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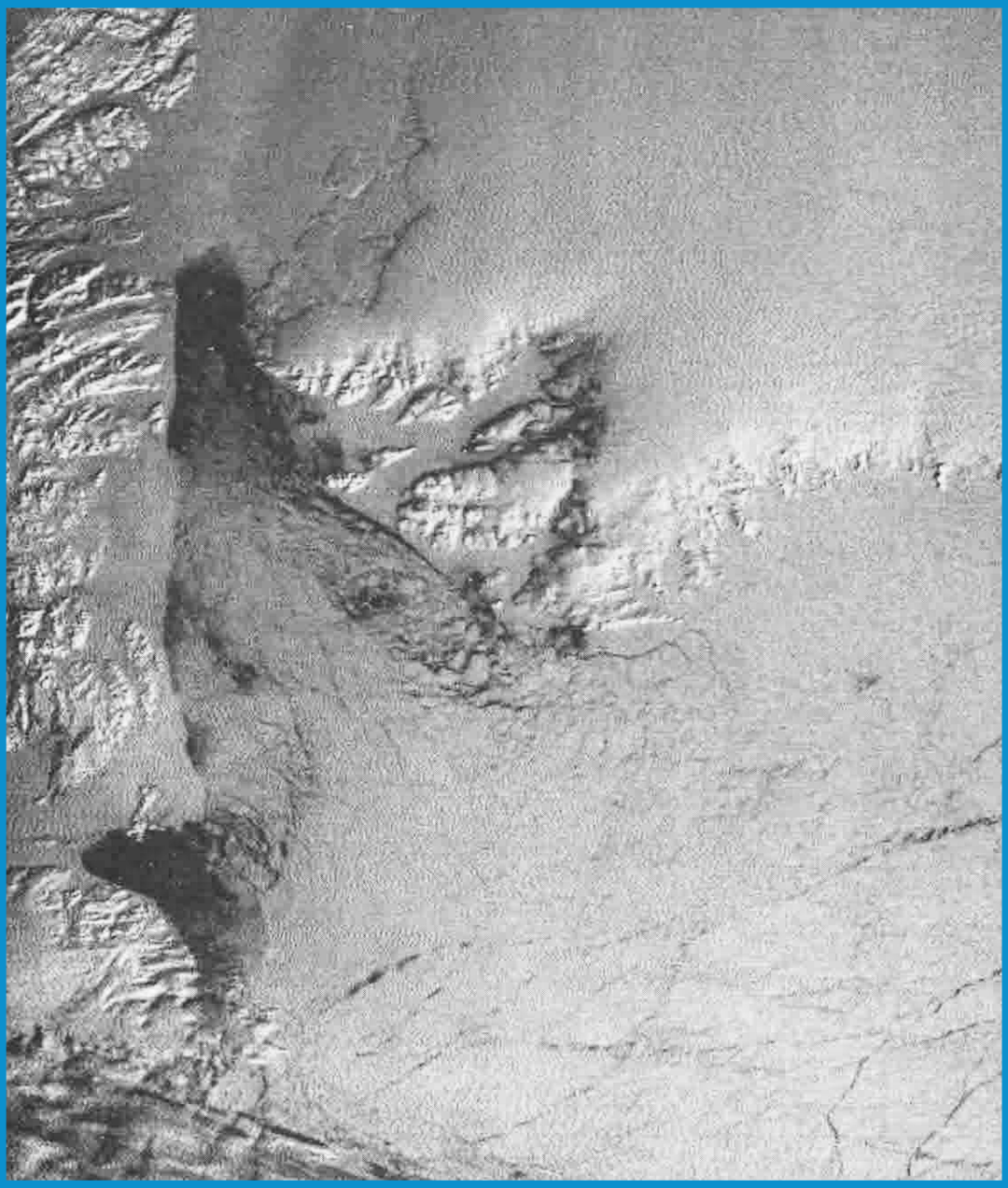

INTERNATIONAL GLACIOLOGICAL SOCIETY

CONFERENCE PROCEEDINGS VOLUMES

The following volumes of proceedings may be obtained from the Secretary General of the International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, England, U.K.

JOURNAL OF GLACIOLOGY

Symposium on Remote Sensing in Glaciology (Cambridge 1974)
Volume 15, Number 73, 1975 ..... £10.00

Symposium on Thermal Regime of Glaciers and Ice Sheets (Burnaby 1975)
Volume 16, Number 74, 1976 ..... £10.00

Symposium on Applied Glaciology (Cambridge 1976)
Volume 19, Number 81, 1977 ..... £20.00

Symposium on Physics and Chemistry of Ice (Cambridge 1977)
Volume 21, Number 85, 1978 ..... £20.00

Symposium on Glacier Beds: the ice-rock interface (Ottawa 1978)
Volume 23, Number 89, 1979 ..... £20.00

Symposium on Dynamics of Large Ice Masses (Ottawa 1978)
Volume 24, Number 90, 1979 ..... £25.00

Symposium on Snow in Motion (Fort Collins, Colorado 1979)
Volume 26, Number 94, 1980 ..... £35.00

ANNALS OF GLACIOLOGY (replacing proceedings series in Journal of Glaciology)

Symposium on Use of Icebergs: scientific and practical feasibility (Cambridge 1980)
Volume 1, 1980 ..... £15.00

Symposium on Processes of Glacier Erosion and Sedimentation (Geilo, Norway 1980)
Volume 2, 1981 ..... £20.00

Symposium on Antarctic Glaciology (Columbus, Ohio, USA, 1981
Volume 3, 1982 ..... £40.00

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CONTENTS

PRESIDENT'S MESSAGE: The Council you have just elected consists of 18 members drawn from 9 different countries. We can justly claim, therefore, to have a truly international form of management as well as world-wide interests. I sincerely hope that all members will feel free to contact the Cambridge office about any aspect of the Society's affairs, and as President I hope to be in touch with anyone who has ideas to share. The new Council is aware of its great debt to the retiring President and to retiring members of Council, and intends to consolidate and if possible to strengthen the services rendered by the Society to the glaciological community.

C.W.M. Swithinbank

COVER PICTURE. NOAA-5 Very High Resolution Radiometer (VHRR) image of the Thule area of Greenland showing the open North Water and the onset of breakup in Baffin Bay. The image was taken on 17 April 1977 and has been computer-enhanced and rectified by NOAA's National Environmental Satellite Service. The VHRR is sensitive to light in the 0.6-0.7 μ range (NOAA/NESS).

RECENT WORK

ARGENTINA

INSTITUTO ARGENTINO DE NIVOLOGIA Y GLACIOLOGIA – REPORT ON GEOCRYOGENIC ACTIVITIES

(Arturo E. Corte)

An investigation of rock glacier hydrology, developed by Enrique Buk and now in its 4th year, involves a pure rock glacier basin and one of mixed origin with glaciers, debris-covered glaciers and rock glaciers. The study shows that the latter two types are important sources of water in the dry sector of the Andes. The objective is to determine the mass balance of a rock glacier; although run-off measurements are considered fairly reliable the measurements of precipitation is difficult due to the bouldery nature of the surface.

The physical and biological aspect of past and present geocryogenic features are being investigated (Dario Trombotto), in particular the influence on the processes of the texture of sand grains and the segregation of salts and heavy minerals in placers (Lia Ahumada).

Field studies will be carried out in the Puna de Atacama (November 1981) and in the mountains of Tierra del Fuego (December 1981 and January 1982).

BELGIUM

CHARACTERISTICS OF BASAL ICE FROM TWO OUTLET GLACIERS IN THE CANADIAN ARCTIC

(R. Lorrain, R. Souchez and T.L. Tison, University of Brussels)

Ice as sampled for chemical and isotopic analyses at the margin of Hook Glacier, Ellesmere Island and Aktineq Glacier, Bylot Island. In the Hook Glacier section there are striking variations in Cl and Na content. This is interpreted as the consequence of recumbent folding which cannot be observed directly. In the section studied at Aktineq Glacier, the relations between $\delta^{18}O$ and δD values of the samples indicate that striking differences exist among basal ice layers. Some of these layers, resulting from a meltwater refreezing process at the bedrock interface, are located at different heights in the section because of recumbent folds, and represent only a minor fraction of the basal part. This implies that the whole basal layer is not a result of accretion processes. Care must thus be taken in evaluating the importance of subglacial erosion by polar outlet glaciers from the thickness of their frontal basal ice and debris layers.

MELTING-REFREEZING AT THE GLACIER SOLE AND THE ISOTOPIC COMPOSITION OF THE ICE

(R. Souchez, Univ. of Brussels and J. Jouzel, Centre d'Etudes Nucleaires de Saclay, Dép. de Physico-Chimie, Gif-sur-Yvette, France)

A model for the isotopic composition in δD and $\delta^{18}O$ of ice formed by refreezing at the glacier sole has been developed. It predicts relatively well the distribution of points representing samples from basal layers of an arctic and an alpine glacier on a $\delta D - \delta^{18}O$ diagram. Some ice samples taken at the glacier sole and in the basal ice layers form a straight line on a $\delta D - \delta^{18}O$ plot with a slope different from that of precipitation. This has been observed here for the first time and appears to be the result of melting without isotopic change and refreezing with isotopic fractionation. The frozen fraction which is part of the liquid that refreezes can be determined for each basal ice layer. This may have implications on the study of the ice-water system at the ice-rock interface.

EXPERIMENTAL REFREEZING OF GLACIAL MELTWATERS

(M. Lemmens and R. Lorrain)

Glacial meltwater has been progressively frozen in a specially designed apparatus which allows:

a) a one-directional progression of a macroscopical planar freezing front,
b) a frequent sampling of a few drops of the remaining water for chemical or isotopic analysis during the freezing experiment,
c) An easy release of the ice core formed in order to perform chemical or isotopic analyses of the ice and/or crystallographic analyses of uncontaminated conditions.

The experimental refreezing of glacial meltwaters is carried out in order to study the rejection of cations in the liquid phase during freezing, the selective incorporation of cations into the ice during freezing and the evolution of δD and $\delta^{18}O$ of both ice and remaining water. The first results concerning the variations in isotopic composition have just been obtained and a paper, mainly on the chemical work, is in preparation.

GROUND ICE ON BANKS AND VICTORIA ISLANDS, ARCTIC CANADA

(J.-S. Vincent, Geological Survey of Canada)

Massive ground ice masses on Banks Island and evidence of the Pleistocene glaciation there were described in a Ph.D. thesis submitted to the University of Brussels. In the summer of

1981 ice will be taken from these ground ice masses for crystallographic analysis and analysis of δD and $\delta^{18}O$ in order to shed some light on their origin

R. Souchez

FRANCE

LABORATOIRE DE GLACIOLOGIE DU CNRS
(L. Lliboutry)

Staff of the Laboratoire de Glaciologie du CNRS did extensive work on the Glacier d'Argentière (French Alps) in September 1979 and the summer of 1980. The results of this and other investigations carried out since 1975 were included in the thesis by Didier Hantz (University of Grenoble I, 28 April 1981) and in the presentations to the meeting of the Glaciological Section of the Société Hydrotechnique de France (Grenoble, 13 March 1981) listed below.

François Gillet: Water borings on Glacier d'Argentière (about 30 borings to the bottom were performed).
Michel Vallon: Petrography of ice from Glacier d'Argentière (a core to the bottom, 237 m, was retrieved from this temperate, fast-moving glacier).
Alphonse Chaillou and Louis Phillippe: Measurement of liquid water content in ice (by the transit time of a cold wave).
Vincent de Montmollin, Paul Duval, Hugues le Gac, Michel Maccagnan, Jacques Meyssonnier, Alain Royer and Michel Vallon: Water content of ice from Glacier d'Argentière (random fluctuations between 0.15 and 1.9%, at the decimetric scale were found, but no general trend from surface to bottom).
Didier Hantz and Louis Lliboutry: Balances and changes in the surface altitude of Glacier d'Argentière (another case of "global dynamics").
Didier Hantz and Charles Carle: Annual velocities, seasonal fluctuations and ice discharge at several cross-sections for Glacier d'Argentière.
Didier Hantz and Louis Lliboutry: Hydrology of Glacier d'Argentière upstream from the catchment.

The main results were presented at the Symposium on High Mountain Hydrology, during the European Geophysical Society Annual Assembly, 24-29 August 1981, Uppsala, Sweden, and will be published in a special issue of Nordic Hydrology. Final results will be submitted for publication in the Journal of Glaciology.

INDIA

HIMALAYAN SNOW
(A.K. Bagchi, Civil Engineering Department, University of Roorkee, U.P. 247672, India)

The snow survey group from the University of Roorkee has undertaken research on various aspects of Himalayan snow in cooperation with the Indian Space Research Institute. The current emphasis is on the generation and forecase of runoff in rivers which are primarily snowfed. A self-imposed constraint is that any model should not call for data not normally available in an average Himalayan basin.

One of the attributes of an average Himalayan basin is that very few data are available and what there are are likely to be at the lowest point. Altitudes range to dizzy heights so it cannot be assumed that all along the basin orographic precipitation will increase without limit. This, along with the fact that there is practically no high altitude data recording programme makes it difficult to develop any precipitation-runoff model applicable to the Himalayas.

