection, by a limited understanding of the interdependence and interaction of the physical and biological processes, and by limitations in our technical ability to extend our measurements and understanding across a range of scales. NSF, as part of its ARCSS global change program, is funding a multi-year program focused on northern Alaska. The program, Land–Atmosphere–Ice Interactions (LAII), involves a group of projects concerned with research on boundary layer processes associated with the vegetative cover, active layer and near-surface permafrost. Many of the study sites are along the route of the oil pipeline and road to Prudhoe Bay and the adjacent Kuparuk River watershed, in which an intensive vegetation–soil–atmospheric gas exchange program known as the Flux Study of the LAII is underway. Details can be obtained from individuals and the LAII pro-ject office at the University of Alaska (patricia@gi.alaska.edu).

An important component of several active layer studies was the establishment of 1-×1-km grids surveyed and marked every 100 m. These grids, installed at Toolik Lake, Imnavait Creek, Happy Valley, West Dock, Betty Pingo, Barrow and Atkasuk, are the U.S. contribution to CALM (see page 21). Thaw depths have been measured at every node on these grids each autumn, and in some cases several times throughout the summer, by many of the cooperating LAII-Flux Study scientists.

Donald Walker, University of Colorado, and his associates have established permanent vegetation plots at inland sites at Toolik Lake, Imnavait Creek and Happy Valley and at coastal sites at Prudhoe Bay, Barrow and Barter Island. Site factors, including soil properties, plant cover, and active layer depth in August, are available. A regional vegetation map of the Kuparuk River basin (8140 km^2) was prepared using existing vegetation classifications and aerial and satellite imagery. Additional plots along the north–south Flux Study transects were established in 1995 to serve as verification for the regional scale extrapolations.

Frederick Nelson, State University of New York–Albany, Ken Hinkel, University of Cincinnati, and colleagues are collaborating on two related projects concerning the spatial variations and temporal trends of the active layer on the ARCSS 1-×1-km grids and the Flux Study 100-×100-m plots. These studies involve intensive probing using formal hierarchical sampling designs. Near-surface (0–120 cm) temperatures and soil moisture are monitored hourly at several of these locations. Temporal (interannual and interdecadal) variations of active layer thickness are being investigated using coupled-flow models of soil thermal evolution, driven by local weather records at Barrow. Heat and mass transport measurements in the active layer and upper permafrost indicate that coupled-flow processes are especially active during snowmelt and when the active layer is thawed, and that these effects extend into the upper permafrost. When the annual field is modeled, the difference between measured and simulated temperatures indicates that nonconductive processes can cause episodic residuals of ± 2°–3°C and, while infiltration of snow meltwater is occurring, can displace the entire thermal field in the upper soil column. Soil moisture appears to be the crucial dynamic parameter. Using historical core data taken at Barrow in 1963 and a replicate sampling in 1993 suggests an average volumetric water (ice) enrichment of up to 5% in the upper few decimeters of permafrost. Stratigraphic analysis of the structures suggested downward movement of water through a network of cracks.

Tom Osterkamp, University of Alaska, and associates are pursuing research to improve understanding of the coupling of climate to permafrost through the intervening snow cover. A model using Barrow air temperatures applied to the ground surface with no snow cover predicted little change in permafrost temperatures. This result disagrees with observations confirming that air temperatures alone cannot account for the observed warming of the permafrost over the last century. Modeling the effects of the snow cover showed that the variable depth hoar fraction can change the daily and mean annual ground surface temperatures by several degrees and the date of active layer freeze-up by several weeks. Permafrost temperatures, obtained from a series of shallow boreholes, have cycled since 1983 over a range of 4°C with a period of at least 11 years, about in phase with the sunspot cycle and with the patterns of cyclonic and anticyclonic circulation in the Arctic Ocean. This range is about the same as the observed warming of the last century and the predicted warming for the next half-century due to greenhouse gases in the atmosphere. Active layer thicknesses also varied systematically, changing by up to a factor of two. About one-third of the active layer freezes from the bottom upwards.

Douglas Kane and Larry Hinzman, University of Alaska, and associates focus upon developing models of hydrologic and thermal processes. The modeling efforts include simulations of meteorologic data, areal extrapolation, soil moisture, stream runoff, active layer thaw depth, and soil temperatures. Data necessary to understand the hydrologic, meteorologic and thermal processes are being collected throughout the Kuparuk River basin. Specific parameters measured include subsurface temperatures and variables necessary to establish the surface energy balance. Soil samples were analyzed in the laboratory for bulk density and hydraulic conductivity. Automated time domain reflectometry (TDR) probes are installed in the active layer to measure unfrozen soil moisture daily during the summer. Depth of thaw of the active layer is measured several times throughout the summer and surface condition is noted in an attempt to relate thaw rates to surface characteristics. Physically based, spatially distributed models of hydrologic and thermal processes have been developed and verified for portions of the Kuparuk River basin. The primary control on the depth of thaw appears to be hydrologic factors. In very wet soils, the depth of thaw is greater than in drier soils, all other factors being nearly the same. Under conditions of running water in surficial drainages the depth of thaw is greater than in drier soils. An extensive network of shallow wells around the Prudhoe Bay site (Betty Pingo) revealed that hydraulic gradients changed from early to late summer. Just after spring melt, the surrounding wetlands supplied water to the tundra ponds; in late summer, however, the gradients were reversed, with water moving from the ponds to the wetlands. The total volumes of water movement were quite low due to low hydraulic conductivities and low hydraulic gradients; however, this supply of water and heat may be important for areas adjacent to small thermokarst features.

James Bockheim, University of Wisconsin, and other LAII investigators have found that nonacidic tundra soils are more extensive in the Kuparuk River basin, accounting for as much as 54% of the total vegetation cover. Properties of 30 soils in moist nonacidic and acidic tundra and 8 soils in nonacidic and acidic shrublands were compared. Although the organic layer is thicker in acidic tundra, the thickness of the A horizon, the maximum thaw depth, and the pH of the upper mineral soil layer are greater in the nonacidic moist tundra and shrubland than in their acidic counterparts. Many of the soils in nonacidic tundra contain a thick, dark-colored surface mineral horizon and abundant base cations. These soils may be more susceptible to carbon release and permafrost table recession in the event of global warming then adjacent acidic, lighter colored soils. The factors controlling the distribution of nonacidic soils are poorly understood but may include distribution of calcareous dust in snowfall, the age of the geomorphic surface and vegetation succession.

Chien-Lu Ping, University of Alaska, and colleagues are studying the relationship between the permafrost table and soil formation in more than 70 pedons excavated to a meter or more from arctic Alaska and associated sites in northwest Canada, and northeast Russia (see Cryosol Working Group report). Field evidence indicates that the zone of permafrost table fluctuation ranges from a few to more than 50 cm, depending on the vegetation type and successional stage, latitude, and landform position. During a cooling period the permafrost table rises and sequesters the soil carbon which was frost-churned or cryoturbated to the lower part of the active layer. During a warmer period, the permafrost

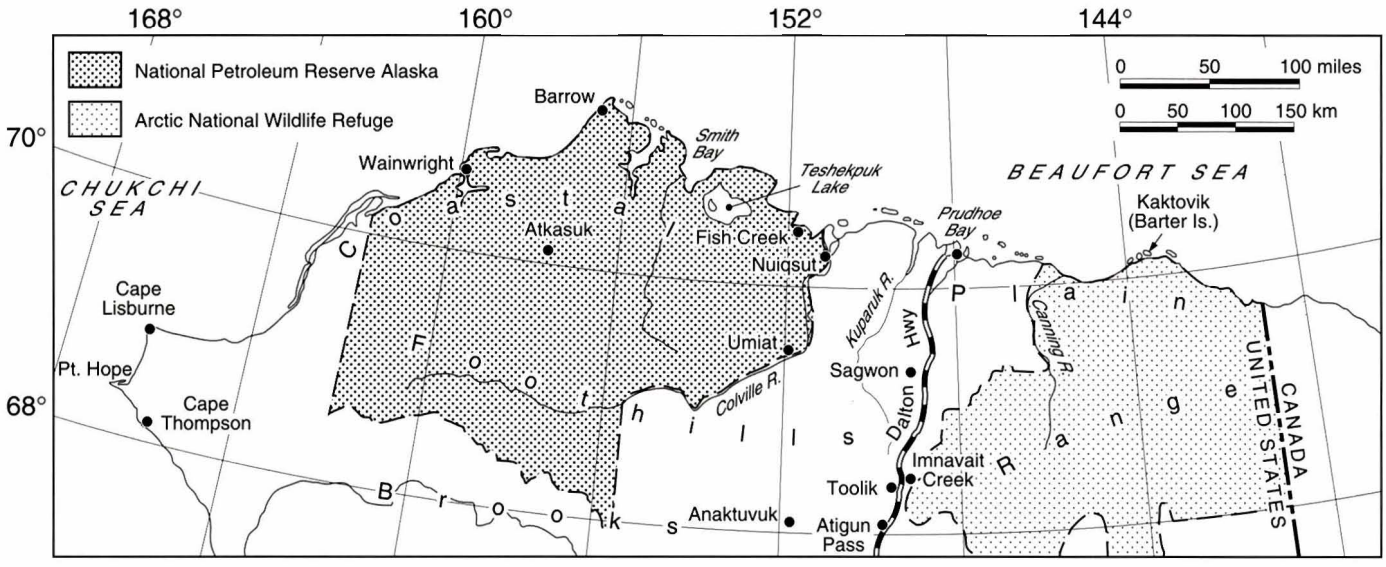

table is expected to be depressed and release carbon and other nutrients to biogeochemical cycling. The increased active layer results in deeper root penetration. Reducing conditions generally occur above the permafrost table. When the saturated zone fluctuates with the rise and fall of the permafrost table, a redox zone is created and mineral weathering is enhanced. Moderately to strongly developed cryogenic structures, including ice lenses and ice nets, commonly occur above the permafrost table. After thawing, these structures become platy and blocky, which provides channels and pores for water and root penetration.

