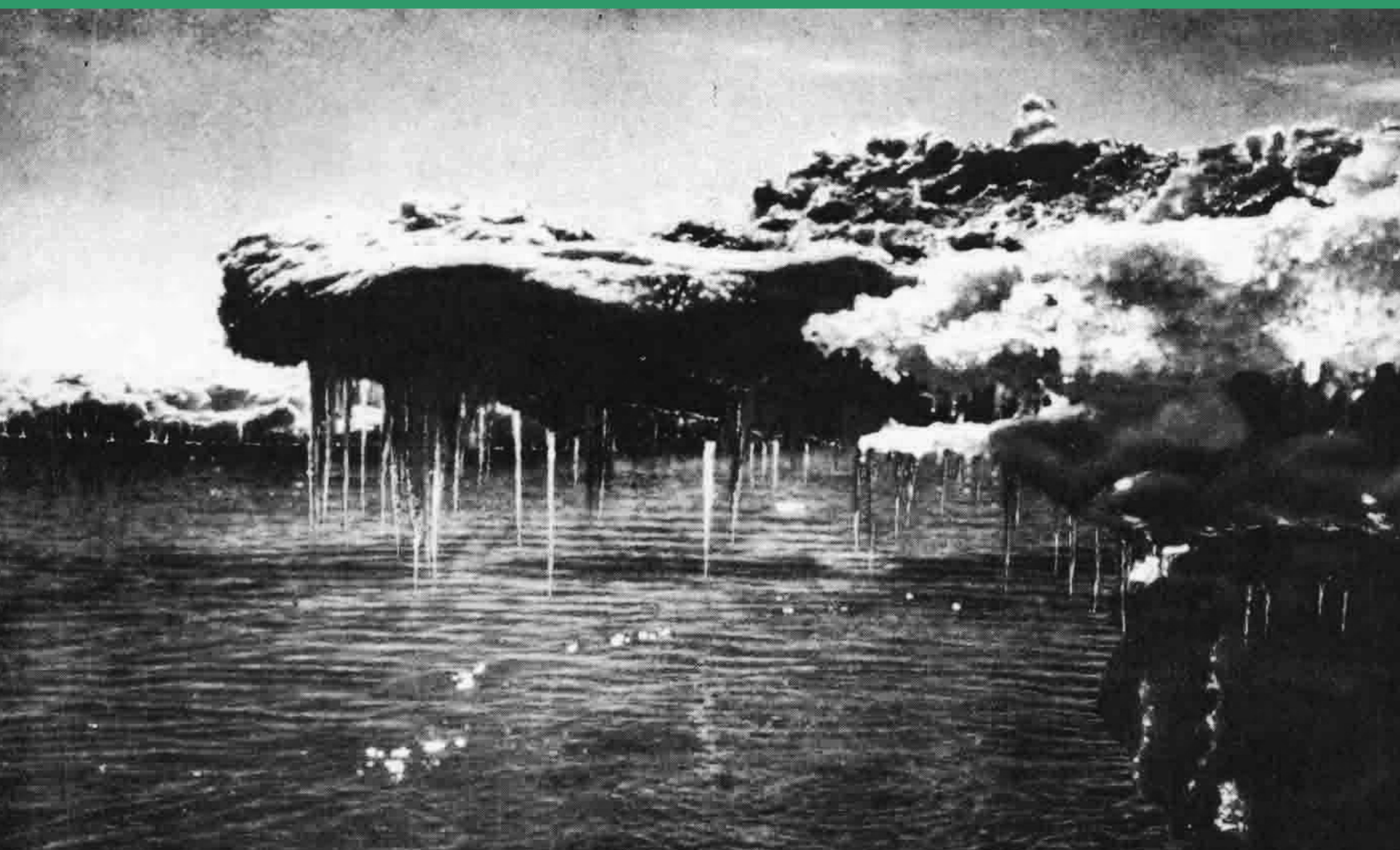


NUMBER 24

AUGUST 1967

ICE



GLACIOLOGICAL SOCIETY
NORTHEASTERN NORTH AMERICAN BRANCH

Second Annual Meeting

to be held on

28 and 29 October 1967

at

Carleton University, Ottawa, Ontario, Canada

See page 5 of this issue of Ice

ICE

NEWS BULLETIN OF THE GLACIOLOGICAL SOCIETY

AUGUST 1967

NUMBER 24

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SELIGMAN CRYSTAL. We are sorry that Dr. Henri Bader cannot come to Switzerland this September to receive in person his Seligman Crystal. He sends us his sincere apologies. On his behalf, the Crystal will be received by Dr. W. F. Weeks, President of the Society's Northeastern North American Branch, who will present it to Dr. Bader at a meeting of the Branch later this year. The most likely date for the presentation in Switzerland will be at a meeting of the Society in Berne on Wednesday 4 October 1967, after the afternoon session of the Commission of Snow and Ice. Final arrangements will be announced in Berne.

WORLD DATA CENTRE C GLACIOLOGY. Members are reminded that World Data Centre C collects, exchanges and distributes information of glaciological interest. The Centre is pleased to receive enquiries from individuals as well as from libraries and other bodies, and will provide, for example, photo' or Xerox copies of any item in its holding at cost price. Enquiries should be sent to: World Data Centre C Glaciology, c/o Scott Polar Research Institute, Cambridge, England. A similar service is offered by WDC A Glaciology at the American Geographical Society, Broadway at 156th Street, New York, N.Y. 10032, U.S.A.

DUPLICATE PAPERS. A list of spare copies of duplicate papers in the Society's library may be obtained from the library at Little Dane, Biddenden, Ashford, Kent, England. Spare copies of papers are available free to members of the Society. We shall be pleased to receive extra reprints of articles published by members in other journals, so that we may continue this service to members.

1967 DUES. Reminders about 1967 dues have been sent to all members who have not paid us their £3/\$9 (£1/\$3 Junior rate) by 30 June 1967. Their copies of the October issue of the Journal of Glaciology will be kept in our Cambridge office pending receipt of their money.

COVER PICTURE. Ice shelf at Cape Royds, Antarctica, taken by M. M. Prebble, New Zealand Antarctic Expedition 1965-66.

Note: The cover picture of Ice, No. 23, April 1967, was taken by William Austin, surveyor and official photographer for the University of Michigan Ross Ice Shelf Expedition during the IGY.

FIELD WORK

BELGIUM

SØR-RONDANE MOUNTAINS

a) During the 1959 and 1960 Belgian Antarctic Expeditions a programme of velocity and ice-thickness measurements was initiated on the drainage glaciers of the central part of the range by T. Van Autenboer and K. V. Blaiklock.

The velocity is determined by repeated resection of the stakes from the main trigonometrical stations while the thickness is calculated from gravimetric measurements.

During the 1964-65 summer programme of the Belgian-Dutch Antarctic Expeditions the stakes were resurveyed for movement measurements.

During the 1966 Belgian-Dutch Antarctic Expedition the measurements were extended to the east and the west and now cover the entire range from Vesthjelmen in the east to Taggen in the west.

A study of the movement of local glaciers was started, while at some localities a detailed survey was made of the complex ice topography at the intersection of local and drainage glaciers. b) The blue ice fields were sampled for analysis of $^{180}/^{160}$ isotopic composition and for measurement of Ra D contents. Deflation measurements were made on some blue ice fields.

THE ICE SHELF

During the 1965 winter the surveyor (J. J. Derwael) measured a large triangulation network on the ice shelf to the north-east of the Base. The network is linked to two astronomical positions and several base lines of which the azimuth was repeatedly measured. This network, which covers an area of about 1000 km², was re-observed during the 1966-67 summer programme.

This ice shelf and other parts of the coast were covered by aerial photography in the beginning of 1965 and 1966. This photography together with the ground control will allow a comparison to be made with earlier situations.

POLAR PLATEAU

A programme of geochemical and isotopic studies of the Antarctic snow cover has been established jointly by the Office of Antarctic Programs (U.S. National Science Foundation), the Ohio State University and the University of Brussels.

E. Picciotto took part in the 1964-65 and 1965-66 Queen Maud Land Traverses and worked during the 1966-67 season at Plateau Station. The aim of the research is the measurement of the accumulation rate by different isotopic methods: ^{210}Pb , radioactive fall-out, and changes in the $^{180}/^{160}$ ratio.

T. Van Autenboer

JAPAN

In the season 1966-67, the Japanese Antarctic Research Expedition initiated the following glaciological studies.

SYOWA STATION

The station is situated on Ongul Island, about 5 km offshore. Observations of snow accumulation and a glacio-geological survey were made around the station. Samples of ice and snow were studied for geochemical properties. Sea ice was studied for rate of growth and for structure. Ocean depth soundings were taken under the sea ice cover.

