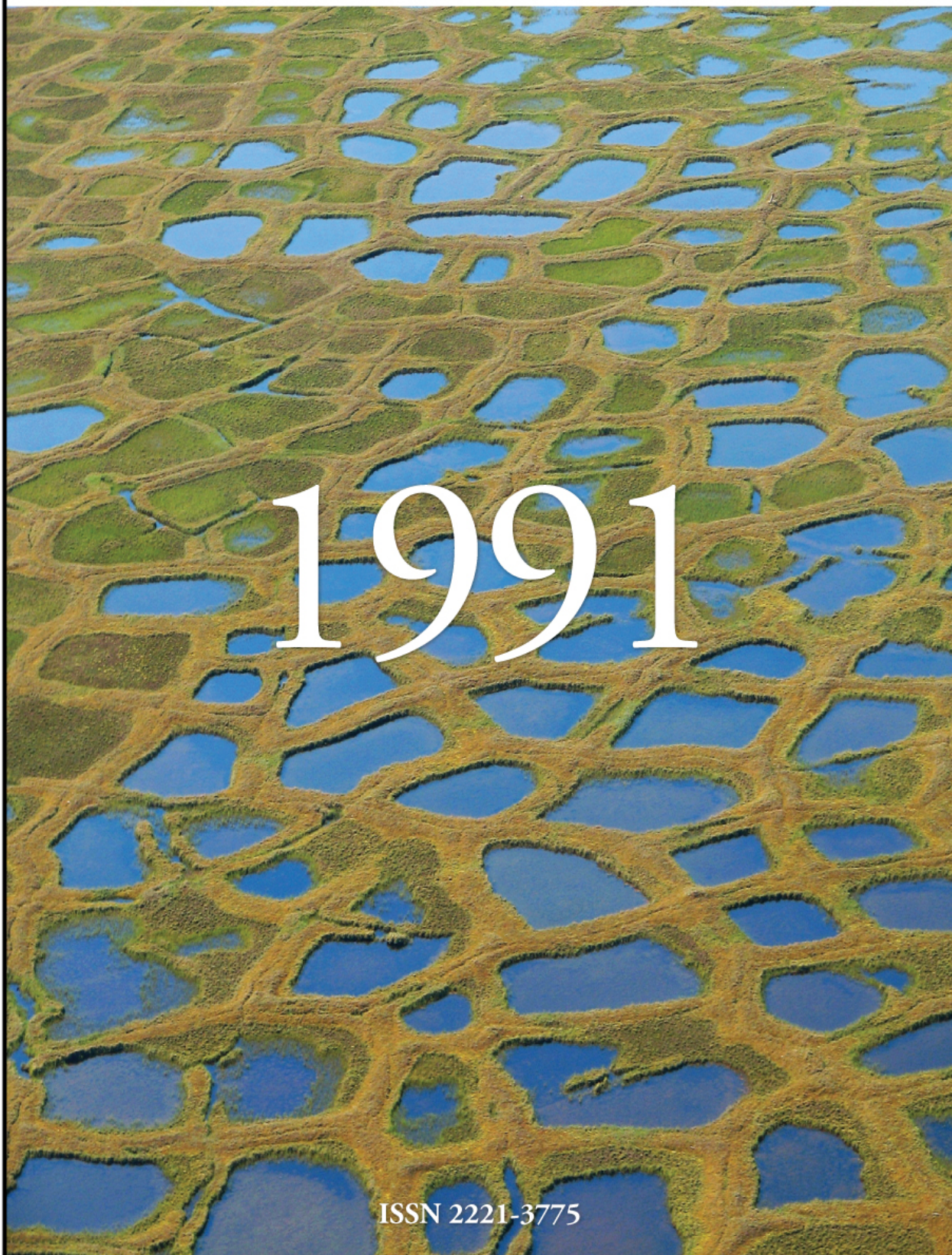


COUNTRY REPORTS



Reports from the Adhering Bodies of the International Permafrost Association



1991

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1 Argentina (and South American Partners)

The International Geological Correlation Programme, Project No. 297, "Geocryology of the Americas," will have its fourth meeting together with the VI International Conference on Permafrost, 5-9 July 1993, in Beijing, China. The aims of the project are clearly defined as:

1. to identify present and past geocryogenic processes,
2. to correlate them across the Americas and the world,
3. to identify areas of future applications and nature conservation, and
4. to stimulate training in geocryology.

