NUMBER 46 3rd ISSUE 1974

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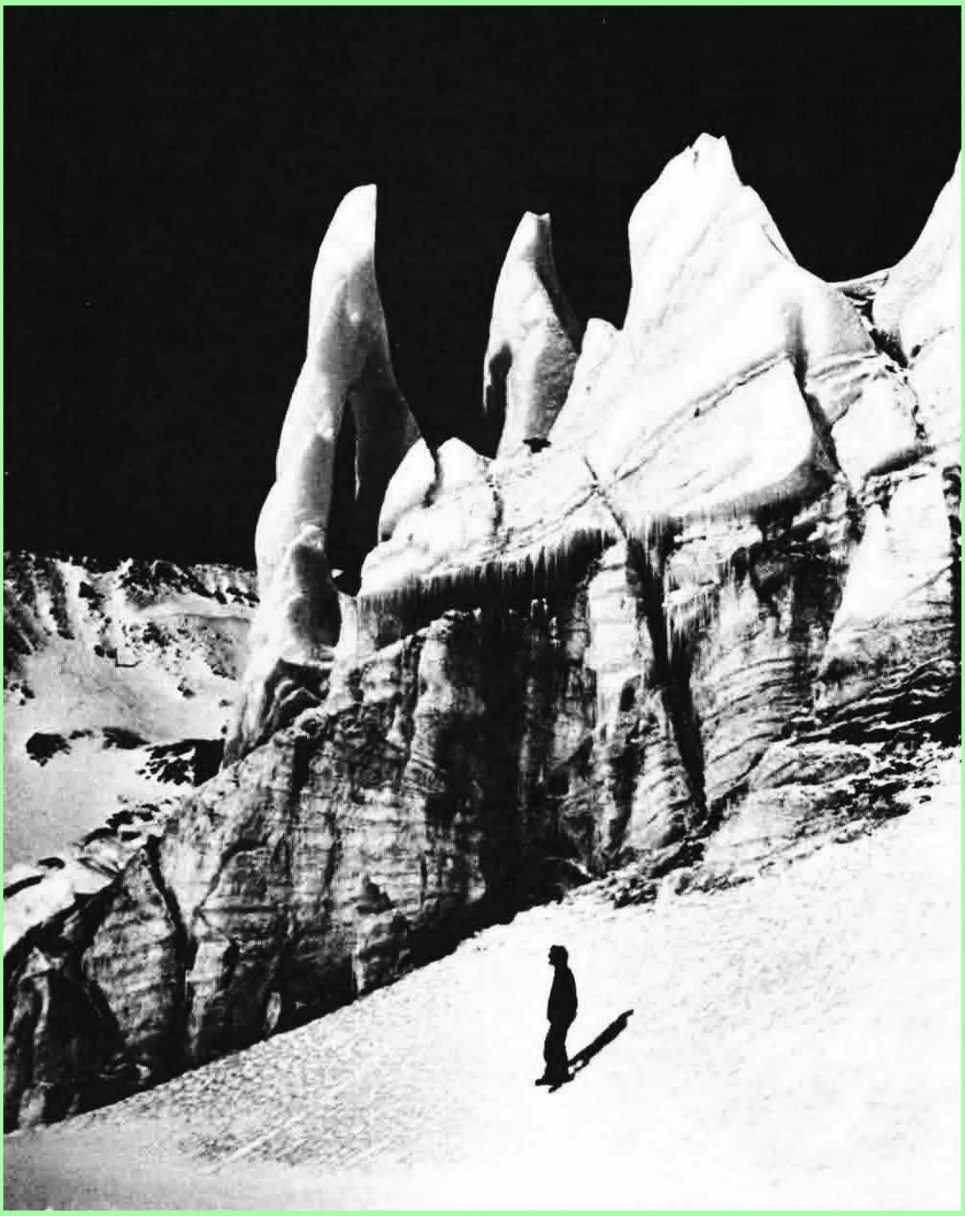

INTERNATIONAL GLACIOLOGICAL SOCIETY

1975 ANNUAL CONFERENCE & ANNUAL GENERAL MEETING

21—23 May The meetings will be held at the Scott Polar Research Institute, Lensfield Road, Cambridge, England.

If you wish to participate, please send the title of your paper to the Secretary of the Society.

(See page 14 of this issue of ICE.)

ICE

NEWS BULLETIN OF THE

INTERNATIONAL GLACIOLOGICAL SOCIETY

3rd ISSUE 1974 NUMBER 46

CONTENTS

LIST OF MEMBERS. Owing to the greatly increased cost of producing this list (the last one was published in 1972) in alternate years, the next one will not appear until the Society's income has caught up with expenditure; in other words, after the next increase in dues. We can, however, provide a few copies of the master list that we keep up-to-date in the office: the cost of xeroxing this is £1.00, to which should be added postage. If you have a genuine need for a copy, please write to the Secretary, enclosing payment at the rates indicated, according to your address:

British Isles — £1.15
N. & S. America,
Africa — £1.60

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New Zealand — £1.70

DUES. We are just able to keep our rates at the same level as in the past three years, but we do need your help in **prompt payment** and in **donations**: please return your payment form NOW, enclosing your cheque/money order. In 1974, **one-third** of our members had not paid by June, when reminders were sent out from the office; this was reduced to one-tenth by the end of November, and we are still making efforts to collect the remainder. The Society does not receive regular grants from any source: we are dependent entirely upon payments from our members, libraries that buy our publications, and organizations that support articles by their employees in the Journal, and upon sales of back issues of the Journal. **Your** help, by paying promptly and by giving a donation, is greatly needed. Thank you.

We regret to announce the deaths of Dr Fritz Loewe and Dr Mikio Shoda.
Obituaries will be published in the Journal of Glaciology.

COVER PICTURE. Snout of the Lyell Glacier, South Georgia. The glacier calves into a lake that freezes in winter months. The ramp consists mainly of lake ice which has been pushed up by the forward movement of the glacier.
Contributed by R. J. C. Hayward.

RECENT WORK

U.S.S.R.

In 1973 Soviet glaciological expeditions carried out investigations in the mountains of the Caucasus, Central Asia, Altay, Polar Urals, Kamchatka, Central Siberia, Khibiny and Antarctica.

CAUCASUS

The Department of Glaciology, Institute of Geography, USSR Academy of Sciences continued glaciological investigations under the I.H.D. programme and multi-disciplinary studies of mass-balance formation in the representative glacier basin, the upper reaches of the Marukha river (West Caucasus). Systematic measurements of heat and ice balances, surveys of variability of snow micro-relief and of shifts of the seasonal snow line were carried out. Processes of ice-formation and internal nourishment were studied. The data on the movement of ice along shear planes were obtained for the first time. The rate of movement proved to be significant.

Possibilities for the application of hydro-chemical methods in glaciology were studied on the glacier. It proved possible to make effective use of the hydro-chemical method, instead of the current method, for the measurements of water discharge in turbulent streams. The same method was applied for three-dimensional surveys of electric conductivity (and purity) of water and ice as well as for the study of the dynamics of surface and intraglacial waters. Quantitative characteristics of vertical flow, coefficients of lateral outflow and "specific" run-off of melt waters through the snow-firn sequence of Lednik Marukhskiy were first obtained by means of lysimetric surveys of meltwater filtration. These surveys were carried out by new methods. Quantitative characteristics of compaction of snow-firn layers caused by settling were obtained for this glacier, following the observations of 1971-72.

For the first time in isotope glaciology, the methods of O^{16}/O^{18} analysis (about 20 samples) were tested successfully on this glacier. They were used to estimate seasonal stratification of firn, the rate of accumulation and infiltration of meltwater on "temperate" glaciers, i.e. under conditions of a significant amount of meltwater. Assumptions concerning the physics of this phenomenon were put forward.

Field studies on glacier climates were continued on Lednik Marukhskiy. Microclimatic surveys of this and of some other glaciers proved that a jump in temperature coincides not only with the boundary of glacier and rock surfaces but with the limit of occurrence of glacier winds. The dependence of the extent of air cooling on the weather type was clarified. This dependence increases in dry, sunny weather and disappears in cloudy weather with precipitation.

Interrelation of glacier-climatic fluctuations with the changes in atmospheric circulation and their recurrence was studied.

A mass balance forecast for the glaciers of this area, the surging Lednik Kolka among them, was prepared. A reconstruction and forecast of the Lednik Kolka mass balance for the period of 1880-2000 was carried out. Possible and actual water accumulation in the glacier basin and its regime were calculated, and a hydrological estimate made of possible flood zones.

The Rostov-on-Don Hydrometeorological Observatory also continued glaciological investigations of Lednik Marukh. Studies under the I.H.D. programme were carried out below the glacier snout throughout the year and on the tongue in July and August. Observations covered 13 more glaciers, situated between the Marukh mountain pass (in the west) and the Mamisonskiy pass (in the east). Surveys of glacier tongue variations made it possible to establish that all glaciers of this area, except for Alibekskiy Lednik, continue to retreat.

The studies of avalanches and the properties of avalanche regime in the El'brus area were carried out by the **Laboratory on the Problems of Snow Avalanches and Mudflows, Moscow University.** Long-term surveys of avalanching were continued along with the study of snow on the slopes. Conditions of the formation of air waves accompanying dry avalanching were studied. It was established that such a wave is a stream of snow and air with a density five times greater than air density, and that it reaches a distance of 300 m from the edges of avalanche deposits. The wave impact near the edges of avalanche deposits reaches 2000 kg/m^2, while near the outer boundary of the zone of avalanche wave activity the impact is 30-50 kg/m^2. The studies under the I.H.D. programme were continued in the selected Dzhankust glacier basin. From the end of April till the end of September snow surveys were carried out three times. During this period the following work was carried out: ablation observations by means of the vast network of stakes and pits, run-off observations on the outlet profile and run-off plots, precipitation surveys in the network of precipitation gauges, meteorological observations below the glacier, measurements of ice temperature at

different depths in the ablation area, radio echo sounding, thermodrilling, surveys of phenological phases of the development of vegetation and the dynamics of bio-mass below the glacier snout. Observational data on the altitude of the accumulation line made it possible to conclude that the mass balance of Lednik Dzhankuat was about zero during the 1972/73 balance year.

Experimental studies of the errors of ablation surveys were continued. It is established that the accuracy of ablation measurements at a point on the glacier surface during a period of 24 hours depends mainly on the accuracy of determination of the thickness of ice that has melted away. During long time intervals (month, season) the value of the relative error approached asymptopically the relative error in the determination of ice density. On Lednik Dzhankuat the relative error in the estimate of ice ablation at a discrete point equalled $\pm 13\%$ for 24 hours, and $\pm 2\%$ for a season.

