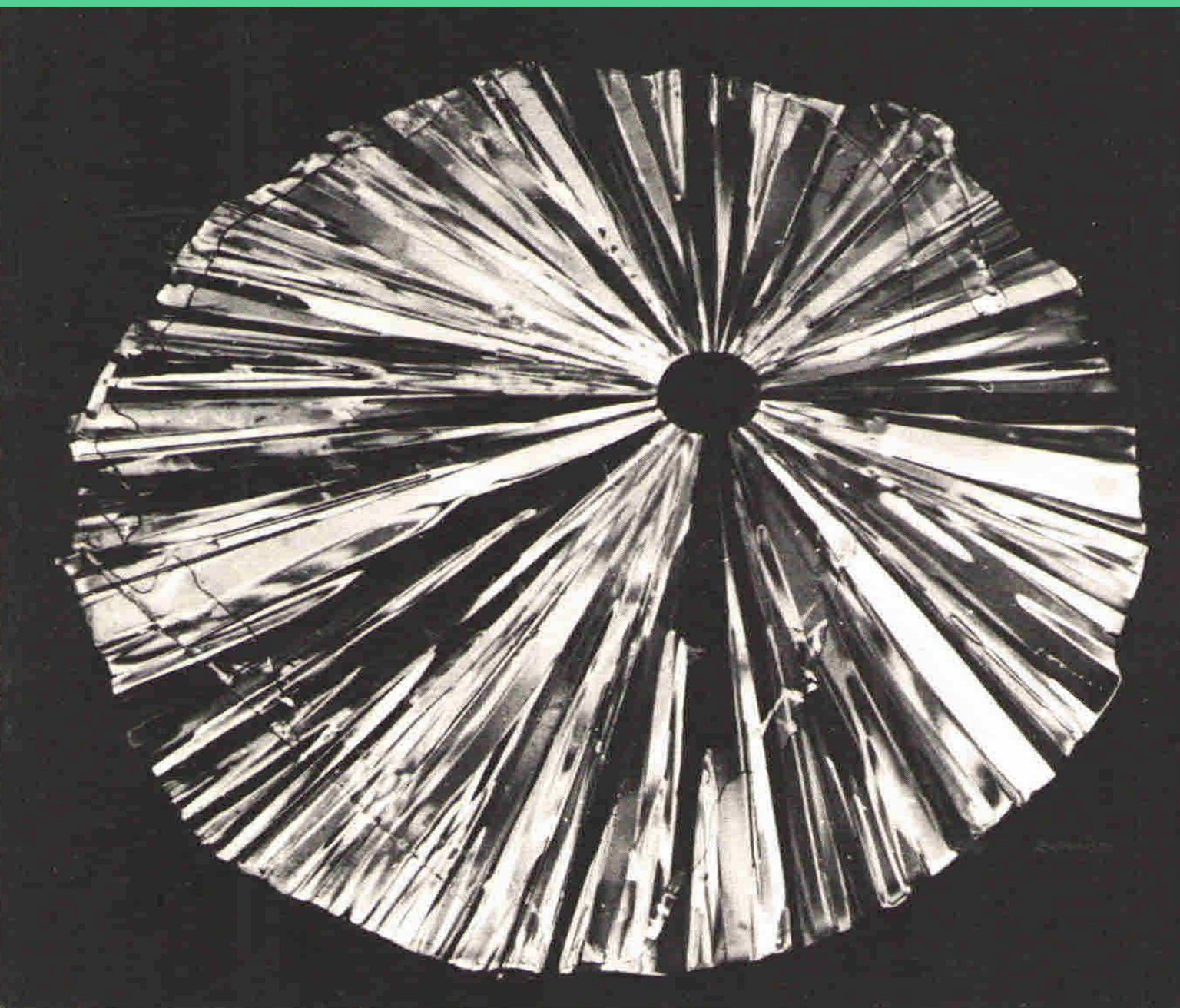
NUMBER 27

AUGUST 1968

# ICE



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# ICE

## NEWS BULLETIN OF THE GLACIOLOGICAL SOCIETY

AUGUST 1968 NUMBER 27

CONTENTS



CHANGE IN THE CONSTITUTION. An overwhelming majority of those members who returned ballot papers by 21 February 1968 were in favour of the change proposed by the Council of the Society: that the number of Elective Members on the Council specified in Rule 8 shall be increased from nine to twelve. Members are asked to amend their copies of the Constitution accordingly.

YOUR ATTENTION is drawn to the two notices on pages 19 and 20, both referring to the Journal of Glaciology.

CONGRATULATIONS to Professor Robert Haefeli on the occasion of his 70th birthday. The Council of the Society has recently elected him to Honorary Membership of the Society, in recognition of his eminent contributions to glaciology. A longer notice will be published in the Journal of Glaciology.

COVER PICTURE. Horizontal section of ice with a radial structure, from ice cores taken from refrozen holes on Peters Lake, Alaska. The sections are about 7 cm diameter. Photograph taken under crossed polaroids. Jiro Muguruma.

# FIELD WORK

## AUSTRALIA

### WILKES

During 1966 Lee Pfitzner repeatedly surveyed by tellurometer and theodolite the triangular stake line covering the northern flank of the Wilkes ice dome and the strain grids set up at various points along the triangle. Together with accumulation data and the earlier measurements by Allen McLaren these data have made possible the first complete mass balance analysis for a medium scale Antarctic ice feature by several methods. All calculations are in good accord and suggest that the surface of the Wilkes dome is subsiding at the average rate of about 40 cm/year.

Various theoretical results have been developed and tested by Bill Budd by means of the Wilkes data. These results will find extensive further use in the interpretation of detailed ice thickness measurements obtained during 1967 by Dave Carter with a Scott Polar Research Institute radio echo sounder. At the same time precision gravimetry confirmed directly the order of magnitude of the surface lowering deduced from the optical and tellurometer surveys and the mass balance calculations.

### MAWSON

During 1966 Dr Koshiro Kizaki, ANARE guest glaciologist and a former member of the Japanese Antarctic Research Expendition, carried out extensive petrofabrics analyses on strained ice obtained near Mawson. The results showed some of the expected dependence of fabric patterns on macrostrain but underlined the role of reorientation by recrystallization especially in the surface layers where most samples had to be obtained. An extension of the work to deeper layers is planned.

During 1967 John Illingworth studied the energy balance of blue ice near Mawson with special attention to processes in the uppermost layers, whose importance had been suggested by Gunter Weller's earlier studies. Techniques were developed for studying melt runoff in summer. In winter, tests and development were carried out on the Wishart-Bird-Illingworth photoelectric drift snow gauge.

### AMERY ICE SHELF

After a difficult landing operation and hazardous crevasse crossings a small station was set up in January 1968 by the ANARE on the Amery Ice Shelf. During 1968 Max Corrie, Alan Nickols, Neville Collins and 'Sam' Samson will attempt to carry out a comprehensive glaciological research programme comprising core drilling through the ice shelf in two places, radio echo soundings, strain and movement measurements, and heat balance studies.

### PLATEAU STATION

A grant from the US National Science Foundation to Uwe Radok and Peter Schwerdtfeger has enabled the Meteorology Department, University of Melbourne, to study the subsurface heat balance and the surface accumulation processes in the centre of East Antarctica. The measurements between November 1966 and February 1968 were carried out by Bob Dingle. Gunter Weller spent a month at Plateau at the start of the project and took the leading role in the analysis of the results. These showed the importance of the radiative and convective heat flux in the uppermost layers and produced new information on the temperature dependence of the thermal conductivity of snow, the sublimation-deposition cycle levelling wind ripples and sastrugi, and snow drift conditions. The work is being carried on during 1968 by Tom Frostman.

### BYRD STATION

As part of the Melbourne University NSF project, and by courtesy of the CSIRO Radiophysics Division, Ted Wishart carried out measurements of the electric charges carried by drift particles and of the current induced by their impact on wires. The results show good agreement with laboratory measurements made in Manchester by Latham and Stow and lend further support to Latham and Mason's ice temperature gradient theory. These Byrd measurements represent the first stage in a thorough investigation of blizzard electricity.

U. Radok

## BELGIUM

### ANTARCTICA

**(1)** A 1967-68 summer party of nine under T. Van Autenboer accompanied the South African Antarctic Expedition to conduct glaciological and geological surveys in the mountain areas south of SANAE. The expedition used two aircraft (one Otter and one Cessna) belonging to the Belgian Antarctic Expedition.

