

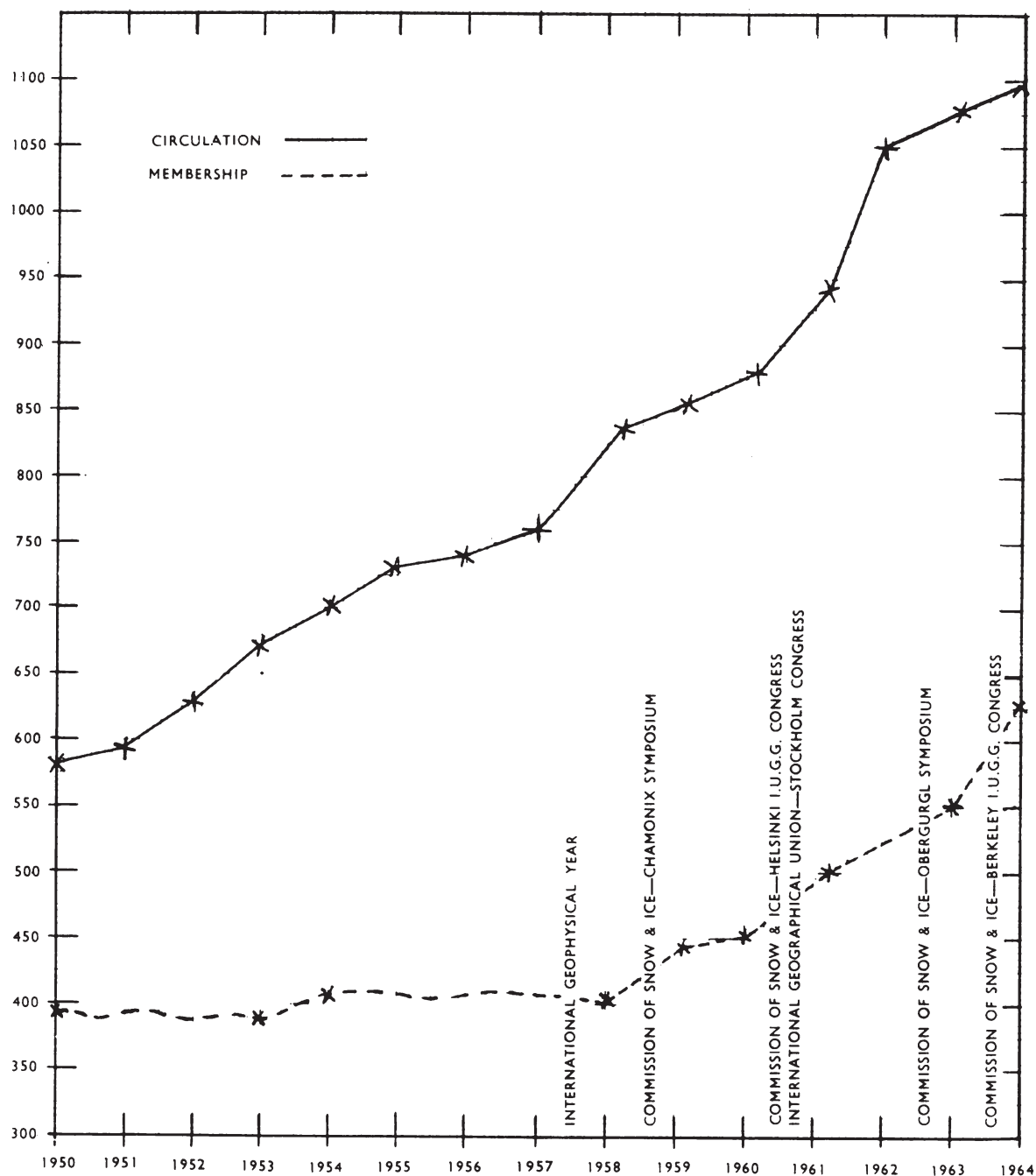
Number 13

December 1963

ICE



CIRCULATION OF THE JOURNAL OF GLACIOLOGY
 (excluding free and exchange copies)
and MEMBERSHIP OF THE GLACIOLOGICAL SOCIETY



ICE

News Bulletin of The Glaciological Society

DECEMBER 1963

NUMBER 13

The Council of the Glaciological Society, at a meeting held in Berkeley, California in August 1963, decided that the Society's news bulletin "Ice" should be published three times a year instead of twice. The field reports formerly appearing in "Glaciological Notes", published by I.G.Y. World Data Center A Glaciology (American Geographical Society, Broadway at 156th Street, New York 32, N. Y., U.S.A.), which will no longer include these reports, will be added to the field work section in "Ice", and will be passed on to Mrs. H. Richardson by Dr. W. O. Field of that Center.

The extra annual issue of "Ice" will also extend the service gladly offered to the Commission of Snow and Ice of publicising the Commission's notices.

DINNER FOR MEMBERS. The Society will arrange a dinner for members and their guests during the 20th International Geographical Congress in London, 1964. The dinner will be held in the evening of Saturday 25 July in the Kensington area of London, close to Congress headquarters. Tickets will cost approximately 30/- (\$4.20) and will be available after March, when full details will be circulated. Members are asked to indicate on their Congress Registration Forms (in the "Special Remarks" section of Form 1) that they are members of the Glaciological Society. Those who have already registered are asked to notify the Congress Secretariat (c/o Royal Geographical Society, London S. W. 7.) of their membership of the Glaciological Society, quoting their Congress Registration Number. **THIS IS IMPORTANT** you may fail to receive final details if your membership of the Society is not registered with the Congress Secretariat.

NORTH AMERICAN MEMBERS. In January 1964 you will be receiving invoices for your 1964 dues, if these are outstanding. You will find that we are trying a new method of collecting dollar subscriptions, with the kind assistance of the Arctic Institute of North America. Because the Society loses more than 40 cents on every \$6 cheque, thereby recovering less than the £2 sterling membership fee, we have arranged that AINA will collect the dollar cheques for us and transmit a monthly total in one cheque to the Society's office. As the invoices indicate, members who wish to mail their dues to AINA in the special envelope provided may pay only \$5.60 (= £2 at the official exchange rate), but those who still wish to mail their dues direct to our office in Cambridge in the form of a personal cheque will have to remit the full \$6.

We are sorry to report the death in October of Dr. R. Finsterwalder, in München. We offer our sympathy to his family and friends. An obituary will be published in the "Journal of Glaciology".

We regret to announce the death in May, on an expedition to Greece, of Mr. J. C. G. Sugden, who worked as glaciologist on Sir John Hunt's 1960 Greenland Expedition. We offer our sympathy to his family.

COVER PICTURE. Photograph taken in the ice cave of Paradise Glacier, Mount Rainier, Washington, U.S.A., during the Glaciology Study Tour of the Commission of Snow and Ice, September 1963. (H. Richardson)

FIELD WORK

ICEFIELD RANGES RESEARCH PROJECT. The third summer field season (reviews of first and second in Ice 10 and 11) lasted 85 days and saw all scientific programs continued and/or expanded. There were six research groups working in five fields of research in four camps. All camps were supplied by the project Helio Courier H391B aircraft.

Snow pit and ram hardness tests continued, the snow facies study was extended down the length of the Kaskawulsh Glacier, and research was initiated on the diagenesis of the annual snow accumulation during the time of maximum instability. Over the past three years the mean annual net accumulation at the highland glacier camp was about 140 cm of water.

Two triangulation surveys were made of the movement net. The study was begun in 1961 and expanded in 1962 and 1963 for flow line and strain measurements. Cross profiles were added as well as an investigation of two tributary glaciers. Movement at the east and west extremes of the line of poles across the divide is about 140 m per year. A reconnaissance altimetry programme was started to examine the surface relief of the highland glacier. Snow samples were collected for $\delta^{18}O/\delta^{16}O$ analysis.

The principal goals of the 1963 seismic group were to obtain a more complete picture of the bedrock profile and extend the refraction profile to the Hubbard Glacier, in order to obtain cross profiles, to map the floors of the main tributaries into the highland glacier, and to measure gravity at all reflection stations and survey cairns. Over 100 reflection seismic stations were occupied, and gravity was measured at 110 locations.

A glacier meteorological camp was established close to the snow divide at 2588 m. Two-hourly and continuous records of micro-meteorological conditions were made. In addition weather screens for standard synoptic observations were located at the base camp, glacier terminus camp, and main glacier camp.