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

Report by Arturo E. Corte

2 Canada

Cold Regions Division, Canadian Geotechnical Society:

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

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

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

The 45th Canadian Geotechnical Conference, to be held in Toronto, 26-28 October 1992, will include two sessions sponsored by the Cold Regions Division: one on Permafrost Terrain and the other on the North Warning System (see Calendar).

Awards:

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

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

Permafrost Research at the Geological Survey of Canada:

The Geological Survey of Canada comprises one of the largest groups in Canada of scientists (as distinct from engineers) and technicians devoted primarily to permafrost research. Most of the work is carried out within the Terrain Dynamics Subdivision. Terrain Sciences Division, based in Ottawa. Other permafrost work is carried out in the Environmental Marine Geology Subdivision. Atlantic Geoscience Centre, in Dartmouth, Nova Scotia, and at the Centre

Géoscientifique du Québec, in Québec City. Because of its implications for petroleum exploration, development and transportation in arctic regions, much of this research is undertaken with funding support from the Energy Research Program of the Government of Canada.

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

A major multidisciplinary project to examine geotechnical and geological conditions in the shore zone of the Beaufort Sea in the Canadian western Arctic was recently completed. The project was a cooperative venture between Geological Survey of Canada, Gulf Canada Resources, Esso Resources Canada, Ltd., Hill Geoscience Research, and the Inuvik Scientific Research Centre. The study comprised the drilling, coring and sampling of a line of six deep boreholes (depths of 30 to 100 m) extending from onshore on northern Richards Island out to a water depth of 12 m, 22 km offshore, plus three shallower holes (18 to 21 m depth) right at the coastline. The drilling was done in late winter of 1990, through the land-fast ice, using terrestrial drilling techniques and chilled drilling mud. Associated studies included 12 cone penetrometer tests, geothermal studies down-hole and other geological tests and observations. Results of the field and laboratory studies are still being analyzed.

In July 1 a party of five scientists and technicians from Terrain Sciences Division visited the Yamal and Gydan peninsulas of northern West Siberia, U.S.S.R., for a cooperative study of geophysical and geotechnical methods used for the detection and mapping of ice-rich sediments in areas of oil/gas well sites and pipelines. The Soviet participants were from VSEGINGEO, U.S.S.R. Ministry of Geology. The techniques utilized comprised engineering geology, seismic and electrical profiling, georadar, and geothermal studies. The Soviet side provided drilling and sampling equipment, camp facilities, and all air and ground transportation. Accomplishments included the development of a new field technique for mapping shallow massive ice (5- to 20-m depth) using combined Soviet and Canadian technology, and exposure of both sides to the equipment and methods of the other. A series of reports is in progress, and joint presentations are being planned for the VI International Permafrost Conference, Beijing, 1993. The Soviet side is expected to visit Canada in March/April 1992, for combined field work in the Mackenzie Delta region.

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

3 China

Report from June 1991

Chinese-Soviet Joint Investigations

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

A result of the 1991 investigations is improved understanding of periglacial phenomena: e.g., the perennial ice-cored frost mound at the Chinese Tianshan Glaciological Station, and palsa, ploughing stone and polygons in Western Bogeda. A group of polygonal cracks filled with humic soil was dated at

4656±93B.P. in the eastern Zailiiski Alatau. At the Chinese Tianshan Glaciological Station the finding of buried humic soil horizons indicated thickening of the permafrost, with the sediment aggrading since 4301±96 B.P.

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

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

In the State Key Laboratory in China experiments on water and solute migration in frozen soils in an open system and under temperature gradients were carried out successfully. Compared with tests carried out by the Department of Geology, MSU in 1973, the sample sizes were about 20 times larger than the earlier ones and the temperature gradients used were 20 to 50 times lower. Gas hydrate was artificially synthesized and its unfrozen water content determined by the nuclear magnetic resonance (NMR) technique. Using

scanning microscope techniques, it was found that ice accumulates at the outer side of a model-test frozen silt wall under confining pressure acting on the inner side of the wall. Roman and Zhu Yuanlin found that the creep test data fit Roman's long-term strength model very well.