OVERSNOW TRAVERSE

In May 1967 an oversnow traverse was made on the mainland by T. Ishida and Y. Yoshida. The traverse extended about 100 km eastwards and the following studies were undertaken: barometric altimetry, gravity measurements, seismic surveys, and at one location, radio echo sounding. An echo of 6 micro seconds was obtained. The Expedition hopes to make another traverse in the 1967-68 season, led by Dr. T. Torii, who is leader of the whole expedition. Glaciological work was planned and led 1966-67 by Dr. K. Kusunoki.

ANNUAL GENERAL MEETING 1967

MINUTES OF THE ANNUAL GENERAL MEETING HELD ON 4 MAY 1967 AT CHURCHILL COLLEGE, CAMBRIDGE, ENGLAND

The President, Dr. J. F. Nye, was in the Chair.

1. The Minutes of the 1966 Annual General Meeting, published in *Ice*, No. 21, August 1966, were approved, and signed by the President.

2. The President made his report for 1966-67: "I should like to preface my first annual report by paying tribute to the work of my predecessor as President, Sir Vivian Fuchs. Our Society was fortunate indeed to have him in office at the time when our new constitution was being written — a time when his wise guidance was of especial value to us. It is fitting that I should begin by thanking him for his services to the Society over many years and by placing on record that at the end of his Presidency the Society in its new international role was more flourishing than ever before.

In the twelve months since the last Annual General Meeting, we have had 105 new members, an increase of 22 over the numbers joining in the previous twelve months. A few resignations and some cancellations through non-payment of annual dues make the final figure for membership 796, compared with 722 in May 1966. The number of subscriptions to the *Journal of Glaciology* has also increased; at our last Annual General Meeting the number was 517; today it is 612. These increases are most encouraging, for the backbone of the Society's finances continues to be its membership and subscription list. May I encourage all members to continue to help the Society by bringing in new members and by persuading their local libraries to subscribe to the *Journal*.

The size of the *Journal of Glaciology* in the calendar year 1966 was 475 pages, compared with 506 in 1965 and 384 in 1964. We have been able once again, for the third year running, to publish this amount without any grant from those outside bodies which have helped us in the past: the Royal Society and the U.S. National Science Foundation. This is the longest period in the Society's history in which we have stood on our own feet. As forecast last year, the cost of printing the *Journal* rose in 1966, while income from all sources remained about the same. This underlines the great importance of our continuing to attract new members and subscribers.

I think you will agree that the Editors have done a good job. We owe them and the Editorial Advisors grateful thanks for the immense amount of painstaking work they do in maintaining and

raising the standard of the *Journal*; for the *Journal* is our major undertaking, and it is primarily by its standards that our Society is, quite rightly, judged by other scientists.

The Treasurer will shortly be telling you more about our financial affairs. All I will add here is that the auditors have said that they consider the Society to be flourishing.

Our news bulletin, *Ice*, is still distributed free to our members and to addresses on the mailing list of *Glaciological Notes* — an arrangement we made in 1963, when the size of *Glaciological Notes* had to be reduced and the Society agreed to ensure that reports of field work should continue to be received by their subscribers. Since the last Annual General Meeting we have changed our arrangements for supplying *Ice* to subscribers to the *Journal of Glaciology*, and *Ice* is now available as a separate publication, with its own subscription list. The accounts for 1967 will reflect an added income of about £400 from this source, as most subscribers to the *Journal* are now also subscribing to *Ice*. In 1966 72 pages were published, compared with 64 in 1965 and 84 in 1964. Field work reports take up the largest share of these pages, and we are happy to devote about 13% of the space to notices from the Commission of Snow and *Ice*. I think our news bulletin serves a useful purpose in keeping us all in touch with each other's activities and in speedy publication of glaciological news.

Once again, one of the Editors, Dr. Glen, and the Secretary have been able to attend conferences and visit glaciological research institutions on our behalf. This year the Secretary was invited to represent us in Japan, at the 25th anniversary celebrations of the Institute of Low Temperature Science, Hokkaido University. She presented an illuminated scroll to the Institute on behalf of the Society and the Scott Polar Research Institute, and gave an address of congratulation. Both she and Dr. Glen were greeted with generous hospitality, and the contacts they made will be much to the advantage of the Society. Our thanks are due to the Institute of Low Temperature Science, the Japan Polar Research Association, the Japanese Society of Snow and *Ice*, and organizations in North America, for kindly providing funds which enabled the Secretary to make this journey.

This coming winter will see the launching of an appeal for the Research and Education Fund.

A brochure is being designed and will be sent to organizations, firms and individuals throughout the world. I should like to repeat the request which your President made last year — please send to the Secretary suitable names and addresses for our appeal.

The Society's new branch, the Northeastern North American Branch, held its first annual meeting last October, in Hanover, New Hampshire. From all accounts the formation of the branch was greeted with enthusiasm and the meeting was greatly enjoyed. We wish them well in their activities.

I am glad to announce that the Council has resolved to make an award of the Seligman Crystal to Dr. Henri Bader; we hope that the presentation will take place at a meeting of the Society in Berne next September.

I should like to conclude by expressing thanks again to our energetic helpers, in many countries."

3. The Treasurer, Dr. T. E. Armstrong, presented the accounts for 1966: The audited accounts for 1966 showed that the Society's finances were in a healthy condition. The Auditors had advised a new method of showing the value of old stocks of the Journal of Glaciology and Ice — a most important source of income for the Society — and this advice had been accepted. The Contingencies Fund having now been brought up to the level considered appropriate by the Council and the Research and Education Fund established, the Treasurer expected that the ordinary operations of the Society over the next year or two would be financed out of income, without showing a large surplus or deficit.

4. Election of auditors for the 1967 accounts. Dr. W. H. Ward proposed and Dr. J. W. Glen seconded that Messrs Peters, Elworthy and Moore, of Cambridge, be elected auditors for the 1967 accounts. This was carried unanimously.

5. Elections to the Council 1967-70. After circulation to all members of the Council's list of nominees, no further nominations had been received. The following people were elected unanimously:

Vice-Presidents (2)	Proposer	Seconder
J. W. Glen	Z. Yosida	H. Hoinkes
V. Schytt	M. F. Meier	U. Radok

Treasurer		
T. E. Armstrong	R. J. Adie	H. Lovenbury

Elective Members (3)		
G. Hattersley-Smith	F. Müller	W. H. Ward
W. Hofmann	M. de Quervain	J. W. Glen
W. H. Ward	M. F. Meier	F. K. Hare

6. Appointment to the Post of Founder. Under Rule 10 of the Constitution, the Council of the Society recommends that Dr. Gerald Seligman's name be put to the Annual General Meeting for appointment to this Post. The appointment was confirmed unanimously.

7. Appointments to Committee of the Research and Education Fund. Under Rule 10 of the Constitution, the Council recommends that the following names be put to the Annual General Meeting for appointment to the Committee of the Society's Research and Education Fund: Sir Vivian Fuchs, Dr. H. Röthlisberger, Dr. V. Schytt, Dr. A. L. Washburn, the President and the Treasurer of the Society ex-officio, and the Secretary of the Society as Secretary. The appointments were confirmed unanimously.

MEETINGS

THE GLACIOLOGICAL SOCIETY

BRITAIN

5 May 1967, Churchill College, Cambridge. Papers were read (as announced in *Ice*, No. 23, p.19, April 1967) by: M. M. Prebble (New Zealand), P. Barnes (U.K.), S. Baranowski (Poland), D. Ragan (U.S.A.), C. W. M. Swithinbank (U.K.), J. T. Hollin (U.K.), J. W. Glen (U.K.), J. F. Nye

(U.K.), H. Hoinkes (Austria), M. F. Meier (U.S.A.), F. Müller (Canada), M. de Quervain (Switzerland), V. Schytt (Sweden), G. Østrem (Norway).

Further details may be obtained from the Secretary of the Society.

FUTURE MEETINGS

THE GLACIOLOGICAL SOCIETY

NORTHEASTERN NORTH AMERICAN BRANCH — SECOND ANNUAL MEETING

Members of the Glaciological Society and others interested in the science of snow and ice in all its forms are invited to participate in the Annual Meeting of the Northeastern North American Branch of the Glaciological Society. The meeting will be held at Carleton University, Ottawa, Ontario, Canada, and will start at 0900, Saturday 28 October and finish at 1200, Sunday 29 October 1967. People wishing to present papers should send titles of their subjects to: Dr. Peter Johnson, Department of Geography, Carleton University, Ottawa 1, Ontario, Canada.