The main glaciological programme consisted of ice thickness (H. Decleir) and ice velocity measurements across the Jutulstraumen, one of the major drainage glaciers in Queen Maud Land. Continuous bad weather and an unusually thick layer of soft snow reduced progress to one or two miles a day, and the velocity measurements had to be abandoned.

A 112 km long gravimetric and magnetic ice thickness profile was measured across the Jutulstraumen and Viddalen. Stations were 4 km apart. A Worden gravimeter and an Elsec proton magnetometer were used.

Oblique aerial photographs were taken of the coastline near SANAE for comparison with earlier (1959) Norwegian photographs. A line of vertical photographs was taken across the crevassed areas of the Jutulstraumen.

After the expedition the two light aircraft were flown back to Belgium from Cape Town.

**(2)** E. Picciotto took part in the US Antarctic Program at Plateau Station. A five ton sample of firn was taken for:

(a) chemical and isotopic analysis;
(b) the study of the frequency of the deposition of extraterrestrial microscopic dust.

T. Van Autenboer

## FRANCE

The first glaciological studies in north-western Spitsbergen were begun by L. Lliboutry and Ch. P. Péguy in 1963. Each summer from 1963 to 1967 an expedition has worked in Kingsbay, 79°N, and has sought to determine the different types of glaciers and the amount of glacial recession since 1900. For the Mayer glacier in Crossbay, this recession has been calculated as 12% for the surface and 25% for the volume. The preliminary results of the velocity and the mass point balance for four glaciers of Kingsbay and Crossbay are now available. For the Central Loven glacier the mass balance problem has been studied since 1963. It has been found to be a function of the winter accumulation, as the climatic conditions during the summers varied very little. The annual mass loss was equivalent to the depth of ice which melted, which is assumed to have been uniform over the surface of the glacier. This depth was 380 mm for the year 15 August 1963 to 15 August 1964, 440 mm for 1964-65, and 660 mm for 1965-66. The programme included a study of the glacial recession and its accompanying phenomena.

H. Geoffray

## NEW ZEALAND

### ANTARCTICA

The original strain network as set out in the summer of 1964-65 was re-surveyed for the final time in 1967-68. Although the original triangle markers were buried under 1-2 metres of snow, they were all located. The main station markers have now been reset and will be maintained for future work in the area. Additional strain lines were set out during the 1966-67 summer and these were also re-measured. Approximately 50 miles (80 kilometres) of levelling was carried out across the western section of the Ice Shelf using a Wild NA2 Automatic level, two staffs and two motor toboggans. A "leap frog" method with a distance of about 100 metres from staff to level was used. Despite some refraction problems, an extremely good closure was obtained. Brine infiltration into the western edge of the Ice Shelf was also investigated and a number of holes drilled. Brine and core samples were obtained for analysis in New Zealand.

When the McMurdo Ice Shelf Project was proposed in June 1962 it was then considered that this particular ice shelf would serve as a model for larger shelves elsewhere in Antarctica and the results of the investigations would be useful in planning future glaciological projects. Although a great deal of analysis of data is still required, it is evident that the McMurdo Ice Shelf is an extremely complex one. Nevertheless a wealth of experience in methods of survey and research has been built up and will be extremely useful in planning future projects.

In the central area of the McMurdo Ice Shelf the ice flow from the Ross Ice Shelf merges with the two glaciers of Ross Island to give a strain pattern which rapidly changes over distances of five kilometres or less. Preliminary calculations of the strain rates show a complex pattern and complete analysis of the field measurements will be required before the overall pattern of strain is clear. Although a total of 70 movement stations have been set out on the 800 square mile (2050 square kilometres) McMurdo Ice Shelf, the survey observations from these points only give the general flow pattern. The basic characteristics of the Ice Shelf are now apparent, and areas which will require more intensive research are obvious.

A. J. Heine

# U.S.A.

## ANTARCTICA

### (1) McMurdo Station

The Polar Division of the US Naval Civil Engineering Laboratory has been working on a variety of applied research problems directly related to needs of the US Naval Antarctic Support Forces. This research includes studies of the movement, accumulation and morphology of the marginal area of the Ross Ice Shelf near McMurdo Station, the physical properties of the annual sea ice on McMurdo Sound, snow movement and accumulation, and the properties of local fast ice.

During the 1968 field season, four 12 cm diameter holes, 16.5 to 44.5 m deep, were drilled through the ice shelf, and several holes up to 21 m deep were drilled in the fast ice and permafrost near McMurdo Station. Other deep holes were drilled for density-temperature data and to determine the position and depth of the brine layer found in the western part of the McMurdo Ice shelf. Ice shelf movement data show a decrease as the ice shelf moves westward, and generally correlate well with data of Heine (NZARP). Net annual accumulation varies widely from none in the ablation area near the Koettlitz Glacier to an average of 29 cm near Williams Field.

Large in-situ, simple beams in the 2 m thick annual sea ice on McMurdo Sound were failed and correlative data obtained on ring-tensile strength, temperature, salinity, and thickness variations during the summer season. Preliminary analyses of ice cores from the McMurdo Ice Wharf showed that this fast-ice area has a complex history that may be related to past changes in sea level.

R. A. Paige

### (2) Queen Maud Land Traverse

The Queen Maud Land Traverse 1967-68 was a joint undertaking of the Institute of Polar Studies (Ohio State University), the University of Wisconsin and US Coast and Geodetic Survey. The traverse departed Plateau Station, 79°15′S, 40°30′E, on 5 December 1967 and headed along a planned route to 75°56′S, 07°13′E, then to 78°42′S, 06°52′W, where it terminated.

The glaciological program consisted of ice temperature measurements to 40 m depth using a quartz thermometer, ice sampling for istope study, and snow stratigraphy investigations. The aims of the snow stratigraphy investigations were:

(1) Determination of the stratigraphic characteristics on the interior part of the East Antarctic Plateau and observation of any changes in these characteristics with relation to changes in elevation and distance to the coast.

(2) Determination of feasibility of using stratigraphic criteria as a means of assessing annual accumulation rates in this region, and the development of study techniques.

(3) Determination of the accumulation rate.

Shallow pits were excavated at 5 mile (8 km) intervals along the 840 mile (1351 km) traverse route. Each pit, 30-90 cm deep, was examined for stratigraphic features and grain size determination. Density samples were taken from the pit walls. At widely spaced intervals, deeper pits, up to 2½ m deep, were excavated, along with several trenches and scattered shallow pits, for more detailed examination and photographic study.

A preliminary analysis has indicated considerable changes in the nature of the firn cover, there being a tendency toward greater crust development toward the coast, and a more easily definable division into winter and summer firn. Accumulation rates appear to increase significantly toward the coast and with decrease in elevation, as interpreted from the shallow pit stratigraphy. Tentative values for given locations are as follows:

| Latitude | Longitude | Accumulation |
|---|---|---|
| 79°14′S | 40°30′E | 3.39 g/cm² |
| (Plateau Station) | | |
| 79°08′S | 36°43′E | 2.95 g/cm² |
| 78°48′S | 33°20′E | 3.07 g/cm² |
| 78°42′S | 29°42′E | 3.58 g/cm² |
| 78°36′S | 27°10′E | 4.38 g/cm² |
| 78°19′S | 23°20′E | 5.19 g/cm² |
| 78°01′S | 20°00′E | 5.73 g/cm² |
| 77°39′S | 17°10′E | 4.70 g/cm² |
| 77°16′S | 14°24′E | 6.32 g/cm² |
| 76°49′S | 11°55′E | 6.78 g/cm² |
| 76°22′S | 09°32′E | 7.48 g/cm² |
| 75°56′S | 07°13′E | 8.40 g/cm² |
| 76°17′S | 05°48′E | 8.16 g/cm² |
| 76°38′S | 04°16′E | 9.92 g/cm² |
| 77°10′S | 01°46′E | 9.91 g/cm² |
| 77°30′S | 00°04′E | 8.80 g/cm² |
| 77°54′S | 01°53′W | 8.57 g/cm² |
| 78°16′S | 04°01′W | 9.35 g/cm² |
| 78°42′S | 06°52′W | 10.38 g/cm² |

The basic conclusion to be drawn from this program of investigation is that, in this area of light accumulation, classical stratigraphic techniques can be successfully employed as a means of determining the annual accumulation rates, provided that several pits are examined at one site or closely spaced pits are studied over a traverse route. It is likely that single, widely spaced pits, for example at 50 mile intervals, could not be successfully investigated individually.