A study begun in 1962 of the glacial history of the northeastern border of the St. Elias Mountains was continued. A detailed map of the surficial geology was completed in 1963. Samples for radiocarbon dating and pollen analysis were collected. In addition, a study was made of the post-Pleistocene history of the terminal area of the Kaskawulsh Glacier and the Slims River Valley.

Plans are now being made for the 1964 summer field season. Persons interested may write to Dr. Walter A. Wood, Project Director, 2 East 63rd Street, New York 21, N. Y., U.S.A.

(Richard H. Ragle)

1963 SUMMER GLACIOLOGICAL INSTITUTE JUNEAU ICEFIELD, ALASKA. The third annual program of the Summer Institute of Glaciology on the Juneau Icefield, Alaska, was carried out in August and September, 1963. The Institute this year was again under the aegis of Michigan State University and was supported by a grant from the National Science Foundation under its Advanced Subject Matter Institutes Program. A teaching staff of four professors, five visiting lecturers, and one graduate assistant conducted the academic program.

An advance team of several staff members flew to the icefield by helicopter on 26 July to prepare the camps and assemble oversnow vehicles. The Alaska Air National Guard provided air transport for the main body of personnel, heavy equipment, food and fuel to the icefield camps. The Auke Bay Biological Laboratory of the U.S. Fish and Wildlife Service and the Douglas Marine Station of the University of Alaska provided boats and other assistance for the Institute's end-of-season field trips to inner Taku Fjord. The U.S. Forest Service also provided assistance and equipment during the low-level field operations and space for evening lectures during the opening and closing days of the program at the Mendenhall Glacier Observatory.

On 6 August the Institute participants were flown to the Taku Glacier and the program thereafter continued at selected camps on the icefield. Two weeks were spent in the névé-line area (Camp 10) at intermediate elevations, followed by two more weeks at the 5-7000 foot levels and in the Vaughan Lewis-Gilkey Glacier trench in the northwest sector of the Juneau Icefield. The program combined academic instruction with field trips, demonstrations and projects. A set of field projects designed to teach methodology and give research experience was carried out. Lectures were given in the fields of glaciology, glacio-meteorology, glacio-botany, ecology, lichenology, glacial geophysics, glacier mechanics,

glacier surveying, bedrock geology and arctic alpine geomorphology. The field trips featured sites where significant phenomena could be observed and discussed.

On 1 September Dr. Cross and those students enrolled in the geo-botany course hiked out from the icefield to observe glacio-botanical phenomena in the peripheral zone and to extend the geobotanical course work into the muskeg and valley train areas of the Mendenhall, Norris and Taku Glaciers. The remainder of the party were evacuated from the main icefield area on 13 September. On 8 September, Dr. Herfield Hoinkes, President of the Commission of Snow and Ice, and Mrs. Hilda Richardson, Secretary of the Glaciological Society, visited Juneau and were shown the terminus of the Taku Glacier by Dr. A. Cross (M.S. U. Summer Institute) and Dr. L. Knowles (Director of the Douglas Marine Station of the University of Alaska).

(Maynard Miller)

IMPERIAL COLLEGE BEERENBERG EXPEDITION, 1963. The expedition was organised to continue the glaciological investigations carried out on Jan Mayen island, Greenland Sea, by parties from Imperial College in 1938, 1959 and 1961. Fourteen men took part in the expedition which was in the field from 5 July to 2 September. Members of the party were:- D.C. Birch (mountaineer), J. Bloor (mountaineer), P. C. Dibben (meteorologist), P. H. Draper (assistant meteorologist), F. J. Fitch (geologist), R. G. Fitch (geologist), P. J. D. Guile (glaciologist), C. J. Leaver (botanist), H. T. Lovenbury (glaciologist and surveyor), J. W. Sheard (Leader), R. Stafford (assistant geologist), D. Thomas (mountaineer), W. N. Whaley (assistant surveyor), A. F. Wilson (assistant botanist). The expedition was again based at Jamesonbukta because of its proximity to Sørbreen, the glacier on which most glaciological investigations have been carried out.

In the first two weeks stake lines were established across Sørbreen at 100, 300, 420, 700, 900 and 1,550 m altitude and their displacements were measured four times during the course of the expedition. Average flow rates varied from 0.6 cm/day for the 100 m line to 40.2 cm/day at 700 m. The flow rates were lower at 100 m and 300 m than in 1959 and 1961 but similar to previous ones at 900 m. The progressive lowering of flow rates near the snout from 1959 to 1963 shows that the surge of ice (109.1 cm/day at 300 m) recorded in 1959 has now outrun itself. The associated advance of the glacier has ceased and the snout is in substantially the same position as it was in 1961. Extending flow, characterised by severe crevassing, at 300 m in 1959 and 1961 has now been replaced by compressive flow with an accompanying lack of open crevasses. Strain measurements verify these observations.

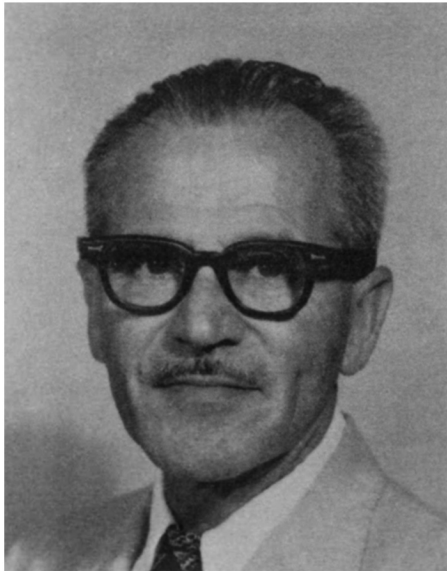
A detailed map of the glacier snout and moraine system of Sørbreen was completed. There is no evidence of the push moraine observed in front of the snout in 1959 and a small ice-cliff at the snout has already disappeared. Other surveys of the present expedition have shown that Petersenbreen, Fotherbybreen and Kerckjoffbreen have taken part in the general advance of the Beerenberg glaciers. Of the 20 glaciers that radiate from the mountain 11 are now known to have advanced in recent years. Six of the remaining glaciers have always been observed discharging into the sea and an advance of these glaciers would be difficult to detect. However, one of the largest of these glaciers, Weyprechtbreen, is known to be more severely crevassed than formerly.

A meteorological station was established at 700 m on the ice-fields adjacent to the glacier proper and was in operation throughout the expedition. It will be of interest to compare the records for this station with those of the Norwegian Meteorological Station on the island. A heat balance study was also carried out but difficulty was experienced because of the uneven snow surface. Ablation studies carried out in conjunction with the meteorological programme gave results of between 1.63 cm/day at 1,550 m and 3.96 cm/day at 100 m. Ablation rates near the snout were in general lower than those recorded in 1959 and 1961 but greater than previous measurements in the accumulation area.

Lichen studies carried out as part of the botanical programme point to a number of theoretical objections to the measuring technique in common practice. It is unlikely that this method will improve the accuracy of the present dating of the moraines on Jan Mayen. Studies on the ecology of lichens and bryophytes were also made in relation to the effect of exposure and radiation on these plants.

The geological programme consisted of mapping previously neglected areas and making additional rock collections for studies already being undertaken. A large number of collections for subsequent paleomagnetic determination were also gathered. Together with studies on the geomorphology of the island it is hoped that this work will lead to further information about the evolution of the Beerenberg mountain and its icefields.

Erratum: Ice no. 12, p. 9, paragraph 6, line 5 - correct to read "1.7 m/100 years" instead of "1.7 m/per year".



Henri Bader

Henri Bader was born January 15, 1907 in Brugg, Switzerland. From the age of seven to nine he attended school in Geneva. During the next five years he lived in England, attending school in Manchester and Derby, which no doubt gave him the foundation for his present fluent English. In 1921 he returned to Switzerland, attending schools in Aarau and Winterthur. He entered the University of Zürich in 1926, mainly studying mineralogy, geology, physics, chemistry and mathematics. He obtained his Ph.D. in mineralogy from Zürich under the famous Professor P. Niggli in 1934.

Dr. Bader began his research on snow and ice in 1935 at the Weissfluhjoch Experimental Station with the Snow and Avalanche Research Commission of Switzerland. Although he has often been accused of being more interested in the ski slopes of Davos than in the structure of snow, he did conduct the research for his important paper "Mineralogical and structural characterization of snow, and its metamorphism", which is chapter one in the famous work "Der Schnee und Seine Metamorphose".