Closing date for receipt of titles is 1 October 1967. Abstracts are not required. Normal presentation time will be 15 minutes with 15 minutes allowed for discussion. Presentations of the results of current field work and experiments are encouraged. The only documentation of the meeting will be the publication of a list of titles in *Ice*. A cocktail party and informal dinner will be held on the evening of 28 October 1967.

Charles M. Keeler, Secretary.

23 June 1967.

SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT

The Fifth Symposium on Remote Sensing of Environment will be held on 16-19 April 1968 at the University of Michigan, Ann Arbor, Michigan, U.S.A. The purpose of the symposium is to stimulate an exchange of information concerning the numerous aspects of remote sensing, with emphasis on accomplishments during the past five years. The subjects will cover the fields of earth sciences, natural resources, engineering, and sensor technology. Attendance is open to all who have an interest in remote sensing. The formal programme will consist of invited papers, but if time permits other contributions may be read by title and copies of the papers will be

made available for distribution at the symposium and will be included in the proceedings. Anyone interested in contributing a paper should submit a comprehensive abstract no later than 15 September 1967 for consideration by a paper-selection committee. Abstracts should be submitted to: Mr. Dana C. Parker, University of Michigan, Willow Run Laboratories, P.O. Box 618, Ann Arbor, Mich 48107, U.S.A.

Further information regarding the symposium may be obtained from: Extension Service, Conference Department, University of Michigan, Ann Arbor, Mich. 48104, U.S.A.

INTERNATIONAL UNION FOR QUATERNARY RESEARCH (INQUA)

The Eighth International Congress of INQUA will take place in Paris, France, from 30 August - 5 September 1969. Mail address of the Secretariat, from where copies of the First Circular may be obtained, is: INQUA Secretariat, Institut de Géographie, 191 rue St.-Jacques, Paris 5, France. Fees have been set at 250 F for participating members, 100 F for accompanying members, 200 F for associated members. Official languages will be English, French, German, Russian and Spanish. Commissions, sub-commissions and sections will meet during the Congress and there will be excursions throughout France before and after the Congress.

Excursions of interest to glaciologists are:

A-6. Eastern and Central Pyrénées—Roussillon—Western Languedoc (Organized by F. Taillefer).

Glacier features of the Pyrénées, especially in the valleys of the Garonne and the Ariège, the chronology and sedimentology of the Quaternary terraces in the south of the basin of Aquitaine (Garonne) Roussillon, Western Languedoc and Corbières. Loess, limon; and the soil patterns in the Garonne valley below the Pyrénées and the Terrefort of Toulouse. Quaternary karsts (the Sault plateau). Prehistoric civilisation and art of the Pyrénées, the dwellings at Aurignac, the decorated caves of the Mas d'Azil, of Niaux, and finally of Gargas and Porte.

Length: 10 days. Cost: 800 F.

A (before the Congress)

A-7. The Alps—The middle course of the Rhône, (Organized by F. Veyret and Y. Bravard).

The central valley of the Rhône, Gresivaudan and Cluse de Chambéry, the Southern Alpine through Vercors, Dicis, Maurienne and Tarentaise, the Chamonix district. In lower Dauphiné (the valleys of the Isère and the Rhône, the peri-glacial regions, Bièvre-Valloire, etc.). Quaternary glaciation will be studied: moraines, terraces, loess, in the great alpestrine valleys, the inter-Riss-Würm, Würm and post-Würm, and in the Diois and the Baronnies, the glaciais resulting from erosion.

Symposium: (In the Institute of Alpine Geography, Grenoble) Quaternary glaciation in the Alps.

Length: 12 days. Cost: 960 F.

A-8. Existing and recent glaciers in the Alps of Dauphiné (Organized by P. Bellair).

The frontal moraines of lower Dauphiné. The approaches of the High Massifs of Dauphiné, the phases of development of the slope profile. Existing and recent glacial phenomena of the Dauphiné massif: the internal zone, the North,

East and South marginal zones. The Durancian ice-age. Some of the excursions will consist of rather long but easy mountain walking.

Symposium: The little ice-age.

Length: 12 days. Cost: 900 F.

C (after the Congress)

C-12. Central and Western Pyrénées — The Landes—Bordelais (Organized by P. Barrère).

Glacial accumulations, fluvio-glacial formations, fluvial terraces, gaps, quaternary periglacial features, in the upper basins of the Neste, the Adour, Gave de Pau, of Gave d'Ossau and Gave d'Oloron. Neoglacial formations, mud avalanches on the upper slopes and mountain morphology. The petrographic characteristics of the quaternary alluvium of the depressions, the identification of the various limons covering their terraces, the pedology of this covering and of these quaternary limons. Some prehistoric data. The chains of dunes in the southern region of the Basin of Arcachon. The dunes of Medoc and their palynology. The estuary of the Gironde and the alluvial surface layers of Médoc.

Symposium: Glacial periods in the Pyrénées.

Length: 10 days. Cost: 750 F.

C-13. Massif Central — Auvergne — Velay (Organized by M. Derruau and P. Bout).

The chaîne des Puys, the glacial features of Cantal and of the Bort district. The Villafranchian of the Perrier district, of the upper basin of the Allier, of the basin of the Puy. Quaternary volcanism and glaciation of Devès. Periglacial, Villafranchian subsidence, paleomagnetism, absolute age, prehistory, especially in the valley of the Allier.

Symposium: Absolute ages, the paleomagnetism of the lavas of the preWürmian glaciations.

Length: 9 days. Cost: 750 F.

C-14. The Lower Rhône, Provence, Côte d'Azur (Organized by E. Bonifay).

The stratigraphy and facies of littoral zone: fluvial and eolian deposits of the lower Rhône (Costière and the Camargue), and of the coastal valleys of Western Provence. Pliocene and quaternary marine deposits in Western Provence and in the Maritime Alps. From the glacial features of the Alps to the coastal formations. Glacial and fluvial deposits of the Var and the Durance. Prehistoric and paleontologic strata, chiefly those of the old and middle quaternary. **Symposium:** Correlation between the old Mediterranean Quaternary and the old Continental Quaternary (fauna and stratigraphy).

Length: 12 days. Cost: 1,100 F.

GLACIOLOGICAL DIARY

1967

19 Aug. - 6 Sept.

International Centennial Year Meeting, Geological Association of Canada, Mineralogical Association, Canada, with Mineralogical Association America & Association for Study of Deep Zones of Earth's Crust. Kingston, Ontario, Canada. Field trips in S. Ontario & Quebec. Symposium on age relations in high-grade metamorphic terrains. (L. G. Berry, Miller Hall, Queen's University, Kingston, Ontario, Canada.)

6 - 8 Sept.

Hydrology Symposium. Fort Collins, Colorado, U.S.A. (V. M. Yevdjovich, Colorado State University, Fort Collins, Colo. 80521, U.S.A.)

23 - 26 Sept.

Symposium on radio echo sounding of glaciers and ice. Strasbourg, France. By invitation. (A. Bauer, 46 rue Geiler, Strasbourg, France.)

27 Sept. - 5 Oct.

Commission of Snow and Ice meetings, during general assembly of International Union of Geodesy & Geophysics. Berne, Switzerland. (See this issue of Ice for programme details.)

8 - 11 Oct.

German Society of Polar Research, annual meeting. Stuttgart, Germany. (B. Brockamp, 44 Münster/Westf., Steinfurterstrasse 107, Institut für Reine & Angewandte Geophysik, W. Germany.)

28 - 29 Oct.

Glaciological Society, N.E. N. American Branch, annual meeting, Carleton University, Ottawa, Canada. (P. Johnson, Dept. of Geography, Carleton Univ., Ottawa 1, Ont., Canada.)

20 - 22 Nov.

Geological Society of America, Annual Meeting. New Orleans, U.S.A. (GSA Headquarters, 231 E 46th Street, New York, N.Y. 10017, U.S.A.)

26 - 31 Dec.

American Association for Advancement of Science, annual meeting, New York City. (AAAS, 1515 Massachusetts Avenue NW, Washington, D.C. 20005, U.S.A.)

1968

24 - 31 Jan.

Australian & New Zealand Association for Advancement of Science, congress. Christchurch, N.Z. (R.H.M. Langer, Lincoln College, Christchurch, New Zealand.)

16 - 19 April

Symposium on the remote sensing of environment. University of Michigan, U.S.A. (Dana C. Parker, University of Michigan, Willow Run Laboratories, P.O. Box 618, Ann Arbor, Mich. 48107, U.S.A.)

6 - 8 June

Symposium on surging glaciers. Banff, Alberta, Canada. Sponsored by Univ. of Alberta and National Research Council. Topics include glacier flow, geomorphological effects, hydrology of glacial surges. Submission of titles by 15 Nov., abstracts by 10 Jan. 68. (C. M. Lockwood, Dept. of Extension, Univ. of Alberta, Corbett Hall, Edmonton, Alberta, Canada.)