The Institute of Geography, Georgia carried out investigations on the glaciers of the southern slope of the Central Caucasus. Glaciological, hydrological and meteorological investigations aimed at the study of glacier regime and the regime of glacier waters were made in the Tbilisi river basin. The melting of ice, firn and snow was measured by means of stakes and the surface run-off from the glacier was determined on Lednik Tbilisa. Meteorological surveys were carried out at the heights of 2600 m (near the foot of the glacier), 3000 m (on the tongue) and 3800 m (in the firn basin). In the central part of the accumulation area annual layers were distinguished. The density and temperature of the firn were measured and samples for chemical and pollen analysis distinguished in each annual layer. Filtration of melt waters was observed.

A photo-theodolite resurvey of Lednik Zopkhito and Lednik Laboda was carried out, and values were obtained for the surface velocities of glaciers and their vectors, ablation at the snout, deformation, and the position of the snout.

Hydrometeorological Service, Georgia continued observations of the selected glacier basin Gergety, under the I.H.D. programme, and surveys of the regime variations of 19 glaciers—10 of them situated on the northern slope and 9 on the southern slope of the main Caucasus range. Meteorological and gradient observations, measurements of ablation and accumulation of snow and ice and of surface velocities, levelling and photo-theodolite surveys were carried out on Lednik Gergety.

The increase in ice mass on the northern and southern slopes of the main Caucasus range was established. It is accounted for by the low air temperature and intense precipitation observed in this area in the summer of 1972 and in the spring of 1973. As result of abundant snowfalls the greater part of the glaciers was covered by a thick snow cover, reaching 2-3 m in the middle of July at altitudes of 3200-3600 m above sea level.

According to data from repeated levellings, the glacier thickness of the Kazbek glacierised area grew by 0.9-2.3 m; on the glaciers of the southern slope it decreased by 0.2-0.4 m. In general about 58% of the glaciers observed retreated during 1968-1973.

Among them were all the glaciers of the southern slope but only 16% of the glaciers on the northern slope. 37% of the glaciers situated on the northern slope have advanced. It was especially typical of the Kazbek mountain massif, where the majority of glaciers advanced from 9 to 45 m during the last 10 years.

Transcaucasian Hydrometeorological Institute and Hydrometeorological Service, Azerbydzhan, continued stationary and route surveys on 8 glaciers of the Central and East Caucasus. It is established that the majority of glaciers under investigation continue to retreat, but the rate of their retreat has fallen.

Kharkov University continued investigations of the present day and former glaciation of the Caucasus. Much attention has been given to the study of the role of meteorological factors in surficial ablation. Calculations of the heat balance constituents of two glaciers, situated in the Teberda and Baksan river basins, have been completed. Dendroclimatic and geomorphological investigations made it possible to calculate coefficients of snowiness in the Teberda basin in 18th-20th centuries.

The Alpine Institute of Geophysics carried out field work on Lednik Bashil' in the Cheget basin. The role of glaciers in the run-off of mountain rivers was studied and the seasonal route of glacial run-off determined. Investigations were made of the relationship of glacial mudflows to air temperature and radiation balance, and of the pattern of evaporation from the snow surface and its dependence on wind conditions. Significant values of evaporation from the snow surface were obtained.

CENTRAL ASIA

Glaciological investigations of the **Section of Physical Geography of the Academy of Sciences, Kazakhskaya SSR** were carried out in the Zailiyskiy, Dzhungarskiy and Kungey Alatau. Long-term observations of glaciers in the river basins of Malaya Almatinka, Talgar and Chilik were continued. Detailed studies were carried out under the new programme of glacier variation surveys on Lednik Tsentral'niy Tuyuksu. The network of glaciological stakes was enlarged, covering the accessible area of this glacier.

In view of the huge mudflow which had descended the Malaya Almatinka river, a topographic survey of the basin of the former

lake was carried out near Lednik Tsentral'niy Tuyuksu. The survey made it possible to estimate the amount of water brought by the mudflow. Stereo-photogrammetric observations were made of the active part of the terminal moraine, which had played a part in the process of mud-flow formation. Throughout the ablation period, surveys were carried out of the meteorology water level variations in lakes, meteorology, snow and ice melting and discharge of glacier waters.

Stationary and route snow-avalanche observations were undertaken on the northern slope of the Zailiyskiy Alatau. In the zone of snow avalanche-formation at the altitudes of 1400-3500 m, these included the elements of snow cover regime, strength of snow, synoptic and meteorological conditions of avalanche formation, regime of avalanches and their distribution. Large scale maps of avalanche hazards have been compiled for a number of river basins. Methods of calculating quantitative characteristics of avalanche hazards (maximum and mean perennial volume, energy and recurrence of avalanches), avalanche volume (according to air photography data) maximum length of avalanche cones and boundaries of avalanche-prone zones were worked out by the section.

In Dzhungarskiy Alatau field work was carried out on three glaciers situated in the western part of the northern slope of the range and on eight glaciers in the central area of the same slope.

Studies of mass balance were continued on Lednik Shumskogo (river basin of the Mailiy Baskan). They included detailed gradient surveys of the periglacial air layer at 13 points, covering the whole of glacier surface. The observations make it possible to calculate the turbulent transmission of heat to the glacier at any point of its surface.

The Laboratory of Glaciology, Institute of Geology and Geophysics, Academy of Sciences, Uzbekskaya SSR, studied the role of glaciers belonging to Chatkal mountain system in the formation of the river Chilik run-off. The basic work was carried out in the Pskem river basin where the main bulk of ice is concentrated. The extent of variability of the vertical ablation gradient in time and space and the amount of evaporation from various surfaces have been estimated. Observations included: regularities in the distribution of debris on the glaciers and its dependence on ice melting, the nature of debris cover, the sources of nourishment of the river Pskem over a long period, characteristics of liquid, solid and chemical run-off from the glaciers, and debris-balance on glaciers. Quantitative indices of turbidity of the glacier waters (mean annual turbidity equals 0.019 kg/m^3) and their chemical composition (hydro-carbonaceous group with mean mineralization of 72 mg/1) made it possible to estimate their purity and freshness.

The Department of Glaciology, Central Asia Hydrometeorological Institute continued the studies of Lednik Abramova (southern slope of Alayskiy Range) under the I.H.D. programme. The Institute of Geography, USSR Academy of Sciences, the Arctic and Antarctic Institute and Leningrad University also participated in these investigations. Numerous observations of the dynamics of this glacier were carried out in view of its abrupt surge, which occurred in 1972-73. The studies of internal feeding of this glacier by means of estimating the changes of water-storage in firn layers of deep pits were continued. The Department also continued experiments in high speed thermodrilling of ice.

Surveys of a number of glaciers in Central Asia made it possible to specify methods of calculating surface ablation from mean daily temperature and weather types, and to work out a theoretical model determining the mean perennial position of the firn line of glaciers. New morphometric glacier coefficients, representing the interrelation between glaciation and topography, have been obtained. "Third-order" observations of snout variations were made on 15 glaciers.

The representative capacity of the network of points, indicating snow cover and precipitation in 43 river basins of Central Asia and Kazakhstan, and the effectiveness of different types of snow observations for hydro-meteorological forecasts in such basins were evaluated. Conditions of avalanche formation, development of avalanche protection measures, regularities of seasonal snow distribution in avalanche source areas and its dependence on the topography and the length of avalanche cones were studied. Recommendations were made on the choice of the most informative meteorological properties of avalanching.

Leningrad University carried out glacio-meteorological investigations on Lednik Abramov. The results made it possible to estimate the daily pattern of evaporation and melting at different absolute heights. Morphostructural peculiarities of the glacier were studied, along with surface ice velocities and firn stratigraphy.

The Department of Glaciology, Institute of Geography, USSR Academy of Sciences continued thorough studies of Lednik Medvezhiy. The data obtained on glacier dynamics made it possible to imagine the picture of the initial and final stages of its surge, which took place in spring of 1973. Conditions of external mass exchange of surging glaciers were studied. A number of anomalies of these conditions, arising from a special type of glacier movement, has been established. High temperatures, depending on abnormal downward movement; low values of albedo, caused by excessive debris cover on glacier tongues and obvious predominance of

condensation, can be enumerated among these anomalies.

In autumn all the glaciers of the northern slopes of the Chatkal'skiy and Alayskiy Ranges in the river basins of Sokha and Isfayramsaya were observed and photographed. A number of surging glaciers was discovered among them. The autumn snow cover, occurring after intense cold intrusion in the mountains, was photographed. The zones of different snowiness, which are thought to be connected with the jet-like nature of air streams in the mountains, have been indicated. It is established that the existing concept of a simple correlation between snow colour and thickness (up to 15 cm according to American data) is not true of the mountains.

In view of the compilation of the Glacier Inventory air-visual observations of glaciers in the Gunt and Shakhdara river basins (the Southern Pamirs) were carried out, accompanied by ground studies in the accumulation areas of three selected glaciers in these basins and in the East Pamirs.

Paleo-glaciological studies were carried out in periglacial areas on the northern slope of the Alayskiy range, including balance calculations for paleo-botanical reconstructions of precipitation anomalies in the late-Pleistocene.

The Hydrometeorological Service of Tadzhikskaya SSR carried out observations of the movement of Lednik Medvezhiy and the advance of its snout during the surge. The survey of the glacier snout, accomplished on 12 May, showed that as a result of the surge, the glacier advanced 350 m from the end of the dead ice and 1.5 km from the end of its active part. The glacier still advanced 160 m during the period 12 May—27 June. A dammed lake was formed in the river Abdukagor valley, which had been crossed by Lednik Medvezhiy tongue. Regime observations of this lake helped to produce new methods for calculating discharge from ice-dammed lakes.

Meteorological and hydrological surveys, observations of glacier terminus variations, of ice movement and of surface ablation were made on Lednik GGP (the northern slope of Gissarskiy range). Periodic studies aimed to estimate variations of glacier regime and its relationship with meteorological conditions were carried out on Lednik Skogach (Darvazskiy Khrebet). Tacheometric surveys were accomplished on five glaciers in the Pamirs and Alay.

The Tien-Shan Physical Geographical Station investigated the Karabatkak glacier (Terskey Alatau range) as part of the programme of glacier variations surveys. Meteorological observations, photo-theodolite and albedo surveys of the glacier surface, debris surveys on the tongue, observations of precipitation, ablation and accumulation of snow and ice and the run-off from the glacier have been carried out.

Hydrometeorological Service, the Kirghiz Republic continued investigations of Lednik Golubin (the Ala-Archa river basin). The studies included meteorological, heat balance and hydrological observations; surveys of accumulation-ablation of snow and ice, and of surface ice movement. The surging glacier Aksu-zapadniy (Kungey Alatau range) was investigated in August. Short term observations of the pattern of meteorological elements, ice melting and run-off were made on the glacier. It is established that the advanced part of the glacier has now entered its phase of degradation and stagnation. Run-off in the stagnant phase exceeds the run-off of the "normal" glacier by 2-3 times. A geophysical survey of the four glaciers showed that in 1973 Lednik Aksu-Vostochniy retreated, Lednik Aksu-Zapadniy and Lednik Dolonata remained stationary and Lednik Golubin advanced 4-10 m.

