

NUMBER 48

2nd ISSUE 1975

ICE



SYMPOSIA TO BE ORGANIZED BY THE INTERNATIONAL GLACIOLOGICAL SOCIETY

1976 Applied Glaciology

Cambridge, England; 12-17 September

(See p. 22-24 of this issue of ICE for Second Circular.)

If you wish to attend the Symposium, please complete the form on page 24 and send it with your registration fee and appropriate deposit to the Secretary of the Society.

1977 Physics and chemistry of ice

Cambridge, England; 11-16 September

(See p. 10 of this issue of ICE.)

1978 Dynamics of large ice masses

venue to be announced; late August or early September

(See p. 10 of this issue of ICE.)

The proceedings of all these symposia will be published in the Journal of Glaciology.
Further enquiries to:

The Secretary
International Glaciological Society
Cambridge CB2 1ER
England

ICE

NEWS BULLETIN OF THE

INTERNATIONAL GLACIOLOGICAL SOCIETY

2nd ISSUE 1975

NUMBER 48

CONTENTS

NOTICES	1
RECENT WORK: France	2
New Zealand	4
PROFILE: Dr O. Løken	6
INTERNATIONAL GLACIOLOGICAL SOCIETY:	
Annual General Meeting 1975	8
Annual Conference 1975	10
Symposia 1977 & 1978	10
branch news	15
Journal of Glaciology	15
library	16
Photography section	11-14
GLACIOLOGICAL DIARY	17
REVIEWS	19
NEWS	20
NEW MEMBERS	21
SECOND CIRCULAR: Applied Glaciology Symposium 1976	22

DUES INCREASE

As stated by the Treasurer at the 1975 Annual General Meeting (see Minutes, p. 9 of this issue of ICE), an increase in dues will take effect in January 1976. We very much regret this move, but we are sure members will have noted that we have held our present rates since 1972, in spite of soaring inflation. To yield the same purchasing power as in 1972, rates in 1975 should have been 50% higher: and yet we not only held the rates at the same level, but published twice as many pages:

1972—486 pages

1975—1030 pages (482 pages=Proceedings of the Symposium on Remote Sensing in Glaciology).

The new membership rates take into account that members are now receiving two volumes a year instead of one, representing a very good bargain at today's prices. We hope to hold these rates for three years, but cannot look further ahead than that.

1976 dues: Members—£10

Junior members—£4

libraries—per volume rate, price on application to the Secretary.

Please would you send your 1976 dues to us as quickly as possible after 1 January 1976.

COVER PICTURE. Photograph taken by Sigurður Thorarinnsson of Hagafellsjökull eystri, one of many Icelandic glaciers now surging. March 1974.

RECENT WORK

FRANCE

INSTITUT DE GÉOGRAPHIE ALPINE

(G. Bocquet, H. Gamuchian, M. Ricq, A. Thomas, R. Vivian)

During 1974 and 1975, the observations and measurements which have been done for several years under Argentières Glacier (2170 m, about 2 km up stream of the front, under 100 meters of ice) and on the glacier have been pursued: measurement of the glacier sliding velocity near the bedrock and size of the cavity (cavitometer), pressure measurement of the water table up stream Lognan, flow measurement, chemical analyses of basic ice, firn ice and sub-glacial waters, meteorological observations, movement measurement of the stakes on accumulation basin.

At the same time, this programme has been widened. A new room bored in the rock at the altitude of 2170 m and placed within 2 m of the glacier, close to the cavity "S6" where the cavitometer works, has been arranged in order to receive the recorders of the apparatus placed under the glacier and to do the first necessary operations before chemical analyses of ice samples.

The micro-climate study of the cavity "S6" has been undertaken in correlation with data provided by the Meteorological Station at 2120 m outside the galleries.

A moving cavitometer with a magnetic recorder (made by J. L. Mermier and J. C. Ricq) is under installation. It will measure the velocity and strain of the vault in several cavities and at different points in those.

Observations and measurements have been done on the permanent crevasses of the plateau edge of Lognan and on their strains (C. Lesca). From March to September 1974, topographic studies have established a topographic survey of the bedrock for measuring simultaneously velocities at the base of the glacier and on its surface, and studying the directions and intensities of ice movement (scale: 1/2000) on the surface.

A tritium content programme in ice and sub-glacial waters has been established with the "Centre de Recherches Géodynamiques de Thonon" (Ph. Olive) (ice dating and origin of running water). Several ice samples have been collected at different levels in the walls of a crevasse and along a longitudinal profile of the glacier, from the accumulation basin to the front (study of the major impurities, repartition in ice).

Two coloured 16 mm films have been made on the glacier movement. During April, the sub-glacial laboratory of Argentières received a team

of scientists from East Anglia University (Norwich). This team went there to make, under the direction of G. Boulton, pressure measurements of ice against the bedrock. These measurements are connected with velocities in order to study abrasion phenomena.

The Geographical Institute has also done other glaciological work: on Chavière Glacier (study of movement by terrestrial photogrammetry) and on "Grande Motte" glacier (determination with triangulation of stakes every 10 days of the direction and intensity of movement affecting ice at the foot of the higher Dome).

GRUPE D'ETUDES DE METALLURGIE PHYSIQUE ET DE PHYSIQUE DES MATERIAUX

Our laboratory began the study of physico-mechanical properties of ice in 1971. In 1972, with the help of the C.N.R.S., this work was directed towards the question: is it possible to obtain information on the plastic behaviour of ice from damping measurements?

Since then, our research has been involved with 4 topics.

1) ULTRASONIC PROPERTIES OF PLASTICALLY DEFORMED ICE

Sound velocity and attenuation of ultrasonic waves have been measured in strained specimens of ice (single and polycrystals); these measurements, done between 100 and 273K at a frequency of 5MHz, show that plastic deformation leads to an increase of attenuation and an increase of velocity. Annealing treatments at 271K cause recovery of propagation characteristics; the increase of attenuation can be interpreted by the theory of dislocations but it implies a decrease of modulus, i.e. of velocity; hence we must postulate that an added phenomenon induced by plastic deformation and connected with ageing effects, screens the effect of dislocations.

We plan to build a new device, able to measure during plastic deformation both attenuation and velocity variations. It will allow us to study more precisely how dislocations induce velocity and attenuation variations when plastic deformation occurs.

2) MICROPLASTICITY AND LOW FREQUENCY INTERNAL FRICTION OF ICE I_h

We have approached the study of microplasticity of Ice I_h by internal friction measurements at low frequency (torsional pendulum). Ice specimens are obtained from single crystal or

polycrystal material; these specimens have a parallelepipedal shape (2 x 8 x 70 mm).

In the case of polycrystal ice, we observed a relaxation peak previously observed by several workers in the kilohertz range, and a very high peak near the melting point which is associated with the presence of grain boundaries.

In the case of single crystals, only the preceding relaxation peak is obtained but it is followed by an increase of damping above 260 K. Furthermore, in this temperature range, internal friction is shown to be amplitude dependent: internal friction δ increases with shear amplitude γ as much as temperature T is high. These features are due to properties and concentration of imperfections in ice; so, impurities modify neatly the relaxation peak. Our results are concerned by imperfections induced by plastic deformation of single of Ice I_h. Indeed, this plastic deformation

is followed by modifications of the spectra $\delta = f(T)$ and $\delta = f(\gamma)$: (i) the structure of the relaxation peak becomes more complicated: in particular, a low temperature component is observed; (ii) high temperature internal friction is increased as much as plastic deformation ratio is important; (iii) high temperature internal friction is more amplitude dependent.

The relaxation peak is generally interpreted in terms of thermally activated rotation of H₂O molecules. The relaxation time depends on a concentration of rotational defects. Plastic deformation leads probably to a modification of their concentration and of their distribution in the crystal, and that could explain the preceding results.

In the high temperature range, the mobility of dislocations increases quickly. During the internal friction measurements, the cyclic stress causes movement of linear defects and damping phenomena. The theoretical analysis of dynamic behaviour of dislocations in ice shows two types of movement: the first is associated with kink diffusion; the second is associated with thermally activated double kinks.

In the first case, internal friction is calculated and is given by:

$$\delta_1 = \frac{\delta_{10}}{\nu} \exp\left(-\frac{U_1}{kT}\right)$$

In the second case, we obtain

$$\delta_2 = \frac{\delta_{20}}{\nu} \exp\left(-\frac{U_2}{kT}\right) \cdot F(\gamma)$$

δ_{10} and δ_{20} are proportional to kink density and dislocation density respectively. Hence, plastic deformation does modify δ_1 and δ_2 .

In conclusion, damping measurements appear to be a very useful tool for the study of the microstructure of ice.

3) DYNAMIC BEHAVIOUR OF DISLOCATIONS IN ICE

The experimental study of the plasticity of ice is generally done through creep experiments and

tension or compression tests. The law $\dot{\epsilon} \propto \tau^m$ is usually verified with m varying between 1 and 4 depending on the origin of the material and on the conditions of experiments.

