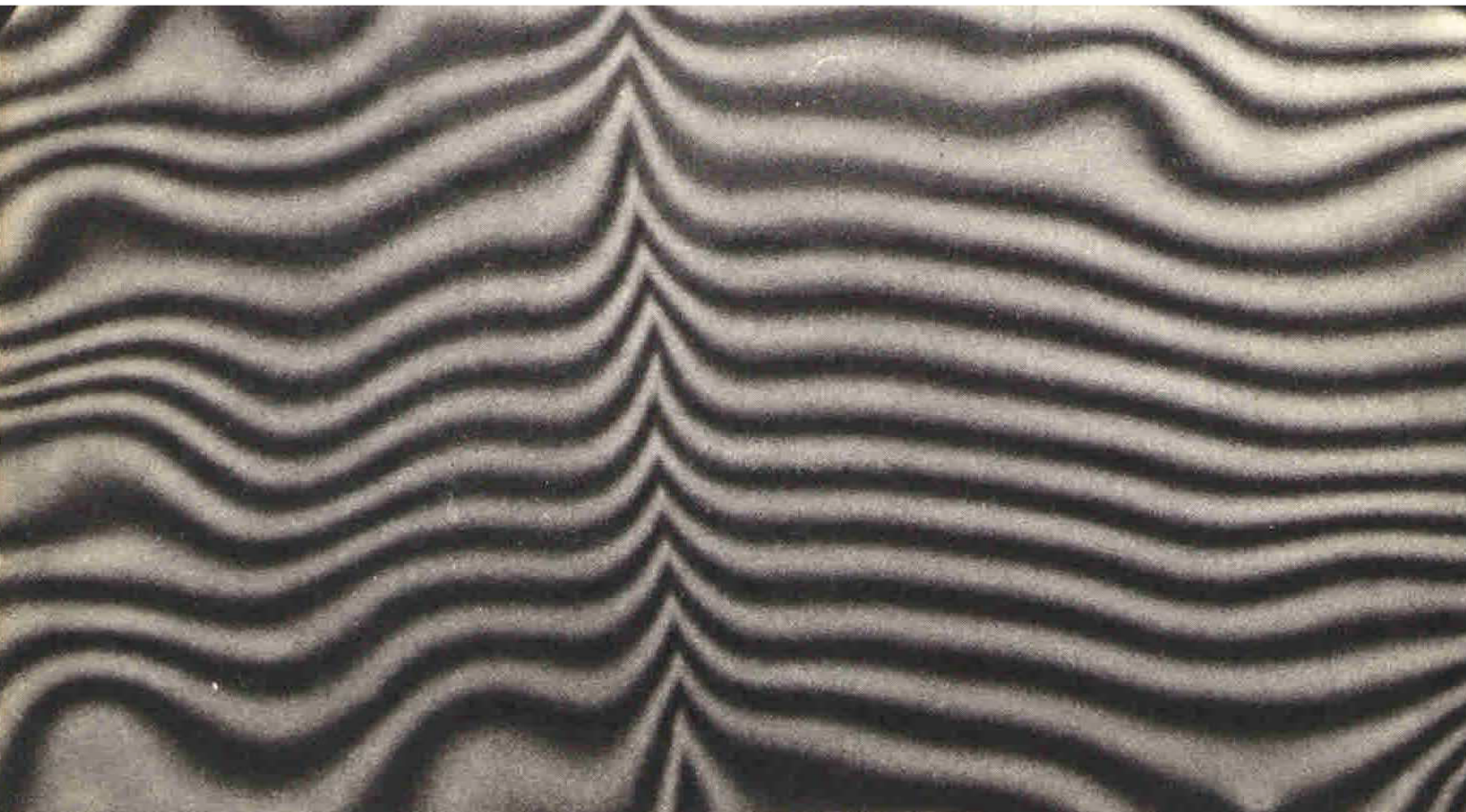
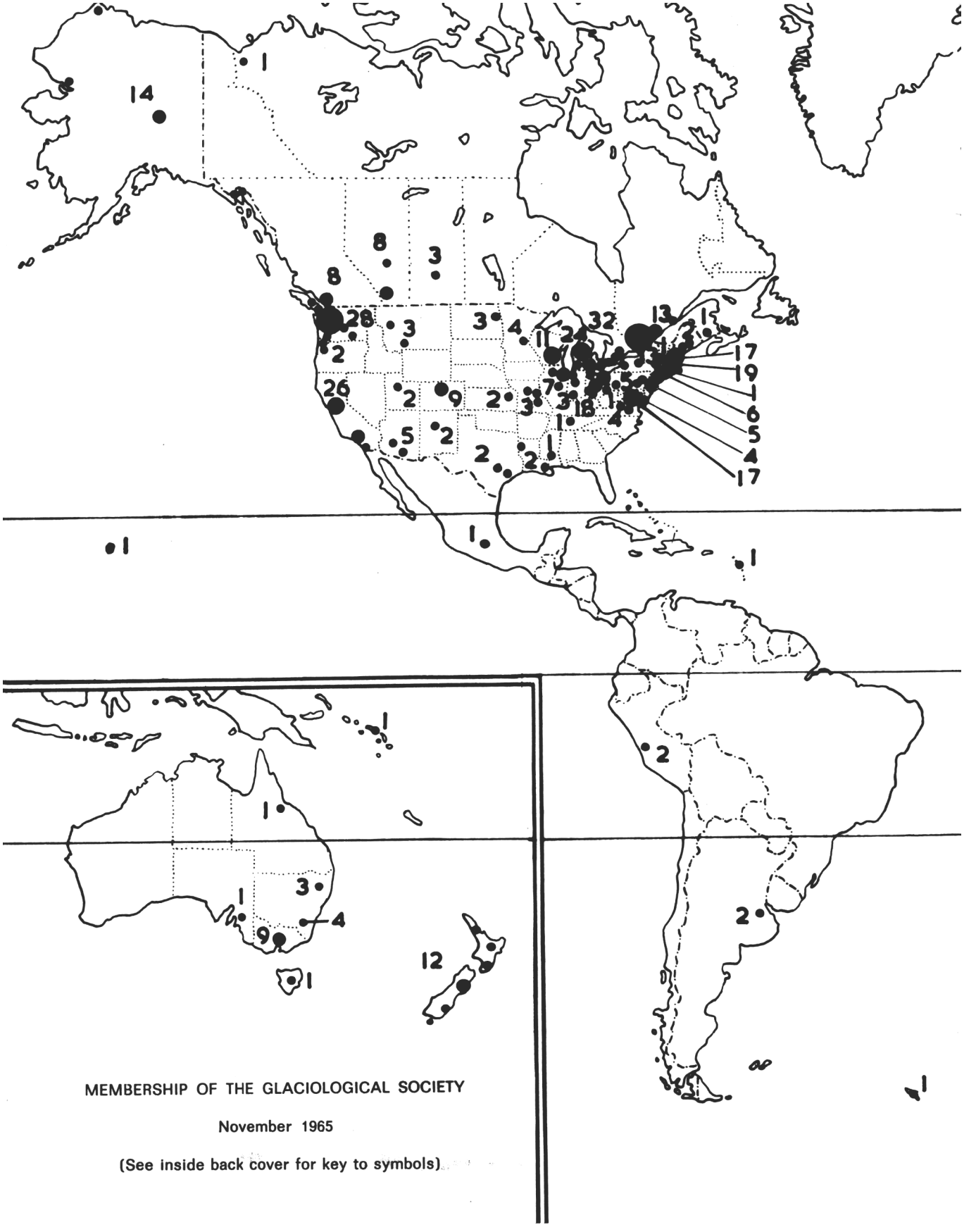
NUMBER 19

DECEMBER 1965

ICE





MEMBERSHIP OF THE GLACIOLOGICAL SOCIETY

November 1965

(See inside back cover for key to symbols)

ICE

NEWS BULLETIN OF THE GLACIOLOGICAL SOCIETY

December 1965 **Number 19**

CONTENTS

DUPLICATE PAPERS. We are pleased to offer members those reprints which are duplicated in our library. If you are interested in obtaining any, would you please write to Dr. G. Seligman, Little Dane, Biddenden, Ashford, Kent. You will then receive a list of papers from which you may make your selection.

JOURNAL OF GLACIOLOGY, VOLUME 4. Bound copies of this volume (nos. 31-36) are now available, in maroon cases with lettering and snow crystal in gilt. Prices of this volume and of the complete set of back issues may be obtained from the Secretary of the Society, c/o Scott Polar Research Institute, Cambridge, England.

RESEARCH FUND. A report of the meetings held to discuss the establishment of this fund appears on page 11 of this issue of ICE.

BRANCH OF THE SOCIETY. A letter was sent to members of the Society in the north-east of the North American continent at the beginning of December 1965 suggesting that a branch be formed in their area. The letter is published on pages 11 - 12 of this issue.