Methods have been developed to estimate the orographic increase in precipitation with altitude using LANDSAT data. Similarly methods have been developed to estimate the form of precipitation from a record of the minimum daily temperature which is more often available, if there is any data collection station in the area. It is now possible to estimate rain/snowfall (minus evapo-transpiration) at any altitude from a record of meteorological data collected at only one point in the basin, which may be the lowest point. Similarly it is possible to estimate the depth of standing snow at any higher altitude.

The basin which has a considerable area above the permanent snowline is appropriately glaciated. From a measurement of the movement of the glacial mass it is now possible to know about the orographic increase in precipitation in the perennial snow area also. An attempt is being made to correlate the precipitation record at a base station with the movement of the glacial mass.

Himalaya literally means the abode of snow but not much work has been done regarding Himalayan snow, which is the major source of water for the north Indian rivers in the summer months. Similarly Himalayan snow must be affecting the climate in a profound way. It is hoped the work initiated at the University of Roorkee will improve water management in a significant way in this part of the globe.

SWEDEN

GLACIOLOGICAL WORK AT TARFALA, 1981

The 1981 glaciological research program at Tarfala field station in northern Sweden involved a continuation of the mass balance, velocity, meteorological, and hydrological measurements that have been in progress for many years. In addition, two new surface-movement projects were started and a drilling project is to be initiated in the spring of 1982.

The 1980-81 budget year marks the 36th year of mass balance measurements on Storglaciären. The data have not been fully reduced yet, but it appears that the mass balance was moderately negative, continuing a trend that started in 1977/78. (The 1979/80 mass balance data, not previously reported, are as follows: winter balance +0.98 m H_2O, summer balance -2.25 m H_2O, and net balance of -1.27 m H_2O). Velocity, meteorological, and hydrological data are currently being reduced.

The two new projects initiated in 1981 were (1) installation of a 20-stake strain network on Storglaciären and (2) installation of a network of 23 movement stakes on Rabots Glaciär. The strain network on Storglaciären is in the form of a 4 x 5 grid with 125 m spacing between grid points. The network was surveyed for horizontal and vertical movement 16 times between late April and early September, and will be surveyed several times during the winter. Results of these measurements will be used to study short-term and seasonal velocity fluctuations, and also to plan for the drilling project to be initiated in April 1982. The stake network on Rabots Glaciär was designed to provide movement data spaced over the entire glacier. These data will be compared with similar measurements from Storglaciären in a study of the response of the two glaciers to climatic change. Rabots Glaciär has only one moraine post dating the Little Ice Age while Storglaciären has five; we will try to establish whether this difference is due to the dynamic characteristics of the two glaciers involved or to local climatic variations.

The drilling project to be initiated in 1982 has as its primary objective the determination of variations in sliding speed of the glacier along a transverse profile from the centerline to the margin. Surface movement, borehole deformation, and basal water pressure will be monitored. One of the principal objectives of this study will be to establish the relation between water pressure and sliding speed.

Valter Schytt and Roger LeB. Hooke

U.S.A.

PUGET LOWLAND – GLACIAL GEOLOGY

(E.W. Domack and J.B. Anderson, Department of Geology, Rice University, Texas)

Detailed sedimentological studies have been done on Late Quaternary glacial and glacial-marine deposits on Whidbey Island, Washington. The sequence represents a transition from a terrestrial to a marine bounded ice sheet and records a complex relationship between subglacial and pro-glacial marine environments. Distinct lithofacies can be recognized and these are found to occur in a predictable succession throughout exposures on the island. This work was carried out in order to better understand processes of glacial marine sedimentation and to compare these deposits to recent sediments of the Antarctic, where the vastly different glacial regime has produced a marine sequence distinct from that of the Puget Lowland, Pleistocene.

ANTARCTICA – GLACIAL MARINE GEOLOGY

(J.B. Anderson et al.)

Beginning in 1978 an investigation of glacial and glacial marine sediments of the Antarctic continental margin was initiated. Since then we have conducted four expeditions to the continental margin and are presently preparing for our fifth expedition this austral summer. A total of 270 piston cores have been acquired from the continental margin of the Weddell Sea, Ross Sea, Dumont d'Urville Sea, and Amundsen-Bellinghausen Seas. These include glacial marine environments bounded by the East Antarctic Ice Sheet, large floating ice shelves, and regions where valley glaciers flow directly into the sea. Sedimentation in these various glacial marine environments is being investigated. We are interested in developing glacial marine sedimentation models for interpreting ancient rocks as well as the Antarctic glacial record.

In 1980 glaciological studies were conducted on glaciers, in the Caucasus, Central Asia, the Altai, the Polar Urals, the Khibiny Mountains, in the mountains of Siberia and on the Siberian plain, in Kamchatka, the Arctic and Antarctica.

CAUCASUS

The Institute of Geography, USSR Academy of Sciences, continued its research in Snezhnaya karst cave in the West Caucasus where explorers reached a depth of approximately 1300 m. Investigations revealed the mechanism for the formation of a subterranean glacier situated at a depth of 200 m: snow is deposited by avalanches descending the slopes of the entrance pit. It was found that ablation occurs only during the warm season, as the result of condensation of water vapour on its surface.

The role of meltwater in transferring atmospheric heat between the different parts of a glacier was confirmed experimentally on Bol'shoi and Malyi Azau glaciers in the El'brus region. This effect triggers the mechanism by which glaciers regulate their melting and morphology. It was established that the content of certain micro-elements is governed by the processes of water migration through the firn and hence by the types of ice formation. It was also found that a correlation exists between the contents of the various micro-elements of glaciers, which fact can be used to trace their origin.

Based on new analytical data relating to the south slope of the Great Caucasus, it was confirmed that ground moraine plays a major part in the formation of marginal glacier complexes in mountains. Data from radiocarbon dating, palynology and diatom analysis established that it is moisture and not temperature that is the dominant influence in these changes. A lichenometric survey permitted reconstruction of the areas and volumes of glaciers for the last 700-800 years.

The Alpine Geophysical Institute developed a method of predicting recrystallization avalanches in the El'brus and Dombai areas. The method is based on a combination of avalanche and meteorological parameters, so that it was possible to devise a technique of differential prediction according to the scale of the avalanche. Three methods of air wave parameter computation have also been developed, and very simple formulae have been derived for determining the main parameters. The Institute also investigated environmental pollution on the glaciers of the central Caucasus, using data on contamination of the "glaciosphere".

The Avalanche and Mudslide Laboratory, Moscow University, summarized long-term observations in the El'brus area which established the relationship between the magnitude and pattern of change in the pressures operating on structures and the characteristics of snow formation and metamorphism on slopes.

The Aerospace Methods Laboratory, Moscow University, made a repeat photogrammetric survey of the Bol'shoi Azau, Terskol, Irik and Dzhankuat glaciers. The results show that the first two have advanced a short distance while the rate of retreat of the last two has slowed somewhat.

The North Caucasus Hydrometeorological Service conducted glaciological and meteorological observations on the Marukh and Sancharo glaciers (in the Kuban river basin) and studied the avalanche regime in the Ardon River basin. Observational data for 1979/80 showed that accumulation and ablation in the West Caucasus were close to the long-term average, whereas in the Central and East Caucasus ablation was lower than the long-term average and accumulation higher. The annual variations of 24 glaciers on the north slope of the Greater Caucasus were determined. In the period 1979/80, 4 glaciers advanced and 20 retreated. The maximum advance noted was for Bezengi Glacier (30.4 m), and the maximum retreat was for Taurtu Glacier (22.4 m).

The Transcaucasian Hydrometeorological Institute continued its glaciological and meteorological observations on Devdoraki Glacier and prepared a record of glaciological observations on that glacier from 1977 to 1980. Large-scale photogrammetric surveys were conducted at the beginning and end of the ablation season on the Kolka, Gergeti, Tviberi, Khlade and Adishi glaciers. The results were used to determine the rate of ice flow and moraine transport on the surface of the glaciers, estimate the true nature of the latter and calculate the glacier indices and annual ablation.

The Vakhuti Geographical Institute, Georgia conducted glaciological, hydrological and meteorological studies in the Tbilisi Mountain glacier basin. Between 1967 and 1980 the glacier retreated 62 m, i.e. an average of 4.4 m/a. Between August 1979 and August 1980 it retreated a further 4 m. Photogrammetric surveys were carried out on the Kartisho, Edena, Khvargula and Shtala glaciers. Analysis of the data obtained revealed that these glaciers are also continuing to retreat, though the rate has dropped considerably to 2-5 m/a.

Moraines in the upper reaches of the Rioni River were studied jointly with the Georgian Polytechnical Institute to see whether they could be used in construction. The distribution of tills was mapped and the thickness and volume of lateral, terminal and basal moraines determined.

The University of Kharkov investigated glacial mudflows and collected tree samples in the Baksan River valley for dendroclimatic studies.

CENTRAL ASIA

The Geography Department, Academy of Sciences of the Kazak SSR, continued to investigate the water balance of mountain glacier basins, the water-ice balance of glaciers and the mechanism of their fluctuations in the Zailiyskiy and Dzhungarskiy Alatau. It also carried on its study of avalanches and the avalanche hazard in areas of intensive economic development and made further progress with the mapping of avalanche-prone districts in the mountains of Kazakhstan and Central Asia. Further studies were made of the water and thermal relations of moraines and periglacial lakes and their influence on the formation of glacial mudflows in the Zailiyskiy Alatau.

Comprehensive field material on ablation, accumulation, glacier surface velocity and flow fields was analysed and data on the latter used to distinguish 28 quasi-stationary dynamic fields on Tuyuksu Glacier in the Zailiyskiy Alatau and Shumsky Glacier in the Dzhungarskiy Alatau. A map of the quasi-stationary dynamics of Shumsky Glacier for 1967-1979 was completed. The average values of all the mass balance components of Shumsky Glacier and the latter's thickness and volume were calculated. Maps were prepared of the mass balance components of Tuyuksu Glacier and a method devised for computing mass balance which takes into account internal mass transfer. Programs were prepared for performing glaciogeodetic calculations on domestic and foreign micro-calculators. Techniques were developed for calculating the mass balance of a glacier using temperature alone.

New methods were developed for making reliable assessments of avalanche risk, for estimating precipitation in the mountains, for adjusting rain gauge data and for calculating soil moisture levels in watersheds. The secular variation in alpine precipitation was determined. The mechanisms controlling the formation, development, outburst regime, and degradation of periglacial lakes were discovered. The first results were obtained from general forecasts of mudflow risk based on the method of pattern recognition.

The balance year 1979/80 in southeastern Kazakhstan was relatively wet and cool compared with previous years. However, the influence of an abnormally dry spell which had lasted for some five years in a row was still apparent in the regime of all the glaciohydrological characteristics of the glacial regions: there was a precipitation deficit, the snowline had risen above the average long-term level, summer snowfalls were infrequent and light, and perennial ice ablation exceeded the annual norm.

On the whole the mass balance of the glaciers was negative, but its value was considerably lower than the extreme indices of the balance year 1977/78. The avalanche risk in the mountains of Kazakhstan and Central Asia was low. There was also a pronounced drop in the mudflow hazard in the glacial zone, although there were individual cases of flows generated by glacial action.

The Central Asian Hydrometeorological Institute finished laying the theoretical groundwork for the organization and planning of a snow survey network for hydrological forecasts involving helicopter gamma-surveying. Methodological recommendations were worked out for the design of an airborne snow survey network in the mountain districts of Central Asia and for the conduct of gamma snow surveys in the mountains. All-year-round studies on Abramov Glacier in the Alai Mountain Range were continued. Numerical modelling of artificial impacts on glacier melting with special reference to the Pskem and Zeravshan river basins was carried out with the aim of increasing the volume of runoff.

The Kirgiz Hydrometeorological Service continued its studies of mass balance and the role of glaciers in the formation of mountain river runoff. Surveys of the lower limits of the tongues and surface levelling were carried out on West Aksu, East Aksu and Dolon-Ata glaciers on the north slope of the Kungei-Alatau Range, Davydov Glacier in the Ak-Shiirak Range, Golubin Glacier on the north slope of the Kirgiz Range, Chong-Tur Glacier on the northwest slope of the Talasskiy Range, and Engil'chek Glacier on the north slope of the Kashkaaltau Range. An analysis of the surveys of the lower limits of the glaciers revealed that the Golubin, Chong-Tur and East Aksu glaciers were stationary, whereas the West Aksu and Dolon-Ata glaciers had advanced. The West Aksu Glacier had moved 50 m in one year and its area had increased by $12.5 \times 10^3 m^2$. In the period from 1965 to 1980 the Davydov Glacier had increased the area of its tongue by $73 \times 10^3 m^2$. During the same time the Engil'chek Glacier retreated an average distance of 150 m and the area of its tongue diminished by $193 \times 10^3 m^2$.

The Tien Shan Station continued its all-year-round observations on Karabatkak Glacier. The mass balance of the glacier has remained negative since 1973, the end of the tongue is contracting and its surface is becoming flatter. Accumulation and ablation studies were completed on the glacier in the Arabel' River basin in the upper reaches of the Bol'shoi Naryn.

It was established that ablation on these glaciers is similar in magnitude to that of the glaciers on the north slope of the Terskei Alatau Range some 400-500 m lower.

In connection with a project for the harnessing of the Sarydzhas River multidisciplinary glaciohydrometeorological investigations were carried out on the Sary-Bet Glacier, which is virtually stationary. The glacier runoff here comprises 34% of the annual total, and in summer it accounts for most of it.