Such results can be interpreted with the help of the theory of dislocations if the variation of the velocity of dislocations with the resolved shear stress is known.

Thus, we propose a model describing the movement of dislocations in ice. This model is based on the following assumptions:

- (i) dislocations can glide only if water molecules in front of them are correctly rotated thanks to rotational defects.
- (ii) The movement of linear defects is obtained through the diffusion of geometric kinks of, and thermal formation of, double kinks.

We obtain expressions which take into account the effect of stress and impurity content and which allow us to give a physical meaning to experimental values of activation energy and activation volume of the plastic deformation.

4) X RAY TOPOGRAPHIC STUDY OF ICE SINGLE CRYSTAL

The study of imperfections on natural and artificial ice single crystals by X ray topography allows us to confirm the well-known results: most of the observed dislocations are located in the basal plane; and the Burgers vector of these dislocations has been identified as

$$\vec{b} = a/3 \langle 11\bar{2}0 \rangle.$$

After our observations, most basal dislocations are not pure screw dislocations. They are recognised as:

$$\text{—}30^\circ \text{ dislocation } (\vec{b} = a/3 [11\bar{2}0], \vec{l} = [10\bar{1}0])$$

$$\text{—}60^\circ \text{ dislocation } (\vec{b} = a/3 [11\bar{2}0], \vec{l} = [21\bar{1}0])$$

—or edge dislocation

$$(\vec{b} = a/3 [11\bar{2}0], \vec{l} = [1\bar{1}00])$$

In addition, when the scanning plane is $(10\bar{1}0)$

and $\vec{g} = [0002]$ the observed dislocations are not strictly parallel with the basal plane. This fact assumes that the dislocations go beyond one basal plane to one another, by a mechanism such as jogs, or by the existence of part of the dislocation in the pyramidal plane.

The initial dislocation density in the ice single crystals obtained by BRIDGMAN or CZOCHRALSKI method is in the order of 10^2 – 10^4 cm/cm². We observe a more important microstructure in artificial ice than in natural ice, and the plastic deformation increases dislocation density and modifies the microstructure.

The results allow us to explain internal friction studies made in our laboratory on specimens with the same origin and agree with thermal conductivity experiments at low temperatures.

J. Perez

NEW ZEALAND

MINISTRY OF WORKS AND DEVELOPMENT, NEW ZEALAND

During 1974/75, glaciological investigations were continued at a reduced level of activity by the Water and Soil Division, Ministry of Works and Development (MWD), Christchurch. Changes in management and organisation of the division have resulted in decreased support for the type of hydrological projects undertaken during IHD and the glacier studies initiated during the decade are now being closed.

SEASONAL SNOW

The 1974 winter was generally mild and dry in the alpine regions with snowfall below normal. The winter was characterised by an unusually high frequency of easterly winds which persisted through the spring when north-westerly winds are usually dominant and usually bring heavy snowfalls to the high alpine regions. However, the eastern foothills received frequent snowfalls from May to October.

Snow courses were monitored at Lake Tekapo by MWD and at Craigieburn by the Forest Service. Work has continued on a preliminary model to assess the snowmelt contribution to Lake Pukaki, the major hydro-lake in the upper Waitaki basin.

TASMAN GLACIER

Mass balance measurements were continued at the three sites representing the névé and the upper and lower parts of the glacier tongue. Continued surface lowering over the tongue and reduction of snow cover in the névé region have made access to the measurement sites increasingly difficult and it has been necessary to use a helicopter to maintain the record.

The project has now been closed after accumulating a nine year record of observations. Since 1965 the glacier has shown a consistently negative mass balance. As an indication of the balance variations during this period the winter balance (specific) and net balance (specific) are listed for the névé site.

Tasman Saddle (altitude 2340m)	Winter Balance (Specific, m water equivalent)	Net Balance
1966-67	+3.4	+2.4
1967-68	+7.3	+5.5
1968-69	+6.0	+4.6
1969-70	+4.3	+1.3
1970-71	+4.1	+2.0
1971-72	+4.4	+3.9
1972-73	+5.7	+4.1
1973-74	+4.7	+2.4
1974-75	+4.0	+1.3

IVORY GLACIER

IHD Representative Basin

Mass balance measurements have continued. Snow accumulation was below average during the 1974 winter and the 1974-75 summer was dry

with above-average temperatures. By the end of the balance year almost no snow remained on the glacier, and a negative mass balance of -4.0 m was recorded over a surface area of 0.8 km². The terminus retreated about 30 m during the year. Streamflow records have been maintained throughout the year.

The project has now been closed, although a photographic record will be continued and a precipitation gauge will be maintained in the basin. Mass balance results for the glacier during the six years of record are summarised below:-

	Maximum (Winter) Balance (m water equivalent)	Annual (Net) Balance
1969-70	+2.1	-2.1
1970-71	+3.9	-1.3
1971-72	+3.0	-1.7
1972-73	+3.1	-1.7
1973-74	+1.6	-3.5
1974-75	+2.1	-4.0

ANTARCTIC

During the 1974-75 summer season the programme of hydrological and glaciological investigations was continued in the "Dry Valleys" region. This programme is operated with support from Antarctic Division (DSIR) and Lands and Survey Department.

Stake networks were measured on the Jeremy Sykes, Alberich, Heimdall, Meserve and Lower Wright glaciers in the Wright Valley and on the Packard Glacier in the Victoria Valley. New stake networks were established on the Upper Wright and Clarke Glaciers to complete a profile of observations in the Wright Valley extending from the coastal piedmont to the continental ice.

Discharge of the Onyx River was recorded through the summer at two locations. The river flow first reached Lake Vanda on 10 December and inflows to the lake resulted in a net gain of 0.33 m in level over the summer. Continuous records of the level of Lake Vanda and Lake Bonney were obtained and the levels of a further seven lakes were measured at the beginning and end of the summer. All lakes except Lake Vashka, which received no inflows, showed significant gains in level during 1974-75.

The Erebus glacier tongue was visited twice during the season but the planned surveys could not be completed due to difficult travelling conditions and lack of time.

During the 1974 winter, instruments were provided to the winter party at Vanda Station to measure wind and temperature profiles at a site on the lake ice. Records were obtained through the winter in conjunction with the climatological programme operated at Vanda by the NZ Meteorological Service.

P. W. Anderton T. J. Chinn

THE DART GLACIER PROJECT

In recent years numerous reports have been received from trampers and climbers of dramatic changes in the glaciers of north-west Otago. In the absence of any glaciological data south of the central alpine region of the Southern Alps of New Zealand, a monitoring programme seemed highly desirable, and a proposal to initiate a small project on the Dart Glacier was suggested. The proposal was greeted with enthusiasm by the Mount Aspiring National Park Board, who agreed to provide a scientific base hut and make funds available for bi-annual visits. The hut was placed on site by helicopter early in March 1975.

The Dart Glacier is a conveniently sized glacier of classical morphology, which feeds the Dart River at the head of Lake Wakatipu. It consists of a flat floored upper basin at an altitude of 1700 m (5500') surrounded by a ring of mountains about 2400 m (8000') high. An icefall, some 150 m (500') high over a resistant rock step buttressed by several greenschist bands, separates the upper basin from a valley glacier some 3 km long and 0.6 km wide. The lower half of this section is covered by surface moraine. The glacier terminus is at an altitude of 1000 m (3500'), the valley section having a gradient of about 115 m/km (600'/mile).

The glaciological programme is deliberately of a rather restricted nature, and is designed to produce information of general interest, rather than a sophisticated glaciological study. A line of ablation/movement poles has been emplaced immediately below the icefall, a series of photo points installed around the glacier, and a levelling point, from which the altitude of the ice surface

can be levelled back onto a stable rock face has been established near the hut.

In view of the mild conditions and heavy exceptionally warm rainfalls in the latter part of March and early April, a brief inspection was made in mid April, before the markers were obscured by winter snowfalls. Ablation in the order of 4–5 cm/day was recorded at all sites. Below the icefall, flow rates are in the order of 1 m/day, although at the levelling site some 0.7 km down valley a flow rate of 0.65 m/day was recorded. The ice level at this point however had dropped 2.5–3.0 m in a period of 35 days. The discrepancy between the amount of ablation and the drop in ice level is thought to be due to the down valley movement of an ice bulge. During this 35-day period the minimum temperature recorded at the hut (altitude 1325 m) was 0.5°C, although a light frost (–0.05°C) was experienced during our visit.

Observations in the upper basin in March indicated no winter snow had survived in the summer melt season below an altitude of c. 2000 m (6500'), and only a very restricted area of snow field is thus contributing to the replenishment of the glacier ice. Furthermore, all winter snow had disappeared from the glacier below the icefall as early as November 1974; thus, this season an ablation period of at least 6 months has occurred. It is of course too early to extrapolate these preliminary figures; however it is expected that a very substantial drop in the ice level will have occurred by the end of the 1975–76 melt season.

