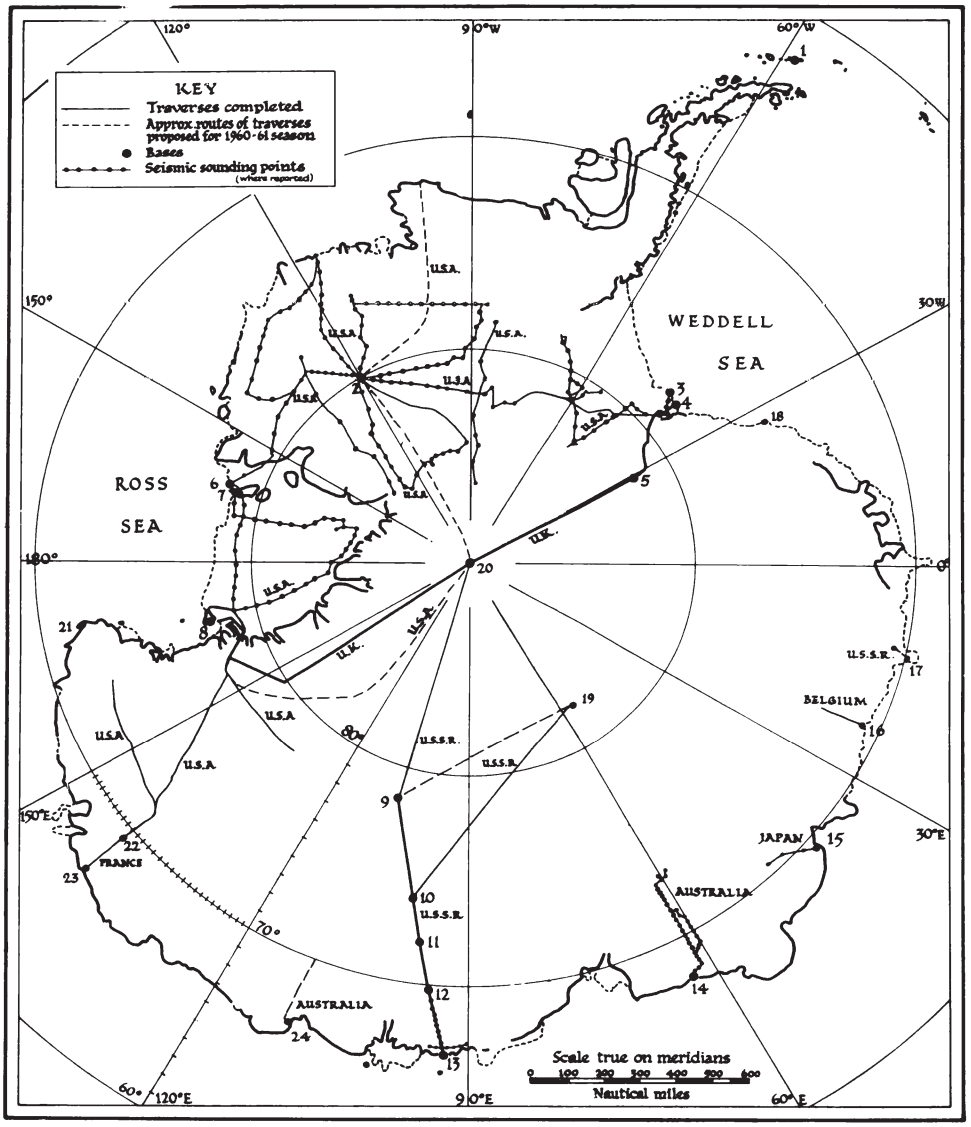
NUMBER 7

JANUARY 1961

ICE

News Bulletin of the British Glaciological Society



Glaciology in the Antarctic during the IGY and IGC has been reported for the stations and traverses shown on the map. Compare with the earlier map published in Ice, no. 3, January 1959. (With acknowledgements to the authors of the reports received at World Data Centre C Glaciology, British Glaciological Society, Cambridge.)

1. Admiralty Bay
2. "Byrd"
3. "Ellsworth"
4. "Shackleton"
5. "South Ice"
6. "Little America"
7. "Camp Michigan"
8. McMurdo Sound and Scott
9. "Vostok"
10. "Komsomol'skaya
11. "Vostok I"
12. "Pionerskaya"
13. "Mirnyy"
14. Mawson
15. "Syowa"
16. "Roi Baudouin"
17. "Lazarev"

17a. "Novolazarevskaja"

18. Halley Bay
19. Pole of Inaccessibility ("Polyus Nedostupnosti")
20. South Pole
21. Hallett
22. "Charcot"
23. "Dumont d'Urville"
24. "Wilkes"

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FUTURE OF THE SOCIETY. The first oversea meetings of the Society were held in Helsinki (I. U. G. G.) and Stockholm (I. G. U.) in July and August 1960. Members gave their unanimous support to the Committee in planning further steps in the Society's evolution, and made many helpful suggestions. Members agreed that changes in the Society's constitution may be inevitable if the expansion of the Society and the Journal is to take place, but hoped that few changes need be made to the present system of editing and administration.

As expansion will require an additional annual income of £2,000-£3,000, the Committee needs to discover how that money may best be obtained without raising members' subscriptions. Some members volunteered to explore possible sources in their own countries. When the results of these researches are known, the Committee will formulate a proposal which will be put before all members of the Society.

REPRINTS. The Society holds a very few reprints of most articles which have appeared in the Journal of Glaciology. Members may obtain these free. Please apply to the Editor, Little Dane, Biddenden, Ashford, Kent.

BOREAL INSTITUTE. The Boreal Institute of the University of Alberta invites applications for the position of Executive Director. The Executive Director will be a full-time appointee who will aid the Directorate in planning the activities of the Institute, implement the decisions of the Directorate, administer the daily operations of the Institute, solicit funds for the advancement of the Institute and publicize the activities and accomplishments of the Institute. Applicants must have an interest in the North, administrative ability, ability to deal with the public and fluency in written and spoken English. Applicants should be willing and able to travel in the North and should have some experience in the North. Applicants must include a complete résumé of experience, educational background, references, other pertinent data and a recent photograph. The appointment will be effective 1 April, 1961. Salary is dependent upon qualifications, but will be in the range of $8,000 to $12,000 per year. Applications should be submitted to reach the Boreal Institute, University of Alberta, Edmonton, Alberta, Canada, prior to 1 February, 1961. Applications will be held in confidence if desired.

GINO WATKINS MEMORIAL FUND. Applications for grants from the Fund must reach the Secretary of the Fund, Scott Polar Research Institute, Cambridge, not later than 15 March 1961. Grants are given to help and encourage, at the outset of their careers, those who plan polar work from the United Kingdom. Applications should be accompanied by a typed statement about the proposed expedition or research, a list of the party and their qualifications and estimate of expenses, information about any other applications that may have been made for financial help, and the names of two referees.

COMMITTEE OF THE SOCIETY. Mr. W. O. Field (U.S.A.) has been coopted on to the Committee for the remainder of the elective year - that is, until the 1961 Annual General Meeting in March. We are grateful for his help in our deliberations on the internationalization of the Society.

KARAKORAM. An international expedition will spend a year in the field from August 1961. Any glaciologist experienced in hydrological relations of glaciers, and interested in joining the expedition, is asked to write to the Secretary, C. U. G. S., Geography Department, Cambridge.

MATERIAL FOR "ICE". The usefulness and interest of the contents of this news bulletin is determined by members' own contributions: the Editor appreciates the many contributions received for this issue, but will welcome far more. Clearly drawn maps and diagrams and sharp photographs on glossy paper can be reproduced easily and cheaply by the printing process used for "Ice". Please send your contribution to the Editor of "Ice", B.G.S., c/o Scott Polar Research Institute, Cambridge, England.