COVER PICTURE. Interferogram of a low angle grain boundary groove on ice at -11° C after 42 minutes in an unsaturated atmosphere. Photograph taken by R. O. Ramseier, U.S. Army CRREL, Hanover, New Hampshire, U.S.A.

The map on the inside pages of the cover shows the distribution of members of the Glaciological Society, November 1965. The numbers give the total membership in countries and states and provinces; the dotted symbols show approximate location.

FIELD WORK

FRANCE

FRENCH ALPS (Université de Grenoble, Laboratoire de Géophysique et Glaciologie)

Much of the field research of this group has been conducted in the Laboratoire de Glaciologie Alpine (formerly the laboratory on the Aiguille de Midi, now run by C.N.R.S. engineers and technicians), which has facilities at Chamonix, on the Plan des Aiguilles (2300 m) and at the Col du Midi (3600 m). In 1965 a total of 18 field workers spent an average of 29 days each in the field, and a much longer time in the construction of instruments, laboratory testing, and in working up results. In order to study the micrometeorology of the snow surface, new apparatus has had to be developed, including miniaturized anemometers which record photoelectrically, integrating thermographs which record the total values at certain time intervals (a radiation balance meter on the same principle is under construction), a humidity meter permitting simultaneous measurements at different heights, and thermometers based on the temperature variations of transistors which record temperature to 0.01° C.

At lower altitudes, movement and ablation measurements have been made on the Mer de Glace, the Glacier de Saint-Sorlin and the Glacier Blanc, and seismic depth measurements have been made on the Glacier du Tacul and the Glacier de Leschaux, two of the tributary glaciers of the Mer de Glace.

In the laboratory further experiments have been made to simulate conditions at the glacier bed, and work has continued on the crystal texture of the Mer de Glace and its relation to glacier flow. Work has started on the water content of temperate ice.

Theoretical studies of the various types of instabilities of ice sheets have been made and applied to the theory of glacial periods, which can be considered as automatic oscillations due to positive feed-back and de-phased negative feed-back in the system consisting of the ice sheet, the atmosphere and the oceans, with other external factors simply acting as triggering signals. Work has also been done on a new theory of flood waves on glaciers, and a new interpretation of the deep layers of low seismic velocity in Antarctica.

L. Lliboutry

EAST GERMANY

SPITSBERGEN EXPEDITION. Glaciological work was carried out during the 1964-65 season by a 16-man group under the leadership of Dr. L. Stange in the Kingsbay region (Kongsfjorden), Vestspitsbergen. The expedition arrived on 26 June 1964 and returned on 8 September, leaving a wintering party of 5 (leader U. Voigt) which remained at the camp at Ny-Alesund until 9 July 1965. A transportable winter hut near the terminus of Kongsfjorden was the base camp for field work in the Kongsvegen Range.

The terrestrial photogrammetric measurements made in 1962 for a map at a scale of 1:25,000 were extended by 300 km^2, including 12 glaciers of the Kongsvegen-Kongsbreen area. Some of the glaciers were surveyed for large-scale mapping.

Velocity measurements were made across the tongue of Kongsvegen glacier. Stereophotogrammetric velocity plates, made throughout the period, cover the heavily crevassed surface from the snout to the firnline. The maximum velocity near the snout was found to be about 3 m/day in July and the minimum velocity about 1 m/day in September. There is some evidence of kinematic waves. The winter ice conditions in the fjord in front of the glacier snout were included in the studies.

In March 1965 fjord soundings along two profiles near Kongsvegen snout gave water depths of about 60 m. During these soundings, it was possible to make observations of the roughness and structure of the lower surface of the glacier on tilted and fixed seracs of glacier ice. Mass budget investigations included ablation readings at 30 stakes, continuous measurements of discharge by the salt dilution method, and heat balance studies. The repeated photogrammetric survey of the terminus of Middle Lovenbre showed considerable mass deficit between 1962 and 1964; levelling across the glacier helped to verify mass budget studies based on the photogrammetric survey.

Gravity depth measurements were made on several profiles across the heavily crevassed Kongsvegen glacier and further gravity observations were carried out on Blomstrandbreen and Middle Lovenbre.

Ice temperature measurements up to 10 m depth were continued on Konsvegen throughout the winter.

Detailed studies on the formation and movement of periglacial features were made on selected test areas on Blomstrandhalvøya, continuing the work done in 1962.

U. Voigt

UNITED KINGDOM

UNIVERSITY OF ST. ANDREWS WEST GREENLAND EXPEDITION 1965. The expedition visited the Sukkertoppen region of West Greenland during the summer of 1965. Glaciological work was done east of Ikamiut fjord on the plateau icefield at 850 m at 65° 45' N, 52° 18' W, by Dr. P. W. F. Gribbon, C. S. M. Doake and J. C. S. Gilchrist. The capacitance and dielectric loss of glacier firn and ice were measured using an A. C. bridge powered by a transistorized oscillator, working between 150 c/s and 150 Kc/s. The capacitance of two parallel wires placed on the surface was measured for wire lengths up to 400 m and for wire separations up to 140 m. The results are being processed, but a preliminary analysis shows that the dielectric loss technique for determining the temperature inside the glacier is strongly influenced by the impurity and water content in the firn of a temperate icefield. Minor crevasses were found to have no effect on the measurements. Results obtained on glacial ice were very dependent on the surface conditions and temperature, and marked variations in the capacitance and dielectric loss occurred as the air temperature dropped below the freezing point of the surface melt water.

Lichen dating carried out on some of the glacier forelands in the region indicates that the average rate of recession within the past few decades is considerably greater than the average rate of recession during the initial stages of retreat at the end of the last century. Most of the lowering of the ice surface has occurred in the ablation region; there has been no marked lowering of the ice surface in the accumulation region on the plateau icefield.

P. W. F. Gribbon

UNIVERSITY OF NEWCASTLE UPON TYNE EXPEDITION TO AFGHANISTAN

The twelve expedition members spent the period from 3 July to 6 September at base camp in the remote Samir Valley, 14,000 ft up in the Hindu Kush. In the course of the field work round Mir Samir a description was made of the topography in relation to the solid geology and mechanism of erosion - frost shatter and exfoliation are dominant but chemical erosion has disintegrated some of the older screes and smoothed the lower boulders (not the schists) with desert varnish. Facets of earlier erosion surfaces were recognised and three halt stages in the glacial recession were locally defined.

Snow stratification and accumulation were interpreted at pits dug in the glaciers; the average accumulation at the snow line is approximately 100 gm/cm^{-2}. The regional snow line is at ca 18,000 ft but a marked topographic control brings this more than 1,500 ft lower over small areas. Ablation was measured at stakes and from a sketch map of the aerial extent of glaciers and snow patches an estimate was made of the melt water draining into the Samir Valley. Glacier margins indicate little change over recent years but for the year of observation a small positive budget is very probable.

The difficult terrain, altitude sickness and failure of the 12 volt petrol generator curtailed the meteorological observations save at a simple meteorological screen set up at base camp (ca 14,000 ft). For two periods of 24 hours at base camp and one such period on the west glacier (17,000 ft) observations were made for calculating a heat balance and evaluating the meteorological elements responsible for ablation. Thermal radiation at the surface was measured and profiles of wind speed and temperature recorded through the lowest 2m layer of air. Temperature profiles in the first $\frac{1}{2}$ metre below the surface were recorded and soil pots weighed as a direct check on the amount of evaporation. Hot wire anemometers, graphically recording wind velocity, inclination and declination, were exposed at different heights during the heat balance observations, from which to calculate coefficients of eddy viscosity. Direct measurement of heat and vapour transfer by wet and

dry bulb temperatures, measured at minute thermocouples (protected from radiation) was less successful.

The hydrological programme was designed to dove-tail with the glaciological programme to complete the water balance for the glacier by providing hourly discharge rates of melt-water. Despite severe temperature drops during the night and difficult gauging conditions, this was accomplished using colorimetric dilution gauging techniques. In addition, the temporal and spatial distribution of suspended sediment was investigated in the Samir River.

A full report of the expedition's work will be published later.

H. Lister

U.S.A.

BLUE GLACIER, UNIVERSITY OF WASHINGTON

The project was in the field from approximately 1 July to 17 September 1965.

A major objective was study of the firnification process in a maritime climate. To this end a pit 17 meters deep was dug in the firn of the upper part of the Snowdome. Excavation required approximately 1 week for three men. An electric hoist was used to remove the digging debris and as an improvised elevator for a platform from which the pit wall could be examined. About 120 samples were collected from the pit wall for density and crystallographic measurements, and selected samples were shipped to Seattle for examination in the cold laboratory. A system of illumination was devised which permitted photography of the pit wall stratigraphy in fine detail. A strain gauge was installed to measure settlement and compaction throughout the depth of the pit.