D. G. Bishop
(N.Z. Geological Survey, Dunedin)

Advertisement

POST VACANT

Applications are invited for the post of Research Fellow tenable from 1 January 1976 or as soon as possible thereafter to work on the project of mechanical and electrical properties of lake, sea and glacier ice, funded by the Natural Environment Research Council. Principal investigator: Dr J. W. Glen. Candidates should hold a Ph.D in an appropriate branch of physics. Starting salary is on the scale (under review) £3186 — £4206 and superannuation, according to age and experience. Further particulars may be obtained from the Assistant Registrar (S), University of Birmingham, P.O. Box 363, Birmingham B15 2TT, England, to whom applications (3 copies) naming 3 referees should be sent by 30 November 1975.

OLAV LØKEN



Norwegian by birth (now a Canadian citizen), Olav Løken was educated in Oslo. At the University he specialised in mathematics, physics and physical geography for his Cand.Mag., which he obtained in 1954, at the age of 23; he then specialised further in physical geography for the Cand.Real., in 1956, writing his thesis on the glacial geomorphology of the Lake Aursunden area. In the summer vacations his time was taken up with research work at the Norsk Polarinstitut as Assistant Glaciologist and he thus became familiar with the problems of polar glaciology in addition to those of Scandinavian glaciology.

In 1956 he went to Canada as an Assistant Glaciologist at the Arctic Institute of North America in Montreal, and worked on the changes in sea level along the Budd Coast in Antarctica and the movement of the Vanderford Glacier. After two years with the Institute, he moved to McGill University as a Research Assistant, and took his Ph.D there in 1962. During this period, he did much research in northern Labrador and wrote his thesis on the deglaciation and postglacial emergence of that area. In late 1961 he combined teaching and research as Assistant Professor at Queen's University, Kingston, Ontario, where he stayed until the summer of 1964. He investigated glacial deposits in Ontario and in eastern and central Arctic Canada, and also the glaciology and glacial chronology in Baffin Island, concentrating on the Barnes Ice Cap and neighbouring areas.

1964 saw a change of direction in Olav Løken's career. He and his family moved to Ottawa upon his appointment as Chief of the Division of Physical Geography in the Department of Energy, Mines and Resources. His abilities as a manager of research projects were soon confirmed and he became successively Head of the Glaciology Subdivision (1967) and Chief of the Glaciology Division (1972) during the various stages of reorganization of the Canadian scientific civil service.

Within the Inland Waters Directorate, the Glaciology Division carries out research in many parts of Canada: Northwest Territories, Western Cordillera, the prairies, Southern Ontario, St. Lawrence Seaway, and the Arctic Ocean. In addition, laboratory research is undertaken in Ottawa. As Chief, Olav is responsible for the planning, implementation, co-ordination and supervision of the research programme, for budget control and for staffing. The Division has about 40 staff members, who study the many aspects of snow and ice that affect the Canadian environment, and contribute to international scientific programmes and the work of other federal and provincial agencies.

From November 1972 to May 1973, Olav was seconded to the Northern Pipeline Directorate, Task Force on Northern Oil Development, as Project Leader responsible for the programme

planning. In addition to his regular work for the Division, he writes major review papers, sometimes in collaboration with other scientists, on subjects such as Arctic hydrology, iceberg studies, and Arctic Islands Pipeline Project; and helps with the organization of conferences and symposia such as the WMO/UNESCO Symposium on the Role of snow and ice in hydrology (1972) and the Third International Permafrost Conference (1978).

Working Groups on Ice in navigable waters (for the Canadian Committee on Oceanography), on Ice reconnaissance and glaciology (for the Canadian Centre for Remote Sensing), on Research facilities in the North (Advisory Committee on Northern Development), and advisory

and planning committees on Permafrost (National Research Council), Glaciers (N.R.C.), Devon Island (Arctic Institute of North America) and scientific developments on the Canadian North—all these claim his attention, expertise, and calm judgement.

As an Associate Editor of the Canadian Journal of Earth Sciences and a member of the governing bodies of a school, of the International Glaciological Society and other professional bodies, and as Past President of the Canadian Nordic Society, Olav Løken certainly leads a full life—and one that has led him far from the Norwegian glaciers that first inspired his enthusiasm for snow and ice studies.



Advertisement

POST VACANT

An der Philosophischen Fakultät der Universität Innsbruck gelangt ein Ordinariat für Meteorologie und Geophysik zur Wiederbesetzung (Nachfolge Prof. H. Hoinkes).

Vom Bewerber — Habilitation Voraussetzung — wird erwartet, daß er auf den Fachgebieten Allgemeine Meteorologie und Klimatologie in Lehre und Forschung tätig ist. Außerdem wird vom Bewerber die Fortführung der laufenden glazialmeteorologischen und mikrometeorologischen Forschungsprogramme des Instituts gewünscht. Die Belange der Theoretischen Meteorologie werden bereits durch ein bestehendes Ordinariat vertreten.

Bewerbungen sind mit den üblichen Unterlagen (Lebenslauf, Schriftenverzeichnis) bis 15. Oktober 1975 an den Dekan der Philosophischen Fakultät der Universität Innsbruck (Innrain 52, A-6020 Innsbruck, Österreich) zu richten.

INTERNATIONAL GLACIOLOGICAL SOCIETY

ANNUAL GENERAL MEETING 1975

MINUTES OF THE ANNUAL GENERAL MEETING OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY 22 MAY AT THE SCOTT POLAR RESEARCH INSTITUTE, CAMBRIDGE, ENGLAND

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

1. **The Minutes of the 1974 Annual General Meeting**, published in ICE No. 46, 3rd issue 1974, were approved and signed by the Chairman.
2. **The President** gave his report for 1974-75: It has only been 8 months since my last report to the membership which was presented during the Annual General Meeting held at the time of our Remote Sensing Symposium. However, even in this short time there has been considerable activity within the Society. The corrected galley of the papers presented at the Remote Sensing Symposium have now been returned to our printers with the final volume of 480 pages expected to be ready for distribution in July. Those of you that keep track of how long it typically takes for a major symposium to be published, will, I am sure, join me in complimenting our editors on their efforts. Work is well under-way on the proceedings volume from the Symposium on the Thermal Regime of Glaciers and Ice Sheets which was held during April 1975 at Simon Fraser University in British Columbia, Canada and to which I referred in my last report. Dr Glen has informed me that this volume should be available early in 1976. Finally, we are well into the preparations for our next special symposium: on Applied Glaciology, which will be held in Cambridge in the fall of 1976. In addition the branches of the Society have been active, with the Northeastern North American Branch concluding a very successful meeting in February that featured the second Can-Am glaciological ski race. All entrants performed with skill and derring-do. The only unfortunate feature of the race was that we mistakingly allowed my 11 year old son to run the course and he beat me by three seconds, and I am reminded of this event quite frequently. The Nordic Branch is planning to meet in Finland, and the Western Alpine Branch in France later this year. It is my belief that our branch activities have been extremely successful by being informative, informal, and fun. The branch activities have also been a great aid in adding new members to the Society.

These signs of activity, in publishing and in meetings, are very encouraging and indicate that the Society is both well supported and well served. This is important for these are difficult times financially for learned societies. The Treasurer will soon be revealing the details of our finances and the measures we propose to use in dealing with the problems facing us. Even though we shall have to charge more for our publications, we still feel that they will remain unusually good value for the money: in 1975, 1976 and 1977 members will receive nearly twice as many pages of the Journal, in two volumes instead of one. This is due to our policy of publishing symposia proceedings as regular Journal issues. Libraries are also now charged on a per volume basis each year as opposed to a simple annual basis. This, coupled with the possibility of obtaining occasional external assistance in publishing proceedings volumes, makes us believe that we will be able to handle the extra heavy expenditures involved.

Whether our current staff can continue to handle this intense work load remains to be seen. There is a limit to the number of hours that even the most dedicated person can devote to a job. In looking ahead in our financial planning we must ensure that we can meet increased costs for editing and administration. Once again I must repeat the message given to you many times before, we are a society of individuals and as such increased membership is our only sure income. By holding symposia on glaciological subjects of interdisciplinary interest, we can both further our own horizons and attract new members from fields not previously covered by our membership. For instance we hope that the Journal's enlarged scope, coupled with our coming Applied Glaciology symposium, will persuade engineers concerned with ice related problems to contribute to the Journal and join the Society. At present our membership stands at 1025 and 676 libraries purchase the Journal.

I am sorry to note the untimely death of Professor Hoinkes, who served the Society as a Vice-President during 1964-1967. His presence at our meetings will be sadly missed. Finally I would like to thank the Secretary,

the Council and the many members who have assisted me during the last three years. Your help has made my term of office a pleasure. I would also like to extend my best wishes to Marcel de Quervain as he assumes the office of the President and to our new Vice-Presidents and Council members. The Society's affairs are clearly in most capable hands.