The Glaciological Laboratory of the Geological and Geophysical Institute of the Uzbek Academy of Sciences studied the relationship between present-day glaciation and the tectonic structure and geomorphological conditions of West Tien-Shan and the Pamirs. The main emphasis was on the glaciers in the basin of the Murgab and on RGO Glacier in the basin of the Vanch. New evidence was obtained that the extent of glacierization depends not only on climate but also on absolute elevation, the depth of entrenchment and structure of valleys, the distance of glacier basins from the valleys, and other indices whose role is enhanced in areas with a drier climate.

The Tadzhik Hydrometeorological Service conducted observations on the fluctuations of 20 glaciers situated in the basins of the Muksu, Obikhingou, Zeravshan and Surkhob. On some of the glaciers a study was made of the ice flow rate, conditions of snow accumulation and meteorology.

The Institute of Geography, USSR Academy of Sciences, continued its studies of Medvezhii and RGO glaciers. A photogrammetric survey was made of the former. Its horizontal velocity in 1979 was analysed and causes of the irregularity of its movement over the last five years studied. Based on the results of 3 years of observations of Medvezhii Glacier an analogy was found between the course of its annual evolution and the main features of the long-term development of its surge. Annual pulses were recorded which occur at the beginning of the melt season and are probably connected with the increase in the amount of water in the glacier and at its base as a result of the initial vigorous melting of snow on the mountain slopes and on the surface of the glacier.

The Geography Department of Leningrad University continued multidisciplinary studies on certain Central Asian glaciers. On Tuyuksu Glacier the firn and ice were investigated by palynological methods and a study was made of the conditions of wind transport of the pollen and spores of plants growing in the alpine zone. The three-dimensional statistical structure of the temperature field and cloudiness was investigated in the high mountain areas of Central Asia. Good correlation coefficients were obtained for observation points located in different environments, at different elevations and at different distances apart. This means that it should be possible to use data from low-level weather stations with a long history of observation to reconstruct weather conditions in alpine areas.

The Limnological Institute of the USSR Academy of Sciences continued its observations of glaciers and permafrost in the Tien-Shan and Dzhungarian Alatau. Continuing retreat of glaciers and considerable degradation of permafrost were noted. Drying up of the large alpine lakes Chatyr-Kul and Son-Kul was also observed.

ALTAI

The University of Tomsk continued its studies in the Altai-Sayan region, including snow surveys and permanent multidisciplinary observations in the basins of the Aktru and Malaya Syya. In terms of snow conditions the winter was about average. Icing was also average and avalanching was rare. Glacier investigation by pulse detection and radio echo sounding was continued. Radar profiles were obtained of Malyi Aktru Glacier and the ablation area of Tete Glacier. The maximum thickness of ice in the accumulation area of the former was 190-210 m. A continuous layer with an elevated water content was discovered on the tongue of this glacier. Glacier recession was assessed from air photos of the glacierized areas of the Bish-Iirdu and Belukha mountains and from photogrammetry in the Aktru basin.

The Institute of Geography, USSR Academy of Science, investigated melting on six glaciers in the Altai. Various zones of ice formation were discovered, including an ice zone. Samples of the ice in the representative Aktru Mountain glacier basin were taken for geochemical analysis.

The Geography Department of the Kazakh Academy of Sciences continued its studies on the glaciers of the Kazakhstan Altai.

SIBERIA

The Institute of Siberian and Far Eastern Geography summarized the results of studies of the cryogenic and nival micro-relief of bald mountains (golets, goltsy) in the Baikal region and North Transbaikalia undertaken from 1973 to 1979. It was found that precipitation accumulating in small clearings may represent from 10-30% of the water equivalent depending on the density and biomass of the phytocenosis.

The Central Asian Hydrometeorological Institute completed a long-term study of avalanche formation along the route of the Baikal-Amur railroad, and on the basis of this study suggested a method of alternative daily

avalanche prediction for fresh snow and also techniques for computing the main factors in avalanche formation.

Moscow University's Avalanche and Mudslide Laboratory developed a method of classifying and making quantitative assessments of avalanche centres based on the conditions of snow cover metamorphism and general climate in the mountain areas along the route of the Baikal-Amur Railway and in the El'brus region.

POLAR URALS

The Institute of Geography, USSR Academy of Sciences, carried out geodetic and mass balance studies on Obruchev Glacier as well as two photogrammetric surveys during the season. Repetitive measurements were made of the density and settlement of firn in a 14 m pit. Since 1970 the Polar Urals as a whole have been characterized by declining rates of glacier retreat, whereas the shape and size of the glaciers have been relatively stable for the last five years. The winter, summer and annual mass balance of these glaciers was found to exhibit greater spatial and temporal variation than in the case of the glaciers of the Caucasus and Pamir owing to the greater air mass contrasts in the Polar Urals.

KHIBINY

The "Apatit" Industrial Association completed a series of experiments begun in 1967 to measure the impact pressure of avalanches under natural conditions. It was found that the impact pressure varied with the height of the obstacle, that the moving avalanche had a two-tier structure at the time of impact, and that a close correlation existed between the average and maximum pressures measured. In the overwhelming majority of cases the actual pressure was approximately half the calculated value. The exceptions were avalanches with a maximum coefficient of snow compaction in the process of impact. These had a maximum impact pressure in excess of the computed value. There appears to be some combination of avalanche parameters beyond which the dynamic indices of the avalanche become extreme.

"Apatit" investigated the growing influences of industry on avalanche development over the last 20 years, using data on 2500 avalanches. It was found that the percentage of "technogenic" avalanches had increased 2.5 times. The total number of avalanches had doubled whereas the total volume of snow displaced had dropped by one third, so that the average volume per avalanche had been reduced by a factor of 3.5. Human modification of avalanche regime has hindered the application of mathematical statistics, but has on the whole helped to reduce the avalanche hazard.

The Mining Institute of the Kola Branch of the USSR Academy of Sciences made an ice engineering study of techniques of effective waste dumping on mountain slopes under polar conditions. A number of recommendations concerning the technological aspects of dumping at mines were drawn up. The Institute has also developed methods of winter dumping, combined storage and dumping of rocks and snow, unloading large dump trucks at tips, rational location of dumps on mountain slopes, etc.

Moscow University's Avalanche and Mudslide Laboratory generalized the results of long-term study site and route observations of snow cover in the Khibiny during the wet avalanche season, discovered some of the factors in wet avalanche development, derived criteria for prediction of the time of avalanching and drew up suggestions for improving protection against wet avalanches.

KAMCHATCKA

The Institute of Volcanology investigated snow cover on glaciers and in the periglacial zone of Avachinskaya volcano group. The annual mass balance of Kozel'sky Glacier was +120 g/cm². It was established that Bil'-chenko Glacier in the Kluchevskaya volcano group surged in 1976-77. Firn thickness on that glacier is about 10 m at 3600-3700 m.

The Institute investigated the glaciers on the west and northwest slopes of Bol'shaya Zimina volcano, which is an isolated glacierization centre. Popov Glacier on the west slope had its firn line at 1800-1900 m, and its tongue at 1350 m. The piedmont Firnovyi Glacier (No.24) had its firn line at 2100 m, and its tongue at 1700 m. The snow-ice transformation takes place after 4-5 years by percolation at a depth of 5 m. Surging by a number of glaciers on the northwest slope of Ostryi Tolbachik volcano was noted. Three previously unknown glaciers were discovered on the outer slopes of Sutnovskyi volcano. The mass balance of the glaciers in the crater was measured and found to be +73 g/cm² on the North-East Glacier and +23 g/cm² on the South-West Glacier.

THE ARCTIC

The Institue of the Arctic and Antarctic (AANII) continued its studies at the Vavilov Dome glaciological station in Severnaya Zemlya. New data were obtained on the thickness of the glacier and the subglacial topography under the southwest part of Karpinski Glacier. The relationship between solar radiation penetration into the snow and ice of Vavilov Glacier and the physical properties of the snow cover was revealed. A more accurate picture of the evolution of the late-Würm and Holocene glaciation of Severnaya Zemlya was obtained from analytical studies of rock samples and organic remains.

Air surveys were used to track the development and destruction of the snow cover along the lower courses and in the estuaries of the Ob, Hadym, Pur, Taz and Yenisei rivers.

The Institute of Geography, USSR Academy of Sciences, completed its summary of the latest research on Spitsbergen, north Europe, the Polar Urals, the northern part of West Siberia, Taimyr and Severnaya Zemlya. It was shown that if the warming trend assumed in some climatic models for the next few decades is sustained the mass balance of the polar ice caps will become sharply negative and they will disappear within a few decades. On the other hand, with cooling and a reduction in the advection of Atlantic water into the Arctic, the Arctic Ocean will become covered with perennial ice which could develop into a "marine" ice sheet. Such ice sheets are unstable and their ice streams may be subject to catastrophic surges with a subsequent rapid melting of the discharged ice and a general rise in sea-level.

A paleotemperature study of an ice core from Spitsbergen revealed that the secular climatic variations in the western part of the Eurasian Arctic are synchronized with the 80-year cycles of Greenland. The known tendency of the Greenlandic cyclones suggests that there may be a warming trend in the Arctic during the 1980s which will continue for forty years.

The Geological Institute of the Estonian Academy of Sciences completed geochemical isotope studies of a glacier core from Vavilov Dome in Severnaya Zemlya. Determination of total beta activity and tritium concentration made it possible to estimate the average annual accumulation over the last few years at 10-12 g/cm^2. Small variations in oxygen isotopes and chlorine concentration in the layers of ice indicate that the climate has been relatively stable for tens of thousands of years. Judging by the profiles obtained, a steady climatic deterioration began 30-40 thousand years ago and persisted right up to the Holocene climatic optimum.

ANTARCTICA

The Arctic and Antarctic Institute and the Geographical Institute of the USSR Academy of Sciences conducted repeated snow surveys along routes leading from Pioneerskaya Station to Dome C and from Mirny to Vostok and then on to Dome B. At a number of points along the latter route radar sounding was used to measure the velocity and direction of surface flow. The velocity dropped from 120 m/a at 54 km to 0.7 m/a 1150 km from Mirny. A 30 km^2 subglacial lake was discovered at a depth of 3560 m at 77°05'S, 94°50'E.

Drilling was continued at Vostok and Pioneerskaya stations and also 40 km from Mirny. Geophysical investigations were carried out and core samples taken for oxygen isotope analysis. At Molodezhnaya, Leningradskaya, Vostok, Russkaya, Novolazarevskaya and Mirny accumulation and ablation observations continued. At Bellingshausen Station a study was made of seasonal geocryological and glaciological processes. It was concluded that the ice sheet covering the South Shetland archipelago is highly dynamic and unstable. Clear signs of present-day shrinkage of the ice sheet on King George Island were found. The ice-free parts were marked by continuous permafrost, which was absent beneath the glacier. The tentative conclusion was drawn that there is a separate geocryological zone on the Antarctic islands which differs markedly from the conditions in the coastal oases of the land mass.

A quantitative assessment was made of mass and energy exchange between the surface of the Antarctic Ice Sheet and the atmosphere. It was found that most of the heat is lost in the form of long-wave radiation from the ice surface and atmosphere into space. The total heat loss from the ice surface and atmosphere above it amounts to 8×10^{18} kcal/a. 82% of the loss is made good by advection of heat from the low latitudes of the southern hemisphere and 18% by the heat released in the phase reactions undergone by the advective moisture during crystallization in the Antarctic atmosphere and on the ice surface.

Oxygen isotope studies of ice samples and interpretation of material obtained from deep holes and along the routes from Mirny to Vostok and to Dome C were continued. Analysis of a deep core led to re-examination and amendment of the age model of the Antarctic Ice Sheet to take into account variable accumulation in the Late Pleistocene. Firn isotope composition was correlated with temperature at the level of obliteration of annual fluctuations.

After study the glacial deposits in the Prince Charles Mountains of MacRobertson Land were divided up according to age. Six main phases in the evolution of Cenozoic glaciation were distinguished. A comparison of regional paleoglaciological schemes of key areas in Queen Maud Land, MacRobertson Land and Victoria Land provided insight into the individual developmental phases of the entire East Antarctic Ice Sheet.

The problem of numerical modelling of the thermal regime and dynamics of the Antarctic Ice Sheet was solved, based on consideration of the two-dimensional non-stationary equation of heat transfer adjusted to take into account energy dissipation through the thickness of ice. Calculations performed on a computer made it possible to study the response of the ice sheet to long-period climatic fluctuations and established that the changes

in climate occurring over the last 100,000 years have had a dramatic influence on the thermal regime of the ice mass. The temperature field of the latter revealed traces of a climatic minimum 18-20 thousand years B.P.

SCIENTIFIC RESULTS

The principal scientific results achieved in 1980 but not reflected in the regional breakdown include the following:

1. The compilation of a Catalogue of Soviet Glaciers, begun in the 1960s, and consisting of 108 parts was completed.

2. An airborne radio echo sounder operating at 620 MHz was developed. Mounted in a helicopter it proved capable of sounding temperate mountain glaciers up to 500 m thick.

3. The concept of nival-glacial systems and their property fields was formulated and methods developed for constructing these fields. Their development and application was made possible and necessary by the preparation of the World Atlas of Snow and Ice Resources. 1980 saw the completion of the first, preparatory, phase and the second, compilation, phase.

