NUMBER 28

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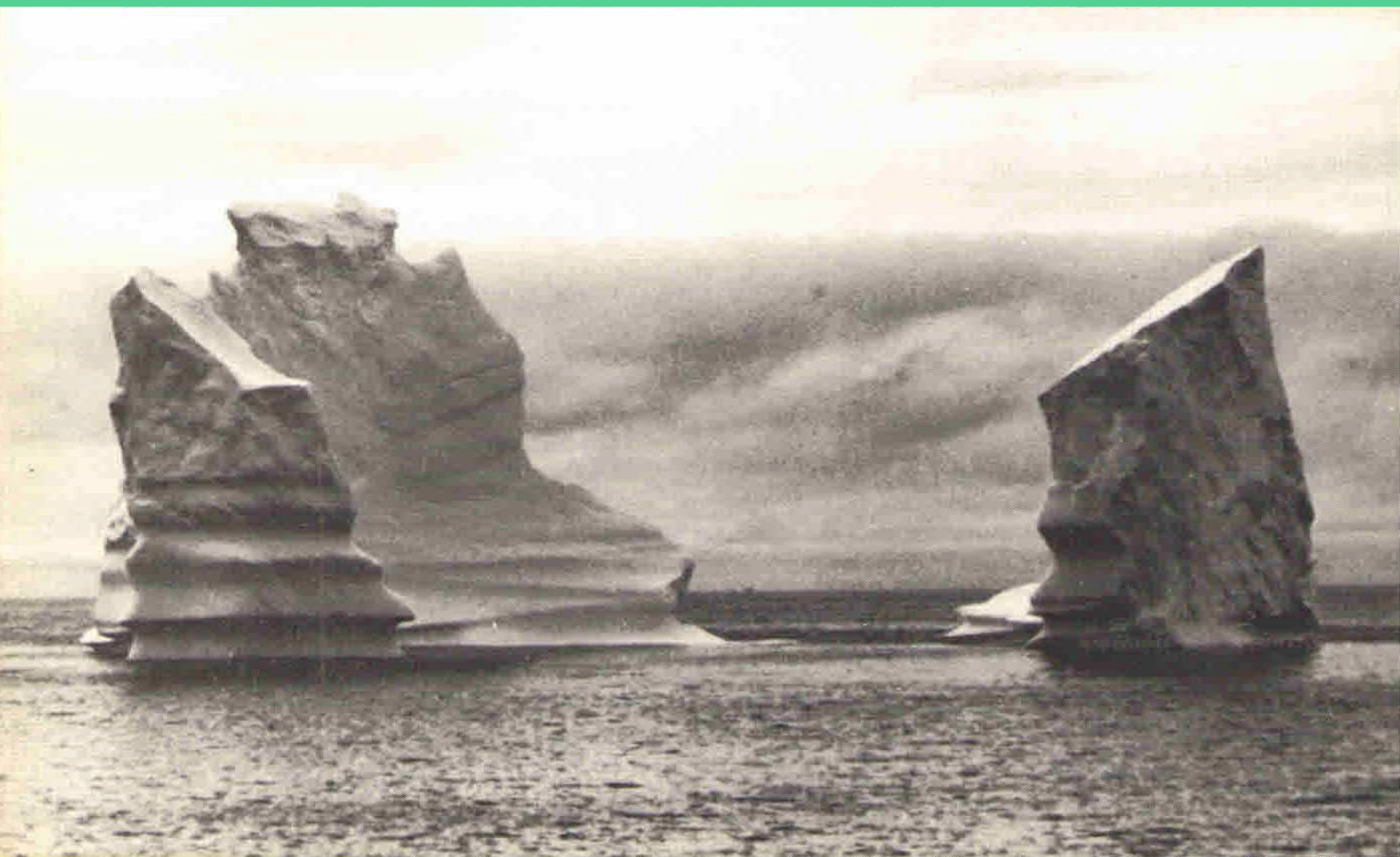
ICE



SYMPOSIUM ON THE HYDROLOGY OF GLACIERS

Cambridge, 7 - 13 September 1969

REMINDER!

Booking forms for registration, social events and tours during and after the Symposium were issued in November 1968, in the Second Circular. If you have not yet returned your forms to the Secretary of the Glaciological Society, please do so without delay—and in any case, not later than 1 April 1969. Early September is still tourist time in Britain, with many music festivals and exhibitions, and hotel rooms become difficult to find.

BOOK EARLY — MAKE SURE OF YOUR PLACE

Extracts from the Second Circular appear on pages 13-17 of this issue of ICE.

All correspondence and requests for information about the Symposium should be addressed to:

The Secretary, Glaciological Society,
c/o Scott Polar Research Institute,
Cambridge, England.

ICE
NEWS BULLETIN OF THE GLACIOLOGICAL SOCIETY

DECEMBER 1968 NUMBER 28

CONTENTS

AIRMAILING THE JOURNAL TO NORTH AMERICAN MEMBERS. Only 31 answers were received in response to this suggestion (see ICE 27, p 19), so we cannot at the moment proceed with plans to help you get your copies quickly. Of those 31 replies, 25 were in favour, 2 were willing to agree if a large majority favoured the idea, and 4 were against it. It is difficult to believe that only 31 members have an opinion; so on page 20 you will find another form, for the remaining 369 members in Canada and USA to complete. If 150 or more of the 400 members in those countries agree, then the airmailing scheme can be used, and those 150 or more members will get their journals 7-14 days after publication date.

1969 DUES. Subscription forms have been sent to members (except those who pay by Banker's Order). Please be prompt in paying your dues—sending further reminders to those of you who are slow to pay costs the Society money it can ill afford.

ANNUAL GENERAL MEETING 1969. This will be held on Thursday, 11 September in Cambridge, England. Notices will be circulated later to all members of the Society. The annual banquet will also be held that evening. The meeting is scheduled for a later date than normal in order to take advantage of the presence of so many members at the Symposium on the Hydrology of Glaciers, which will be held in Cambridge 7-13 September. Members will be very welcome at the meeting and at the banquet, whether or not they are participants in the Symposium. For those who will **not** be attending the Symposium, a booking form for the banquet appears on page 20 of this issue of ICE. Members who will be attending the Symposium may book their tickets for the banquet on the appropriate form in the Second Circular.

We are sorry to report the death in November, 1968 of Paul Siple, the well known Antarctic explorer and geographer, who was the first scientific leader at the South Pole Station during the I.G.Y.

COVER PICTURE. Split iceberg resting on a bank at the mouth of Jakobshavn Fiord in Disko Bay, W. Greenland. Taken by A. Kosiba during the Polish Greenland Expedition, 1937.

FIELD WORK

DENMARK

ICE THICKNESS MEASUREMENTS (Technical University of Denmark)

Airborne radio echo sounding of the ice cap and glaciers in mid-west Greenland was carried out in May 1968 by members of the Laboratory of Electromagnetic Theory, the Technical University of Denmark, Lyngby. The soundings, carried out as part of the programme for the EGIG 1968 campaign, provided valuable experience in the technique of making soundings from an aeroplane in order to evaluate the ice thicknesses. The measurements were carried out at 35 MHz with folded dipole aerials mounted on a DC 4 aeroplane. The measurements were seriously affected by radio interference from short-wave broadcast stations in Europe and North America.

Recordings of bedrock echoes were obtained over several hundred kilometres with thicknesses between 450 and 2200 metres. Bedrock echoes could only be obtained when flying low, i.e. below about 300 metres above the ice surface. The minimum thickness was determined by the duration of the surface reflected pulse while the maximum thickness was determined by the system's ability to overcome the dielectric absorption of the ice. Along the western part of the EGIG track, echoes were obtained from layering. Up to six layers have been observed in the depth interval 400 to 800 metres. With the technique employed it was found difficult to detect bedrock echoes in glacier valleys, owing to severe scattering from the crevassed surface and to strong echoes from the surrounding mountains. Bedrock echoes were obtained at Eqip Sermia when the aeroplane flew at a height of about 20 metres.