15 - 19 July

International conference on crystal growth. Birmingham, England. (A. D. McQuillan, Dept. of Physical Metallurgy, Univ. of Birmingham, Birmingham 15, England.)

19 - 28 Aug.

International Geological Congress, Prague, Czechoslovakia. (International Geological Congress, 23rd Organizing Committee, Malostranske namesti 19, Praha, Czechoslovakia.)

Sept.

SCAR Glaciology Symposium. Dartmouth College, Hanover, New Hampshire, U.S.A. (Details not yet available.)

11 - 13 Nov.

Geological Society of America, annual meeting. Mexico City. (GSA Headquarters, 231 E 46th Street, New York, N.Y. 10017, U.S.A.)

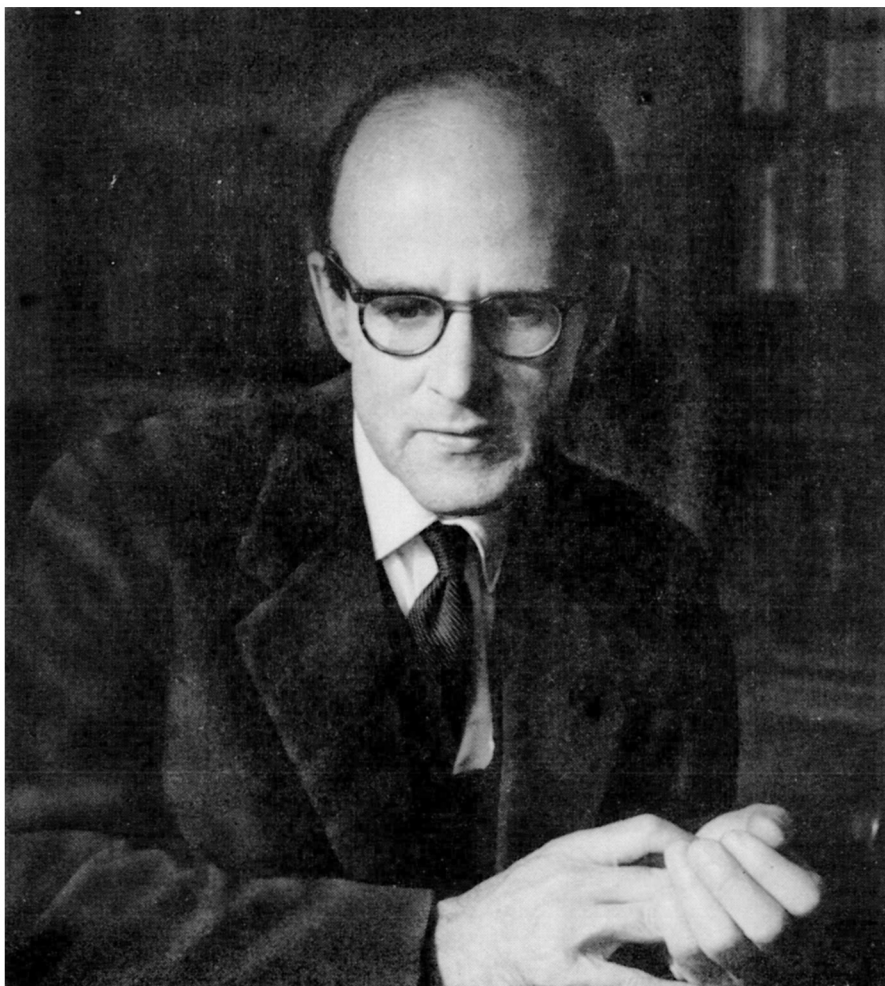
1969

30 Aug. - 5 Sept.

International Union for Quaternary Research, VIII Congress, Paris, France. Excursions and symposia before and after Congress. (INQUA Secretariat, Institut de Géographie, 191 rue Saint-Jacques, Paris 5, France.)

7 - 13 Sept.

Glaciological Society, symposium on hydrology of glaciers. Cambridge, England. (Mrs. H. Richardson, Glaciological Society, c/o Scott Polar Research Institute, Cambridge, England.)



MAX PERUTZ

Max Ferdinand Perutz was born in Vienna, Austria, 19 May 1914. His parents came of textile families who had prospered by introducing mechanical weaving and spinning to Austria during the 19th century. After grammar school in the Theresianum he entered, in 1932, Vienna University. His parents had wanted him to study law as preparation for entering the family business, but he persuaded them to let him study chemistry. After five "wasted" semesters of inorganic analysis, his interest was excited by mention, in a course of organic biochemistry, of the work of Sir F. G. Hopkins at Cambridge. He determined to continue his studies at Cambridge and in 1935 joined the Cavendish Laboratory as a graduate student under J. D. Bernal.

After Hitler's invasion of Austria and the expropriation of his family's business, he was enabled to continue study as a research assistant 1939-45 to Sir Lawrence Bragg. In 1945 he was given an Imperial Chemical Industries Re-

search Fellowship, and in October 1947 he was appointed head of the new Medical Research Council Unit for Molecular Biology. He continued there until 1 March 1962, when he was made chairman of the new Medical Research Council Laboratory of Molecular Biology.

His interest in the structure of haemoglobin stemmed from a conversation with F. Haurowitz in Prague in 1937. He got his first crystals of haemoglobin from G. A. Adair and learned to take and interpret X-ray pictures from Bernal and I. Fankuchen. In 1953, after prolonged effort, he found a method that permitted him and his colleagues to solve the structure of haemoglobin and myoglobin. These successes were rewarded by a Nobel Prize in Chemistry in 1962. Many other important discoveries were made during his administration of the Unit, including the solution of the structure of DNA by Watson and Crick in 1953 and the triplet nature of the genetic code in 1952.

His research on glaciers, he has written, is "for the fun of it and for a passionate love for the mountains, for skiing and climbing and for the simple, happy companionship they bring". He has been an expert skier from boyhood, and when an undergraduate in Vienna joined an expedition to Jan Mayen. In Cambridge, he became friends with scientists who shared his love of mountains and snow and ice, and joined Gerald Seligman and others on the Jungfrauoch Research Party in 1938. This expedition investigated the mechanism of glacier flow and the transformation of firn into glacier ice on the Grosser Aletschgletscher and neighbouring regions. A mechanism of plastic deformation was proposed, based on the growth, deformation and reorientation of ice crystals.

The war years he spent partly in Canada, saved from the possibility of internment in Britain by the intervention of senior scientists. In Canada, he was involved in the planning of "Operation Habbakuk", the project in which Winston Churchill took a keen personal interest. It was devised by Geoffrey Pyke who proposed that an iceberg, natural or artificial, should be used as a shelter for aircraft and as a runway. A description of the iceberg aircraft carrier and its problems was written as an article in the *Journal of Glaciology*, Vol. 1, No. 2, p. 95-104. The investigations involved Perutz still further in the problems of the mechanical properties of ice. On his return to Cambridge he studied glacier flow

and crystal texture, devising schemes to work on the problems at first hand in the field — admittedly as an excuse to be in the mountains and to meet for the first time his parents-in-law in Switzerland.

Perutz was one of the first people to carry out velocity flow measurements within a glacier where extrusion flow was thought to be important. In the Society's archives there is a dramatization of the "life and work" of the Jungfrauoch Research Party 1948, which he planned along with F. P. Bowden, C. E. Bullard, W. V. Lewis, A. Austin Miller, E. Orowan, G. Seligman, G. Taylor and J. M. Wordie. In Switzerland help was also given by R. Haefeli, G. Hattersley-Smith, P. Kasser, A. Roch, among others. Nearly everything that could have gone wrong on such an expedition went about as wrong as it could go, and in imaginatively improbable ways. Essential equipment was lost out of a train window, and, when replaced, was struck by lightning. A pipe wrench was dropped down the hole bored with immense and heroic effort into the glacier. But, finally, all came right, and despite every kind of bad luck, he got his results.

Glaciology owes a great deal to this molecular biologist, whose gentle manner, quizzical humour, and engaging personality have enlivened for others so many encounters with the ice. One is tempted to wonder what might be the state of our knowledge if he had been able to devote more than spare time "for the fun of it" to glaciology.