International Geophysical Year

The Society has received for World Data Centre C Glaciology about 75 reports in the period July - December 1960. Pressure of space prevents detailed listing of all these. Members who are interested in knowing what is in the Centre are asked to write to Mrs H. Richardson, WDC C, British Glaciological Society, c/o Scott Polar Research Institute, Cambridge. Copies of the data catalogue, brought up to date every 6 months, may be borrowed from the Centre.

Field Work

CANADA - REPORT OF THE SUB-COMMITTEE ON GLACIOLOGY OF THE ASSOCIATE COMMITTEE ON GEODESY AND GEOPHYSICS, NATIONAL RESEARCH COUNCIL. The meeting of the Sub-Committee on 2 November in Ottawa reported on the 1960 summer work. The reports will be published in a section on glaciology to be printed in the "Canadian Geophysical Bulletin" for 1960. Some of the projects are briefly summarised below. The areas covered in the full report are: Athabasca Glacier, Selkirk Range and northern Coast Mountains; S. E. Ellesmere Island, W. Axel Heiberg Island, Meighen Island; Gilman Glacier, Ward Hunt Ice Shelf; Devon Island. The work on the inventory of Canadian glaciers, and photogrammetric and laboratory studies are also summarised. Many members of the Society from Canada, U.S.A. and U.K. were concerned with this work.

INVENTORY OF CANADIAN GLACIERS. Certain sections of the inventory are being prepared for publication. The project, under the direction of G. Falconer, is a continuing one. It is intended to accumulate data on glaciers in order to record fluctuations and to keep the inventory up to date.

GLACIOLOGICAL WORK ON AXEL HEIBERG ISLAND, N. W. T. IN 1960: JACOBSEN-McGILL ARCTIC RESEARCH EXPEDITION.
The Jacobsen-McGill Arctic Research Expedition is a joint undertaking of McGill University and Dr. G. Jacobsen, Montreal. Support has been given by the following Canadian government agencies: the Photogrammetric Research Section of the National Research Council, the Geographical Branch of the Department of Mines and Technical Surveys, the Meteorological Branch of the Department of Transport, the Royal Canadian Air Force, and the Geophysics Section of the Defence Research Board. The main aim of the expedition is "to study the evolution of the mountainous and strongly glacierized and glaciated area of the central part of western Axel Heiberg Island". The following earth sciences were studied: surveying, glaciology, geophysics, meteorology, geomorphology, geology, permafrost research and botany. The expedition will extend over a period of three to four years, and then the facilities established will become a permanent Arctic research station for McGill University.

During the summer 1959 a reconnaissance party of four members was in the field for six weeks to determine the area of study, the base camp site, and to initiate the long-term glaciology programme. The 1960 party consisted of thirty members; most of them were in the field from 8 May until 30 August. Fourteen men were directly involved in glaciological work.

Logistics: Base camp was established by a small lake near the tongue of White Glacier at 79° 25' North and 90° 30' West. The accommodation consisted of two prefabricated fibreglass houses with living and working facilities for twelve men. The 75-mile airlift of heavy equipment (55 tons of instruments, food, fuel, houses) from Eureka was carried out by a Beaver aircraft of Bradley Air Services Ltd., Ottawa, between 8 and 28 May. Transportation on the island was most successfully performed by one, at times two, Piper Supercubs, operating on skis until mid-July and thereafter on large balloon tires. Throughout the whole season two Eliason motor-toboggans were used on the glaciers.

Surveying: A programme of photogrammetric survey of the expedition area was organized by the Photogrammetric Section of the National Research Council (Mr. T. J. Blachut). Mr. Dieter Haumann, in charge in the field, assisted by Jörg Leisinger, established a complete network of ground control points covering the three typical glaciers of the selected area, Hugh Thompson Glacier including the related sector of McGill Ice Cap, White Glacier, Baby Glacier, and adjacent areas. The altitude ranges from sea level to about 1800 m.

a.s.l., the total area being about 800 sq. km. Some 23 signals, 31 cairns, and 49 plates were set up as ground markers. The base line for the triangulation was measured by tellurometer by a survey team of the Polar Continental Shelf Project. On 2 August a Lancaster Squadron 408, R.C.A.F., successfully flew twelve low-level air-photo flight lines over the area, heights ranging between 1700 m. a.s.l. (over the glacier tongues) and 6100 m. a.s.l. (over the ice cap). The camera used was a Wild RC8. Four flight lines were re-flown at a different time of day on 15 August. Two Swiss mountaineers helped to complete the ground survey.

Glaciology, including hydro-glaciology: This programme was carried out by Dr. Fritz Müller (scientific leader of the expedition), W. Peter Adams, and Hans U. Maag (assistant). For measurement of accumulation, ablation and surface velocity a total of 252 stakes were inserted and periodically surveyed. The glaciers investigated were: 1. Hugh Thompson Glacier, including part of McGill Ice Cap, as an example of a large outlet glacier, its tongue near equilibrium : three cross-profiles staked out, the upper one being on the Ice Cap and 9.0 km. long (30 stakes). 2. White Glacier, medium size, Alpine-type valley glacier, the tongue in slight recession. Most work was done on this glacier: one major longitudinal profile (75 stakes) and five cross-profiles. 3. Baby Glacier, a small remnant glacier lying at an elevation between 800 m. and 1000 m. and lacking an accumulation area: three cross profiles. The equilibrium line for the area was found to be at an altitude between 950 m. to 1050 m. Pressure waves were studied below the second ice fall on White Glacier in a longitudinal profile of 14 stakes. The previous winter's snow cover was investigated in some fifty pits. At an elevation of 1300 m. on the Alpine-type glacier a pit of 8 m. depth was dug; the lowest accumulation layer in this pit represented the year 1911. A second shaft 4.5 m. depth, reaching down to the accumulation of 1933, was excavated near the culmination of the ice cap. It is planned to deepen the latter pit in 1961. Temperature being a significant factor in the calculation of glacier flow, thermistors and Pl.-elements were frozen into 10 m. drill holes in the accumulation area, the zone of equilibrium, and the tongue areas. A special study of rate and modus of ablation, and of the related run-off was made by Peter Adams. In addition to the classical current meters he used also the much more accurate Thompson Weir and the chromate dilution method.

Geophysics: This programme was closely related to the glaciological studies. Alex Becker (responsible for gravity survey) and Bruce Redpath (seismics) with their assistants Ulrich Sysset and Keith Smith, frequently operated together with the glaciologists, using the accumulation and ablation stakes and their elevation values as gravity and seismic stations. Ice thickness was determined by gravity measurements at 178 stations and by seismic sounding at 24 points. Redpath shot three velocity profiles. He used a 12-channel high-resolution reflection seismograph. For the gravity work a Worden gravimeter was used, reading to 0.01 milligal. In addition, Becker established 17 gravity stations around the shore line of Axel Heiberg Island to study the isostatic re-adjustment of the area.

Glacial meteorology: Two stations were established. The "Upper Ice Station", near the culmination of the McGill Ice Cap at an elevation of 1700 m., was operated from 29 May until 28 August by James M. Havens and Simon M. Stones (assistant). The "Lower Ice Station", situated in the ablation zone of White Glacier at 220 m. a.s.l., was run from 16 May to 26 August by Rodney H. Andrews and Otto Hegg (assistant). Professor Svenn Orvig spent the first ten days with the party to initiate the meteorology programme. Instrumentation for radiation and general glacial-meteorological observations in the first 8 m. of the air mass above the glacier surface was similar at both stations. The compact Mörikofer solarimeter and the watch spring driven self-recorders were used very successfully.