The Laboratory on the Problems of Snow Avalanches and Mudflows, Moscow University mapped avalanches in the mountain areas of Central Asia.

THE ALTAY

Tomsk University continued investigations under the I.H.D. programme in the selected glacier basin Aktru and observations in the Mul'ta river basin. In the Aktru basin the basic studies were carried out on Lednik Maliy Aktru at a height of 2340 m and at the station "Uchitel", 3050 m. The programme included aerial, electro-thermometric and actinometric surveys, investigations of the temperature field, humidity and wind, hydrometric observations on cross-sections, studies of icings, snow patches and processes on the slopes. Stake observations were made of glacier accumulation and ablation up to a height of 3250 m, and by means of a pair of stakes (one darkened by a sun screen) at heights of 2340 and 3100 m. The latter provided separate registration of melting factors. On Lednik Aktru and Lednik Leviy Aktru snow surveys and topographic surveys of glacier snouts were carried out, and ice velocities measured. It has been established in the pits of the Maliy Aktru firn area that annual accumulation equals 100 g/cm^2, and visible run-off begins at a height of 3350m.

Meteorological conditions in 1973 were close to mean perennial conditions. The Altay glaciers continue to retreat. Paleo-glaciological observations were made in the Central Altay valleys. The stage nature of glacier retreat has been confirmed (8 stages in all). Additional information about the limits of the maximum (Mid-Quaternary) glaciation in the Chuyskaya basin was obtained. It was established that the scale of glaciation exceeded that assumed.

The section of Physical Geography of the Academy of Sciences, Kazakhskaya SSR in summer continued glaciological observations in the Berel' river basin. "Second order" observations were carried out on Lednik Malyy Berel'skiy and Lednik Bol'shoy Berel'skiy under the new programme of glacier variation surveys.

THE MOUNTAINS OF CENTRAL SIBERIA

The Institute of Geography of Siberia and Far East, Siberian Branch of the USSR Academy of Sciences, studied the snow cover and avalanches in the treeless zone of the Khamar-Daban range. Observations of icing and snow patch melting were started at heights of over 2000 m. The relationship of snow thickness to the density of trees, gradient of relief and the height of herbal cover in the steppe was established. At the stations of the Minusinskaya basin evaporation from the snow cover was studied and several snow survey profiles crossing the water catchment area were carried out. Aero-visual survey of icings was made in the Irkut river basin. Traces of former glaciation were studied in the Ona river basin, Zapadnyy Sayan.

Tomsk University carried out glaciological studies in the Kuznetskiy Alatau. Conditions of glacier occurrence at low absolute levels (1200-1400 m) were investigated. It has been established that the annual amount of precipitation on the northern slopes of this range reaches to 200 g/cm^2 and wind concentration of snow equals about 600 g/cm^2. "Temperate" zones of ice-formation develop under deep snow cover.

POLAR URALS

The Department of Glaciology, Institute of Geography USSR, continued long-term studies in the selected basin of the Bol'shaya Khadata river. Investigations included the formation mechanism of glacier climates and water-ice balance, mass budgets for the whole area of Lednik Obrucheva and Lednik IGAN, photogeodetic work and photo-surveys on a 1:1,000 scale of the glaciers situated on the Oche-Nyrd range, and further development of the network of precipitation gauges.

New apparatus for obtaining glaciological information in the course of thermo-drilling was tested. During these tests data on the thickness of Lednik Obrucheva were obtained at six points along longitudinal and transverse profiles (the maximum thickness measured was 137 m). The data also contained information about the stratification of the whole glacier including the position of the firn-ice boundary in the accumulation area of the glacier. The records of the drilling velocity show that water pressure near the bed-rock is close to hydrostatic ice-pressure. This conclusion is important when excavation of a tunnel in the ice is planned: any tunnel with no drainage in its lower part will be filled with water.

Investigations of glacial morphogenesis and the history of the Urals glaciation in the Holocene and Late Pleistocene were also carried out. In the northern part of the Polar Urals the spreading of stadial moraines and their correlation with paleo-lacustrine and alluvial deposits was studied. The pollen analysis of paleo-lacustrine deposits and peat-bogs made it possible to distinguish 7 phases in the development of vegetation during the Holocene. On the basis of new radiocarbon ages of organic material of these deposits, four stages of glaciation in the Polar Urals in the Holocene and Late Pleistocene were identified.

KHIBINY

The "Apatit" Mine Avalanche Protection Service carried out phototheodolite surveys of avalanches aimed at estimating possibilities of obtaining their exact parameters. Avalanche impact was studied with the help of transmitters. The impacts of three avalanches were registered in 1973; the impact of one of them exceeded all the values registered before (mean value 29 tonne/m^2, maximum value 72 tonne/m^2). The effect of technological influence on avalanche regime was studied. The data of 1933-1973 showed that changes in the morphology of the avalanche source situated in industrial regions where regular preventive measures are taken caused the mean avalanche dimensions to decrease 3 times and their general number 3.5 times.

The Laboratory on the Problems of Snow Avalanches and Mudflows, Moscow University accomplished the cycle of long-term studies of snow, water and rock flows in the Koashva river basin. Geomorphological and meteorological conditions of the formation of these flows, their formation mechanism and movement were determined. It was established that these flows occupy an intermediate position between avalanches and mudflows, sometimes large in volume and sometimes flooding constructions at their termini. Several defensive engineering measures were proposed.

KAMCHATKA AND SAKHALIN

The Institute of Volcanology, USSR Academy of Sciences continued investigations of the recent glaciation in the areas of active volcanism. Field work was carried out on Lednik Kozel'skiy (Avacha group of volcanoes) and Lednik Ermana (Klyuchevskaya Group). A snow survey was carried out on Lednik Kozel'skiy at the end of May. It was accompanied by studies of stratigraphy and the structure of snow sequence in three pits (at the absolute heights of 1840, 1600 and 1250 m). Continuous observations on the glacier were carried out from 15 July to 13

October. Meteorological observations at heights of 850 m (near the terminal moraine) and 1600 m (in the accumulation area), surveys of the water level and discharge in the glacier fed river, of snow and ice ablation were completed during this period. Annual accumulation in the snow-firn sequence, which has changed from 110 cm in 1968/69 to 330 cm in 1972/73, was determined according to observations of the crevasse at the height of 1450 m. Meteorological and snow surveys were made on Lednik Ermana in September.

The Novosibirsk Institute of Railway Transport carried out instrumental observations of the dynamics of the internal structure of artificial avalanches in the trough constructed in southern Sakhalin. The length of the trough is about 100 m and the velocity of snow blocks exceeds 40 m/sec. These studies made it possible to develop a theory of avalanche movement and to specify methods of calculating defensive constructions capable of withstanding the impacts of the most rapid avalanches. For the first time in the USSR devices to promote destruction by wind of snow cornices on the crests of avalanche-prone ravines were built and tested in the mountains of southern Sakhalin.

ANTARCTICA

Investigations under the long-term programme of the International Antarctic Glaciological Project were carried out. The inland glaciological traverse from "Mirny" to "Vostok" station was continued in February-April. Investigations were carried out at a distance of 153-360 m from the coast. A snow survey was carried out on the previously established stakes and new stakes. Detailed geophysical and glaciological studies were carried out on two polygons (5 x 5 km) at the 153rd and 355th kilometres. They included stratigraphic studies of snow sequence in pits down to a depth of 3 m and detailed snow surveys on legs of the route. A survey of subglacial topography by radio echo sounding was carried out on both polygons. Resurveys make it possible to determine the velocity and direction of ice movement. With this purpose vertical gradients of the magnetic field were determined on two traverses, 6 km long, situated in the area of the 350th km. At polygon "355 km", in a bore-hole 70 m deep, the temperature gradient was measured and samples for geochemical and isotopic analyses were selected.

The thermodrilling of the deep bore-hole was continued at "Vostok" station and ice-cores obtained. Geophysical studies were carried out in the bore-hole. Integral ice samples were selected from the core for O^{16}/O^{18} analysis.

The Arctic and Antarctic Institute, the Institute of Geography USSR Academy of Sciences and Moscow University continued joint O^{16}/O^{18} analysis of ice-cores obtained from the bore-hole at "Vostok" station. About 400 ice samples were selected for O^{16}/O^{18} content analysis from the 500 upper metres of this hole. It was found possible to distinguish seasonal isotopic differences in the sequence, at least at depths where the thickness of the annual layer reaches 2 cm of ice. This conclusion is of great methodological importance. A profile of climatic change in Central Antarctica has been obtained for the last 22,000 years.

The analysis of the radiogeodetic measurements on pentagons determined during the seasons of 1963/64 and 1968/69 by the Soviet-French team along the "Mirny"-"Vostok" traverse was continued. It became possible to work out a mathematical method for determining the direction of movement of ice, and the value and direction of the velocity gradient, according to the measured rates of deformation. Approximate functions of the distribution of velocity values and ice deformation along the zone of profile covering polygons from "Mirny" to "Vostok" were obtained by means of numerical analysis.

Maps of subglacial Antarctic topography, scale 1:5 000 000 and of Enderby Land, scale 1:1 000 000, were plotted. Maps of atmospheric precipitation and nourishment of the Antarctic Ice Sheet and also graphs of evaporation-sublimation for some areas of Antarctica have been compiled.

Moscow University continued studies of the history of the dry valley glaciation, taking into account synchronous neotectonic movements. An improved development hypothesis for the Ferrar, Taylor and Wright outlet glaciers has been worked out. The results obtained made it possible to put forward a hypothesis of neotectonic control of the extent of Antarctic glaciation in its present day stage.

The following results in glaciology in 1973 should be considered the most important:

1. Basic premises for the organization of glacier variation surveys have been compiled and published as a paper. Theoretical assumptions, instructions and analysis of organization problems of such observations in our country are formulated in this paper. In accordance with the document, surveys of glacier variations are organized by the Academy of Sciences, Hydrometeorological Service and Universities, under the methodological guidance of the Section of Glaciology, USSR Academy of Sciences.
2. The time and extent of the Lednik Medvezhiy surge were forecast. Information on the impending surge, given in good time, made it possible to complete all the preventive measures necessary and to reduce considerably the damage. A method was devised for calculating the discharge from glacier-dammed lakes by means of a system of differential equations.

3. A cycle of statistical studies of snow made it possible to expose the basic regularities of deformation and changes in snow strength under stress. The relationship between changes in snow structure in the course of creep and the spreading rates of supersonic waves has been established.

4. An algorithm of the movement of trough-like snow avalanches has been worked out. Methods of specification of parameters in this algorithm have been introduced. Studies in the Elbrus area were the first among avalanche forecasting experiments carried out with the help of computers. The programme for computers has been compiled and tested on the data obtained.