4. In connection with the above Atlas a number of indirect methods of calculating solid precipitation, snow cover, glacier morphology and regime, alpine climatic conditions, snowmelt and discharge were developed to the point of practical application. With the aid of these methods a series of maps of the Caucasus, Tien-Shan and Pamiro-Alai were prepared. Analysis of the map data led to new conclusions about the nature of these high-mountain regions, their precipitation and the mechanisms of snow and ice phenomena.

5. A portable drilling rig and instruments for deep thermal drilling and core removal were designed and techniques for remote monitoring of heat and mass exchange beneath glaciers were developed. The new equipment was used to drill six holes on Spitsbergen, the deepest being 586 m, and also to drill through the entire thickness of the Ross Ice Shelf. Analysis of the core removed and monitoring of the underside of the Ice Shelf established directly for the first time that bottom freezing does take place.

6. Oxygen isotope analysis was performed on an ice core encompassing a period of 60,000 years which was recovered from a hole drilled at Vostok Station. The results, when compared with data from Greenland, indicated synchroneity of the main climatic boundaries in the northern and southern hemispheres, and isotope profiles from Spitsbergen, embracing 800-1000 years, show that climatic changes took place synchronously throughout the Arctic, although the fluctuations during the period in question were complex.

7. For the first time in paleoglaciology an objective analysis of glacial deposits was made by a range of analytical techniques. The results indicated that the Holocene deposits are younger than was previously thought and that major expansions of glaciers took place in historical time, which means that they may be repeated in the near future.

8. The foundations of a glaciology of "marine" ice sheets – marine glaciology – have been established. Details of the distribution, developmental history and dynamics of "marine" glaciers have been analysed, including their structural instability. The latter property means that their dynamic response to changes in climate and sea level may be catastrophic.

9. A system of numerical modelling permitting efficient computerized calculations of the main parameters of glacier dynamics has been completed. The system, which has been tested on a number of real objects, comprises 15 algorithms ranging from the processing of field observation data to calculation of the three-dimensional non-isothermal mechanics of glaciers, including the geometry of the enclosing surfaces.

10. Principles have been worked out for combining engineering and glaciological description and mapping of areas on different scales, making it possible to divide the areas up into zones on the basis of their hazardous snow and ice phenomena and the intensity of the latter. A study of snow cover regime in conditions of complex orography established that many factors govern the distribution of snow cover in mountains of medium elevation, and that there is a reduction of the number of factors involved as the glacierized zone is entered, which should make it easier to make forecasts for the high-mountain areas.

11. Based on the theory of plastic flow and concepts of molecular kinetics a probabilistic approach was used to investigate ice deformation in relation to the duration of stress and temperature. The possibility of monitoring and predicting the deformation of ice masses under stress with the aid of acoustic emission records was demonstrated. The results of experiments involving dynamic loading of ice specimens confirmed the essential similarity of ice destruction processes under static and dynamic loading and the correctness of selecting the critical number of structural defects as the criterion of ice destruction.

V.M. Kotlyakov and M.Yu. Seregina

THE INTERNATIONAL COMMISSION ON SNOW AND ICE

The International Commission on Snow and Ice, or ICSI, occasionally advertises its existence by organizing or sponsoring major symposia, but for the rest of the time it remains a slightly mysterious old boy group, a sort of Cosa Nostra of glaciology.

On the face of things, ICSI is easy enough to explain, as it occupies a definite but lowly place in the hierarchy of international organizations. The ICSI is one of the six Commissions of the International Association of Hydrological Sciences (IAHS), which itself is part of the International Union of Geodesy and Geophysics (IUGG). The IUGG is, in turn, a member of the International Council of Scientific Unions (ICSU), which operates under the aegis of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The ICSI is therefore a very humble ingredient of the alphabet soup, and well qualified for obscurity. However, unlike such brash upstarts as UNESCO, the ICSI is of ancient lineage, making it heir to mild eccentricity and a blithe unconcern for superincumbent bureaucracies.

ICSI is a lineal descendent of the International Commission of Glaciers, which was founded in Zürich in 1894. The Commission of Glaciers was combined with the Commission of Snow in 1939 to create the present organization, and in 1948 there was a formal resolution that the title thereafter would be "The Commission of Snow and Ice". During more recent times, "International" crept back into the title, and in the English version, "of" changed to "on", perhaps because of some vague linguistic unease (cf. "commission of sins"). In 1960, ICSI developed its own substructure by forming four divisions to deal with: (1) Glaciers and Ice Sheets, (2) Seasonal Snow Cover and Avalanches, (3) River, Lake and Sea Ice, and (4) Ground Ice. During the mid-sixties, ICSI brought into existence the Permanent Service on the Fluctuation of Glaciers (PSFG), which was eventually established within the Federation of Astronomical and Geophysical Permanent Services (FAGS!), with the ICSI officers forming its governing board (see Profile in ICE, Nos 62 & 63, p.20-22, 1980). A comparable effort in the mid-seventies created another closely related organization, the Temporary Technical Secretariat for the World Glacier Inventory (TTS). Both the PSFG and the TTS were, until recently, directed by the late Fritz Müller.

The permanent structure of the ICSI is supplemented from time to time by temporary working groups which deal with specific problem areas, such as avalanche classification, glacier mass and energy balances, meltwater runoff, and ground ice problems.

ICSI has nine officers: a President, three Vice-Presidents, a Secretary, and four Division Chairmen. These people represent a broad spread of research interests and geographical areas. They are elected at four-year intervals during the IUGG Congress, by the kind of democratic process which is common in professional associations and learned societies (i.e., one candidate for each post, with nominations coming from the outgoing Bureau). The officers meet each year, and they are often assisted in their deliberations by the appointed chairmen of working groups or by other invited experts. Some financial support for these meetings is usually provided by the Water Sciences Division of UNESCO, since ICSI functions as its working group for the International Hydrological Decade(s) (IHD). The Commission has National Correspondents in about 30 countries, with whom it communicates rather infrequently as circumstances demand.

The basic purpose of ICSI can be stated quite simply. The objectives are to encourage research that leads to improved understanding of ice and snow, to facilitate the exchange of ideas, and to promote international cooperation in appropriate scientific fields. The way these objectives are pursued is not quite so straightforward.

The most visible Commission activities are the symposia organized or sponsored by ICSI, together with their published proceedings, usually in the form of IAHS "redbooks". Less familiar are the doings of the working groups, survey group, and suchlike, which from time to time issue their findings in a variety of ways. One of the less well known functions of ICSI is the organization of training courses, which in recent years have been concentrated in India and Pakistan, with emphasis on snow, snow hydrology, and avalanches. In addition to these things, there are wholly unseen activities, and it may well be that this hidden part of the "iceberg" is the most significant part. Most of this work is in the general area of international collaboration, where formal requests, recommendations and endorsements from an official international body can carry considerable weight. In situations or places where heavy formality is unnecessary, the old boy network can be exploited shamelessly for the greater glory of snow and ice research.

Apart from its international mandate and its letterhead, ICSI has little in the way of assets. It has no premises, sustaining funds or permanent staff. All of the officers have full-time professional commitments.

Their office expenses and travel for ICSI are subsidized by their home institutions, and sometimes by they themselves. Thus the ICSI Bureau feels entitled to be strongly self-critical on occasions.

In recent years, one topic of concern has been the need for balanced coverage of modern snow and ice research. Within the Commission, there is little sympathy for the view that ICSI, being part of IAHS, should concern itself exclusively with hydrology. However, without an expansion of the present Bureau, ICSI is not equipped to deal with much of the modern research which has been motivated by engineering problems in the Arctic. Thus there has been a move to develop closer relations with other international organizations which have overlapping interests, such as the International Association for Hydraulic Research (IAHR) and the International Union for Theoretical and Applied Mechanics (IUTAM).

Malcolm Mellor

PAST ICSI PRESIDENTS AND SECRETARIES

	President	Secretary
1939-48	J.E. Church	E.E. Matthes
1948-51	H.W. Ahlmann	P.D. Baird
1951-54	G. Seligman	P.D. Baird
1954-57	R. Haefeli	P.D. Baird
1957-60	R. Finsterwalder	P.D. Baird
1960-63	P.A. Shumsky	W.H. Ward
1963-67	H. Hoinkes	W.H. Ward
1967-71	M.F. Meier	W.H. Ward
1971-75	J.F. Nye	F. Müller
1975-79	U. Radok	M. Mellor
1979-83	E.F. Roots	M. Mellor

ICSI PUBLICATIONS

PUBLISHED UNDER THE AUSPICES OF THE INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES (SCIENTIFIC HYDROLOGY)

No. 14 - Report of the Commission of Glaciers (1930)
No. 23 - Reports and Technical Notes of the Commission of Snow and Ice: Edinburgh (1936)
No. 30 - Travaux de la Commission de la neige et des glaciers, procès-verbaux des séances, Tome II: Assemblée Générale d'Oslo (1948)
No. 32 - Snow and Ice, Tome I: General Assembly of Brussels (1951)
No. 39 - Comptes-rendus et rapports de la Commission des Neiges et des Glaces, Tome IV: Assemblée Générale de Rome (1954)
No. 46 - Snow and Ice. Volume IV: General Assembly of Toronto (1957)
No. 47 - Physics of the Movement of the Ice: Symposium of Chamonix (1958)
No. 54 - Snow and Ice Commission: General Assembly of Helsinki (1960)
No. 58 - Variations of the Regime of Existing Glaciers: Symposium of Obergurgl (1962)
No. 61 - Commission of Snow and Ice: General Assembly of Berkeley (1963)
No. 69 - International Symposium on Scientific Aspects of Snow and Ice Avalanches: Symposium of Davos (1965)
No. 79 - Commission of Snow and Ice, reports and discussions: General Assembly of Bern (1967)
No. 86 - International Symposium on Antarctic Glaciological Exploration (ISAGE): Hanover, U.S.A. (1968)
No. 95 - Symposium on the Hydrology of Glaciers: Symposium of Cambridge (1969)
No.104 - Snow and Ice Symposium: General Assembly of Moscow (1971)
No.107 - The Role of Snow and Ice in Hydrology, 2 volumes: Symposium of Banff (1972)
No.114 - Snow Mechanics Symposium: Symposium of Grindelwald (1974)
No.118 - Isotopes and Impurities in Snow and Ice: Symposium of Grenoble (1975)
No.126 - World Glacier Inventory Workshop: Riederalp, Switzerland (1978)
No.131 - Sea Level, Ice, and Climatic Change: General Assembly of Canberra (1979)

UNESCO TECHNICAL PAPERS IN HYDROLOGY

No. 1 - Perennial ice and snow masses
No. 2 - Seasonal snow cover
No. 3 - Variations of existing glaciers
No. 4 - Antarctic glaciology in the International Hydrological Decade
No. 5 - Combined heat, ice and water balances at selected glacier basins
No. 5 - Combined heat, ice and water balances at selected glacier basins. Part II - specifications, standards and data exchange
No. 9 - Guide to world inventory of sea, lake and river ice
No.19 - Remote sensing of snow and ice (Mark F. Meier)

MISCELLANEOUS PUBLICATIONS

Fluctuations of Glaciers 1959-1965 (1967)
Fluctuations of Glaciers 1965-1970 (1973)
Fluctuations of Glaciers 1970-1975 (1977)
Climatic roles of ice: a contribution to the International Hydrological Programme (IHP): UNESCO Technical Documents in Hydrology SC.78/WS.9 (U. Radok, 1978)
Mechanical properties of polycrystalline ice: an assessment of current knowledge and priorities for research (R.LeB.Hooke, M.Mellor et al., 1980)

ANNUAL GENERAL MEETING 1981

MINUTES OF THE ANNUAL GENERAL MEETING OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY

11 SEPTEMBER AT THE OHIO STATE UNIVERSITY, COLUMBUS, OHIO, USA

The President, Dr L.W. Gold, was in the Chair

1. The Minutes of the 1979 Annual General Meeting, published in ICE No.65, 1st Issue 1981, p. 16-21, were approved and signed by the Chairman.

2. The President gave his report for 1980-81: For the past few years our Society has been following the practice of sponsoring its own symposium every second year and in the in-between years, of accepting an invitation to co-sponsor a symposium organized by others. This year we co-sponsored two: the International Symposium on Ice organized by the International Association for Hydraulic Research, and the SCAR International Symposium on Antarctic Glaciology. Such invitations are a recognition of the very significant contribution our Society makes to the development of glaciology. We are very pleased to be associated in this way with the exciting advances that are being made in our knowledge of snow and ice and with the opportunity that the SCAR Symposium has provided for holding our Annual General Meeting in Columbus, Ohio.

When I took office in 1978, we were faced with a serious financial deficit. Through the very positive cooperation of our Journal editors, for which I am most grateful, careful management by our Secretary General and her staff and sound advice from members, particularly our Treasurer, we have been able to bring about an encouraging improvement in our situation. In 1979 we broke even. I am pleased to report that for 1980 we have a surplus of just over £8,200. Even with this improvement in our affairs, however, we still have a major challenge to maintain that surplus in the future and re-establish the position we enjoyed in 1977.