Geomorphology: Dr. Benoît Robitaille and Claude Greffard (assistant) in the survey of the geomorphology paid special attention to the moraine deposits at the glacier termini and to the marine strand lines. So far marine shells were found in western Axel Heiberg Island 70 m. a.s.l., on the eastern side of the island at 130 m. a.s.l., and near Eureka at an elevation of 210 m.

Geology: The senior geologist, Dr. Peter Fricker, was mainly concerned with an analysis of the bed rock structures in the areas of the glaciological and geophysical profiles, and with the tectonic factors controlling the valley pattern. The gypsum structures, remarkably frequent and influential in the area, were the subject of a special study by Ernest Hoen.

Botany: Ancillary studies were carried out by Dr. Roland Beschel, specialist in lichenology. The two, or several, sub-Recent moraine states of the expedition area have been tentatively dated. Several very rich peat profiles were discovered, including one 3 m. thick at an elevation only a few m. above present sea level. C14 dating of this material will supply most significant facts to the glacial history of the area.

In a film of the expedition by Mr. F. R. Crawley, glaciological methods and instrumentation will be specially featured. Next year's operation is planned to be on a similar scale. The "Upper Ice Station" will be run on a reduced programme, whereas for the "Lower Ice Station" more detailed work is envisaged. The concentration on the study of White Glacier will be continued.

ATHABASCA GLACIER, CANADIAN ROCKIES.

A party from the University of British Columbia continued work on certain of the projects which had been started during the previous summer. The field season extended from 4 July to 16 August. Professor J. C. Savage was in charge of the deep drilling programme. Four holes were drilled at various points along the centre line of the glacier using an improved design of hotpoint. The depths were 1057, 686, 635, and 380 feet. All but the last reached the bottom of the ice. The holes were cased with aluminium pipe and an inclinometer survey, at 50 foot intervals, was made in three of them. Rapid formation of ice within the pipe prevented the survey of the 635 foot hole. The inclinometer measurements will be repeated next summer using hotpoints, if necessary, to clear ice from the insides of the pipes. The surface movement study was continued by Mr. W. S. B. Paterson. About 90% of the previous season's markers were recovered and their positions were redetermined by triangulation. Annual velocities can thus be compared with summer velocities, measured in 1959, The positions of certain selected markers were determined at intervals during the summer.

ARCTIC TERRAIN RESEARCH: FIELD PROGRAM - April-September 1960.

Fletcher's Ice Island (T-3).

The outstanding events of the period of this report were the break-off from T-3 of a large triangular-shaped piece about 3.5 square miles in area, with subsequent smaller breaks; and the grounding of the island on 22 May at 71° 50'N, 160° 20'W, a location approximately 80 miles WNW of Point Barrow. The major fracture of the island is believed to have occurred on 5 May. The ice Island remained at its initial grounded location from 22 May until 16 July when favourable winds brought about a drift of 6 miles to the southwest, then 9 miles east-northeast. From this point it then drifted 12 miles in a generally westerly direction and on 29 July was back to its original grounded position where it has remained until the present.

A combination of shallow water, lack of drift, high temperatures and extensive summer melt greatly curtailed the seismic reflection, oceanographic, marine biology, gravity and ice physics programs. However, it was thought too soon to abandon the camp this fall as drift may occur this winter. The planned fall and winter program has been oriented toward a non-drifting station with a concentration of effort on such things as a seismic study of long period surface waves in an ice-covered ocean; seismic studies of changes in physical constants of ice with change in temperature; seismic refraction studies of the crustal structure beneath the ocean floor; microseism recordings; study of ice island oscillations as indicated by gravimeter; continuing ice physics studies; continuing meteorological and micro-meteorological studies; operating an All-Sky camera for aurora studies; and recording total magnetic intensity with a nuclear resonance magnetometer.

Ablation measurements - Ablation measurements were made at intervals of 7 to 10 days at two sites used in 1958. Two new profiles of 10 stakes each were placed across a section of pronounced ridge and trough topography. In addition, readings were made daily at several stakes near the micromet station. Approximately 6 meters of ice have been lost since September 1953 near the old camp. The average ablation of ice for the summer of 1960 was 1.8 meters.

Ice physics - Studies of candled ice, old sea ice and stratified ice were continued. Over 400 axial determinations of candled ice were made, and further studies indicated that a piece of candled ice is almost invariably monocrystalline. Determinations of elastic properties, such as Young's Modulus and internal viscosity of various types of ice, were carried out. Variations of these properties with temperature constituted a major part of the studies. The big event of the season was the successful coring of a hole through the island. The entire core was retrieved. Ice thickness was about 113 feet. Another core was obtained through the island near Colby Bay where the ice was 30 feet thick. The heavy dirt layer found at 90 feet and other depths near the old camp and outcropping near Silk Hill was not present in either of the two cores obtained near the new camp. Studies were also made on samples of "basement" ice (Marshall), with strong stratification in the Colby Bay region. A surprisingly large number of specimens showed basal planes parallel to the "bedding" (stratification) planes. This ice also exhibits a gently folded pattern, a series of synclines and anticlines sub-parallel to the edge of the island.

Engineering Properties of Ice and Snow.

Following up the field tests conducted at Pt. Barrow, Alaska, during March 1960, experiments under controlled conditions at the Climatic Laboratory, Eglin AFB, commenced on 15 June and terminated on 2 September 1960. Scientific personnel included Dr. W. David Kingery. The purpose of the program was to investigate methods and techniques of processing, strengthening and using ice as a structural material under field conditions, together with studies of the resultant ice properties. Detailed experiments on spray solidification of salt water involved several types of spray nozzles and forced feed in the "all-weather room". The effects of air and ice temperatures, liquid mass flow, and heights of micro-structure, and rupture strength.

Ice formed by a small chipping machine was investigated for feasibility of mixing with liquids for solidification. Density, amount of liquid, necessary pressures, rate of solidification, salinity and resulting ice strengths were determined. Studies on salt migration through ice formed from frozen brine were made by use of radiant heating apparatus and measurements of controlled temperature and salinity effects. A refrigerated aluminium plate with layers of ice and a bank of ultra-violet lamps were employed. Surface ablation, heat absorption and erosion were tested with various surface ice treatments.

Reinforcement of ice comprised the major portion of the research. Means and relative effectiveness of introducing various kinds of fiberglas (chopped, strand or mat) were investigated with fresh water, sea water, and various aggregate liquid mixtures. When frozen, strength tests and analysis of ice density, structure and composition enabled determination of the optimum resulting product and necessary reinforcement techniques. During August a large area of the main Climatic Laboratory hangar was utilized in cooperation with the U.S. Naval Civil Engineering Laboratory to test their large ice-chipping machine and to build structures approximately 10 ft. by 10 ft. directly on the cold floor from chopped ice, sea water and fiberglas additive combinations.

Another controlled temperature test chamber was utilized for experiments on the insulating properties of various aqueous foams generated under low temperature conditions. Ice sheets were grown and foams applied in various thicknesses. Temperature profiles, heat conductivity and amount of simulated solar radiation were measured and correlated with rate of ice melt. Conclusions were that the foams gave very good insulating protection for an ice surface under a large variety of conditions and could be satisfactorily generated under field conditions.

Ellesmere Ice Shelf.

The Ellesmere Ice Shelf was occupied during the period of April to September 1960, in order to determine the history and character of the shelf ice, its relationship to its environment, and to develop techniques for improving its trafficability throughout the year. Personnel: Dr. George Rigsby, principal investigator, AINA; Dr. Harold Lister, field leader (glaciologist), AINA; Mr. Brian Sagar, meteorologist, AINA; Mr. Richard Ragle, glaciologist, AINA.

Meteorological Program - Synoptic surface observations were carried out at two stations, as well as several cooperative micro-meteorological efforts. It is hoped that a representative heat balance for the ice surface can be obtained for that period.