5. The dependence of the mechanical properties of ice on formation conditions has been investigated. The ways of changing its mechanical peculiarities purposely by means of creating adequate thermodynamic conditions of ice-formation have been determined. It has been established that under long deformation, the structure of ice changes. Three stages of recrystallization, corresponding to three stages of creeping, can be observed; the stage of collective recrystallization, of relative stabilization of structure and that of crystal crushing. New data on glacier movement have been obtained by means of constructing a model of non-stationary glaciers, taking temperature fields into account.

6. An ice core to the depth of 500 m was obtained from the "Vostok" station bore-hole. The O^{16}/O^{18} analysis of this core made it possible to construct the profile of climatic changes in Central Antarctica for the last 22,000 years. It is established that 10,000-14,000 years ago climatic warming of 5°C took place in Antarctica and the O^{18} content in precipitation increased on average by 5%. This and some other results of core analysis testify to the synchronism of the main temperature boundaries of the Holocene in both hemispheres.

7. Paleoglaciological studies in the Arctic carried out in Zemblya Frantz Iosifa, Spitsbergen, Greenland and the Canadian Archipelago during recent years proved that the scale of Pleistocene glaciation in the Arctic Ocean was more extensive than had been supposed before. Peculiarities of the regime, history of glaciation and geological activity of ice sheets covering water areas of seas were distinguished. These studies resulted in the first geophysical classification of ice sheets. The classification comprises the class of continental ice sheets, classes of ice sheets on continental shelves and above deep seas. This work ushered in the possibility of glaciological interpretation of facts now used by opponents of the glaciation theory.

V. M. Kotlyakov

NORBERT UNTERSTEINER

Norbert Untersteiner was born in February 1926 in Meran, in that long-disputed part of the eastern Alps on the Austrian-Italian border. His family was Austrian and he was educated at the Real-Gymnasium in Salzburg. There he distinguished himself in physical education, while gaining, it is rumoured, the worst possible marks in all other subjects. Military service with mountain troops occupied him for twelve months from May 1944, during which time he rose to what he has described as the exalted rank of sergeant. The latter half of 1945 saw him at the University of Innsbruck, where he studied until 1950, specialising in the meteorology of mountain areas. His adviser was Alfred Defant, under whom he gained his Ph.D. in 1950. During this period at the University of Innsbruck he served from 1949-51 as a Demonstrator in the Institut für Meteorologie und Geophysik, working with Herfried Hoinkes, director of the Institute. In 1952 he took the post of Assistant at a similar institute in the University of Vienna, where he stayed until 1956. He gained further field experience in glacial meteorology when he went to Asia in 1955 as a member of an expedition to the Karakorum.

Up to 1957, Norbert's researches had been concerned with the effect of meteorological parameters on glaciers, and in particular with ablation, mass and radiation balance studies, and banding in glacier ice. But a move to North America in 1957 shifted the emphasis of his work from alpine areas to sea ice. His first acquaintance with sea ice came when he spent the year 1957-58 as Senior Scientist at the University of Washington and scientific leader on Ice Station Alpha, one of the two drifting stations in the Arctic Ocean studied by U.S. scientists during the International Geophysical Year. With F. I. Badgeley he worked on the thermal budget of the pack ice during the summer and autumn—a field of research that occupied him on his return to Vienna. He held the post of Research Meteorologist at that University 1958-62, and was awarded the Austrian Honorary Cross for Arts and Sciences in 1959 and his senior doctorate (Docent) in 1961.

In 1962 he returned to Seattle as a Research Associate Professor at the University of Washington, a post he held until 1971 when he became Professor of Atmospheric Sciences and Geophysics. His main study was the ice budget of the Arctic Ocean. This took him into the field on many occasions, and the results of his work may be seen in the articles published during this period on mass and heat budget, heat storage in ice, temperature regime, and thickness changes at the bottom of floating ice. He became involved in organizational work concerned with studies in

the Arctic Ocean and served as a member of various committees and panels and as adviser and consultant to groups in the United States and Canada. He has been a member of the Editorial Board of the Journal of Glaciology since 1966 and was a member of the Council of the Glaciological Society 1968-71.

Norbert's growing interest in the overall picture of Arctic Ocean thermo-dynamics led in 1969 to the formulation with K. L. Hunkins and under the auspices of the Office of Naval Research of a plan to study from drifting stations the interaction of ice, air and sea. The idea for a multi-disciplinary project to study problems related to the movement of pack ice dates from the early occupation of ice island T-3 and the IGY drift of Alpha, and by 1969 the idea, by its approach and timeliness, was clearly worthy of support. It was thus that AIDJEX—Arctic Ice Dynamics Joint Experiment—was born, with J. O. Fletcher as Co-ordinator. In 1971, when Col. Fletcher moved to the National Science Foundation, Norbert took over as Co-ordinator. Since then he has been fully involved in the realisation of its aims, which are to provide an understanding of the large-scale response of sea ice to its environment, in order to help with the solution of many important theoretical and practical problems, such as the interaction between ice cover and global circulation and the passage of ships in ice-covered seas. The measurements are being taken from an array of drifting stations, some manned, some unmanned; several pilot studies have already been made and the main array will be in operation in the spring of 1975. (See ICE, 1971, No. 35, p. 16-18.)

If Norbert's earliest major contribution to glaciology was with H. Hoinkes in the field of glacial meteorology, his subsequent one is as the driving force behind AIDJEX, potentially one of the most important glaciological experiments. It represents a whole new dimension of co-operation in glaciological research, in a project that is too big for one organization or group to undertake alone, yet not big enough to become a full governmental effort. It is the kind of project that is difficult to operate, depending as it does on the fruitful co-operation of several groups of scientists and support teams, from more than one country. Gerald Seligman's Jungfraujoch expedition of 1948, albeit a small one, was an earlier example of first-time co-operation on a particular piece of glaciological research, while the Norwegian-British-Swedish Expedition 1949-52 marked a new level of joint endeavour in Antarctic regions.

Although he may have obtained low marks for school work, he would now gain top marks as an interpreter of the finer points of language. He is specially adept at marking the pitfalls that lie in wait when English-speakers and American-speakers try to converse with each other, and he can give full value to an interchange between either of those tongues and his own native German. Equally appreciated are his wit and lively sense of humour, while his fund of anecdotes has brought a sparkle to many a party.

PROFILES IN ICE

No. 5, Jan. 1960	Richard Finsterwalder (President, Comm. Snow & Ice)
No. 6, July 1960	Gerald Seligman (President, Glaciological Society)
No. 7, Jan. 1961	Robert P. Sharp
No. 8, July 1961	Robert Haefeli
No. 9, Jan. 1962	Hans W:son Ahimann
No. 10, July 1962	Petr. A. Shumskiy (President, Comm. Snow & Ice)
No. 11, Jan. 1963	W. H. Ward (Secretary, Comm. Snow & Ice)
No. 12, July 1963	Valter Schytt
No. 13, Dec. 1963	Henri Bader
No. 14, Apr. 1964	Sir Vivian Fuchs (President, Glaciological Society)
No. 15, Aug. 1964	Marcel de Quervain
No. 16, Dec. 1964	Herfried Hoinkes (President, Comm. Snow & Ice)
No. 17, Apr. 1965	Fritz Loewe
No. 18, Aug. 1965	Geoff Hattersley-Smith
No. 19, Dec. 1965	Bert Crary
No. 20, Apr. 1966	Z. Yosida
No. 21, Aug. 1966	John Nye (President, Glaciological Society)
No. 22, Dec. 1966	Bill Field
No. 23, Apr. 1967	L. Lliboutry
No. 24, Aug. 1967	Max Perutz
No. 25, Dec. 1967	J. Eythórsson
No. 26, Apr. 1968	Mark F. Meier (President, Comm. Snow & Ice)
No. 27, Aug. 1968	Uwe Radok
No. 28, Dec. 1968	John Glen (Senior Editor, Journal of Glaciology)
No. 29, Apr. 1969	Manfredo Vanni
No. 30, Aug. 1969	Peter Kasser
No. 31, Dec. 1969	Akira Higashi
No. 32, Apr. 1970	Brian Roberts
No. 33, Aug. 1970	Sigurdur Thorarinsson
No. 34, Dec. 1970	D. Kuroiwa
No. 35, Apr. 1971	V. Kotlyakov
No. 36, 2nd 1971	J. Weertman
No. 37, 3rd 1971	L. Gold
No. 38, 1st 1972	Honorary Members
No. 39, 2nd 1972	W. F. Weeks (President, Int. Glaciological Society)
No. 40, 3rd 1972	F. Müller (Secretary, Int. Comm. Snow & Ice)
No. 41, 1st 1973	G. Østrem
No. 42, 2nd 1973	E. R. Pounder
No. 43, 3rd 1973	H. Röthlisberger
No. 44, 1st 1974	E. R. LaChapelle
No. 45, 2nd 1974	W. Dansgaard
No. 46, 3rd 1974	N. Untersteiner

"You mustn't miss this! The last lot walked 400 miles, stuck a pole in the ground and then went back again."

INTERNATIONAL GLACIOLOGY SOCIETY

ANNUAL GENERAL MEETING 1974

MINUTES OF THE ANNUAL GENERAL MEETING OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY 1 MAY 1973 AT THE CHEMICAL LABORATORY, CAMBRIDGE, ENGLAND

The President, Dr Wilford F. Weeks, was in the Chair.

1. **The Minutes of the 1973 Annual General Meeting,** published in ICE, No. 42, 2nd issue 1973, were approved, and signed by the Chairman.

2. **The President** gave his report for 1973-74: As my previous President's report to the membership was given at the 1973 spring Annual General Meeting, 16 months have now passed since that time. This period has been one of considerable Society activity. It has also seen a growth in the membership which at the end of April 1973 stood at 992. Today our membership is 1050, and 679 libraries subscribe to the Journal. Much of this increase in membership has been due to the activities of the Branches. In 1973 the Northeastern North American Branch met in Canada, the Nordic Branch met in Greenland, and the Western Alpine Branch met in Switzerland. Following this, in 1974 the Nordic Branch met in Western Norway, the Western Alpine Branch met in Italy, and the British Branch, which had been somewhat dormant during the last few years in that it had been able to substitute our usual spring Annual Conferences for Branch meetings, aroused itself and met in Birmingham. During this same period, the Society's Headquarters was busy with the preparations for the Remote Sensing Symposium and I can assure those of you that have never organized a Symposium that it took a lot of work indeed, particularly for the people serving on the Papers Committee and on the Local Organizing Committee.

   The Journal continues to maintain its high standards and our Editors are hard at work trying to reduce the publishing delays to the shortest time possible. I am also pleased to announce that extra volumes of the Journal will be published in 1975, 1976 and 1977 arising from this year's symposium, from a Canadian symposium on the "Thermal Regime of Glaciers and Ice Sheets" to be held in British Columbia next year, and from our Applied Glaciology symposium in 1976. Thus we have, at least, succeeded in establishing our long-hoped for series of conference proceedings, encompassing our own meetings and also those of other organizers who may wish to avail themselves of the Journal of Glaciology as a publishing medium. The Council stated some years ago that this was their policy, and we are now pleased to be able to implement it. We shall welcome enquiries from other organizations about our system for arranging publication in the Journal of Glaciology, with each enquiry being dealt with by the Council on its merits.