A. Rundle

Elevations of the ice surface along the traverse route were measured with 11 temperature-corrected aneroid altimeters. Simultaneous altimeter readings were made at 8 km (5 mile) intervals and nearly continuous readings were made with a single altimeter. Elevations ranged from 3625m above sea level at Plateau Station to 2210 m at the end point (78°42′S, 06°52′W). The surface sloped downward from Plateau Station to the turning point at an average gradient of 1 to 2 m per mile. This gradient increased sharply on the south-west leg of the traverse. Two pronounced valleys, about 50 m in depth and 10 km in width, and several smaller valleys were encountered near the end of the traverse.

Ice thickness measurements were made by both seismic and electromagnetic reflection (radio echo sounding) methods. Vertical seismic reflections obtained at 18 major stations established thicknesses, and gravity determinations every 8 km provided detail between major stations. The electromagnetic sounding (EMS) system was monitored continuously but bottom echoes were received over only one-third of the track. Strong reflections were received at Plateau Station and for the first 100 miles. From this point up to mile 800 only occasional spots of thin ice yielded reflections.

Three short refraction profiles and three wide-angle reflection profiles (one profile employed a common reflecting point) were established to determine the seismic wave velocities in the ice. Two long refraction profiles were attempted and one yielded good arrivals for determining sub-glacial velocities.

Two detailed EMS wide angle profiles were established in order to determine the electromagnetic wave velocity structure in the first 1200 meters of ice. A third EMS wide angle profile was carried out to determine the average vertical velocity for the ice column, the basis for all EMS profiling. Field tests were carried out on a digital EMS profiling system. This system was designed to record the vertical travel-time at selected intervals and store it on paper tape. This prototype system, which also plots a chart of the ice thickness, worked successfully when tested near the end of the season.

The strain network established by QMLT II in January 1966 was remeasured with tellurometers in December 1967.

J. W. Clough, C. R. Bentley and C. K. Poster

## (3) Summary of Glaciological Work in Wright Valley

Field work involving the investigations of the mode of flow of a cold glacier was carried out during the austral summers of 1965-66 and 1966-67 by expeditions from the Institute of Polar Studies (Ohio State University). Data reduction is presently being continued.

The most important results obtained from an ice tunnel are:

(1) The indication of zero flow of basal ice (−17.9°C) with respect to boulders embedded in the basal ice plus till admixture at 34.4 m below the glacier surface.
(2) The existence of a seven-fold increase in the sum of the concentrations of the common ions, in the ice layer from the base to about 80 cm, with respect to the ice above this zone.
(3) The existence of cavities formed on the downstream side of boulders on which were observed salt smearings and random clusters of salts principally calcite with a trace of $Mg^{++}$ ions.

The inference is that the basal ice is absorbing basal salt, clay silt and sand in some localities and depositing this load in other localities. This is supported by other evidence of a structural and displacement nature. Consequently the basal ice has a greater plasticity than the clear ice above it, or any clear ice adjacent to it. This is directly supported by strain and displacement measurement.

The exponential in the flow law, derived from a vertical bore-hole, is $n=2.67$. Using tunnel closure data, the exponent appears to be less by about 35 per cent.

G. Holdsworth

## (4) Ice flow studies on Roosevelt Island

During the 1967-1968 austral summer, the third season of intensive study of ice flow was completed by an expedition from the University of Wisconsin. During the first two seasons, a a strain network was established, the depth of ice and subsurface conditions determined and the accumulation measured.

The work included: the determination of the surface configuration of the ice cap at the boundary between the grounded ice and the Ross Ice Shelf; the remeasurement of approximately 700 kilometers of strain rate network; the determination of the change in azimuth of the network due to ice flow; and the extension of precise vertical control over approximately 300 kilometers of the ice cap.

Data on the surface configuration were obtained in order to study the possible relationship of surface characteristics to small variations in the bed rock formation, or to the pressure of the adjacent ice shelf. The remeasurement of the strain network was obtained to determine the surface strain rates. The determination of the absolute change in azimuth of the strain network was made to permit the calculation of displacement vectors for the strain network control points which will permit an evaluation of the influence of the surounding ice shelf upon the Roosevelt Island ice cap. The vertical control was extended to define more precisely the step-

like surface profile near the edges of the ice cap and to relate all measurements to a common datum.

Field operations were conducted in four phases. First, a reconnaissance was conducted to relocate and remark the control points on the strain network. Second, measurements were taken on the network lines with a Trackmaster-mounted MRA-2 Tellurometer system. Third, three wire levels were run with a Zeiss Ni2 automatic level establishing vertical control on the network. (Small networks at the north and south edges of the ice cap were tied in with barometric levelling.) Fourth, astronomic observations were taken to determine the true azimuth of critically located lines.

All instruments and systems proved reliable and the party was fortunate in having uniformly good weather. During the field season a minimum number of days was lost due to mechanical failure or adverse weather.

J. L. Clapp and C. R. Bentley

### (5) Glaciological Research on the Byrd Strain Net

Seismological, gravimetric, and snow accumulation observations were made by an expedition from the Institute of Polar Studies, Ohio State University during the summer 1967-68 along the Byrd Strain Net, for the investigation of the internal structure of the Antarctic ice sheet and the relationship between sub-ice topography and surface flow features. The Strain Net is a 156 km line of 3 x 3 km quadrilaterals for detailed strain-rate measurement between Byrd Station and the Amundsen Sea-Ross Sea ice divide to the north-east. Ice thickness was determined by seismic soundings supplemented by a network of gravity readings. The ice was found to increase in thickness from less than 2500 m near Byrd Station to more than 3000 m at the divide. Early seismic reflections from within the ice were obtained at several points. Wide-angle reflection shots for the determination of average vertical velocity and detailed studies of compressional and shear wave velocities in the snow-firn layer were also made.

G. Dewart

## GLACIOLOGICAL RESEARCH ON THE CASEMENT GLACIER, SOUTH-EAST ALASKA

The Casement Glacier (58°57′N, 135°57′W), a glacier with an extremely negative balance, has been studied for the past three summers by an expedition from the Institute of Polar Studies (Ohio State University). In addition to movement, heat and mass balance studies, valuable information has been gained on the mechanics of basal sliding from observations in tunnels excavated in 1966 and re-excavated in 1967. The mechanism of drainage of a glacier-dammed lake has been investigated—the ice front lifts before drainage. A noteworthy feature of the glacier is the abundance of ice worms (Mesenchytraens solifugus). Despite the disbelief of the human natives, ecological studies on these have been started and electron microscope studies of their ultrastructure have already revealed many unsuspected features.

D. N. Peterson

## ALPINE SNOW AND AVALANCHE RESEARCH

(Rocky Mountain Forest and Range Experiment Station—U.S. Forest Service)

### (1) Snow fences studies

Slat and wire snow fences of 40 percent density have been under study at four high elevation sites in central Colorado for the past four years. These fences were located upwind of natural snow accumulation sites in an attempt to augment natural snow accumulation and thus increase summer streamflow from the alpine area. This work is the culmination of over 10 years' study of techniques to improve water yields from alpine areas and will terminate the empirical, field phase of the work.

### (2) Wind profiles over two alpine ridges (R. A. Schmidt)

This is the first step in the development of a better theoretical understanding of snow transport in irregular terrain and of a more analytical evaluation of potential snow fence sites in such areas. Vertical wind profiles were taken at two of the fence sites mentioned in part (1) above. At one of the sites, the fence successfully increased snow depths and prolonged melt well into the late summer months. At the other site, the fence changed the natural snow accumulation pattern in its lee but did not prolong the melt period because a windward drift reduced the trapping efficiency and downwind eddy pattern behind the fence. Analysis of windflow data revealed intermittent separation of flow upwind of the fence at the unsuccessful site in contrast to the successful fence site where separation took place right at the fence location.

### (3) Mass flux of snow in alpine terrain (R. A. Schmidt and R. A. Sommerfeld)

In March 1968, field measurements were made of the vertical profiles of wind, vertical distribution of blowing snow, and the still air fall velocity of snow particles at the crest of a ridge in central Colorado. Sensitive anemometers

and a bivane were used to measure the winds and light attenuation particle counters to count the blowing snow. The counters consist of a compact light source which throws a narrow beam on to a pair of small slits behind which are two photo diodes. A particle moving through the counter casts a shadow first on one slit, then on the other. This electrical signal is amplified, conditioned, and then transmitted over 200 meters of line to a magnetic tape recorder.