In 1938 Bader went to Argentina where he prospected and did some mining on his own. From January 1940 to May 1941 he was mineralogist at the National Chemical Laboratory in Bogotá, Colombia, and also gave lectures in mineralogy and engineering geology at the National University. From May 1941 to May 1945 he was quarry superintendent of the Curaçao Mining Company, Newport, Curaçao. To those of us who know him well, many interesting stories have come from this South American and West Indian period of his life. He moved to the U.S.A. in the summer of 1945 to become Associate Research Specialist at Rutgers University, New Brunswick, New Jersey, and Assistant Director of the Bureau of Mineral Research. He did field and laboratory studies of mineral deposits in New Jersey and taught graduate work in geology and mineralogy.

While at Rutgers, Dr. Bader brought to the attention of the U.S. Government the lack of knowledge in snow and ice mechanics in the U.S.A. As a result the War Department General Staff sent him to Europe in the spring of 1947 to review and evaluate snow and ice research accomplished up to that time in England, France, Switzerland and Germany. His report formed the basis of a conference on snow and ice at the Pentagon on 12 August 1947 which stressed the need for such basic research and its Corps of Engineers was assigned the task of initiating the Snow, Ice and Permafrost Research Establishment, which was

located at first in St. Paul, Minnesota. Research on snow and ice was conducted by contract with the University of Minnesota. In September 1949, Bader left Rutgers University and accepted the position of Research Associate, Institute of Technology, University of Minnesota to work under this Army contract. By June 1951, a laboratory was ready in Wilmette, Illinois, and the Snow, Ice and Permafrost Research Establishment became an operating laboratory on its own as part of the U.S. Army Corps of Engineers, with Bader as Supervisory Physical Science Administrator. He soon became the Acting Scientific Director and the Chief of the Snow and Ice Basic Research Branch and in 1953 was made Chief Scientist. This post he held until 1960, when he moved to Miami, Florida as Research Professor in the University of Miami, under government contract and grant. He became a naturalized citizen of the U.S.A. in 1952. He has served for many years on the Panel of Glaciology of the Committee on Polar Research of the U.S. Academy of Sciences, helping in the growth of glaciology in the U.S.A. during and since the International Geophysical Year.

Recently Dr. Bader has had the honour of being appointed Scientific Attaché to the U.S. Ambassador, Bonn, Germany, a post which he takes up at the end of 1963.

Bader married in 1938, and Adèle, a charming woman, whisked him off to Argentina, which she had previously visited and where she studied Spanish. The Baders are also fluent in English, German, French and their native Swiss dialect.

Dr. Bader has a long list of publications ranging from the mineralogy and metamorphism of snow, the problems in deep core drilling in ice sheets, natural particulate fall-out incorporated in polar glacier ice, to the lime marl deposits in New Jersey. His colleagues admire his scientific and administrative ability as well as his personal characteristics which make him well liked. Many people have contributed to the U.S. research programme on snow and ice, but Dr. Bader's multiple contributions as an initiator, educator, researcher, adviser and scientific director single him out as pre-eminent.

MEETINGS

SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH. The seventh meeting of SCAR was held in Cape Town, South Africa, 23 - 27 September 1963. The President, G.R. Laclavère, was in the chair, and delegates were: Argentina: R.N.M. Panzarini; Australia: B.P. Lambert; France: C.J. Lorius; Japan: T. Tatsumi; New Zealand: R.W. Willett; Norway: T. Gjelsvik; South Africa: S. Naudé; United Kingdom: G. de Q. Robin (Secretary); U.S.A.: L.M. Gould; IGY: W.J. Talbot; IUPAC: E.F.C.H. Rohwer; WMO: H.R. Phillpot; IUGG: G.R. Laclavère; IUGS: R.W. Willett. The new President for the period 1963 - 66 is L.M. Gould. The list of observers and advisers and details of the business transacted at the meetings may be found in SCAR Bulletin no. 16, in the Polar Record (published by the Scott Polar Research Institute) vol. 11, no. 76, January 1964. An item of particular interest to glaciologists was the approval of the proposal from the Working Group on Glaciology that a symposium on Antarctic glaciology be held in 1967 in conjunction with a SCAR meeting. The SCAR Working Group on Geology held a symposium on Antarctic geology in Cape Town, 16 - 20 September. Abstracts of the papers presented are given in SCAR Bulletin no. 15, in the Polar Record, vol. 11, no. 75, September 1963, and the proceedings will be published in a volume entitled "Antarctic geological research", containing about 1200 pages, editor: R.J. Adie, assisted by E.S.W. Simpson and F.C. Truter.

INTERNATIONAL GEOGRAPHICAL UNION. As announced in Ice no. 12, July 1963, the 11th General Assembly and the 20th International Geographical Congress will be held in the United Kingdom in 1964, with the main Assembly and Congress sessions in London 21 - 28 July. Circulars may be obtained from the Congress Secretariat, c/o Royal Geographical Society, London S.W. 7. Application forms must be returned by 1 February. Members of the Glaciological Society who plan to attend the meetings are asked to read the notice on p. 1 of this issue of Ice, referring to a dinner for members on Saturday 25 July in London. All members attending the Congress are asked to indicate in the "Special remarks" section of Form 1 that they are members of the Glaciological Society.

COMMISSION OF SNOW AND ICE

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

RESOLUTIONS ADOPTED AT THE 13th GENERAL ASSEMBLY OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS AT BERKELEY, CALIF., ON 23 AND 27 AUGUST 1963.

1. The officers of the Commission for the next three years shall be:

President	Dr. H. C. Hoinkes	(Austria)
Vice-Presidents	Prof. G. A. Avsiuk	(U.S.S.R.)
	Dr. M. F. Meier	(U.S.A.)
	Dr. V. Schytt	(Sweden)
Secretary	Dr. W. H. Ward	(U.K.)

2. The Chairmen of the Divisions shall remain:

Seasonal Snow Cover and Avalanches:	Dr. M. de Quervain (Switzerland)
Ground Ice and Frozen Ground Phenomena:	Dr. J. A. Bender (U.S.A.)
Sea, Lake and River Ice:	Dr. E. R. Pounder (Canada)

3. The subjects for discussion at the 14th General Assembly in 1966 (the place has not been fixed yet) shall be:

- a) One session devoted to a discussion of the measurement of the mass-budget of very large ice sheets and their variations. No papers to be published but speakers to be invited if necessary.

- b) Papers of high quality on any glaciological subject, especially on the physical properties of snow and ice, and on phenomena occurring at the bed of a glacier.

Not more than about 40 papers shall be accepted by the screening committee. The Officers of the Commission shall have the right to modify this programme in the light of other related conferences which may be announced in the future.

4. The agreement of the International Association of Scientific Hydrology shall be sought to hold a Symposium entitled "The scientific aspects of snow and ice avalanches" at Davos, Switzerland, in early April 1965. This Symposium to be organised locally by Dr. M. de Quervain as Chairman of the Division of Seasonal Snow Cover and Avalanches in cooperation with the Officers of the Commission. Not more than 30 papers shall be accepted by the Screening Committee for publication. The papers to be duplicated and made available to the attendants at the opening of the Symposium and subsequently edited with the discussion and published in one volume as soon as possible after the meeting.

5. The Commission having accepted the report of its Sub-Committee on the Variations of Existing Glaciers issued in Publication No. 58 of the International Association of Scientific Hydrology (1962), p. 306-309, shall implement the programme of measurements on a world-wide basis by urging National Committees of each member country:

- a) To formulate a detailed programme for their territories, or modify an existing one, preferably in association with the Hydrological Decade programme, indicating which glaciers are to be measured and the scope of the measurements planned. To put the programme on a continuing basis and to include the maximum number of glaciers for which an unbroken series of measurements can be expected in the future.
- b) To assume responsibility for the annual collection and summary of the data from its territories, and to establish centres for this purpose.
- c) To summarize past measurements on glacier variations in its territories.
- d) To send copies of their national programmes and the addresses of the national centres to the Secretary of the Commission (Dr. Ward, 147 Rickmansworth Road, Watford, Herts., England) before 1 April 1964.