William Reeburgh, University of California–Irvine, and his students measured methane fluxes, using static chambers, at weekly intervals at 43 sites during the 1994 and 1995 thaw seasons. Five vegetation cover classes were used in the sampling site selection: barrens, moist non-acidic tundra, moist acidic tundra, shrublands, and wet tundra. The methane fluxes were integrated over the thaw season to produce annual methane emission estimates. The vegetation-classified methane fluxes were used to define four general methane emission categories (sink and low-, moderate-, and high-source) and were combined with the Kuparuk River basin vegetation map to produce a regional methane emission map. Field water table manipulation experiments are in progress near Toolik Lake. These experiments involve lowering (and raising) wet meadow water tables inside 1- × 1-m cofferdams to determine the effect of water table level changes on methane and carbon dioxide emissions.

John Hobbie, Marine Biological Laboratory, and colleagues are conducting research on two major aspects of the active layer. First, the project monitors thaw depth in a small watershed at the LTER Toolik Lake site through surveys conducted in early and in late summer. The database now contains six years of information (see CALM table, page 21). Comparison of data between Barrow (coastal) and Toolik (inland foothills) shows the same depression of thaw penetration in 1991 reported by Osterkamp's project in the Prudhoe Bay area. Second, the project is monitoring soil chemistry and hydrology in the same watershed. Weekly measurements of water table, soil temperature, and soil water gases, nutrients, and dissolved organic carbon are being made at eight different sites representing upland tussock tundra and riparian birch and willow. Soil water gases reach 100,000 microatmospheres of CO_2 and 500,000 microatmospheres of methane due to plant and microbial respiration. Most of the nitrogen and phosphorus leaves the watershed in the dissolved organic forms. Soil water concentrations of dissolved organic carbon are correlated with different vegetation types and position of the sample in the watershed.

Terry Chapin, University of California–Berkeley, and associates are measuring water and energy exchange in all the major tundra vegetation types in the Kuparuk River basin, including those that are expected to become more common with global warming. Included in these measurements is an estimation of ground heat flux, measured as a function of vegetation type, climatic factors (e.g. temperature), and net radiation. At each site, other important variables influencing ground heat flux are also measured, including leaf area index, moss cover, soil moisture, and soil temperature. These measurements are at the same locations where Nelson's project measures active layer depth.

Walt Oechel, San Diego State University, and several associated groups obtain active layer depth measurements associated with a series of experiments. These include net CO_2 flux chamber plots, several permanent meteorological tower sites, and a water table–surface temperature manipulation experiment at a Prudhoe Bay site (West Dock). The water table was lowered on average 7 cm below the ambient water table, and surface temperature was increased by approximately 1°C using the open-top ITEX chambers. Several of these studies are closely related to similar ones in the Russian Arctic. Descriptions of the extensive data sets and experimental designs for the San Diego projects and the other ARCSS-LAII projects will be available as part of an ARCSS data management project at the National Snow and Ice Data Center, University of Colorado.

Reports of several recent NSF–ARCSS-sponsored workshops on arctic land–shelf–basin interactions are available. The results of three workshops held in Columbus, Ohio, Arlington, Virginia, and St. Petersburg, Russia, describe research priorities for the Eurasian land–shelf system, including both onshore and subsea permafrost. The report is available as Byrd Polar Research Center Misc Series M-397, Ohio State University, Columbus, Ohio 43210-1002. The second report of a workshop held in March 1995 discusses issues and research questions for the arctic shelf–basin interactions. That report is available from the Polar Science Center–APL, University of Washington, Seattle, Washington 98105-6698.

Other News

The Transportation Research Board (TRB) Committee on Frost Action chaired by Billy Connors (Alaska Department of Transportation and Public Facilities) met on 9 January during the Seventy-Fifth Annual Meeting of the TRB. In addition to committee business, presentations were made on the IPA Global Geocryological Database (Jerry Brown), neural networks (Lufto Raad), moisture accumulation in pavements (K. Eigenbrod), and evaulation of sea-

sonal variability in cohesive subgrades (Ken Anderson). The TRB program included a seven-paper session on Geotextiles in Cold Regions.

Jess Walker reports that on 13 April, 20 papers devoted to the cryosphere were presented in four sessions of the annual meeting of the Association of American Geographers (AAG) in Charlotte, North Carolina. Six papers were devoted to various aspects of snowfall, including such topics as snow depths in the former Soviet Union and snow cover fluctuation as derived from satellite observations. Other papers dealt with the active layer, permafrost, glaciers, rock glaciers, arctic soil development and alpine talus deposits. IPA working group chairs Roger Barry, Fritz Nelson and Antoni Lewkowicz co-chaired several sessions and presented papers. IPA Vice President Hugh French presented a paper entitled Periglacial Environments, Pleistocene and Recent.

The general consensus was that the sessions were very successful and that we should pursue attempts to form a Cryosphere Specialty Group within the AAG. To that end a petition containing the names of 106 potential members was submitted to the AAG requesting that the Cryosphere Specialty Group be established. It was subsequently approved and the group is now official. Future plans call for two or three sessions to be held at the meeting in Fort Worth (1–5 April 1997) and for expanded sessions in Boston (25–29 March 1998). Further information is available from H.J. Walker (hwalker@unix1.sncc.lsu.edu).

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Reports of Working Groups

Substantial progress is being made in many of the working groups. Detailed reports follow for several working groups. We remind interested individuals who wish to become corresponding members of working groups to contact the appropriate chair or secretary. Addresses for chairs and secretaries may be found on page 36.

Global Change and Permafrost

In 1995, the Global Change and Permafrost Working Group surveyed field researchers to obtain information about existing programs involving long-term measurement of climate-related parameters in permafrost and seasonally frozen ground. The survey identifies and documents state-of-the-art monitoring programs focused on permafrost and frozen ground; highlights useful techniques, parameter suites, and analytic methods that could lend themselves to standardization; and implicitly identifies parameters and geographic areas not being monitored adequately. The survey complements the Mountain Permafrost WG's inventory of similar information for the mountain environment, as well as the Data and Information WG's inventory of existing data sets. The survey's implementation also anticipated a resolution, later passed at the IPA Council meeting in Berlin, for establishment of an international network for long-term monitoring of the thermal state of permafrost and the active layer in both hemispheres (see *Frozen Ground* No. 18, p. 11).

More than 40 respondents described their research sites, many of which are associated with a range of national and international arctic programs (GEWEX, ARCSS, ITEX, LTER, ZERO, etc.). Results from the survey indicate an impressive array of topical and geographic coverage. Some programs involve sites at which observation periods span several decades, while others incorporate long-distance transects over the transition between the discontinuous and continuous permafrost zones. Process-oriented work involves a variety of effective designs for studying near-surface heat, moisture and gas transport processes. Opportunities for possible collaboration are apparent, and some dormant or unused sites of good potential might be reactivated with modest outside assistance.

Despite the good response by the research community, some researchers were undoubtedly missed, and some requests are still outstanding. Only three responses came from the Southern Hemisphere (six sites), but we have leads on others, particularly in Antarctica. Uneven geographical coverage is a distinct problem, with many "blank" areas in both circumpolar regions.

Decadal-scale changes in the thickness of the active layer overlying permafrost will be a sensitive indicator of any ongoing climate change and vegetation modification that may accompany it. The survey revealed that ground temperature and active layer thickness are not widely monitored in consistent fashion; these are inexpensive parameters that could be added to measurement programs at many sites with little expenditure of funds and effort. Because there appeared to be no standard procedures for sampling and monitoring the active layer, the WG developed the Circumpolar Active Layer Monitoring program (CALM), based on a statistically robust strategy for long-term measurement on a standard grid. CALM has now been adopted for the International Tundra Experiment (ITEX) sites, and proposed for the Global Terrestrial Observing System (GTOS of WMO/UNESCO/UNEP/ICSU) and for independent sites (see CALM results on page 21). Also, frost tubes are used by several groups to record the maximum development of the active layer each season. Miniature temperature data loggers are available now from several manufacturers for less than a few hundred dollars. We have an opportunity here to develop standards or recommendations to improve the comparability of ground temperature measurements between groups, and to highlight any pitfalls.

New approaches are being used to map soil moisture content from satellite imagery, and several groups are involved with long-term research watersheds. Only a few respondents monitor carbon storage, although it is likely that we missed many researchers from the biological community. Permafrost geomorphology appears to be a widespread endeavor that can reveal useful information about paleoenvironments and provide a basis for observing subtle ongoing changes. The permafrost community has a rich legacy: at least five sites have measurements going back one or more decades. Efforts should be made to encourage, particularly in this era of financial restraint, continuing activities at these "heritage permafrost sites."

Recalling the Berlin resolution, the task ahead is to recommend selection of further sites and to consider whether further "standards" or protocols would be helpful to the community. CALM suggests the use of frost tubes, and for ITEX purposes soil temperature recording at a depth of 15 cm. Active layer studies should obtain temperatures at additional depths. These are suggestions and are open for further discussion. Should we develop protocols for soil and air temperature networks, given the low cost of miniature data loggers? Should a user of frost tubes have engineering drawings prepared and made available to the com-

munity? A couple of researchers have developed soil gas recovery and analysis techniques... and so on.

The survey tells us, unambiguously, that field expertise is a strong characteristic of our research community, and that we need to encourage utilization of this resource as groups and individual scientists bring new projects to life. At the Hanover meeting in December 1995, we indicated our group would make contributions to the IPA handbook on recommended methods for periglacial processes (under thermal regime), but in light of the above, there may be several other topics to which our community could contribute. Our WG will be discussing such issues over the next few months, and input from the wider community is hereby sought.