## (4) Snow slab study (M. Martinelli, Jr. and A. Judson)

Field data have been collected for parts of 3 winters on the weather conditions associated with the formation of hard slab and soft slab in the starting zone of avalanche paths. Wind speed, wind direction, new snow depths, new snow water equivalent and air temperature have been recorded for storm periods. After the storm, the following features of the snow cover were measured: snow density, ram resistance, temperature, crystal type, crystal size, air permeability, tensile strength (by two methods), and shear strength.

## (5) Simulated sonic boom (A. Judson and US Army CRREL)

Preliminary field tests were run this winter to see under what conditions a sonic boom would release avalanches. An array of explosive prima cord produced a shock to the snow similar to that created when the sonic boom from an aircraft strikes the ground. Field evidence so far is inconclusive because of mechanical problems encountered in manipulating the 80 foot long charge of prima cord in rough terrain under storm conditions. This study will be continued during the winter of 1968-69.

## (6) Uniform reporting of weather, snow and avalanche conditions for western U.S. (A. Judson)

A uniform system of observing and reporting weather, snow, and avalanche conditions was tested in Western U.S. during the winter of 1967-68. Data collected by local observers at ski areas, mining operations, mountain highways, and mountain towns were sent to the Rocky Mountain Forest and Range Experiment Station for summarization and eventual use in an objective evaluation of avalanche hazard.

During the first winter, weather records were taken at about 25 locations, and avalanche reports at about 40 to 50 locations. For the period December 1967-February 1968, 1368 avalanches were reported excluding sluffs which were defined as snow slides of less than 150 feet slope distance. All weather, snow and avalanche data are being punched for machine sorting, summarization, and analysis.

Preliminary statistical analysis of 1 year's data from one area carried out at US Army CRREL is encouraging. A discriminant function analysis was used to predict the occurrence or non-occurrence of avalanches on three avalanche paths based on 5 weather factors.

## (7) Crystal riming as a factor in new snow strength (R. Perla and E. R. LaChapelle, Alta, Utah)

How rime on new snow crystals influences the initial strength and the rate of change in strength of freshly deposited snow is being studied at Alta, Utah, under a cooperative agreement with the Rocky Mountain Forest and Range Experiment Station.

During storm periods, a photographic record is made of new snow crystal types—from this, a subjective evaluation is made of the degree of riming on the crystals. At frequent intervals during the storm, the following data are taken on the freshly deposited snow: depth, temperature, ram resistance, tensile strength and viscosity.

Ram resistance is being measured by a new light-weight ram of the same geometry as the traditional instrument. Tensile strength is being measured in situ with a modified beam test procedure. Another year's field observations may be needed to confirm initial impressions.

## (8) Chemical modification of ice crystals (R. A. Sommerfeld)

Ice crystals are being grown in a cloud diffusion chamber with pure water and in the presence of certain volatile chemicals. The change in growth habit is being observed. It is hoped that such observations will lead to some hypothesis of ice crystal growth and how this is influenced by such chemicals as aldehydes. The study is now in the data gathering stage. Crystals grown in pure water vapor have displayed the growth habits previously reported. In the presence of benzaldehyde, a pronounced increase in growth in the basal plane is evident.

M. Martinelli

## UWE RADOK

Uwe Radok has had a career as varied and brilliant as the clothing which he dons to brighten excursions in the mountains. Born in Königsberg (now Kaliningrad) on 8 February 1916, his early life was spent learning classical Greek and Latin in a setting of polar winters, icebreakers and occasional pack ice. He deserted the classics for science in 1933, when he went to Albertus University in Königsberg for a year, studying physics, mathematics and meteorology.

In 1934, Radok moved to the Technische Hochschule in Munich, where he spent four years studying mechanical engineering. He received his Dipl.Ing. in 1938. His early interest in meteorology, and particularly in the problems of air turbulence, was maintained during these years, and was reflected in his hobby of gliding.

It was an intriguing turn of fate that led him to take his next steps in the direction of Britain, where he took a job as an engineering draughtsman with Sir Wm. Arrol and Co., in Glasgow. Upon the outbreak of the Second World War in September 1939 he was interned, and had therefore to leave not only his draughtsman's table but the pilot's seat in the gliders of the Scottish Gliding Union, where he was an assistant instructor.

His subsequent moves around the world were determined by the changes in British policy on internees: in July 1940 he was put on a ship bound for Canada, only to find that he was diverted to Australia, where he spent the next two years in an internee camp in upstate Victoria. In 1942, when the war had spread to the Pacific, he was released and served as a private in the Commonwealth Military Forces until 1944.

In Melbourne at this time was the eminent meteorologist Fritz Loewe, who had left Germany as a political refugee in 1934 and had spent the years 1934-37 in England, at the Scott Polar Research Institute. In 1937, Loewe had moved to Melbourne, where he created the first and only university department of meteorology in Australia. In succeeding years he worked on the meteorology of Australia and the southern hemisphere, and kept up his interests in polar meteorology, which stemmed from his early expeditions to the Greenland ice cap. The fortuitous presence of Radok in Australia became known to Loewe, and in August 1944 he was discharged to become Loewe's assistant.

So began a new chapter in Uwe Radok's life. Under the influence of Fritz Loewe his interests in dynamic meteorology broadened to encompass similar problems in glaciology. In 1950 he became a lecturer in the Department, and in 1957 he was appointed a Senior Lecturer, having taken his Ph.D. in 1953. In 1961, on Loewe's retirement, he became Reader-in-Charge of the Department.

The International Geophysical Year aroused interest in glaciology on a scale never before experienced by the discipline. Australian expeditions worked in the Antarctic at Mawson and Wilkes Stations and on traverses inland. Their studies produced significant contributions on snow drift, temperature gradients in ice caps and

ice shelves, and mass balance. One of the principal investigators on these expeditions was Malcolm Mellor, who was based in Melbourne, and he brought Radok even more securely into the glaciological fold. Uwe now serves on the Council of the Glaciological Society, and is Secretary of the Working Group on Glaciology of SCAR (Scientific Committee on Antarctic Research), in which capacity he is responsible for a symposium on Antarctic glaciological exploration to be held in Hanover, NH, USA in September 1968.

His work on committees and as an administrator, no less than as an eminent research scientist, reveals his ability to engender keen enthusiasm in his colleagues and students. Even when recently confined to a hospital bed his output of work remained prodigious. He arouses and maintains interest as much by letter-writing as by rapid conversation and pungent comment. His cultured mind encompasses many interests, shared with his wife and three daughters. He displays no mean prowess on piano and organ, and has a wide-ranging knowledge of literature and the arts. While he now has few opportunities to experience personally the effects of free air turbulence, he delights in field excursions to glaciated areas, where he is famous for his sartorial splendour. His style is best described as "International War Surplus", featuring an irregular camouflage design. It was noted on a glaciological tour in September 1967 that the reflected brilliance of his clothing caused rapid ablation of the snout of the Aletschgletscher. No less sparkling is his sense of humour, which delights his companions, even when it moves too fast for them. The ability to match his crisp, dry and often self-deprecating verbal thrusts requires a wit as lively as his own, and this is not commonly found.

# ANNUAL GENERAL MEETING 1968

## MINUTES OF THE ANNUAL GENERAL MEETING HELD ON 25 APRIL 1968 AT THE SCOTT POLAR RESEARCH INSTITUTE, CAMBRIDGE, ENGLAND

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

1. **The Minutes** of the 1967 Annual General Meeting, published in Ice, No. 24, August 1967, were approved, and signed by the President.

2. **The President** made his report for 1967-68: The year has been noteworthy for two events. First, and unhappily for the Society, the retirement of Gerald Seligman as Editor of the Journal of Glaciology. This is the end of an era in the Society's history, which started in 1936 with the founding by Seligman of the Association for the Study of Snow and Ice as a British group within the International Commission of Snow. After the war years Seligman was the moving spirit in founding the British Glaciological Society as the successor to the Association, and he remained its President from 1945 until 1963, by which time it had assumed its present international form under the name of the Glaciological Society. The publishing of the Journal has always been the main activity of the Society. The Zeitscshrift für Gletscherkunde had lapsed during the war, and in 1947 on Seligman's initiative the Journal of Glaciology was launched, helped by the backing of the Scott Polar Research Institute and the Royal Society. It was jointly edited by Gerald Seligman, Launcelot Fleming, Brian Roberts and Robert Moss until the fourth number in October 1948 when Seligman became Editor and the others an Advisory Editorial Committee. He has continued as editor, at first with various assistants and later as senior editor on the Editorial Board, until the present time.