6. The Check List of glacier variation observations and measurements prepared during the Assembly by a Sub-Committee consisting of G. de Q. Robin (representing C.I.G. World Data Centres), M. F. Meier and G. A. Avsiuk shall be used as a guide by national centres in organizing the world-wide programme of measurements of the variations of existing glaciers, and by the World Data Centres.
7. The recommendations of the Chairman of the Sub-Committee on the preparation of a glaciological terminology shall be accepted; the Commission shall proceed to arrange for the preparation and publication of an International Glaciological Terminology with a standard list in English, and shall invite the Scott Polar Research Institute to undertake the task, detailed arrangements to be agreed between the Officers of the Commission and the Director of the Institute. To assist in this work the International Association of Scientific Hydrology shall be asked to provide a sum not exceeding 3000 U.S. dollars over the next three years.
8. The comments and recommendations of its officers on the UNESCO programme for the Hydrological Decade were adopted and the Commission recommends:
 Since about 80% of the fresh water storage of the world is in the form of snow and ice, since run-off from snow and ice is a dominant factor in the economy of many populated areas, and as snow and ice in the polar regions form an integral part of the world's water budget and an important resource where human activities are rapidly expanding, that the UNESCO programme should include the following broad topics:
 - a) An inventory of perennial and annual ice and snow masses over the whole world.
 - b) Implementation of a programme of measurements of glacier variations, such as the one being organised by the Commission, on a world wide basis.
 - c) Combined mass-budget, precipitation, meteorological and hydrological measurements over representative glacierized catchment areas distributed as widely as practicable over the world and continued for a whole decade in order to establish relationship between the glacier variations and the climatic environment. A North-South chain of stations might extend from Arctic America to the Antarctic Peninsula, a West-East chain might extend from the Atlantic through Europe and Asia to the Pacific.
 - d) Studies of the possibilities of the artificial control of storage and melting of snow and ice to provide water when and where it is required.
 - e) A study of the influence of snow, ice, and frozen ground on the availability of surface and ground water supplies.
 - f) Evidence of the climatic history obtained from studies on ice and snow masses (including frozen ground) as an aid in forecasting water supplies.
 - g) The training of specialists in the study of snow and ice in all its aspects.
 - h) The standardization of observations, measurements and procedures, which are just as important in the study of snow and ice as in other hydrological parameters.
9. A vote of thanks shall be recorded to Dr. P. A. Shumskiy and the retiring Officers, and to all those responsible for organising the Berkeley Assembly, including Dr. M. F. Meier and his screening committee, the Chairman of the meetings, Prof. L. J. Tison and the Secretary of the Commission.

W. H. WARD
Secretary

CHECK LIST OF GLACIER VARIATION OBSERVATIONS AND MEASUREMENTS. In connection with its programme of world-wide measurements of the variations of existing glaciers the Commission has approved the following list of observations and measurements for use by national centres, and by the World Data Centres. The observations are listed in order of priority, beginning with the simplest and most essential. The list is intended as a guide. It is hoped that useful information can be provided on most questions listed under "Basic observations", plus when possible information on more elaborate programmes listed under "More comprehensive measurements".

Basic observations

- 1
 - a) Name of glacier
 - b) Geographical location
 - c) Latitude and longitude
- 2
 - a) Name of observer
 - b) Address of centre where principal data on glacier are held
- 3 General description
 - a) Morphological type
 - b) Total area
 - c) Length
 - d) Maximum elevation
 - e) Elevation of terminus
- 4 Photographs
 - a) Number available
 - b) Number established cairns for photography
 - c) Where photographs are stored
- 5 Position of terminus
 - a) When measured with respect to fixed points
 - b) Period since last survey
 - c) Vertical displacement of terminus
 - d) Horizontal displacement of terminus
 - e) Angle of slope of ice surface at terminus
 - f) Angle of slope of glacier bed at terminus
- 6
 - a) Altitude of snow line on glacier at end of ablation season
 - b) Accumulation area as fraction of total area
- 7 Surface elevations at selected points
 - a) Near snow line
 - b) Middle accumulation area
 - c) Middle ablation area

Date measured	Methods	Change since last measurem
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- 8 Map
 - a) Is published map available?
 - b) Reference

More comprehensive measurements

- 9 Profiles
 - a) When longitudinal profile of glacier measured
 - b) When transverse profiles of glacier measured
 - c) Where held
- 10 Detailed mapping
 - a) When glacier was mapped
 - b) Method
 - c) Where published (or)
 - d) Address where manuscript map is held
- 11 Methods of measurements of following
 - a) Accumulation ; period covering
 - b) Ablation ; period covering
 - c) Density ; period covering
- 12 Will mass budget be calculated?
- 13 Movement
 - a) Method
 - b) Number of stations
 - c) Date of first measurement
 - d) Date of last measurement
 - e) Where data are held
- 14 Bedrock topography
 - a) Method
 - b) Number of profiles
 - c) Number of spot depths in addition to (b)
 - d) Where held
- 15 Temperature measurements below level of seasonal changes
 - a) Maximum depth of measurements
 - b) Temperature
 - c) Date
 - d) Method
 - e) Number of locations measured
 - f) Geophysical classification

Accumulation zone	Ablation zone
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- 16 Any other information
- 17 Bibliography

SYMPOSIUM ON SCIENTIFIC ASPECTS OF SNOW AND ICE AVALANCHES 1965

FIRST CIRCULAR, OCTOBER 1963

At its General Assembly held in Berkeley 1963, the International Association of Scientific Hydrology accepted a proposal from the Division of Seasonal Snow Cover and Avalanches to organise a symposium on the scientific aspects of snow and ice avalanches in the spring of 1965 in Davos (Switzerland).

1. TOPICS

Avalanches are a serious menace to residents and visitors in mountainous areas, yet despite many studies they are not fully understood. In order to collect together our present knowledge and to promote further research on the subject, all scientists familiar with the special problems related to the formation, the behaviour and the effects of snow and ice avalanches are invited to take part in the symposium and to present papers for discussion. In view of the wide scope of the problems some restriction must be placed on the subjects, and a number of practical problems such as applied engineering work, rescue operations and economic questions can not be included in the symposium. Papers dealing with the following topics are invited:

- a) Meteorological conditions related to avalanches (snow fall intensity and distribution in mountain regions, influence of wind and temperature).
- b) Physical properties of the snow cover or of ice masses in connection with avalanches (mechanical, crystallographic, thermodynamic properties and processes etc.)
- c) Forecasting avalanches.
- d) Mechanism of avalanche formation.
- e) Influence of topography, vegetation and subsoil conditions on avalanche formation, frequency and effects.
- f) Scientific features of outstanding avalanches.
- g) Dynamics of avalanching snow and ice (velocity, forces, friction, destruction features of scientific interest).
- h) Other effects (for instance: hydrological consequences of avalanches).
- i) Scientific methods which might be useful in preventing, releasing or fighting avalanches.

Special attention should be given to the classification of avalanches, and it is hoped to obtain agreement on this matter which was raised in the Toronto Assembly (1957).

2. DATE AND LOCATION

As a tentative date the week from Monday 5th to 10th April 1965 is proposed. The meeting place will be Davos - Platz (1550 m above sea level) in eastern Switzerland, which is a well-known Alpine ski-ing resort.

The Federal Institute for Snow and Avalanche Research (Weissfluhjoch above Davos, 2670 m above sea level) which is actively engaged in avalanche research will be open to visitors during the symposium.

3. GENERAL PROGRAMME

The proposed programme will comprise five days for presentation and discussion of papers separated by a trip to the Weissfluhjoch and followed by an excursion to the Upper Engadine. Other points of interest in the surroundings of Davos may also be visited (with or without skis).

4. PAPERS

In order to provide ample time for discussion and committee work, the total number of papers will be limited to about 30. The following schedule must be observed in the submission of papers:-

Submission of tentative titles:	March 31st, 1964 (see form on page 23)
Submission of papers in duplicate:	January 31st, 1965

The papers must be written in either English or French, with abstracts in both languages, and must not be longer than 15 typed pages including illustrations. They will be screened by a Committee of the Commission of Snow and Ice and, if accepted, will be mimeographed (except photographs) by the organising committee for distribution at the symposium. Acceptance of the papers will be communicated to the authors in due time. After the symposium the papers will be printed in the series of the International Association of Scientific Hydrology (I. A. H. S.).

5. ORGANISATION ADDRESS

The local arrangements will be made by a committee of the Commission of Snow and Ice and the Swiss Federal Snow and Avalanche Research Institute working in co-operation with the Swiss Commissions on Hydrology, Snow and Avalanches and Glaciers. All communications regarding the symposium should be addressed to the local organiser:-

Dr. M. de Quervain,
Avalanche Symposium,
Federal Snow and Avalanche Research Institute,
DAVOS/Weissfluhjoch,
Switzerland.

6. FURTHER INFORMATION

A second circular with the tentative plan of the meetings and a more detailed programme will be issued in October 1964. It will also give full details on the preparation of the manuscripts for reproduction.