The firn became essentially ice at 16-17 meters depth. Another six meters below this was mostly ice, as revealed by a coring auger. The lowermost layer in the pit was dated at 1959; thus snow is converted to glacier ice in about six years at this site. The density was approximately a straight-line function of depth until ice was formed at around 0.85 g/cm^3.

A separate trench was dug in the face of the Snowdome where accumulation is shallow. This trench exposed a cross-section for 1956 to 1965 accumulation layers over a height a little over 2 m. In the absence of overburden, remarkably little densification had taken place. With the aid of stratigraphic identification established from this trench, the prominent unconformity in layering on the face of the Snowdome was dated at 1948-50. This figure agrees with climate records.

A statistical study of problems in measuring snow melt, begun last season, was continued again this year. A warm summer and fair weather produced heavy suncup formation, affording a chance to examine the ablation in these circumstances.

Mass budget and climate observations continued as usual. The glacier this year has experienced a substantial negative mass budget. The snow cover thickness at the Snowdome reference site was 16.0 feet on 1 June, the lowest figure that has been noted here since 1962. Fair weather prevailed during most of the summer, leading to a long melt season which was particularly intense late in July. Pending receipt of late season ablation information, a specific net mass budget of about -3.3 feet of water is estimated. Precipitation during the summer was light. Precipitation totals are 0.92" for July, 4.50" for August, and 1.22" up to 17 September. Fair weather persisting through September has brought light snow melt but relatively little net ablation as nocturnal radiation cooling becomes the dominant element of surface energy exchange and maintains a thick frozen layer beneath the snow surface.

In August an automatic recording analyzer for carbon dioxide was installed at the station building and operated for nearly a month. The CO_2 content of the atmosphere was found to undergo large diurnal variations during fair weather at this site. A maximum was achieved during the day and a minimum at night. This peculiar pattern is attributed to a complex relation between mountain-valley winds and pollution sources.

The adjacent Black Glacier exhibited an advancing kinematic wave which is expected to lead by next year to a terminus advance similar to that observed in 1957-58. The Blue Glacier itself has maintained a fixed terminus position for the past 10 years.

E. R. LaChapelle

The Editor of Ice can vouch from personal experience for the efficiency of the Blue Glacier Project, and for the thoughtful and cheerful care given to the cuisine and to the welfare of visitors. This can, as she discovered, assume great importance when airborne departures from the Snowdome are delayed for several days by all-obscuring clouds.

UNITED STATES GEOLOGICAL SURVEY, Tacoma, Washington

1. South Cascade Glacier

A new and shorter (13 km) trail into South Cascade Glacier was located, marked, and partially cleared. The existing research station was doubled in size and is now an efficient place for eight people to live and work. Thermal drilling to obtain ice thicknesses was attempted with equipment developed by E. R. LaChapelle. The greatest depth obtained was 210 m. Long-term recording instruments for precipitation, air temperature, wind, and runoff operated continuously during the 1964-65 winter, and the usual detailed measurements of climate, mass budget, and water runoff were made in spring, summer, and fall.

(a) Glacier mass budget (W. V. Tangborn). Spring snow accumulation on the glacier was slightly above average (350 cm of water at the mid-glacier index station compared with seven-year average of 320 cm). June was quite cool and wet and ablation rates were low. However, July and August were very warm and much melting occurred on the glacier. The net mass balance this year was about -0.5 m, slightly less negative than the 1958 - 64 average. Thick firn from the markedly positive net budget of the preceding year kept the average albedo high, so the high-radiation conditions in midsummer had less effect than usual.

(b) Drainage wind study (W. J. Campbell). In previous seasons periodic pulsations in temperature and velocity of the glacier wind had been observed but never systematically and accurately measured. Two sets of instruments were developed to measure temperature continuously to an accuracy of 0.2° C and wind velocity to 0.2 m/sec. Five more instruments of slightly less accuracy, two measuring temperature and wind velocity and three measuring wind velocity and direction, were developed by Dr. N. Thyer of the University of British Columbia, who cooperated in the study. The seven instrument pairs were placed on the glacier in various arrays across and up and down glacier, and approximately two and one-half weeks of data were collected under various meteorological conditions. The results suggest many cases of periodic pulses but of varying frequencies. A dynamic modelling study will be started when the data reduction is complete.

(c) Remote sensor experiments. Studies on the remote sensing of a glacier and its environment from airborne instruments were carried out successfully 22 and 23 September 1965 on South Cascade Glacier. This was part of the National Aeronautics and Space Administration Test-Site program, cooperative with several other agencies, to explore the potentialities of satellites in many aspects of geographic research.

A twin-engine Convair airplane, provided by the National Aeronautics and Space Administration, carried a 9-lens multispectral camera operating in the 0.35 to 1.1 micron region of the electromagnetic spectrum. This system was developed and provided by the Air Force Cambridge Research Laboratories. An RC-8 cartographic camera was used with both color and color-infrared film. In addition to these the NASA airplane was equipped with infrared scanning radiometers working in both the 4.5 to 5.5 and the 8 to 13 micron bands. Profiles (not images) of passive microwave radiation were obtained at frequencies of 9.15, 15.8, 22.2, 34.0 gigacycles. Conventional vertical and oblique aerial photographs were taken at the same time by A. S. Post in another airplane. Two helicopters provided logistical support.

Two flights were made by the NASA airplane: one between 2220 and 2230 hours, Pacific daylight time, on 22 September, and another between 1400 and 1500 hours, Pacific daylight time, on 23 September. The daytime flight included runs at 920 m and 3400 m above the glacier surface. The weather was nearly perfect for these missions: the sky was completely cloudless, and although a blue smoke haze hung in the lower valleys none was visible at higher elevations. The relative humidity was low and surface air temperatures were in the high forties to mid-fifties during the flights.

Ground spectral data were collected to assist in the interpretation of aerial imagery. Simultaneous photographs in the same spectral regions as the 9-lens camera were taken, and measurements were made of snow albedo, relative humidity, and air temperature. The apparent radiant temperature of ice, snow, various rock types, vegetation, and the lake was measured at the time of the flights.

Planning and coordination of this remote sensing mission was carried out by Robert Alexander (Office of Naval Research) and M. F. Meier (Geological Survey). Leo Childs (National Aeronautics and Space Administration) directed the flights which were made in a NASA aircraft; John Cronin, Carlton Molineux, and Bruce Harding (Air Force Cambridge Research Laboratory) carried out the photometric "ground truth" data collection; and

Robert Alexander measured parameters on the ground at longer wave lengths. A second flight may be scheduled in midwinter, at which time the snow cover will be extensive and its temperature differences greater.

2. Aerial reconnaissance (A. S. Post)

As part of a continuing annual investigation of snow conditions and glacier activity over a broad region, oblique and vertical aerial photographs were obtained in August and September 1965 of selected glaciers in the following mountain regions of Western United States: Alaska - Coast, St. Elias, Chugach, Kenai, and Chigmit Mountains; Washington - Cascade and Olympic Mountains; Oregon - Cascade Mountains; California - Sierra Nevada; and Wyoming - Wind River Mountains. While en route to Alaska, selected glaciers in the Coast Mountains of British Columbia were photographed.

Unusually large quantities of snow on glaciers near the end of the ablation season indicate positive to strongly positive net mass budgets for many glaciers in all observed areas with the exception of the Southern Coast Mountains in British Columbia and the mountains of Washington State. In these latter areas slightly negative net mass budgets appear to be most common.

Advances of several glaciers were recorded. Glaciers of Mt. Rainier, Washington, showed the most striking activity with 7 of the 11 largest glaciers advancing. This represents the largest number of major terminal advances yet noted on the mountain. Coleman Glacier on Mt. Baker also advanced; Taku, Johns Hopkins, Grand Pacific, and Meares Glaciers in Alaska all made gains. The 1.6 km retreat of Muir Glacier, a greater loss than in previous years, may be due to the widening of the tidal inlet at its present position. The 300 m (approximate) recession of Guyot Glacier in Icy Bay was much less than in recent years and may be due to the constriction of the bay where it now ends.

3. Maclure Glacier (M. F. Meier, W. V. Tangborn)

A short field trip in August to the Sierra Nevada was carried out to select a glacier for a future glaciologic study as part of the International Hydrological Decade program. Maclure Glacier, a small, high-altitude cirque glacier in Yosemite National Park, was chosen. It occupies about one-third of a 1.4 km^2 drainage basin, extending from 3600 to 4000 m in altitude. Installation of hydrologic and glaciologic instruments is planned for the summer of 1966.

M. F. Meier

(Mark F. Meier, project chief; William J. Campbell, meteorologist; Austin S. Post, glaciologist; Wendell V. Tangborn, hydrologist; H. Joe Witte, meteorologist; and James H. Hoff, Robert M. Sprenger, James P. Stuart, summer field assistants.)

OHIO STATE UNIVERSITY, INSTITUTE OF POLAR STUDIES.