   Members of the Society will receive all these extra volumes at the normal all-inclusive yearly price. We have been greatly aided in achieving this broad distribution of our conference proceedings by a recently announced U.S. National Science Foundation Grant of $10,900 to support our publishing of the current symposium. As the Treasurer will soon tell you, we can maintain our present subscription rate during 1975. However, after that time the normal rate will undoubtedly have to be increased to keep ourselves above the rising waters of international inflation. I feel that, by any standard, membership in the International Glaciological Society is an excellent buy—however, this is partly true because we still do not operate on a fully business basis in that we clearly pay less than the going rate for staff and for equipment. The council is aware of this problem and is taking steps to correct it. Moreover, we feel that when this is corrected, membership in the Society will still be a good buy.

   Our Senior Editor, John Glen, already has the Proceedings of the Remote Sensing Symposium well in hand, and he plans that the volume will appear no later than the middle of next year. Meeting this goal will, of course, depend upon the co-operation of all involved—authors, rapporteurs, reviewers —but accomplishing it is quite important in that it will reflect the kind of time-scale

that we plan to achieve with future conference proceedings. Such timing will be extremely good for a journal with the overall publishing quality of the Journal of Glaciology. This timeliness, as well as the broad circulation of the Journal, will increase the impact that these proceedings have upon the widely scattered members of our profession.

I regret to inform you of the deaths of two of our Honorary Members: Professor Hans Ahlmann and Sir Raymond Priestley. Their presence will be greatly missed by their many friends in the Society.

To counter this sad news, I remind you that in a few short hours I will have the pleasure of presenting the Seligman Crystal to Stan Evans for his contributions to the development of radio echo sounding.

In summary, I feel that the Society is in excellent health indeed for these difficult times. The Council and the staff of the Society are interested in serving the membership in as many ways as possible. We welcome your suggestions and we appreciate the support that you have given us during this last year.

3. **The Treasurer**, Dr J. A. Heap, gave his report: The accounts for 1973 show that the Society achieved a surplus of income over expenditure for the year of £919 as compared with a deficit for 1972 of £636 and a deficit for 1971 of £1,512. It would seem that over the last three years, during a period of inflation which has now reached unprecedented levels, the Society's finances have prospered in a manner which our individual experiences over these years would lead us to find surprising.

   I closed my Report for 1972 with the warning that your Council would need to reconsider the subscription rates unless the membership could be significantly raised. This Report—covering 1973—is being written in September 1974, almost six months later than usual, which helps me to view the 1973 accounts in perspective. The view is not reassuring. The membership of the Society has risen slowly and is now hovering around the 1000 mark, but the costs of the Society have risen sharply. The costs of printing the 1973 volume of the Journal of Glaciology rose to £5,939 as compared with £4,852 for the 1972 volume and our administrative expenses rose from £4,842 to £5,197. Our budget of the Society's recurring income and expenditure during 1974 suggests that there is likely to be a substantial deficit. At the same time the Society has embarked, as your President remarks, on an ambitious programme of editing and publishing the proceedings of international glaciological conferences and symposia as volumes of the Journal. Your Council believes that this development promises to be of great benefit to members of the Society and to the coherence of glaciological research, but the programme does impose heavy burdens on our editorial and administrative arrangements. Although each of these publishing ventures is expected to be financially self-supporting, your Council feels that the Society needs to budget additional sums to meet these burdens if the development is going to mark a permanent step forward in the Society's progress.

   Although I am happy to report that the Society's finances are in good heart, I cannot end other than by saying that the need to meet inflation and the additional costs involved in improving the services of the Society to its members bring the need to increase subscriptions one year nearer.

4. **Election of auditors for the 1974 accounts**: Dr J. A. Heap proposed and Dr C. W. M. Swithinbank seconded that Messrs Peters, Elworthy and Moore, of Cambridge, be elected auditors for the 1974 accounts. This was carried unanimously.

5. **Elections to the Council 1974-77**: After circulation to all members of the Society of the Council's suggested list of nominees, no further nominations had been received. The following people were therefore elected unanimously:

   Elective Members— C. Lesca
   O. Orheim
   A. Palmer
   E. R. Pounder

   The President thanked the retiring Council members for their years of service: W. Ambach, W. F. Budd, W. Dansgaard and G. de Q. Robin.

THE SELIGMAN FUND

At a meeting held on 20 September 1974, the Council of the Society agreed on the following terms of reference for the Seligman Fund:

1. The Seligman Fund shall consist of the legacy left to the Society by Gerald Seligman together with such interest as may accrue from the investment of the legacy. The initial capital sum shall remain invested and the interest may accrue, or be invested, or be used to assist with the following expenditures:
   a) the purchase of Seligman Crystals;
   b) the reimbursement of general funds annually with the sum they would otherwise have received from those members who have been created Honorary Members;
   c) the payment of fees for an occasional special lecture, on the recommendation of the Council;
2. The Treasurer shall submit proposals to the meeting of the Council held at the time of the Annual General Meeting for the use in accordance with the above provisions.

1975 ANNUAL CONFERENCE

The **Conference** will be held in Cambridge, England from Wednesday 21 May to Friday 23 May, in the Scott Polar Research Institute, Lensfield Road, by kind permission of the Director. If you wish to present the results of recent research, please send the title of your talk to the Secretary before 15 April 1975. The Sessions will last from 0930 to 1245 and from 1415 to 1715.

The **Annual General Meeting,** for the presentation of reports by the President and Treasurer and for the confirmation of elections, will be held on Thursday 22 May at 1730, after the afternoon session.

The **Annual Dinner** will be held on Thursday 22 May at 1930 (sherry time) in Clare Hall, Herschel Road. The cost is £3.00, wines and coffee included. Reservations for the dinner or for accommodation should be booked via the Secretary: circulars and booking forms will be issued to every member in January 1975.

BRANCH NEWS

WESTERN ALPINE BRANCH

The 3rd Meeting of the Branch took place in Courmayeur, Italy, from 6-8 September 1974. It was attended by more than 70 researchers and specialists coming from France, Switzerland, Austria, Italy.

The opening speeches were given by Mr Lavini, councillor responsible for Education in the Aosta Valley, and Mr C. Agustoni, on behalf of Prof. Desio. They represented the two organizations supporting the Meeting.

The session was directed by Prof. Lliboutry, with the following papers:

W. Schneebeli
Datations de moraines d'après des documents historiques (tableaux, cartes topographiques): le glacier de Breney, Val de Bagnes (Valais).

H. Leuzinger
Chronologie de la Période postglaciaire d'après des horizonts de terre subfossiles dans les langues de solifluction: Mont Chavagl (Grisons) et Val de Bagnes (Valais).

F. Röthlisberger
Datations des variations glaciaires d'après des horizonts de sol couverts de moraines: Glacier de Findelen, Zermatt (Valais).

H. N. Müller
Dendro-(xylo-) chronologie-climatologie: Une possibilitée de chronologie postglaciaire? Reserches fondamentales dans la région du glacier de Rossbolen, Simplon (Valais).

A. Bezinge
Analyses de troncs morainiques du climat postglaciaire.

Charrier-Peretti
Analyses palynologique et datation radiometrique C-14 de quelques dépots tourbeux intermoreniques dans les Alpes Occidentales Piémontaises; déductions au regard des paléoclimats locaux pendant le Quaternaire Supérieur.

C. Lesca
Photointerprétation et représentation cartographique des moraines.

C. Lesca
Les glaciers inconnus du Mont Blanc.

On the following day, with beautiful weather, an excursion was made in the Ferret Valley, where Mr G. Piovano and Mrs A. Cerutti explained the work carried on and the variations of the Pré de Bar glacier in the last years.

In the afternoon a group went sightseeing in the town of Aosta and another group went to Valnontey to visit the "Gran Paradiso" glaciers.

In the evening a meeting of the Branch was held. A. Bezinge, the President in office, read a report on the activities carried on during 1973-1974. In accordance with the constitution, Ing. C. Lesca was appointed President; Ing. F. Valla, Vice-President; Dr. R. Bocquet, Secretary.

It was decided to hold the 4th Meeting in the Douphiné, in a locality to be chosen. The theme will be "Correlation between glacier variations and weather conditions".

On September 8, Veni Valley was visited and particularly the glaciers "Brenva" and "Miage". On the peaty basins which surround the Miage Lake, coring tests were made with Atlas-Copco sets.

On the same glacier Mr Piovano's team gave an interesting demonstration of depth measurements by geoelectric sets. After a short stop at the Lake bank, the group reached the front of the "La Lex Blanche" glacier. Mr C. Lesca, who had recently studied this glacier, explained its characteristics.

In the evening everyone attended a pleasant feast.

Corrado Lesca

THE LIBRARY

BOOKS RECEIVED

Calkins, Darryl J. A research hydraulic flume for modeling drifting snow. Design, construction and calibration. *U.S. Army Cold Regions Research and Engineering Laboratory. Technical Report* 251, 1974, iii, 16p.

Colbeck, S. C. and Gow, A. J. Isua, Greenland: glaciological investigations during 1973. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 318, 1974, iii, 15p.
[Results of drilling experiments in connection with proposed mining activities.]

Desio, A. *and others.* Results of half-a-century investigation on the glaciers of the Ortles-Cevedale mountain group (central Alps). By A. Desio, S. Belloni, A. Giorcelli and G. Zanon. *Consiglio Nazionale delle Ricerche Commissione Incaricata di Coordinare la Partecipazione Italiana al Decennio Idrologico Internazionale. Pubblicazione* No. 6, 1973, 107p.
[Summary of *I ghiacciai del gruppo Ortles-Cevedale (Alpi Centrali).* Torino, Palazzo Carignano, 1967. Text also given in Italian.]

Dyunin, A. K., *ed.* Proyektirovaniye zheleznykh dorog v slozhnykh prirodnykh usloviyakh [The planning of railways in difficult natural conditions]. *Trudy Novosibirskogo Instituta Inzhenerov Zheleznodorozhnogo Transporta,* Vyp. 147, 1973, 180p.

Glen, J. W. The physics of ice. *U.S. Army Cold Regions Research and Engineering Laboratory. Cold Regions Science and Engineering. Monograph* II-C2a, 1974, vii, 81p.
[Summarizes existing knowledge of the physics of ice.]

Grosval'd, M. G. *and others. Oledeneniye Zemli Frantsa-Iosifa* [*Glaciers of Zemlya Frantsa Iosifa*]. Moscow, Izdatel'stvo "Nauka", 1973. [352]p.

Hanamoto, Ben. Cobra: positive pitch controlled articulated testbed. *U.S. Army Cold Regions Research and Engineering Laboratory. Special Report* 207, 1974, iii, 11p
[Tests on vehicle performance.]