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

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

Prepared by
Cheng Guodong *Report from December 1991*

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

1. Glaciology
2. Glacier inventory
3. Glaciological hydrology
4. Glaciological climatology
5. Ice core
6. Ice sheets in the polar regions
7. River, lake and sea ice
8. Ice chemistry
9. Ice physical parameters
10. Landsat MSS, TM, SPOT images and CCT data in typical glacial areas
11. Engineering parameters of ice

Geocryology

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

Snow cover

1. Ground observation data
2. Snow chemistry
3. Snow avalanche and snowdrift
4. Snow physical parameters
5. Snow remote sensed data: AVHRR, SMMR, TM, SPOT Northern Hemisphere-winters and springs from 1966-1983) (CCT, ½ inch) Snow spectrum reflection data in different state (0.38- to 1.2-µm; resolution: 10 mm, density: 1600/800, ½ inch)
6. Engineering parameters of snow

Data and publications available include:

- * Glacier inventory of China
Qilian Mountains (1 volume)
Altayshan (1 volume)
Parnir (1 volume)
Inland water system on Qinghai-Xizang Plateau (the basin of Zhari Namco) (1 volume)
- * Kunlun Mountains and Karakorum (5 volumes)
- * Journal of Glaciology and Geocryology (quarterly) (volumes 1-13)
- * Memoirs of Lanzhou Institute of Glaciology and Geocryology (5 volumes, 1980-1985)
- * Geocryology (numbers 1-6)
- * Annual Report of Tianshan Glacial Station (5 volumes, 1966-1983)

Maps

- * Map of Snow, ice and Frozen Ground in China, 1:4,000,000
- * Glacier Map of Qomolangma Peak Area, 1 :50,000
- * Batura Glacier Map, 1 :60,000
- * Gonggashan Glacier Map, 1 :50,000
- * Glacier Map of Tianshan Glacier No. 1, 1 : 10,000 and 1 5,000

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

The Arctic Studies Centre (Centre d'Etudes Arctiques)

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

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

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

A scientific club, founded in 1983, promotes links between French researchers and industrialists. The club meets from two to four times a year, allowing 50 people to exchange ideas and knowledge, under the chairmanship of a banker, about different topics such as oil and gas prospects, ice properties, human chronobiology, ozone layer holes, circumpolar Native educative programs, etc. The Centre houses the French Permafrost Association, a member of the International Permafrost Association. The Committee heading the French association comprises J. Aguirre-Puente, A.M. Gages-Pintaux, J.P. Lautridou and J. Malaurie.

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

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

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

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

Submitted by
Prof. A.M. Cames-Pintaux. Secrétaire Général
on behalf of
Professor Jean Malaurie, Director
Association Française du Pergélisol
Centre d'Etudes Arctiques du CNRS

5 Germany

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

On the engineering side, and with respect to artificial ground freezing, investigation of the properties of frozen soil continued at several university institutes. Deep shafts in frozen ground are under construction; the shaft of Rheinberg especially deserves mention. Artificial ground freezing also is used frequently in tunneling. For a major project the main problems are the drilling of roughly 100-meter-long horizontal freeze

pipes and the increase of water content needed to achieve the required strength of the frozen ground above the water level.

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

prepared by
Prof. Dr. Lorenz King

6 Poland

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

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

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Prepared by

7 Russia

Report from the U.S.S.R., June 1991

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

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

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

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

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

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

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

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

Prepared by
N.A. Grave

The All-Union Research Institute of Hydrology and Engineering Geology

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

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

West Siberia.

Study and mapping of geocryological conditions when exploring placer deposits in permafrost zones : The technology obtains, rationally and economically, information on geocryological conditions needed for deposit mining, including temperature, icing and geocryologic properties of ice-rich loose rocks, and possible cryogenic physical and geological processes.

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

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

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

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

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

current.