Casement Glacier, Southeast Alaska

A three-year study of this temperate glacier in Glacier Bay National Monument was begun in 1965 by a six-man team. They carried out mass balance and meteorological studies, in relating the present behavior of the glacier to its known retreat of about 5 miles in the last sixty years. In addition, fabric studies were made of the surface ice and of the ice exposed in a 60-meter tunnel excavated under the glacier.

Sherman Glacier, South Alaska

In March 1964 about half of the ablation zone of this simple valley glacier was covered by a thick debris slide, dislodged from the valley walls during the Alaska earthquake. This summer a three-man party started a series of investigations of the effect of this slide on the regime of the glacier. It is hoped that this work will continue in 1966 and that detailed studies will also be made then of the mechanics of emplacement of the debris slide itself.

Kaskawulsh Glacier, Yukon Territory

Two Institute members continued their work with the Icefield Ranges Research Program, at the confluence of the north and central arms of the Kaskawulsh Glacier. Most of their work was on the seismic properties of glacier ice and the crystallographic changes produced by the stresses at the confluence.

Red Rock, Northwest Greenland

During summer 1965, a four-man party spent approximately one month at Red Rock, Northern Nunatarssuaq, Greenland (76° 54' N, 67° 00' W) to re-examine an ice cliff on which extensive studies were carried out ten years ago.

The principal task was to obtain the terrestrial photography and necessary survey control for the construction by photogrammetric means of a topographic map of the cliff face with a 25 cm contour interval. In addition a plane table map of the ice drainage basin above the cliff was drawn with 5 m contour interval and an investigation of the plant ecology at the edge of the ice was carried out.

The analysis of the changes in the shape and position of the cliff face will rely principally on a comparison with the previous map and will yield detailed quantitative results. This analysis has not yet been completed.

Anvers Island, Antarctica

In February 1965, a new U.S. Antarctic Research Program station (Palmer Station) began operations on Anvers Island off the northwest coast of the Antarctic Peninsula. The island is approximately 30 miles wide and 40 miles long and lies between latitude 64° and 65° S and longitude 62° 30' and 64° 30' W. Much of the island is ice-covered and it is dominated by Mt. Français, 9060 feet. Five scientists and three support personnel are carrying out studies in glaciology, meteorology, and biology. The station has been in continuous operation since last February and will continue so during the coming season.

The glaciological program consists of snow accumulation measurements by stakes and shallow pits, ice movement by stakes and stake networks, and snow and ice temperatures at depth using thermohms.

August was the coldest month with an average temperature of -10.5° C. The average temperature for the summer months may well be above 0° C. The prevailing wind direction is north-northeast and the winds are generally light. The sky is seldom clear and it is overcast more than fifty percent of the time. Precipitation as rain and snow is frequent.

Antarctic Traverse

The First Queen Maud Land Traverse left the South Pole on 4 December 1964 and arrived at the Pole of Relative Inaccessibility on 27 January 1965. Surface glaciological studies included snow hardness, snow accumulation rate, depth-density and temperature profiles to 40 m. As measured at the instrument shelter, the snow accumulation rate at the Pole of Relative Inaccessibility for the period December 1958 - January 1965 is 3.6 gm/cm^2 per year.

Field Work planned for 1965-66 in Antarctica

(a) The main objective of the glaciological work on the Second Queen Maud Land Traverse will be to determine the amount of snow accumulation in this never-before-visited part of Antarctica. Pit studies will be carried out in detail, with particular attention to the following parameters: density, stratigraphy, grain size, O^{16}/O^{18}, stable isotope ratio, microparticle content, and conductivity. Core samples to depths of 8-10 meters will be taken to aid in this analysis. Density and temperature profiles will be recorded in deep bore holes (40 m). Density records will be obtained by a continuous logging technique utilizing a neutron source/detector probe. Temperatures will be recorded at discrete levels with a quartz crystal thermometer to $\pm$ 20 millidegrees Celsius. It is expected to measure the temperature gradient between 20 and 40 meters to $\pm$ 1 millidegree Celsius.

(b) A two-man party will revisit the line of markers set out in the summer of 1962-63 between Byrd Station and the Whitmore Mountains in Antarctica for the purpose of measuring the motion of the ice sheet by photogrammetric technique.

The party will inspect and resurvey the markers which are to be rephotographed this year. In addition, stakes set out previously will be measured to determine accumulation along the traverse line. Conventional stratigraphic studies in shallow pits will be carried out and accumulation values determined by this means will be compared to those obtained by direct measurement.

(c) A two-year investigation starting in the southern summer of 1965-66 will be made on a small polar glacier in the Wright Valley, Antarctica. A team of five will study the mechanics and dynamics of this ice slab. Two 100-meter tunnels will be excavated in the glacier at the ice-bedrock interface. The movement, deformation, fabric, and thermal regime of the basal ice will be studied. In addition, vertical boreholes will be driven from the surface to the base so that the thermal regime and the structure of the whole glacier may be studied.

C. B. Bull

RADIO-SOUNDING OF POLAR ICE THICKNESS (UNIVERSITY OF WISCONSIN)

Since the U.S. Army Signal Corps Antarctic Research Team, headed by A.H. Waite, first reported their successful ice soundings to the IGY Symposium at Wellington, New Zealand in February 1958[1], interest in the new technique has reached international proportions. Extensive field trials on the Greenland Ice Cap during June-August 1964 saw British and American radio-sounding teams continuously profiling over 400 miles of ice varying in thickness from zero to over 1800 meters. Following the Greenland experiments, the Signal Corps radio-sounding equipment was loaned to the University of Wisconsin Geophysical and Polar Research Center for continued, more extensive, field tests in Antarctica during the 1964-65 season.

Measurements of the various parameters which determine the reliability and limitations of the radio method were undertaken. The experiments were conducted in a variety of glaciological environments (e.g. floating and grounded ice, varying ice thicknesses, different temperature ranges) where previous geophysical studies had been completed.

Initial studies began in mid-November 1964 on the Ross Ice Shelf adjacent to New Zealand Scott Base (the "McMurdo Ice Shelf"). Measurements of radio wave velocity in ice were taken at three locations on the shelf. As many as four multiple reflections were recorded during the velocity tests and while continuously profiling ice thickness. A maximum thickness of slightly over 300 meters was measured within 20 miles of Scott Base.

Following the shelf experiments, the ice sounding team was airlifted to the Skelton Glacier. Measurements in this area approximately coincide with seismic and gravity stations established in 1958 during the Victoria Land Traverse. Velocity measurements were made and approximately 30 miles were profiled. Radio echoes were also measured from horizons between 300 and 600 meters in depth, where total ice thickness varied from 750 to 1650 meters. Similar "near surface" echoes were recorded in Greenland[2].

In late December, studies were made on and near Roosevelt Island where the University of Wisconsin has recently undertaken extensive geophysical and glaciological investigations. Over 100 miles of grounded and floating ice were continuously measured along previous seismic lines.

The project was completed in early January 1965 at South Pole Station where the value of ice thickness measured (about 2800 meters) favorably agrees with that obtained by previous seismic soundings. Reflecting horizons within the ice were also noted here at apparent depths as great as 1500 meters.

References

1. Waite, A.H. and Schmidt, S.J. Gross Errors in Height Indication from Pulsed Radar Altimeters Operating Over Thick Ice or Snow, Institute of Radio Engineers Convention Record, Part 5, March 1961, pp. 38-54.
2. Bailey, J.T., Evans, S., Robin, G. de Q. Radio Echo Sounding of Polar Ice Sheets, Nature, Vol. 204, October 31, 1964, pp. 420-421.

G.R. Jiracek
C.R. Bentley

QUEEN MAUD LAND TRAVERSE, 1964-65

This was the first leg of a four-year program of traverses, which will follow a zig-zag route from the South Pole, across Queen Maud Land to the coast. This wedge shaped segment of the continent, between approximately 30° E and 30° W longitude, is the largest unexplored region of Antarctica. The 1964-65 traverse followed the route between the South Pole Station and the Pole of Inaccessibility.

Determination of surface elevations and topography, and measurement of sub-glacial rock elevations were among the principal objectives of the traverse. Field geophysical techniques were expected to provide information regarding the physical properties of the snow and ice, the nature of the rocks beneath the ice, and the character of the geomagnetic field. Other objectives included the collection of ice samples for laboratory studies, establishment of strain networks, and the collection of meteorological data.

The traverse left South Pole Station on 4 December 1964 and followed a zig-zag route to the abandoned Pole of Inaccessibility station, arriving 27 January 1965. Navigation was done by sun compass and solar fixes. The traverse covered almost 800 nautical miles in 54 field days.