This concludes my report to you for 1974-1975.

3. **The Treasurer, Dr J. A. Heap,** gave his report:

The accounts for 1974 show that the Society's affairs were arranged in the course of the year to achieve a deficit of £67 as compared with deficits for 1971 and 1972 of £1512 and £636 respectively and a surplus for 1973 of £720. I use the word "achieve" advisedly. In my last Report to you covering 1973 I forecast a "substantial" deficit in 1974. Given that the official British government figure for inflation during 1974 was 19.9% it was, indeed, an achievement on the part of your Secretary, in her day to day handling of the Society's finances, to practically break even. During the year the costs of printing the **Journal of Glaciology** increased from £5939 (1973) to £7367 and administrative costs increased from £5197 to £6570.

I closed my last Report with the warning that the need for your Council to consider raising the subscription rates was "one year nearer". The inflation phenomenon has been worldwide in its effects, and it will not, therefore, come as a surprise that the need has now caught up with us. Your Council has therefore decided that the subscription rates will be increased as from the beginning of 1976.

Your Council has given close consideration to how much the rates should be raised. Five factors have influenced your Council:

(i) The British government figures for inflation since the subscription rates were last raised on 1 January 1972 until mid April 1975 suggest the need for a subscription rate for Members of £7.79 in order to achieve the same purchasing power as £5 had on 1 January 1972.

(ii) The Society should so arrange increases in its subscription rates that the interval between them is as long as reasonably possible. The Council has, in part, based the 1976 rate rise on the expectation that subscriptions will not need to be raised again until 1979.

(iii) Because inflation has been running at a higher rate in Britain than in most other countries and because the pound sterling has been consequently devalued against other currencies, the proposed increase for the majority of Members of

the Society and Libraries, who pay in currencies other than sterling, will be less, in real terms, than appearances would suggest.

(iv) Your Society needs to continue its progress towards paying the market price for the editing and secretarial services it requires.

(v) The number of pages published in the **Journal of Glaciology** in 1971 was 424 as compared with 567 in 1974. Moreover, the Society's policy of editing and publishing the proceedings of international glaciological conferences and symposia will result in a very considerable improvement in the services offered to Members of the Society. In 1975 it is expected that Members will receive not only the normal volume of three issues (about 500 pages) but, in addition, a separate volume of 482 pages comprising the proceedings of the Remote Sensing in Glaciology Symposium held in Cambridge in September 1974. Other such additional volumes are expected in the next four years.

Taking all these factors into account your Council has decided that subscription rates should be increased as from 1 January 1976 to:

Members	£10 (covering all our publications)
Junior members	£4 (covering all our publications)
Libraries	£20 (per volume of the Journal)

Much as your Council regrets the need for this increase, it is felt to be justified by the factors outlined above.

4. **Election of auditors for the 1975 accounts:**

Dr J. G. Paren proposed and Dr G. Manley seconded that Messrs Peters, Elworthy and Moore, of Cambridge, be elected auditors for the 1976 accounts. This was carried unanimously.

5. **Elections to the Council 1975-78:**

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	M. de Quervain
Vice-Presidents	E. R. LaChapelle C. W. M. Swithinbank
Elective Members	C. B. Bull M. Kuhn O. Løken I. Zotikov

The President thanked the retiring Council members for their years of service: A. Corte, V. M. Kotlyakov, W. S. B. Paterson and R. Vivian. He gave special thanks to Valter Schytt, who had served on the Council since 1967 and as President 1969-72.

ANNUAL CONFERENCE 1975

Sixty members of the Society, from 10 countries, gathered in Cambridge from 21-23 May to hear about the latest research projects and to join in discussions. The following are some of the contributions. (For further information, please write to the authors.)

- D. J. Gooman & A. J. Allan—Wire strainmeters on ice.
D. C. B. Evans & J. F. Nye—The physics of skating.
P. Martin—Ridges on snow domes.
M. Hambrey—Foliation, minor folds and boudinage in glacier ice.
G. S. Boulton & E. Morris—The formation of glacier fluting in lodgement till.
W. B. Whalley—Thin valley glacier tongues as a model for rock glacier behaviour.
F. Müller—Some preliminary results of the North Water Project.
W. F. Weeks & J. F. Nye—AIDJEX.
D. A. Peel—Oxygen isotopes in the Antarctic Peninsula.
M. F. Ashby—Some recent theoretical studies on the sintering of snow.

- J. G. Paren—Dielectric behaviour of artificially produced snow.
O. Orheim—Glaciological significance of microwave images of Antarctica.
P. Sellman, W. F. Weeks & W. J. Campbell—Some interesting features of SLAR imagery from ice-covered lakes on the Alaskan North-slope.
D. J. Drewry—Implications of network topology of glaciers in the Transantarctic Mountains.
C. W. M. Swithinbank—Antarctic Peninsula radio echo sounding 1975.
C. S. M. Doake—Bottom sliding measured by radio echo sounding.
H. Björnsson—The explanation of jökulhaups from Grimsvötn, Vatnajökull, Iceland.
D. N. Collins—Sediment transport in the Gornera, Gornergletscher, Switzerland.
M. Kuhn—The effect of gross surface features on the albedo of polar snow fields.
V. Haynes—Network topology in Scotland.
I. Hogg—Heat, ice and water balances in South Georgia.
G. Ashton—The arching of fragmented ice covers.

SYMPOSIUM ON PHYSICS & CHEMISTRY OF ICE 1977

A Symposium on the Physics and Chemistry of Ice will take place on 11-16 September 1977 in Cambridge, England, and will be organized by the International Glaciological Society. Information about topics, the submission of summaries and final papers will be given in circulars to be published in 1976.

The Symposium will form one of the series, the latest of which was held in Ottawa in 1972.

PUBLICATION

Papers presented at the Symposium will be refereed according to the usual standards of the Journal of Glaciology before being accepted

for publication in the Proceedings of the Symposium. The Proceedings will be published by the International Glaciological Society as a volume of the Journal of Glaciology.

FURTHER INFORMATION

You are invited to attend this Symposium. Requests for copies of the First Circular and enquiries about the Symposium should be addressed to:

The Secretary,
International Glaciological Society,
Cambridge CB2 1ER,
England.

SYMPOSIUM ON DYNAMICS OF LARGE ICE MASSES 1978

A Symposium on the dynamics of large ice masses will take place in August or September 1978 and will be organized by the International Glaciological Society. (The exact dates and venue will be announced later.) Information about topics, the submission of summaries and final papers will be given in circulars to be published in 1976 and 1977.

PUBLICATION

Papers presented at the Symposium will be refereed according to the usual standards of the Journal of Glaciology before being accepted for publication in the Proceedings of the Symposium.

The Proceedings will be published by the International Glaciological Society as a volume of the Journal of Glaciology.

FURTHER INFORMATION

You are invited to attend this Symposium. Requests for copies of the First Circular and enquiries about the Symposium should be addressed to:

The Secretary,
International Glaciological Society,
Cambridge CB2 1ER,
England.

INTERNATIONAL GLACIOLOGICAL SOCIETY

BRANCH MEETINGS 1974 & 1975

The North-East North American Branch met in Hanover, New Hampshire in February 1975
(see report in ICE 47, p. 17-18).



Members worked hard in the sessions,



competed in the 2nd Can-Am Ski Race and



wined and dined, to the accompaniment of an inimitable speech on the state of the Society from W. F. Weeks, President at that time.

(Photographs by S. Ommanney & S. Colbeck)

The Nordic Branch, whose 1974 meeting took place in the Jostedalsgreen area of Western Norway in August (see report in ICE 47, p. 15-16), clearly believes in training glaciologists from infancy



. and has a distinct family atmosphere on its excursions.



(Photographs by V. Schytt)

One issue of ICE each year has a 4-page spread of photographs, produced by photo-lithography to be as inexpensive as possible. Thus some photographs submitted to the Editor may have to wait several months before they can be included in such an issue. Even though they have then lost some topicality, they are still interesting as a record — and often even more amusing because in retrospect. (The Editor also has a file of "candid camera" shots, submitted by her more daring contributors: eventual publication will depend on how many other contributions are forthcoming, to make a supplement already christened 'ICE TWO — or BERGY BITS'.) Ed.

The Western Alpine Branch held its 1974 meeting in Courmayeur, Italy (see summary in this issue of ICE, p. 15)



under the Presidency of A. Bezinge



and with L. Lliboutry chairing one of the sessions.



Several well organized visits were paid to neighbouring glaciers, including the Glacier de Pré de Bar.

SYMPOSIUM ON THE THERMAL REGIME OF GLACIERS AND ICE SHEETS

held at Simon Fraser University, B.C., Canada, April 1975



Participants enjoyed
the fine view from
Simon Fraser
University

. and the lively conversation
during meal-times (top right inset
— Brian Sagar, local organizer).