You are invited to attend this symposium and to return the form on page 23 as soon as possible. If you feel that other people you know will be interested please pass the information on to them.

Commission of Snow and Ice	Division of Seasonal Snow Cover and Avalanches
Dr. H. C. Hoinkes (Austria) President	Dr. M. de Quervain Chairman
Dr. W. H. Ward (U. K.) Secretary	(Director, Swiss Federal Institute for Snow and Avalanche Research)

Commission of Snow and Ice Glaciology Study Tour, 2—6 September 1963, following the I.U.G.G. Congress in Berkeley, California, U.S.A.

Cameras worked overtime on the Tour, for the sun blazed down from a cloudless sky and there were many subjects worthy of record. Here are a few samples, to catch the spirit of those light-hearted albeit instructive days.



Mount Rainier. Washington, the scene of the Tour . . .

(H. Richardson)



We studied glaciology the easy way . . .

(E. R. LaChapelle)

We walked, and looked
at trees and moraines . . .



(W. H. Ward)



and ate heartily
(G. Manley, M. F. Meier,
H. C. Hoinkes, J. W. Glen)

(E. R. LaChapelle)



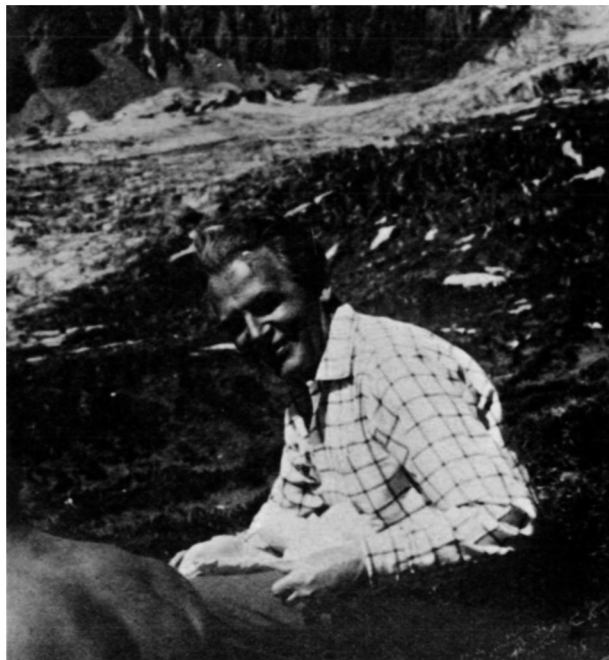
12 sparing a crust for the
ground squirrels . . .

(H. Richardson)



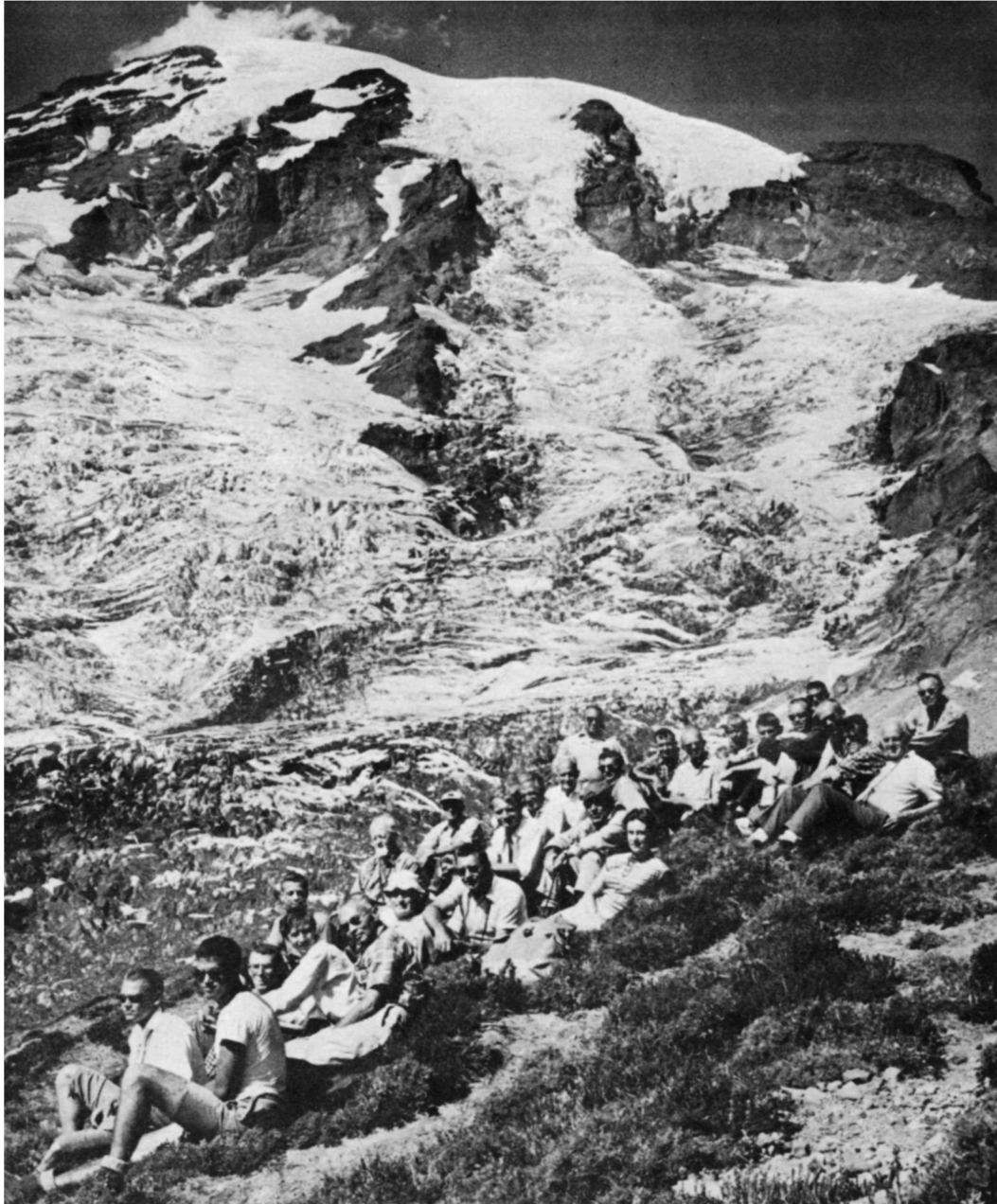
(H. Richardson)

▲
and drank nobly (thanks to
the excellent organization) . . .



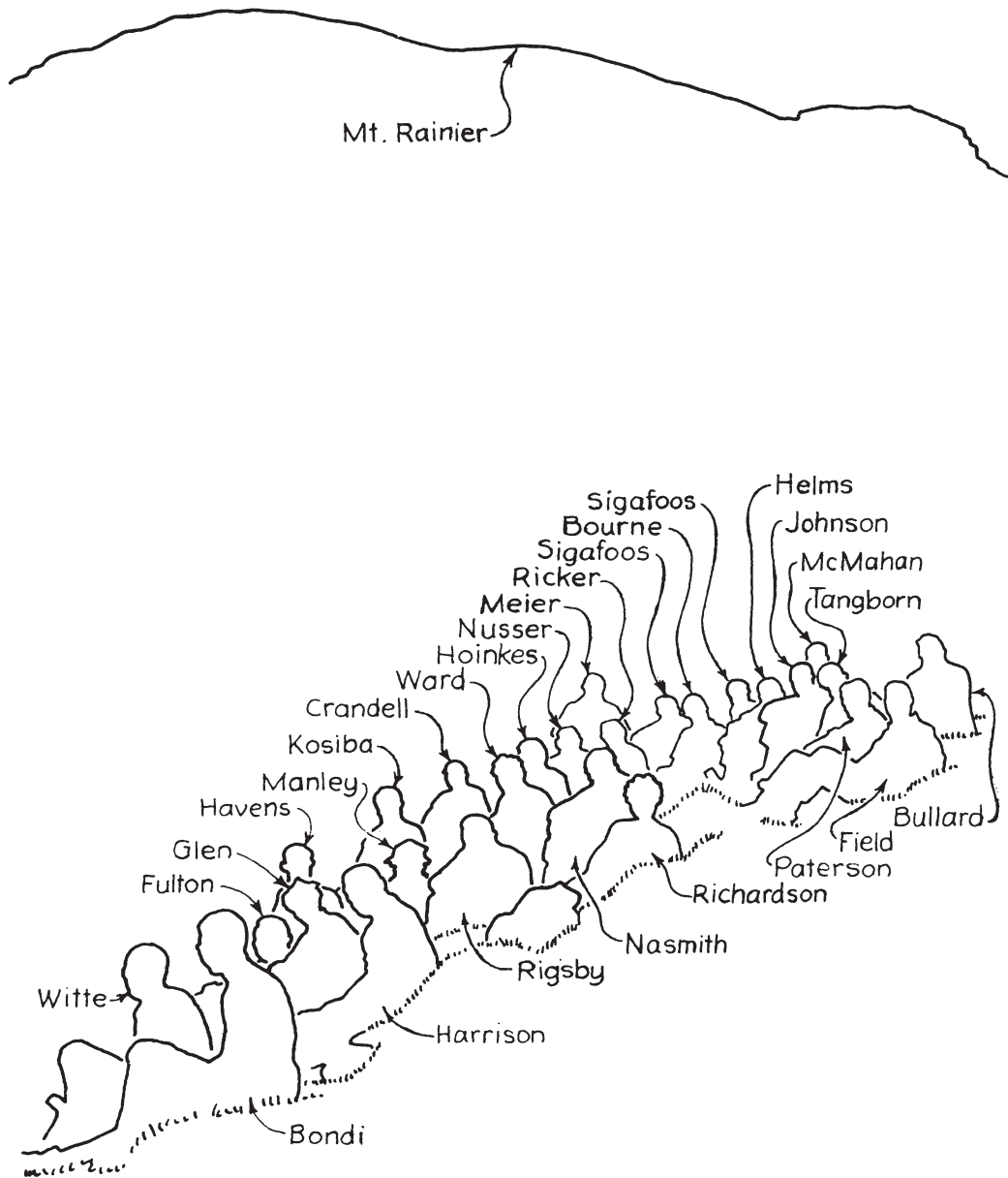
But above all, like the
President of the Commission, ►
H. C. Hoinkes . . .