COMMISSION OF SNOW AND ICE

(Int. Association of Scientific Hydrology of the Int. Union of Geodesy and Geophysics)

REPORT OF MEETING OF OFFICERS AND CHAIRMEN OF WORKING GROUPS WITH UNESCO-IHD SECRETARIAT, PARIS, 2-3 MAY 1967

Present:

Dr. H. Hoinkes (Austria)	CSI
Dr. M. F. Meier (U.S.A.)	
Dr. V. Schytt (Sweden)	
Prof. G. A. Avsiuk (U.S.S.R.)	
Ing. P. Kasser (Switz.)	
Dr. M. de Quervain (Switz.)	
Prof. F. Müller (Canada)	
Dr. W. H. Ward (U.K.)	
Mr. J. A. da Costa (part time)	UNESCO-IHD
Mr. N. A. Bochin	
Mr. L. Serra (part time)	IASH
Mr. F. Fournier (part time)	

- i) E. Picciotto should be asked to revise the section on isotope techniques for studying glacier accumulation;
- ii) P. Kasser should provide a data submission list based on the Pilot Study for inclusion in the document;
- iii) minor amendments should be made to the section on publication;
- iv) Dr. Ward should complete the revision and forward the document for duplication by UNESCO as a technical note for distribution to IHD National Committees with glacierized areas before the Berne Assembly i.e. at the same time as the Pilot Study is distributed. Copies should also be available for free distribution by the Commission at the Berne Assembly.

1. The draft agenda was adopted.

2. IHD Resolution No. I-13

a) Pilot Study on the fluctuation of glaciers.

Ing. P. Kasser submitted a report on the present position with this project and on the establishment of a Permanent Service. It was noted with pleasure that IASH and UNESCO will jointly publish the Pilot Study and that this publication will appear before the Berne Assembly (IUGG 1967). It was agreed that:

- i) the word "pilot" should be avoided in the title; it should indicate that the document is the first of a series to appear under the Permanent Service;
- ii) the President (Dr. Hoinkes) should prepare a foreword to the Pilot Study document;
- iii) IASH and UNESCO should be requested to provide a free copy to those who contributed data;
- iv) COWAR should propose to the Co-ordinating Council that IHD National Committees of countries with glacierized areas be invited to appoint a correspondent whose task should be to collect and forward the information required by the Permanent Service on the Fluctuation of Glaciers, as soon as it is established.

b) Guide on the measurements of the variations of existing glaciers.

Dr. Ward reported that this document had been re-edited, except for two small sections which had become out of date. It was agreed that:

3. Co-operation with SCAR during IHD

Dr. Hoinkes reported that Dr. Radok, the Secretary of the SCAR Working Group on Glaciology, had requested its national representatives to prepare hydrological evaluations of their glaciological-meteorological research programmes in Antarctica for submission to COWAR and to the IHD Co-ordinating Council (third meeting). The Australian and S. African evaluations were already available. It was evident that a vast amount of hydrological work on snow and ice was in progress in the Antarctic though it was realised that the hydrology was, in fact, entirely glaciology, for obvious reasons. The Commission welcomed the co-operation from SCAR and expressed a wish to have a meeting with their working group on glaciology to discuss their report on the hydrological evaluation of the Antarctic programmes. This meeting could be arranged at Berne.

4. IHD Resolution No. I-12

a) Guide on the measurement and mapping of seasonal snow cover.

Dr. de Quervain presented a draft of the above guide. It was agreed that:

- i) the title should be as given above;
- ii) the definitions of terms should serve the purpose of the guide;
- iii) the general form of the draft was acceptable, but a clear account should be included of the various "snowlines" on the ground and on glaciers, and it

- should be made clear that the objective of the guide was to provide a measure of the total storage of water and its variations above the ground both for single catchments and for global purposes (see also para. 4.c) i));
- iv) mention should be made of newly-developed methods of measuring deposited snow, giving references;
 - v) participants should send detailed comments to Dr. de Quervain by the end of May;
 - vi) Dr. de Quervain should obtain for consideration comments on the draft from experts suggested by W.M.O.;
 - vii) the guide should not deal with "snow courses" designed solely for purposes of runoff forecasting;
 - viii) the guide was solely the responsibility of the Commission and should be published jointly by IASH and UNESCO in the IHD technical note series;
 - ix) a final draft of the guide should be submitted for consideration by the Commission at Berne.
- b) **Comments on W.M.P. Guide on hydro-meteorological practices.** Several members commented on the guide recommendations on snow measurement. It was agreed that participants should send their detailed comments to Dr. de Quervain for him to send to COWAR for submission to the Co-ordinating Council of IHD by the end of May.
- Dr. Ward reported his own and Dr. Pounder's comments on the sections in the W.M.O. guide dealing with sea, lake and river ice. It was agreed that:
- i) they were inadequate for IHD purposes for people without experience and quite unnecessary to those with such experience;
 - ii) the detailed comments should be sent by Dr. Ward by the end of May to Mr. Serra, as Secretary of COWAR, for submission to the IHD Co-ordinating Council;
 - iii) Dr. Pounder be asked to set up a working group to prepare a guide on the measurements and recording of the quantity and extent of river, lake and sea ice and their seasonal variations on a world-wide basis, taking into account existing manuals on the subject. The group should include representatives of U.S.A., U.S.S.R., and of Antarctic knowledge in this field. A complete draft of the guide should be presented for consideration by the officers of the Commission in the spring 1968.
- c) **Guide to world inventory of perennial ice and snow masses on and beneath the land surfaces.** It was agreed that:
- i) a paragraph defining "snowline" and equilibrium line should be added. The definitions should be consistent with those to be incorporated in the guide on the measurement and mapping of seasonal snow cover (see para 4.a) iii));
 - ii) any information on elevations of "snowlines" and on accumulation area ratios for earlier years should be requested;
 - iii) information on permanently frozen high mountain areas should be requested;
 - iv) a section on seasonal ground ice should be prepared; Prof. Avsiuk agreed to have this done by one of his colleagues for submission to the Commission at Berne;
 - v) Dr. Müller should explore with W.D.C.s the feasibility of their handling the data;
 - vi) participants should send their detailed comments to Dr. Müller by the end of June for him to submit a final draft of the guide for consideration by the Commission at the Berne Assembly;
 - vii) the guide should be published jointly by IASH and UNESCO in the IHD technical note series.
- 5. IHD Resolution No. I-14**
- Combined water, ice and heat balance at selected glacier basins**
- Dr. Meier submitted a second draft of the first part of a guide on the above subject and a detailed discussion took place on the scientific aspects of the project. It was agreed that:
- i) participants should send their detailed comments to Dr. Meier by the end of June in time for his group to prepare a final draft of the first part for consideration by the Commission at Berne;
 - ii) Dr. Meier should submit a draft on the second part dealing with mass and water balances in time for consideration by the Commission at Berne;
 - iii) Dr. Meier should appoint a Sub-Committee to report on standardising heat budget measurements;
 - iv) only those stations meeting **all** the criteria specified in the draft guide should be included in the project. COWAR should be asked to recommend to the IHD Co-ordinating Council that the nations concerned with the existing and proposed stations listed in Appendix I of the draft be encouraged to meet those criteria and to co-operate in the project;

- v) Part I of this document should be published jointly by IASH and UNESCO in the IHD technical note series.
- 6. IHD Resolution II-13**
This resolution on snowline observations was welcomed by the officers of the Commission and it was agreed that such measurements are necessary. The observations have therefore been included in the guide being prepared under resolution I-12. There is no need to set up another project for this purpose.
- 7. Working Group on world water balance**
Dr. Ward reported that he attended the last meeting of the above working group and had reported on the activities of the Commission of Snow and Ice and SCAR.

8. General Assembly at Berne

Dr. Ward reported that he had already received 54 brief abstracts and knew that 12 others were in the post and more could be expected. It was agreed that:

- i) a group be appointed to screen the abstracts and report accordingly to the national correspondents on acceptance;
- ii) Ing. P. Kasser should find out whether an additional room was available at Berne to have two simultaneous sessions on Thursday 28 September and Tuesday 3 October;
- iii) only authors should be permitted to present their papers for discussion.

W. H. Ward
Secretary

May 1967.