Glaciological Program - Snow depths, temperatures, density and texture were measured on the Ice Rise and on the Shelf, when profiles of accumulation were recorded. These, with surface profiles made before and after the ablation, along a line from the pack-ice to Ward Hunt Island, should permit an assessment of mass balance of the Shelf and point the difference between crest and trough.

One party core drilled to ca. 40 metres in a trough and over a crest on the Shelf and to ca. 20 metres at the Re-entrant and to 50 metres on the Ice Rise. The latter reached what seemed to be bottom. It is sad that this hole closed by melt water while trying to insert thermocouples and much re-drilling was of no avail. Ice structures were mapped between Ward Hunt Island and N. Ellesmere and recorded radiation absorption in different ice types was recorded.

Geophysical Program - A gravity survey was made during the spring period in order to delimit better the coastal trenches common to the bathymetry of the area.

Tidal Observations - Tidal stations were maintained at the junction of the pack and shelf ice, as well as in the Ellesmere moat area. The shore station showed a fluctuation of from 0.2 to 1.1 feet between high and low tides, and an irregular lag of up to eight hours between the pack and moat stations.

Surveying - Several surface surveys were made to define the ice shelf form. These included a resurvey of the 1959 lines, as well as new lines extending from the pack ice over the shelf through Ward Hunt Island to the Ellesmere mainland.

Ice Engineering - Three experimental sites were established to determine ice behavior while protected by various amounts of thermal insulation. Data relevant to this study are presently undergoing analysis.

UNIVERSITY OF ALASKA GULKANA GLACIER EXPEDITION, 1960. During the summer of 1960 glaciological investigations were initiated on Gulkana Glacier in the central Alaska Range by members of the Department of Geology, University of Alaska. Project supervisor and head: Dr. Troy L. Péwé.

Interior Alaska is a physiographic and climatic area heretofore almost neglected for glacier studies, in contrast to southeastern Alaska. At least two glaciers in the central Alaska Range are unique inasmuch as they have undergone advances as rapid or more rapid than any previously recorded in the world. Gulkana Glacier lies on the south side of the Alaska Range 4 miles east of the Richardson Highway and about 135 miles southeast of Fairbanks. This glacier was chosen specifically because of the accessibility, size, and structure, and because a 50 year old photographic record is available. The glacier is $2\frac{1}{2}$ miles long and flows essentially south; the average width is approximately one mile. On the west side, an ice fall divides the glacier roughly in half. The lower half of the glacier is composed of three ice streams. The elevation at the terminus is 3950 feet and ice in the cirque areas has an elevation of 6500 feet to 7000 feet. Field work took place between June and mid-September 1960.

The work was divided into two broad projects: ablation and flow studies, and a study of structure. A topographic map of the entire glacier was constructed by plane table methods. The map has a scale of 1:2000 with 20 foot contour intervals. A triangulation net with vertical elevations was also completed in order to have greater control for flow and ablation studies.

A brief outline of studies that were carried on is as follows:

Ablation Studies - Sixty-five 10 foot, 1 inch-diameter wood stakes were set in the glacier to give information on rate of lowering of the ice surface. These were installed with the use of a SIPRE ice auger and all the stakes held firm. Resetting of stakes on the lower glacier was necessary. Measurements were taken on the total number of stakes at 10 day intervals and daily measurements were made on a few stakes for correlation with meteorological data that were recorded daily throughout the course of the summer. Additional stakes were set in the glacier where there were various thicknesses and types of morainic cover on the ice. It was found that the total summer lowering of the clean ice surface was 15 feet near the terminus and 17 inches in the upper parts of the glacier.

Movement - The ablation stakes were also used for movement studies. Control was set up on the various ice streams composing the glacier. The stakes were surveyed with a theodolite at the time they were set. They were surveyed later to determine movement. Two transverse profiles were established between the terminus and the ice falls. These will be used for an annual check of actual level of the ice at these sections. Photographs were taken from established photo stations that had been occupied at various times during the last 50 years.

Structure - Most of the effort on structural studies was directed toward the mapping of foliation. Dips and strikes of the folia were mapped in detail with brunton compass and located by bearings taken on known points. An arc pattern of foliation is displayed from below the ice falls to the terminus: the dip of the folia in general becomes less steep down-glacier. In the main ice stream on the east an indistinct half arc is present. Near the margin of the glacier and adjacent to moraines foliation is dense with very steep dips. Transverse, en échelon, splaying, and chevron crevasses were plotted with use of air photographs. Forbe's bands and sedimentary layers also occur and were plotted. A series of faults is present in the terminus and was mapped by plane table methods.

Geophysical measurements - Gravity measures were made along two controlled transverse sections.

Glacial geology - Moraines of at least two recent advances were mapped. Lichenology was used exclusively for relative dating inasmuch as the area is above tree line. It is believed that the advances will correlate with the 1750 and 1850 advances of Canwell, Castner, and Black Rapids Glacier to the north where both lichen and tree ring studies have been made.

JUNEAU ICEFIELD RESEARCH PROGRAM, 1960.

The Juneau Icefield Research Program continued its annual investigations in the Northern Boundary Range of Alaska during the months of July and August. Under the aegis of the Foundation for Glacier Research the field studies concentrated on obtaining further data on the Taku-Llewellyn Glacier system, thus extending the record which has been made con-

secutively over the past 15 years. Support was given to the program by the Geology Department of Michigan State University, by the United States Air Force, and by the Civil Air Patrol. The U.S. Forest Service and the U.S. Geological Survey also helped through the loan of scientific instruments. Via the office of the President of Michigan State University a cooperative program was also initiated in the field with a Japanese research group from the University of Hokkaido. This effort was preliminary to an international cooperative glacio-physical study anticipated in the program of the 1962 summer season.

The 1960 J.I.R.P. expedition comprised a field team of 11 persons, and included a ski-wheeled Cessna 180 aircraft which accomplished 40 icefield landings in support of the summer's work. The program also employed helicopters for the first time, using them for special operations. Further logistical support was delivered by the Alaska Air National Guard which made a series of landings on the icefield with C-123J ski-aircraft. It is of interest that this is the largest aircraft to make ski-landings on an Alaskan Glacier to date, and is a type capable of transporting ten tons of supplies and equipment in a single load. The effectiveness of the unloading ramp on the tail-gate was particularly demonstrated for glacier work by this mission. By this means heavy generators and bulky research instruments, as well as lumber, metal sheeting, and other construction materials, were easily transported to camps on the 4000-foot and 6000-foot névés, lying respectively 35 and 55 miles north and east of Juneau.

The scientific program extended the basic régime measurements and sub-surface thermal studies of previous years. It also repeated and enlarged upon some of the critical glacier movement surveys for long-range comparisons. Synoptic meteorological records were obtained at the camps on the intermediate and high-level névés. These data for the correlative purposes of the icefield study were also transmitted to the U.S. Weather Bureau station at Juneau for use in local and regional forecasts. The program's annual survey of frontal and névé-line fluctuation of the main outflowing glaciers was also conducted, most of this being accomplished by photogrammetric methods. This season's data show the 1960 summer to be one of the most continuously wet on record. At the site of the program's new research station in the central icefield sector the record from minimum-registering thermometers for the interval 1958-1960 revealed winter temperatures to -90° F. The extreme thermal hostility of this location with respect to any future winter operations is important to know, but the particular interest of this unexpectedly low temperature is its relation to the geophysical character of the extensive crestal névé of this icefield. Another striking observation was that the zone of maximum snowfall has taken a strong downward shift during the last years of this decade. Coincident with this a significant thickening of the ice on the Taku Glacier was noted in the vicinity of the mean névé-line.