P. Gudmandson

ISCENTRALEN NARSSARSSUAQ (Danish Meteorological Institute)

Routine sea ice reconnaissance over Greenland waters by air was performed by Iscentral Narssarssuaq. In addition, in the period 3-24 May the icerecco aircraft was on a mission to the glaciers between Upernavik and Jakobshavn for the purpose of measuring the thickness of the outlet glaciers by radio echo sounding. This programme was organized by the Technical University of Denmark.

EAST GREENLAND (Greenland Geological Survey)

In connection with the Geological Survey of Greenland Expedition to Scoresby Sound in July-August 1968, a glaciological programme was carried out by N. Reeh and O. B. Olesen.

The main objects of the study were frontal movement and calving processes in the three outlet glaciers in the innermost part of Nordvestfjord, Daugaard-Jensen, Charcot and Graah Glaciers. At Daugaard-Jensen Glacier, by far the greatest and most productive of the three, frontal movement was observed both by theodolite and by time lapse photography. At Charcot and Graah Glaciers only theodolite measurements were carried out. Calvings were observed and photographed and the volume of ice given off by each calving estimated. A special automatic camera for registration of the amplitude and wavelength was set up approximately 6 km from the front of Daugaard-Jensen Glacier.

A small surging glacier in Stauning Alper was visited and a short study of ice movement and surface collapse was undertaken. Moraine successions indicate that the glacier has advanced at least once and probably twice during historical time, apart from this recent advance which started between 1950 and 1961 as indicated by aerial photographs.

O. B. Olesen

ICELAND

(1) VATNAJÖKULL EXPEDITION (Iceland Glaciological Society & Dept. of Physics, University of Iceland)

The expedition took place 1-14 June 1968 and was led by Sigurdur Thorarinsson. There were 13 other members, including two physicists (Bragi Árnason and Páll Theódórsson), two engineers (Carl J. Eiríksson and K. Benediktsson), and a hydrologist from Leningrad (Dmitri Sokoloff).

The main aim of the expedition was to collect samples of firn and ice at various depths (up to 39 m) and in many places, in order to determine their content of deuterium and tritium. Similar sampling was carried out on Langjökull in 1967 and in April 1968, and is a part of a systematic study of the groundwater circulation in Iceland, which began in 1962. The measuring of the tritium and deuterium content of firn and ice down through many annual layers also serves various glaciological purposes. Because of bad weather the expedition could only cover the northern half of Vatnajökull and the sampling from its southern part had to be postponed to spring 1969.

The second purpose of the expedition was to continue the annual studies of changes in the Grímsvötn area, and also the Kverkfjöll where a new powerful solfatara came into existence May 24 1968.

(2) BÆGISARJÖKULL (H. Björnsson and J. Sigurjónsson)

The detailed study (begun in 1967) of this glacier in Northern Iceland was continued in 1968.

(3) POLISH EXPEDITION (Polish Geographical Society)

The expedition, led by Professor R. Galon, spent most of the summer of 1968 on Skeidarársandur and at the margin of Sídujökull, carrying out various studies of glacial and periglacial phenomena.

Sigurdur Thorarinsson

(4) FIELD COURSE AT BREIDAMERKURJÖKULL (University of Glasgow)

During the period 1964-68 members of the staff and research students of the Department of Geography, University of Glasgow, have been involved in a research project studying glaciological and glacial geomorphological problems at Breidamerkurjökull, Iceland. Photogrammetric techniques have been used to produce 1:15,000 maps of the snout of the glacier and its glacial area. Ice wastage, ice movement and the evolution of the proglacial landforms and drainage have been studied.

In order to demonstrate the work which has been done at Breidamerkurjökull, a field course was organized by R. J. Price, assisted by P. J. Howarth, and took place between 7 and 20 July 1968. The purpose of the excursion was to demonstrate landforms, deposits and drainage systems in an area of very rapid deglacierization.

Sixteen members of the Quaternary Field Study Group representing a wide range of interests (university lecturers in geology and geography, members of the Institute of Geological Science, and of the Soil Survey) took part in six field excursions in the Breidamerkurjökull area. One day was also spent visiting the outlet glaciers of Vatnajökull between Breidamerkurjökull and Skaftafellsjökull. Small groups then spent two days re-visiting areas, for further investigation and discussion. The last day of the field course was spent in the Reykjavík area on an excursion led by Thorliefur Einarsson.

R. J. Price

JAPAN

VISIT TO ALASKA

With financial aid from the Education Ministry, four men (K. Higuchi, T. Takahashi, O. Watanabe, H. Ushiki) from Nagoya University and one (G. Wakahama) from Hokkaido University stayed in Alaska from 12 February to 15 March 1968 and studied the mechanism of water circulation in the Arctic hydrosphere. They divided into two groups. One group made observations on ice nuclei, snowfall and permafrost near Barrow, Alaska. The other group, after a stay of several days in Barrow, visited Fairbanks, Anchorage and Juneau to study differences due to locality of deposited snow and glacier ice.

(1) Ice nuclei. Ice nuclei in the atmosphere were observed with a millipore filter at an observation hut belonging to the Arctic Research Laboratory, operated by the University of Alaska. The results of the observations showed that solid particles floating in the air became activated into ice nuclei by the severe cold of the Arctic. Such an activation of solid particles by cold temperatures had been observed experimentally in a cold room by Higuchi and and Fukuta in 1966.

(2) Snow crystals and ice crystals in the air. A number of snow crystals and ice crystals floating in the air were caught, and were photographed through a microscope or copied by plastic replicas. The crystallographic axes of the crystals were determined by a polarising microscope and by the etch pits formed upon their surface.

(3) Deposited snow. Deposited snow was examined on Ice Island T3 (81°40.4′N, 157°38.8′E), at Point Barrow, at Fairbanks, at Anchorage and at Juneau (places located respectively in the Arctic Ocean, on the Arctic coast, in the centre of Alaska and on the Pacific coast). The structure and texture of deposited snow showed different features, characteristic of the respective places.

(4) Glacier ice. In 1964, the Alaskan Glacier Expedition of Hokkaido University had put marks on the medial moraines of the Mendenhall Glacier, Juneau. The distance which these marks had moved during the past four years was determined in 1968 by land survey. Core samples were taken out of the glacier by drilling and the dielectric constant was measured on these samples.

(5) Permafrost ice. Samples of mass ice, wedge ice and lens ice were taken from the walls of a tunnel dug by CRREL in the permafrost near Fairbanks, and their ice fabric was examined in a cold room of the Arctic Research Laboratory. A relationship was found to exist between the orientation of mud layers and that of the crystallographic axis of wedge ice.

Z. Yosida

USA

ALASKA

Glaciological research at the University of Alaska continues to concentrate on problems unique to the arctic and subarctic winter environment. The studies include research on: (1) the freezing process in turbulent streams, (2) the properties of, and diagenetic processes within, the seasonal snow cover, (3) atmospheric ice formation with special emphasis on ice fog problems, (4) the seasonal temperature distribution in aufeis deposits, and (5) the petrofabric structure of stream overflow ice.

The main area of year round glacier study has been in the Wrangell Mountains where measurements have been continued of the interaction between volcanic heat and the snow and ice cover. A study of summer heat balance has been completed on a glacier in the Chugach Range and plans are under way to begin year round work on the McCall Glacier in the Brooks Range.