(H. Richardson)



we enjoyed the sun and the scenery.

(official photograph)



CURRENT RESEARCH ON SNOW AND ICE

5. AUSTRALIA

Glaciology has become an active field of research in Australia despite the handicap imposed by the need to cross the sea for access to glaciers. The Meteorology Department of the University of Melbourne provides a focus for most of this work both through its cooperation with the Scientific Section of the Antarctic Division and through its programme of Australian snow studies.

At home every effort is being made to be in on the start of any trend towards a lower snow line and re-formation of glaciers in the Australian Alps. A semi-permanent snow drift on Mt. Twynam (7200 ft) has been under regular surveillance since early 1962 and has been studied this year by means of aerial photogrammetry carried out by the Survey Branch of the Snowy Mountains Hydroelectric Authority (S.M.A.). It is planned to obtain cores from the lowest layers of the drift at the end of the coming summer. Principal worker: Harry Black (O.I.C. Wilkes 1960).

Attempts are continuing to find a suitable field technique for measuring the free water content throughout a snow pack. A transistorized version of Dr. W. Ambach's instrument for dielectric measurements and a resistivity bridge were tested recently at the Meteorology Department's new glaciological laboratory on Mt. Buller (6000 ft, cf. photo) and at the S.M.A. station Spencer's Creek. Apart from their immediate purpose these measurements are to serve for a physical classification of different snow types and structures. Principal worker: John Bennett.

Moving away from Australia proper, glaciological studies have been made on Heard Island and are planned in New Zealand. Photographs obtained last February by Dr. Jon Stephenson (University College, Townsville, Queensland) and Nils Lied (Bureau of Meteorology) are being compared with earlier photos in order to determine the precise degree of recession that has occurred on the island, last manned by the A.N.A.R.E. in 1954. In New Zealand next autumn Australian trainee glaciologists may assist Dr. Ian McKellar of the N.Z. Geological Survey with his studies of the Tasman Glacier, and it is hoped that this cooperation will later be expanded to include micrometeorological investigations.

In Antarctica the Australian glaciological studies are moving from the stage of first surveys (still to be made however at Davis in the Vestfold Hills oasis) to the more thorough investigation of such features as the Lambert Glacier - Amery Ice Shelf drainage system east of Mawson and the local ice cap south of Wilkes which has a diameter of about 200 km and is created by the major rock depression occupied by the Vanderford, John Quincy Adams, and Totten glaciers. Extensive stake systems are planned for these regions together with detailed seismic and gravity surveys of ice thickness and rock topography; a radio altimeter is to be used experimentally on the Amery Ice Shelf. Ted Wishart and Robin Simon, the present glaciologists at Mawson and Wilkes, will hand over this work to Bill Budd and Peter Morgan at the beginning of next year.

Specialized studies in glacio-meteorology are continuing both in Antarctica and at home on drifting snow, thermal processes in ice sheets and sea ice, radiation processes above and in ice and snow, and the isotope and trace element content of snow.

Snow drift and associated phenomena such as the particle size distribution and wind profile as functions of height are being studied by means of extensive data obtained last year at Byrd station by Bob Dingle, working under a contract from the U.S. Weather Bureau to the Meteorology Department of the University of Melbourne. Additional comparisons of different types of drift snow traps will be made next year at Mawson where also two different photo-electric drift gauges will be in operation. One of these was developed by Ian Landon Smith and Barry Woodberry during 1962 at Mawson and subsequently in Melbourne. The other was built this year at Mawson by Ted Wishart, who also has taken the first steps in a study of the electrical properties of drifting snow.

Ice temperature calculations with the computer technique described by Jenssen and Radok in the *Journal of Glaciology* (vol. 4, no. 34) have been made for the ice cap profile between Vostok and Wilkes explored last summer by an A.N.A.R.E. party which included Alastair Battye as glaciologist and Don Walker (Bureau of Mineral Resources) as geophysicist. New theoretical developments in this field aim at the use of more general flow states (Bill Budd) and the generation of realistic, not necessarily steady-state, ice cap shapes from accumulation data, an initial temperature profile, and different temperature-dependent flow laws (Dick Jenssen, Uwe Radok).

The thermal properties of sea ice, subject of a survey just published in the Journal of Glaciology, are being simulated in an analogue computer which will provide ice thickness and temperature profiles from a surface temperature input. A planned complete study of the heat economy of Antarctic sea ice at Davis has been postponed for another year in order to prepare it more thoroughly. New instruments are being developed for the study of radiation processes in snow and of the physical factors determining the albedo of a snow surface. Principal worker: Dr. Peter Schwerdtfeger.

Isotope analysis of Antarctic cores is under development in the Physics Department of the University of Melbourne by Bob Wilkinson in cooperation with Dr. Fred Jacka, who heads the A.N.A.R.E.'s Scientific Section. The chemical analysis of trace elements in Australian and Antarctic snow and ice is being developed under the direction of Dr. John Anderson in the Chemistry School of the University of Melbourne.

(Contributed by Uwe Radok, correspondent for Australia)



Forestry Commission fire lookout on Mt. Buller, Victoria, which serves as glaciological laboratory of the Meteorology Department, University of Melbourne, in winter. In background on right Mt. Stirling and on horizon Mt. Feathertop (left) and Mt. Hotham (right).

NEWS

Heavy snowfalls on the Japanese Sea coast. In late January 1963 abnormal snow falls along the central part of the Japanese Sea coast produced an unusually thick snow cover, which hindered all kinds of transportation for a month or more. In the preceding two winters snow had also been more abundant than usual, though not as excessive as in 1963. Snow researchers sent from other places cooperated with those of the districts in making observations and measurements on the snow cover. Layer structure, microscopic texture of each layer, vertical distribution of density, and free water content were observed or measured at more than ten places. The central third of the snow cover was found to be made of wet hard snow, sandwiched between soft layers of wet granular snow. The microscopic texture of the central layer was similar to that of compact snow subjected to metamorphosis by sublimation. The Geographical Survey Institute, Ministry of Construction, made for the first time in Japan air photogrammetry maps of snow thickness over an area 400 km x 50 km. These maps covered not only the coastal districts but also the large mountainous areas where the distribution of snow has been difficult to discover in detail because of complicated land forms.

The Meteorological Society of Japan held a special meeting to discuss the cause of the heavy snow falls on the Japanese Sea coast in the last three winters.