In my previous two annual reports I gave appreciable attention to our publications and publication policy. I emphasized, in particular, the *Journal of Glaciology* - the high standard we expect of it, its value to our Society, its cost. The reason for doing this was not just to inform our members of a critical situation but also to encourage them to think carefully about the future development of what is, perhaps, the greatest and most enduring contribution of our Society to the scientific community. The *Journal of Glaciology* is an extremely valuable record of glaciological research during what may be the most dynamic period of development of our discipline. It is also the major part of our budget. During the past three years several members of the Society have given careful consideration to how these costs can be kept at a level that will allow the Society to continue publishing this record.

We have been publishing the proceedings of symposia in the Journal and this practice has increased costs significantly. In response to a recommendation of a Working Group on Publication Policy, the Council established the *Annals of Glaciology* during the past year. In general, in future, symposia are to be self-supporting and their proceedings published in the Annals. This action will ease the situation with regard to the Journal but it is clear that the Council will have to continue to control its size to ensure that it stays within our financial means.

At its meeting in Geilo, the Council set up an ad hoc committee "to investigate cheaper methods of printing the *Journal of Glaciology* especially the latest development in computer techniques". John Nye kindly agreed to chair the committee; the other members were John Glen, Senior Editor of the Journal and John Heap, our Treasurer. They were asked to look at the present cost of publication and the expected change in it over the next three years; to investigate the effect on these costs of going to computer typesetting; to determine what other cheaper forms of publication can be reasonably considered and the consequences of adopting them; and to recommend to Council what action it should consider to ensure that the Society and the Journal remain in a sound financial position.

The Committee found that if we maintain our current publishing procedures, we would again be in a deficit position by 1982 if fees are not increased. Quotations for printing the Journal were requested from several companies, including printers in Europe and North

America. One quotation was markedly lower than the others. By using that printer we would save about £1200 per issue, or £3600 per annum. The Committee considered that the firm would give good service. It uses a computer method for typesetting and, as it is one of the printers for the *Journal of Physics*, it has experience in producing scientific journals. In view of this saving, the recommendation of the ad hoc committee and the need to make a decision for the printing of the 1982 volume, the Secretary General was authorized in May to arrange for a contract.

This was a difficult decision to make as our current printers, Headley Bros. Ltd. have given us very good service. The change, however, should preserve the Journal as it is; there should be little discernible difference between Volume 27 and 28. It now remains to explore the possibility of further savings that would alter the appearance of the Journal by changing, for example, the paper, the page size, style of printing and general presentation. The Council has decided to appoint a new printing Committee and to ask it to investigate what further savings might be made by changes in format and production procedures. The earliest that these changes could be introduced would be in 1983 (Volume 29).

Costs of publication will continue to increase. There are limitations to the savings that we can obtain through changes in printing methods and format while still retaining the desired quality. The only ways we have for meeting increased costs in the long run are to increase membership fees, increase revenue from page charges and to seek other sources of financial support. Individuals do consider seriously how much they are willing to pay for a journal that may contain only one or two papers per issue that are of direct interest to them, even if they are fully supportive of the aims of the Society providing the publication. Attitudes toward page charges are changing. It is becoming more generally recognized that publication is the final step in research and should be an accepted part of the cost of the project.

These factors indicate that probably we have reached the stage where it should be mandatory for authors to pay at least 50% of the cost of publishing their paper in the *Journal of Glaciology* and to pay the full cost of pages above a certain limit. Not all research is funded, however, and allowance would have to be made for such situations. If the Society could count on at least 50% of the total cost of publication being provided through page charges, it should be possible to ensure financial stability for at least the next five years without requiring a major increase in fees, particularly if additional sources of financial support can be found.

I do want to recognize at this time the tremendous job that our Editor-in-Chief, John Glen, and his co-editors David Homer, Ray Adie and Doris Johnson are doing for us. It has been a very difficult and trying period for the past two years for them as they have had to work within a limitation of 500 pages. Only now is the back-log caused by this constraint beginning to clear. Our editors have had to raise standards and encourage shorter papers. They have done an excellent job in maintaining the high technical and editorial standards we expect of the Journal and deserve our thanks.

Another reason why I have emphasized the Journal and publication policy in my reports was to provide background information for a consideration of the type of communications we want our Society to provide in the future and the most effective means of doing so. We know that journals are changing. We know that the ways in which individual scientists keep informed of their fields of interest are also changing. In what ways will glaciologists become informed of completed and current work 5 years from now - 10 years - 20 years? Our Society must know so that we can adjust to these changes. I would hope that the ad hoc committee looking into ways of reducing the cost of the Journal might evolve into a permanent one on communications policy that would give careful consideration to these questions that are so basic and important to our Society.

During the past year, we began publication of the *Annals of Glaciology*. This shows good promise of being a successful venture. The first two volumes - the Proceedings of the Conference on the Use of Icebergs held in Cambridge in April 1980 and the Proceedings of the Geilo Symposium on Glacier Erosion and Sedimentation have now been issued. Sales to members and libraries are providing good circulation and a sound financial position. Experience with the first two volumes indicates that we can publish an annual volume of about 300 pages (equivalent to about 500 pages of the Journal) with modest grant support. The size of the grant required increases with the size of the volume. Support for the first volume was provided by the King Faisal Foundation and Iceberg Transport International Ltd., and for the second volume by the Nordic Publishing Group. On behalf of the Society, I wish to thank these organizations for the support which was so instrumental in getting this series off to a good start. Volume 3 will be the Proceedings of the International Conference on Antarctic Glaciology. Support for it is being provided by SCAR and the U.S. National Science Foundation and I wish to express our thanks to these two organizations as well. Support for Volume 4, which will be the Proceedings on Applied Glaciology, is currently being negotiated.

In order to produce Annals volumes quickly at minimum cost, some sacrifice in publication quality is necessary. Through our technical editing procedure and the dedicated efforts of our house editor, Ailsa Macqueen, however, the quality of the papers remains high. These factors, along with the attractive appearance of each issue, are attracting attention; we are receiving requests from others to include proceedings of conferences in the series. At present there are some gaps, but with Hilda's continuing P.R. efforts, I know it will not be so for long.

The Annals are produced from our Cambridge office and the method of financing them is easing our general financial situation. Not only does the operation cover the salary of our staff for the time they spend on each issue, it also carries on a pro-rated basis part of our overhead. All of these details are in Hilda's capable hands as manager of the Series. The Annals could not have got off to such a good start without the dedicated efforts of Hilda and her assistants and of Ailsa Macqueen. On your behalf I wish to express to them our sincere appreciation. I also want to thank the individuals that edited Volumes 1, 2 and 3 and in particular Charles Swithinbank, Chief Editor for Volumes 1 and 3, and Garry Clarke, Chief Editor for Volume 2. The success of our Society is due to the dedicated efforts of individuals such as these.

One of the decisions taken last year was to appoint Simon Ommanney as the Editor of ICE. This allowed our Secretary General to devote more of her time to organizing symposia and processing proceedings. Producing three issues of ICE per year is not an easy job. I want to thank Simon for taking on this task and to put in a plea to our Correspondents to submit their reports to him on time and in a form that will minimize his editing chores. ICE is our newsletter and Simon can use all the help we can give him in producing it.

Our Society has continued to be active. Each of the branches have held meetings during the past year. Unfortunately, our membership is not increasing and is, in fact, down from last year. Six hundred and seven libraries receive the Journal, also down a little. This probably reflects the increase we had to make in our fees. We have reviewed our list of organizations that receive the Journal free or on exchange, and the number is now 26. With a little campaigning on the part of our members and our branches, we should be able to get our membership over 1000 again.

Looking ahead, the next Society symposium will be on Applied Glaciology and will be held next year in Hanover, New Hampshire. Local arrangements are being look after by our colleagues at CRREL. Everything is proceeding satisfactorily.

We have accepted an invitation to hold the 1984 Society symposium in Japan. The theme will be Snow and Ice Processes at the Earth's Surface. Topics have been selected to encourage local participation and support. Our Secretary General has arranged for a travel agent to make a special tour, which will include attendance at the Symposium, visits to places of special interest in Japan and an optional post symposium study tour to China. The study tour to China will be for a maximum of 30 people and will include a visit to a glaciological field station in the Tian Shan.

This will be the first symposium of our Society to be held in Asia. It will provide an excellent opportunity to hear about and see the glaciological research work in Japan and to learn about some of the activity in China. I wish to express our appreciation to Dr Wakahama for his help in making the arrangements for the symposium and to say how grateful we are for the interest and support of the Japanese Society for Snow and Ice and its President, Dr Z. Yoshida, and of the Lanzhou Institute of Glaciology and Cryopedology in China, and its Director, Shih Yafeng, and Deputy Director, Wang Wenying.

We have had some changes at our Cambridge office. Beverley Baker has decided that keeping a home is to be a full time activity for the next few years and left at the end of March. Beverley very capably assisted our Secretary General for the past ten years. We wish her the very best. Her mother, Pat Lander, who assisted us part time for over two years and prior to that helped at several symposia held in Cambridge, is now with us full time. Because of the additional load imposed on the office by the production of the Annals and the organization of symposia, periodically we will have to take on extra help. It is now becoming obvious as well that more up-to-date means will have to be found for handling membership lists, publication distribution lists, symposia registration and other records to reduce the labour that is now involved with this activity.

I am very pleased to announce that the Council has accepted the recommendation of the Awards Committee to award the Seligman Crystal to Dr Marcel de Quervain. Dr de Quervain has devoted his professional life to glaciological research and to stimulating research in snow and ice, not only as Director of the Swiss Federal Institute for Snow and Avalanche Research but through our Society and other international and Swiss bodies as well. His contribution is unique in the broadest sense of the criterion for this award. The award is to be presented in Hanover, N.H. at the time of the conference on Applied Glaciology.

This is my last report as President of your Society. I wish to say how much I have

enjoyed working with the Council during the past three years, with the editors of the Journal and with all our members who so willingly contributed their time to the several tasks that were carried out. I am especially indebted to Hilda, our Secretary General, and to Beverley and Pat for their strong support, for looking after our affairs so ably and for keeping me out of trouble. It was a challenging and a stimulating period. Now that I am at the end of it, I find I am even more convinced that I was at the beginning of the great benefits we obtain from societies such as ours, that provide opportunities for communication and working together on subjects of common interest and concern. I also appreciate much more deeply how much we owe the Scott Polar Research Institute and its Director, Dr Gordon Robin, for the support we have received from them over the years and for providing us a home within a world renowned centre of glaciological research.

3. The Treasurer, Dr J.A. Heap, submitted a report, which was summarized by the President:

"The Society's affairs, overall, are in reasonably good shape. The move to publish conference and symposium proceedings in the separate Annals series looks as though it is going to be viable because of cost consciousness coupled with careful monitoring of cash flow in the light of budgetary constraints. Considered as a small publishing business the Society's fixed cost overheads, rents, salaries, etc., are apportioned between its three publishing ventures involving the Journal, the Annals and Ice. Of these the latter two are adequately covering their costs but the expected losses on the Journal must give cause for concern. The fact of the matter is that the overall viability of the Society depends to an extent that I find uncomfortable on the contribution to the overheads made by the Annals. The financial consequences of not publishing a volume of conference proceedings in the Annals series in any one year would be serious. This situation calls for a degree of hard-headed professionalism of the sort that has been brought to bear on production of the Annals. Our concerns, considered in business terms, must be to publish what our market wishes to buy, thus maximising our income, while keeping our costs as low as possible. It is with that in mind that I now turn to the losses on the Journal.

In my report to Council in August last year I pointed out that in 1982 the subscription would need to be raised again unless steps were taken to avoid it. The steps required involved a decision by Council that cheaper printing methods should be sought for the Journal. The ad hoc committee appointed by Council to study the matter proposed a two-step approach to savings costs on the Journal: firstly, to find a cheaper printer while leaving the appearance of the Journal substantially unchanged and, secondly, to investigate additional savings that could be made if it were to be accepted that the appearance of the Journal could be changed. The first step has been agreed by Council and a new printer has been appointed for the 1982 issues.

I have now to report to you that I believe it to be Hobson's choice that we should move quickly to investigate the second step of saving, involving changes in the appearance of the Journal. The alternative course, that of raising the subscriptions, a possibility foreseen in my report to you last year, is not, in my view, now open to us. The reason is simple: raising the subscription from £15 in 1980 to £20 in 1981 brought in very little additional income. The additional income hoped for was practically wiped out by members resigning or simply not renewing their subscriptions.

I conclude from this that we should
(a) not raise the subscription to members for 1982;
(b) continue to seek savings from the printing costs of the Journal;
(c) draw to the attention of all members the need to recruit more members (including a drive to find our "lost sheep")."

The Secretary General presented the accounts for 1980 on behalf of the Treasurer.

4. Election of Auditors for the 1981 accounts J.W. Glen proposed and C.W.M. Swithinbank seconded that Messrs. Peters, Elworthy and Moore of Cambridge be elected auditors for the 1981 accounts. This was carried unanimously.

5. Elections to the Council 1980-83: 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:

President	C.W.M. Swithinbank
Vice Presidents (2)	C.F. Raymond
	H. Röthlisberger
Elective Members (4)	W.F. Budd
	W. Harrison
	V.M. Kotlyakov
	C.J. Lorius

The President thanked the retiring Council members for their years of service:
M. de Quervain, O. Orheim, H. Björnsson, G. Golubev and P. Schwerdtfeger.

Dr Gold then invited the incoming President, Dr C.W.M. Swithinbank to address the meeting.