(1) Ice formation in turbulent streams (J. Kreitner, J. C. Mungall and C. S. Benson)

Freezing in a small turbulent stream is being studied for the sixth consecutive year at the Goldstream research site 5.5 km from the campus. Each fall a horizontal datum plane has been established on marked pipes driven into the banks of the stream, and the topography of the ice has been measured every week from

just before freeze-up in October until after break-up in May. The behavior of the stream during the onset of freezing has been observed. The water temperature and its specific electrical conductance were measured during the two weeks preceding freeze-up in October 1967. Motion pictures were made of the underwater ice formations which frequently contain suspended bits of rock. In October 1968, for the third consecutive year, a string of thermocouples has been installed across the stream bottom prior to freeze-up in the middle of the test area. After freeze-up, during the past two years, a second string of thermocouples was frozen on to the ice surface directly over the bottom string. When the original ice surface was covered by an overflow, a third string of thermocouples was frozen on to the new surface. Five strings of thermocouples were emplaced in this manner during each of the past two years. Temperatures were read each week with a well insulated portable potentiometer. From these readings, on nearly 50 thermocouples, vertical isothermal cross-sections of the stream ice were constructed. Places where water channels, or sheets of water, exist along the stream bottom can be identified on the thermal cross-sections. Cores and oriented samples of ice have been removed each year and a cross-sectional trench was excavated across the stream for detailed study prior to break-up. The petrofabric structure of this ice is being studied.

(2) Seasonal snow cover of interior and arctic Alaska (D. Trabant, C. S. Benson)

The seasonal snow cover of interior Alaska, between the Alaska and Brooks Ranges, and of arctic Alaska, primarily north of the Brooks Range, has been studied since 1961. Reports on both of these areas have been completed, but there is obviously need for more research. Studies at a research site on the University of Alaska campus are continuing on a permanent basis.

The salient feature of the snow cover of interior Alaska is its extreme development of low density (0.20 g cm^{-3}) depth hoar. The experimental set-up described in Ice No 22, p 5-6, has been used each year. The rate of upward migration of water vapour in the snow is computed by directly comparing the rates of densification in adjacent snow packs, one with and one without a temperature gradient. Therefore, the existence of significant convection is clearly established.

(3) Ice fog (T. Ohtake, P. Huffman, T. Henmi, S. Bowling, W. Murcray, J. Murray, T. Roberts and C. S. Benson)

Research is continuing on the size, distribution and nuclei of crystals in ice fog. The synoptic conditions leading to ice fog events and the radiative exchange between crystals suspended in a dense ice fog are also being studied. The air pollution aspects of the ice fog problem are receiving an ever increasing amount of attention not only from the University but from the US Public Health Service, and the Alaska Department of Health and Welfare is now actively involved.

Visits in February from five Japanese glaciologists brought much interest to the 1967-68 academic year. For the entire year, Yosio Suzuki undertook research as a visiting NSF Fellow; he studied residual entropy and the surface structure of ice, and took part in several glaciological discussion groups. Gunter Weller, from the University of Melbourne, Australia, has recently joined the staff and is contributing especially to work on the physical processes in the snow and in the air layer above it. Neil Streten has recently left for Australia after a visit of two years; he had carried out analyses of Antarctic meteorological satellite data, and worked with Gerd Wendler on a heat balance study of the Worthington Glacier in the Chugach Range.

Carl S. Benson

JOHN GLEN

Some 16 or 17 years ago, when glaciology began its trend towards a rigorous mathematical aspect and papers from all quarters of the world began to flood into the **Journal of Glaciology,** Gerald Seligman (then the sole editor of the **Journal**) judiciously selected John Glen as his assistant in the arduous task of editing the more mathematical and physical papers. As time has proved, this choice was indeed a wise and most successful one, since John had already had much experience both in the laboratory and in the field, and his real interest lay in attempting to understand the physics of snow and ice.

Born in London on 6 November 1927, he was educated at Epsom College and at Clare College, Cambridge, where he became an undergraduate in 1946. His first degree was a blend of mechanical sciences and physics, with the emphasis on solid state physics. He became a research student in the Cavendish Laboratory in 1949, under E. Orowan and M. F. Perutz, and stayed there until 1952.

The Glacier Physics Sub-Committee of the British Glaciological Society, set up in 1947, decided to promote research into the physics of glacier ice by field work (Perutz's pipe experiment on the Jungfraufirn) and by laboratory measurements on the flow of ice. In the Cavendish, Perutz was studying the plastic properties of ice and wanted a research student to make such laboratory studies and correlate them with his Jungfrau work on the flow of glaciers. Orowan, who was also on the Glacier Physics Sub-Committee and was one of the pioneers of the theory of creep of metals, had at that time a large group of research students working with him in the Cavendish. At the instigation of Perutz and Orowan, Glen changed from working on metals to working on the mechanical properties of ice. John Nye, already one of Orowan's research students, also took a close interest in his work.

Glen did his experiments in a cold chamber in the basement of the Cavendish, taking the measurements through a window in the door of the chamber. He also set out to survey the relevant glaciological literature and thus laid the foundations of what has now become an encyclopaedic knowledge of ice physics. His experiments resulted in what has become known as Glen's flow law, which forms the starting point for modern interpretations of glacier flow. Previous work on the creep of ice had been done in rather uncontrolled conditions; his contribution was to study the creep of ice for the first time under a well-defined stress and temperature.

Glen's laboratory work was closely related to field work on glacier flow. His first-hand

knowledge of glaciers began in 1950 when Perutz took him and John Nye to the Mer de Glace. They also visited the Arolla and other glaciers, and looked in at the Jungfraujoch where Perutz was remeasuring his pipe. In 1951, with enthusiastic encouragement from Vaughan Lewis, Glen and Nye visited John McCall's tunnel excavated in Veslskautbreen, Norway. Glen was thus able to see, at first-hand, techniques of tunnel deformation measurement which he was later able to exploit to great advantage in the tunnel at the foot of Odinsbreen ice-fall (Austerdalsbreen, Norway). He measured the deformation of the latter tunnel with the meticulous precision that is typical of all his work. He visited Austerdalsbreen each year from 1955 to 1959 as a member of the Cambridge Austerdalsbre Expedition, and after his work on the tunnel and on the stake system covering the wave ogives he went on to a detailed study of the motion of the extreme snout.

In 1952 he left the Cavendish, and moved briefly to the Atomic Energy Research Establishment at Harwell, as a Scientific Officer. He was awarded his Ph.D. in 1953, when, upon election as a Fellow of Clare College, he returned to Cambridge and continued his research on creep, but this time at really low temperatures, that of liquid helium, and under irradiation. Here, working with cadmium in the Mond Laboratory, he discovered that the quantum-mechanical tunnelling effect had a hitherto unsuspected part to play in creep at these very low temperatures. In 1956 he moved to the Physics Department of Birmingham University where he has remained as Lecturer and, from October 1968, Senior Lecturer. His special responsibility at Birmingham has been to set up and run a post-graduate course on the Physics of Solids. His early engineering training is shown in his specific interest in the application of glaciological principles to engineering. Recently he has made the exciting discovery that the plastic and the electrical properties of ice are intimately related. He realised that plastic deformation of the ice structure could not take place without disturbing the electrical defects which are inherent in the structure—and that this fact has important implications for the plastic properties. He predicted that minute amounts of the right sort of impurity should have a dramatic effect on the strength of ice, and he and his research student, Stephen Jones, were able to confirm experimentally that this is indeed what happens.

From an initial approach via solid state physics, as a ground bass, his knowledge of glaciology has expanded to all its themes. A fluent knowledge of French and German, as the decoration on a harmonic framework, makes John a particularly welcome participant at international gatherings of glaciologists. His knowledge of the historical background to glaciology and of the literature is detailed and comprehensive. This rare attribute, combined with his meticulous care for accuracy of observation and fact, and his ability to argue with clear logic, admirably qualify him for the important role he now plays in The Glaciological Society—the successor to Gerald Seligman as Senior Editor of the **Journal of Glaciology.** He had been appointed to the Editorial Advisory Committee in 1953, and became Assistant Editor in 1955. It is perhaps not only those closely associated with him in this additional work who appreciate and value his freely given advice; he is encouraging and constructively critical to the young glaciologist attempting to publish his first paper, but at the same time he is doubly critical of the established glaciologist who submits for publication a paper which is imprecise and in which he does not argue his case rigorously.