The lectures



(under the watchful eye of
Dr Nye) were interesting
and often challenging.



Photographs by G. Holdsworth

The Proceedings of the Symposium will be published in **early 1976** in the *Journal of Glaciology*, Volume 16, Number 74. Members of the Society whose dues are fully paid up will receive copies automatically.

BRANCH NEWS

WESTERN ALPINE BRANCH 1974

It was to work on the theme of "Method and technology of moraine dating and historical climatological research" that delegates gathered together at the Hôtel Palace Bron in Courmayeur on the rainy morning of 6 September 1974. Some courageous souls who had left Chamonix the previous day to cross the Mont Blanc massif by the Col du Géant had enjoyed the advantage of some beautiful weather to put them in the mood for glaciology.

At the scene of the colloquy, Vice-President Corrado Lesca, assisted by a team from the Comitato Glaciologico Italiano which had spared neither time nor effort, had done a masterful job of organizing these three days which will certainly be remembered by the delegates as both highly enjoyable and scientifically profitable. We could never pay sufficient thanks to all the organizers for their contribution to the complete success of this colloquy.

Full details about the meeting may be obtained from the Secretary of the International Glaciological Society.

NEW OFFICERS:

In conformity with the statutes, Vice-President Corrado Lesca becomes president for the coming year.

François Valla and Gérard Bocquet agreed to stand as candidates for the posts of Vice-President and Secretary-Treasurer respectively.

The assembly accepted these candidatures and unanimously elected the new officers.

FOURTH COLLOQUY (1975)

Date: from Friday 3 October to Sunday 5 October 1975.

Theme of excursions: rocky glaciers; buried ice, fossil or modern; glaciers in a karst landscape, etc.

The studies presented will be approached from glaciological, climatic, physico-chemical angles, but also from historical (former uses) and practical points of view.

Place: Barcelonnette and Massif du Chambeyron, Alpes de Haute Provence, France.

JOURNAL OF GLACIOLOGY

The following papers have been accepted for publication in forthcoming issues of the Journal of Glaciology:

Raymond D. Watts & A. W. England

Radio echo sounding of temperate glaciers: ice properties and sounder design criteria.

M. J. Gay & J. Latham:

The freezing behaviour of supercooled water drops.

W. S. B. Paterson:

Vertical strain-rate measurements in an Arctic ice cap and deductions from them.

R. LeB. Hooke:

Pleistocene ice at the base of the Barnes Ice Cap, Baffin Island, N.W.T., Canada.

D. E. Garfield & H. T. Ueda:

Resurvey of the "Byrd" station, Antarctica drill hole.

E. M. Morris:

Experiments on the motion of ice past obstacles by regelation.

S. Mae:

The freezing of small Tyndall figures in ice.

M. Vallon, J. R. Petit & B. Fabre:

Study of an ice core to the bedrock from an Alpine glacier.

C. M. Clapperton & D. E. Sugden:

The maximum extent of glaciers in part of West Falkland.

E. C. Potter:

Pleistocene glaciation in Ethiopia: new evidence.

C. S. M. Doake, M. Gorman & W. S. B. Paterson:

A further comparison of glacier velocities measured by radio-echo and survey methods.

M. Ricq-de Bouard:

Instruments and methods: A method of concentrating the major impurities contained in ice by ion exchange.

S. C. Colbeck:

Instruments and methods: on the use of tensiometers in snow hydrology.

H. Oeschger, B. Stauffer, P. Bucher & M. Moell:

Instruments and methods: Extraction of trace components from large quantities of ice in bore holes.

Short Notes

R. A. Sommerfeld, R. M. King & F. Budding:

A correction factor for Roch's stability index of slab avalanche release.

P. J. Martin:

Ridges on Antarctic ice rises.

THE LIBRARY

BOOKS RECEIVED:

AIDJEX Bulletin, Seattle, No. 28, 1975.

Asseyev, A. A. *Drevniye materikovyye oledeneniya Yevropy* [Ancient continental glaciations of Europe]. Moscow, Izdatel'stvo "Nauka", 1974. 319p.

Ashton, George D. Air bubbler systems to suppress ice. *U.S. Army Cold Regions Research and Engineering Laboratory. Special Report* 210, 1974, viii, 37p., illus. [Two-dimensional line source systems used to induce convective melting of under-surface of ice cover are analysed and effectiveness predicted.]

Ashton, George D. Isua, Greenland: glacier freezing study. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 334, 1975, vii, 19p., illus. [Examines scheme for cooling lower portion of edge of ice sheet, which abuts potential mining operation. Over period of one year, it appears possible to cool this portion by -1° to -2°C .]

Brown, R. J. E. and Kupsch, W. O., eds. Permafrost terminology. *Canada. National Research Council. Associate Committee on Geotechnical Research. Technical Memorandum* No. 111, 1974, 62p. \$3.

Bushuyev, A. V. and others. *Atlas ledovykh obrazovaniy* [Atlas of ice formations]. By A. V. Bushuyev, N. A. Volkov, V. S. Loshchilov. Leningrad, Gidrometeoizdat, 1974. 139p., illus. [Glossary in Russian and English, with many annotated photographs.]

Calkins, Darryl J. and Ashton, George D. Arching of fragmented ice covers. A laboratory study. *U.S. Army Cold Regions Research and Engineering Laboratory. Special Report* 222, 1975, iv, 16p., illus. [Reports study of arching across gap in surface obstacle.]

Hattersley-Smith, G. *North of latitude eighty. The Defence Research Board in Ellesmere Island*. Ottawa, Defence Research Board, 1974. ix, 121p., illus.

Hibler, William D., III and others. Differential sea ice drift. By Hibler, William D., III, Weeks, Wilford F., Kovacs, Austin and Ackley, S. F. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 329, 1975, v, 37p., illus. [Analyses 1972 AIDJEX (Arctic Ice Dynamics Joint Experiment) results: spatial and temporal variations in sea ice deformation, and comparison of mesoscale strain measurement with linear drift theory predictions.]

Hobbs, Peter V. *Ice physics*. Oxford, Clarendon Press, 1974, xvii, 837p. £27.00. [To be reviewed in the *Journal of Glaciology*.]

Kerr, Arnold D. The bearing capacity of floating ice plates subjected to static or quasi-static loads. A critical survey. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 333, 1975, iv, 43p., illus. [Literature survey.]

Mahaney, W. C., ed. *Quaternary environments: proceedings of a symposium. First York University Symposium on Quaternary research*, 1974. Toronto, York University, Atkinson College, 1974. vii. 318p. (Geographical Monographs No. 5.)

Munis, R. H. and others. Detecting structural heat losses with mobile infrared thermography. Part 1. Description of technique. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 326, 1974, iii, 13p., illus. [Method of assessing quickly insulation effectiveness.]

Outcalt, S. I. and others. A digital computer simulation of the annual snow and soil thermal regimes at Barrow, Alaska. By Outcalt, S. I., Goodwin, C., Weller, G. and Brown, J. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 331, 1975, iv, 18p., illus. [Demonstrates feasibility of constructing generalised annual snow-soil temperature model of tundra and permafrost terrains.]

Pavlov, A. V. and Olovin, B. A. *Iskusstvennoye ottaivaniye merzlykh porod teplom solnechnoy radiatsii pri razrabotke rossypey* [Artificial thawing of frozen ground by warm solar radiation during mining of placer deposits]. Novosibirsk, Izdatel'stvo "Nauka", 1974. 182p.

Smirnov, V. I. *Ledovyye usloviya plavaniya sudov v vodakh kanasko-alyaskinskoy Arktiki* [Ice conditions affecting navigation in Canadian and Alaskan waters]. Leningrad, Gidrometeoizdat, 1974. 179p.

Sweeny, Bruce D. and Colbeck, Samuel C. Measurements of the dielectric properties of wet snow using a microwave technique. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 325, 1974, vi, 33p., illus. [Concludes that dielectric constant is function of porosity and water content only.]

Takagi, S. Spline approximation to the freezing of water in a cylindrical hole drilled in an ice sheet. *U.S. Army Cold Regions Research and Engineering Laboratory. Research Report* 328, 1975, iii, 13p. [Supplement to Research Report 323.]