ANNALS OF GLACIOLOGY

The Council of the International Glaciological Society approved the following amended policy and appointments for the Annals of Glaciology on 6 September 1981. Further information on the editing responsibilities and procedures may be obtained from the Society's office.

IGS POLICY

1. The *Annals of Glaciology* are to be used for occasional publications such as proceedings of symposia.
2. Each volume of the Annals will have a chief editor, who for a symposium volume will be a Chief Scientific Editor, with associate editors if necessary. In the case of a symposium proceedings, the Chief Scientific Editor and Senior Editor will be drawn from the Papers Committee.
3. When a decision is made to produce a volume of the Annals, the Council will appoint the Chief (Scientific) Editor who will serve on the Annals Editorial Board. The Council will have power to co-opt other people to the Board, as necessary.
4. The Editorial Board will submit to the Council for each volume a budget stating the sources of financing for that volume, prior to the decision to produce it. In general, each volume of the Annals is to be "self-supporting".
5. Scientific papers must be refereed and be acceptable to the Chief Scientific Editor before being included in an Annals volume.
6. The scientific and copy editing for each volume is to be at a generally high standard in keeping with the traditions of the Society.
7. Editors of the Annals are to be responsible for the scientific editing; a House Editor for the copy editing and liaison with the printers; the Secretary General for all management matters and setting of the budget.
8. The Annals are to be produced by a photographic method from camera-ready copy, or method of similar quality of equivalent or less cost.
9. Annals volumes are to be sold on an individual basis at a reduced price to members of the Society and at a favourable price to libraries and non-members.

EDITORIAL BOARD

The Editorial Board of the *Annals of Glaciology* will be composed of:

Chairman
Vice-Chairman
Chief Editor of Annals volume in production
House Editor
Treasurer, IGS
Secretary General, IGS

The Chairman and Vice-Chairman will be appointed for three year terms renewable except that the term of the first Chairman will be for two years. The Chairman (or alternate if the Chairman is unable to attend) shall represent the Board on the Council of the Society. Chief Editors of Annals volumes will be members of the Editorial Board during the period their particular volume is in production.

The Editorial Board will ensure that the policies established by the Council concerning the type of material to be published in the Annals, editorial procedures and the quality of the publication, are followed and are understood by outside bodies when publication is to be undertaken on their behalf. For each proposed Annals volume, the Board will prepare for approval of the Council a budget clearly stating the source of financial support for that volume.

EDITORIAL BOARD 1981-82

Chairman — L.W. Gold

Vice Chairman — C.W.M. Swithinbank

Chief Editor
— C.W.M. Swithinbank (TISAG)
— S.C. Colbeck (Applied Glaciology II)

House Editor — A.D. Macqueen

Treasurer, IGS — J.A. Heap

Secretary General, IGS — H. Richardson

Roger Braithwaite writes that the name *Annals of Glaciology* has a long and honourable history. It was the official sub-title of the old *Zeitschrift für Gletscherkunde* founded by Ed. Brückner in 1906. From its inception, the Zeitschrift (Annals Mark I) was intended to be an international journal and it was noteworthy that it continued to carry the names of correspondents in enemy countries throughout the First World War.

The sub-title Annals was dropped from the first post-war volume of the Zeitschrift but reappeared on the cover for the 1921-22 volume and remained until the old Zeitschrift ceased publication after 28 volumes towards the end of the Second World War. The Zeitschrift was revived after the war in a new form by R. von Klebelsberg but no longer carries the English sub-title Annals.

THIRD INTERNATIONAL SYMPOSIUM ON ANTARCTIC GLACIOLOGY

The Third International Symposium on Antarctic Glaciology (TISAG), hosted by the Institute of Polar Studies of the Ohio State University, took place on the university campus in Columbus, Ohio from 7-12 September 1981, thirteen years after the previous symposium held in Hanover, New Hampshire. Thanks to the enthusiastic and efficient organization of Colin Bull and able support at the local level of David Elliot, Peter Anderson and Lynn Choate the Symposium went off without a hitch. A Survey of the participants carried out during the meeting showed how much everyone appreciated the work they and others on the Organizing Committee put into the technical and social programmes.

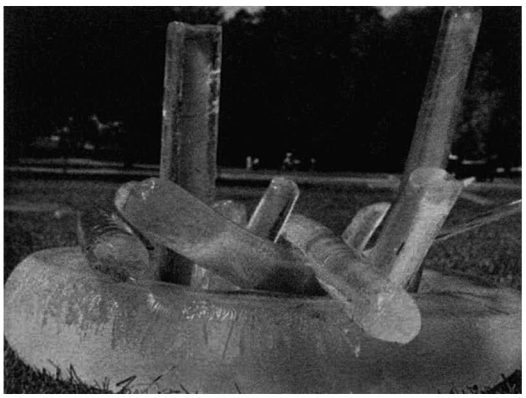
Colin Bull

The Symposium was attended by 163 registered participants from 12 countries. Although the organizers had anticipated that some 60 papers would be submitted, by the abstract deadline 126 summaries had been received of which 97 papers were accepted for presentation, 76 in regular sessions, and 21 in three 90-minute Poster Sessions. The latter were introduced this year to cope with the much greater number of papers than expected and to avoid holding parallel sessions. The general consensus was that they were a good idea. In addition, 7 informal presentations were made on recent results, 3 in lectures and 4 in poster sessions.

Poster Session

Papers were presented in 8 sessions: Ice Sheet Stability (C.W.M. Swithinbank and G. de Q. Robin, Chairmen); Model Studies (W.S.B. Paterson and J. Weertman, Chairmen); Sea Ice (G. Weller, Chairman); Ice Shelves (A.J. Gow and W.F. Budd, Chairmen); Glacial Geology and History (O. Orheim, Chairman); International Antarctic Glaciology Program (U. Radok, V.M. Kotlyakov, C. Lorius and C.R. Bentley, Chairmen); Stratigraphic Studies (A. Higashi and L.W. Gold, Chairmen) and Atmospheric and Surface Processes (J.W. Glen, Chairman).

Students in the Arts Faculty, alerted to the theme of the symposium being held on their campus, appropriately chose to use ice as a medium. Their colourful sculptures were laid out around the Ohio Union each morning and slowly melted away during the course of the day. Other sculptures using meltwater were set up on the terrace outside the conference area.



Ice Sculpture

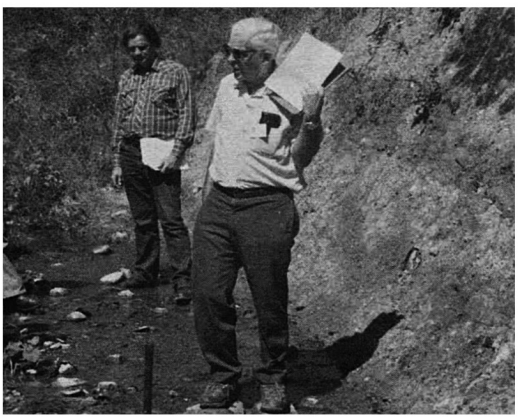
On Friday a 90-minute general discussion was held chaired by W.F. Budd. Discussants submitted their contributions in writing and these, combined with additional material from the taped session, will form the basis of a discussion article.

The proceedings, consisting of 65 edited papers, the abstracts of a further 40 or so papers and the discussion article, will be published in the *Annals of Glaciology*.

This occasion brought together three previous recipients of the Seligman Crystal – Barclay Kamb, Lyle Hansen and John Glen.

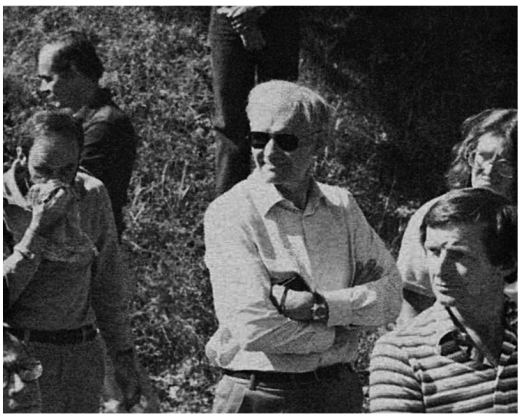
Seligman Crystal Recipients

About 105 participants also took part in an all-day field excursion on September 9. On this trip Emeritus Professor R.P. Goldthwait discussed the glacial forms and remnants of the Wisconsinan and Illinoian Ice Sheets around the Scioto River and in the foothills of the Appalachian lower plateau.



Dick Goldthwait at Biers Run cuts

He demonstrated the techniques that he and his co-workers have used during the last three decades to unravel the glacial history of central and southern Ohio and to learn much about the processes by which the ice sheets and their outflowing rivers have formed the geomorphic features observed.



Our new President at Hanna Lane cut

With the combination of exquisite weather, beautiful countryside, and an enthusiastic exposition by Dr Goldthwait, culminating in an excellent cook-out in the Hocking Hills, most participants greatly enjoyed themselves.

Past and present editors of *Ice*

Following the main symposium some 40 participants travelled to Kelleys Island in Lake Erie to examine the giant glacial grooves. This trip was organized by Ian Whillans and Gillian Bull and the scientific discussions were led by Drs Whillans and Goldthwait. As expected, there were approximately as many different hypotheses advanced for the origin of the glacial grooves as there were participants.

INTERNATIONAL GLACIOLOGICAL SOCIETY

SYMPOSIUM ON ICE AND CLIMATE MODELLING

FIRST CIRCULAR

Northwestern University, Evanston, Illinois, U.S.A.
27 June – 1 July 1983

The Society will hold a Symposium on Ice and Climate Modelling, at Northwestern University, Evanston, Illinois, U.S.A. in 1983.

Registration will take place on Sunday 26 June, and sessions will be from Monday 27 June to Friday 1 July.

TOPICS

The Symposium will be concerned with the following topics:

1. Ice data for the present climate: continental and marine ice sheets, sea ice and snow cover.
2. Modelling of the present climate:
   a. atmospheric climate models, e.g. global climate models, energy balance models
   b. oceanic climatic models
   c. ice models
   d. coupled atmospheric, oceanic and ice models.
3. Ice and climate data for the Pleistocene and the Holocene:
   a. reconstructions of the 18k bp climate and climate episodes in the Holocene
   b. ice volume, ocean temperature time series reconstructions.
4. Climate modelling of the Pleistocene and the Holocene:
   a. snapshot or episodic modelling, e.g. 18k bp or the Climate Optimum
   b. time series modelling of ice volume, temperature, etc.

PAPERS

The Papers Committee will be happy to consider any paper on the above topics. The number of papers accepted will be limited to allow ample time for interdisciplinary discussion of broad issues and future co-operative modelling. Details about the summaries and final papers will be given in the Second Circular, to be published in the summer of 1982. Dates for submission are firm ones and must be adhered to.

The Committee may decide to invite review papers on some of the topics if submitted contributions do not give sufficient coverage.

PUBLICATION

The Proceedings of the Symposium will be published by the Society in the Annals of Glaciology. Papers will be refereed according to the Society's usual standards before being accepted for publication.

ORGANIZATION

The main organization is undertaken at the Society's Headquarters office in Cambridge, U.K., while the local organization will be effected by our members at Northwestern University. The Society's Annual Dinner will be held during the week.

FURTHER INFORMATION

You are invited to attend the Symposium and to return the attached form as soon as possible. The Second Circular will give information about accommodation, general programme, preparation of summaries and final papers.

Requests for copies of the Second Circular should be addressed to the Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, U.K.

Note: Members of the International Glaciological Society will automatically receive a copy.

ORGANIZING COMMITTEE

G. E. Birchfield
H. Richardson
S. Schneider
J. Weertman

INTERNATIONAL GLACIOLOGICAL SOCIETY

SYMPOSIUM ON ICE AND CLIMATE MODELLING, 1983

Family Name .....

First Name ..... Title .....

Address .....

.....

* I hope to participate in the Symposium, 1983 ☐

* I expect to submit a summary of a proposed paper on topic no ..... ☐

* without obligation

TO BE SENT AS SOON AS POSSIBLE TO:

Secretary General, International Glaciological Society, Cambridge CB2 1ER, U.K.

The following papers and short notes have been accepted for publication in the first two 1982 issues of the Journal:

G.K.C. Clarke:
Glacier outburst floods from "Hazard Lake", Yukon Territory, Canada, and the problem of flood magnitude prediction.

Vincent de Montmollin:
Shear tests on snow explained by fast metamorphism.

P. Wellman:
Surging of Fisher Glacier, eastern Antarctica: evidence from geomorphology.

M.K. Kaul, A.R. Sharma and D.N. Bhattacharya:
Geomorphology of the Gor Gorang Glaciers, Himachal Pradesh, India.

Stephen J. Jones:
The confined compressive strength of polycrystalline ice.

C.J.L. Wilson and D.S. Russell-Head:
Steady-state preferred orientation of ice deformed in plane strain at -1°C.

S.R. Rotman, A.D. Fisher and D.H. Staelin:
Inversion for physical characteristics of snow using passive radiometric observations.

L.W. Morland and I.R. Johnson:
Effects of bed inclination and topography on steady isothermal ice sheets.

D.A. Pell and H.B. Clausen:
Oxygen isotope and total beta radioactivity measurements on 10 m ice cores from the Antarctic Peninsula.

H.Ito and F. Müller:
Ice movement through Smith Sound in northern Baffin Bay, observed in LANDSAT imagery.