Copies of the current survey results and the CALM guidelines (in ITEX style) are available through the Secretary (altaylor@kcorp.com), via FTP over the Internet, or by regular mail. The WG Secretary (along with the Chair of the Mountain Permafrost WG) will be presenting a multi-author paper at the International Symposium on Representation of the Cryosphere in Climate and Hydrologic Models in Victoria, Canada, in August. We would hope to meet with some more of you there or at the AGU fall meetings in San Francisco in December.

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Circumpolar Active Layer Monitoring (CALM) Program

Site and region	*Latitude, Longitude*	*Grid size (m)*	*Late summer thaw (cm)* 1991	1992	1993	1994	1995
Canada							
Truelove Lowland, Devon Island [1]	75°33′N, 84°40′W	60		–	—	30	31
Russia							
Parisento, Gydan Peninsula[2]	70°05′N, 75°30′E	1000	—	82	91	—	94
Maare Sale, Yamal Peninsula [2]	69°50′N, 66°50′E	1000					131
Vaskiny Dachy, Yamal Peninsula [3]	70°10′N, 68°32′E	100	—	86	93	86	99
Labaz Lake, Taimyr [4]	72°23′N, 99°30′E	100	—	—	—	42	50
Levinson Lessing Lake, Taimyr [5]	74°32′N, 98°36′E	100	—	—	—	36	42
Bolshoy Olyer Lake, Kolyma [6]	69°28′N, 156°18′E	10	—	—	—		48
Upper Kargoplgyno River, Chukotka [7]	64°05′N, 177°04′E	100	—	59	51	56	
Onemen, Chukotka [7]	64°49′N, 176°50′E	100	—	—	—	43	43
Sweden/Svalbard							
Kapp Linne, Svalbard [8]	78°03′N, 13°37′E	100	89	92	113	99	97
Abisko area [8]	68°20′N, 18°50′E	100	69	66	65	66	61
United States (Alaska)							
Barrow [9]	71°19′N, 156°36′W	1000	—	22	30	35	35
Barrow, CRREL Plots [9]	71°19′N, 156°35′W	10	23	23	29	34	34
Atkasuk [9]	70°27′N, 157°24′W	1000	—	—	—	—	44
West Dock [9]	70°22′N, 148°34′W	1000	—	—	48	55	52
Betty Pingo [9]	70°17′N, 148°52′W	1000	—	—	52	54	54
Happy Valley [9]	69°06′N, 148°30′W	1000	—	—	44	45	43
Imnavait Creek [9]	68°30′N, 149°30′W	1000	—	56	60	60	49
Toolik [9]	68°37′N, 149°36′W	1000	—	—	—	—	45
Toolik LTER [10]	68°37′N, 149°36′W	Transect	28	40	46	36	43

[1] Larry Bliss and Warren Gold; [2] Nataly Moskalenko, V. Dubrovin, and Evgeny Melnikov; [3] Marina Leibman; [4] Martin Sommerkorn; [5] Julia Boike; [6] Vladimir Ostroumov; [7] Anatoly Kotov; [8] Jonas Åkerman; [9] ARCSS—Christian Bay, Jerry Brown, Ken Hinkel, Larry Hinzman, Doug Kane, Fritz Nelson, Yuri Shur, Skip Walker and Pat Webber; [10] George Kling, Gus Shaver, and Jim Laundre

Note: Abstracts and posters reporting these results were presented and published in April 1996 at the ITEX workshop in Copenhagen and the geocryology conference in Pushchino. Additional mountain sites and those measuring soil temperatures are being identified and will be added to the network and reported with 1996 observations.

Data compiled by Jerry Brown; dashes indicate no data available.

Mountain Permafrost

For its second 5-year period of activity, the Working Group on Mountain Permafrost envisaged international coordination and cooperation with regard to mapping, modeling and monitoring of mountain permafrost in order to reach a more complete view in space and time of present conditions and potential future developments. High priority was given to the development of the monitoring component as part of the newly established Global Geocryological Database (GGD) and the formation of Global Climate Terrestrial Observing Systems (GTOS of WMO/UNESCO/UNEP/ICSU). The schedule for the corresponding steps to be undertaken comprises: 1) development and circulation of a questionnaire about existing programs in 1994, 2) compilation of an inventory or overview on the basis of the results from the questionnaire in 1995, and 3) delivery of actual data into GGD during 1996/97. Following a presentation at the Hanover meeting in December 1995, a review paper is presently being prepared compiling the results of step 2. It briefly introduces the basic concepts used, lists the programs in the participating countries, makes reference to selected publications, and points to the first trends becoming visible from the database.

This first systematic overview of long-term monitoring programs related to mountain permafrost provides information from 10 countries or regions (Argentina, Canada, Norway, Germany, Switzerland, Austria, Italy, Kazakstan, Central Asia and China). Additional information can be expected from France, Japan, Russia, Sweden, the USA, and hopefully others. Information is now becoming available on borehole temperatures in the Canadian Rockies and the European Alps, in Scandinavia and Svalbard, in the Kazak/Kirghiz/Chinese Tien Shan, and on the Qinghai–Tibet Plateau. In most of these regions, rock glacier flow is being monitored, and maps and geophysical soundings exist at selected sites. The most important signal becoming visible by now is from borehole temperatures obtained over the past few years to decades. In the Canadian Rockies seemingly constant thermal conditions in perennially frozen ground sharply contrast with the simultaneous mass losses of nearby glaciers as observed within the framework of worldwide glacier monitoring. In all other regions, warming of permafrost seems to be pronounced.

Modeling and mapping efforts continue in various countries. As an example, the area of discontinuous mountain permafrost in southern Norway is estimated at about 4000 km^2, not including a total glacierized area of about 1600 km^2 (J.L. Sollid and R.S. Ødegard). The area underlain by permafrost in the Swiss Alps is roughly estimated at about 2000 km^2 (F. Keller), or somewhat more than the total glacierized area (about 1300 km^2). Monitoring and modeling efforts are closely interrelated: results from long-term monitoring, as they become available, can be used to calibrate models of transient response at individual points (e.g. heat conduction, melting and thaw settlement in material with variable ice content, etc.). Calculations for individual points can later be combined with spatial simulations of surface permafrost conditions in order to simulate typical transient effects at depth for extended areas. In a further step, such model simulations must be tested and further developed by applying appropriate sounding methods at characteristic sites indicated by model simulations. They could then hint at especially sensitive areas and help assess how representative are results from long-term monitoring at a restricted number of sites.

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Cryosols

Members of several working groups met twice: in Seattle, 24–25 February, and in Pushchino, 24-25 April. Both meetings combined activities of the IPA WG, the International Soil Science Society (ISSS) Cryosol Working Group, and the International Committee on Permafrost-Affected Soils (ICOMPAS).

Seattle Meeting

Participants were Jim Bockheim, Jerry Brown, Wendy Eisner, Lynn Everett, David Gilichinsky, John Kimble, Fritz Nelson, Ron Paetzold, Chien-Lu Ping, Ron Sletten, Scott Smith, Dave Swanson, and Charles Tarnocai.

The overall purpose of the meeting was to review and refine some of the activities concerning nomenclature, classification and mapping of cryosols and to review plans and progress of ongoing and future activities. Items included: 1) Chersky soils map and reports, 2) soil map of the permafrost region, 3) gelisol and cryosol proposals, 4) soil temperature data, 5) terminology, 6) field excursions, 7) contributions to the 1998 IPA conference and World Congress of Soil Science, and 8) other topics, including GGD.

Chersky

Materials collected on the 1994 international expedition to Chersky in northeast Russia were reviewed. A paper entitled A Description and Classification of Soils and Landscapes of the Lower Kolyma River, Northeastern Russia, by C.A.S. Smith et al., was published in *Polar Geography and Geology*, vol. 19, p. 107–126. It was agreed that all the Chersky information (maps, Swanson's soil survey report, and laboratory data) should be compiled by January 1997

and published in the Soil Survey Investigation Report (SSIR) series.

Charles Tarnocai presented a Chersky draft poster, including the two soil maps representing Russian and North American soil mapping approaches, with legends, correlation tables for the different soil classifications, and three soil transect cross sections. The revised poster will be presented at the All-Russian Soil Science Conference in St. Petersburg in June and at the next Soil Science Society of America meeting. Gilichinsky indicated the importance of the soil classification correlation table and emphasized that a report should also be prepared for the June 1996 St. Petersburg conference.

Soil Map

A proposal for a circumpolar soil map, including a GIS database, was presented by Tarnocai. The map scale will be 1:10,000,000, the same as the IPA permafrost map. As a first step, a test area running from northwestern Canada, across Alaska, to longitude 125°E in Siberia will be used to develop the methodology for the map. Swanson will take the lead in preparing the legend and joint correlation table. The map will include all areas north of the southern limit of the discontinuous permafrost zone. The North American portion of this pilot map area will be prepared as a GIS product under the supervision of Kimble and Tarnocai by June 1996. Gilichinsky will explore the feasibility of using the 1: 4,000,000 digitized soil map of Russia. Contacts will be made to obtain digitized maps for Greenland and other permafrost areas.

Gelisol Classification

It was agreed that a definition was needed to embrace the unique material formed by cryoturbation. Gelic material with or without the presence of permafrost in various combinations should be used to define the Gelisol order. A new definition was agreed upon. The soil key to the United States Soil Taxonomy was reviewed and revised to conform to the proposed Gelisol order. The revised key and definition of gelic material will be recommended for incorporation into the United States Soil Taxonomy. It was unanimously agreed that the Cryosol order of the FAO/ISSS World Reference Base for Soil Resources (WRB) should be further developed following the concepts and structure of the new Gelisol order. Bockheim and Tarnocai will prepare a description of the new Cryosol order and submit it to ISSS.