As a university teacher, John Glen leads an overfull existence, devoting considerable time and energy not only to the well-being of his students but also to departmental affairs. Apart from his work for the **Journal of Glaciology,** he is a Vice-President of the Glaciological Society, and at various times has served on advisory committees set up by the Royal Society for snow and ice research and for metric units, and has helped with local physics societies. He is a church warden of his parish church and is active in the many aspects of its work. His wife, Margaret, is equally busy with church and welfare activities, and, even with the demands made on her time by two small and lively children, is always ready to give a warm and generous welcome to their many friends. Several glaciologists have happy memories of time spent in the company of the Glen family—enhanced by Margaret's good cooking and young Marion's bright eyes and eager curiosity about the world. This must be a reflection of her father's admission that he is "a geographer at heart"—a trait which makes him a stimulating companion on travels abroad, an observant and reasoning student of people and place. From Sapporo to Rome, and from Helsinki to Fairbanks, his hilarious sense of humour, his kindness, and his willingness to talk with loud emphasis and unstoppable fluency on any subject are well known. (Though only those few people who were present in a Swiss mountain hut will also know of his virtuoso abilities in song and dance.)

Fortunate in these days is the scientific journal which can count on the personal loyalty as well as the professional expertise of its editorial board. The **Journal of Glaciology** has always been so blessed, and members of the Glaciological Society are well aware of the debt they owe to all those who have helped with the editing of the Journal—especially to Gerald Seligman, who retired in 1968, Ray Adie, Doris Johnson, and John Glen, in whose good hands the affairs of the **Journal** now flourish.

MEETINGS

THE GLACIOLOGICAL SOCIETY

BRITAIN

1 November 1968, Bristol University; (Joint meeting with the University Geographical Society)

Carl S. Benson—Glaciological and vulcanological research on Mount Wrangell, Alaska.

5 December 1968, Leicester University: (Joint meeting with the University Geographical and Geological Societies)

C. W. M. Swithinbank—In search of an ice age.

SEMINAR ON THE CAUSES AND MECHANICS OF GLACIER SURGES

The Seminar was held at the Gault Estate of McGill University, Quebec, Canada, on September 10 and 11 1968, as announced in ICE No 27, and was organized by Fritz Müller. A varied programme of papers was presented, covering observational data, theory, and speculation on the large-scale effects of surges. A summary of the papers and the discussion was made by Mark F. Meier, and John Hollin reported on recommendations for further research, drawn up by a working group. We hope to publish these recommendations later. Dr Meier's summary included the following list of questions:

Questions Answered and Unanswered

(a) As a result of this symposium certain points appear now to be well established:

1. Many surging glaciers exist and many types of glaciers surge. However, no surging glaciers which are below freezing at their beds have yet been identified.
2. Surging glaciers occur only in certain limited areas, and these areas apparently are not related to climate, so that some property at the glacier bed must be a necessary condition for a glacier surge.
3. Most, if not all, surging glaciers surge repeatedly and with a period which is reasonably constant.
4. The general pattern in the changes of the shape of a glacier during a surge is known.
5. The cause of surges apparently involves drastic changes in bed friction which may be related to water at the bed, either as a thin film or in isolated pockets.

(b) However, some very important questions are still outstanding:

1. The temperature regimes in surging glaciers are still unknown.
2. Whether there is a continuous spectrum of behaviour from surging glaciers to ordinary "normal" glaciers, or whether surging glaciers are a class apart, is still an open question.
3. The relation of surging glacier periodicity to mass balance changes or climatic histories cannot yet be defined.
4. The exact role of water at the bed as well as the proper concept of bed roughness have not yet been defined adequately from either a theoretical or observational point of view.

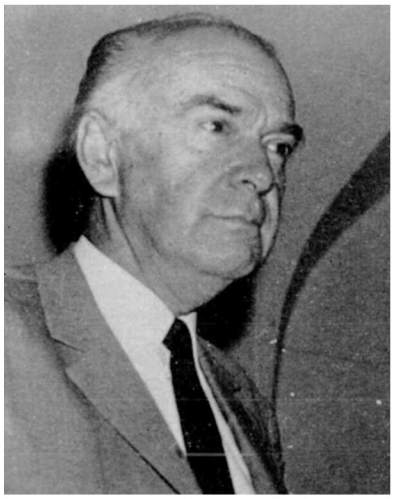
It was not possible to define glacier surges in a completely satisfactory way, partly because different glaciologists place emphasis on different aspects of this interesting phenomenon. To some extent the observation of a noted glaciological philosopher, "Everyone goes out the same door he came in" (C. S. Benson, 1968, personal communication), applies to the papers and discussion of this symposium. However, this opportunity to bring together people from so many parts of the world to compare observations on glacier surges will certainly have a beneficial impact on future work. Now we see the major problems more clearly, and both theoretical and observational work of the future should be directed in a more intelligent and fruitful way.

SYMPOSIUM ON THE PHYSICS OF ICE

The Symposium was held in the Department of Physics, Munich, September 9-14, 1968. The following papers were read; further details may be obtained from Prof Dr N. Riehl, 8 München 2, Arcisstrasse 21, Germany.

H. Gränicher	Review on problems of the physics of ice.
E. Whalley	Structural problems in ice.
W. C. Hamilton, B. Kamb, S. J. LaPlaca, A. Prakash	Proton arrangements in the high-pressure forms of ice.
S. W. Rabideau, E. D. Finch	Structural studies of ice polymorphs by neutron diffraction, proton and deuteron nuclear magnetic resonances.
K. B. Renker, P. v. Blanckenhagen	Lattice dynamics of ice.
J. D. Cross	Study of the surface of ice with a scanning electron microscope.

P. V. Hobbs	The planar growth of ice from the pure melt.
G. Noll	Segregation of ammonium fluoride into ice single crystals.
G. Kvajic, V. Brajovic, E. R. Pounder	Rejection of impurities by growing ice from a melt.
H. Müller-Krumbhaar	Neutron and gamma activated nucleation of Tyndallstars.
A. Higashi	Mechanical properties of ice single crystals.
J. Muguruma	The effects of surface condition on the mechanical properties of ice crystals.
S. J. Jones, J. W. Glen	Impurity effects on the plasticity of ice and their explanation in terms of hydrogen reorientation.
E. Hahne, U. Grigull	Some experiments on the regelation of ice.
G. Dantl	Elastic moduli of ice.
D. Helmreich	Elastic anomalies of ice at low temperatures.
A. Fukuda, A. Higashi	X-ray diffraction topographic studies on deformation behaviour of ice single crystals.
J. E. Dykins	Tensile and rupture modulus properties of saline ice.
K. Eiben	Irradiation produced solvated electrons in ice.
G. Nilsson	Solvated electrons.
O. E. Morgensen	Positron annihilation in water and ice.
J. Engel	H-bonds in biological systems.
L. Onsager	Thermodynamic and kinetic theories of the protonic semi-conductors.
C. Jaccard	Thermoelectric effect.
H. Wolff	The vapour pressure isotope effect of ice and its isomers.
M. Pick	Specific heat of pure and doped ice.
E. Whalley	Infrared spectrum of ice Ih in the range 4000 to 15 cm^{-1}.
G. L. Hofacker	Theory of protonic mobility.
P. Gosar	Proton-proton and proton-phonon interactions in ice.
B. Bullemer, H. Engelhardt, N. Riehl	Protonic conduction of ice Part I: High temperature region.
H. Engelhardt, B. Bullemer, N. Riehl	Protonic conduction of ice Part II: Low temperature region.
A. Kahane	Experimental and theoretical studies on the DC-conductivity of ice.
H. Gränicher	On the interpretation of the pressure dependence of properties controlled by lattice defects.
P. R. Camp, W. Kiszenick, D. Arnold	Electrical conduction in ice.
R. G. Seidensticker, R. L. Longini	Impurity statistics in ice.
P. G. Bishop, J. W. Glen	Electrical polarization effects in pure and doped ice at low temperatures.
H. P. Glockmann	Conduction anomalies and polarization in ice at low temperatures.
L. K. Runnels	Diffusion and relaxation phenomena in ice.
M. Rattner, —. Fischer, G. L. Hofacker	Quasi particle model.
R. H. Cole, O. Wörz	Dielectric properties of ice I.
R. Ruepp	Dielectric relaxation, bulk and surface conductivity of single crystalline ice.
S. Mounier, P. Sixou	A contribution to the study of conductivity and dipolar relaxation in doped ice crystals.
J. Paren	Dielectric properties of ice.
G. Siegle, M. Weithase	Interpretation of the proton magnetic spin-lattice-relaxation in ice.
H. Haltenorth, J. Klinger	Diffusion of hydrogen fluoride in ice.
J. W. Glen	Implications of ice physics for problems of field glaciology.
E. J. Workmann	Atmospheric electrical effects resulting from the collision of supercooled water drops and hail.
D. A. Johnson	The separation of charge due to the fracture of freezing water drops.
R. Reiter, W. Carnuth	Charge separation in ice needles containing traces of NO_3 ions.
L. Levi, A. N. Aufdermaur	Orientation of ice crystals grown by accretion of supercooled droplets.