PROGRAMME OF MEETINGS AT BERNE, SWITZERLAND, DURING

I.U.G.G. 1967

TUESDAY, 26 SEPTEMBER

- 14.00 hrs.** Meeting of Officers, Chairmen of Divisions and Working Groups

WEDNESDAY, 27 SEPTEMBER

- 09.00 hrs.** **Presidential Address** by Dr. H. Hoinkes (Austria)
Papers Session I — Avalanches and snow-drift
Salm, B. (Switzerland)—On dynamic processes involved in the deflection of avalanching snow.
Bahhvalov, N. S., Bruhhanov, A. V., Grigorian, S. S., Eglit, M. E., and Yakimov, Y. L. (U.S.S.R.)—The motion of snow avalanches. Theoretical hydraulic considerations and observational data.
Montagne, J., Super, A., Townes, H. and McPartland, J. (U.S.A.)—Status of snow cornice investigations, Bridger Range, Montana, U.S.A.
Komarov, A. A. (U.S.S.R.)—Drifting snow and modern methods of investigation.
Kotliakov, V. M. (U.S.S.R.)—Role of the blizzard transport in the surface regime of glaciers.
- 14.00 hrs.** **Papers Session II — Glacier bed problems**
Lilboutry, L. (France)—Théorie générale au glissement des glaciers.
Meier, M. F. (U.S.A.)—Calculations of slip of Nisqually Glacier on its bed: no simple relation of sliding velocity to shear stress.
Budd, W. F. (Australia)—The longitudinal velocity profile and basal friction of large ice masses.

- Nye, J. F. and Martin, P. C. E. (U.K.) — Glacier erosion.
Röthlisberger, H. (Switzerland) — Erosive processes which are likely to accentuate or reduce the bottom relief of valley glaciers.
Lister, H., Pendlington, A. and Prior, D. (U.K.) — Laboratory experiments on abrasion of sandstones by ice.

- 20.00 hrs.** **Meeting of Commission Officers, Chairmen of Divisions and Working Groups, with SCAR Working Group on Glaciology**

THURSDAY, 28 SEPTEMBER

- 09.00 hrs.** **Papers Session III—Glacier flow**
Campbell, W. J. (U.S.A.)—An heuristic numerical model for three-dimensional, time-dependent glacier flow.
Swithinbank, C. W. M. and Collins, I. F. (U.K.)—Rifts at the foot of the Beardmore Glacier, Antarctica.
Hofmann, W. (West Germany)—The movement of the Ross Ice Shelf.
Dolgushin, L. D. and Osipova, G. B. (U.S.S.R.)—"Pulse glaciers" and the problem of prognosis of their catastrophic advances.
Pillewizer, W. and Voigt, U. (East Germany)—Block movement of glaciers.

09.00 hrs. Papers Session IV — Radioactive dating of glacier ice

- Ambach, W., Eisner, H. and Prantl, F. A. (Austria) — Investigations on fission products in the accumulation area of an alpine glacier (Kesselwandferner, Oetztal Alps).
- Picciotto, E., Crozaz, G., Ambach, W. and Eisner, H. (Belgium) — Lead-210 and fission products in an alpine glacier.
- Ambach, W., Eisner, H. and Thatcher, L. L. (Austria)—Tritium content in the firn layers of an alpine glacier.
- Picciotto, E. (Belgium)—Measurements of the rate of snow accumulation on the East Antarctic Plateau.
- Clausen, H. B., Buchmann, B. and Ambach, W. (Denmark)—Silicon³² -dating of an alpine glacier.
- Hamilton, W. L. and Langway, C. C. (U.S.A.)—A stratigraphic correlation of microparticle concentrations with oxygen isotope ratios in 700-year-old Greenland ice.
- Lorius, C. (France)—Etude physico-chimique de la glace côtière prélevée par carottage en Antarctique.
- Fireman, E. L., McCorkell, R. and Langway, C. C. (U.S.A.)—Radioactivities in the Greenland ice sheet.

14.00 hrs. Papers Session V — Sea ice and frozen ground

- Lofgren, G. and Weeks, W. F. (U.S.A.) — Effect of growth parameters on sub-structure spacing in NaCl ice crystals.
- Langleben, M. P. (Canada) — The heat budget of a melting cover of sea ice.
- Untersteiner, N. and Maykut, G. (U.S.A.)—A thermodynamic model for predicting thickness and temperature of sea ice.
- Koslowski, G. (West Germany) — On the influence of large scale weather situations on the changes in extent of ice cover in the northern Baltic Sea and in the Gulf of Finland and consideration of the influence of wind on ice drift.
- Pounder, D. R. and Langleben, M. P. (Canada)—Acoustic attenuation in sea ice.
- Grave, N. A. (U.S.S.R.) — New data on azonal phenomena of permafrost in Siberia.

14.00 hrs. Papers Session VI — Glacier fluctuations

- Müller, F., Ommanney, C. S. L. and Stanley, A. D. (Canada)—Three pilot studies for the I.H.D. World Inventory of Glaciers.
- Kick, W. (West Germany) — Aspects of comparing geometric elements of glacier variations.
- Röthlisberger, H. and Aellen, M. (Switzerland)—Annual and monthly velocity variations on Aletschgletscher.
- Vanni, M. (Italy) — Les variations des glaciers Italiens au cours des dix dernières années 1957-1966.
- Marangunic, C. and Bull, C. C. (U.S.A.)—Preliminary results of Sherman Glacier studies, 1965 and 1966.
- Haefeli, R. (Switzerland)—Changes in the behaviour of the Unteraargletscher during the last 125 years.
- Tonini, M. and Rossi, G. (Italy)—Le glacier de la Marmolada—variations depuis 15 années.

20.00 hrs. Meeting of SCAR Working Group on Glaciology

FRIDAY, 29 SEPTEMBER

to

MONDAY, 2 OCTOBER

- 07.45 hrs.** Study tours B.41 to B.46 depart Berne main railway station.

TUESDAY, 3 OCTOBER

09.00 hrs. Papers Session VII—Glacier mass budgets

- Hoinkes, H., Horwoka, F. and Schneider, W. (Austria)—Glacier mass budget and mesoscale weather in the Austrian Alps, 1964-66.
- Giovinetto, M. B. and Zumberge, J. H. (U.S.A.)—The ice regime of the eastern part of the Ross Ice Shelf drainage system.
- Tangborn, W. V. (U.S.A.) — Accumulation, ablation, and mass budgets of some northern Cascade glaciers as determined by hydrologic parameters 1920-65.
- Mock, S. J. (U.S.A.) — Mass balance studies, Thule Peninsula, Greenland.
- Mellor, M. (U.S.A.)—The Greenland mass balance — flux divergence considerations.
- Løken, O. H. and Sagar, R. B. (Canada)—The mass budget of the Barnes Ice Cap, Baffin Island, Canada.
- Avsiuk, G. A. and Krenke, A. N. (U.S.S.R.) —The first results of the glaciological investigations in the U.S.S.R. under the projects of I.H.D.

09.00 hrs. Papers Session VIII — Glaciers and their fluctuations

- Schytt, V., Hoppe, G., Grosswald, M. and Blake, Jr., W. (Sweden) — Studies of the Würm glaciation of Spitzbergen and northern Barents Sea.
- Mercer, J. H. (U.S.A.)—Antarctic ice and Sangamon sea level.
- Bauer, A. (France)—Premières données sur les glaciers actuels des Iles Kerguelen.
- Maag, H. U. (Switzerland) — Ice-dammed lakes in Axel Heiberg Island, Canadian Arctic Archipelago.
- Hattersley-Smith, G. and Serson, H. (Canada)—Ice-dammed bodies of water in Northern Ellesmere Island.
- Temple, P. H. (Uganda)—Changes in the Ruwenzori glaciers over the last 60 years.
- Black, R. F. and Bowser, C. J. (U.S.A.) Salts and associated phenomena of the termini of the Hobbs and Taylor Glaciers, Victoria Land, Antarctica.

14.00 hrs. Papers Sessions IX — Properties of ice

- Barnes, P. W. (U.K.)—Plastic flow and pressure melting in the deformation of ice.
- Higashi, A. (Japan) — Structure and behaviour of dislocations in deformed ice single crystals.
- Bartlett, J. T. and Readings, C. J. (U.K.)—Some optical effects in deformed single crystals of ice.
- Jones, S. J. and Glen, J. W. (U.K.) — The mechanical properties of single crystals of ice at low temperatures.
- Haefeli, R., Jaccard, C. and de Quervain, M. (Switzerland)—Deformation of ice under high hydrostatic pressure.
- Jaccard, C. (Switzerland)—Automatic thin section analysis with the tomograph.

- 14.00 hrs. Papers Session X — Properties of Snow**
 Gow, A. J. (U.S.A.) — On the rates of growth of grains and crystals in south polar firn.
 Cavazza, S. (Italy)—Variations de densité dans les parties supérieures et inférieures de la coupe de neige (Calabre, Italie).
 Shimizu, H. (Japan)—Air permeability of snow.
 Wakahama, G. (Japan)—Metamorphism of wet snow.
 Kuroiwa, D. (Japan)—Liquid permeability of snow.
 Hobbs, P. V. (U.S.A.)—The metamorphism of deposited snow at a uniform temperature.
 Wakahama, G. and Endo, Y. (Japan) — Actual distribution of melt water in snow cover.