V.J. Nijampurkar, N. Bhandari, C.P. Vohra and V. Krishnan:
Radiometric chronology of the Neh-nar Glacier, Kashmir.

L.G. Thompson, T.F. Bolzan, H.H. Brecher, P. D. Kruss, E. Mosley-Thompson and K.C. Jezek:
Geophysical investigations of the tropical Quelccaya ice cap, Peru.

M. Nakawo and G.J. Young:
Estimate of glacier ablation under a debris layer from surface temperature and meteorological variables.

Huang Maohuan, Wang Zhongxian and Ren Jiawen:
On the temperature regime of continental-type glaciers in China.

J. Jouzel and R.A. Souchez:
Melting-refreezing at the glacier sole and the isotopic composition of the ice.

V.R. Parameswaren:
Fracture criterion for ice using a dislocation model.

J. Dowdeswell:
Supraglacial resedimentation from meltwater streams on to snow overlying glacier ice, Sylgjujökull, West Vatnajökull, Iceland.

D.K. Perovich and T.C. Grenfell:
A theoretical model of radiative transfer in young sea ice.

Y.Y. Macheret and A.B. Zhuraulev:
Radio-echo-sounding of Svalbard glaciers.

R. Bindschadler:
A numerical model of temperate glacier flow applied to the quiescent phase of a surge-type glacier.

H. Gubler:
Strength of bonds between ice grains after short contact times.

J.S. Walder:
Stability of sheet flow of water beneath temperatue glaciers and implications for glacier surging.

D.D. Kvasov and M.Ya. Verbitsky:
Numerical simulation of the evolution of ice cores using the Scandinavian and Laurentide ice sheets as examples.

R.V. Birnie and G. Thom:
Preliminary observations in two rock glaciers in South Georgia, Falkland Islands Dependencies.

I.G.G. Hogg, J.G. Paren and R.J. Timmis:
Summer heat and ice balance on Hodges Glacier, South Georgia.

V.I. Morgan:
Antarctic ice sheet surface oxygen isotope values.

A. Denoth:
A pendular-funicular liquid transition and snow metamorphism.

R.W. Jacobel:
Short-term variations in velocity of South Cascade Glacier.

S. Hastenrath and P. Kruss:
On the secular variations of ice flow velocity at Lewis Glacier, Mount Kenya.

Instruments and methods:

R. Perla:
Preparation of snow specimens for photomicrography.

H. Shoji and C.C. Langway, Jr:
Hoar crystal method for ice fabrics.

Short notes:

S. Baranowski:
Naled ice in front of some Spitzbergen glaciers.

E.E. Adams and R.L. Brown:
Further results on studies of temperature-gradient metamorphism.

SEA LEVEL
ICE and CLIMATIC CHANGE

Edited by Ian Allison

Sea Level, Ice, and Climatic Change is the proceedings of a symposium organized by ICSI and sponsored by IAHS, IAMAP and IAPSO during the General Assembly of the International Union of Geodesy and Geophysics in Canberra, December 1979. Many of the papers, listed below, highlight the complexity and multidisciplinary nature of the relationships between three phenomena of such general scope.

1 ICE AND SNOW AS ELEMENTS IN THE WEATHER AND CLIMATE SYSTEM AND AS INDICATORS OF CHANGE

The record of climate change in glaciers

Climate and glaciers (invited review paper) *M. Kuhn*; Recent fluctuations of glaciers in the eastern part of Nepal Himalayas *Hiroji Fushimi et al.*; The derivation of past climate changes from observed changes of glaciers *I. N. Smith & W. F. Budd*; Effects of debris cover on the heat balance of Khumbu Glacier, Nepal Himalayas (abstract only) *O. Watanabe et al.*; Ice core studies from Mt Kenya, Africa, and their relationship to other tropical ice core studies *Lonnie G. Thompson*; The Lewis Glacier (Mt Kenya) and possible links with tropical climate *C. E. Vincent et al.*

The climatic role and environmental effects of snow

Climatic role of snow covers (invited review paper) *George Kukla*; Relationships between snow distribution and climate in mountain areas *Tomomi Yamada et al.*; Ecological roles of river icings in the Tsichu River Valley, Northwest Territories, Canada *Don Gill & G. P. Kershaw.*

Sea ice as a climatic element

A review of sea-ice weather relationships in the Southern Hemisphere (invited review paper) *S. F. Ackley*; Antarctic sea ice growth and oceanic heat flux *Ian Allison*; Variations of sea ice conditions in Lützow-Holm Bay area, in Antarctica, in the last 20 years *Lou Kusunoki*; Sea-ice atmosphere interactions in the Weddell Sea using drifting buoys *S. F. Ackley*; The effect of sea ice on a general circulation model of the Southern Hemisphere *Ian Simmonds.*

Evidence of past climatic change from large ice sheets

Climate into ice: the isotopic record in polar ice sheets *G. de Q. Robin*; Evidence of climatic change in Antarctica over the last 30 000 years from the Dome C ice core *C. Lorius et al.*; Glaciological interpretation of microparticle concentrations from the French 905-m Dome C, Antarctica core *L. G. Thompson et al.*; Total gas content of ice and past changes of the northwest Greenland ice sheet (extended abstract) *D. Raynaud & I. M. Whillans*; Measured and computed temperature profiles at Mizuho station, East Antarctica *Fumihiko Nishio et al.*; Variations in valley glacier activity in the Transantarctic Mountains as indicated by associated flow bands in the Ross Ice Shelf *C. R. Bentley*; Mass balance studies in East Antarctica *V. I. Morgan & T. H. Jacka.*

2 FEATURES AND INTERACTIONS OF SEA LEVEL, ICE AND CLIMATE IN THE QUATERNARY

The global record of late Quaternary changes of sea level, ice and climate

Palaeogeodesy: late Quaternary geoidal configurations as determined by ancient sea levels *Walter S. Newman et al.*; Eustasy, palaeogeodesy and glacial volume changes (extended abstract) *Nils-Axel Mörner*; The fluctuations of climate, glaciers and sea level since late Pleistocene in China *Shi Yafeng & Wang Jingtai*; African climatic changes in late Pleistocene and Holocene and the general atmospheric circulation *S. E. Nicholson & H. Flohn.*

Processes of interaction between sea level, ice sheet and climate

Isolation of the Arctic from the global ocean during glaciations *Michael E. Vigdorchik*; West Antarctic ice volume: the interplay of sea level and temperature, and a strandline test for absence of the ice sheet during the last interglacial *J. H. Mercer*; Responses of ice sheets to environmental changes *N. W. Young*; Climatically and non-climatically induced glacier changes: a review of Soviet studies *V. M. Kotlyakov & M. G. Grosswald*; The growth and retreat of ice sheets in response to orbital radiation changes *W. F. Budd & I. N. Smith.*

Sea level, ice, and climatic change: invited summary reviews

Relative and average sea level changes, and endo-, epi-, and exogenic processes on the Earth *John Chappell*; Climatic change, ice sheets and sea level *H. Flohn*; The importance of ice sheets in long term changes of climate and sea level *W. F. Budd.*

Published in 1981 by the International Association of Hydrological Sciences as IAHS Publication no. 131 the book has 471 + xv pages and is now available from either the Office of the Treasurer IAHS, Washington, DC, or the IUGG Publications Office, Paris (see order form below for full addresses).

Price $50 (US) or the current equivalent in internationally convertible monies.

ORDER FORM

To: *The Office of the Treasurer IAHS, 2000 Florida Avenue NW, Washington, DC 20009, USA*

or

IUGG Publications Office, 39 ter Rue Gay Lussac, 75005 Paris, France

I would like to order ..... copy/ies of IAHS Publication no. 131 (Proceedings of the Canberra Symposium, December 1979)

I enclose payment/please invoice .....

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Mailing address for publication(s) .....

.....

..... Signed ..... Date .....

(Please make remittances sent to *Washington* payable to *IAHS*, and remittances sent to *Paris* payable to *IUGG*)

FUTURE MEETINGS (of other organizations)

INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS GENERAL ASSEMBLY

15-26 August 1983, Hamburg, Germany

The Scientific Programme for the IAHS part of the General Assembly has been drawn up with the following proposals.

Symposia

1. Remote sensing and data transmission.
2. Relation of groundwater quantity & quality.
3. Hydrology of humid tropical regions with particular reference to the hydrological effects of agriculture and forestry practice.
4. Effects of man on long term design and control of water resources systems.
5. Energy questions at the sea ice margin (ICSI/IAPSO).
6. The dissolved loads of rivers and surface water quantity/quality relationships.

Workshops

1. World water balance assessments (ICSW)
2. Remote sensing (ICRS & DT)
3. Glacier runoff (ICSI/IAMAP)

Union lecture

M.F. Meier:
The balance of ice and water on earth.

For circulars and further information write:

J.C. Rodda,
Secretary General IAHS,
Water Data Unit,
Reading Bridge House,
Reading RG1 8PS, U.K.

25th INTERNATIONAL GEOGRAPHICAL CONGRESS

27-31 August 1984, Paris, France

The IGU Assembly, the working sessions of the Geographical Congress and most of the activities will take place in Paris, at the Palais des Congres (Porte Maillot, near l'Etoile), between 27 and 31 August 1984. Commission and working-group meetings will be held before the Congress, between 20 and 26 August 1984. Each National Committee involved (Austria, France, Italy, Federal Republic of Germany and Switzerland) is planning a number of post-Congress tours. One of the six sections will deal with the Natural Environment under the following three themes:

1. Processes and measurement of erosion.
2. Man as a geomorphological agent.
3. Recent climatic changes.

Of the two general symposia the one on the problems of mountains may be of interest to Society members. One of the five themes will treat "Mountains as leisure space" and another "Environmental changes in high mountains during postglacial times".

Provisional registration forms should be submitted before 1 October 1982, one abstract only by 1 October 1983 and full papers before the end of 1983. Circulars and further information may be obtained by writing to:

Comité International d'Organisation
du Congrès de Géographie,
19, rue Isidore-Pierre, 14000 Caen (France)

11th INTERNATIONAL CONGRESS ON SEDIMENTOLOGY

22-27 August 1982, Hamilton, Ontario, Canada

The program of the 11th IAS Congress at McMaster University, has been divided into themes and symposia of which the following may be of interest to Society members:

Themes

6. Low Temperature Geochemistry (J. Vezier, Department of Geology, University of Ottawa, Ottawa, Ontario, K1N 6N5, Canada)
8. Geomorphology of Depositional Landforms (B. McCann, Dept. of Geography, McMaster Univ., Hamilton, Ontario, L8S 4K1, Canada)

Symposia

18. Sedimentation in a Cold (non-glacial) Climate (H. French, Dept. of Geography, Univ. of Ottawa, Ottawa, Ontario, K1N 6N5)
19. Glacial Marine Sedimentation (G.H. Eisbacher, Geological Survey of Canada, 100 W. Pender Str., Vancouver, B.C., V6B 1R8)
20. Behaviour of Glaciers as Deduced from Till Facies (N. Rutter, Dept. of Geology, University of Alberta, Edmonton, Alberta, T6G 2E1, Canada)

GLACIOLOGICAL DIARY

1982

1-2 June
Workshop on Hydraulics of Ice Covered Rivers. University of Alberta, Edmonton, Alberta. (R. Gerard, Dept. of Civil Engineering, Univ. of Alberta, Edmonton, Alberta, T6G 2G7, Canada)

7-11 June
Second Canadian Conference on Marine Geotechnical Engineering. Bedford Inst. of Oceanography, Dartmouth, Nova Scotia, Canada. (C.F.M. Lewis, Bedford Inst. of Oceanography, Atlantic Geoscience Centre, P.O.Box 1006, Dartmouth, Nova Scotia, B2Y 4A2, Canada)

13-17 June
International Symposium on Hydrometeorology. Marriott City Center Hotel, Denver, Colorado. (A.I. Johnson, Woodward-Clyde Consultants, 2909 West 7th Avenue, Denver, Colorado 80204, U.S.A.)

14-15 June
Canadian Hydrology Symposium 82, Hydrological Processes of Forested Areas. Univ. of New Brunswick, Fredericton, New Brunswick, Canada. (R.B.B. Dickison, Dept. of Forest Resources, Univ. of New Brunswick, Bag Service No.44555, Fredericton, New Brunswick, E3B 6C2, Canada)

22-24 June
Third International Symposium on Ground Freezing. CRREL, Hanover, New Hampshire, U.S.A. (ISGF 82, USA CRREL, Box 282, Hanover, New Hampshire 03755, USA)

19-30 July
International Association of Hydrological Sciences, Exeter Assembly. Exeter, Devon, U.K. (The Organizing Committee, IAHS Scientific Assembly, Institute of Hydrology, Wallingford, Oxford, U.K.)

1-9 August
INQUA Conference. Moscow, U.S.S.R. (I.P. Kartashov, Secretary General of the XI INQUA Congress, Geological Institute, USSR Academy of Sciences, Pyzhevsky 7, Moscow 109017, U.S.S.R)

2-6 August
6th International Symposium on the Physics and Chemistry of Ice. Rolla, Missouri, U.S.A. (P.L.M. Plummer, Dept. of Physics and Cloud Physics, University of Missouri-Rolla, Rolla, Missouri 65401, U.S.A.)