Dr. C. R. Bentley, of the University of Wisconsin, organized and led the traverse for the first month. Other University of Wisconsin personnel were traverse engineers R. Koski and E. Parrish, and geophysicists J. Beitzel and B. Redpath. The leader during the second month was Dr. R. L. Cameron of Ohio State University. Glaciologists, in addition to Cameron, included J. Gliozzi and H. S. Kane, also of Ohio State, and Dr. E. Picciotto of the University of Brussels. Olav Dybradskog, of the Norsk Polarinstitutt, Oslo, Norway, was meteorologist, and N. Peddie of the U. S. Coast and Geodetic Survey was navigator and geomagnetician. Two Tucker 843 Sno-Cats provided working and living quarters for the traverse party. A third Sno-Cat, a Tucker 742, had a drill mounted on the bed for boring the forty meter shot holes. Supplies and equipment were hauled in two Rollitrailers and four sleds. Additional fuel and supplies were brought in on re-supply flights, of which there were three during the traverse and one at its conclusion. The first re-supply, on 23 December, was a highly successful airdrop, consisting principally of fuel. At the second, on 6 January, the plane landed on a makeshift runway and delivered fuel and much-needed mechanical parts. The third, a small airdrop on 12 January, was necessitated by a mechanical breakdown.

Seismic stations were established, in general, at intervals of between twenty-five and thirty miles, and were occupied overnight. Minor stations were established at five-mile intervals for the purpose of taking gravity readings, slope shots, weather observations, and simultaneous readings of all the altimeters and of the magnetometers. On several occasions, either in order to do more scientific work or because of mechanical breakdowns, a station was occupied for more than one night.

Frequent mechanical failures, coupled with heavy loads and unfavorable surface conditions, limited the rate of travel. Although no crevasses were encountered, progress was frequently hampered by soft snow and high sastrugi. Fields of sastrugi ranging up to a meter in height were not uncommon. On a larger scale, the surface along the entire traverse route was characterized by irregular relief of the order of tens of meters in height and several kilometers in horizontal extent. This relief was superimposed on the regional slope of the surface, which for the last 250 miles of the traverse was an uninterrupted ascent with an average grade of about 3.3 meters/mile.

Surface elevation measurements were made using twelve barometric altimeters. In addition, slope shots, which determined the directions of the points of minimum and maximum elevation on the horizon, were made at each five-mile station. The altimeters, however, were monitored continuously, as were the two Varian M-49 magnetometers, which provided total magnetic field determinations. The twenty-nine seismic reflection stations, including one at the South Pole itself, augmented by 180 gravity stations, indicated rugged sub-glacial topography along most of the traverse route. The ice thickness, which ranged from about 1700 meters to about 3700 meters, averaged approximately 3000 meters (almost two miles). Three wide-angle reflection and three short refraction profiles were shot in an effort to determine accurately the mean seismic velocity of the ice cap and the near surface velocity variations. In addition, long-range refraction profiles were carried out and are expected to yield data which, together with the gravity and magnetics data, may provide clues to the rock types beneath the ice. Other investigations of the ice cap included two short electrical resistivity profiles, temperature and density profiles to a depth of forty meters, and the establishment of a tellurometer strain network at South Pole Station. Routine meteorological observations were made four times daily, although temperature and wind data were also recorded at each five-mile station.

C. R. Bentley

A. P. Crary

In the continuing "Profile" series it is difficult to differentiate an individual with zest for hard work and scientific adventure, since most of the leading glaciologists fall within such a general description. Yet Bert Crary is a person who manages to amaze hard-working men by being able to outwork and outrelax many of them, including those half his age. Born in up-state New York in 1911, Bert graduated magna cum laude from St. Lawrence University (B.S. in chemistry) and obtained an M.S. in physics at Lehigh University. In 1933 he started his work in geophysics under Maurice Ewing, and together they published papers on various topics in seismology, electrical resistivity of rocks and submarine geophysics. His work days at St. Lawrence and Lehigh were often ended with periods dedicated to weight-reducing wrestling in the local gym; these periods were followed by periods of weight-increasing libations at the local pub. These practices helped him to develop an extremely high metabolism for intellectual and physical labour.

From 1935 to 1945 Bert worked in geophysical oil prospecting in Colombia, Venezuela and England, with an interruption for antisubmarine research during 1941-42 at Woods Hole Oceanographic Institution. His research on upper air acoustics for the U.S. Air Force resulted in a series of papers on upper atmosphere winds and temperatures; this research was interrupted by a short period of oil exploration on the Persian Gulf.

With this background Bert made contact with polar glaciology in 1951, a relationship which has been beneficial to the discipline at large and to the many workers who had an opportunity to share field experience with him. From 1951 to 1955 he worked on an assortment of problems dealing with the sea ice, the ice islands and the ocean. When Lt. Col. J. Fletcher occupied T-3 ice island in 1952, Bert was chief scientist for the Air Force work on the island, continuing until it was abandoned in 1955. In 1954 he joined up with Geoff Hattersley-Smith in the exploration of the Ward Hunt Ice Shelf and during this trip became fascinated by Cherry Garrard's book, "The worst journey in the world", an account of Scott's last expedition to the Antarctic.

His interest in polar glaciology became more intimate and time-consuming when in 1955 he was lent by the Air Force to carry out I.G.Y. operations and set up the Glaciological Headquarters to carry out the recommendations of the U.S. I.G.Y. Panel on Glaciology. Bert organized the U.S. Antarctic work in glaciology, including oversnow traverses. In 1957 he went to Antarctica as Deputy Leader of the U.S. scientific efforts under the late Harry Wexler and scientific leader at the Little America Station. He remained in Antarctica until 1959, leading the summer traverses on the Ross Ice Shelf, 1957-58, and in Victoria Land, 1958-59. In 1960-61 he returned to lead the McMurdo-South Pole traverse.

It is hard to tell when in his life Bert developed the habit of getting up at 4 or 5 o'clock in the morning to do his research work if he is in a city or on a station, or to prepare breakfast for the rest of the expedition if he is in the field; whatever the origin of this habit, it is one that has allowed him to fulfill his heavy administrative responsibilities without losing his drive and opportunities for research. Not that his friends in the field always appreciate his early rising: "Goddam a guy who feels good in the morning", was the cry wrung from one Arctic companion when faced with an early bowl of hot steaming porridge.

His opportunities for research were nearly cut disastrously short one day in the Antarctic, when part of the ice shelf on which he was making observations calved and began drifting out to sea, tipping Bert into the icy waters. Fortunately he was quickly rescued. He soon received a cable from his friends at Woods Hole: "Appreciate your interest in oceanography, but please do not repeat the experiment".

He has returned to the Antarctic in recent years in the research vessel "Eltanin". His output of research work is as versatile as it is large and he is regarded as one of the most outstanding scientists in his field. Recognition of his work has come in the form of many distinguished awards: the U.S. Department of Defense Distinguished Civilian Service Award, the Cullum Geographical Medal of the American Geographical Society, the Patron's Medal of the Royal Geographical Society, the U.S. Department of Navy Distinguished Public Service Award, Honorary Degree of Doctor of Science from St. Lawrence University, and Phi Beta Kappa.

It is typical of Bert's wry humour that he, the first man to set foot on both Poles, should comment after a traverse in Victoria Land: "There's a lot more ice up there than anyone ever thought". Bert Crary's contribution to the growing knowledge of that ice is comparable with that of the greatest polar workers of the past.

GENERAL MEETINGS OF THE SOCIETY 1965

- RESEARCH FUND

As announced in a circular sent to all members of the Society in July 1965, two general meetings were held in North America in August and September 1965, to discuss the formation of a research fund.

The meetings, held in Boulder, Colorado on 31 August and in Ottawa on 21 September, took a similar form. Dr. W.H. Ward (Vice-President) was in the Chair, and the Secretary and Dr. W.O. Field gave background information. There were 17 members at the Boulder meeting and 40 at the Ottawa meeting; 4 members were present at both meetings.

90% of those present contributed to the lively and interesting discussions. Considerable support was shown for the establishment of a research/scholarship fund. The following points were made:

BOULDER. The majority agreed that it was difficult for young research workers and smaller universities to get grants, and that even small support could be effective in encouraging glaciological research. The fund could help people to get to a site where expensive equipment was being used, or to where an established programme of work was in progress.

Examples were quoted of other societies and clubs which have similar research funds and which raise money by special efforts and by putting some of their surplus money into the funds.

A resolution was proposed by A. L. Washburn, seconded by K. Bengtson, and carried unanimously:

> This meeting recommends that the Society establish a Research Fund, on the understanding that further money will be forthcoming to support the Fund. We strongly recommend the Society to seek outside support to build up the Fund, so that it may be effective.

OTTAWA. Examples were quoted of the difficulties experienced by young research workers in obtaining funds, and most people felt that even a small Fund could do much good. It was pointed out that glaciologists were in competition for funds with people from bigger disciplines and that they were therefore at a disadvantage. In view of the work planned for the International Hydrological Decade, when it is important to get as wide a coverage of glaciers as possible, a Research Fund would be welcomed by those countries where there is little money available for this work.