Soil Temperature Data

Gilichinsky presented the status of the project to compile in digital form the long-term soil temperature data collected at meteorological stations in Russia. Records for about 90 stations will be available to the GGD later this year. He also stressed the importance of correlating the Russian soil classification with other soil classifications so that the soil temperature data could be compared with data collected in other countries. Paetzold reviewed the current activities on soil temperature and moisture measurements in northern Alaska and described the NRCS soil climate projects in the contiguous United States.

Permafrost Terminology

Brown discussed the IPA multi-language glossary of permafrost terms. He suggested that the internationally used permafrost soil terminology could also be incorporated into this glossary. Tarnocai agreed to circulate the 1991 cryosol glossary. In turn, van Everdingen, Chair, Terminology WG, will be asked to circulate for review the English list of terms for the IPA glossary.

Field Excursions

It was agreed that priority for the next several years should be on publications, with less emphasis on field excursions and other field activities. The proposed Ellesmere Island field trip (1996) was canceled. The Baikal region trip (1996) was unlikely to take place and might be combined with the 1997 Syktyvkar conference. The northern Greenland and northern Lapland trips are still under consideration for 1998.

Conferences

Plans were described by Gilichinsky for the International Conference on Fundamental Research of Earth Cryosphere in Arctic and Subarctic on 23-26 April 1996 in Pushchino (see Russian report, p. 10). A two-day cryosol meeting would focus on cryogenesis and soil forming processes. Three abstracts were submitted by Tarnocai, Bockheim, Kimble, and Ping in an effort to present the Gelisol order, the circumarctic soil–permafrost map, and the pedon concept used in North America to the participants at the meeting. The working groups would reconvene with Russian members and others.

Information is now available via E-mail on the Second International Conference on Cryopedology, August 1997, Syktyvkar, Russia (komi@omkomi.intec.ru).

Tarnocai presented a proposal for a one-day post-conference field trip at the 7th International Conference on Permafrost, June 1998, Yellowknife, Canada. The theme is Cryosols of the Subarctic. It was agreed to propose a symposium during the conference: Cryogenic Soil and Landscape Processes and Cryoturbation. The working groups propose to organize a similar cryosol–gelisol symposium for the 16th

World Congress of Soil Science in Montpellier, France, in August 1998. This proposal, presented by Kimble and Targulian, depends on the forthcoming ISSS Organizing Committee's decision.

Other Topics

Membership of the IPA and ISSS Cryosol Working Groups was reviewed. The IPA working group is limited to eight full members, including the Chair and Secretary; others can be corresponding members. It was agreed to seek a replacement for the Chinese member and to invite Brigitte Van Vliet-Lanoe (France) and Iain Campbell (New Zealand) to be corresponding members. The new membership is listed at the end of this report.

The status of the Global Geocryological Database was reviewed by Brown. More metadata are required for cryosols. Tarnocai and others agreed to review additional soil data for submission to the GGD.

The following publications are planned by the working groups:

Magadan report, summarizing the 1992 Upper Kolyma trip; Swanson and Mazhitova will take the lead.

Review paper entitled What is Cryopedogenesis?; Ping and Russian co-authors (Professor Makeev).

Review paper on cryoturbation prepared for *Geoderma*; Bockheim and Tarnocai.

Paper on Dynamic Processes of the Upper Permafrost; Ping and Shur.

Review of the available gelisol pedon data; Bockheim, Kimble, Tarnocai, and Ping.

Monograph or book on cryosols. This comprehensive work on permafrost-affected soils will be a cooperative effort of all members of the working groups.

Journal publications covering the following areas: Yukon (Smith), Delta Junction (Swanson), and Fairbanks (Ping).

Summary of meeting for ISSS Bulletin by Kimble.

Pushchino Meeting

The second meeting of the working groups took place at the Institute of Soil Science and Photosynthesis, Pushchino, Russia, on 24-25 April. Participants included Jim Bockheim, Gabriele Broll, David Gilichinsky, Stanislav Gubin, Demitri Federov-Davidov, Sergey Goryachkin, John Kimble, Oleg I. Khudyakov, Demitri Konyushkov, Galena Mazhitova, Oleg Makeev, Eugeni Naumov, Chien-Lu Ping, Ilia Sokolov, Ronald Sletten, Victor Targulian, and Charles Tarnocai.

Essentially all topics discussed at the February meeting were presented and discussed in detail. A summary and conclusions are presented; details are available from WG Secretary Ping.

1998 Conferences

The ISSS Executive Council gave approval for a symposium at the World Soil Congress entitled Permafrost and Global Change Associated with Environmental Problems. It will be co-chaired by David Gilichinsky and Brigitte Van Vliet-Lanoe and will consist of oral presentations and posters. The question of funding for participation in the Yellowknife permafrost conference was discussed; ISSS has funds for two participants, and perhaps the Russian Science Foundation will provide some assistance.

Permafrost Soil Classification

The discussion continues on criteria to be used for classifying cold-dominated soils. To convey the different views of classification of permafrost soils in the World Reference Base for Soil Resources (WRB) system, the three groups will present their proposals to the WRB meeting as follows: 1) Cryosols with permafrost within 1 m regardless of diagnostic horizons (Bockheim, Tarnocai, Broll, Ping); 2) Cryosols defined as permafrost soils subjected to cryoturbation only (Sokolov); and 3) No Cryosol/Gelisol order, but a Gelic subgroup in existing orders (Sletten).

Permafrost Soil Map

Sokolov will select and provide base soils maps of Russia for digitizing, and Kimble will acquire the best maps from US sources for digitizing. The final scale is 1:10,000,000. The coverage is limited to permafrost soils, and the boundary will correlate with the IPA permafrost map. The USDA–NRCS start the work this summer on legend translation and correlation and map compilation

Permafrost Soil Monograph

It was generally agreed that there is need for such a book. The book should cover all aspects of permafrost soils and be able to relate to other soils. The book has to be refereed and saleable. Tarnocai will take the lead by preparing a provisional table of contents and authors and contributors list.

Database and Correlations

The participants realized that there is a lack of databases for those soils under discussion for classification, including Chernozem, Solonetz, Solonchak, and the cold alpine soils which have permafrost within 1 m. Sokolov proposed a soil correlation trip to the Trans-Baikal region to visit sites with these soils in 1997. The ICOMPAS also urged the Russian colleagues to provide a database of permafrost soils to help test the gelisol proposal.

Several informal technical reports were presented: 1) results of freezing experiments by Gilichinsky, 2) soil formation during the final stage of loess–ice sedimentation by Gubin, 3) permafrost soils' response to fire on the upper

Kolyma by Mazhitova, and 4) pedological studies in the high Arctic of Taimyr by Goryachkin.

In addition to the working groups' meetings, two special cryosol sessions took place at the Pushchino conference titled Cryogenesis and Soil Formation Processes. The first session, with 10 papers, was chaired by Gilichinsky and Tarnocai. The second, with four papers, was chaired by Targulian and Kimble. Abstracts in English and Russian appear in the conference abstract volume.

The new membership of the IPA Cryosols Working Group is: D.A. Gilichinsky, Chair (Russia), C.L. Ping, Secretary (USA), J. G. Bockheim (USA), G. Broll (Germany), Luo Goubao (China); B. Jakobsen (Denmark), G. Mazhitova (Russia), C. Tarnocai (Canada). Ex-Officio: J. Brown (USA). Corresponding members are: L. Beyer (Germany), I. Campbell (New Zealand), J. Kimble (USA), Qiu Guoqing (China), B. Van Vliet-Lanoe (France), Gong Zitong (China).

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Terminology

The mutilanguage glossary of permafrost terms currently contains terms in nine languages (English, French, German, Italian, Norwegian, Polish, Russian [plus transliteration], Spanish and Swedish). Several terms have recently been added; Italian, Russian, Spanish and Swedish translations for these are still needed. Final corrections and additions to the Polish terms have been completed. The Russian terminology received extensive improvements during a visit by Nikolai Romanovskii to Calgary in October and November 1995. A listing of Icelandic terms, started by Halldór G. Pétursson (Akureyri, Iceland) in 1995, is expected to be available by fall 1996. Preparation of a listing of Romanian terms is being undertaken by Petru Urdea (Timisoara, Romania).

Work is continuing on definitions for the Russian/English Glossary of Geocryology Terms, which is being developed by Nikolai Romanovskii and co-workers.

A few printed copies of the preliminary 1994 edition of the Multilanguage Glossary of Permafrost and Related Ground Ice Terms are still available from the Working Group Chair for US $20, including postage. Copies of the glossary are also available on two MF2HD diskettes, in WordPerfect 5.1 for MS DOS, formatted for HPIII laser printer, for US $15, including postage.

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Periglacial Processes and Environments

Recent activities focussed on two areas; publications and field excursion. Many of the papers presented at the Hanover meeting in December 1995 (see *Frozen Ground*, No. 18, p. 14) are being submitted for publication in *Permafrost and Periglacial Processes*. It is expected that at least 10 will be published in a special issue of the journal.

Final preparations were made for the High Arctic Symposium, 8–17 July 1996, on Ellesmere, Axel Heiberg and Cornwallis Islands in the Canadian Arctic Archipelago. This field meeting is to focus on the effects of climatic change and variability on geomorphic processes. Eight participants from six countries will take part. Weather permitting, they will view long-term monitoring of solifluction near Resolute and Eureka, active layer detachments and debris flows, retrogressive thaw slumps, patterned ground, cold-based glaciers, recovery from terrain disturbance, and construction techniques on permafrost. There will also be a one-day Symposium held at Eureka. A full report of the meeting will be given in the next issue of *Frozen Ground*.

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Data and Information

A new proposal by Roger Barry and Claire Hanson, Implementation of a Pilot Global Geocryological Database at the WDC-A Glaciology, has been funded by the U.S. National Science Foundation. This provides some funding for the Russian development of priority data sets and enables the WDC-A to inventory, retrieve and organize selected priority data sets from other IPA members. Toward this end, Roger Barry met with Nikolai Romanovskii in St. Petersburg in early June. A small meeting of North American and UK project participants is being held in Boulder in July and discussions will continue at the GTOS and Cryosphere meetings in Victoria in August. The soil temperature data from Russia, as well as other countries, will be incorporated into the pilot project as files are reviewed and corrected.