Hutter, Kolumban. On the fundamental equations of floating ice. *Mitteilungen der Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie en der Eidgenössischen Technischen Hochschule* (Zürich), Nr. 8 ,1973, xviii, 150p.

Jellinek, H. H. G. Adhesion of ice frozen from dilute electrolyte solutions. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 317, 1974, ii, 9p.
[Discusses experiments by Smith-Johanssen and suggests possible mechanism of adhesion.]

Kaplar, Chester W. Freezing tests for evaluating relative frost susceptibility of various soils. *U.S. Army Cold Regions Research and Engineering Laboratory. Technical Report* 250, 1974, iv, 37p.

Langway, C. C. *and others.* Chemical profile of the Ross Ice Shelf at Little America V, Antarctica, By C. C. Langway, jr., M. Herron and J. H. Cragin. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 316, 1974, ii, 7p.
[Measurements of concentrations of Na^+, K^+, Mg^{2+} and Ca^{2+} made on samples from 255 m deep core.]

Miller, Maynard M. A principles study of factors affecting the hydrological balance of the Lemon Glacier system and adjacent sectors of the Juneau icefield, southeastern Alaska, 1965-69. *Michigan State University. Institute of Water Research. Technical Report* No. 33, 1972, [x], [313]p.

Mock, S. J. *and others.* Arctic terrain characteristics data bank: description. By S. J. Mock, V. LaGarde and W. B. Tucker. *U.S. Army Cold Regions Research and Engineering Laboratory. Technical Report* 247, 1974, iii, 47p.
[Contains topographical information characterizing terrain types found in pack ice, tundra and littoral areas in connection with surface effect vehicle design in the Arctic.]

Perham, R. E. Forces generated in ice boom structures. *U.S. Army Cold Regions Research and Engineering Laboratory. Special Report* 200, 1974, iv, 36p.
[Presents and discusses measurements made on two ice booms near Ogdensburg, N.Y., St. Lawrence Seaway.]

Popov, A. I. *and* Tushinskiy, G. K. *Merzlotovedeniye i glyatsiologiya (kratkiy kurs). Dopushcheno Ministerstvom vysshego i srednego spetsial'nogo obrazovaniya SSSR v kachestve uchebnogo posobiya dlya studentov geograficheskikh fakul'tetov universitetov [Permafrost studies and glaciology (a short course). Recognised by the Ministry of higher and secondary education of the U.S.S.R. as a textbook for students in university geographical faculties].* Moscow, "Vysshaya shkola", 1973, 271p.

Vershinina, L. K. *and* Dimaksyan, A. M., *eds.* Issledovaniya metodov, apparatury i technosti opredeleniya zapasov vody v snezhnom pokrove [Study of methods, instruments and accuracy in determining water content of snow cover]. *Trudy Gosudarstvennogo Gidrologicheskogo Instituta,* Vyp. 178, 1969, 174p.
[Collected papers on use of airborne gamma survey method.]

Whalley, E., *and others, eds. Physics and chemistry of ice. Papers presented at the Symposium on the Physics and Chemistry of Ice, held in Ottawa, Canada, 14-18 August 1972. Edited by E. Whalley, S. J. Jones and L. W. Gold.* Ottawa, Royal Society of Canada, 1973, xiii, 403p.
[Separate papers have been listed in the *Journal of Glaciology,* Vol. 16, No. 68, 1974, in the Glaciological Literature section.]

RECENT MEETINGS (of other organizations)

ICE-CORE DRILLING SYMPOSIUM AT THE UNIVERSITY OF NEBRASKA

28 - 30 August 1974

The following report has been written by John F. Splettstoesser, University of Nebraska, Lincoln.

For some years it has been recognized that the retrieval and study of ice cores from glaciers are necessary to evaluate climatic and related parameters of the Earth because of the atmospheric record preserved in glaciers. Because ice cores can be retrieved from glaciers only by drilling, the technology of drilling in ice has received considerable attention in the last decade or more. Dr A. P. Crary, former Chief Scientist of the Office of Polar Programs at NSF, pointed out several significant accomplishments in glaciology and further problems to be solved when he gave his Presidential Address at the International Symposium on Antarctic Glaciological Exploration in September 1968. His "suggestion for future glaciological studies [was] simple: . . . drill, drill, and drill some more."

In order to provide more visibility for the state of the art of drilling in ice, an Ice-Core Drilling Symposium was held at the University of Nebraska, Lincoln, in August 1974, sponsored by The National Science Foundation and hosted by the Ross Ice Shelf Project Management Office. Twenty-nine registrants attended the Symposium, representing ten countries. Fifteen papers were on the program, representing advances and reviews of drilling programs and equipment. I. G. Bird, Antarctic Division, Department of Science, Melbourne, reviewed Australian developments and experiences of thermal ice drilling on an ice dome near their station in Antarctica and on an ice shelf. Since their program began in 1968, more than 1600 m of ice core has been taken from eight intermediate-depth (to nearly 400 m) holes. F. Gillet, Laboratoire de Glaciologie, Grenoble, described an electrothermal drill that has been used successfully to core holes on glaciers in France, and also on the ice sheet near their Antarctic station on Adélie Coast. A depth of 1000 m is anticipated with this drilling system in the austral season of 1975-76 when a deep-drilling program is planned for East Antarctica.

B. L. Hansen (who was awarded the Seligman Crystal of the International Glaciological Society in 1972 for his significant contributions in ice-drilling) presented a proposal to conduct deep core drilling in the East Antarctic ice sheet to a depth of around 3000 m, using a wireline system. W. D. Harrison (University of Alaska) presented a paper by himself and B. Kamb on drilling to the base of Blue Glacier, Washington, by means of an electrothermal drill and a cable tool (for dirty ice) to observe subglacial conditions and sliding motion with a borehole camera. Developments in deep drilling in Antarctica by the Soviet Union were given by Ye. S. Korotkevich (Arctic and Antarctic Research Institute, Leningrad) in a paper by Korotkevich and B. B. Kudryashov. The Soviets have used electrothermal drilling devices to drill holes at Vostok, where a depth of 952 m was reached in one core hole.

Since the inception of the U.S. polar ice core drilling program, CRREL has been responsible for the central storage and curatorial activities of the ice cores recovered under the auspices of NSF-supported research programs. C. C. Langway (CRREL) discussed the ice-core storage facility at CRREL, where about 400 1.5-m core tubes are stored; space exists for thousands more at a nearby commercial facility.

Part of the consideration that goes into the design of a drilling system is that of the power required to do the job. Significant work along these lines is being done at CRREL by M. Mellor and P. Sellmann, and was discussed by Mellor. W. S. B. Paterson (Polar Continental Shelf Project, Ottawa) presented the program on thermal core drilling by the Canadians on Meighen Island and Devon Island. A thermal probe system was described by K. Philberth (Puchheim, West Germany) as it was used in Greenland during the Expédition Glaciologique Internationale au Groenland in 1968. J. Rand (CRREL) discussed the electromechanical drill that he designed for use in drilling to 100 m.

Some recent improvements in the design of a lightweight drill were described by H. Rufli (University of Bern) in a paper by Rufli, B. Stauffer, and H. Oeschger. A complete electromechanical drilling system, consisting of a drill unit with cable, a tower, winch and generator, no component weighing more than 50 kg, can be assembled and ready to drill a 50-m hole by two men in about two hours. The drill was shipped to Lincoln from Greenland, where it had been field-tested in the 1974 summer. As part of his talk, Rufli showed how it was very efficiently packed and how the components worked.

Japanese drilling activities in Antarctica were discussed by Y. Suzuki (Institute of Low Temperature Science, Hokkaido University); and P. Theodórsson, University of Iceland, told about the thermal and mechanical drills that were used to drill holes to 108 and 417 m, respectively, into the ice cap of Vatnajökull in Iceland.

Two authors were unable to attend, but their papers will be included in the proceedings volume of the Symposium. P. Taylor, University of Washington, has been involved in the development of hot-point drills which have been used in temperate ice. S. Johnsen, University of Copenhagen, prepared a paper on two types of snow-sampling devices which can collect samples from the upper 2-3 meters from the sides of a drilled hole.

It was obvious in the presented papers and discussions that much of the groundwork and continuing work in the field of ice-core drilling has been done by personnel at CRREL. Indeed, many of the thermal and electromechanical drilling-system designs discussed in the papers were modifications of equipment that had been developed there. Partly because of that, not much new technology was presented. It was apparent that improvements on drilling technology are often a 'seat-of-the-pants' exercise involving modifications in the field because of the differences in drilling conditions that are encountered as drilling progresses. In this regard, one of the most prevalent problems mentioned in deep drilling in ice is that of hole closure.

This unique Symposium provided an opportunity for almost all the people who have been or are now engaged in ice core drilling to exchange information which will inevitably advance the state of the art in this field.

National Science Foundation Grant GV-44390 provided partial support for the Symposium. A proceedings volume is planned for early publication.

FUTURE MEETINGS (of other organizations)

QUATERNARY STRATIGRAPHY SYMPOSIUM

(York University, Toronto, Canada, 23-25 May 1975)

The Symposium on the Quaternary Stratigraphy of North America will be held at York University on 23-25 May 1975. The Symposium is sponsored by Atkinson College of York University. Information concerning transportation, pre-registration, registration, accommodation and the programme may be obtained from W. C. Mahaney, York University, Atkinson College, Department of Geography, 4700 Keele Street, Downsview (Toronto), Ontario M3J 2R7, Canada.

Pre-registration may be obtained by submitting the form (obtainable from W. C. Mahaney) on or before 1 May 1975. The pre-registration fee is $10.00 (professional), $5.00 (student). Make cheques payable to the Quaternary Stratigraphy Symposium.

Registration will take place on Thursday 22 May from 1500 to 2200 hours, in the Atkinson College Faculty Lounge, Room 004, Phase I. Registration will also take place on Friday and Saturday from 0800-1200 hours. Participants are asked to check in at the registration desk in Lecture Hall "L", Curtis Lecture Halls. The registration fee payable after 1 May 1975 is $15.00 (professional), $7.50 (student).

Participants may obtain rooms on the York University campus at $10.00 per night. The block booking arrangements are for bed and breakfast, and bookings begin on Thursday night. Participants who wish off-campus accommodation will be provided at registration with a list of hotels and motels in North Toronto.

Invited speakers will present papers on the Quaternary column in selected areas of North America, problems of age-determination, long-distance correlation, and future research trends.

SYMPOSIUM ON ISOTOPES AND IMPURITIES IN SNOW AND ICE

(International Commission of Snow and Ice, Grenoble, France, 28-30 August 1975)

EXTRACTS FROM THE SECOND CIRCULAR

An International Symposium on Isotopes and Impurities in Snow and Ice will be held in Grenoble France, from 28-30 August 1975, during the 16th General Assembly of IUGG. The first two days will be under the joint sponsorship of the International Association of Hydrological Sciences (IAHS) and the International Association of Meteorological and Atmospheric Physics (IAMAP), and the third day (Saturday, 30 August) will deal with specific glaciological aspects. The Symposium will be organized by the International Commission of Snow and Ice (ICSI) in co-operation with the French Organizing Committee for the 16th General Assembly of IUGG.