(Z. Yosida)

Firn research on Mt. Tateyama (Toyama Prefecture). Small firn fields are found in the mountainous areas covering the central part of Honshu, but no glaciological research has ever been made on them. Prof. K. Ogasawara of Toyama University, who had undertaken much geomorphological research in the mountains around Mt. Tateyama, urged Prof. Z. Yosida and his colleagues from the Institute of Low Temperature Science in Hokkaido to study the firn fields. In October 1962 the most easily accessible firn field was studied. It measured 70 m in diameter and was 5 m thick. The density increased rapidly with depth reaching 0.7 gm/cm³ at 30 cm below the surface and fluctuated between 0.87 and 0.9 below 80 cm. Plates of ice cut out through the whole depth showed that some layers of ice were composed of single crystals several cm in diameter. The age of the ice at the bottom was provisionally estimated from the layer structure of the firn as 10 years. In October 1963 the study on the same firn was repeated together with exploratory researches on other firn fields.

(Z. Yosida)

Fast-flowing Pamir glacier. Some background information is now available on Lednik Medvezhiy, the glacier in the Pamirs which advanced two kilometres in a few days in May-June 1963 (see Ice, no.12, p.26). B.S. Chuchkalov, in a note in "Meteorologiya i Gidrologiya", 1963, no.9, makes clear the unusual nature of this glacier. Originally a cirque glacier, it eroded its back wall until it made contact with the much larger Lednik Akademii Nauk, which flows in the opposite direction, into Lednik Fedchenko. At the point of contact there is an ice fall, and whenever heavy precipitation over Lednik Akademii Nauk raises the level of the latter and stimulates its activity, ice escapes over the ice fall into Lednik Medvezhiy, which, being much smaller, reacts sharply to the great increase in its alimentation. A swift advance of nearly a kilometre, presumably caused by this mechanism, was noted in 1950. The drop in altitude from the ice fall to the snout of Lednik Medvezhiy is such (5000-3000 m) that the recently advanced ice must melt quickly, and release the waters of the two ice-dammed lakes which have formed.

Ice Island WH-5. This ice island was the easternmost and largest (20 x 9 km) of the islands resulting from the massive calving of the Ward Hunt Ice Shelf in the winter of 1961-62. WH-5 drifted eastward, while the other four islands drifted westward. WH-5 has been tracked through radar photography by US Navy "Birdseye" ice reconnaissance flights. The island broke into 3 pieces on 22 July 1963 and moved irregularly across the Kane basin. Each piece was mounted with instruments and marked so that tracking could continue through the 1963-64 winter; on 29 September the position of one piece, Alpha, was 77° 33' N, 76° 45' W, just off Smith Bay in southern Ellesmere Island. In the period 20 - 29 September the southerly drift was 10.7 miles per day. The other pieces of WH-5 appear to have broken up. The ice island remnant Alpha can be identified by radar photography, and, depending on its rate of drift southward, it may be possible for the US Navy "Birdseye" flights to locate and identify the island by reconnaissance from Søndrestrøm, Frobisher or Goose Bay.

(D. C. Nutt)

Two members of the Society received honorary degrees from McGill University in Montreal on 17 September 1963. T.E. Armstrong, Assistant Director of the Scott Polar Research Institute, was awarded the degree of Doctor of Laws, to mark his contributions to knowledge of the Soviet Arctic and to mark the close and happy link between McGill University and the Scott Polar Research Institute, justly famous for the role it has played in polar research. "Armstrong is known throughout the world for his authoritative work on the Soviet Arctic, and above all for his study of the Northern Sea Route, along which the U.S.S.R. maintains annually a heavy flow of sea-borne freight to the Siberian coast of the Arctic Ocean. In 1958 Armstrong published a two-volume atlas entitled 'Sea ice north of the U.S.S.R.'... To the extent that we know and are able to applaud their achievement in maintaining this great marine passage we are almost wholly indebted to Dr. Armstrong." P.A. Shumskiy, Deputy Chairman of the Antarctic Committee of the Soviet Academy of Sciences, was awarded the degree of Doctor of Science in recognition of his outstanding contributions to glaciological studies in both Arctic and Antarctic, and of his directorship of the V.A. Obruchev Institute of Permafrost Studies.

As reported briefly in the July issue of *Ice* (no. 12) and in the October issue (no. 36) of the *Journal of Glaciology*, the Founder of the Glaciological Society, Gerald Seligman, was awarded the honorary degree of Doctor of Philosophy by Innsbruck University on 29 June 1963 in recognition of his outstanding contribution to the science of snow and ice. In the Laudation, spoken by Dr. H.C. Hoinkes, his career in glaciology was traced from its beginnings, when he first became fascinated by the snow on which he skied, through the period when he and other enthusiasts conducted experiments on the Grosser Aletschgletscher, to the revival of glaciology in his home country by the founding of the *Journal of Glaciology* and the encouragement of young glaciologists from many scientific disciplines. "Seligman's interest was far-reaching, from the miracle of the falling snow crystal to the destroying power of avalanches, from the densification of firn snow to the glittering glacier-grain. With numerous contributions he enlarged our stock of knowledge... Out of a country which is far from glaciers, fresh impulses were again given to glaciology, as in the days of Forbes and Tyndall."

Several members of the Society are working in the Antarctic this summer season. An oversnow traverse from Byrd Station to the Filchner Ice Shelf will be conducted by members from the University of Wisconsin. R.L. Cameron, from Ohio State University, will make glaciological studies at Byrd Station. Patterned ground studies, by R.F. Black of the University of Wisconsin, will be continued in the ice-free areas near McMurdo Sound and in Victoria Land. W.E. Long is continuing his investigations of the geology and glacial geology of the central Queen Maud Range. US Army CRREL members are studying snow and ice deformation and analyzing deep ice cores. Two members of the Society have joined the USSR expedition. A. Bauer (France) is participating in a joint Franco-Soviet traverse during the 1964 summer, from Vostok to Mirny, led by P.A. Shumskiy. C.W.M. Swinbank (UK) will work as the glaciologist at Novolazarevskaja for one year; a Soviet glaciologist will work for the same period with the British Antarctic Survey in Graham Land.

The Ski Club of Great Britain has awarded the Pery Medal for 1963 to André Roch for his distinguished contributions to mountaineering and ski-ing.

Dr. Walter Wood has been made an Honorary Member of the Arctic Institute of North America.

THE SOCIETY'S LIBRARY

Works received for the Society's library since June 1963.

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.

Bauer, A.	Magnani, M.
Bloch, M. R. (2 items)	Muguruma, J. (5 items)
Brown, R. J. E.	Østrem, G.
Dylik, J. (3 items)	Paterson, W. B. (3 items)
Fuchs, Sir V. E.	Portmann, J. -P.
Fujino, K.	Ray, L. L. (5 items)
Goldthwait, R. P. (2 items)	Rüegg, W. (2 items)
Hamelin, L. -E. (2 items)	Schmidt, R. A.
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Ives, J. D. (3 items)	Swithbank, C. W. M. (3 items)
Legget, R. F. (2 items)	Tabata, T.
Leighton, M. M. (2 items)	Weertman, J.

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 Institute of Polar Studies, Ohio State University (8 items)
 McGill Sub-Arctic Research Laboratory (2 items)
 Norsk Polarinstitut, Oslo (4 items)
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 Polish Cultural Institute (6 items)
 Royal Society of New Zealand (5 items)
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 Sveriges Meteorologiska och Hydrologiska Institut (2 items)
 Terrestrial Sciences Laboratory, Air Force Cambridge Research Laboratories,
 U.S. Air Force
 The Geological Society of America
 The Royal Society (2 items)

REVIEWS

LEDOVEDENIYE I LEDOTEKHNICA [GLACIOLOGY AND ICE TECHNOLOGY].

I. S. PESCHANSKIY. Leningrad, Izdatel' stvo "Morskoy Transport", 1963. 345 p., illus., 88 kopecks.

The lack of an advanced textbook, or of a monograph, on floating ice has been felt increasingly of late. The last large-scale attempt to bring together the many aspects of the subject was N. N. Zubov's *L' dy Arktiki* [Arctic ice], published in 1945. Many advances have been made since then, both in the Soviet Union and outside it. Now Professor Peschanskiy, the genial glaciologist of the Arctic and Antarctic Research Institute at Leningrad, has published a work which goes far towards filling the gap.

Although the title does not make the point, this book is concerned almost entirely with floating ice. The first chapter, on the physical properties of ice, is the only one which (quite properly) goes beyond floating ice. As the title does imply, however, there is emphasis on practical aspects. The last two chapters will be found particularly useful. One is on the behaviour of floating ice under load, and includes methods of calculating load-bearing capacity, and methods of constructing roads and railways on ice. The other discusses various ways of promoting break-up, by icebreakers and other mechanical means, explosives, electrical heating, salt, bubbles, and scattering dark powder. In an interesting section the author considers likely future developments in this field.