The Journal is exactly twenty-one years old as Seligman retires. With fatherly care he has watched it grow from infancy to its present secure position. "Watched" is not the right word if it gives an impression of inactivity. On the contrary, a scientific periodical does not flourish automatically; it needs constant attention and the exercise of good judgement. Most fortunately for us, Seligman's concern for the development of the Journal has been devoted and unceasing, and, as a result, we in the glaciological community find ourselves with a journal of high scientific and editorial standards well suited to our needs. We should not take this for granted; we should recognise how it has been achieved. As Gerald Seligman retires from his editorship we give him our sincere thanks and we send him our best wishes for the future.

The second event affected our domestic arrangements. The Society's Secretariat is now housed in the splendid Isolation of its own room in the Scott Polar Research Institute—suitably warmed, for dealing with our icy subject, by scarlet hessian on the walls, and providing enough space for two desk units, filing cabinets, cupboards, and bookshelves and a reading desk for our library. Though the constant friendly to-and-fro of our former quarters, up in the Institute's gallery, is sometimes missed, at least our secretarial staff no longer has to take it in turn to use a desk and a typewriter. We are most grateful to the Director of the Institute (Dr. Gordon Robin) for generously giving us this room, and storage space for our stock of back

issues of the Journal. Thus the happy cooperation between the Scott Polar Research Institute and the Glaciological Society continues, to the great benefit of the Society.

The Society's library has been affected by these two events. Previously housed at Dr. Seligman's house in Kent, it is now being reorganized in our headquarters in Cambridge. By the end of this summer, we hope to have the library functioning once more, and ready for consultation by members, who are entitled to borrow items from it as a privilege of membership.

During the past twelve moths, we have had 64 new members — not as many as in the previous year, which had a record increase of 105—but about the average increase for the past four years. Resignations, deaths, and cancellations of membership through non-payment of annual dues make the final figure for membership 798, compared with 796 in May 1967. The number of subscriptions to the Journal of Glaciology has fallen slightly, from 612 to 590, but this drop is accounted for by the normal strange fluctuations in bulk orders from China, U.S.S.R., Poland and Czechoslovakia.

We published 493 pages in the Journal of Glaciology in the calendar year 1967, compared with 475 in 1966. For the fourth year running no outside support in the form of a grant was sought, and in those four years we have consistently published more than in any other four year period in our history. Printing costs have again risen, but income from sales of back issues rose by a greater amount, so that we were able to publish all high-quality material which was submitted to our Editors.

The Editors deserve our thanks once more for maintaining the high standards they have set themselves, and we should also not forget the Editorial Advisors and the many others who help us, including those faceless watchdogs, the referees, with whose opinions we, as authors, may not always agree, but who, collectively, are essential to the running of the Journal.

The Treasurer will be reporting on our financial situation. I will merely say here that the auditors have commented on our "useful liquidity of over £3,000". Our new arrangement for selling Ice to subscribers to the Journal of Glaciology, instead of giving it to them free, has yielded useful income without causing more than 10% of our subscribers to withdraw from the circulation list for Ice.

The meetings in Switzerland in September and October 1967 of the Commission of Snow and Ice, during the congress of the International Union of Geodesy and Geophysics, gave us an opportunity of holding a Council meeting in Berne. This follows our custom of trying to hold one Council meeting every year outside Britain, which, as the location of our headquarters, has to be our more usual meeting place. We were also able to hold a meeting of the Society in Berne at which an award of the Seligman Crystal was made to Dr. Henri Bader.

The Society has held other meetings in various centres in England, in Scotland for the first time, and two small conferences. One of these was the second Annual Meeting of the Northeastern North American Branch of the Society held in Ottawa in October 1967, and the other was here in Cambridge after our 1967 Annual General Meeting. Lists of the papers read at these conferences have appeared in Ice.

Plans for the 1969 Symposium on the Hydrology of Glaciers are proceeding well. The First Circular has been published and the Papers Committee is evolving what they hope will be an efficient and fair method of dealing with papers submitted to them.

Plans for the distribution of the appeal brochure for the Research and Education Fund are almost complete: all members will get a copy and will be asked to assist by recruiting contributors. In addition, our national correspondents will receive copies for distribution within their own country, preferably on a personal basis. It is important that every member tries to find at least one other person to contribute to this worthy cause. We need to emphasize that any country may benefit from the Fund and that the Fund is primarily designed to provide support for small-scale activities, which might not attract support from the large grant-giving bodies. The primary mailing of the brochure will take place later in the year, followed by appeals outside our own membership.

The activities that I have described represent a continued growth in the affairs of the Society. Members in many parts of the world have contributed by their help and on behalf of the Society I should like to express our gratitude to them.

3. **The Treasurer,** Dr. T. E. Armstrong, presented the accounts for 1967. He drew attention to the surplus of £372, making it clear that £200 of this sum represented the value of the stock of Journals published in 1967. The general financial position was much as had been expected, with a reassuring growth of annual subscriptions and a gratifying total of page charge contributions and sales of back issues of the Journal of Glaciology. He hoped that in 1968 the Society would break even, despite increased printing costs and the clear need to ensure that salaries kept pace with the rise in the cost of living.

4. **Election of auditors for the 1968 accounts.** Dr. T. E. Armstrong proposed and Dr. J. A. Heap seconded that Messrs. Peters, Elworthy and Moore, of Cambridge, be elected auditors for the 1968 accounts. This was carried unanimously.

5. **Elections to the Council 1968-71.**
After circulation to all members of the Council's list of nominees, no further nominations had been received. The following people were elected unanimously:

| **Elective Members (4)** | **Proposer** | **Seconder** |
|---|---|---|
| J. A. Heap | V. Schytt | H. C. Hoinkes |
| P. Kasser | W. Hofmann | M. F. Meier |
| N. Untersteiner | W. F. Weeks | C. W. M. Swithinbank |
| J. Weertman | U. Radok | G. Hattersley-Smith |

6. **Appointments to Posts and Committees:** Under Rule 10 of the Constitution, the Council of the Society had made the following appointments, subject to the approval of the Annual General Meeting:

**Special Post of Founder:** Gerald Seligman

**Awards Committee** (for Seligman Crystal and Honorary Membership): H. C. Hoinkes, M. F. Meier, V. Schytt, the President (ex-officio), the Secretary of the Society as secretary.

**1969 Symposium Committees—Local Organizing Committee:** T. E. Armstrong, J. F. Nye, C. W. M. Swithinbank, W. H. Ward (representing the Commission of Snow and Ice), the Secretary of the Society as secretary.

**Papers Committee:** J. F. Nye (Chairman), J. W. Glen (representing the Editors of the Journal of Glaciology), P. Kasser, W. H. Mathews, M. F. Meier, V. Schytt, the Secretary of the Society as secretary.

The appointments were confirmed unanimously.

# MEETINGS

## SYMPOSIUM ON SURGING GLACIERS

The symposium was held at the Center for Continuing Education of the Banff School of Fine Arts, Banff, Alberta, Canada, on 6-8 June 1968, and was sponsored jointly by the National Research Council of Canada and the University of Alberta. Particular emphasis was placed on the possible geologic effects of surging glaciers, both now and in the past, but some attention was given to the hydrology of such glaciers. Because the Steele Glacier, in the south-west Yukon, is one of the better known surging glaciers, it was the topic of several papers.

It was apparent from the beginning of the conference that the term "surging glacier" was used by the participants in different ways. At least three field criteria were suggested as indicative of a surge: (1) an unusually high velocity of the glacier, (2) a depression or collapse of the ice surface in the accumulation zone of the glacier, and (3) the presence of intensely crevassed or fractured surface of the glacier. A surprisingly large number of glaciers seem to have surged, but the distribution of this type of glacier is not well known, mainly because of the difficulties of access. Almost all information on surging glaciers is from areas of mountain glaciers. One paper and some informal discussion brought out the fact that there is no synchroneity of surges of mountain glaciers.

The possibility of glacial surges at the margins of continental glaciers is of great importance to Pleistocene geologists, because the interpretations of glacial history are now based on the assumption that ice fronts were stable for relatively long time spans in areas of prominent recessional moraines, and that synchroneity existed in advances along the margins of different ice lobes. The means of recognition in the geologic column of the deposits from a surging glacier are little known. Dr. N. W. Rutter, Geological Survey of Canada, presented the results of a comparative study of the deposits of mountain glaciers, one of which had surged in the past, and the other lacking any evidence for a surge. There was no clear-cut orientation in the till fabric of the moraine of the surged glacier.