There was considerable support for the view that the Fund should be used to build for the future, by helping with the training of young glaciologists. The Fund should thus aim to provide scholarships as well as other help in research.

It was suggested that some of the money in the Fund might be used to publish a field manual, along the lines of the Society's "Technical Notes".

Although there was a minority who felt that a small fund could do little good, all agreed that a special drive for funds should be made. The details of the use of these funds could be decided when the amount available was known. To attract money, a definition of the Fund was needed, but its constitution should be kept broad and elastic.

A resolution was proposed by E.R. Pounder, seconded by F. Müller, and carried unanimously:

> This meeting considers favourably the establishment of a Research and Educational Fund for the Glaciological Society and requests the Council to consider the matter and circulate a draft constitution to members.

Both meetings agreed that it would be helpful to glaciology and to the Society for members in the NE of North America to form a branch. A circular has been sent to members in the area and it is reproduced below.

Discussions with members in other parts of North America and Britain and letters received in reply to the circular showed further support for the establishment of a research fund. The Council of the Society, at a meeting held in London on 26 November 1965, accordingly gave formal approval to the proposal and appointed a Committee to draft a constitution, which will be circulated to all members of the Society in accordance with the Ottawa resolution. The Committee members are: W.O. Field, F.K. Hare, F. Müller, J.F. Nye, the President, the Treasurer, and the Secretary.

NEW BRANCH

Dear Fellow Member of the Glaciological Society:

There has recently been some expression of the thought that the existing forums for the exchange of scientific knowledge are not entirely suitable for discussions in the general fields of snow and ice. For example, only rarely is a meeting held that will accept presentations covering the whole field of glaciology. In consequence, it is proposed that a regional meeting of persons interested in exchanging ideas in all aspects of snow and ice research be scheduled annually. To avoid a "population explosion" it is further proposed that the meeting be aimed primarily towards those living and working on the Eastern seaboard of North America.

For the purpose of giving the initial meeting some semblance of organization it is suggested that this be run as a regional branch of the Glaciological Society of which nearly 125 members reside between Ottawa, Ontario, Washington, D.C. and Buffalo, New York. Sanction and encouragement for such regional association is found in the constitution of the Glaciological Society: Article 3. "The Society shall encourage the establishment of branches in any country to foster the objects of the society." Realizing, however, that all persons interested in snow and ice may not be members of the Glaciological Society, it is urged that membership in the parent society need not be a criterion for participation in the regional meetings and that all interested persons shall be made welcome. It is planned that these annual meetings will be informal and the emphasis placed on free discussion rather than numbers of presentations. No doubt you have at one time experienced considerable frustration arising from the lack of free discussion at meetings where a large number of papers of diverse quality are presented. It is particularly to be hoped that students and younger scientists will find this a meeting where they can fully express their opinions.

If you are interested in the formation of such a regional group would you please indicate the degree of your enthusiasm on the enclosed form. If the response to this letter warrants it we will be pleased to welcome you all in Hanover sometime during the Winter of 1966.

CHARLES M. KEELER
STEVEN J. MOCK
RENE O. RAMSEIER
WILFORD F. WEEKS

1. Are you interested in forming a regional branch of the Glaciological Society?

2. Would you be interested in attending an annual meeting of the Branch?

3. Would you prefer that this meeting be a separate one or would you desire that it be a part of a regional meeting of an existing society (i.e., GSA, AGU, Eastern Snow Conference, etc.)?

4. Do you have any desires or suggestions regarding the aims and administration of the branch?

NAME TITLE

ADDRESS

Discipline of interest:

P.S. If you have any colleagues who have not received this letter, would you please bring it to their attention.

Please return questionnaire to Dr. W. F. Weeks, U.S. Army Cold Regions Research and Engineering Laboratory, Box 282, Hanover, New Hampshire 03755.

MEETINGS

FOURTH SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT. The Symposium will be held on 12, 13, 14 April 1966 on the campus of the University of Michigan, Ann Arbor, Michigan, U.S.A., and will be conducted as part of a continuing program investigating the field of remote sensing, its potential in scientific research and engineering practices, and some of the factors that are important to growth of the field. This work is being conducted by the Willow Run Laboratories of the University of Michigan's Institute of Science and Technology, and it is sponsored by the Office of Naval Research with funds made available by the ONR Geography Branch and the Air Force Cambridge Research Laboratories. The purpose of the Symposium is to stimulate an information exchange on all aspects of remote sensing, with emphasis on the needs for remotely sensed data. This exchange will interest people in geography, geology, glaciology, meteorology, oceanography, forestry, agriculture. Attendance at the Symposium is open to all who have an interest in remote sensing. Anyone interested in presenting a paper should submit a comprehensive one-page abstract no later than 1 December 1965 for consideration by a paper-selection committee. Abstracts should be submitted to: Mr. Dana C. Parker, The University of Michigan, Willow Run Laboratories, P. O. Box 618, Ann Arbor, Michigan 48107, U.S.A. Further information may be obtained from the Extension Service, Conference Department, University of Michigan, Ann Arbor, Michigan 48104, U.S.A.

AMERICAN GEOPHYSICAL UNION. For the first time in many years, the AGU will hold its Annual Spring Meeting under one roof. The Sheraton-Park Hotel in Washington, D.C., will be the site for the 47th Annual Meeting to be held 19 - 22 April 1966. Sessions will be planned for all nine Sections. Members and non-members are invited to submit papers for consideration. Each Section will organize its own programme, co-operating, when appropriate, with other Sections. The deadline for titles and abstracts is 15 January 1966. Forms for the submission of abstracts may be obtained from the AGU office (1145 19th Street, NW, Washington, D.C. 20036) or from the Chairmen listed below:

Meteorology - Richard E. Hallgren, Office of the Administrator, Environmental Science Service Administration, Washington, D.C. 20235.

Hydrology - Harry E. Schwarz, 9619 McAlpine Road, Silver Spring, Maryland 20901.

Include with your abstract the time required for presentation of your paper (most papers will be allowed from 10 to 20 minutes), what projection equipment will be needed, and whether it will be published in the Journal of Geophysical Research. Abstracts will be printed as part of the programme in the March 1966 issue of Transactions, AGU. They should be concise and informative, not over 200 words. Longer abstracts will be reduced or omitted at the Editor's discretion. No revisions will be accepted after 1 February 1966. To keep the press fully informed, complete manuscripts, if possible, should be submitted to the AGU office by 10 April.

The session on "Frontiers of Geophysics" will open the meeting. Tentative plans include the Social Hour on Tuesday evening, the Honors Meeting on Wednesday evening and the banquet, to be held jointly with the American Meteorological Society, on Thursday evening. Room reservations for the meeting may be made with the Sheraton-Park Hotel, Washington 8, D.C. Further information and a form will appear in the December issue of Transactions, AGU.

INTERNATIONAL UNION OF CRYSTALLOGRAPHY. The Seventh General Assembly will be held in Moscow, U.S.S.R., 12 - 21 July 1966. A Symposium on Crystal Growth will take place on 20 and 21 July. Most sessions will be held at the Moscow State University. All correspondence and enquiries should be addressed to Prof. N. V. Belov, Chairman of the Programme Committee, and Prof. N. N. Sheftal, Convenor of the Symposium, both c/o Institute of Crystallography, Leninskiy Prospekt 59, Moscow B-333, U.S.S.R.

PACIFIC SCIENCE CONGRESS. The 1966 Congress will be held in Tokyo, Japan, 22 August - 10 September 1966. Symposia of glaciological interest are:

No. 13 - Ice and snow in the Pacific area. (To be held in the first week)
No. 14 - Satellite meteorology.
No. 22 - Antarctic research.

Concurrent meetings will be arranged by international organizations; for example, UNESCO will hold one on the International Hydrological Decade. The Institute of Low Temperature Science of Hokkaido University will hold in the second week a conference on the physics of snow and ice; this conference will take place in Sapporo.

Further information about the Pacific Science Congress may be obtained from Dr. Higashi Kuno, Geological Institute, Faculty of Science, University of Tokyo, Tokyo, Japan.

Further information about the Sapporo conference may be obtained from Dr. Z. Yosida, Director, Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.

INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY. The Symposium on the "Hydrology of lakes and reservoirs", originally planned for the IUGG General Assembly in 1966, will, despite the postponement of the Assembly until 1967, still be held in 1966. The Italian National Committee and the Department of Geography of the University of Padova (Prof. Morandini) have invited the Association to hold this Symposium during the first days of October in Garda on the lake of this name (North Italy). All correspondence concerning the Symposium should be addressed to:

Prof. L. J. Tison, General Secretary, I.A.S.H., 61 Braamstraat, Gentbrugge, Belgium.