Several other European proposals are pending which will also support GGD activities. Details of these activities will be reported in a future issue of *Frozen Ground*.

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Other News

Upcoming Meetings

Geomorphic and Climatic Significance of Rock Glaciers

In spring 1996 the American Geophysical Union announced a Chapman Conference on rock glaciers. The stated purpose of the conference is to bring together a wide variety of researchers, including glaciologists and geochemists as well as Quaternary geologists and geomorphologists, with the goals of reaching a consensus on the formation, dynamics, and paleoclimatic significance of rock glaciers and of developing strategies for future research. Topics for abstracts included, but were not limited to: internal composition, temporal context, climatic significance, origin and dynamics, monitoring and geotechnical aspects, and research priorities. The conference will be held 24-29 August 1996 near Yellowstone National Park, and includes a field trip to the Galena Creek rock glacier. For results of the conference contact the conveners: Doug Clark and Alan Gillespie (University of Washington), Eric Steig (University of Colorado), and Noel Potter (Dickerson College). See Forthcoming Meetings, p. 33.

Fifth Chinese Conference on Glaciology and Geocryology

The Fifth Chinese Conference on Glaciology and Geocryology (5th CCGG) is being held at the Yefu Science Palace of Lanzhou University 18-22 August 1996. This conference is under the auspices of the Chinese Society of Glaciology and Geocryology and is organized by the Lanzhou Institute of Glaciology and Geocryology (LIGG), Chinese Academy of Sciences, with the collaboration of its State Key Laboratory of Frozen Soil Engineering and the Laboratory of Ice Core and Cold Regions Environment. There are four special sessions:

- Cryosphere and global climate change
- Engineering in cold regions
- Hydrology in arid and cold regions
- Physical, mechanical and chemical properties of snow, ice and frozen soil

Paper sessions include:

- Cryosphere, global change and hazard and environment in cold regions
- Engineering and hydrology in cold regions
- Physical, mechanical and chemical properties and their testing techniques of snow, ice and frozen soil

A 7-day post-conference field trip along the route Lanzhou–Zhangye–Jiuquan–Jiayuguan–Dunhuang–Lanzhou has been organized.

Those still interested in attending or receiving publications should contact Cheng Guodong or Zhu Yuanlin. Tel: 86 931 882 2818; 86 931 884 1490; Fax: 86 931 888 5241. E-mail: liggplan@ns.lzb.ac.cn

8th International Specialty Conference on Cold Regions

The conference Cold Regions Infrastructure: An International Imperative for the 21st Century will be held in Fairbanks 12-17 August 1996. The conference is being organized by the American and Canadian Societies of Civil Engineers. The ASCE Technical Council on Cold Regions Engineering (TCCRE) will present four sessions totaling 80 papers on geotechnical, transportation, utilities, environmental, buildings, materials, and water resources topics. The TCCRE Cold Regions Monograph on Transportation and a symposium of lessons learned from the construction of the Trans Alaska Pipeline will also be presented. For results of the conference contact the organizers (see Forthcoming Meetings, p. 33).

ISGF–97 and FROST '97

The 8th International Symposium on Ground Freezing (ISGF–97) and the 3rd International Symposium on Frost in Geotechnical Engineering (FROST '97), will be held in Luleå, Sweden, 15–17 April 1997. Additional information about the Symposium and Luleå University of Technology is available on the Web (http://www.luth.se/depts/anl/frost97/). Also see *Frozen Ground* No. 18 for more details.

ISCORD '97

The Fifth International Symposium on Cold Regions Development will be held in Anchorage 4–10 May 1997. Updated information may be obtained on the Web (http://www.orst.edu/~vinsont/iscord/html) or by contacting the Secretariat (see Forthcoming Meetings, p. 33).

Topics include:

- Development policy and projects
- Building, housing and construction
- Regional development, infrastructure, and transportation
- Rural, recreational, and energy source development
- Environment

International Symposium on Physics, Chemistry and Ecology of Seasonally Frozen Soils

Information for the symposium (10–23 June 1997), including registration, can be obtained on the new Web site (http://www.nstl.gov/frozen). Also see *Frozen Ground* No. 18 and Forthcoming Meetings, p. 34.

Second International Conference on Cryopedology, 1997

The conference organizers in Syktyvkar have a new E-mail address (biol@omkomi.intec. ru) and fax number (7 8212 42 01 63). The contact is Dr. I.V. Zaboeva. Also see *Frozen Ground* No. 18 and Forthcoming Meetings, p. 34.

11th International Northern Research Basins Symposium and Workshop

The NRB Symposium and Workshop will be convened at Prudhoe Bay and Fairbanks, Alaska, 18–22 August 1997. The main theme is An Evaluation of Spatial Variability of Hydrologic Processes in the Circumpolar Arctic. The objective is to examine available process-oriented, spatially distributed data sets (water and energy fluxes) and make a comparison amongst them to see if a generalized understanding can be developed. A second theme is Development in Northern Regions: Implications and Considerations. This topic should foster discussion on hydrologic problems encountered by communities and industry in arctic and subarctic areas. Participants will visit facilities and a small wetland watershed in the Prudhoe Bay area, the research facility at Toolik Lake, and the Imnavait Creek and Upper Kuparuk watersheds. The workshop/symposium will conclude with additional technical sessions at the University of Alaska in Fairbanks (see Forthcoming Meetings, p. 34).

Fourth International Conference on Geomorphology

The International Association of Geomorphologists (IAG) will convene its fourth conference at the University of Bologna, Italy, 28 August–3 September 1997. The conference is organized by the Gruppo Nazionale Geografia Fisica e Geomorfologia del Consiglio Nazionale delle Ricerche. IPA is co-organizing a session and field trips on permafrost, slope stability and periglacial processes. The pre-conference excursion (M-4, 22–28 August) is to the Swiss and Italian Alps and is organized by Francesco Dramis and Wilfried Haeberli. Included will be a one-day paper session on Mountain Permafrost Monitoring and Mapping, at Bormio on 27 August. The post-conference excursion (B-5, 4–8 September) focuses on the geomorphology and Quaternary geomorphology of central Italy (see Forthcoming Meetings, p. 34).

16th World Congress of Soil Science

The Congress will be held in Montpellier, France, 20–26 August 1998. The Cryosol working groups will organize and present the Symposium: Cryosols and Their Relationship to Global Climate Change (see p. 34). The symposium will comprise a formal session of oral presentations and two half-day poster sessions. Written proposals for the oral session (not to exceed 2500 characters) must be submitted to the Congress Secretariat and convenors no later than 1 May 1997. Final text of selected papers will be due 31 December 1997. The convenors are David Gilichinsky and Brigitte Van Vliet-Lanoe (see p. 36 and 6, respectively, for complete addresses).

Geological Indicators of Rapid Environmental Change

Tony Berger reports that the IUGS Commission on Geological Sciences for Environmental Planning has developed a checklist of geoindicators for tracking changes in the dominantly abiotic components of forest, aquatic, desert, coastal, polar, mountain and other terrestrial ecosystems. Geoindicators are high-resolution measures of short-term (<100 years) surface or near-surface changes that are significant for environmental monitoring and assessment. Most deal with changes on the landscape (0.1–1.0 km) and meso-scales (10–100 km). Included among the 27 indicators is Frozen Ground Activity. Each indicator is described using a framework of 16 descriptors. The checklist will be part of a monograph authored by A.R. Berger and W.J. Iams, Geoindicators: Assessing Rapid Environmental Changes in Earth Systems, to be published by A.A. Balkema, Rotterdam. The checklist is available on the Web (http://www.gcrio.org/geo/title.html).

Technical Committee on Frost

Eero Slunga reports on the four working groups of Technical Committee 8 of the International Society of Soil Mechanics and Foundation Engineering (ISSMFE): 1) Field and laboratory methods for the determination of deformation parameters of thawing soils; 2) The procedure for a reference frost heave test including sampling; 3) Estimation of frost heave and thaw weakening by statistical methods and physical models; and 4) Related effects of frost action. Reports of groups 1, 3 and 4 will be mainly based on earlier research and literature. The work of group 2 consists of a series of laboratory frost heave tests which are to be conducted in 10 or 12 laboratories in different countries. J.-M. Konrad has provided soil material for the tests and will analyze the results. The working group will report results at the April 1997 International Symposium on Ground Freezing and Frost Action in Soils in Luleå, Sweden (see Forthcoming Meetings, p. 33).

ITEX Workshop

The Seventh International Tundra Experiment (ITEX) Workshop was held in Copenhagen on 25-29 April. Sixty

participants from Canada, the Czech Republic, Denmark, Finland, Iceland, Norway, Russia, Sweden, Switzerland, the United Kingdom, and the United States attended. Summer 1995 results were reviewed and several working groups developed and discussed future plans and synthesis activities. Of direct interest to IPA readers are the results of the working groups on intersite monitoring and below-ground processes; both are concerned with soil thermal regime and active layer monitoring.

A circumpolar ITEX synthesis meeting is being planned for fall 1996 in Santa Barbara, California. A series of ITEX manuscripts have been submitted for a special issue of the journal *Global Change Biology*. The 1997 ITEX Workshop will be in the United Kingdom. The revised ITEX manual is available from the Danish Polar Center (DPC), as is more information from the ITEX Secretariat (Thomas Bjorneboe Berg–DPC), E-mail: tbb@dpc.dk. Phil Wookey, University of London, is the new ITEX chair, E-mail: p.wookey@rhbnc.ac.uk.

Maps

Several mapping projects are well underway or beginning; their status follows.