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

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

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

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

in areas of oil and gas field development in the north of West Siberia.

Modified from a report by
S.E.Grechishchev, Head
Geocryology Department, VSEGPJGEO *Report from the U.S.S.R., December 1991*

The Problem of Climate Change and Permafrost:

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

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

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

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

Project 2: The evolution of heat balance in permafrost by the natural and man-induced climate change within the limits of different blocks of lithosphere Special stations for systematic temperature measurements in permafrost to the depth of 20-30 m are being established. One of those stations is situated near Yakutsk and is being managed by the U.S.S.R. Permafrost Institute and Japanese Institute of Low Temperature Science. Two stations in Yamal Peninsula (West Siberia) and at the Viljuii hydropower station (Yakutia) are under construction. Additional stations are proposed to be established in different areas of Siberia, the Far East and in China along meridians crossing the permafrost area.

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

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

The Conference on Ground Ice and Cryomorphogenesis:

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

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

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

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

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

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

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

Vaikmaye presented results of comparative analysis of isotope composition of oxygen in ground ice and glaciers for paleoclimatic reconstructions. Fukuda addressed a paper on occurrence of ice-wedge ice and its chemical composition in the Tertiary bedrock at Seymour Island, Antarctic Peninsula. Dubikov's primary concern was geochemistry of massive ice and frozen host soils. Raukas discussed the current state of the problem of the Pleistocene cryogenic periods and glacial formations. He proposed critical analysis of the most recent stratigraphic schemes compiled on the U.S.S.R. European part and also their correlation. Kotov, Bogutsky, Voloshin and others discussed paleocryogenic problems of ground ice formation in Chukotka and Western Ukraine.

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

Roujansky and Danilov discussed relationships between development of the permafrost zone in the Northern Eurasia in the Late Cenozoic and neotectonics. They showed the role of different scale tectonic movements in the evolution of the permafrost zone, in particular, of its cryogenic topography.

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

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

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

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

The Conference was a success thanks to support of its sponsors: Center of Youth's Initiative, Yakutsk:

Northeastern Research Institute, Far Eastern Branch. U.S.S.R. Academy of Sciences, Magadan and Anadyr; Executive Committee of Soviet of People's Deputies of Chukotka, Anadyr.

The Conference provided an excellent opportunity for Soviet, American and Japanese participants to share their achievements and new ideas on permafrost science and cold regions engineering. The next meeting is proposed to be held in Lvov, Ukraine, U.S.S.R., and Tallinn, Estonia, in 1993.

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

8 Switzerland

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

Efforts continued to develop a system for long-term monitoring of alpine permafrost by photogrammetrically analyzing repeated aerial photography of several rock glaciers and by measuring borehole temperature and vertical/horizontal deformation. Monitoring of borehole temperatures at the Murtèl drill site reveals a pronounced warming trend as a consequence of the late 1980s. At 10-m depth where the amplitude of annual temperature variations is reduced to about 0.3°C, the warming rate during the past four years was about 0.5 to 1 °C per decade. Following detailed geophysical mapping and surface sounding (BTS, seismic refraction, DC resistivity, radar), two new permafrost boreholes into bedrock were installed, logged and equipped at the site Ursina above Pontresina/Engadin in connection with problems of avalanche protection and debris flow hazards. First results from borehole temperature and deformation measurements are now available from this site: mean annual permafrost temperatures are close to -0.6° and -1.7°C, permafrost thicknesses are about 35 and 40 m, and surface creep rates of the frozen sediments with up to about 80% ice by volume are 6 and 10 cm/year.

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

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

Prepared by Wilfred Haeberli

9 United States of America

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

ASCE News:

The Technical Council for Cold Regions Engineering (TCCRE) of the American Society of Civil Engineers (ASCE) met in Orlando, Florida, 24-26 October 1991. A four-paper session was held on Highways and Airfields in Cold Regions. The next meeting of TCCRE is scheduled for 8-10 March 1992 in Long Beach, California. TCCRE/ASCE is considering the formation of a Standing Committee on Permafrost; a decision will be reached in 1992.

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

Report by C.W. Lovell,
Chairman, USCDPA