The programme of the Symposium is as follows:
1. Water balance and water level fluctuations.
2. Physics and chemistry (including ice conditions).
3. Hydrological basis of reservoir design.
4. Origin and history of lakes.
5. Methods of establishment of an inventory of lakes and ponds by national and regional surveys.

GLACIOLOGICAL SOCIETY: BRITISH BRANCH. On 11 November 1965, Professor David Linton lectured on "Glacial erosion in the Antarctic" at a joint meeting of the Society and the Joint Schools Geographical Association in King's College, University of London.

COMMISSION OF SNOW AND ICE

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

RESOLUTIONS ADOPTED BY THE SYMPOSIUM ON GLACIER MAPPING OF THE IUGG-IASH COMMISSION OF SNOW AND ICE 20 - 22 SEPTEMBER 1965.

The Symposium on Glacier Mapping, sponsored by the IUGG-IASH Commission of Snow and Ice, in Ottawa, 20-22 September 1965, adopted the following resolutions, and requests the Commission to take appropriate further action to implement these resolutions.

1. The Symposium recognizes the value of the resolution, adopted by the Council for the IHD, on a World Inventory of Perennial and Annual Snow and Ice Masses. The Symposium recommends that the Commission urge UNESCO to encourage the member states to support glacier mapping activities that are an integral and necessary part of this IHD programme, and recommends that these mapping activities include: (a) small-scale maps, showing the distribution of glaciers, from which total glacier areas can be determined; (b) larger-scale contour maps of as many glaciers as possible in representative areas drawn with sufficient accuracy for valid comparisons of mass changes, at intervals of about ten years. For all maps, the date, means of survey, and accuracy should be specified, and glaciers should be included with (but differentiated from) other masses of snow and ice which persist for more than one year.

2. The Symposium strongly emphasizes the need for detailed, large-scale glaciological maps of representative glaciers, including their complete drainage basins, particularly for the purposes of the study of the glacier-climate relationship as part of the IHD programme, and as a necessary background for many other scientific and technological programmes associated with glaciers. A scale 1:10,000 or larger is desirable.

3. Considering the importance in some areas of glaciers as water resources, as elements of attraction or danger to mankind, and as elements in the natural environment, the Symposium recognizes the great need for proper delineation of glaciers on maps of standard topographical series, and urges government agencies responsible for topographical surveys and international organizations such as UNESCO to pay special attention to the continually changing forms of glaciers and the proper distinction between glaciers and ephemeral or persistent snow masses.

4. The Symposium recommends that the Commission consider the formation of a Committee on Glacier Mapping to have a continuing responsibility to investigate, promote the study of, and report on new techniques for glacier mapping and other ways to record and present spatially distributed glaciological information. This Committee should work in liaison with other groups in similar fields.

5. The Symposium calls to the attention of the Commission the need for (a) a manual on glacier mapping; (b) a standardization of symbols on glacier maps; (c) preparation of recommendations for international exchange of glaciological maps and data, especially those relating to international programmes such as the IHD.

6. The Symposium on Glacier Mapping requests the Subcommittee on Glaciers, National Research Council of Canada, to explore means of giving suitable recognition to Sebastian and Richard Finsterwalder in the Proceedings of the Symposium.

7. The Symposium recognizes the great value of bringing photogrammetrists, cartographers, glaciologists, and other interested persons together for these discussions, and expresses its gratitude to the National Research Council of Canada and to the Organizing Committee.

W. H. Ward
Secretary, Commission of Snow & Ice

With reference to Resolution 6, the following cable was sent to Frau Maria Finsterwalder in Munich:

"Participants at Symposium on Glacier Mapping recognize distinguished pioneer work of Richard and Sebastian Finsterwalder and honour their memory. They send you warm greetings."

Participants at the Symposium on Glacier Mapping, Ottawa, 20-22 September 1965.

NEWS

We are sorry to report the death on 26 November 1965 in Cambridge, England, of one of our Honorary Members, Professor Frank Debenham, Founder-Director of the Scott Polar Research Institute 1925-46. As a young man he went to the Antarctic with Scott. From 1931-46 he was head of the Geography Department in Cambridge, and several members of the Society studied glaciology in the Department during Deb's Professorship. He was one month short of his eighty-second birthday when he died. A full obituary will appear in the Journal of Glaciology.

We are sorry to report the death of Jeremy Bailey in Antarctica. Three members of a British Antarctic Survey field party were killed when their tractor fell into a crevasse 250 miles from their base camp at Halley Bay. Mr. Bailey, aged 24, was a research student at the Scott Polar Research Institute, Cambridge, where he was helping in development of the radio echo equipment described in ICE no. 16. He was one of the party invited by the U.S. Army Electronics Laboratory to work in Greenland in the summer of 1964 and shortly afterwards joined the British Antarctic Survey at Halley Bay. He has been responsible for many advances in the technique and we hope that some of his records obtained in the Antarctic will be recovered and used as a memorial to a promising but brief career.

We are also sorry to report the death at the age of 61 of L. R. Wager, Professor of Geology at Oxford University, England. A noted explorer and mountaineer, in 1933 he was a member of the British Everest Expedition and made an attempt on the summit. In 1935 he led the British East Greenland Expedition, crossing the Christian IV Glacier, one of the largest in the world.

We have received an appeal about the library of the late Vilhjalmur Stefansson. The world-famous Stefansson Collection, purchased by Dartmouth College in 1952, is now being dismantled as a single, separate library devoted to northern research in the humanities and social sciences. It contains over 20,000 bound volumes and about 40,000 pamphlets and old and new maps. The Collection has been housed at Dartmouth since 1951. Recently the College decided to abandon its northern studies program and has implemented the following policy for the Collection:

> It will be an historical library only; termination dates for arctic subjects will be 1925 and about 1940 for the Antarctic. Eskimo materials will be removed and placed in the College's main library. Most of the periodical collection will be removed to the main library. Much of the famous and invaluable pamphlet collection will be dismantled. The irreplaceable special sections, such as "Diet and health", will be dismantled. The general section, containing many books indispensable for comparative studies, will be dismantled.

Nowhere in the western world is there a library devoted to northern research in the humanities and social sciences which surpasses the Stefansson Collection. It is felt that there is a need in North America for an active research library devoted to northern research and that the Collection has the prerequisites for such a library. Several North American universities are able and willing to purchase, house and support the Collection. Should it therefore be dismantled? Many people feel that the Collection should be restored to its original condition and housed intact in a North American university where it will be actively used as a research library. Supporters of the Collection ask those who agree with these points to write to the President of Dartmouth College (Hanover, New Hampshire, U.S.A.) urging him to save this unique research library.

Dr. R. P. Goldthwait has become Chairman of the Geology Department of the Ohio State University but remains a member of the Board of Directors of the Institute of Polar Studies. He has been succeeded as Director by Dr. C. B. Bull.

The Geophysical Institute of the University of Alaska invites applications from persons well qualified in classical physics and mathematics for appointment to the Institute's group concerned with the physics of ice, the movement of glaciers and related glaciology and meteorological phenomena. The position is primarily for research but some teaching may be required at graduate level. Qualifications: Ph.D. in physics or equivalent capability and research experience. Depending on qualifications and experience, appointments will be made in the range from Assistant Professor to Professor. The starting salary will be not less than $13,200 per year for Assistant Professor. Visiting Professorships may be offered to scientists applying from abroad. Apply to the Director, Geophysical Institute, College, Alaska, U.S.A

THE SOCIETY'S LIBRARY

Works received for the Society's library since June 1965.

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.

Adie, R.J.
Bauer, A.
Bentley, C.R.
Bloch, M.R.
Castiglioni, G.B.
Cooper, C.F.
Fitzpatrick, E.A.
Haefeli, R.
Hallett, J. (4 items)
Higashi, A. (2 items)
Higuchi, K. (4 items)
Holmes, G.W.
Jackson, C.I.
Martinelli, M., Jr. (2 items)
Miller, M.M. (4 items)
Ostenso, N.A.
Paschinger, H. (4 items)
Paterson, W.S.B.
Ray, L.L. (4 items)
Schneider, A.F.
Shōda, M.
Vivian, R.
Wundt, W.

American Geographical Society (Department of Exploration and Field Research)
Antarctic Division, Department of External Affairs, Melbourne, Australia (2 items)
Arctic Institute of North America
Association Internationale d'Hydrologie Scientifique (3 items)
Department of Atmospheric Sciences, University of Washington, U.S.A.
Department of Geography, University of Lund, Sweden (2 items)
Department of Mines & Technical Surveys, Ottawa, Canada
Division of Building Research, National Research Council, Ottawa, Canada (3 items)
International Council of Scientific Unions
Institute of Civil Engineering, U.K. (2 items)
Norske Meteorologiske Institutt, Oslo
Ohio State University, Institute of Polar Studies, U.S.A. (5 items)
Osservatorio Geofisico Esperimentale, Trieste, Italy
Polish Academy of Sciences (3 items)
Société de Hydrotechnique de France
Sveriges Meteorologiska och Hydrologiska Institut, Stockholm (4 items)
U.S. Army, Cold Regions Research and Engineering Laboratory (3 items)
United States Department of Agriculture, Forest Service (Rocky Mountain Forest & Range Experiment Station)
Universität Geographisches Institut, Wien, Austria
Zespół Katedr Geografii, Torún, Poland (2 items)

BOOKS RECEIVED

ARTHUR HOLMES. Principles of Physical Geology. (New and fully revised edition). London, Thomas Nelson & Sons Ltd., 1965. 1288 p., illus., 24 cm., 84s.0d.