For use in the continuing program a permanent Snow and Glacier Research Observatory was completed on a nunatak at the 7000-foot level (Camp 8). This new station lies directly on the divide between the Taku and Llewellyn névés and within one mile of the International Boundary between Alaska and Northern British Columbia (lat. 60°N.). Further supplies and equipment were flown to an adjunct station site at the 5400-foot level where a smaller station is to be constructed. Also in this season an additional aluminium-clad building was erected at the 4000-foot station (Camp 10), where the program's permanent field headquarters is maintained. At each of these station sites new VHF radio equipment was installed to improve the reliability of future communications between icefield camps.

Members of the 1960 field party included M.M. Miller and B. Prather.

IMPERIAL COLLEGE ØKSFJORDJØKUL EXPEDITION: ARCTIC NORWAY 1961.

This summer, four members of Imperial College, London, intend to visit the Øksfjordjøkul ice cap (mid-way between Trømso and Hammerfest, Northern Arctic Norway). This is a small ice cap and has on its southern side an interesting, cone-shaped regenerated glacier which reaches the sea in Jøkelfjord. The ice is known to have retreated considerably since it was surveyed in 1900. The aims of the expedition, initially suggested by the Norsk Polarinstitutt, are to determine the present extent of the ice cap and to make a careful study of the regenerated glacier.

GORNER GLACIER, PENNINE ALPS, SWITZERLAND.

From June 1959 to September 1960 G.R. Elliston, a research student attached to the Scott Polar Research Institute, Cambridge, carried out observations for a Ph.D. thesis on the Gorner glacier above Zermatt. He was assisted in this work by unpaid volunteers, mostly students, recent graduates and officers and men of the British Army on leave, predomin-

antly engineers and geographers with survey training, working in relays throughout the sixteen month period. The first summer was largely occupied in building the hut which was to be the winter base, setting up and triangulating the network of over thirty signals to very high accuracy, and beginning the mass balance and surface velocity observations on stakes set in the glacier at kilometre intervals from the head of the accumulation zone at 3500 metres to the tongue at 2000 metres altitude. Due to the rapid ablation and the malfunctioning of a deep-boring machine it was not possible to obtain satisfactory strain-rate measurements at all the stake positions as planned and in the autumn the Swiss Glacier Commission kindly loaned to the expedition a suitable borer, with which all the stakes were re-emplaced by early winter.

From mid-January to the end of September 1960 the mass balance and surface velocity observations were supplemented by the measurement every few weeks of the principal strain rates at each of the twenty-two stake positions. Any significant changes in the strain rates will be compared with the known topography of the glacier bedrock and any significant change in the surface velocity, which was measured with an accuracy sufficient to detect a change of between five and ten percent in a two week period. During the summer of 1959 G. S. White initiated a detailed study of the flow of the ice at the snout of the glacier, including observations of bedslip and active thrustplanes, over a period of sixty days, and these observations were continued at intervals through the winter and more frequently the next summer by G. R. Elliston. A map of the snout was produced in August 1959 on a scale of 1:2000 and in 1960 the heights of the glacier. In October 1959 a map of the ice-dammed Gornersee at the foot of Monte Rosa was made shortly after its annual evacuation, but in 1960 this lake failed to refill with meltwater for the first time in its twenty years' life. A programme of detailed heat-balance studies was begun by members of the Meteorology Department, Imperial College, in August 1959, but broke down through lack of trained observers and unsatisfactory equipment.

The expedition will return to the glacier for several weeks in June/July 1961 to complete the observations. The base hut, strongly built and well insulated with accommodation for up to eight men, will remain on the site for several years for the use of scientific observers, and is in the care of Prof. A. Renaud of the Swiss Glacier Commission.

THE SOVIET ANTARCTIC EXPEDITION, Southern winter and spring, 1960. [From Vodnyy Transport and Moscow Radio, 26 October - 29 December 1960]. A fire broke out at Mirnyy on the night of 2-3 August, during a gale with wind velocities of up to 125 m.p.h., and eight meteorologists tragically lost their lives, among them O. G. Krichak, the chief of the upper air group and well known for his earlier Antarctic work.

The main traverse party, consisting of three tractors hauling sledges and manned by ten men under B. Krasnikov, left Mirnyy on 26 October. The object was to carry out seismic, gravimetric, magnetic and other work over a course which would include the triangle "Komsomol'skaya" - "Vostok" - "Sovetskaya" - "Komsomol'skaya". By 6 December the party had reached "Komsomol'skaya" on the outward journey, having made a detour of 250 km. to cover new ground on the way. Air support was provided en route. The field season at "Lazarev", Dronning Maud Land, started with geological and geographical parties leading for the mountains to the south. The first flight from Mirnyy to "Lazarev" took place in early October, with stops at the intermediate Australian, Japanese and Belgian stations.

The "Ob'" left Leningrad on 5 November with the members of the sixth expedition under V. M. Driatskiy. M. M. Somov was in charge of the oceanographical group. The wintering party of 116 included one American and three East German scientists. On 11 December the ship berthed alongside the fast ice off "Lazarev", at a point 21 km. from the edge of the ice shelf. On the 14th the first tractor train headed inland for the new site to which "Lazarev" was to be transferred, at Schirmachervatna, 80 km. from the coast. This station will be known as "Novolazarevskaya", and V. Gerbovich will be the leader. The "Ob'" sailed for Mirnyy on 20 December, having left 55 members of the sixth expedition in Dronning Maud Land.

Robert P. Sharp

It is usually difficult to determine what diverse influences have played a part in guiding persons into particular types of endeavor. With Robert P. Sharp, it may be that tales of the frozen north spun by his father, a participant in the Klondike Gold Rush of '98, or youthful struggles across huge lateral moraines and up glaciated canyons in California's Sierra Nevada planted the glacier virus in his veins. It is a foreign virus because he was born on 24 June 1911 in the mild mediterranean climate of southern California, grew up there, and now resides in this comfortable environment.

A stimulating course in physical geology at the California Institute of Technology presented by a master teacher, the late John P. Buwalda, converted Bob Sharp to a career in geology, a profession in which he just naturally felt at home. Graduating from Caltech in 1934 with a Bachelor's degree in Geology he migrated to the opposite side of the United States for a Ph. D. in Geology from Harvard in 1938. During pursuit of Ph. D. thesis research in Nevada, primarily devoted to structural geology and some aspects of geomorphology, he mapped the glacial geology of the Ruby-East Humboldt Range by instinct and almost as a hobby. However, it provided the subject for the first of his published papers on the area.

Sharp's first full-fledged professional job was as a member of the geology staff at the University of Illinois. This introduced him to the heartland of a classical area of continental glaciation. Over a five-year period he gained a valuable knowledge of continental glacial deposits and morphological features. It was during this time, specifically in 1941, that he received and happily accepted an invitation to participate in an American Geographical Society expedition led by Walter A. Wood to the heart of the St. Elias Range along the Alaska-Yukon border. This brought Bob Sharp for the first time into contact with large valley glaciers and was the beginning of an extended and fruitful association with Walter Wood.

During World War II Sharp served as an officer in the U. S. Air Force attached to the Arctic, Desert and Tropic Information Center, organized in part by L. M. Gould. During this service he spent considerable time in Canada, Alaska and the Aleutians, some of it on glaciers testing cold-weather equipment.

Following the war he joined the staff of the Geology Department at the University of Minnesota which brought him back into contact with areas of continental glaciation. In 1947 he returned to Caltech and in the summer of 1948 initiated a program of glaciological research in Alaska as part of Project Snow Cornice, an activity of the Arctic Institute of North America led and directed by Walter Wood. Work on this project extended into 1954 and was largely concerned with the upper Seward and Malaspina glaciers. During this same period another project was initiated in 1952 on the Saskatchewan Glacier of the Canadian Rockies with Mark F. Meier who carried it to completion in 1954. In 1957, as part of the IGY program, Sharp led a party on to the lower Blue Glacier of the Olympic Mountains in Washington. Work has continued in this area for four years, and prospects are that it will go on for one or two more.