The conference concluded with a panel discussion on the needs for future study of surging glaciers. The panel consisted of Dr. Walter A. Wood, Dr. Aleksis Dreimanis, Dr. A. E. Harrison, and Dr. L. A. Bayrock. From the discussion, a number of conclusions were drawn: (1) a need for standardization of the terminology of surging glaciers; (2) a need for further study of the physics of the ice in such glaciers, preferably starting on glaciers on which a surge is anticipated: (3) a need for more data on the weather in the area of such glaciers; and (4) a need for a careful examination of the stratigraphic record, for the purpose of recognizing possible large scale glacier surges during the Pleistocene.

# FUTURE MEETINGS

## INTERNATIONAL SYMPOSIUM ON ANTARCTIC GLACIOLOGICAL EXPLORATION (IS-AGE)

**Dartmouth College, Hanover, New Hampshire, U.S.A.—3-7 September 1968**

EXTRACTS FROM THE SECOND CIRCULAR

**Papers**

It is requested that speakers in the symposium mail extended summaries of their papers prior to 1 August to Dr. Radok, and that they also bring 50 copies of their summaries with them to Hanover for distribution at the meeting. Symposium proceedings will be published by SCAR, and a deadline of December 15, 1968 has been set for the acceptance of final papers for publication. The papers should be written in English, should not exceed 15 pages of typescript, including illustrations, and should include an abstract. The format used in the **Journal of Glaciology** is recommended. Final papers may be mailed to Dr. J. B. Lyons, ISAGE Local Committee, Box 555, Dartmouth College, Hanover, N.H. 03755, U.S.A. Projection equipment for 35 mm and 3 x 4 inch slides is available, but if special facilities are required, the local committee should be so advised by letter.

**Excursions**

Arrangements have been made for a post-meeting excursion to the top of Mt. Washington, N.H., under the leadership of Dr. R. P. Goldthwait, on Sat., Sept 7, and Sunday, Sept. 8. The trip will originate in Hanover and return to Hanover where participants may stay in the Dartmouth dormitories on the evening of Sept. 8. Cost of this trip including meals, lodging, cog-railway fare to the top of the mountain, etc. will be in the range of $25 to $30. The climatology of Mt. Washington is sub-arctic and those planning to go to the mountain are advised to bring warm clothing and rain gear.

Tours of the Cold Regions Research and Engineering Laboratory and of Dartmouth College are also planned. Half-day trips to points of local interest will be arranged for wives of participants or participants themselves if there is sufficient interest.

**Registration Form**

A fee of $18 will be charged.

All who have not returned a preliminary registration form are requested to write to:

Dr. J. B. Lyons, ISAGE Local Committee, Box 555, Dartmouth College, Hanover, New Hampshire 03755, U.S.A.

## PROVISIONAL PROGRAM

Technical Sessions: Hopkins Center, Dartmouth College

(Questions concerning the papers should be addressed to:— Dr. Uwe Radok, Department of Meteorology, University of Melbourne, Parkville 3052, Victoria, Australia.)

**Tuesday, September 3rd, 1968**

MORNING: Arrival and registration at Tuck School, Dartmouth College

AFTERNOON: Registration at Hopkins Center, Dartmouth College

1400 hrs.

GLACIO-CHEMISTRY I—ACCUMULATION

Chairman: C. C. Langway

**Papers:**

Lorius, C. et al.

Methods of estimating accumulation.

Picciotto, E. and Crozaz, G.

Radioactive methods for measuring snow accumulation — application to the East Antarctic Plateau.

Linkletter, G. O.

The use of cationic ratios in determining annual stratigraphic layers in polar ice.

Leung, S.

Chemical quality and ionic measurements on polar snow and ice cores.

GLACIO-CHEMISTRY II—PARTICLES

Chairman: C. Lorius

**Papers:**

McCorkell, R. H., Pinson, W. H., Fireman, E. L. and Langway, C. C.

A search for cosmic dust in polar ice.

Hamilton, W. L.

Horizontal and vertical distribution of microparticles in the 1965 layer between the Whitmore Mountains and Byrd Station, Antarctica.

Wright, Frances and Hodge, P.

The question of the origin of the magnetic spherules found in Antarctic ice.

Vosters, M., Hanappe, F., Picciotto, E. and Deutsch, S.

Chemistry of Antarctic ice.

**Wednesday, September 4th**

MORNING: 0830

DEEP SOUNDING I—TECHNIQUES

Chairman: C. R. Bentley

**Papers:**

Lange, G. R.
Modified rotary core drilling in Greenland and Antarctica during the IGY (1956-59)

Hansen, B. L.
Deep core drilling in ice.

Ueda, H. T. & Garfield, D. E.
Deep core drilling at Byrd Station, Antarctica.

Aamot, H. W. C.
Self-contained thermal probes for remote measurements within an ice sheet.

Weertman, J.
A method of setting a lower limit on the water layer thickness at the bottom of an ice sheet from the time required for upwelling of water into a borehole.

DEEP SOUNDING II—RESULTS

Chairman: G. Robin

**Papers:**

Langway, C. C.
Features and measurements of deep polar ice cores obtained by various drilling methods.

Gow, A. J.
Preliminary results of studies of ice cores from the 2164 m deep drill hole, Byrd Station, Antarctica.

Raynaud, D. and Lorius, C.
Gas inclusions contained in ice—a study of two vertical profiles in Terre Adélie (Antarctica).

Gonfiantini, R., Tongiorgi, E., De Breuck, W. and Picciotto, E.
Oxygen isotope studies on ice cores from the 116 m deep drill hole at Base Roi Baudouin, Princess Ragnhild Coast, Antarctica.

AFTERNOON: 1400

DEEP SOUNDING III—SEISMIC AND RADIO ECHO RESULTS

Chairman: P. Kapitza

**Papers:**

Robin, G. de Q., Swithinbank, C. W. M. and Smith, B. M. E.
Radio echo exploration of the Antarctic ice sheet.

Clough, J. W. and Bentley, C. R.
Electromagnetic wave velocities in the upper Antarctic ice sheet.

Bentley, C. R.
Anisotropy of the West Antarctic ice sheet.

Ishida, T.
Glaciological researches on the inland traverse of the 8th Japanese Antarctic Research Expedition.

PRESIDENTIAL ADDRESS

A. P. Crary

**Thursday, September 5th**

MORNING: 0830

THERMODYNAMICS

Chairman: P. Shumsky

**Papers:**

Zotikov, I. A. and Moiseeva, G. P.
Approximative methods for temperature calculation in Antarctic glaciers.

Robin, G. de Q.
Stability of ice sheets as deduced from temperature gradients at depths below 150 m.

Radok, U., Jenssen, D. and Budd, W. F.
Steady-state temperatures in ice sheets.

Kane, H. S.
A study of 10-metre firn temperatures in Central East Antarctica.

DYNAMICS

Chairman: J. F. Nye

**Papers:**

Campbell, W. J., and Rasmussen, L. A.
An heuristic numerical model for three-dimensional, time-dependent glacier flow.

Beitzel, J.
The relationship of ice thicknesses and surface slopes in Queen Maud Land.

Holdsworth, G.
The flow law of cold ice.

Lliboutry, L.
Ice flow law from ice sheet dynamics.

AFTERNOON: 1400

GLACIAL METEOROLOGY I

Chairman: H. C. Hoinkes

**Papers:**

Bauer, A.
Relation between continental shelf morphology and iceberg discharge of the outflow glaciers from the Antarctic ice sheet.

Stephenson, P. J.
Features of shallow snow metamorphism at Southice, Antarctica.

Benson, C. S.
Studies of snow strata at Byrd Station, Antarctica.

Lister, H.
Snow accumulation over Antarctica.

GLACIAL METEOROLOGY II

Chairman: U. Radok

**Papers:**

Hoinkes, H. C.
Radiation budget at Little America V, February 1957 to January 1958.

Lister, H.
Air turbulence near a cold surface.

Weller, G. and Schwerdtfeger, P.
Thermal properties and heat transfer processes in the snow of the Central Antarctic Plateau.

Kuhn, M.
Ice crystals and solar halo displays, Plateau Station, 1967.

**Friday, September 6th**

MORNING: 0830

MASS BUDGETS—PRESENT AND PAST ICE AGES

Chairman: A. Bauer

**Papers:**

Shumsky, P.
Regimes of the Antarctic ice sheet.