Seen at the Symposium on the Physics of Ice, Munich, Germany, 9-14 September, 1968.

Photographs by D. Helmreich & G. Noll

FUTURE MEETINGS

THE GLACIOLOGICAL SOCIETY

Northeastern North America Branch

Third Meeting, February 7 - 9, 1969

The following extracts are from a circular sent in October 1968 to members of the Glaciological Society in the north-east areas of USA and Canada. Further details may be obtained from Prof E. R. Pounder, Physics Department, McGill University, Montreal 2, P.Q., Canada.

The Branch this year plans to combine the usual sessions of papers and discussions with some experimental glaciology. The theme of the experiments is the use of hydrophobic organics to reduce the friction between wood or metal and snow, and the experiments themselves will involve a re-examination of some widely disputed concepts of momentum, inertia, and the reactions between animate and inanimate matter at various degrees of inclination. As a field site we have selected Mont Tremblant, 90 miles north-west of Montreal, Quebec, which has some of the longest and steepest snow slopes readily available.

Sessions

The ground rules are as at previous Meetings. Sessions will provide for informal reports on work completed or in progress, and can also give you an opportunity to discuss an experiment you are planning to do yourself or think someone else should. Neither abstracts nor papers will be published by the Branch. (A list of papers read at the meeting will be published in the next issue of Ice.)

Business Meeting

The business meeting of the Section is scheduled for Saturday, February 8th, right after lunch. The main item will be to elect a Vice-President so that he can do all the work for the following year; and at the same time to depose the present President. The Secretary will be lurking nearby to receive dues and bribes. Anyone with other business to be brought up should if possible contact one of the present Executive in advance of the meeting.

C. M. Keeler	Secretary
E. R. Pounder	Vice-President
E. F. Roots	President

GERMAN SOCIETY OF POLAR RESEARCH

The main theme of the meeting this year will be "Variations of glaciers and ice caps". The meeting will take place 9-11 April, in Münster/Westfalia. Titles of papers, which should not exceed 20 minutes, should be sent to Dr Brockamp before 31 January. Abstracts (up to two typewritten pages) should be submitted by 1 March. All enquiries should be addressed to:

Dr B. Brockamp, 44 Münster/Westf., Steinfurter Strasse 107, Institut für Reine und Angewandte Geophysik, Germany.

EIGHTH INTERNATIONAL CONGRESS OF CRYSTALLOGRAPHY

The Eighth Congress of the International Union of Crystallography will be held 13-21 August 1969 at the State University of New York, Stony Brook, Long Island, New York, USA. During the period of the Congress a full programme of non-scientific activities is planned for participants and their families. Visits to scientific laboratories in Washington, D.C., will be arranged for 23-27 August. Further information may be obtained from: International Union of Crystallography, Congress Headquarters, State University of New York at Stony Brook, Stony Brook, New York 11790, USA.

SYMPOSIUM ON THE REMOTE SENSING OF ENVIRONMENT

The Sixth Symposium will be held 14-16 October 1969 at the University of Michigan, and will be conducted by the Center for Remote Sensing Information Analysis. Reports on work in progress, especially on new sensors or major advances in technology, and information concerning data acquisition, interpretation and handling techniques will be considered by the Program Committee. Comprehensive abstracts should be submitted before 15 February in twelve copies, 400-600 words in length, to: The Center for Remote Sensing Information and Analysis, Willow Run Laboratories, The Institute of Science and Technology, The University of Michigan, P.O. Box 618, Ann Arbor, Michigan 48107, USA. Further information about the Symposium may be obtained from the Extension Service, Conference Department, The University of Michigan, Ann Arbor, Michigan 48104, USA.

GLACIOLOGICAL DIARY

1969

7 - 9 February
Northeastern North America Branch of the Glaciological Society, Mt. Tremblant, Québec, Canada. Annual Meeting. (Dr E. R. Pounder, Dept. of Physics, McGill University, Montreal, P.Q., Canada.)

9 - 11 April
German Society for Polar Research, Münster/Westf. Annual meeting—Variations of glaciers and ice caps. (See p 11 of this issue of ICE for details.)

13 - 21 August
Eighth International Congress of Crystallography. State University of New York at Stony Brook, N.Y., USA. (See p 11 of this issue of ICE for details.)

30 August - 5 September
International Union for Quaternary Research (INQUA). VIII Congress, Paris, France. (INQUA Secretariat, Institut de Géographie, 191 rue Saint-Jacques, Paris 5, France.)

7 - 13 September
Glaciological Society, Cambridge, England. Symposium on the hydrology of glaciers. Sponsored by the Glaciological Society and the Commission of Snow and Ice (IASH). (Mrs H. Richardson, Glaciological Society, c/o Scott Polar Research Institute, Cambridge, England.) (See p 13-17 of this issue of ICE for the Second Circular.)

11 September
Glaciological Society 1969 Annual General Meeting and Banquet. (See p 20 of this issue of ICE for booking form.)

14 - 16 October
Remote Sensing of Environment, Sixth Symposium. Center for Remote Sensing of Environment, University of Michigan, Ann Arbor, Mich., USA. (See p 11 of this issue of ICE for details.)

1970

15 - 23 July
Symposium on the world water balance. Reading, England. (Unesco/IASH.)

1971

(dates not announced)
XVth General Assembly of IUGG, Moscow, USSR. Symposium on environmental and interdisciplinary studies of glaciers and of snow in mountain regions. (IASH/Unesco.) Symposium on air-water reactions involving floating ice. (IASH/Unesco.)

Pacific Science Association, congress. Australia. (Geography Chairman: Akira Watanabe, Dept. of Geography, Ochanomizu Univ., Bunkyo-ku, Tokyo, Japan, Meteorology Chairman: J. F. Gabites, Director, Met. Service, P.O. Box 722, Wellington, New Zealand. Solid Earth Sciences Chairman: W. H. Mathews, Dept. Geography, Univ. of British Columbia, Vancouver 8, B.C., Canada.)

1972

(dates not announced)
International Geological Union Congress
International Geographical Union Congress } both in Montreal, Canada, on successive weeks.

Tentatively planned (as given in the provisional calendar for symposia planned within the framework of the International Hydrological Decade, Unesco) are:
Distribution of precipitation in mountainous areas. (WMO.) ?1970.
Symposium on the use of isotope techniques on hydrology. (IAEA/Unesco.) ?1970.
Symposium on the hydrology of snow and ice. (Unesco/Canada.) ?1972.

SYMPOSIUM ON THE HYDROLOGY OF GLACIERS

September 7—13 1969

Cambridge, England

Organized by the Glaciological Society

and jointly sponsored by the Commission of Snow and Ice

(International Association of Scientific Hydrology of the International Union of Geodesy and Geophysics)

Second Circular

November 1968

All correspondence and requests for information about the Symposium should be addressed to:

The Secretary, Glaciological Society,
c/o Scott Polar Research Institute,
Cambridge, England.