Sharp's glaciological publications touch on such matters as glacial advances, behavior of stagnant ice, superglacial debris, accumulation and ablation, firnification, meltwater circulation in firn, thermal regimen of firn, glacier constitution and structures, vertical velocity profiles, and oxygen isotopes in glacier materials. He has also mapped the deposits of ancient glaciations in half a dozen different areas in central and western United States. During these activities he has enjoyed an association with a number of young able men who have contributed significantly to glaciology. These include G. P. Rigsby, F. B. Leighton, M. F. Meier, L. F. Nobles, C. R. Allen, W. B. Kamb, R. L. Shreve, J. C. Savage, and C. S. Benson.

Sharp is primarily a geologist who attempts to make his contribution largely in the field. About 50 per cent of his 65 published papers deal directly or indirectly with glaciology or glacial geology. The others are largely in arid region geomorphology, structure, and other geological topics. He is currently Professor of Geology and Chairman of the Division of Geological Sciences at the California Institute of Technology in Pasadena, California.

International Meetings

TRI-ENNIAL ASSEMBLY OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS, HELSINKI 24 JULY - 1 AUGUST 1960.

Many members attended the sessions of the Commission of Snow and Ice and presented papers there and in the Symposium on Antarctica. The papers will be published in March 1961 by the Association for Scientific Hydrology. Orders should be placed with the General Secretary, Professor L. J. Tison, 61 rue des Ronces, Gentbrugge, Belgium. (For A. I. S. H. publications, see advertisement in forthcoming issue of the Journal of Glaciology, number 29, March 1961). The Commission's new officers for 1960 - 63 are:- P. A. Shumskiy (U. S. S. R.) President; A. Bauer (France), W. O. Field (U. S. A.) and G. Morandini (Italy) Vice-Presidents; W. H. Ward (U. K.) Secretary.

INTERNATIONAL GEOGRAPHICAL UNION Xth GENERAL ASSEMBLY AND XIXth INTERNATIONAL GEOGRAPHICAL CONGRESS, STOCKHOLM 6 - 13 AUGUST 1960.

Symposia and excursions were held in all five host countries of Norden, before and after the Congress itself. A bibliography of the papers presented at the Congress, giving title, author and reference to publications in which the papers appear in full, will be published in the autumn of 1961. Members of symposia will receive copies of all papers presented at their symposium. Non-members of the Congress may be able to purchase surplus stocks of publications; detailed information will be given in the IGU Newsletter. Secretary of the Union and Editor of the Newsletter is Prof. Hans Boesch (Geographisches Institut der Universität, Freiestrasse 30, Zürich 32, Switzerland), to whom all enquiries should be addressed.

Future Meetings

INTERNATIONAL ASSOCIATION ON QUATERNARY RESEARCH (INQUA)

The VIth International Congress will be held in Warsaw, Poland, 1 - 7 September 1961. There will be excursions and symposia before and after the Congress. All communications about the Congress should be addressed to the Secretariat of the Organising Committee, Geographical Institute of the University, Toruń, Poland.

Two sections are of particular interest to glaciologists:

Periglacial Section - Director: Prof. J. Dylik.

a) Significance of periglacial facts for Pleistocene stratigraphy.
b) Influence of periglacial environment on sedimentation.
c) Periglacial problems of Late Pleistocene.
d) Connection between periglacial and Palaeolithic researches.

Palaeoclimatological Section - Director: Prof. A. Kosiba.

a) Problem of contemporary climatic changes (last 100-150 years).
b) Climate of the "Little Ice Age" (ca 1500 - 1850 A.D.)
c) Climatic changes in historic times.
d) Climate of the decline of the glacial.
e) Climate of the last glacial.
f) Climate of the last interglacial.
g) Climate of the older glacials and interglacials.
h) Climate of the present nival, subnival, glacial and periglacial terrains.
i) Criteria for classification of the palaeoclimate.
j) Theories of climate changes in the light of recent geophysical, palaeobotanical and palaeozoological researches.

There will also be a symposium on marginal glacial deposits, Director: Prof. B. Krygowski. It will include (a) Classification of marginal deposits.
(b) Methods of studying end moraines.
(c) Character and degree of transformation of marginal glacial deposits of older glaciations.

COMMISSION OF SNOW AND ICE. A Symposium will be held in September 1962, probably in Obergurgl, Austria, on "Variations of the régime of existing glaciers". Further news of this will be given in subsequent issues of "Ice".

WORLD METEOROLOGICAL ORGANIZATION AND UNESCO. A Symposium on climatic change will be held in Rome 2-7 October 1961, and will include discussion of glacier fluctuations. National Committees for Geodesy and Geophysics will approach prospective participants. The Convenor of the Symposium is Dr. R. C. Sutcliffe, F. R. S., Meteorological Office, Victory House, Kingsway, London W. C. 2.

News

Several members of this Society are currently engaged in research in the Antarctic. C. W. M. Swithinbank and J. Tuck are working on the Ross Ice Shelf; J. Reid is at Camp Michigan, Ross Ice Shelf; J. H. Mercer is in the Horlick Mountains; C. R. Bentley is on the traverse from Byrd Station to Ellsworth Highland to Bellinghausen Sea; A. P. Crary is on the traverse from McMurdo Sound to Victoria Land to South Pole, and with him is M. Giovinetto; J. C. Behrendt is on the traverse from the Koehler Range to Hudson Mountains. Many other members are also concerned with the investigation of the observations made by the field parties.

Carl S. Benson is now on the staffs of the Geophysical Institute and the Geology Department of the University of Alaska, and plans to continue his work on glaciers and other snow and ice problems of polar regions, with Alaska as a base.

Colin Bull is working in the lower Koettlitz Glacier area, Antarctica, near the Taylor Dry Valley region in which he worked in 1958-59. The party hopes to be able to interpret the recession of the glacier, its nature and timing, from an examination of the glacial moraines.

A. P. Crary has received the U.S. Department of Defense Distinguished Civilian Service Award for his research in polar regions.

Earl G. Droessler, Program Director for Atmospheric Sciences, U.S. National Science Foundation, has been elected a councillor of the American Meteorological Society for a three-year term.

R. F. Flint, Professor of Geology at Yale University, has been elected a Fellow of the American Academy of Arts and Sciences.

W. V. Lewis, lecturer in geography in the University of Cambridge and Chairman of this Society's Committee, has been awarded a Bursary under the Royal Society and Nuffield

Foundation Commonwealth Scheme to assist him to visit the Arctic Institute of North America, Montreal, from June to September. He will travel to Labrador, Arctic Canada and finally Alaska in his study of permafrost areas and areas once covered by continental glaciers. In addition, he will be based on Chicago University and the Geological Survey in Washington from March to June, and will lecture at many centres.

F. Loewe has retired from his position as head of the Meteorology Department in the University of Melbourne, Australia, and expects to take up a research professorship at Ohio State University, U.S.A., on polar glaciological problems. His influence on Australian glaciology will be strongly felt for many years, as the glaciological programme of the Australian National Antarctic Research Expeditions has been largely governed by his work and inspiration.

N. E. Odell has been appointed to the Chair of Geology in the University of Peshawar, West Pakistan, by the S.E. Asia Treaty Organization. A glacier in Australian Antarctic Territory has been named after him; it drains into the Mawson Glacier from the S.W. side of Mount Brooke.

Brian Roberts is U.K. Observer with the U.S. Operation "Deepfreeze" in the Antarctic, and is visiting the McMudro Sound area, inland stations, and the coast eastwards from the Ross Ice Shelf to Graham Land.