LOUIS LLIBOUTRY. Traité de Glaciologie. Tome I. (Glace - Neige - Hydrologie Nivale) Paris, Masson & Cie, 1964. 427 p., illus., 27 cm. 180 fFr.

HELLMUT SCHROEDER-LANZ. Morphologie des Estetales. Hamburger Geographische Studien, Ht. 18, 1964. 180 p., illus., 3 map inserts.

NEW MEMBERS

Andrieux, P., Laboratoire de Géophysique Appliquée, 16 rue Pierre Curie, Paris V, France.
Calkin, P.E., Department of Geological Sciences, State University of New York at Buffalo, Crosby Hall, Library Circle, Buffalo, New York 14214, U.S.A.
Cochron, R., 1441 Broadway, Boulder, Colorado, U.S.A.
Cope, D.R., Fitzwilliam House, Cambridge, England.
Dewart, G., Institute of Polar Studies, Ohio State University, 125 S. Oval Drive, Columbus, Ohio 43210, U.S.A.
Dibben, P.C., 9 Marlings Park Avenue, Chislehurst, Kent, England.
Dorrer, E., Klessingweg 4/1, 8 München-Allach, Germany.
Emetaz, R.V., 501 E. Mill Plain Boulevard, Vancouver, Washington 98660, U.S.A.
Ewing, Miss K.J., Department of Geography, University of Michigan, Ann Arbor, Michigan, U.S.A.
Gribbon, Dr. P.W.F., Department of Natural Philosophy, The University, St.Andrews, Scotland.
Hoyer, M.C., Department of Geology, Arizona State University, Tempe, Arizona 85281, U.S.A.
Johnson, J.P., Jr., Department of Geography, Carleton University, Ottawa 1, Ontario, Canada.
Knazovicky, Dr. I.L., Tatra National Park, Tatranska Lomnica, Czechoslovakia.
Kobayashi, D., The Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.
Konecny, G., 302 Fulton Avenue, Nashwaaksis, Fredericton, N.B., Canada.
Løken, Dr. O.H., Geographical Branch, Department of Mines and Technical Surveys, 601 Booth Street, Ottawa, Ontario, Canada.
Maykut, G.A., 764 Hayes Street, Seattle, Washington 98109, U.S.A.
Paren, J.G., 21 The Birches, Winchmore Hill, London N.21, England.
Parker, W.E., 18 Guilden Sutton Lane, Guilden Sutton, Chester, England.
Poulin, A.O., RFD, Lyme, New Hampshire, U.S.A.
Reinwarth, O., 27/0 Sachrangerstrasse D-8000 München 9, Germany.
Sprenger, R.M., 2723 N. 31st Street, Tacoma 7, Washington, U.S.A. (from Feb. 1966) Pension Andreas, Wien, Austria.
Stuart, J.P., 8214 W. 19th Street, Tacoma, Washington 98466, U.S.A.
Terroux, A.C.D., 66 The Linton, 1509 Sherbrooke Street West, Montreal 25, P.Q., Canada.
Unger, J.D., 35 Brookline Street, Cambridge, Mass., U.S.A.
Wagner, D.H., 8214 W. 19th Street, Tacoma, Washington 98466, U.S.A. (from Feb. 1966) Pension Andreas, Wien, Austria.
Wiesnet, D.R., 89 Sophia Avenue, Brockton, Mass., U.S.A.
Wilson, R.G., c/o Department of Geology, University of North Dakota, Grand Forks, North Dakota, U.S.A.
Wishart, E.R., 9 Emilton Avenue, St. Kilda, Melbourne, Victoria, Australia.
Worsley, P., Department of Geography, The University, Reading, Berks., England.
Yakopatz, G.L., c/o Box 959, Juneau, Alaska 99801, U.S.A.

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, from 1 January 1965:

Private members—	Sterling: £3 0s. 0d.	U.S. dollars: $9.00
Junior members (under 25)—	Sterling: £1 0s. 0d.	U.S. dollars: $3.00
Institutions, libraries—	Sterling: £6 0s. 0d.	U.S. dollars: $17.00

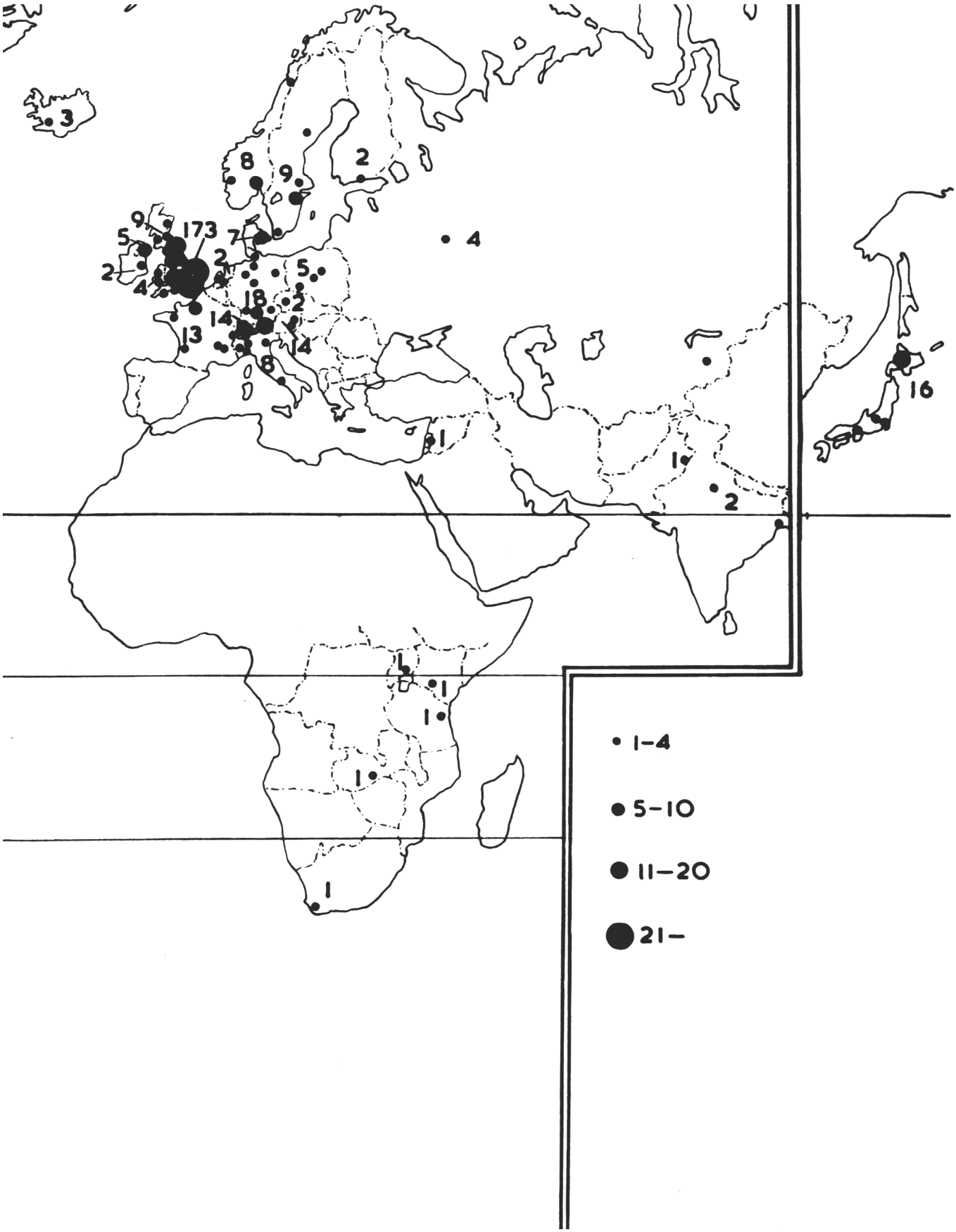
(The dollar rates include Bank conversion charges)

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

ICE

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.


3
8
9
2
9
5
173
7
2
2
4
5
18
2
14
13
14
8
4
16
1
1
2
1
1
1
1
1
1-4
5-10
11-20
21-

Printed by Metcalfe & Co. Ltd., Cambridge