Little use is made of recent North American work in sea ice studies, but perhaps this was not necessary. The book is intended primarily for those taking the course on sea ice at Soviet marine engineering colleges, and is therefore a textbook and not a monograph. It could be very usefully translated, in whole or in part, to serve a similar purpose in the west.

Terence Armstrong

GEOLOGIE VON DEUTSCHLAND UND EINIGEN RANDGEBIETEN. GEORG KNETSCH. Stuttgart, Ferdinand Enke Verlag, 1963. [vii], 386 p., 28 tables, maps. DM. 66.00, soft cover DM. 58.00

This volume is not intended to be a handbook on the geology of Germany but rather a personal impression of that geology and the Earth history of "Middle Europe". The coloured geological map, on a scale of 1 : 4½ million, covers the area from eastern England and southern France on the west to the Pripjet Marshes and Roumania on the east but in general the area dealt with in the text is much more restricted. The author takes up the Earth history of different regions in turn and the stratigraphy, in the common restricted use of the term, is presented in a series of tables at the end. The references included are mainly recent ones but it is not always easy to track down the sources of his information even where a reference is given. The index is far from complete but with only one entry under "glazial" and three under "Gletscher" one can assume that it is the solid geology which interests the author most.

Isles Strachan

BOOKS RECEIVED

- W. A. BENTLEY and W. J. HUMPHREYS. Snow crystals. New York, Dover Publications, Inc.; London, Constable and Co., 1962. 266 p., illus. \$2.95. [Unaltered reprint of the work first published by McGraw-Hill Book Co., Inc., 1931.]
- A. HOEL and W. WERENSKIÖLD. Glaciers and snowfields in Norway. Norsk Polarinstitutt. Skrifter, Nr. 114, 1962. 291 p., maps, + 8 maps in separate folder. N. kr. 40.
- L. C. KING. South African scenery: a textbook of geomorphology. Third edition, revised. Edinburgh, London, Oliver and Boyd, [1963]. xxv, 308 p., illus., map. 50s.
- W. D. KINGERY, ed. Ice and snow: properties, processes, and applications: proceedings of a conference held at the Massachusetts Institute of Technology, February 12-16, 1962. Cambridge, Mass., The M.I.T. Press, 1963. xv, 684 p. \$16.
- J. KUNSKÝ. Kras a jeskyně. Praha [Czechoslovakia], Pfirodovědecké Nakladatelství, [19--]. 163, xxxvi p., illus.
- F. D. OMMANNEY. The ocean. Second edition. London, etc., Oxford University Press, 1961. ix, 244 p., illus. (The Home University Library of Modern Knowledge, 203.) 10s. 6d.
- S. K. RUNCORN, ed. Continental drift. New York and London, Academic Press, 1962. xii, 338 p. (International Geophysics Series, Vol. 3.) 86s.
- J. TRICART and A. CAILLEUX. Traité de géomorphologie. Tom. 3. Le modèle glaciaire et nival. Paris, Société d'Édition d'Enseignement Supérieur, 1962. 508 p., illus.

NEW MEMBERS

New Members of the Society since July 1963 are:

- Alleman, W. T., 2330 Russell Street, Berkeley 5, Calif., U.S.A.
 Anderson, Gary, Department of Geology, University of Alaska, College, Alaska, U.S.A.
 Anderson, James H., 4331 11th Avenue NE, Seattle 5, Wash., U.S.A.
 Assur, Dr. Andrew, 48 Rip Road, Hanover, N.H., U.S.A.
 Beltramino, Dr. J. C., 720 Fifth Avenue, 14th Floor, New York 19, N.Y., U.S.A.
 Bennington, Dr. Kenneth O., 3741 15th Avenue NE, Seattle 5, Wash., U.S.A.
 Bilello, Michael A., 12 Spencer Road, Hanover, N.H., U.S.A.
 Bourne, H. K., United Kingdom Scientific Mission, British Embassy, 3100 Massachusetts Avenue NW, Washington, D.C., U.S.A.
 Clarke, Garry, 8630 Saskatchewan Drive, Edmonton, Alta., Canada.
 Cleary, Nicholas E., 1275 Tara Drive, Ottawa 3, Ont., Canada.
 Cross, Dr. Aureal T., Glaciological Institute, Department of Geology, Michigan State University, East Lansing, Mich., U.S.A.
 Hannah, Mrs. Barbara C., c/o Mr. W. Rudolph, 67 Palmgrove Road, Avalon Beach, N.S.W., Australia.
 Heilemann, Arne, Egevaenget 4, Kongens Lyngby, Denmark.
 Hewings, Geoffrey J., School House, Beaulieu Drive, Pinner, Middx., England.
 Hosking, Anthony J., c/o Bank of Adelaide, Gumeracha, South Australia.
 Lasca, Norman P., Department of Geology and Mineralogy, University of Michigan, Ann Arbor, Mich., U.S.A.
 Lutzen, Edwin E., 102 Kutters Road, Fairbanks, Alaska, U.S.A.
 Markkanen, Pertt, Harjuviita 18 A 17, Tapiola, Finland.
 McGregor, V. R., 58 Campbell Road, Onehunga, Auckland S.E. 5, New Zealand.
 Mock, Steven J., RD No. 1, South Royalton, Vermont, U.S.A.
 Morgan, Peter James, 437 Buckley Street, Essendon W. 5, Vic., Australia.
 Morris, Miss R. E., Department of Geography, The University, Southampton, England.
 Nasmith, H. W. 1861 Forrester Street, Victoria, B. C., Canada.
 Noble, Miss Joy, Students' Union, The University, University Road, Leicester, England.
 Orvig, Dr. S., Department of Meteorology, McGill University, Montreal, P.Q., Canada.
 Prather, Barry, W., Glaciological Institute, Department of Geology, Michigan State University, East Lansing, Mich., U.S.A.
 Prentice, Miss V., U.S. Army CRREL, Hanover, New Hampshire, U.S.A.
 Ragan, Dr. Donal M., Department of Geology, University of Alaska, College, Alaska, U.S.A.
 Richards, David, Glaciological Institute, Department of Geology, Michigan State University, East Lansing, Mich., U.S.A.
 Swanston, Douglas, Glaciological Institute, Department of Geology, Michigan State University, East Lansing, Mich., U.S.A.
 Tabata, Dr. Tadashi, Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.
 Thams, Dr. Johann-Christian, Director, Osservatorio Ticinese della Centrale Meteorologica Svizzera, Locarno-Monti, Switzerland.
 Thomas, Alexander Walter, 659 Concord Avenue, Williston Park, N.Y., U.S.A.
 Torii, Dr. T., 2-290 Nishiokubu, Shinjuku, Tokyo, Japan.
 Wartena, Dr. L. Lovinklaan 1, Arnhem, Netherlands.
 Weigle, Charles B., 760 Santa Ynez, Stanford, Calif., U.S.A.
 Wilhelm, Dr. Friedrich, Nederlingerstrasse 33a, 8 München, Germany.
 Wu, Dr. Tien H., Glaciological Institute, Department of Geology, Michigan State University, East Lansing, Mich., U.S.A.

CUT HERE

SYMPOSIUM ON SCIENTIFIC ASPECTS OF SNOW AND ICE AVALANCHES 1965

DAVOS

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1) I expect to participate in the Symposium on avalanches of
I.A.H.S. at Davos in April 1965. ☐ *
Tick

2) I expect to submit a paper. ☐ *

3) Tentative title of the paper and brief note on contents:

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* without obligation.

TO BE SENT AS SOON AS POSSIBLE BUT NOT LATER THAN MARCH 31ST, 1964 TO:

Dr. M. de Quervain,
Avalanche Symposium,
Federal Snow and Avalanche Research Institute,
Weissfluhjoch/DAVOS,
Switzerland.

THE GLACIOLOGICAL SOCIETY

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

President: SIR V. FUCHS

Secretary: MRS. H. RICHARDSON

DETAILS OF MEMBERSHIP

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

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	U.S. dollars:	\$12.00

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Further details may be found in the *Journal of Glaciology*,
published in February, June and October.

I C E

Editor: MRS. H. RICHARDSON

This news bulletin is issued free to all members and subscribers of The Glaciological Society, and is published in April, August and December. Contributions should be sent to Mrs. H. Richardson, c/o Scott Polar Research Institute, Lensfield Road, Cambridge, England.