Charles Swithinbank's Ross Ice Shelf group, which includes Jack Tuck, discovered near the Dailey Islands partially decomposed remains of several fish of the genera nototheniidae and numerous gastropods, brachiopods and siliceous sponges. Some of the remains were very fragile and some of the sponges were still attached to the rocks that presumably came with them from the sea floor. C14 dating has shown that the fish were about 1100 years old, according to results of tests made on specimens sent to New Zealand and the U.S.A. Strong support is thus given to Professor F. Debenham's theory that the fish were trapped in the ice by freezing when the bottom of the ice shelf touched the sea floor and were then slowly brought to the top by progressive melting of the upper surface while new ice formed on the bottom. The top of the ice shelf in this unusual part of the Antarctic is melted by the sun's heat through volcanic ash that is blown on to it, and there is a net decrease each year in the ice shelf; the only way it can persist is by freezing from below. Dr. Swithinbank's group has also made a new determination of the shelf's velocity by measuring the movement of stakes from a 1640-foot base-line of land at Cape Crozier, across Ross Island from the naval air facility at McMurdo Sound. The movement of the shelf seawards is about $5\frac{1}{2}$ feet a day - about a foot a day faster than had been indicated by measurements several years ago of the movement of a food cache left on the shelf by Scott.

An Australian Correspondent sends the following news:

The Antarctic Expeditions this year include two glaciologists. At Mawson R. Wyers will study the ice movement near the base and in the Mt. Henderson-Casey Range region. Snow drift is to be measured by the traps developed there by M. Mellor, a pupil of F. Loewe.

At Wilkes extensive drift measurements are planned, including katabatic wind measurements to 500 metres, using the American radiotheodolite. The Wilkes glaciologist, W. Budd, will also use a newly developed borehole thermometer for measurements down to 200 feet, to study the effect of drilling on the surrounding ice temperature in winter and temperature changes along a traverse to the south in summer. At both stations the plastic replica technique of Schaefer will be used, following the example of the British North Greenland Expedition, to make measurements of snowfall; these will be aided by the direct measurements of the total drift density. All the glaciological work remains under the guidance of the Meteorological Department in the University of Melbourne.

Our Finnish Correspondent sends us the following news:

In Lappland there have been established many new field research stations. The Subarctic Field Research Station of the University of Turku can receive foreign students. The head of the Station is Professor Paavo Kallio. Facilities are available for botanists, zoologists and meteorologists. Other stations in Lappland are run by the University of Oulu. Details of these will be given later.

Soviet specialists are exploring the possibility of prolonging the navigation period on rivers of the European part of the U.S.S.R. which are icebound for 3 or 4 months a year. It is planned to provide pumping installations at the reservoirs of the Dnieper power dam which will pump warm water from the deeper layers of the reservoirs into the stream below the dam. This is expected to delay the formation of the ice by about 2 months.

The annual report of the Swiss commission for the study of glaciers shows that during the year 1958-59 the recession continued; the average was 45 feet, compared with 49 feet in the previous year. Snowfalls were less abundant than usual. 77 glaciers were examined. 2 were at a standstill, 69 were retreating and 7 (against 6 the previous year) were advancing.

The Oberaar retreated by 180 feet, the Gorner by 168 feet, the Saleina by 138 feet, the Findelen by 123 feet the Morteratsch by 117 feet and the Lower Grindelwald by 114 feet. The decrease in volume is notable in the Unteraar glacier, which lost 29,00 sq. ft. in surface and nearly 868,000 cubic ft. in volume. The Oberaar lost about 233,000 cubic ft.

The Society's Library

Works received for the Society's Library since June 1960.

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 "Glaciological Literature" at the end of the Journal of Glaciology and bound in the Society's collection of glaciological papers.

Ambach, W. (4 items)
Bauer, A.
Blundell, B.J.
Cailleux, A. (3 items)
Elliston, G.
Fristrup, B. (19 items)
Galibert, G.
Gerdel, R.W. (2 items)
Gold, L.W. (2 items)
Goedecke, E. (4 items)
Harrington, H.J.
Heinsheimer, G.J.
Hole, F.D.
Ives, J.D.
Kasser, P.
Kolb, A.
Kosiba, A.
Meier, M.F.
Nye, J.F.
Oulianoff, N.
Palosuo, E.
Péwé, T.L.
Réméniéras, G.
Roch, A.
Schytt, V.
Smith, E.J.
Stephens, N. (3 items)
Stokes, J.C.
Victor, P.E., and Bauer, A.
Woollard, G.P.

Academy of Sciences of the U.S.S.R. (2 items)
Antarctic Division, Dept. of External Affairs, Melbourne (2 items)
Centre National de Recherches Polaires de Belgique (2 items)
Centre National de la Recherche Scientifique, Paris
Defence Research Board, Canada (5 items)
Det Norske Meteorologiske Institutt
Expédition Polaires Françaises (2 items)
Falkland Islands Dependencies Survey, Meteorological Service (2 items)
IGY World Data Center A, Washington (4 items)
Institute of Low Temperature Science, Japan
Japan Antarctic Office
McGill Sub-Arctic Research Laboratory
Meteorological Office
National Research Council, Canada (2 items)
Osterreichischen Alpenvereins
Royal Geographical Society
Scott Polar Research Institute (3 items)
S.I.P.R.E. (32 items)
Société Hydrotechnique de France
Sveriges Meteorologiske och Hydrologiska Institut, Stockholm
The Royal Society (8 items)
Union Géodésique et Géophysique Internationale (2 items)
U.S. Air Force, Cambridge Research Center, Massachusetts

OTHER BOOKS RECEIVED

Donor	
Seligman, G.	Mers, Glaciers, Volcans. By E.Scaioni. Larousse, Paris, 1958. 104 p., plates, 10 x 8 in.
Secretary of the I.U.G.G.	Chronique de l'union Géodésique et Géophysique Internationale 1959. International Union of Geodesy and Geophysics. 407 p. +56 p. supplement.
Fristrup, B.	Guidebook - Denmark. Contributions to problems discussed in Symposia and Excursions. International Geographical Congress, 1960. Københavns Universitets Geografiske Institut, 1960. 372 p., illus., maps.
Norsk Geografisk Tidskrift	Isavsmeltningstidens Drenering. By Just Gjessing. (The

	drainage of the deglaciation period, its trends and morphogenetic activity in northern Atnedalen, with comparative studies from northern Gudbrandsdalen and northern Østerdalen. (East-central southern Norway.)). Ad Novas, No.3, Norwegian Geographical Society, Universitetsforlaget, Oslo, 1960. 492 p., illus., map insert, (p. 441 - 85 English summary), 25 cm.
Norsk Geografisk Tidskrift	Norges Tettbygde Steder 1875 - 1950. By Hallstein Myklebost. (Density of Norwegian settlements). Ad Novas, No.4, Norwegian Geographical Society. Pub. by Universitetsforlaget, Oslo, 1960. 371 p., map insert, (p.364-71 English summary), 25 cm.
The English Universities Press Ltd.	The world around us. Ed. Sir Graham Sutton. The English Universities Press Ltd., London, 1960. 122 p., illus., 22 cm. 16s.0d.

Reviews

PRELIMINARY REPORT ON THE BERING STRAIT SCHEME. M.J.DUNBAR. NCRC-60-1. Ottawa, Department of Northern Affairs and National Resources, 1960. 17 p.

About a year ago newspaper headlines in western countries proclaimed a Soviet proposal to dam Bering Strait. The scheme, put forward unofficially by the engineer P.M.Borisov, envisaged a 50-mile long dam through which water would be pumped from the Arctic Ocean into the Pacific. It was not, in fact, a new scheme, but its predecessor of some years before had envisaged pumping water from the Pacific into the Arctic Ocean. Grandiose seems too small a word to describe these ideas, yet they were put forward seriously, as others of the same sort had been earlier. No one knew quite what to think about it. Anxious not to rebuff any genuine offer of corporate effort, a U.S. senator from Alaska pressed for a joint study of the project.