The Symposium will be concerned with the basic problems of measurement and interpretation of isotopes and impurities in snow and ice before and after deposition. The influences of weather, space and time will be discussed. Papers on salinity in sea ice are explicitly excluded.

In response to the call for papers (First Circular issued by ICSI) 70 titles were submitted, i.e. more than twice the number envisaged. As a result, the Convenor, the Papers Committee and the ICSI officers faced some serious difficulties which they have resolved as follows:

1. There will be three categories of papers:
   a) invited papers (not more than 5 papers, max. 14 pages typescript)
   b) "long" papers (not more than 10 papers, 12 pages typescript)
   c) short papers (all remaining papers, length not more than 6 pages typescript).

   NB:—1 page typescript=max. 250 words
   —The above mentioned length of papers includes: title, abstracts in English and French, references, all graphics and tables.
2. There will be two types of presentation:
   a) The invited and "long" papers will be presented in the customary way to the full audience; presentation time including discussion is limited to 40 minutes.
   b) The short papers will be presented in a "poster" or "box" system: some six papers will be informally presented and discussed simultaneously in fenced-off areas of the large lecture hall; the total time allocated again being 40 minutes. In each "box" there will be display space, a blackboard and—it is hoped—a slide projector (5 x 5 cm) and a viewgraph (20 x 20 cm).

The papers must be written in English or French, with abstracts in both languages. Instructions about the preparation and submission of abstracts and papers are given in the ICSI Second Circular, which may be obtained from: Professor F. Müller, Secretary, ICSI, Swiss Federal Institute of Technology, Department of Geography, Sonneggstrasse 5, CH-8006, Zürich, Switzerland. Approved papers will be published in the proceedings of the Symposium by the International Association of Hydrological Sciences. Only papers presented at the meeting by one of the authors will be published.

EXCURSIONS

1. Short excursion: On Saturday (30 August, evening, 18.00 h) and all day Sunday (31 August), there will be a traverse of the glaciers of Mont de Lans and la Girose, from Deuz Alpes to La Grave, organized by Professor L. Lliboutry. Cost: approx. 150 Ffr.
2. 5-day after-congress excursion: Sunday, 7 September until Thursday, 11 September 1975, to the Chamonix area, organized by Professor L. Lliboutry. Cost: approx. 600 Ffr.
3. Assistance for privately organized excursions: There is a time lapse of one week between the end of the main Symposium and the main excursion of interest to glaciologists. Though there are many activities of great importance scheduled for this week, it may be impossible for some participants to wait for the after-congress excursion. Professor Robert Vivian of the University of Grenoble kindly has agreed to provide assistance for a privately organized 3-day excursion, Wednesday, 3-5 September, covering some of the same ground as the 5-day after-congress excursion.
4. During the General Assembly, visits to scientific institutions in the Grenoble area will be organized, among others:
   a) the Laboratory of Glaciology of the Centre National de la Recherche Scientifique (Professor Lliboutry) which specializes in the geochemistry of ice-caps, mechanics of ice, air-ground energy transfer, physics of precipitation.
   b) the Laboratory of Snow Physics of Col de Porte.

Important Notice:

—for complete Assembly Programme, for Registration and for a multitude of other information please contact the Second IUGG Circular (Oct. 74), or C.N.F.G.G. directly.

Only for copies of the ICSI Second Circular and correspondence specifically concerning the Symposium on Isotopes and Impurities in Snow and Ice address yourself to the ICSI Secretariat at the address given earlier in this notice.

A **third circular** containing further details will be issued in May/June 1975 to all those who return the questionnaire of the Second Circular.

SYMPOSIUM AND WORKSHOPS ON THE APPLICATION OF MATHEMATICAL MODELS IN HYDROLOGY AND WATER RESOURCES SYSTEMS

(Bratislava, Czechoslovakia, 8-13 September 1975)

The Symposium and Workshops are being planned within the framework of the International Hydrological Programme. They will be convened by the International Association of Hydrological Sciences and organized by the Czechoslovak Committee for the International Hydrological Programme in co-operation with the IAHS and with the support of Unesco and WMO. Attention will be focused on the *practical application* of deterministic, stochastic and system models in hydrology and the gap between theory and practice in the modelling of catchment behaviour and of water resources systems and exploration of the relationship between catchment models and water resource system models.

The Workshops and Symposium are to be held from 8-13 September 1975 inclusive in Bratislava, Czechoslovakia, following the IUGG General Assembly at Grenoble. An excursion is foreseen after the Symposium. Registration for the Workshops will be in the morning of 8 September and registration for the Symposium will be in the afternoon of 10 September.

PARTICIPATION
Unesco and WMO will notify through appropriate channels the appropriate national authorities of the countries participating in the International Hydrological Programme and in the Operational Hydrological Programme, as well as other International Organizations concerned with hydrology. In addition, the IAHS will send out notices to its National Committees and correspondents.

For the Workshops preference will be given to models which can be demonstrated in the workshops with data supplied by the organizers. When sending the provisional registration form and abstracts authors are requested to inform the organizers which type of data they require as model input.

Each of the Workshops will be limited to not more than 25 persons and a limited number of persons may participate as observers. The final selection of participants as active members will be made by the IAHS, Unesco, WMO and the Organizing Committee.

PAPERS
Only original papers giving information on the relationship between already existing operational catchment and water resources system models will be accepted for the plenary sessions.

INFORMATION about the symposium may be obtained from:
Organizing Committee for the Symposium on Mathematical Models in Hydrology, Hydrometeorological Institute, Jeseniova 43, 88532 BRATISLAVA, Czechoslovakia.

GLACIOLOGICAL DIARY

1975

8-10 April
Symposium on the thermal regime of glaciers and ice caps. National Research Council of Canada, Simon Fraser University, Vancouver, Canada. (Dr R. B. Sagar, Dept. of Geography, Simon Fraser University, Burnaby, B.C., Canada.)

6-7 May
Meeting of Task Force in soil-water problems in cold regions, Calgary, Alta., Canada. Sponsored by Section of Hydrology, American Geophysical Union. (James N. Luthin, Dept. of Water Science and Engineering, University of California, Davis, CA 95616, USA.)

20-23 May
Canadian Geologists and Geophysicists Conference on Advances in exploration technology, in Calgary, Alta. Sponsored by Canadian Society of Petroleum Geologists and Canadian Society of Exploration Geophysicists. (W.G. Ayrton, Amoco Canadian Petroleum Co. Ltd., 444 Seventh Ave., S.W., Calgary, Alta., Canada.)

23-25 May
Symposium on Quaternary stratigraphy, York University, Toronto, Canada. (W.C. Mahaney, York University, Atkinson College, Geography Dept., 4700 Keele Street, Toronto, Canada.) (See p. 18 of this issue of ICE.)

8-13 June
Penrose Conference on Plio-Pleistocene geochronology, Mammoth, California, USA. Sponsored by Geological Society of America. (Lois Elms, Penrose Conference Co-ordinator, G.S.A., 3300 Penrose Place, Boulder, CO 80301, USA.)

26-28 June
National Symposium on precipitation analysis for hydrologic modeling, University of California, Davis. Sponsored by AGU Section of Hydrology. (AGU, 1707 L St., N.W., Washington, DC 20036, USA.)

30 June–2 July
National Symposium on water resources problems in metropolitan areas, New Brunswick, NJ. Sponsored by American Water Resources Association and Rutgers University. (William Whipple, Jr., Director, Water Resources Institute, Rutgers University, New Brunswick, NJ 08903, USA.)

11-15 August
Third International Conference on Port and Ocean Engineering under Arctic conditions, Fairbanks, Alaska, USA. (POAC 75, Institute of Marine Science, University of Alaska, Fairbanks, Alaska 99701, USA.)

18-20 August
International Symposium on the geochemistry of natural waters, Burlington, Ontario, Canada. Sponsors: Working Group on Geochemistry and Cosmochemistry, the International Association of Hydrological Sciences and Canada Centre for Inland Waters. (Mary E. Thompson, Chairman, Canada Centre for Inland Waters, Burlington, Ontario, Canada.)

18-21 August
International Association of Hydraulic Research Committee of Ice Problems and US Army Cold Regions Research and Engineering Laboratory — Symposium to include ice management and engineering as related to extended season navigation of inland waterways, ice jam control, and effects of sea ice on marine structures. (G. Frankenstein, CRREL, Hanover, N.H. 03755, USA.)

25 August–6 September
XVI General Assembly for the International Union of Geodesy and Geophysics, Grenoble, France. (C.N.F.G.G., 136bis, rue de Grenelle, 75700 Paris, France.)
Symposium on isotopes and impurities in snow and ice, International Commission of Snow and Ice, Grenoble, France, during 1975 General Assembly of I.U.G.G. (Dr Fritz Müller, Secretary ICSI, Geog. Inst. der ETH, Sonneggstrasse 5, Zürich 8006, Switzerland.) (See p. 19 of this issue of ICE.)

27 August
Symposium on snow and ice crystals, International Commissions on Cloud Physics (IAMAP) and on Snow and Ice (IAHS), Grenoble, France, during 1975 General Assembly of IUGG. (Dr R. List, Dept. of Physics, McLennan Physical Labs., University of Toronto, Toronto 5, Ontario, Canada.)

5 September
Symposium on weather modification, International Associations of Hydrological Sciences (IAHS) and Meteorology and Atmospheric Physics (IAMAP), Grenoble, France, during 1975 General Assembly of IUGG. (Dr H. K. Weickmann, International Commission on Cloud Physics, NOAA-ERL, PSRB No. 3, Boulder, CO 80303, USA.)

8-13 September
Symposium and Workshops on the application of mathematical models in hydrology and water resources systems, Bratislava, Czechoslovakia. Convened by International Association of Hydrological Sciences with support of Unesco and World Meteorological Organization. (Symposium Organizing Committee, Hydrometeorological Institute, Jeseniova 43, 88532 Bratislava, Czechoslovakia.)

1-8 December
International Symposium on hydrological characteristics of river basins, Tokyo Prince Hotel, Tokyo, Japan. Sponsored by International Association of Hydrological Sciences, organized by Science Council of Japan. (Arnold I. Johnson, USNC/IAHS, U.S. Geological Survey National Center, MS-417, Reston, VA 22092.)

12-17 December
The Second World Congress on Water Resources, New Delhi, India. (C. V. J. Varma, Secretary Indian National Committee for International Water Resources Association, Central Board of Irrigation and Power, Kasturba Gandhi Marg, New Delhi-110001, India.)

14-19 December
Conference on foundations on Quaternary deposits, Norwich, England. Engineering Group of Geological Society of London. (A. B. Hawkins, Dept. of Geology, University of Bristol, Bristol BS8 1TL, England.)