- T. J. Hughes. Is the west Antarctic ice sheet disintegrating? *ISCAP Bulletin* (University of Maine at Orono), No. 3, 1974, iv, 93p.
- Takahashi, Kihei. *Nippon no yuki* [Snow of Japan]. [Tokyo], Yomiuri Shinbunsha, 1974. 143p. [Extensive collection of unusual, interesting and beautiful photographs of snow forms.]
- Thompson, G. E., ed. *Proceedings . . . Second Canadian Symposium on Remote Sensing. University of Guelph, Guelph, Ontario, Canada. April 29-May 1, 1974. Theme: the applications of remote sensing and benefits to Canada. . . . Vols. 1 and 2.* Ottawa, Canadian Remote Sensing Society, 1974. 2 vols.
- Timokhov, L. A. Dinamika ledyanogo pokrova [Dynamics of floating ice]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 316, 1974, 218p.
- Tolstikhin, O. N. *Naledi i podzemnyye vody Severo-Vostoka SSSR* [Nalads and underground waters of north-eastern U.S.S.R.]. Novosibirsk, Izdatel'stvo "Nauka", 1974. 164p.
- Avalanche protection in Switzerland. *U.S. Dept. of Agriculture. Forest Service. General Technical Report RM-9*, 1975, vi, 168p. [Translation of F. Castleberg and others, eds. Lawinenschutz in der Schweiz. *Bündnerwald. Zeitschrift des Bündnerischen Fürstvereins und der SELVA, Genossenschaft der bündnerischen Holzproduzenten*, Beiheft Nr. 9, 1972. Contains 16 articles.]
- Wilhelm, Friedrich. *Schnee- und Gletscherkunde*. Berlin/New York, Walter de Gruyter, 1975. vii, 434p. (Lehrbuch der Allgemeinen Geographie, Bd. III/3). [To be reviewed in the *Journal of Glaciology*.]
- [Sea Ice.] *Problemy Arktiki i Antarktiki*, Vyp. 43-44, 1974.

GLACIOLOGICAL DIARY

1975

- 24-26 October
Conference on glacial and periglacial processes and landforms, Glasgow, U.K. British Geomorphological Research Group. (Dr R. B. Price, Dept. of Geography, University of Glasgow, Glasgow G12 8QQ, U.K.)
- 2-9 November
Symposium on global scale palaeolimnology and palaeoclimate, Kyoto, Japan. (Bureau, Otsu Hydrobiological Station, Kyoto University, Otsu 520-01, Japan.)
- 1-8 December
Symposium on hydrological characteristics of river basins, Tokyo Prince Hotel, Tokyo, Japan. Sponsored by International Association of Hydrological Sciences, organized by Science Council of Japan. (Arnold I. Johnson, USNC/IAHS, U.S. Geological Survey National Center, MS-417, Reston, VA 22092.)
- 12-16 December
The Second World Congress of Water Resources, New Delhi, India. (C. V. J. Varma, Secretary Indian National Committee for International Water Resources Association, Central Board of Irrigation and Power, Kasturba Gandhi Marg, New Delhi-110001, India.)
- 14-19 December
Conference on foundations on Quaternary deposits, Norwich, England. Engineering Group of Geological Society of London. (A. B. Hawkins, Dept. of Geology, University of Bristol, Bristol BS8 1TL, England.)

1976

- 26-30 July
Cloud Physics Conference, Boulder, CO, USA. Sponsored by International Association of Meteorology and Atmospheric Physics and International Commission on Cloud Physics; co-sponsored by American Meteorological Society. (H. K. Weickmann, NOAA/APCL, Boulder, CO 80302, USA.)
- 22-26 July
Symposium on the geography of the polar regions, Leningrad, USSR, prior to International Geographical Congress. (A. F. Treshnikov, Organizing Committee of the 23rd International Geographical Congress, symposium: The Geography of the Polar Regions, Staromonetny per.29, Moscow 109017, USSR.)
- 28 July-3 August
23rd International Geographical Congress, Moscow, USSR, (V. Annenkov, Institute of Geography, Academy of Sciences USSR, Staromonetny 29, Moscow 109017, USSR.)
- 15-25 August
25th International Geological Congress, Sydney, Australia. (Secretary-General, 25th International Geological Congress, P.O. Box 1892 Canberra City, ACT 2601, Australia.)
- 23-27 August
International Weather Modification Conference, Colorado Springs, CO. Sponsored by International Association of Meteorology and Atmospheric Physics/International Commission on Cloud Physics and Weather Modification Panel of World Meteorological Organization; co-sponsored by American Meteorological Society and Academy of Science of Australia. (H. K. Weickmann, NOAA/APCL, Boulder, CO 80302, USA.)

Autumn

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

- 12-18 September
Symposium on Problems of Applied Glaciology, Cambridge, England. International Glaciological Society. (Mrs. H. Richardson, Secretary, Cambridge CB2 1ER, England.) (See this issue of ICE for Second Circular.)

1977

- 16-24 August
International Union for Quaternary Research, 10th Congress, Birmingham, England. (W. G. Jardine, Dept. of Geology, University of Glasgow, Glasgow G12 8QQ, U.K.)
- 11-16 September
Symposium on Physics and chemistry of ice, Cambridge, England. International Glaciological Society. (Mrs H. Richardson, Secretary, International Glaciological Society, Cambridge CB2 1ER, England.)

1978

- 10-13 July
Third International Conference on Permafrost, Edmonton, Alberta, Canada. National Research Council of Canada. (M. K. Ward, c/o National Research Council of Canada, Ottawa, Ontario K1A 0R6, Canada.)
- August & September
Symposium on Dynamics of large ice masses. (Venue to be announced.) International Glaciological Society. (Mrs. H. Richardson, Secretary, Cambridge CB2 1ER, England.)

REVIEWS

R. J. E. Brown and W. O. Kupsch. *Permafrost terminology*. National Research Council of Canada, 1974. 62 p.

Drs Brown and Kupsch have performed a needed service in bringing out this terminology. Such guides, while essential, are of their nature temporary; at least, they have to be continually revised as knowledge of their subject matter grows. The authors recognise this—and all the more credit to them for having a first go. They are selective, as they should be. Their object is 'to promote current usage where it is acceptable and encourage development of better usage where improvement is required'. They have chosen 146 concepts for inclusion, and have provided a definition and a term for each. The definitions are short, but often followed by helpful 'comment', which explains and justifies the definition and sometimes discourages use of other terms for the same concept. References are given to fifty or so key sources, and there are twenty illustrations.

This is the right way to begin. There should now be criticism, argument, additions and deletions; not too much, for the authors have probably pondered the subject more carefully than most potential critics, but some. More photographs could be added, too. In this way one may hope that a consensus will gradually grow, the useful terms surviving and the superceded terms disappearing.

Terence Armstrong

Gwen Schultz. *Ice Age Lost*. Anchor Press/Doubleday, New York, 1974. 342p.

This is an informative book written for the general reader in that industriously bright and lively manner that has become fashionable in America; a twentieth century development of the popular scientific works that the Victorians found agreeable a hundred years ago. It is a style that we begin to know in Europe, with its hint of that combination of curiosity, shrewdness, irony and love of excitement that flourishes in the huge monotony around Old Man River.

Of its kind, the book is good; the author tells a coherent story about the world's store of natural ice on land, its behaviour, its vicissitudes past and present, with embroideries on climatic fluctuation, the tourist industry, prehistory and the march of civilisation. It is furnished with a useful collection of references, some attractive glacier photographs, and an index. We are not given many figures or quantities. The author, an accomplished "science writer", tells us that for some time she has known that the glacier story was not getting across as well as it might. She writes from the home of the University of Wisconsin, with its world reputation in the field

of Quaternary research, and she has done her homework well, from a good source of inspiration and assistance to which she gives proper acknowledgement, together with a number of institutions abroad. British readers will like to read of corries and tarns, even if they will question the notion (p. 272) that fog is the most expected attribute of London; and she is agreeably up-to-date for example on the subglacial contours of Antarctica. Quite a number of informed readers will be entertained by the author's quest for metaphor in explaining so much in terms of drama—not of the Goodies and Baddies dear to the simple-minded, but of heat and cold; for like so many of us she has a liking for the ice.

We are taken on to a summary of the recent developing interest in the prospect of climatic fluctuation and change; we hear of Neanderthal Man and Homo Sapiens, of Ellsworth Huntington, of those Norse colonists in Greenland. Recent meteorological events like the great Chicago snowstorm of 1967 and the disturbing effects of drought and heat in New York provide salutary reminders; but some European events of the winter of 1963 appear to be exaggerated. Not only do we learn how those favourite old Italian wolves reappeared around Rome; Englishmen will find it odd to read that Londoners plodded through a foot of snow for two months in 1963; very few Scots can have found sheep on their roofs. But in the great cities of America the provision of artificial shamrocks in Dublin for St. Patrick's Day must indeed have been news. None the less, the author covers a wide field indeed, and while there will be a good many statements that will give pause for the expert, as a whole the book fulfils its purpose in providing lively descriptive reading around the theme of the world's glaciers. And the author does well to remind her readers how little we really know from the existing scatter of meteorological observations over the past two centuries or so. Not really a book for the informed; but lively, well enough put together, and fulfilling a demand.

Gordon Manley

Polar Deserts and Man. Eds. T. L. Smiley and J. H. Zumberge. The University of Arizona Press, Tucson, Arizona, 1974. 173p.