Giovinetto, M. B.
The Antarctic ice sheet and its bi-modal response to climate.

Dort, W., Jr.
Climatic causes of Alpine glacier fluctuations, Southern Victoria Land.

Hollin, J. T.
Antarctic glaciology and Quarternary history.

MASS BUDGETS—REGIONAL STUDIES

Chairman: H. Lister

**Papers:**

Rundle, A. S.
Snow accumulation and ice movement on the Anvers Island ice cap, Antarctica.

Neethling, D. C.
Snow accumulation studies on the Fimbul Ice Shelf, Antarctica.

Allen, G. A. and Whitworth, R.
Ice thickness determinations at Wilkes.

Budd, W. F.
The Wilkes ice cap project.

Carnein, C. R. and Bull, C.
The mass balance of a cold glacier—the Meserve Glacier, South Victoria Land, Antarctica.

AFTERNOON: 1400

FRINGE REGIONS

Chairman: K. Kusunoki

**Papers:**

Budd, G. M. and Stephenson, P. J.
Recent glacier retreat on Heard Island.

Everett, K. R. and Behling, R. E.
Chemical and physical characteristics of the Meserve Glacier Morainal soils, Wright Valley, Antarctica: an index of relative age?

Yoshida, Y.
Glacio-geological survey on Prince Olav Coast.

Souchez, R. A.
Formation of shear moraines in upper Ferrar Glacier—South Victoria Land.

GLACIAL METEOROLOGY III—BLOWING SNOW

Chairman: W. F. Budd

**Papers:**

Oura, H.
A study of drifting snow.

Dyunin, A. K.
Theoretical analysis of snow drift measurements in Antarctica.

Schwerdtfeger, W. and Mahrt, I. J.
The effect of horizontal temperature gradients upon the surface wind regime over the interior of Antarctica.

Radok, U.
Report on preliminary blizzard electricity study.

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**Saturday, September 7th**

MORNING: 0830

ICE SHELVES

Chairman: D. C. Neethling

**Papers:**

Dorrer, E.
Movement determination of the Ross Ice Shelf, Antarctica.

Swithinbank, C. W. M.
Ice movement in the McMurdo Sound area of Antarctica.

Dalinger, R. E. and Soria, L. F.
Observations on the movement of the Larsen Ice Shelf between latitudes 65° and 66°S.

Behrendt, J. C.
Structure of the Filchner Ice Shelf, Antarctica.

SEA ICE

Chairman: W. F. Weeks

**Papers:**

Schwerdtfeger, P.
Sea ice—Antarctic aspects.

Limbert, D. W. S.
Thermal balance of sea ice at Halley Bay.

Yoshida, Y., Ishida, T. and Kusunoki, K.
Sea ice observations around Syowa Station and off Prince Olav Coast.

Assur, A.
Antarctic sea ice.

AFTERNOON: 1400

Current research reports
and/or
Closing session.

Mt. Washington trip.

## SEMINAR ON THE CAUSES AND MECHANICS OF GLACIER SURGES

**sponsored jointly by The National Research Council Sub-Committee on Glaciers and McGill University**

The seminar will be held on September 10 and 11 1968 at the Gault Estate of McGill University, St. Hilaire, P.Q.

**Registration:**

A fee of $10.00 will be charged which includes reprints and other materials but not accommodation. Forms and further information may be obtained from:

Dr. F. Müller
Room C-102, Old Chemistry Building
McGill University
Montreal 2, P.Q., Canada.

### PROGRAM

Meier, Mark F., Austin Post
What are surges?

Hollin, J. T.
Ice sheet surges and the geological record.

Wilson, A. T.
The climatic effects of large scale surges of ice sheets.

Schytt, V.
Glacier surges in Spitsbergen.

Field, William O.
Current observations on three surges in Glacier Bay, Alaska, 1965-68.

Stanley, A. D.
Observations on the surging Steele Glacier.

Dolgushin, L. D.
'Pulsatory' glaciers in the Pamirs and Tien Shan and some peculiarities of their movement.

Robin, G. de Q.
Initiation of glacier surges.

Weertman, J.
Water lubrication mechanism of glacier surges.

Nielson, Lawrence E.
The ice-dam, powder-flow theory of glacier surges.

Lliboutry, L.
Contribution to the theory of glacier surges.

Barnes, P. and Robin, G. de Q.
Propagation of glacier surges.

Campbell, W. J. and Rasmussen, L. A.
Three-dimensional surges and recoveries in a numerical glacier model.

## GLACIOLOGICAL DIARY

### 1968

19 - 28 August
International Geological Union, congress. Prague, Czechoslovakia. (Int. Geological Congress, 23rd Organizing Committee. Malostranske namesti 19, Praha, Czechoslovakia.)

2 - 7 September
SCAR Working Group on Glaciology—International Symposium on Antarctic Glaciological Exploration. (With support of Commission of Snow and Ice, IASH.) Dartmouth College, Hanover, New Hampshire, USA.

9 - 14 September
Symposium on the physics of ice. München, Germany. (See ICE no 26, April 1968, p 22 for details.)

10 - 11 September
Seminar on the causes & mechanics of glacier surges. Montreal, Canada. (See p. 15 of this issue of ICE for details.)

11 - 13 November
Geological Society of America, annual meeting. Mexico City. (GSA HQ, 231 E 46th Street, New York, NY 10017, USA.)

### 1969

January or February (exact date to be announced)
Northeastern North American Branch of the Glaciological Society, Montreal, Canada, Annual meeting. Field trip at Mt. Tremblant follows. (Dr E. R. Pounder, Dept. of Physics, McGill Univ., Montreal, P.Q., Canada.)

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

7 - 13 September
Glaciological Society, symposium on the hydrology of glaciers. (Jointly sponsored by the Society and the Commission of Snow and Ice, IASH.) Cambridge, England. (Mrs H. Richardson, Glaciological Society, c/o Scott Polar Research Institute, Cambridge, England.) (See ICE no 26, April 1968, p 23 for First Circular.)

### 1971

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

# NEWS

## AWARD

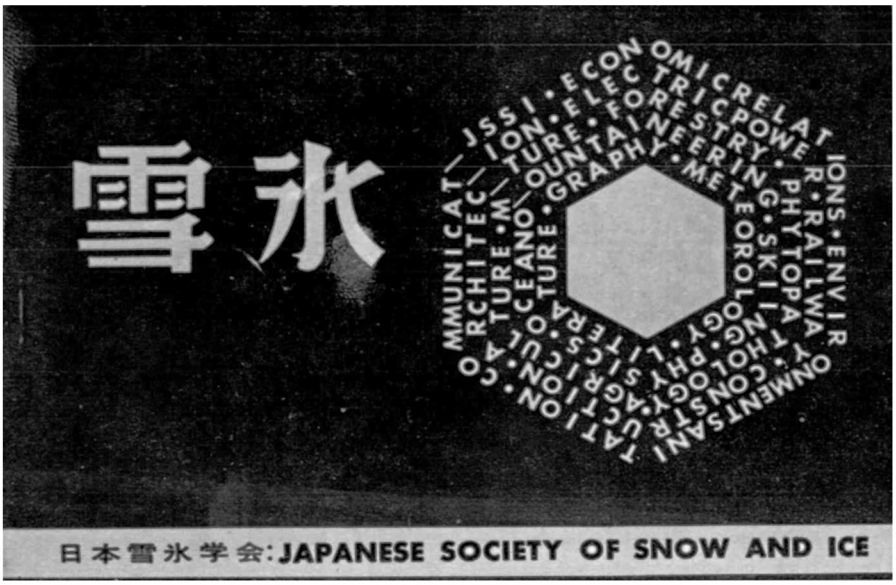
H.M. The Queen has approved the award of the Royal Geographical Society's Founder's Medal, 1968, to **W. Brian Harland,** Cambridge University, for Arctic exploration and research.

## APPOINTMENTS

**Johannes Weertman** has been appointed to a Walter P. Murphy Professorship in the Department of Materials Science, Northwestern University, Evanston, Illinois, U.S.A. Dr Weertman joined Northwestern University in 1960 as a professor of materials science, and has been chairman of that department since 1964. Since 1963 he has also been a professor of geology. The Walter P. Murphy professorships were established in 1950 as a memorial to Murphy, president of the Standard Railway Equipment Co. of Chicago, who in 1939 had given funds for the construction of the University's Technical Institute, and in 1942, upon his death, had bequeathed monies to endow the Institute.