The Symposium on the Hydrology of Glaciers, to be held in Cambridge, England, 7—13 September 1969, is organized by the Glaciological Society and is jointly sponsored by the Commission of Snow and Ice (International Association of Scientific Hydrology of the International Union of Geodesy and Geophysics).

1. PARTICIPATION

This Circular includes booking forms for registration, accommodation, social events and tours during and after the Symposium. The forms should be sent to the Secretary **before 1 April 1969.**

Payment should be made at the same time,

by cheque payable to: Glaciological Society 1969 Symposium and sent to the Secretary; or

by Bank transfer to: Glaciological Society 1969 Symposium, Account No. 54769981 and sent to the Westminster Bank, Ltd., St Andrew's Street, Cambridge, England; or

by Giro transfer to: Giro Account No. 240 4052.

(Please do *not* include payments to the Glaciological Society for other items, such as annual dues.)

Registration Fees:

Participants	=£5/US$12
Junior Members of Glaciological Society	=£3/US$7.20
Accompanying persons 18 or over	=£2/US$4.80

(There is no fee for those under the age of 18.)

2. TOPICS

The Symposium will include papers on the water balance of glaciers, the movement and storage of water within glaciers, the glacier considered as a ground-water system, and the glacier considered as a source of stream flow.

3. PROGRAMME

Presentation and discussion of papers will take place during five mornings and four afternoons. On one afternoon, participants may join a countryside tour. There will be a Civic Reception one evening and a Banquet on another evening. A Ladies Programme is planned, and will include visits to colleges and other buildings, villages, antique shops and inns. Tempted participants will be welcome on these tours. After the Symposium, tours of Scotland and Norway will take place during the week 13—20 September. Details of these programmes are found later in this Circular.

4. ACCOMMODATION

Block reservations have been made in Emmanuel College and the University Arms Hotel.

Emmanuel College: Single rooms are available for men and women aged 18 and over. Junior members of the Glaciological Society are offered a reduction of 10s/US$1.20 on the full rate of £3.5s/US$7.80 per day for room, all meals and service.

University Arms Hotel:

	single room	*double room* per day
Bed & Breakfast	£3 US$7.20	£5 US$12
Demi-pension (breakfast & one other meal)	£3.17s US$9.20	£6.14s US$16
Full pension (all meals)	£4.8s US$10.60	£7.6s US$17.50
Extra for room with private bath	15s US$1.80	£1 US$2.40

Service extra.

A few single rooms may be available in University licensed lodging houses at approximately £1/US$2.40 per day, but no meals are provided.

Deposits for accommodation:
A £5/US$12 deposit per person should be paid when booking for accommodation in Emmanuel College, the University Arms Hotel, or lodging houses. This deposit is returnable if notice of cancellation reaches the Secretary before 7 August 1969.

If participants prefer to make their own arrangements for accommodation, please indicate this on the booking form; no deposit will then be required by the Society. A list of hotels, with prices for room and breakfast and for room and all meals, will be supplied upon request.

5. PAPERS

There will be two categories:
(a) invited papers,
(b) short contributions.

(i) SUBMISSION OF PAPERS

As announced in the First Circular (April 1968) those participants who would like to contribute in either category should first submit a summary of their proposed paper in English or French: this summary should contain sufficient detail to enable the Papers Committee to form a judgement on the likely merit of the proposed paper, but should not exceed three pages of typescript. Summaries must be submitted on paper of international size A4 (210 x 297 mm) with wide margins and double spaced lines.

Date for submission of summaries intended for consideration in category (a): 15 January 1969.

Date for submission of summaries intended for consideration in category (b) only: 1 March 1969.

(ii) SELECTION OF PAPERS

Each summary will be assessed by the members of the Papers Committee, acting independently of each other, taking into account scientific quality and relevance to the themes of the Symposium. The Papers Committee will then invite a strictly limited number of papers for presentation and thorough discussion at the Symposium (not necessarily confining themselves to authors who have submitted summaries). Other summaries containing important results, including some of those not accepted in category (a), will be accepted as the basis of short contributions allocated considerably less time for presentation and comment at the Symposium. It is hoped to notify authors of invited papers and short contributions by 1 April 1969.

(iii) DISTRIBUTION OF SUMMARIES

Authors of accepted papers in both categories will be required to send 150 copies of their summaries to the Secretary for distribution free by surface mail to all participants before the Symposium. These 150 copies must reach the Secretary by 1 June 1969.

(iv) SUBMISSION OF FINAL PAPERS AND PUBLICATION

The Proceedings will appear as a *Publication of the International Association of Scientific Hydrology.* Papers presented at the Symposium will be considered for publication in these Proceedings, provided they have not been submitted for publication elsewhere. Final typescripts of these papers should be submitted to the Secretary of the Glaciological Society by 1 August 1969. They should be written in English or French and prepared in accordance with the instructions for preparation of papers for the *Journal of Glaciology* to be found inside the back cover of the Journal. Fuller details will be sent to authors with the notification of acceptance of the papers for the Symposium. The maximum length for papers in category (a) will be 5000 words or the equivalent length including any illustrations, and in category (b) will be 1500 words or equivalent. The papers will be refereed according to the usual standards of the *Journal of Glaciology* before being accepted for publication.

6. SOCIAL EVENTS & TOURS DURING SYMPOSIUM

(i) GENERAL TOURS

On Wednesday 11 September there will be a choice of two local tours for everyone attending the Symposium. No session will be held that afternoon.

Tour 1: Picturesque East Anglia villages, centres of the wool industry in the Middle Ages — old churches and inns, shops for antiques and crafts.

Cost=£2/US$4.80, including lunch.

Tour 2: Mediaeval villages in Norfolk, moated Norman castle, pre-historic flint mines and workshops.

Cost=£1.5s/US$3, including lunch.

(Allowance for lunch will be made on the bills for Emmanuel College and University Arms.)

(ii) LADIES PROGRAMME

On each day there will be arrangements made to interest families and friends of participants. Participants tempted to join these tours will be welcome. Some tours will be free. Those tours which include the use of special transport and meals are listed here and require payment in advance, as indicated on the booking form.

Tour 3: Guided tour of modern colleges. Tea in riverside village near Cambridge.

Cost=12s 6d/US$1.50.

Tour 4: Visit to large stately home, picnic lunch in grounds; and to smaller Tudor manor house. Short tour of attractive market town in Essex, with shops for antiques and crafts.

Cost=£1/US$2.40.

Tour 5: Visit to Ely Cathedral, in the Fens.

Cost=10s/US$1.20.

(iii) SOCIAL EVENTS

On Monday 8 September there will be a Civic Reception at 6 p.m., at the kind invitation of the Mayor of Cambridge.

On Thursday 11 September at 8.15 p.m. there will be a Banquet in the University Centre. Tickets for this will cost £2.5s/US$5.40, inclusive of wines. Payment should be made in advance.

7. POST-SYMPOSIUM TOURS

TOUR 6: FIELD STUDY TOUR OF THE SCOTTISH HIGHLANDS

The tour will begin in Cambridge on the evening of Friday 12 September, after the end of the Symposium. It will finish at Aviemore, Inverness-shire, in the late afternoon of Friday 19 September, in time for connexions to be made with rail and air services to Glasgow, Edinburgh and London.

Cost=approximately £40/US$96

(Cambridge to Aviemore, inclusive)

(Allowance for Friday night's accommodation will be made on the bills for Emmanuel College and the University Arms.)

The tour has been designed to be of interest both to those who wish to study the glaciation and history of the Scottish mountains and to those who wish to use the opportunity to see something of the scenery and life of the Highlands. As far as possible, alternative programmes, scientific and general, will be arranged each day. The main feature of the scientific programme will be a study of the contrasts between the glacial features of the Isle of Arran, representative of of the West Highlands, and those of the Cairngorms. A visit will be arranged to a large hydro-electric scheme of the pumped storage type. The itinerary will include some attractive cruising on the Firth of Clyde; further opportunities for cruising will be provided in the general programme, which will also include visits to a historic castle and to a whisky distillery.