Polar deserts are defined in the preface of this book as glacier-free regions of the earth's surface where not more than 25 centimetres water equivalent of precipitation fall per year and monthly mean temperatures never exceed 10° Celsius.

The book itself is adapted from fourteen papers presented at the Polar Deserts Symposium sponsored by the Committee on Arid Lands of the

American Association for the Advancement of Science at Philadelphia in December 1971. The selected contributions are published under authors' names although the collection does not claim to be a complete or official report of the proceedings of that Symposium. The book is handsome. Its text is generously illustrated with line drawings, tables and photographs which are generally relevant, well-captioned and of good quality. A more informative picture of the ubiquitous snowmobile than figure 12.17 should perhaps have been provided. Most chapters have a useful bibliography and the book itself is thoroughly indexed.

The majority of contributions are in the nature of reviews by experts in their particular fields of interest. This gives the book authority, a wide appeal and a slightly uneven style. There is no systematic use of cross-references between contributions and certain key ideas, such as the definition of a polar desert region and the fragility of the desert ecosystem, are very frequently repeated. However the book is well arranged: part one is a logical sequence of papers dealing with the polar desert environment: its climate, geomorphology, geology and limnology, soils, micro- and macro-ecological systems and its indigenous peoples. These contributions are generally of a high standard. The first paper is rather marred by some careless definitions and obscurities. For example on page 3 the radiation terms under discussion cancel out of the quoted heat balance equation. On page 6 Fourier's series is misquoted and does

not contain the quantities a_1, a_2 which it is purported to define. Furthermore this reviewer sometimes found it difficult to take the author's meaning or to concur with the conclusions he draws from his data. It would perhaps have been better, in view of the structure of the rest of the book, to have started with a less specialised paper: an informed and digestible review of the regional climate. This would woo the general reader and lay a useful foundation for the subsequent interesting and lucid articles.

Part two deals with the costs (in the widest sense) and the problems of developing arctic desert resources. There are major technical difficulties of supply and construction peculiar to polar deserts; the discussion also touches upon the philosophy and practice of nature conservation in the high arctic.

Part three reviews problems of transport, health and housing which face immigrants. The polar wilderness fascinates the scientist and challenges the technologist, but it can provide a dreary dwelling place for the dependants of immigrants and for settled indigenous people. Boredom, isolation and stress, it seems, can lead to low spirits, the breakdown of community life and even crime in the high arctic just as in any deprived urban community.

I commend this collection of thoughtful and interesting professional essays as an education for the general reader and as a valuable source of information for anyone proposing to associate himself with the high arctic.

Michael Walford

NEWS

AWARDS

Dr Gordon Robin, Director of the Scott Polar Research Institute, Cambridge, has been awarded one of the two premier medals of the Royal Geographical Society—the Patron's Medal—for his work in polar research and exploration. He has also been elected Vice-Master of Darwin College, Cambridge.

Dr Willi Dansgaard, head of the Geophysical Isotope Laboratory, København, has been awarded the Vega Medal of the Swedish Society for

Anthropology and Geography for his work in stable isotope glaciology.

Sir Vivian Fuchs, a Past President of the International Glaciological Society, has been made a Fellow of the Royal Society for his lifelong furtherance of scientific research in the Antarctic.

Dr J. A. Jacobs, head of the Department of Geodesy and Geophysics, Cambridge, has been awarded the medal of the Canadian Association of Physicists for his achievements in physics.

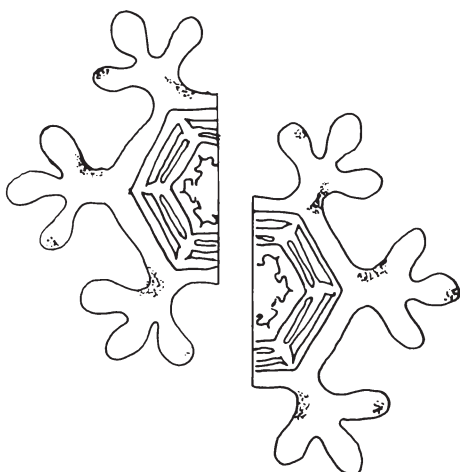
NEW MEMBERS

- Bozonnet, Rémi, Institut de Géographie Alpine, Rue Maurice Gignoux, 38031 Grenoble, France.
 Germain, 91530 St. Cheron, France.
- Brügger, Franz, Bergbahnstrasse 592, 6780 Schruns Vorarlberg, Austria.
- Burroughs, Benjamin J., 2 Faculty Court, Bozeman, MT 59715, USA.
- Claraz, Jeannette, 1301 Les Poissons, Place Charras, 92400 Courbevois, France.
- Classen, David F., Department of Physics, University of Victoria, Victoria, British Columbia, Canada.
- Darmois, Mireille, Rue des Marsaults, Le Val-St. Germain, 91530 St. Cheron, France
- Escritt, E. A., 86 Dovedale Crescent, Buxton, Derbyshire SK17 9BQ, England.
- Eyles, N., Department of Geography, Memorial University of Newfoundland, St. John's, Newfoundland A1C 5S7, Canada.
- Fujii, Toshishige, Snow and Ice Research Laboratory, Railway Technical Research Institute, Japanese National Railways, Kokubunji-City 2-8-38, Tokyo 185, Japan.
- Galibert, G., 7 Rue de Vincennes, 35000 Rennes, France.
- Gell, Alan W., Department of Geography, University of British Columbia, Vancouver, B.C., Canada.
- Hansom, James D., Department of Geography, University of Aberdeen, Scotland.
- Harrison, William L., RR1 Box 191, New London, NH 03257, USA.
- Hronek, Clarence L., 5347 McKinnon St., Vancouver, B.C. V5R 4C7, Canada.
- Ishihara, Dr K., President KCS Co. Ltd., Nishimaki Building, 4, 6-Bancho, Chiyoda-ku, Tokyo, Japan.
- Jorda, M., La Source, Chemin de la Repentance, 13100 Aix en Provence, France.
- Kenning, Michael J., School of Mathematics and Physics, University of East Anglia, Norwich NOR 88C, England.
- Keage, Peter, Glaciology Section, Department of Meteorology, Melbourne University, Melbourne, Australia.
- Klouda, George A., Department of Geology, State University of New York at Buffalo, 4240 Ridge Lea Road, Amherst, NY 14226, USA.
- Körner, Dr Helmut J., 8014 Neubiberg, Eichenstrasse 15, West Germany.
- McMechan, Robert D., 1185 Lawson Avenue, West Vancouver, B.C. V7T 2E4, Canada.
- Milnes, A. G., Eidg. Technische Hochschule Zürich, Geologisches Institut, CH-8006, Zürich, Sonneggstrasse 5, Switzerland.
- Mitchell, W. A., Department of Geography, Polytechnic of North London, Marlborough Building, 383 Holloway Road, London N7 6PN, England.
- Monterin, Willy, Osservatorio M. Rosa, 11020 Gressoney la Trinité, Aosta, Italy.
- Reynaud, L., Les Chaumières, Herbèys, 38320 Eybens, France.
- Rossiter, James R., Department of Physics (Geophysics), University of Toronto, Toronto, Ontario M5S 1A7, Canada.
- Röthlisberger, Frédéric, Kirchgartenweg 15, CH 5000 Arrau, Switzerland.
- Russ, Ronald G., 4603 North Ninth St., Tacoma, WA 98406, USA.
- Shinojima, Kenji, Snow and Ice Research Laboratory, Railway Technical Research Institute, Japanese National Railways, Kokubunji-City 2-8-38, Tokyo 185, Japan.
- Smith, Ian N., 14 Davis St., West Coburg, Victoria 3058, Australia.
- Sonnier, J., CT GREF BP 114, 38402 St. Martin de'Hères, France.
- Suggitt, S. C., Department of Geography, University of Liverpool, Liverpool L69 3BX, England.
- Valadas, B. 4, Rue Malledent de Savignac, 87000 Limoges, France.
- Vining, Mark R., 15713 SE 26th St., Bellevue, WA 98008, USA.
- Waddington, Edwin D., Department of Geophysics & Astronomy, University of British Columbia, Vancouver, B.C. V6T 1W5, Canada.
- Wilson, Jeffrey C., Department of Meteorology, University of Melbourne, Melbourne, Victoria 3052, Australia.
- Woodruff, A. H. W., Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER, England.
- Wrenn, Miss S., University of Alaska, AEIDC, 707 A. St., Anchorage, Alaska 99501, USA.
- Yano, Katsutoshi, The Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.

INTERNATIONAL GLACIOLOGICAL
SOCIETY

**SYMPOSIUM ON
APPLIED GLACIOLOGY**

(application of fundamental
properties of snow and ice to the
solution of engineering problems)



Cambridge, England

12-17 September 1976

*Organized by the
International Glaciological Society*

SECOND CIRCULAR

August 1975

A Symposium on Problems of applied glaciology will be held in Cambridge, England, 12-17 September 1976. Registration will take place on Sunday 12 September and sessions will be held from Monday 13 to Friday 17 September.