Since then, informed comment has been published on both sides. The U.S. Weather Bureau expressed doubts about the meteorological consequences, and this was interestingly followed by a deflating paper by a Soviet meteorologist, D. A. Drogaytsev, who raised similar doubts no less forcefully. And now Professor Dunbar has examined the proposal as a biologist and oceanographer, and likewise has his doubts. He concludes that there are mechanical difficulties which may be insurmountable, and that although fisheries would be improved, another glaciation might also result. He assumes there is just enough in the scheme to take it seriously, but he is not too sure about this ("it is not clear whether the Russians are putting the plan forward seriously, or as a means of testing our sense of humour"). In this reviewer's opinion, our sense of humour is not the subject of the experiment; rather can the whole matter be attributed to an attack of technological exuberance among Soviet dam constructors, brought on by immoderate successes in other parts of the country.

EXPLORING GLACIERS WITH A CAMERA. A.E.HARRISON. San Francisco, Sierra Club, V111. 71 p., illus., 23.5 cm. $1.95.

This book is intended primarily as a guide to glacier photography for the layman who might become interested in obtaining a deeper insight into the structure and fluctuations of glaciers. Much of the text is therefore elementary, but there is much more than that. The photographs themselves, and there are no less than 58 in the 71 pages, are excellent. They portray for the most part glaciers of the western United States, and should prove of interest to the expert, showing, as several of them do, fluctuations over the years, mostly retreat. There is a section on the technique of glacier photography, on photogrammetry and on 3-dimensional photographs, and another on the focal lengths of the lenses used.

It is the reviewer's opinion that this work will interest many experienced glaciologists.

THE WORLD AROUND US. Ed. Sir Graham Sutton. The English Universities Press Ltd., London, 1960. 122 p., illus., 22 cm. 16s.0d.

This work contains six essays based upon popular lectures given at the Royal Institutions in 1958.

The subjects and their contributors are:-
The ionosphere - J.A. Radcliffe, C.B.E., F.R.S.
The earth's magnetism - J.M. Stagg, C.B., O.B.E., B.Sc.
Exploration of the upper atmosphere - R.L.F. Boyd, Ph.D.
The lower Atmosphere and its weather - O.G. Sutton, C.B.E., D.Sc., F.R.S.
The Sea and its problems - G.E.R Deacon, C.B.E., F.R.S.
The Antarctic - G. de Q. Robin, M.A., M.Sc., Ph.D.

Although the lectures were for the most part for the benefit of young people, they provide a useful summary of knowledge of our world and some of the influences to which it is subjected, which should be useful to a wider range of readers than those for which the lectures were primarily intended.

FILMSTRIP - GLACIATION IN HIGHLAND BRITAIN. EDUCATIONAL PRODUCTIONS LTD. (Series: Geology and Physical Geography). Number C 6287, 1960. Colour, 38 frames, 27/6d.

The strip is produced for the London County Council under the general editorship of Miss E.M.J. Campbell. The authors are C.M. Barrett, and C.M. Dixon. The photographs were taken by Mr. Dixon, except for number 31, which is reproduced by permission of Aerofilms. The strip is designed to fit in with the syllabus of G.C.E. examinations in Geography at ordinary and advanced levels.

The reviewer considers that the strip is attractive and instructive and gives a good representation of three areas - Skye, the Lake District and North Wales. Most of the photographs are excellent and both beautiful and instructive. Minor criticisms are that the key maps follow the photographs to which they refer, and scale is lacking from close-ups. Some features are not well illustrated; the "drumlins" at the head of Langdale are almost certainly moraines; the "kames" could be any feature - there are better ones which could have been chosen; Edinburgh Castle Rock has been shown by borings to be solid rock and has no or extremely small traces of a tail of a moraine.

New Members

New members of the Society since July 1960 are:

Adams, Prof. Clyde M., Jr., 3 Summit Road, Lexington 73, Mass., U.S.A.
Allen, Clarence R., Division of Geological Sciences, California Institute of Technology, Pasadena, Calif., U.S.A.
Ambach, Dr. W., Physikalisches Institut, Schöpfstrasse 41, Innsbruck, Austria.
Atherton, D.L., 485 Rushton Road, Toronto 10, Canada.
Behrendt, John C., Geophysical and Polar Research Center, University, of Wisconsin, 6021 South Highland Road, The Highlands, Madison 5, Wisc., U.S.A.
Bergström, Rolf, Institute of Quaternary Geology, Kabovagen 2-4, Uppsala, Sweden.
Bradford, J.P., 110 Trenchard Close, Royal Air Force, Newton, Notts.
Dalrymple, Paul C., 7 Jennison Road, Cochituate, Mass., U.S.A.
Davey, Miss Ann, 8 Studland Road, Kingston-on-Thames, Surrey.
Ekman, S., Föreningsvägen 24, Saltsjö-Boo, Sweden.
Fisher, Frederick G., Box 9, Kotzebue, Alaska, U.S.A.
Gerdel, Dr. R.W., 2211 Robincrest Lane, Glenview, Ill., U.S.A.
Jackson, C. Ian, London School of Economics and Political Science, Houghton Street, Aldwych, London, W.C.2.
Killingbeck, J.B., 50 Eastwood Road, South Woodford, London, E.18.
Koerner, R.M., 40 Kimbolton Road, Copnor, Portsmouth, Hants.
Ksandr, Prof. Dr. Jiri, S.N.B. 32, Praha-XIII, Czechoslovakia.
Lloyd, Prof. Trevor, Geography Department, McGill University, 539 Pine Avenue W., Montreal, P.Q., Canada.
Potter, Noel, Jr., 918 Buchanan Avenue, Lancaster, Pa., U.S.A.
Pounder, Dr. E.R., Physics Department, McGill University, Montreal, Canada.
Raine, David F., 100 Coverton Road, Tooting, London, S.W.17.
Sugden, J.C.G., 62 Highbury, Newcastle-upon-Tyne.
Thiel, Dr. Edward, Geophysical and Polar Research Institute, University of Wisconsin, 6021 S. Highland Road, Madison 5, Wisc., U.S.A.
Twentyman, Miss Margaret, M.R: 71, Rochester, Minnesota, U.S.A.
Wallen, C.C., Sveriges Meteorologiska och Hydrologiska Instituts, Fridhemsgatan 9, Stockholm 12, Sweden.
Weber, Dr. J.R., Dominion Observatory, Gravity Division, Ottawa, Ont., Canada.

1. Prof. F. Debenham

:ated, left to right) Prof. F. Debenham,
: James Wordie, Miss Bowers (sister
Lt. Bowers), Sir George Simpson.

George Simpson,
Prof. G. Manley.

r. C. J. W. Simpson,
. G. C. L. Bertram,
Raymond Priestley,
. N. A. Mackintosh.

The 50th anniversary of the sailing of Scott's ship, the "Terra Nova", was celebrated on the 26 November 1960 at the Scott Polar Research Institute, Cambridge. Members of the expedition present at the party were Professor Frank Debenham (geologist), Sir Raymond Priestley (glaciologist)- co-founders of the Institute, and Sir George Simpson (meteorologist). Professor Griffith Taylor (geologist) sent a message on tape from Australia; picture number 2 was taken during the playing of the tape.

BRITISH GLACIOLOGICAL SOCIETY

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

President and Honorary Editor of the Journal of Glaciology G. SELIGMAN

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. 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 March and October.

ICE

Editor: MRS. H. RICHARDSON

This news bulletin is issued free to all members and subscribers of the British Glaciological Society, and is published in January and July. Contributions should be sent to Mrs. H. Richardson, c/o Scott Polar Research Institute, Lensfield Road, Cambridge, to arrive not later than the 15 November and 15 May.

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