WEDNESDAY, 4 OCTOBER

- 14.00 hrs. Business meeting of the Commission.**
 1). Election of Officers
 2). Discussion of drafts of I.H.D. guides
 3). Any other business
20.00 hrs. Meeting of SCAR Working Group on Glaciology.

THURSDAY, 5 OCTOBER

- 09.00 hrs. Papers Session XI—Glacier sounding and thickness changes**
 Swithinbank, C. W. M. (U.K.)—Radio echo sounding of Antarctic glaciers from light aircraft.
 Bentley, C. R. (U.S.A.)—Seismic evidence for moraine within basal Antarctic ice sheet.
 Weber, J. R. (Canada) — A gravimetric determination of the vertical ice movement of the Penny Ice Cap, Baffin Island.
To be followed by presentations and discussions of very recent glaciological work.
- 14.00 hrs. Papers Session XII—Glacio-meteorological relations**
 Weller, G. (Australia)—The energy transfer above and inside Antarctic blue ice.
 Lettau, B. (U.S.A.)—Meteorological constraints upon the mass budget of the Antarctic ice sheet.
 Lang, H. (Switzerland)—Relation between heat balance elements at the glacier surface and meteorological observations made at a station away from the glacier.
 Müller, F. (Canada) — Automatic weather stations for glacier-climate relationships.
 Paterson, W. S. B. (Canada)—Temperature measurements in the Meighen Ice Cap.
 Diunin, A. K. (U.S.S.R.) — The snow evaporation and its influence on snow storms and on physical properties of the snow cover.
 Alford, D. (U.S.A.)—A possible factor in the determination of firn line elevation.
 Campbell, W. J. (U.S.A.)—Synoptic temperature measurements of a glacier lake and its environment.
 W. H. Ward,
 Secretary,
 Commission of Snow and Ice,
 147 Rickmansworth Road,
 Watford, Herts., England.

NEWS

UNIVERSITY OF WASHINGTON QUATERNARY RESEARCH CENTER

The establishment of a Quaternary Research Center to encourage interdisciplinary study and research in the natural sciences was announced by the University of Washington in Seattle in June 1967. Dr. A. L. Washburn is Director of the new Center and Dr. S. C. Porter is associate director.

The purpose of the Center is to provide a facility, transcending departmental boundaries, which will serve as a focal point for study and attract students interested in Quaternary research. It will also help raise research funds and administer special projects.

Many fields of research will be relevant to the work of the Center: archaeology, botany, climatology and paleoclimatology, meteorology, oceanography, ecology, geomorphology and glacial geology, glaciology, periglacial research, photo-interpretation and photogrammetry, radiometric dating, sedimentology, soil mechanics, stratigraphy and zoology. Several new courses are being introduced, among them a series of courses in glaciology that will represent an area of specialization towards a Ph.D. in geophysics.

The Center does not offer degrees, but where appropriate it can act in an advisory and super-

visory capacity with respect to graduate students whose work requires special interdisciplinary arrangements. The Center is responsible to the Graduate School of the University and to an administrative board consisting of the assistant vice-president and the deans of the Colleges of Arts and Sciences, Engineering, Forestry and the Graduate School.

Dr. Washburn is well known to glaciologists for his work on periglacial research and on geomorphology of polar regions. He is a member of the U.S. National Academy of Sciences Committee on Polar Research and of the Glaciology Panel. For the past seven years he has been a professor of geology at Yale University and retains his senior research appointment there. From 1945-50 he was executive director of the Arctic Institute of North America and in 1951 was director of the Washington, D.C. office of the Institute. In 1952 he was appointed director of the Snow, Ice and Permafrost Research Establishment of the U.S. Army Corps of Engineers, and then joined Dartmouth College as a professor of northern geology. He is a graduate of Dartmouth and received his doctorate from Yale University in 1942.

GLACIOLOGY IN THE ARCTIC

A report on Glaciology in the Arctic has been prepared by the Glaciology Panel of the U.S. National Academy of Sciences Committee on Polar Research. The report is of widespread interest and gives the Panel's recommendations for work on glaciers, seasonal snow cover, frozen ground and Quaternary chronology. Copies will

be mailed to members of the Glaciological Society later this year, but any member who wishes to receive a copy quickly may send his request to: Secretary, Glaciology Panel, Committee on Polar Research, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C.20418, U.S.A.

**PROCEEDINGS OF THE SYMPOSIUM ON GLACIER MAPPING, OTTAWA,
20-22 SEPTEMBER 1965**

Members are reminded of the existence of this publication (announced in Ice, No. 22, December 1966, p.12). At \$2.00 it is an excellent bargain, with twenty papers and a folio of fourteen glacier maps. The Proceedings form a special issue of

the Canadian Journal of Earth Sciences, November 1966. Copies may be obtained by sending a cheque for \$2.00 to: Administration, National Research Council, Ottawa 7, Ontario, Canada.

AWARDS

Dr. Wilford F. Weeks and Mr. B. Lyle Hansen of the U.S. Army Cold Regions Research and Engineering Laboratory have been selected by the Chief of Research and Development Department of the Army to receive Army Research and Achievement Awards for 1967. The men are two of only seven individuals named for the awards from among scientists of the Army Materiel Command for significant research contributions.

Dr. Weeks receives the award for his internationally recognized research in glaciology and geology, emphasizing the formation and physical properties of sea ice. His work has resulted in the U.S.A. becoming the centre of work on the

aspects for understanding of sea ice as a material.

Mr. Hansen is cited for the successful penetration of the Greenland ice sheet last summer in the Laboratory's deep drilling programme. The USA CRREL drilling team reached the bottom of the ice sheet after drilling through nearly a mile of ice with especially-developed drilling systems. As a result, the Laboratory has been provided with a continuous ice coring sample of the ice sheet from top to bottom and some 12 feet into the soil surface. These cores are undergoing thorough laboratory analysis and are expected to yield climatological and other data not otherwise obtainable.

THE SOCIETY'S LIBRARY

WORKS RECEIVED FOR THE SOCIETY'S LIBRARY SINCE FEBRUARY 1967

We thank the following authors or donors of papers and pamphlets, and regret that it is impossible to acknowledge them individually. The glaciological works, with their complete references, will be listed in the "Glaciological Literature" at the end of the Journal of Glaciology and bound in the Society's collection of glaciological papers:

Andrews, J. T. (2 items)	Hoinkes, H. C.
Bauer, A. (4 items)	Kick, W.
Bellair, P.	Løken, O. H.
Brockamp, B. (3 items)	Magono, C. (4 items)
Bull, C. C. (2 items)	Meier, M. F. (12 items)
Crary, A. P.	Miller, M. M.
Curry, R. R.	Mosetti, F.
Derbyshire, E.	Paterson, W. S. B.
Gold, L. W.	Philberth, K. (4 items)
Goldthwait, R. P.	Porter, S. C. (5 items)
Grove, J. M.	Ramseier, R. O. (3 items)
Haefeli, R.	Stephens, N. (4 items)
Hamelin, L.-E.	Untersteiner, N.
Harland, W. B.	Vivian, R. (7 items)

Antarctic Division, Department of External Affairs, Melbourne, Australia (3 items).
Cold Regions Research and Engineering Laboratory, U.S. Army (13 items).
Comité Scientifique des Recherches Antartiques, Bruxelles, Belgium.
Comiteul de Stat al Geologiei, Inst. Geologic, Bucharest, Rumania.
Danske Meteorologiske Institut, Charlottenlund.
Department of Geology, Arizona State University, U.S.A. (5 items).
Department of Transport, Meteorological Branch, Toronto, Canada.
Division of Building Research, Canada (3 items).
Expéditions Polaires Françaises.
Geophysical and Polar Research Center, University of Wisconsin, U.S.A. (6 items).
Grønlands Geologiske Undersøgelse, København, Denmark.
Institute of Polar Studies, Ohio State University, U.S.A. (4 items).
Instituto de Geologia, Parana, Brazil (2 items).
Instituto Nacional del Hielo Continental Patagonico, Buenos Aires, Argentina.
McGill Sub-Arctic Research Laboratory, Montreal, Canada.
Norske Meteorologiske Institutt, Oslo.
Office of Geography, Department of the Interior, Washington, D.C.
Polish Academy of Sciences (5 items).
Sveriges Meteorologiska och Hydrologiska Institut, Stockholm.
Sveriges Meteorologiska och Hydrologiska Institut, Uppsala (2 items).

BOOKS RECEIVED

Hindukus (Photographic description of the Czechoslovak expedition to the Hindu Kush in 1965).
Photography by Vilem Heckel and text by Jaromir Wolf. Praha Sportovni a Turisticke Nakladatelstvi,
1967. 228 p., 28cm.
L'Antarctique. André Cailleux. Paris, Presses Universitaires de France, 1967. 128 p., 18cm.
Antarktika. Günter Skeib. Urania-Verlag, Leipzig, 1965. 284 p., illus., map. 24cm. 15 MDN.