1. PARTICIPATION

This circular includes booking forms for registration and accommodation. The forms should be sent to the Secretary **before 1 June 1976** with the appropriate deposits, as indicated on each form. (Registration fees cover organization costs and distribution of preprints of summaries.)

Payment should be made—

by **cheque** payable to: International Glaciological Society Symposium, and sent to the Secretary; or

by **Bank transfer** to: International Glaciological Society Symposium, Account No. 54775302, and sent to the National Westminster Bank Ltd., 67 St. Andrew's Street, Cambridge CB2 3BZ, England; or

by **Giro transfer** to: Post Office Giro Account No. 240 4052.

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

Registration Fees:

Participants	£16
Junior Members of the International Glaciological Society	£8
Accompanying persons aged 18 or over ...	£4

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

2. TOPICS

The Symposium will be concerned with the application of fundamental properties of snow and ice to the solution of engineering problems, and will include such topics as:

- ice forces,
- bearing capacity,
- strength and deformation of ice,
- avalanches,
- ice in and on the ground,
- ice and snow hydrology,
- mechanical properties of ice,
- snow handling,
- ice accretion on and around structures,
- properties of and techniques for producing unusual snow and ice materials used in industrial processes.

3. SESSIONS

Sessions will be arranged under the following broad headings:

1. Ice forces.
2. Bearing capacity.
3. Strength and deformation of ice.
4. Avalanches.
5. Engineering problems of snow.

6. Ice and snow accretion on and around structures.
7. Production and processing of snow and ice.
8. Structures and permafrost.

4. PROGRAMME

A detailed programme will be given in the Third Circular. On Monday evening, 13 September, there will be an informal party, and on Thursday evening, 16 September, the Symposium Dinner will be held. Visits to colleges and other buildings will be arranged for those interested in local tours, and may be booked when registering in Cambridge on Sunday 12 September.

5. ACCOMMODATION

Block reservations have been made in Colleges and some hotels.

Colleges: Single rooms are available for men and women aged 18 and over, at approximately £7.00 per day for room, all meals and service. (Married couples will be allocated neighbouring rooms.)

Hotels: approximate prices per day: Single room (without bath) and breakfast £7.20; Double room (without bath) and breakfast (2 people) £11.80; Single room (without bath) and all meals £11.50; Double room (without bath) and all meals (2 people) £20.00. Extra for private bath per day £2.50. There may be a few rooms available in small second class hotels for bed and breakfast £3.50-£4.50.

Deposits for accommodation:

A £5 deposit per person must be paid when booking for any of the above accommodation. This deposit is returnable if notice of cancellation reaches the Secretary before 12 August 1976.

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. Last date for registration and accommodation bookings: **1 June 1976**

6. PAPERS

(i) SUBMISSION OF PAPERS

Those participants who would like to contribute to the Symposium should first submit a summary of their proposed paper in English; 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.

**Last date for submission of summaries
12 January 1976**

(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). It is hoped to notify authors of papers during April 1976.

(iii) DISTRIBUTION OF SUMMARIES

The summaries of the accepted papers will be distributed by surface mail to all participants before the Symposium.

(iv) SUBMISSION OF FINAL PAPERS AND PUBLICATION

The Proceedings will appear in the Society's *Journal of Glaciology*. 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 International Glaciological Society by **1 August 1976**. They should be written in English 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 Symposium. The maximum length for papers will be **5000 words** or the equivalent length including any illustrations. The papers will be refereed according to the usual standards of the *Journal of Glaciology* before being accepted for publication. The Society can normally publish proceedings within one year after a Symposium, provided authors co-operate as indicated above.

**Last date for submission of final papers
1 August 1976**

7. SOCIAL EVENTS

(i) INFORMAL PARTY

On Monday 13 September there will be an "Ice breaker" in one of the Colleges for everyone attending the Symposium. Coffee will be provided and drinks will be available from a cash bar.

(ii) SYMPOSIUM DINNER

The Dinner will be held on Thursday evening 16 September. The cost, inclusive of wines and coffee, will be approximately £6. Tickets for the dinner may be bought when registering on Sunday 12 September.

8. POST-SYMPOSIUM FIELD EXCURSION

There will be a post-Symposium field excursion to the Scottish Highlands, 17-25 September 1976.

The excursion will pass through some of the most beautiful and historical areas of Scotland. Though now devoid of glaciers, many of the engineering problems met with in Scotland, especially in the highlands, are the direct result of glaciation. We

shall visit a rig construction site for the offshore oil industry, a hydro-electric scheme, a winter ski-ing area where there is a centre for avalanche studies, and some other less serious localities.

Itinerary:

Friday 17 September—Evening, leave Cambridge by overnight train.
 Saturday 18 September—Arrive Glasgow for breakfast. Travel to Glencoe.
 Sunday 19 September—Travel by boat to the Isle of Skye.
 Monday 20 September—Excursions on Skye.
 Tuesday 21 September—Travel to the Great Glen.
 Wednesday 22 September—Travel to Aviemore.
 Thursday 23 September—Excursions in the Cairngorm mountains from Aviemore.
 Friday 24 September—Travel to Edinburgh.
 Saturday 25 September—Optional tours in Edinburgh.

We shall travel by coach in Scotland, but long journeys will be avoided and much of the time will be spent out of the coach. Boots, waterproof clothing and a warm sweater are recommended. Participants who wish to do so may leave from Edinburgh on the evening of Friday 24 September. A tour of Edinburgh will be arranged on Saturday for those who wish it.

The excursion will officially end on Saturday 25 September.

Cost

The approximate inclusive cost of the whole excursion will be £125, from Cambridge to Edinburgh. An exact figure will be quoted in a later circular.

Deposit

If you wish to take part in the excursion, please send a deposit of £10 with your registration fee for the Symposium. Last date for bookings: 1 June 1976. The deposit is returnable if notice of cancellation is received before 12 July 1976. After that date, the deposit will only be returned if the vacancy can be filled by another participant.

DATES TO REMEMBER 1976

12 January: Last date for submission of summaries of papers for consideration.

1 June: Last date for reservations: registration, accommodation, post-Symposium field excursion.

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

Registration, Accommodation, Excursion SYMPOSIUM ON APPLIED GLACIOLOGY 12 - 17 September 1976

Mail to:

Secretary, International Glaciological Society,
Cambridge CB2 1ER, England

See reverse of this form for methods of making payment BEFORE 1 JUNE 1976

A REGISTRATION FORM

(please type or print in black ink)

Name of participant

Title

Address

Accompanied by (indicate age if under 18)

Name

Name

I send registration fee/s as follows:

(i) Participants£16 each.....

(ii) Junior members £8 each.....

(iii) Accompanying
persons £4 each.....

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

TOTAL REGISTRATION FEE/S = £.....

B ACCOMMODATION FORM

Please reserve the following accommodation for the nights of 12-17 September 1976, for which I enclose a deposit of £5 per person. (Arrival on 12 September, departure on 18 September.)

(i) Colleges (single rooms only):

.....room/s

(ii) Hotels:

(a)single room/sdouble room/s

(b)breakfast or.....all meals

(c)with bathroom orwithout
bathroom

(iii) Small second-class hotel (if available):

..... single room/s (with breakfast)

(iv) Own arrangements (delete if not applicable):

I prefer to make my own arrangements:

(No deposit required)

TOTAL DEPOSITS

FOR ACCOMMODATION = £.....

C POST-SYMPOSIUM FIELD EXCURSION

I wish to join the excursion to Scotland and hereby reserve places, for which I enclose a deposit of £10 per person.

TOTAL DEPOSITS

FOR EXCURSION = £.....

D SYMPOSIUM DINNER

I hope to attend the Dinner and will wish to reserve tickets. (Payment to be made at time of arrival in Cambridge.)

TOTAL PAYMENT (sections A, B, C)

(sent by Cheque/Bank transfer/Giro transfer)

= £.....

SYMPOSIUM ON APPLIED GLACIOLOGY 1976

Registration Fees and Deposits

METHODS OF MAKING PAYMENT

By cheque payable to: International Glaciological Society Symposium, and sent to:
Secretary, International Glaciological Society, Cambridge CB2 1ER, England.

By Bank transfer to: International Glaciological Society Symposium, Account No. 54775302, and sent
to: National Westminster Bank Ltd., 67 St. Andrew's Street, Cambridge CB2 3BZ, England.

By Giro transfer to: Post Office Account No. 240 4052.

INTERNATIONAL GLACIOLOGICAL SOCIETY

Cambridge CB2 1ER, England

DETAILS OF MEMBERSHIP

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

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

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

I C E

Editor: Hilda Richardson

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

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