The IPA permafrost and ground ice map of the Northern Hemisphere is nearing completion. For the past year the authors have been involved in numerous editorial changes, and associated complex cartographic revisions have delayed the final product. The map should be printed in late 1996 as U.S. Geological Survey Map CP45. In addition, plans are well advanced to issue a digital version through the UNEP GRID office in Arendal, Norway. Details of availability will be posted under "What's New" on the IPA Web site as soon as they are available.

We published a provisional legend for the map in December 1991 in *Frozen Ground*. On pages 29 and 30 is the final legend. The Russian sector is more detailed than the rest. Due to the complexities of the map, the digital version will only contain the coded data for classes of continuity of permafrost and ice volume plus some thematic boundaries (sea ice, glaciers, treeline). The complete citation is Circum-Arctic Map of Permafrost and Ground Ice Conditions, by J. Brown, O.J. Ferrians, Jr., J.A. Heginbottom and E.S. Melnikov. Some 14 additional individuals are contributors.

The mapping project of paleo-reconstruction of permafrost within the framework of the IUGS/UNESCO Project Climatic Extremes of the Past (CLIMEX) is nearing completion. Nikolai Romanovskii and Olga Lisitsyna, Moscow State University, have prepared paleopermafrost maps of Eurasia covering the period of the glacial maximum 18,000 years ago and the Holocene optimum 7000 years ago. The maps are based on analysis of paleopermafrost and modern permafrost conditions of the former Soviet Union, China and Mongolia. Modern permafrost maps are the source of information about permafrost distribution, thickness, temperature, ground ice content, periglacial processes and phenomena (both modern and ancient). The maps will be presented and discussed at the 30th International Geological Congress in Beijing in August 1996. They will be incorporated into the global mapping project at a scale of 1:25,000,000 under the direction of Nicole Petit Maire, CNRS, and in collaboration with Brigitte Van Vliet-Lanoe, Université de Rennes.

The IPA Cryosol Working Group, in cooperation with the ISSS, has begun preparing a soils map of the permafrost regions of the Northern Hemisphere. Details are presented in the working group report.

Donald Walker reports that a new vegetation map of the Arctic is under development. It will provide a common legend and language for the ecosystems of the arctic region and will be a key component of circumpolar geographic information system databases. As an initial step in preparing the new map, the first Circumpolar Arctic Vegetation Mapping Workshop was held in St. Petersburg, Russia, 21–25 March 1994. The 51 participants reviewed the status of vegetation mapping in each circumpolar country, formulated a strategy for making a vegetation map database, and developed a framework for the legend. They also agreed that key participants from each country should meet again to reach consensus on the legend and to determine the strategy for funding the first map at approximately 1:5,000,000 scale on a Lambert equal area circumpolar projection consisting of a mosaic of cloud-free false-color AVHRR images. This is currently under development by the U.S. Geological Survey Earth Resources Observation System Field Office in Anchorage, Alaska. Since the St. Petersburg workshop two journal articles and a volume of abstracts and short papers from the conference have been published:

Walker, D.A. (1995) Toward a new circumpolar arctic vegetation map: St. Petersburg workshop. *Arctic and Alpine Research*, **31**: 169–178.

Walker, D.A. et al. (1995) Toward a new arctic vegetation map: Review of existing maps. *Journal of Vegetation Science*, **6**: 427-436.

Walker, D.A. and C.J. Markon (Ed.) (1996) Circumpolar arctic vegetation mapping workshop: Abstracts and short papers. Open File Report No. 96-251, U.S. Geological Survey, Reston, Virginia.

The Second CAVM workshop was held at the United Nations Environment Programme (UNEP) Global Resource Information Database (GRID) facility in Arendal, Norway (GRID–Arendal), 20–24 May 1996. The workshop focused on three topics: 1) the final vegetation map legend; 2) a base map, GIS, and remote sensing products; and 3) a strategy for international funding of the mapping project.

Legend for IPA Permafrost and Ground Ice Map

Permafrost Extent (percent of area)	Ground Ice Content (visible ice in the upper 10–20 m of the ground; percent by volume)				
	Lowlands, highlands, and intra- and intermontane depressions characterized by thick overburden cover (> 5–10 m)			Mountains, highlands, ridges, and plateaus characterized by thin overburden cover (< 5–10 m) and exposed bedrock	
	High (> 20%)	Medium (10–20%)	Low (0–10%)	High to medium (> 10%)	Low (0–10%)
Continuous (90–100%)	Ch	Cm	Cl	Ch	Cl
Discontinuous (50–90%)	Dh	Dm	Dl	Dh	Dl
Sporadic (10–50%)	Sh	Sm	Sl	Sh	Sl
Isolated patches (0–10%)	Ih	Im	Il	Ih	Il

Variations in the extent of permafrost are shown by the different colors; variations in the amount of ground ice are shown by the different intensities of color and, for the large bodies of ground ice, by symbols. Letter codes assist in determining to which basic permafrost and ground ice class any particular unit belongs. The symbols for the large bodies of ground ice contribute to the definition of the map units. For example, "Ch▽▬ " indicates a unit underlain by continuous permafrost with high ice content, and characterized by sparse ice wedges and abundant massive ice.

OTHER FORMS OF PERMAFROST

Deep relict permafrost (where known)

χ Cryopegs (shown only for Russia)

GROUND ICE BODIES— General distribution of known occurrences of large bodies of ground ice

▽ ▼ Ice wedges (sparse, abundant)

▭ ▬ Massive ice bodies (sparse, abundant)

○ ● Pingo ice and other perennial frost mound ice (sparse, abundant)

TEMPERATURE AND THICKNESS OF PERMAFROST

–15.7 Typical mean annual ground temperature at the base of the layer of annual temperature fluctuations (°C)

–3/–7 Range of typical mean annual ground temperature at the base of the layer of annual temperature fluctuations (°C). On the map, ranges are shown for both units and subunits; on cross sections, ranges are shown for combined areas and represent end-member values; values are shown at the tops of the profiles

■ 16 Measured or interpolated thickness (m)

■ (197) Extrapolated or calculated thickness (m)

$\frac{150}{400}$ Depth to the top (numerator) and bottom (denominator) of relict permafrost (m)

SURFACE ICE

Ice caps and glaciers

Icings (shown only for Russia)

BOUNDARIES

Boundaries of permafrost and ground-ice units; long dashed where gradational or estimated

⊥ ⊥ ⊥ Southern limit of deep relict permafrost

▬ ▬ ▬ Northern limit of the area within which subsea permafrost is known or presumed to occur

– – – – Lithological and mean annual ground temperature boundaries for morphogenetic and natural geosystems subunits

♣♣♣♣ Northern limit of trees

MORPHOGENETIC AND NATURAL GEOSYSTEMS

19 Morphogenetic and natural geosystem types (see Tables A and B for explanation)

LITHOLOGICAL CLASSES — Dominant rock types within the upper 10-20 m of the ground (shown only for Russia)

Unlithified:

c Clay and silt
d Coarse clastic deposits (debris)
l Loess and eolian-sand deposits
p Peat
s Sand

Lithified:

k Soluble rocks (limestone, dolomite, gypsum)
r Insoluble rocks

Note: Combinations of letters indicate mixed composition of unlithified rocks (*pc*), listed in order of predominance, or layered composition of unlithified over lithified rocks (*c/k*). Saline ground is indicated by a bar above the letter (s̄).

Table A. Complexes of Cryogenic Processes in Different Regions

Geocryological regions (Figure1)	Permafrost zones*	Morphogenetic groups of natural geosystems (Table B)	Basic complex of cryogenic processes*	
I Arctic Islands	C	***2, 12, 13***	*t, c*	
		17	*n, s, r*	
II European North of Russia	C	***1, 7***	*t, c, h*	
	D	***4***	*h, c, t*	
		7	*h*	
	S	***1, 3***	*h*	
		4	*h, t*	
		17	*n, h*	*h* in depressions only
	I	***1, 3,4, 7***	*h*	
		17	*h*	in depressions
III Ural	C	***1***	*t, c, h*	
		14	*s, h*	
		19	*n, s, r, i, h*	*h* in depressions
	D	***17***	*i, s*	
		19	*n, s, r, i, h*	*h* in depressions
	S	***19***	*s, r, i, h*	*h* in depressions
	I	***7***	*h*	
IV West Siberia	C	***1, 2,4***	*t, c, h, s*	
	D	***1, 2,4***	*t,h*	
	S	***1, 2,3, 4***	*t, h*	*h* in peatlands only
	I	***2, 4***	*h*	in peatlands
V East Siberia	C	***2***	*t, c, h* *t, h, i*	in tundra in middle taiga
		3	*c, h*	
		7	*c, h, i* *h, i*	in north taiga in middle taiga
		11	*t* *d, c, h* *h*	in north taiga depressions in north taiga in middle taiga
		12,14	*c, h, s*	
		13	*t, c, h, s*	
		17	*r, s, d* *h, i*	on interfluves in valleys
		18	*d, s, r, n* *c, h* *d, r* *c, h, i* *r* *h, i*	on mtn taiga interfluves in mtn taiga valleys on mtn taiga interfluves in north taiga valleys on mtn taiga interfluves in middle taiga valleys
		19	*n, r, s*	
	D	***11, 18***	*r*	on interfluves
	S	***7, 11, 18***	*h, i* *h, i*	in valleys in valleys
	I	***11, 18***	*h, i*	in valleys