The general plan will be as follows: leave Cambridge Friday evening and travel by sleeping-car train to Glasgow; breakfast in Glasgow; short journey by train and boat to Arran in the Firth of Clyde. Saturday and Sunday nights will be spent on Arran. Between Arran and Aviemore, in the Cairngorms, travel will be by boat and special coaches, spending two nights en route and arriving in Aviemore on Wednesday afternoon. The group will spend Wednesday and Thursday night at the Aviemore Centre.

Further details of the arrangements will be sent to applicants in April 1969. If you wish to participate in this Study Tour, please complete the appropriate form in this Circular and send it to the Secretary by 1 April 1969. A deposit of £5/US$12 for each person must be paid at the same time. The deposit will be returned if a cancelled place can be filled by the Secretariat.

Book Early —

Make Sure of Your Place

TOUR 7: GLACIER STUDY TOUR IN NORWAY

The tour will start in Bergen on the evening of Sunday 14 September, so that participants in the Symposium will have time to travel by train and ship from Cambridge.

Cost=approximately £50/US$120, not including fares from Cambridge to Bergen and return.

If many people apply for this tour, it will be possible to duplicate it for those people who prefer to travel by air from London to Bergen on Saturday 13 September. This tour, if it is arranged, will start and finish exactly one day earlier than the dates mentioned in the following paragraphs.

The tour will finish at Gol in the Hallingdal Valley on Saturday 20 September. Gol is on the Bergen-Oslo railway line. Participants will be able to choose to return to Bergen that day or to proceed to Oslo.

The glacier tour is designed to give a view of various types of glaciers—from the maritime west coast to the continental areas inland—and will include cirque glaciers, valley glaciers and glaciers of the ice cap type. Emphasis is laid on glacier hydrology, factors governing water discharge from glaciers, and man's use of this water. Problems connected with the sediment load in glacier streams will also be demonstrated and discussed. Visits will be made to some glaciers where, if weather permits, participants will be able to walk on or across the ice to study installations for mass balance, stream discharge and sediment transport studies.

The general plan, weather permitting, will be as follows: leave Bergen Sunday evening by coast steamer to Måløy. Monday, by chartered motorboat to Ålfoten, visit Ålfotbreen by cable-car and on foot (rain clothing necessary); accommodation in the Nordfjord area. Tuesday, by bus to Olden Valley, with short trip on foot to Briksdalsbreen, an outlet glacier from Jostedalsbreen ice cap. Wednesday, by bus across Strynefjell to Lom and on foot to a glacier in Jotenheimen (strong boots necessary). Thursday, by bus across Sognefjell to Jostedal; visit Nigardsbreen. Friday, study sedimentation in glacier lake; then by bus and ferry across Sognefjorden to Laerdal; possibly visit I.H.D. representative basin on Filefjell. Saturday, by bus to Gol for train connexions to Bergen or Oslo.

Further details will be sent to applicants in April 1969. If you wish to participate in this Study Tour, please complete the appropriate form in this Circular and send it to the Secretary by 1 April 1969. A deposit of £5/US$12 for each person must be paid at the same time. The deposit will be returned if a cancelled place can be filled by the Secretariat.

Book Early —

Make Sure of Your Place

Your copy

GLACIOLOGICAL SOCIETY
SYMPOSIUM ON THE HYDROLOGY OF GLACIERS
September 1969

The following reservations were made on the forms returned to the Secretary on ...../...../196
(day) (month)

A. REGISTRATION FEES

(i) Participant @ £5/US$12 .....
(ii) Junior Member @ £3/US$7.20.....
(iii) Accompanying person @ £2/US$4.80.....

B. ACCOMMODATION DEPOSITS

£5/US$12 per person
(i) Emmanuel College .....
(ii) University Arms Hotel .....
(iii) Lodging houses .....

C. TICKETS FOR EVENTS DURING SYMPOSIUM

General Tour 1 (£2/US$4.80 each) .....
General Tour 2 (£1.5s/US$3 each) .....
Ladies Tour 3 (12s 6d/US$1.50 each) .....
Ladies Tour 4 (£1/US$2.40 each) .....
Ladies Tour 5 (10s/US$1.20 each) .....
Banquet (£2.5s/US$5.40 each) .....

D. POST-SYMPOSIUM STUDY TOURS DEPOSITS

£5/US$12 per person
Tour 6: Scotland .....
Tour 7: Norway .....

TOTAL PAYMENT (sum of A. B. C. D) ...=£.....
Sent by cheque/Bank transfer/Giro transfer US$.....

DATES TO REMEMBER
1969

15 January: Last date for submission of summaries of papers for consideration in category (a).

1 March: Last date for submission of summaries of short contributions for consideration in category (b) only.

1 April: Last date for reservations; registration, accommodation, social events, tours.
also: Authors of selected papers (both categories) will be notified.

1 June: Last date for submission of 150 copies of summaries of selected papers (both categories), for distribution to participants.

1 August: Last date for submission of final versions of papers for consideration for publication in the Proceedings.

SYMPOSIUM ON THE HYDROLOGY OF GLACIERS

7—13 September 1969

Mail to: Secretary, Glaciological Society,
c/o Scott Polar Research Institute,
Cambridge, England.

See 1 Participation for methods of making payment

BEFORE 1 APRIL 1969

A REGISTRATION FORM

(Please type or print in black ink)

Name of participant Mr / Mrs / Miss .....

Address .....

.....

.....

Accompanied by (indicate age if under 18):

Name .....

Name .....

I send registration fee/s as follows:

(i) Participants ..... =£5/US$12 .....
Junior Members of Glaciological Society =£3/US$7.20 .....

(ii) Accompanying persons =£2/US$4.80 .....

(There is no registration fee for accompanying persons under the age of 18)

TOTAL REGISTRATION FEE/S =£.....
US$.....

B ACCOMMODATION FORM

Please reserve the following accommodation for 7—13 September 1969, for which I enclose a deposit of £5/US$12 per person:

(i) *Emmanuel College* (single rooms only):
... room/s.

(ii) *University Arms Hotel:*
... single room/s ... double room/s
... bed & breakfast ... demi-pension
... full pension with/without bathroom

(iii) *Lodging houses* (if available):
... single room/s.

(iv) *Own arrangements* (delete if not applicable):
I prefer to make my own arrangements.
(No deposits required)

TOTAL DEPOSITS =£.....
FOR ACCOMMODATION US$.....

C TOURS AND SOCIAL EVENTS DURING SYMPOSIUM

Please reserve the following tickets, for which I send payment:

General Tour 1: ... tickets @ £2/US$4.80 each
General Tour 2: ... tickets @ £1.5s/US$3 each
Ladies Tour 3: ... tickets @ 12s 6d/US$1.50 each
Ladies Tour 4: ... tickets @ £1/US$2.40 each
Ladies Tour 5: ... tickets @ 10s/US$1.20 each
Banquet: ... tickets @ £2.5s/US$5.40 each

TOTAL PAYMENT FOR TICKETS =£.....
US$.....

D POST-SYMPOSIUM TOURS

Tour 6: Scottish Highlands Field Study Tour
(12—19 September 1969)

Tour 7: Glacier Study Tour in Norway
(13—20 September 1969)

Please register the following people for *SCOTLAND/*NORWAY
(*delete as necessary):

Please specify Mr/Mrs/Miss .....

1. Name .....
   Address .....
   .....
   .....
   Accompanied by (indicate age if under 18)
2. Name .....
3. Name .....

Tour 6: Scotland

Of the persons listed above, it is probable that ..... will be mainly interested in the scientific programme and ..... will prefer the general programme. (This is not a binding commitment, but will be of great help in the planning.)