1976

August
23rd International Geographical Congress, Moscow, USSR, (V. Annenkov, Institute of Geography, Academy of Sciences USSR, Staromonetny 29, Moscow 109017, USSR.)

15-25 August
25th International Geological Congress, Sydney, Australia. (Secretary-General, 25th International Geological Congress,

P.O. Box 1892 Canberra City, AGT 2601, Australia.)

17-20 August
International Cloud Physics Conference, Colorado Springs, USA. Sponsored by International Association of Meteorology and Atmospheric Physics and International Commission on Cloud Physics: co-sponsored by American Meteorological Society. (H. K. Weickmann, NOAA/APCL, Boulder, CO 80302, USA.)

23-27 August
International Weather Modification Conference, Colorado Springs, CO. Sponsored by International Association of Meteorology and Atmospheric Physics/International Commission on Cloud Physics and Weather modification Panel of World Meteorological Organization; co-sponsored by American Meteorological Society and Academy of Science of Australia. (H. K. Weickmann, NOAA/APCL, Boulder, CO 80302, USA.)

Autumn
International workshop on dynamics of glacier fluctuations and surges, sponsored by ICSI, organized by and held in USSR.

12-18 September
Symposium on Problems of applied glaciology, Cambridge, England. International Glaciological Society. (Mrs H. Richardson, Secretary, Cambridge CB2 1ER, England.)

1978

10-13 July
Third International Conference on Permafrost, Edmonton, Alberta, Canada. National Research Council of Canada. (M. K. Ward, c/o National Research Council of Canada, Ottawa, K1A OR6, Canada.)

NEWS

INSTITUO ARGENTINO DE NIVOLOGIA Y GLACIOLOGIA (IANIGLA), ARGENTINA

The Consejo Nacional de Investigaciones Cientificas y Tecnicas called a meeting of several Argentinean Institutions interested in research in Hydrology. They met in Mendoza on 13 May 1972 to establish "Instituto Argentino de Nivologia y Glaciologia" (IANIGLA), a new Institute on Snow and Ice to be located at the foothills of the Andes in Mendoza. These institutions were: CONICET, the organizing agency, (1) Agua y Energia Electrica, (2) Instituto Nacional de Economia y Legislacion del Agua (INELA), (3) Provincia de Mendoza, (4) Provincia de San Juan, (5) Subsecretaria de Recursos Hidricos, (6) Servicio Meteorologico Nacional, (7) Universidad Nacional de Cuyo and (8) Universidad Nacional del Sur.

Dr Henri Bader was invited to attend another meeting in February 1973 and has since acted as Consultant to IANIGLA. Dr Arturo E. Corte was appointed as research and acting Director. The new Institute was activated at the end of 1973.

Objectives

The objectives of the Institute are: to contribute to the scientific and technological progress of the nation by means of:

1. formation of an Argentine group of competent researchers on Snow-Ice and Geocryology and related subjects;
2. research within the national territory in cooperation with other national and provincial agencies;
3. the main objective of the research will be to understand ice properties and the behavior of ice as a material in its different forms and conditions, as a basis for the development of a sound engineering practice. This engineering will be mainly in hydraulics but will also be concerned with avalanche control, glaciological accidents, cordilleran highways, the lay-out of skiing and tourist areas, etc;
4. participation in international activities when they are in the national interest.

Research Programmes

At the present there are the following Departments: (1) Snow and ice, (2) Geocryology, (3) Photointerpretation, (4) Terrain Analysis.

Within the next five years it is expected that some 30 persons will be working in the following Departments: (1) Snow and ice, (2) Geocryology, (3) Meteorology and climatology, (4) Photointerpretation, (5) Paleoclimatology, (6) Hydrology. There will be a Department of Documentation and Publication, and a logistics section.

As work progresses several consultants for differents disciplines will be called in.

At the present time the following programmes are under way:

1. Snow and ice: Photo-survey of the central Argentine Andes. This survey covers the areas of glaciers and rock glaciers, which in the region are very abundant. Aerial-photographs taken in 1962-63 are compared with others taken in May 1974.

2. Geocryology: Several surveys have been started in 1973-74 on rock glaciers and glaciers. The dry high Andes seem to be the largest rock glacier area in the world. The Hydrological significance of these rock glaciers will be evaluated.
3. Photointerpretation: About 2.500 km^2 of high mountains are being surveyed, mapping glaciers and rock glaciers.
4. Paleoclimatology: In the Centre high Andes and in the foothills a survey was started mapping Pleistocene glacier extensions. A programme using tree ring analysis, pollen analysis, sedimentary analysis and radiocarbon dating is planned.
5. Hydrology: Hydrological analysis of river run-off from snow, glaciers and rock glaciers melting.

Location
The Institute is located in Parque General San Martin in the City of Mendoza, western Argentina. Plans are already made for the construction which will be started in December 1974. Facilities for foreign researchers are also included.

Address of the Institute:
Casilla de Correos No. 330—Mendoza, Argentina —Tel. 247-681.

Note
The Instituto Argentino de Nivologia y Glaciologia will appreciate receiving photographs and other documents showing distribution of ice areas in different places and dates within the Argentinean Territory.

A. E. Cote

CANADIAN REMOTE SENSING SOCIETY

The Society has been formed as a separate society within the Canadian Aeronautics and Space Institute. At least two of the Institute's journals each year will be devoted to remote sensing and will bear the name of "The Canadian Journal of Remote Sensing".

The aims of the Society will be to forge and strengthen bonds between the various technologies in sciences employed in remote sensing in order to provide a mutual transfer of experience:

1 between technologists, scientists and practical users, to encourage the development of effective and useful instruments by bridging difficult communication gaps, such as those between bio-scientists and physicists or engineers;
2 between different users in order to disseminate and compare experiences of new analysis techniques and instruments;
3 between those who have knowledge of the potential applications of remote sensing and administrators or planners in governments and industry.

A successful Remote Sensing Society, therefore, must provide a forum which can encompass a wide range of backgrounds and experiences.

The specific objectives of the Remote Sensing Society will be:

1 to bring together all those professionally engaged in the many aspects of remote sensing;
2 to promote knowledge in the art and science of remote sensing.
3 to provide a means for the dissemination of new knowledge and information by means of:
   (i) seminars
   (ii) conferences
   (iii) publications (e.g. journal, symposia, conferences, proceedings etc.)
   (iv) training.
4 to encourage free exchange of ideas and communication among those contributing to the advance of remote sensing.
5 to support, promote and organize intra-disciplinary as well as inter-disciplinary contacts and cooperation in fields concerned with, or affected by, remote sensing;
7 to maintain close liaison with other Canadian organizations in subjects of common interest, and with other Remote Sensing groups or organizations that may be established abroad;
8 to act as a focus of remote sensing information in Canada by publishing a journal;
9 to liaise and cooperate as necessary, with official agencies, professional institutions and user communities as well as individual persons for the purpose of achieving the above aims.

DEFINITION

Remote sensing, as defined by the Society, is the measurement of electromagnetic radiation reflected, emitted or absorbed by the surface of the earth and/or its atmosphere in the frequency range between microwaves and ultra violet, for the purpose of providing information which can contribute to the more efficient management of the earth's resources and environment. Measurements are usually made from an airborne or space vehicle and are often accompanied by "ground truth" studies. The definition also includes the analysis and interpretation of the data.

AWARD

Dr Maxwell Gage has been presented with the Hutton Medal of the Royal Society of New Zealand for his work in the Pleistocene and glacial geology. Dr Gage has retired from the University of Christchurch, and is now working at the Canterbury Museum.

APPOINTMENT

Dr Lorne Gold has been appointed Assistant Director of the Division of Building Research, National Research Council, Ottawa, Canada.

NEW MEMBERS

Birnie, Richard V., 346 Queens Road, Aberdeen, Scotland.

Bollen, Dr R., Stanfield Research Institute, Bldg. 44, Menlo Park, CA 94025, USA.

Clement, Poul, Erøgade 8, 8000 Århus C, Denmark.

Finkel, Robert C., Physikalisches Institut, Sidlerstrasse 5, CH-3012 Bern, Switzerland.

Hartline, Mrs B. K., Geophysics Program AK50, University of Washington, Seattle, WA 98195, USA.

Huxter, E. A., 3 Fordwich Close, St. Arvans, Chepstow, Gwent NP6 6EL, Wales.

Jensen, Willy H., Lab. for Fysisk Geografi, Geologisk Institut, 8000 Århus C, Denmark.

Johari, G. P., Glaciology Division, 562 Booth Street, Department of the Environment, Ottawa, Ontario K1A 0E7, Canada.

Mackeith, Peter L. C., 35 Bloomfield Terrace, London SW1, England.

Meadows, T., Department of Geography, University of Reading, Reading, Berkshire, England.

Noussan, Emilio, Via Torre del Lebbroso 41, Aosta, 11100 Italy.

Parameswaran, Dr V. R., Inland Waters Directorate, Glaciology Division, Department of the Environment, 562 Booth Street, Ottawa, Ontario K1A 0E7, Canada.

Shively, Joseph, 424 Purdue, Salina, KS 67401, USA.

Skvarca, Pedro, Av. Rivadavia No. 6338–p. 12–"D", Buenos Aires, Argentina.

Sterling, Claude J., Converse, Davis and Associates Inc., 100 West Harrison Street, Seattle, WA 98109, USA.

Turpening, Roger M., Geophysics Laboratory, Environmental Research Institute—Michigan, Box 618, Ann Arbor, MI 48107, USA.

Vickers, Dr R., Stanfield Research Institute, Bldg. 44, Menlo Park, CA 94025, USA.

Williams, P. J. Department of Geography, Carleton University, Ottawa, Ontario, K1S 5B6, Canada.

Wohl, Gary M., Department of Atmospheric Sciences–AK40, University of Washington, Seattle, WA 98195, USA.

INTERNATIONAL GLACIOLOGICAL SOCIETY

Cambridge CB2 1ER, England

DETAILS OF MEMBERSHIP

Membership is open to all individuals who have scientific, practical or general interest in any aspect of snow and ice study. Payment covers purchase of the Journal of Glaciology and Ice. Forms for enrolment can be obtained from the Secretary. No proposer or seconder is required. Annual payments 1975:

Private members	Sterling:	£5.00
Junior members	Sterling: (under 25)	£2.00
Institutions, libraries	Sterling:	£10.00 per volume (1975=2 volumes)

Note—Payments from countries other than Britain should be calculated at the exchange rate in force at the time of payment. If you pay by bank draft, rather than by personal cheque, please ensure that sufficient money is included to cover the bank charges of £0.50p per cheque. Thank you.

I C E

Editor: Mrs Hilda Richardson

This news bulletin is issued to members of the International Glaciological Society and is published three times a year. Contributions should be sent to Mrs H. Richardson, International Glaciological Society, Cambridge CB2 1ER, England.

Annual cost for libraries, &c, and for individuals who are not members of the Society: Sterling £1.50.

Foister & Jagg Ltd., Abbey Walk, Cambridge