Geocryological regions (Figure 1)	Permafrost zones*	Morphogenetic groups of natural geosystems (Table B)	Basic complex of cryogenic processes*	
VI North East Siberia	C	***13, 15, 16***	*t, c, h, d*	
		17	*d, s*	
		19	*n, s, r* *i, c, h*	on interfluves in valleys
VII Far East	C	***13, 16***	*t, g, h*	
		14	*c, h, s*	
		17	*s, d*	
		19	*n, s, r* *i, c, h*	on interfluves in valleys
	D	***13, 16***	*h, c*	
		19	*s, n, r* *h, c, i*	on interfluves in valleys
	S	***19***	*r, n* *i, h*	on interfluves in valleys
	I	***13***	*h*	
		17, 19	*h*	in valleys
VIII Mountains of South Siberia and Transbaikalia	C	***13, 16***	*h, c*	
		17	*r* *h, i*	on interfluves in valleys
		19	*r, s, n* *i, h*	on interfluves in valleys
	D	***16***	*h, c, i*	
		17	*r* *i, h*	on interfluves in valleys
		19	*r, s, n* *i, h*	on interfluves in valleys
	S	***16***	*h*	
		17	*r* *h*	on interfluves in valleys
		19	*r, s, n* *h*	on interfluves in valleys
	I	***12, 13, 16*** ***17*** ***19***	*h* *h* *r* *h*	 in valleys on interfluves in valleys
IX Mongolia	C	***13***	*h, t*	
		19	*r, s, n* *h, i*	on interfluves in valleys
	D	***19***	*s* *h, i*	on interfluves in valleys
	S, I	***13, 16***	*h, i*	
		17	*h, i*	in valleys
		19	*n* *h, i*	on interfluves in valleys

* Definitions:

C Continuous
D Discontinuous
S Sporadic
I Isolated patches

c Cracked-thermokarst complex (frost cracking with ice wedge formation, thermokarst)
d Dale complex (furrow, ravine, thermal erosion)
h Heaving-thermokarst (perennial cryogenic heaving, thermokarst)
i Icing formation (icing, seasonal heaving with formation of injection ice, thermokarst)
n Nival-glacial complex (destructive-accumulative action of snow bodies and glaciers)
r Kurum (rock) complex (deserption, cryogenic weathering, suffosion)
s Solifluctional complex (solifluction, gelifluction, deserption, creep)
t Thermo-destructional complex (thermokarst, thermoerosion, thermosolifluction, thermo-abrasion, landslides)

Figure 1. Geocryological Regions of Russia and Mongolia.

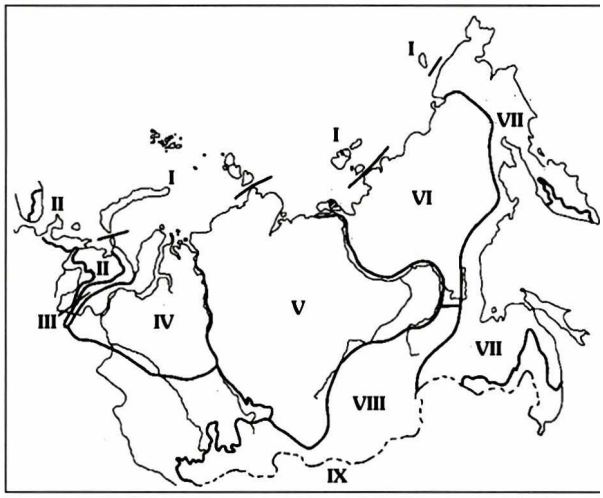
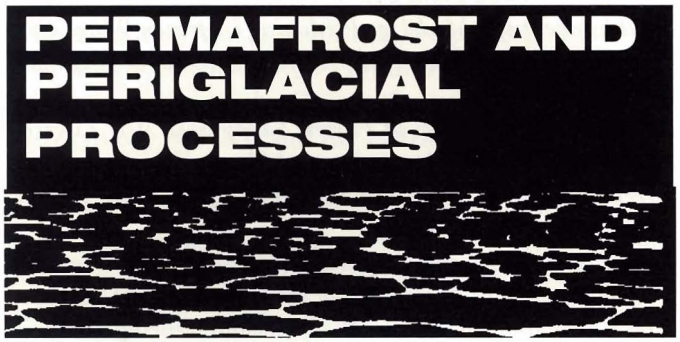


Table B. Morphogenetic Groups and Natural Geosystem Types

Genetic category	Physiographic class: Lowland plains	High plains	Basins and piedmonts	Highlands and plateaus	Mountains
ACCUMULATIONAL					
Marine and glacial marine	***1***	***5***	***12***		
Alluvial and lacustrine	***2***	***6***	***13***		
Glacial and fluvio-glacial	***3***	***7***	***14***		
Alluvial, proluvial, deluvial, and solifluctional		***8***	***15***		
Eolian		***9***			
Undifferentiated	***4***	***10***	***16***		
EROSIONAL		***11***	***17***	***18***	***19***

PUBLICATIONS



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Rates of Periglacial Processes in the Central Tianshan, China, Cheng Zhu

Short Communication

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Volume 7, Issue No. 2 (April–June 1996)

Active Layer Distortion of Annual Air/Soil Temperature Orbits: Permafrost and Past Climates, H. Beltrami

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Soil Moisture Variability in Relation to Diurnal Frost Heaving on Japanese High Mountain Slopes, N. Matsuoka

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Surficial Characteristics Associated with the Occurrence of Permafrost near Mayo, Central Yukon Territory, D.J. Williams and C.R. Burn

Climatic and Ecological Controls on Ice Segregation and Thermokarst: The Case History of a Permafrost Plateau in Northern Québec, M. Allard, S. Caron and Y. Begin

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Selected Frozen Ground Titles

Volume 17, No. 2 (June 1995)

Studies on Altitude and Climatic Environment in the Middle and East Parts of Tibetan Plateau During Quaternary Maximum Glaciation, Shi Yafeng, Zheng Benxing, Li Shijie et al.

Permafrost Degeneration in the East of Tibetan Platean, Zhu Linan, Wu Ziwang and Liu Yongzhi

The Vegetation and Climatic Changes in Zoige During the Last 20,000 Years Determined by Pollen Records, Liu Guangxiu, Shen Yongping, Wang Suming et al.

Some Tensile Creep Characteristics of Frozen Loess, Shen Zhongyan, Miao Lina and Liu Yongzhi

Analysis of Microstructural Changes in Frozen Sandy Soil Under Confining Pressures Using Scanning Electron Microscope, Ma Wei, Wu Ziwang, Chang Xiaoxiao et al.

The Study of Practicability of Photoviscoelastic Simulation Test for Frozen Soil Creep, Wang Tingdong, Wu Jianjun, We Ziwang et al.

Modeling Test on the Building with Short Piles and Ventilating Foundation in Permafrost Regions, Zhu Linnan, Li Dongqing, Guo Xingming et al.

The Response Functions of Tree-Ring Chronologies in Western Tianshan Mountains, Yuan Yujiang and Li Jiangfeng

The Features of Nivation Landforms in the Changbaishan Mts., Song Changqing, Cui Zhijiu, Zhu Cheng et al.

Permafrost Distribution in the Dabanshan Pass Section of Ning-Zhang Highway in Eastern Qilian Mts., Wang Shaoling, Chen Xiaobai, Zhang Zhizhong et al.

Rapid Calculation of Direct Radiation on Sloping Fields, Wang Jian, Lu Anxin, Li Wenjun et al.

Volume 17, No. 3 (September 1995)

The Pedogenic Processes and Evolution of the Soils on Moraines in Alpine Periglacial Environments, Liu Gengnian, Song Changqing and Xiong Heigang

Study on the Sequences of the Quaternary Glaciations in the Bayan Har Mountains, Zhou Shangzhe

The Vegetation and Climate of Holocene Megathermal in Zoige, Northwestern Sichuan, China, Liu Guangxiu, Shen Yongping and Wang Suming

Influence of Temperature and Pressure on Cryogenic Structure of Freezing Soil, Wang Jiacheng, Xu Xiaozu, Zhang Lixin et al.

Unfrozen Water Content of Soil Containing NaCl Relating to Freezing–Thawing Processes, Zhang Lixin, Xu Xiaozu and Deng Yousheng

Strength Characteristics of Frozen Soil Under Torsional Loading, Peng Wanwei, Zhang Jianming, Kang Guojin et al.

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Volume 1, 1995

Foreword, Cheng Guodong

Progress in Glaciology and Quaternary Glaciation Research in China Since 1978, Shi Yafeng and Li Jijun

Geocryology Research in China in the Last Decade: Review and Prospect, Cheng Guodong

A Study on Spatial and Temporal Distribution of $\delta^{18}O$ *in Precipitation in the Tibetan Plateau,* Zhang Xinping, Yao Tandong and Tian Lide

The Climatic Features Near the Tanggula Pass in the Centre of the Tibetan Plateau, Zhang Yinsheng, Yao Tandong, Pu Jianchen, T. Ohata and H. Yabuki

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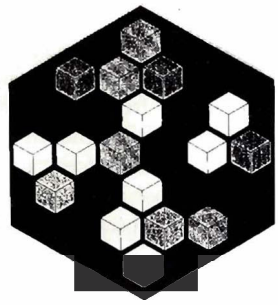

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Volume 24, No. 1

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The Effect of Climate Warming on the Qinghai-Tibet Highway, China, Tong Changjiang and Wu Qingbai

Other Publications

La Conception et la Réhabilitation des Infrastructures de Transport en Régions Nordiques. Branko Ladanyi, Ministère de Transport, RTQ-94-07, 1996.

Memoirs of Lanzhou Institute of Glaciology and Geocryology, Chinese Academy of Sciences
No. 8, 1995

The Monitoring of Snow Disaster Using Remote Sensing and the Studies on the Information System in Cold Regions

Newsletters of the International Association of Geomorphologists (IAG) are published in the journal *Z. Geomorph. N.F.* IAG news is available on the Internet from John Lee (j.lee@ttu.edu). News items can be submitted to Avijit Gupta (geoagup@nus.sg).

Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change—Scientific-Technical Analyses, R.T. Watson, MC. Zinyowera and R.H. Moss, Editors. Available from Cambridge University Press, Dept. PJL, 40 West 20th Street, New York, NY 10011-4211. Fax: 212 691 3239. $95.00 (hardcover), $35.95 (paperback).