Tour 7: Norway

If the tour must be duplicated, I shall prefer to start from Bergen:

(i) Saturday evening .....
(ii) Sunday evening .....

At the end of the tour, I shall proceed from Gol to:

(i) Bergen .....
(ii) Oslo .....

I send a deposit of £5/US$12 per person.

DEPOSIT/S FOR SCOTLAND TOUR =£.....
US$.....

DEPOSIT/S FOR NORWAY TOUR =£.....
US$.....

TOTAL PAYMENT (sections A, B, C, D) =£.....
(Sent by Cheque/Bank transfer/Giro transfer) US$.....

INSTITUTE OF ARCTIC AND ALPINE RESEARCH (INSTAAR), UNIVERSITY OF COLORADO, BOULDER, COLORADO

Late in 1967 the University of Colorado went ahead with the first phase of expansion and development of its Institute of Arctic and Alpine Research, founded in 1951 under the directorship of Dr John W. Marr. Dr Jack D. Ives was appointed Director, and during the subsequent twelve months the following appointments have been confirmed: Dr Waldo Glock (dendrochronologist), Dr John T. Andrews (geomorphologist and Quaternary geophysicist), Dr Nelson Caine (geomorphologist), Dr Roger G. Barry (climatologist), and Dr Patrick Webber (plant ecologist).

The major objective of INSTAAR is the evaluation and appreciation of arctic and alpine environments through research and teaching. The term "environment" is intended to stress the need for an inter-disciplinary philosophy and approach to research, and to teaching through research, at various levels. INSTAAR'S particular role is the study of some of the earth's more extreme environments that are found at high altitudes and high latitudes or that occurred during glacial phases of the Quaternary Era. As the Institute is going through a phase of major expansion, current emphasis is being placed on the so-called field sciences (earth, biological and atmospheric); the study of man's present and past use and appreciation of these extereme environments will be added to the program in the near future.

INSTAAR possesses a well equipped Mountain Research Station at 9,600 feet elevation in the Front Range of the Colorado Rocky Mountains. This provides year-round accommodation and logistical support to altitudes over 12,000 feet within 90 minutes travel time of the Boulder campus headquarters. Laboratories and general facilities are being developed on the campus.

INSTAAR, therefore, is an inter-disciplinary research and teaching organization within the Graduate School, with its faculty appointed jointly in the Institute and in the relevant academic department, usually in the College of Arts and Sciences. Their research activities are related to the Graduate School while their teaching responsibilities are coordinated with the relevant department, although special inter-disciplinary courses are developed by the Institute and cross-listed for academic credit currently in Biology, Geography and Geology. In addition to full-time faculty, INSTAAR staff includes field and laboratory technicians, editorial, secretarial and administrative personnel. Faculty of other departments interested in the Institute's program cooperate as INSTAAR Research Associates.

Graduate students interested in the work of the Institute should apply for graduate status within the academic department most closely associated with their thesis topic, and obtain financial support through the normal University channels, although the Institute does administer one teaching assistantship valued at $2,650 for the academic year together with a waiver of tuition fees.

Research activities. During the past year extensive reconnaissance has been undertaken, particularly in the Front Range of the Colorado Rocky Mountains, as the first step in establishment of a series of long-range, interrelated research programs. These include glaciology, hydrology, climatology, Pleistocene geology, archaeology, geomorphology, botany and zoology. Weather stations, apparatus for precise measurement of ground surface heave, and thermoelectric elements as the first phase of permafrost research have been established.

Several graduate students are already working on various phases of the program to provide material for their graduate dissertations. As support, the Mountain Research Station facilities are being expanded, former "summer" buildings are being winterized and a fleet of oversnow vehicles is being built up.

In addition, two small field expeditions were supported in eastern Baffin Island during the 1968 summer and plans are being developed for a year round study of the ecology of Dall sheep in central Alaska.

Publications. The Institute has made preparations for publication of a new quarterly scientific journal entitled "Arctic and Alpine Research". A printer has been selected and manuscript for the first issue, scheduled for release in January 1969, is already in press. The journal will be sold on an annual subscription of $12.00; papers are solicited from all those who are involved in some aspect of arctic and alpine research or related topics. The printing time-lag between final editing and approval of a manuscript should be three to five months. No page charges are to be levied and authors will receive the first 100 reprints free.

Other facilities. The campus headquarters are presently housed in the Armory Building; although plans are in progress for an early 1969 move to the upper floor of a modern research building on the east campus. This will provide the Institute with over 20,000 square feet of space and will help the rapid development of palynology, geomorphology, soils and climatology laboratories.

NEW MEMBERS

Adamache, L. N., Box 614, Nelson, British Columbia, Canada.
Chinn, T. J. H., 30 Devon Street, Timaru, New Zealand.
Clausen, H. B., Hellerupgaardvej 8, 2900 Hellerup, Denmark.
Fitzharris, B. B., Geography Department, University of British Columbia, Vancouver 8, British Columbia, Canada.
Goodrich, L. E., 3682 rue Orléans, Ville de Brossard, Québec, Canada.
Holdsworth, G., Institute of Polar Studies, Ohio State University, 125 South Oval Drive, Columbus, Ohio 43210, USA.
Johannessen, O. M., Marine Sciences Centre, McGill University, Montreal, P.Q., Canada.
Johnson, P. G., Geography Department, University of Leeds, Leeds 2, England.
Mayr, Dr Franz, Geology Department, University of Montreal, C.P. 6128, Montreal 3, P.Q., Canada.
Muguruma, Dr Jiro, Department of Applied Physics, Hokkaido University, Sapporo, Japan. (Until August 1969 at the Cavendish Laboratory, Cambridge, England.)
Osterkamp, T. E., 2 McNulty Drive, Manchester, Missouri 63011, USA.
Skinsley, M., Wyndham School, Egremont, Cumberland, England.
Stengle, T. R., Chemistry Department, University of Massachusetts, Amherst, Massachusetts 01002, USA.
Suzuki, Dr Yosio, Institute of Low Temperature Science, Hokkaido University, Sapporo. Japan.
Turner, Dr C., Eastling Manor, Eastling, Faversham, Kent, England.
Vincent, P. J., Geography Department, University of Durham, Science Laboratories, South Road, Durham City, Co. Durham, England.

JOURNALS BY JET

Would those members resident in Canada and USA who would like to receive their Journal by jet please complete the form below and return it to the Secretary.

Do not send money at this stage: if enough members are interested, those people will be invoiced later. No copies will be sent by jet unless the $1 has been paid in advance. To simplify administration, the $1 will be used only for those Journals published in a calendar year: no refunds, no credit balances.

JOURNAL OF GLACIOLOGY — by jet to North America

I am willing to take part in this scheme and will pay US $1 before 1 January each year, upon receipt of invoice.

..... Signature

Do you think it would be a good idea to add US $1 to **all** N. American Members' dues and send all copies by jet? (Ordinary Members = $9 instead of $8, Junior $4 instead of $3.)

☐ Yes*
☐ No*

*Check

Mail, without delay please, to the Secretary, Glaciological Society, c/o Scott Polar Research Institute, Cambridge, England.

ANNUAL GENERAL MEETING & BANQUET 1969

I hope to attend the meeting and the banquet on Thursday evening, 11 September.

I wish to book ..... places at the banquet @ £2 5s/US $5.40 each.

I *enclose a cheque/have sent by Bank draft/have sent by National Giro (240 4052)

£...../US $.....

Signed .....

Address .....

.....

.....

* delete as appropriate

THE GLACIOLOGICAL SOCIETY

c/o Scott Polar Research Institute, Lensfield Road, Cambridge, England

President: Dr. J. F. Nye

Secretary: Mrs. H. Richardson

DETAILS OF MEMBERSHIP

Membership is open to all who have scientific, practical or general interest in any aspect of snow and ice study. Members receive the Journal of Glaciology free. Forms for enrolment can be obtained from the Secretary. No proposer or seconder is required. Annual subscription rates are as follows:

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Editor: Mrs. H. Richardson

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