**James H. Zumberge** is leaving his post of President of Grand Valley State College, Michigan, U.S.A., in August 1968, after six and a half years, to become Director of the School of Earth Sciences at the University of Arizona in Tucson. At the time of his appointment as its first President in 1962. Grand Valley State College did not exist except as an idea. Now it has an enrolment of 2000 students for September 1968 and a faculty of 100.

## THE 30th ANNIVERSARY OF THE JAPANESE SOCIETY OF SNOW AND ICE




The Japanese Society of Snow and Ice was established in March 1939. The Society is planning to celebrate its 30th anniversary in September this year. Simple computation gives 1968—1939=29, and it may seem strange to have the celebration this year. It is the custom in Japan, however, to count age from the first year.

Japan is a country which suffers from severe snow disasters every winter. Cold monsoons carry abundant moisture from the Japan Sea and precipitate it along the north-western coast of Japan as heavy snow falls (2 or 3 meters in depth), giving rise to avalanche damage and many troubles with traffic and electrical communications. Hokuetsu Seppu, a documentary essay written and published by Bokushi Suzuki about one century ago, tells how people in snowy districts suffered from troubles caused by snow. In 1939, Dr Tokutaro Hirata, one of the pioneering workers of snow, proposed the establishment of a society to study snow and ice and became its first president. Drs

Kuroda, Nakaya, Hatakeyama, Fukui and others helped him as council members of the Society. The journal named "Geppo" (monthy report), Volume 1, No. 1, was issued by the Society in April 1939, and later its name was revised to "Seppyo" (snow and ice). Since then this journal has been published monthly except several months just after the second world war. The present subscribers number approximately one thousand. The picture shows the design of the front cover of the journal: English words arranged round a white hexagon, showing the many subjects closely related to snow and ice. The contributions to "Seppyo" have been made in Japanese so far, but foreign papers written in English will also be welcome. Recently Dr Yosida succeeded Dr Hatakeyama as President of the society.

D. Kuroiwa

## ARCTIC INSTITUTE OF AMERICA

The resignation of the Executive Director, Dr John C. Reed, who lived in Washington, and the appointment of Brig. H. W. Love, who is based in Montreal, which occurred on 1 January 1968 has resulted in some adjustments in Institute staff organization. For a number of years there has been a Washington Office and a Montreal Office, each in charge of a Director. The appointment of an Executive Director in Montreal has resulted in a decision not to appoint a new Director, Montreal Office, at least for the moment. Mr Robert C. Faylor remains Director of the Washington Office. Mr Kenneth de la Barre continues as Executive Officer in the Montreal Office. The staff is small enough to permit considerable flexibility in organization and in the assignment of responsibility. Everything will continue to be done to improve administrative effectiveness and operate as economically as possible. As the Chairman of the Board of Governors, Dr Trevor Lloyd, lives in Montreal, he is able to devote appreciable time to Institute affairs.

## ANTARCTIC ICE CORES FOR RESEARCH PURPOSES

The National Science Foundation (NSF) announces that a nearly continuous ice core has been recovered from a 7,100 foot (2,164 meter) borehole at Byrd Station, Antarctica. The core is about 4 inches (10 cm) in diameter and is cut into approximately 5 foot (1.5 meter) lengths.

The drilling program was conducted with NSF support by the US Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire. This agency is responsible for certain phases of the analysis of the core, for storage of the core samples in the United States, and for the distribution of core material to scientists collaborating in the analysis. About 400 feet (124 meters) of the core samples, including the bottom 16 foot (4.9 meter) section with its entrapped rock and debris, are now at CRREL and available for immediate study by approved investigators. It is planned to ship approximately 1,500 feet (460 meters) of core to the United States in January 1969. This will constitute every fifth 5 foot (1.5 meter) section of the entire core. If core material in longer contiguous sections is required for a given experiment, it will be necessary that the specific requirement be known by 1 August 1968 if it is to be included in the January 1969 shipment.

Scientists interested in obtaining core samples or samples of contained volcanic ash, cosmic particulates, etc., should address their request to the Chief Scientist, Office of Antarctic Programs, National Science Foundation, Washington, D.C. 20550, U.S.A.

J. Renirie

## INTERNATIONAL COMPETITION

### FOR WRITTEN STUDIES ON THREE SUBJECTS REGARDING THE DEFENCE OF THE SOIL AGAINST HYDRO-GEOLOGICAL PHENOMENA

The Accademia Nazionale dei Lincei announces an international competition with three prizes worth a million lire each, for written studies on the following subjects, all regarding the problems of the safeguarding of the soil against harmful hydro-geological phenomena:

1. Mathematical schemes and models in hydrology.
2. Comparisons between the various legislative provisions regarding the defence of the soil in various countries.
3. The total expenditure of the Italian State for the defence of the soil from 1861 to the present day.

National Members of the Accademia dei Lincei cannot take part in the competition.

The studies, with four copies, shall reach the offices of the Accademia Nazionale dei Lincei (Via della Lungara, 10-00165 Roma-Italy) not later than the 31st of December, 1968, together with an application to enter in which competitors are required to state which of the three subjects they have chosen.

For each of the three prizes the panel of judges will consist of three National Members of the Accademia dei Lincei.

**Rome, December 1967.**

THE PRESIDENT
Beniamino Segre

## NEW MEMBERS

Barnett, D. M., Geological Survey of Canada, 601 Booth Street, Ottawa 4, Ontario, Canada.

Bartos, L. R., 501 Pine Avenue, Kemmerer, Wyoming 83101, USA.

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Chorlton, John, 21 The Ramparts, Newcastle-upon-Tyne 5, England.

Dansgaard, W., Phys. Lab. II, H. C. Orsted Institut, Universitetsparken 5, København, Denmark.

Dyunin, A. K., Red Avenue, 56,52, Novosibirsk 5, USSR.

Eden, A. C., P.O. Box 14, Franz Josef Glacier, South Westland, New Zealand.

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Illingworth, J. J., Meteorology Department, University of Melbourne, Parkville, Victoria 3052, Australia.

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Langleben, Dr. M. P., Physics Department, McGill University, Montreal 2, Canada.

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Miller, Penelope M., 1300 30th St. B4-16, Boulder, Colorado 80302, USA.

Monroe, Miss R-L., Box 142, R.R. No. 2, Ottawa, Ontario, Canada.

Rinehart, Dr. J. S., Environmental Science Service Administration, Boulder, Colorado 80302, USA.

Rott, Helmut, W-Greil-strasse 12, A-6020 Innsbruck, Austria.

Steptoe, Ian, 65 Point Royal, Rectory Lane, Bracknell, Berkshire, England.

van Stuijvenberg, J., Depotstrasse 12, 3012 Bern, Switzerland.

Tiffany, Miss M. A., 1828 Vinewood, Ann Arbor, Michigan 48104, USA.

Trabant, Dennis, Geology Department, University of Alaska, College, Alaska 99735, USA.

## JOURNALS BY JET

With a minimum of 150 members in a country, it is now possible to mail the Journal of Glaciology by jet at the small annual fee per member of US $1.00. At the moment, the only region with sufficient members is North America. This notice is therefore of direct interest to members in Canada and U.S.A. Under the scheme, the Journal would reach members on the eastern seaboard one week after publication and those on the western seaboard two weeks after publication.

The scheme cannot be adopted, however, until the Secretary knows whether enough members are interested: if less than 150 members are (about half the membership in Canada and U.S.A.), then the scheme cannot be used at all.

Would those members resident in Canada and U.S.A. who would like to receive their Journal by jet please complete the form below and return it to the Secretary IMMEDIATELY. A quick response may mean that the scheme can start with the 1969 Journals.

Do not send money at this stage: if enough members are interested, those people will be invoiced in November 1968. No copies will be sent by jet unless the $1 has been paid in advance. To simplify administration, the $1 will be used only for those Journals published in a calendar year: no refunds, no credit balances.

## JOURNAL OF GLACIOLOGY — by jet to North America

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

..... Signature

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

☐ Yes*

☐ No*

*Check

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

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Thank you for your co-operation.

# THE GLACIOLOGICAL SOCIETY

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

President: Dr. J. F. Nye

Secretary: Mrs. H. Richardson

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

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## I C E

Editor: Mrs. H. Richardson

This news bulletin is issued free to members 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.

Annual subscription for libraries, &c, and for individuals who are not members of the Glaciological Society:

| | |
|---|---|
| Sterling | £1 0s. 0d. |
| U.S. dollars | $3.00 |

Printed by Metcalfe & Co. Ltd., Cambridge