REVIEWS

E. D. DERBYSHIRE, M. R. BANKS, J. L. DAVIES and J. N. JENNINGS. A glacial map of Tasmania. Royal Society of Tasmania, July 1965. 11 p., folding map. (Special Publication No. 2).

In this useful article, complete with a folding map on a scale of 1:250,000, the authors do much to rectify some of the anomalies associated with the Pleistocene glaciation of Tasmania. Lewis in his works between 1922 and 1945 advanced the theory of multiple glaciation for the island, consisting of three full glaciations of progressively decreasing severity. Although, as the authors state, "the increasing volume of new work has served to indicate major deficiencies in Lewis's scheme of three distinct glacial stages, it has not yet succeeded in providing a coherent alternative".

The spate of recent literature, combined with studies of air photos and an increasing amount of field work, especially in the difficult western area of Tasmania, has shown that many features can be explained in terms of a single glaciation of recent date. However, there is an obvious need for more field work to be accomplished, and the value of the present work is that it is a timely summary of the literature, as well as providing a map which portrays, as far as it is possible, the present knowledge of the glacial features of Tasmania.

Because of the small size of the island the major elements of glaciation can be adequately shown on one sheet at a scale of 1:250,000. Symbols and colouring of the features of ice erosion and deposition are very distinct. Large use has been made of aerial photographs in plotting the present coverage, and it is to be hoped that further field work will be attempted in areas where the pattern has been inferred.

M. M. Prebble

Trevor HATHERTON, Editor. *Antarctica*. London, Methuen, 1965. Copyright by the New Zealand Antarctic Society. xvi, 511 p., illus., 150 figs., folding map. £4 10s.

This volume is the successor to the New Zealand Antarctic Society's "The Antarctic Today: A Mid-Century Survey" of 1952. Owing to the great expansion of Antarctic activity since 1952, and also perhaps to the attitude and interests of the editor, the present volume is more concerned with the scientific aspects of Antarctic endeavours than its predecessor. Although there is still a "Pacific" flavour to the volume, it is more international in its scope and coverage than the rival work "Antarctic Research" (edited

by Sir Raymond Priestley, R. J. Adie and G. de Q. Robin), which is subtitled "A Review of British Scientific Achievement in Antarctica". Ten of the contributing authors to "Antarctica" are non-New Zealanders (out of a total of twenty-one) as compared with five in "The Antarctic Today", and two authors also have articles in "Antarctic Research".

Dr. Hatherton, as editor, has skilfully, yet unobtrusively, projected a unity to this volume, by aiming the book more at the researcher who is concerned with gaining a comprehensive coverage of the present state of scientific knowledge in Antarctica. The editor has also done an impressive job in relating cross references between articles and illustrations appearing in different chapters. The index is thoroughly adequate, and the appendixes on the Antarctic Treaty of 1959 and a record of the occupation of all national stations and bases in the Antarctic are very useful.

The book is arranged in four parts: (1) The nations in Antarctica, composed of three articles which are the only concession to interests other than scientific, (2) The Southern Ocean, composed of four articles, (3) The Antarctic Continent, composed of seven articles, and (4) The South Polar Atmosphere, composed of four articles. Of interest to the earth scientist are articles in the section: The Antarctic Continent, by Charles Swithinbank and James H. Zumberge on The Ice Shelves, by Anthony J. Gow on The Ice Sheet, by Charles R. Bentley on The Land Beneath the Ice, by Guyon Warren on The Geology of Antarctica, and by R. H. Clark on The Oases in the Ice. The article by John A. Heap on The Antarctic Pack Ice in the section on the Southern Ocean, and the article by Morton J. Rubin and William S. Weyant on Antarctic Meteorology in the section on the South Polar Atmosphere are also of considerable interest.

The articles by Heap, Swithinbank and Zumberge, Gow, and Bentley present much new information largely as a result of the continuous and intensive investigations that have stemmed from the IGY. Warren's account of the Geology of Antarctica is factual, with an impressive number of references, once again indicative of the burst of reconnaissance work in the last ten years. Clark, writing about The Oases in the Ice, refers mainly to the McMurdo Oasis of South Victoria Land, and he emphasises here the unusual importance of this area to scientists of many disciplines.

Although the illustrations are strictly functional in content, there are also many excellent tables and diagrams which are well drawn, very clear to read, and which greatly help understanding of the articles. However, the standard of

cartography is uneven and many of the maps, especially in Bentley's article, have been reduced almost to an illegible state. In Clark's article, the locality map of the McMurdo Oasis could have been more imaginative in its layout, and a structural map would have added greatly to Warren's article. For the volume, the New Zealand Department of Lands and Survey has produced a third edition of its "Map of the Antarctic Regions" at a scale of 1:16,000,000 at 71°S. This folding map contains much new information and place names, although one feels that it is about time that political divisions of Antarctica were removed altogether, or to a small inset map, to avoid cluttering. By colour tinting, ice shelves and land below sea level (taken from the American Geographical Society map of 1962) are shown distinctly.

This volume has come at a very opportune time. The rapid advance of man's knowledge of the south polar environment has mainly occurred since 1956, and this progress has been comprehensively recorded by Hatherton's volume. Now that most of the blanks have been removed from the map and research is on a continuous and well supported basis, this volume is a survey of inestimable value for scientists concerned with Antarctic research.

M. M. Prebble

P. GROEN. The waters of the sea. London, Van Nostrand, 1967. 328 p., illus., maps, 24 cm.

This is a translation of the revised (1961) edition of *De Wateren van de Wereldzee*, in which the distinguished Dutch physical oceanographer popularises his subject both for the general reader and for the student. The major part of the book is concerned, as the author says, with the 'classical' findings of oceanography. This is certainly true of the 50 pages he devotes to 'Ice in the seas'. Nansen, Sverdrup and E. H. Smith provide the main basis. Points are clearly and effectively made, and the general reader will gain much. But there are some flaws which somewhat reduce the value to the student. Some are simply misprints: 1.9°C should be -1.9°C. (p.72), Kolynuchin should be Kolyuchin (p.98), Table 41 should be Tables 13 and 14 (p.118). Others are more misleading: the caption to Plate X does not fit the picture, which is apparently reproduced upside-down, the South Pole is not the coldest place in the southern hemisphere (p.86), the maximum height of the ice front of the Ross Ice Shelf is given as 50 m on p.81 and 80 m on p.91, no Alaskan glaciers discharge into the Bering Sea (p.81, 104). And there is some trouble with terminology. The author appears to use the WMO terminology, yet

he (or the translator) speaks of table bergs, ice barrier, snow ice, and shelf ice, which are not approved by WMO, and the polar ice he illustrates in Plate X is not what he defines on p.78. He also goes beyond WMO in introducing 'polar cap' for the old pack ice about the North Pole — a term already appropriated by upper atmosphere physicists for something quite other — and he contrasts pack ice with Arctic pack, whereas the second is essentially a subdivision of the first. In general, the exposition suffers from insufficiently up-to-date knowledge of the subject. Professor Groen is not a specialist in floating ice, and it is an unhappy index of the fragmentation of knowledge that this lack shows.

Terence Armstrong

L. A. BAYROCK. Catastrophic advance of the Steele Glacier, Yukon Territory, Canada. A report on surveys conducted on the Steele Glacier from August 20 to August 23, 1966. Boreal Institute, University of Alberta, Edmonton, Alberta, 1967. Occasional Publication No. 3. 20 p., 16 plates, 5 figs., 3 tables.

In this short report the author presents the results of determinations of the motion of the Steele Glacier derived from triangulation of four stakes and from analysis of sequences of photographs. The motion was so great (on the order of 10 meters per day) that it was possible to obtain significant results over a period of just four days.

Evidence is presented to show that the motion is due largely to basal slip. It was also found that a large push moraine advanced by slipping at its base while small push moraines were rapidly incorporated into the base of the glacier. An explanation of the mechanism of the incorporation of these moraines is postulated. Dead ice from a previous advance was incorporated into the glacier by "squeezing".

The report includes a large number of plates to illustrate the points made by the author.

The legends "Edge of Steele Glacier, 1951" and "Edge of Steele Glacier, Aug. 1966" in Figure 1 of the report are unclear and, I believe, inaccurate. The topographic map referred to by the author shows the glacier terminus to have been well down around the bend of the valley in 1951, very near the present terminus.

Henry H. Brecher

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Editor: Mrs. H. Richardson

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