16-20 August
4th International Symposium on Antarctic Earth Sciences. Adelaide, Australia. (J.B. Jago, School of Applied Geology, South Australian Inst. of Technology, P.O. Box 1, Ingle Farm, South Australia 5098, Australia)

22-27 August
11th International Congress on Sedimentology, Int. Ass. of Sedimentologists. McMaster University, Hamilton, Ontario, Canada. (IAS Congress, Dept. of Geology, McMaster University, Hamilton, Ontario, L8S 4M1, Canada)

23-25 August
5th International Symposium – 1982, Prospecting in Areas of Glaciated Terrain. Memorial Univ. of Newfoundland, St. John's, Nfld, Canada. (Prospecting in Glaciated Terrain 1982, c/o Falconbridge Nickel Mines Ltd., 77 Bond Str., Suite 201, St. John's, Newfoundland, A1C 1T2, Canada)

23-27 August
Second Symposium on Applied Glaciology. Hanover, New Hampshire, U.S.A. (Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, U.K.)

30-31 August
Ice Drilling Technology Workshop. Univ. of Calgary, Calgary, Alberta, Canada. (G. Holdsworth, National Hydrology Res. Inst., 4616 Valiant Drive N.W., Rm.101, Calgary, Alta, T3A 0X9, Canada)

16-18 September
Science in the North, 33rd Alaska Science Conference. Fairbanks, Alaska, U.S.A. (Vera Alexander, Inst. of Marine Science, University of Alaska, Fairbanks, Alaska 99701, U.S.A.)

21-23 September
International Symposium on Hydrological Research Basins and their Use in Water Resources Planning. Bern, Switzerland. (M. Spreafico, Landeshydrologie, Postfach 2742, CH-3001 Bern, Switzerland)

21-23 October
International Snow Science Workshop. Montana State University, Bozeman, Montana, U.S.A. (J. Montagne, Dept. of Earth Sciences, Montana State University, Bozeman, Montana 59717, USA)

4-6 November
International Symposium on Hydrological Aspects of Mountainous Watersheds. Roorkee, India. (Organising Secretary, Int. Symp. on Hydrological Aspects of Mountainous Watersheds, School of Hydrology, University of Roorkee, Roorkee 247672, India)

1983

5-9 April
7th International Conference on Port and Ocean Engineering under Arctic Conditions (POAC-83). Finlandia Hall, Helsinki, Finland. (Sirpa Suomela, Secretary General POAC 83, Technical Res. Centre of Finland, Lab. of Structural Engineering, Betonimiehenkuja 1, SF-02150 Espoo 15, Finland)

27 June – 1 July
Symposium on Ice and Climate Modelling. Northwestern University, Evanston, Illinois, U.S.A. (Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, U.K.)

18-22 July
Fourth International Conference on Permafrost. University of Alaska, Fairbanks, Alaska, U.S.A. (Louis de Goes, Executive Secretary, Polar Research Board, National Academy of Sciences, 2101 Constitution Avenue N.W., Washington D.C. 20418, U.S.A.)

15-26 August
18th General Assembly of the IUGG. Hamburg, Federal Republic of Germany. (J.C. Rodda, Secretary General IAHS, Water Data Unit, Reading Bridge House, Reading, RG1 8PS, U.K.)

1984

18-23 August
Snow and Ice Chemistry and the Atmosphere. Trent University, Peterborough, Ontario, Canada. (R.M. Koerner, Polar Continental Shelf Project, EMR, 880 Wellington Street, Ottawa, Ontario, K1A 0E4. Canada)

2-7 September
Symposium on Snow and Ice Processes at the Earth's surface. Tokyo and Sapporo, Japan. (Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, U.K.)

P. Tryde (Editor). Physics and Mechanics of Ice. Springer-Verlag, Berlin, 1980. (xiv), 378 p., illus. (International Union of Theoretical and Applied Mechanics. Symposium, Copenhagen, 6-10 August 1979. Technical University of Denmark, $43.70)

The IUTAM Symposium on the Physics and Mechanics of Ice was held during five days in August 1979. It took as its main subjects the physical and mechanical properties of ice, the development of mechanical models for the calculation of ice force on structures and the applied mathematics used in such modelling.

All the papers which were presented at the conference appear in the proceedings volume in the form of camera-ready copy supplied by the author. These authors and their papers are (in abbreviated form): Assur, Promising trends in ice mechanics; Bercha, Multimodal ice failure theory; Brepson, Ice failure theory; Dempster Iceberg mechanics; Duval and le Gac, Non-elastic deformation in polycrystalline ice; Edwards, Ice-ship interactions; Emery and Mirza, Simulation of ice flow; Frankenstein, CRREL ice laboratory facilities; Frederking, Forces on inclined structures; Gold and Sinha, Small-strain rheological behaviour; Goodman, Critical stress intensity factors in polycrystalline ice; Hutter and Williams, Floating ice sheets; Kerr, Buckling of ice plates; Kry, Structure width implications; Kure and Jacobsen, Danish icebreaker design; Masterson and Strandberg, Creep and relaxation in ice platforms; Mellor, Mechanical properties; Michel, Creep with cracking activity; Miller, Applications of fracture mechanics; Nevel, Wedge bending and buckling; Ralston, Plastic limit analysis of ice loads; Reeh, Temperate ice flow in vertical shafts; Reinicke, Plasticity theory for ice forces; Saeki and Ozaki, Ice forces on piles; Tabata and Nohuguchi, Failure of sea ice by repeated compression. In addition, there are some 16 pages devoted to discussion of papers (only written discussion, apparently) and a resume of the oral discussion. I did not find these sections useful.

Professor Tryde tells us in his preface that he corrected only the spelling and grammar of the papers, but he implies that there was no scientific refereeing or editing of the usual kind (I gather that the papers were sifted at the time of submission of abstracts). Presumably, such a decision was taken in order to speed up production of the volume. Even so, I am not sure that such a decision is correct as one merit of the conventional system is that it does protect authors from themselves and readers from ambiguities. The result of publishing the proceedings of a conference verbatim is often a volume containing papers of widely varying standard ranging, in the case here, from review papers of the very highest scientific and typographic quality to papers which have in substance appeared elsewhere (not too terrible a crime) or which are obscure in points of detail.

Fortunately, this IUTAM book does not contain papers with errors of major proportions, but there are annoying failures on the part of authors to attend to the fine detail; a formal editing procedure might have helped here. For example, some references are obscure (and indeed incorrect) in the extreme. Some of the citations to the obscure documents would be of no help at all in tracing information. Further, the standard of equation setting (usually type- or hand-written) verges on the atrocious. Please, authors, do try to find a typewriter which distinguishes between 1 (one) and l (alphabetic) — it is not always clear from the context! There are, in addition, some very remarkable mathematical statements which have arisen as a result of the failure of authors to check subscripts, superscripts, signs, and so on.

So, in conclusion, this volume represents a complete and useful record of what appears to have been a stimulating conference, but I do advise you to read the papers with an alert and critical eye.

D.R. Homer

Permafrost Engineering Design and Construction. G.H. Johnston (Editor). Associate Committee on Geotechnical Research, National Research Council of Canada, John Wiley & Sons, Toronto, 540 pp., 1981, $35 (Can)

At its inception the task of compiling and editing the vast amount of material contained in this volume must have been daunting but on examination of the product the result of the work is eminently worthwhile. Research into permafrost has rapidly advanced as a result of engineering activities in the north and the continuing pressures for development of resources and associated infrastructure. It was imperative for someone to undertake the compilation of a state of the art presentation drawing together the information which is stored in a very wide variety of sources.

The nature of the problem involved a multitude of cross disciplinary links.

Although by opting for a book-type presentation the material obviously is a few years out of date, now that it has become available, the collection of material and information is a most valuable, concise compendium plus a staring point for anyone coming into the field and for those already established in the field when considering any aspect of this most diverse subject.

The design of the book encompasses geomorphology, geophysics, engineering, planning and development areas all with a fundamental interest in permafrost but also is presented in a format which should be of considerable practical use to scientists in the biological, zoological and botanical areas. The absence of political overtures, which seems to creep into most northern oriented books, means that the volume will rapidly become a basic reference for northern field scientists.

The contents of the book deal with permafrost and its manifestations in the landscape, the geotechnical properties of the materials in both frozen and thawed condition, the thermal properties of materials, siting and routing concerns and specific conditions associated with foundation design, transportation and utility engineering.

Despite the multiplicity of contributions both in the volume as a whole and within individual sections the editor has maintained a consistency which ties the book together and makes it as readable as any book of the compendium format (essential when the reviewer is trying to read systematically through the book while in field camp where by 2100 hours technical material can be rather soporific). The presentation is also such that it will be comprehensible to the senior undergraduate without losing any of its utility to the professional and the academic in specialized fields. The use of photographs, diagrams and maps amply demonstrate the material presented and will, in themselves, stimulate interest of the undergraduate population in many of the areas discussed.

As a final comment this volume will be extensively used as a starting point for any permafrost enquiry but I think it is necessary here to return to the fact that the material is already dated in a field which is rapidly advancing and that this may reduce the eventual value of the book.

Peter G. Johnson

NEWS

AWARDS

Dr Peter V. Hobbs, Professor of Atmospheric Sciences, University of Washington, has been elected a Fellow of the American Association for the Advancement of Science. The citation reads.

> "For pioneering research in many areas of atmospheric science, including cloud and precipitation physics, mesoscale meteorology, atmospheric chemistry, air pollution and ice physics."

Dr Hobbs serves as an Editorial Advisor to the *Journal of Glaciology* and is the author of the books Ice Physics (Oxford University Press), Atmospheric Sciences: an Introductory Survey (Academic Press), and Clouds: their Formation, Optical Properties and Effects (Academic Press).

RECENT DEATHS

It is with great regret that we note the death of Professor Dr Aleksander Kosiba, retired Senior Professor of the Meteorological and Climatological Observatory at Wroclaw University, Poland, on September 18, 1981. At the time of his death he was the Polish Correspondent for the International Glaciological Society.

SNOW AND ICE COVER OF THE NORTHERN HEMISPHERE

The NOAA/NESS Northern Hemisphere Weekly Snow and Ice Cover charts for 1966-1980 have been digitized and put on computer compatible magnetic tape. Amongst other things the data can be used to create maps of weekly or monthly snow and ice cover, and to determine area, frequency and anomalies. Copies of the tape and documentation at a cost of $72 can be ordered from Bruce Needham, MOAA/EDIS, Room 100, World Weather Building, Washington D.C. 20233, U.S.A.

SUMMER SCHOOL OF SPACE PHYSICS

The Summer School of Space Physics dealing with space oceanology, space techniques and general ocean circulation and organized by the Centre National d'Etudes Spatiales (CNES) will be held at Grasse, Alpes-Maritimes, France, from 1-28 July 1982. Lectures of particular interest to Society members will be those by L. Lliboutry on Ice Sheet Dynamics and by W. Campbell on Sea Ice Dynamics. A conference on Ocean and Ice Dynamics and Climatology will be presented by P. Morel.

Further information may be obtained from:
Centre National d'Etudes Spatiales,
Département des Affaires Universitaires,
18, avenue Edouard-Belin,
31055 Toulouse Cedex (France)
Tel:(61)53.11.12/Ext.50.12 Telex: 531 081 F

STUDIES IN POLAR RESEARCH

A new book series entitled *"Studies in Polar Research"* has been announced by the Cambridge University Press. It reflects the growth in polar research activity and was formalised after discussions between the Scott Polar Research Institute and the British Antarctic Survey. The objective is to publish fairly short (about 200 pages in 228 x 152 mm format), illustrated books covering in the main the biological, physical and social sciences and directed to research students and professional scientists. Further information can be obtained from the Chairman of the editorial board T.E. Armstrong, Scott Polar Research Institute, Cambridge.

MÜLLER ICE SHELF AND MÜLLER ICE CAP

On 9 December 1981, the Antarctic Place-names Committee chose to recognize the contribution of the Swiss and Canadian glaciologist Fritz Müller by their approval of the name Müller Ice Shelf on Arrowsmith Peninsula, Loubet Coast, Graham Land (67°15'S, 66°52'W), in an area where the names of glaciologists are grouped. This ice shelf is the furthest north such feature on the west side of the Antarctic Peninsula.

Earlier, in August 1980, the Government of the Northwest Territories in Canada had approved the name Müller Ice Cap for the main central ice cap on Axel Heiberg Island in recognition of Fritz Müller's contribution to knowledge of that area, through his 20 years of research on the Island, and to the field of glaciology. The ice cap had previously been referred to as the McGill or the Akaioa Ice Cap.

NEW MEMBERS

Allen III, Boyd, Department of Earth Sciences University of New Hampshire, Durham, NH 03824, U.S.A.

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Squire, Vernon A., Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER, U.K.

INTERNATIONAL GLACIOLOGICAL SOCIETY

Lensfield Road, 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 General. No proposer or seconder is required.

ANNUAL PAYMENTS 1982

Private members	Sterling: £20.00
Junior members	Sterling: £10.00
Institutions, Libraries	Sterling: £45.00 for Volume 27 (Nos. 98, 99, 100)

Annals of Glaciology—see inside front cover of this issue of Ice.

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. Thank you.

ICE

Editor: Simon Ommanney

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Annual cost for libraries, etc. and for individuals who are not members of the Society: Sterling £6.00.

All enquiries about the International Glaciological Society should be addressed to Mrs H. Richardson, Secretary General of the International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, England.

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