Forthcoming Meetings

Resolution of IPA Council, 5 August 1995

In order to involve maximum engineering and scientific participation in the international permafrost conferences held once every five years, all members and working groups are urged to encourage societies and professional organizations to coordinate the scheduling of their meetings, workshops and field trips within the 12-month period prior to and following the permafrost conferences. Following the June 1998 conference in Yellowknife, Canada, the next conference is provisionally scheduled for summer 2003 in Europe.

1996

Carbon Sequestration in Soil: An International Symposium
22–26 July 1996, Columbus, Ohio, USA
Contact: L. Everett, School of Natural Resources, 2021 Coffey Road, Ohio State University, Columbus, Ohio 43210, USA
Tel: 1 614 292 9909; Fax: 1 614 292 7432
leverett@magnus.acs.ohio-state.edu

30th International Geological Congress
4–14 August 1996, Beijing, China
Contact: Professor Zhao Xun, P.O. Box 823, Beijing 100037, China
Tel: 86 10 8327772; Fax: 86 10 8328928
zhaox@bepc2.ihep.ac.cn

28th International Geographical Congress, International Geographical Union
5–10 August 1996, The Hague, The Netherlands
Contact: Congress Secretariat 28th IGC, Faculteit Ruimtelijke Wetrenschappen Universiteit Utrecht, P.B. 80.115, 3508 TC Utrecht, The Netherlands
Tel: 31 30 532044; Fax: 31 30 540604
r.vanderlinden@frw.ruu.nl

International Symposium on Representation of Cryosphere in Climate and Hydrological Models
12–15 August 1996, Victoria, British Columbia, Canada
Contact: Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, United Kingdom
Tel: 44 223 355974; Fax: 44 223 336543

8th International Specialty Conference on Cold Regions Engineering
12–17 August 1996, Fairbanks, Alaska, USA
Contact: Larry Bennett, School of Engineering, University of Alaska, P.O. Box 755900, Fairbanks, Alaska 99775, USA
Tel: 1 907 474 6121; Fax: 1 907 474 6087
fyasce@aurora.alaska.edu

5th Chinese Conference on Glaciology and Geocryology
18–22 August 1996, Lanzhou, China
Contact: Zhu Yuanlin, Lanzhou Institute of Glaciology and Geocryology, Lanzhou 730000, China
Tel: 86 931 8841490; Fax: 86 931 8885241
liggplan@nslzb.ac.cn

Chapman Conference on the Geomorphic and Climatic Significance of Rock Glaciers
24–29 August 1996, Cody, Wyoming, USA
Contact: Doug Clark, Geological Sciences, Box 351310, University of Washington, Seattle, Washington 98195, USA
doug@rad.geology.washington.edu

International Symposium on Cold Regions Engineering
11–14 September 1996, Harbin, China
Contact: Permafrost Institute, Yakutsk, 677018 Russia
Tel: 4 46 34, 5 38 56, 5 39 12; Fax: 095 230 2919 (Yakutsk, Merzlota)
lans@imzran.yacc.yakutia.su

49th Canadian Geotechnical Conference
23–25 September 1996, St. John's, Newfoundland, Canada
Contact: Jack Clark, C-CORE, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X5
Tel: 1 709 737 8350; Fax: 1 709 737 4706
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1997

ISGF-97 and FROST '97
15–17 April 1997, Luleå, Sweden
Contact: Sven G.O. Knutsson, Luleå University of Technology, S-951 87 Luleå, Sweden
Tel: 46 920 913 32; Fax: 46 920 720 75
sven.knutssun@anl.luth.se
http://www.luth.se/depts/anl/frost97/

ISCORD '97 International Symposium on Cold Regions Development
4–10 May 1997, Anchorage, Alaska, USA
Contact: Chairman of the Organizing Committee, The Northern Forum, 4101 University Drive, APU Garr-Gottstein Center, Suite 221, Anchorage, Alaska 99508, USA
Tel: 907 561 3280; Fax: 907 561 6645
iscord97@ccmail.orst.edu
http://www.orst.edu/~vinson/iscord.html

ISOPE-97: 7th International Symposium on Offshore and Polar Engineering
25–30 May 1997, Honolulu, Hawaii, USA
Contact: Jin S. Chung, ISOPE, P.O. Box 1107, Golden, Colorado 80402-1107, USA
Tel: 1 303 273 3673; Fax: 1 303 420 3760

International Symposium on Snow and Avalanches
26–30 May 1997, Chamonix Mont Blanc, France
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See IPA Web site for updates on meetings:
http://www.geodata.soton.ac.uk/ipa

International Symposium on Physics, Chemistry, and Ecology of Seasonally Frozen Soils
10–12 June 1997, Fairbanks, Alaska, USA
Contact for meetings: Brenton Sharrat
Tel: 1 612 589 3411
bsharrat@mail.mrsars.usda.gov
Contact for logistics: Conferences and Special Events, University of Alaska, Fairbanks, Alaska, USA
Tel: 1 907 474 7800
fyci@aurora.alaska.edu
http://www.nstl.gov/frozen/

International Symposium on Antarctica and Global Change
14–18 July 1997, Hobart, Australia
Contact: Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, United Kingdom
Tel: 44 1223 355974; Fax: 44 1223 336543
100751.1667@compuserve.com

Second International Conference on Cryogenic Soils
5–8 August 1997, Syktyvkar, Russia
Contact: I.V. Zaboeva, Institute of Biology, Komi Center, Russian Academy of Sciences, 167610 Syktyvkar, Komi Republic, Russia
Tel: 7 821 22 25213; Fax: 7 821 22 25231
biol@omkomi.intec.ru

11th Northern Research Basins Symposium and Workshop
18–22 August 1997, Fairbanks, Alaska, USA
Contact: Douglas L. Kane, Water Research Center, University of Alaska, Fairbanks, Alaska, USA
Tel: 1 907 474 7808; Fax: 1 907 474 7979
ffdlk@aurora.alaska.edu

IV International Conference on Geomorphology and IPA Executive Committee Meeting
28 August–3 September 1997, Bologna, Italy
Includes pre- and post-conference permafrost excursions
Contact: M. Panizza, Universita Degli Studi di Modena, 59-41100 Modena, Italy
Tel: 059 23 0394; Fax: 059 21 8326

1998

7th International Conference on Permafrost and IPA Council Meeting
23–27 June 1998, Yellowknife, N.W.T., Canada
Contact: J.A. Heginbottom, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario K1A 0E8, Canada
Tel: 1 613 992 7813; Fax: 1 613 992 2468
permafrost.conference@gsc.emr.ca
http://www.nrcan.gc.ca/gsc/permaf_e.html (English)
http://www.nrcan.gc.ca/gsc/permaf_f.html (French)

16th World Congress of Soil Science
20–26 August 1998, Montpellier, France
Contact: Agropolis-Avenue, Agropolis-34394, Montpellier, Cedex 5, France
Tel: 33 6704 7538; Fax: 33 6704 7549

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Needle Ice

Needle ice is a cluster or bundle of slender ice crystals that form at, or immediately beneath, the surface of the ground and grow upward in the direction of heat loss. Elongation is perpendicular to the cooling surface, and on horizontal ground the ice structure is nearly vertical. Long crystals tend to bend or curve near the top. They generally form at night during strong radiation cooling. Organic-rich, moist, silty soils are perhaps the most favorable for growth.

As the crystals grow, they may carry upward on top of the needle ice cluster soil particles, pebbles and stones. Cobbles and small boulders are known to have been lifted or moved by the growth of needle ice.

The process of growth of needle ice, with the attendant uplifting of surface sediments and then the collapse of the needles upon thawing, is an important factor in sediment sorting and perhaps in the origin of some forms of small dimension patterned ground. The process also is important in differential movement downslope of fine and coarse material. The disrupting effect of needle ice growth on vegetation is perhaps responsible for exposing bare soil at the surface in periglacial areas.

Needle ice is most common in arctic and alpine environments, but is known to occur in more temperate areas. The following notes describe needle ice near the tropics. Needle ice was observed on 17 July 1975 near Curitiba in southern Brazil, just south of the Tropic of Capricorn. The area is 50 km from the Atlantic coast at an elevation of about 1000 m. July 16 was a rainy day but the weather cleared in late afternoon and the night was cold and clear, with strong radiative cooling. It was reported that the air temperature reached –8°C and that the local coffee crop was destroyed by freezing. The soil in the area is a reddish clay-rich silt with abundant angular fragments of disintegrating granite giving mineral crystals, grains, and pebbles in a loamy matrix. The ground was exceedingly moist, but no free-standing surface water was observed.

During the night, well-developed needle ice formed in a large, flat field covered with patches of grass interspersed with large areas of bare, moist soil. Several hundred square meters of needle ice growth was present. Areas several square meters in extent were characterized by a multitude of long, white, slender, vertical ice crystals up to 6 cm long sprouting from the ground and gracefully curving outward near the top. Closer inspection revealed that clusters of needles were capped with moist orangish-brown silt grains and pebbles 5 to 10 mm in diameter held together by the sticky soil. Stones up to 20 mm in diameter were also buoyed up. Some needle ice clusters were bowed over as if influenced by the weight of their red cap during the final part of their growth. It should be mentioned that also thrust vertically upward 6 cm were horizontal sticks, stones, and the flat-lying top to a 1-gallon paint can. The glistening, white "ice flowers" were photographed at 8 a.m., and by the late morning the ice had disappeared under the tropical sun.

Discussions of needle ice can be found in English in:

Washburn, A.L. (1980) *Geocryology.* Wiley and Sons, New York.

French, H.M. (1996) *The Periglacial Environment.* Longman Group Ltd., New York, 2nd edition.

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Needle ice on horizontal ground near Curitiba, Brazil. Ice crystals are 5 to 6 cm long. Photograph No. PK 19,448 by Troy L. Péwé, 17 July 1975.