NUMBER 5

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ICE

News Bulletin of the British Glaciological Society

CIRCULATION OF THE JOURNAL OF GLACIOLOGY



January 1954-January 1960

1960 PUBLICITY CAMPAIGN

With financial assistance from the Nuffield Foundation, the Society has produced a new illustrated publicity brochure. During 1960 we intend to send copies to universities, institutions and individuals in an effort to increase the circulation of the Journal of Glaciology.

We shall be grateful to receive addresses of possible subscribers from our present members and from anyone reading this announcement. Please send suggestions to the Secretary, British Glaciological Society, c/o Scott Polar Research Institute. Lensfield Road, Cambridge, England.

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1960 SUBSCRIPTIONS. These become due on 1 January. The Secretary will be grateful for prompt payment of debts.

LOAN OF BOOKS AND PERIODICALS. The Committee of the Society has agreed that books and periodicals, except for rare volumes, should be made available on loan to members in the United Kingdom during an experimental period of 6 months. Items may be borrowed in person, or by post on application to the Secretary, c/o Scott Polar Research Institute, Lensfield Road, Cambridge, on condition that postage is paid both ways by the member. Not more than 3 items may be borrowed at one time, and they must be returned within one month. A list of available books and periodicals will soon be ready and may be obtained from the Secretary.

DUPLICATE PAPERS. A new list of papers in the Society's library available for distribution to members can now be obtained from the Editor of the "Journal", Little Dane, Biddenden, Ashford, Kent.

EQUIPMENT FOR SALE. 12 2'6" auger extensions, galvanised steel; also snow-sampler in excellent condition. Apply to John Trubshaw, St. John's College, Cambridge.

APPLICATIONS FOR GRANTS FROM THE GINO WATKINS MEMORIAL FUND

The Gino Watkins Memorial Fund is a Trust resulting from an appeal to the public to raise a memorial to H.G. Watkins, who lost his life in Greenland in 1932. The joint Trustees are the Royal Geographical Society and Martins Bank. The Fund is administered through the Scott Polar Research Institute in Cambridge.

The Deed of Trust defined the main objects of the Trust as:

- "(a) the improvement and diffusion of knowledge of the polar regions:
- (b) the promotion of the acquisition of special knowledge necessary for the success of polar exploration and for the prevention of accidents and loss of life on polar expeditions;
- (c) with a view to the objects aforesaid, the assistance by financial and other means, of suitable polar expeditions."

The Fund is administered by a Committee appointed by the Trustees. The Committee wish to emphasise that their aim is to help and encourage, at the outset of their careers, those who plan polar work from the United Kingdom.

Applications for grants to expeditions must reach the Secretary not later than 14 March 1960.

Applications should be accompanied by a typed statement about the proposed expedition or research, a list of the party and their qualifications, an estimate of expenses, and information about any other applications that may have been made for financial assistance.

International Geophysical Year

Reports received in the World Data Centre C Glaciology. The Society has received reports during the period July - December 1959 from the following places:

STATION	PROGRAMME	PERIOD	
Australia: Mawson (Antarctica)	Ice thickness and sastrugi.	-	(Reprint: Polar Record, Vol.9, no.62)
Belgium: Roi Baudouin (Antarctica) """	Scientific observations. Meteorological report.	1959 1957-58	
Bulgaria: Golemia Kazan	Glaciological observations.	July-December 1957	
Canada: Ottawa, Saskatoon, Resolute, Glacier, Moosonee, Aklavik, Knob Lake	Density and hardness of new snow.	1957-58 winter	
Salmon Glacier	Summer climate.	-	(Reprint: Journal of Glaciology, Vol.3, no.23)
и и	Atmospheric potential gradient.	-	(Reprint: Quarterly Journal of the Royal Meteorological Society, Vol.85, no.363)
ii it	Map.	1956-57	
All stations	Progress report on all glaciological and meteorological work, and bibliography.	1956-58	
France: Charcot (Antarctica)	Calculation of height of station.	-	(Reprint: Comptes rendus des séances de l'Académie des Sciences, t.248)
India: Gangotri and other glaciers	Study of some of the Central Himalayan glaciers.	-	(Reprint: Journal of Scientific and Industrial Research, Vol.17A, no.12, supplement)
Mexico: Citlaltepetl, Popocatepetl, Iztaccihuatl	Glaciological observations.	April-May 1958	
Switzerland: Alps	Variations in the glaciers of Switzerland.	1957-58	
United Kingdom: Trans-Antarctic Expedition	Ice thickness and gravity readings.	November 1957 March 1958	-

STATION	PROGRAMME	PERIOD	
0.5.A.: Antarctica - general	Foreign clothing and equipment, I.G.Y.	1956-57	
	Chronology of events during "Operation	September 195 April 1959	4 -
11	Ice thicknesses.	-	(Reprint: IGY Bulletin no.13)
"Byrd"	Geothermal heat and glacial growth.	-	(Reprint: Journal of Glaciology, Vol.3, no.25)
11	Airborne traverses -	1958-59	
11	Geology of the Horlick Mountains.	1958-59	
"Ellsworth"	The Filchner ice shelf.	-	(Reprint: Annals of the Association of American Geographers, Vol. 49, no. 2)
"Little America"	Core drilling in ice.	October - December 1958	3
" " and South Pole	Studies of solar and net radiation.	1957-58	
"Wilkes"	Bedrock geology of the Windmill Islands.	1958-59	
Northern Hemisphere Blue Glacier, Wash.	-Mass and energy exchange.	-	(Reprint: Journal of Geophysical Research,
	Summary of technical	1959	V01.64, no.4)
II II	Glacial meteorology.	1958-59	
Cascades	Glacier observations.	1957	
"Lemon Creek" Glacier, Alaska	Mapping.	-	(Reprint: Photogram - metrical Engineering,
Kange II II	Movement.	-	Dec. 1958) (Reprint: Journal of Glaciology, Vol. 3, pp. 25)
	Thickness.	-	(Reprint: Transactions of A.G.U., Vol.38,no.5)
"McCall" Glacier	Mapping.	May-June 1958	
11 11	Glacier studies.	-	(Reprint: Arctic, Vol.12, no.2)
Arctic	Proceedings of Arctic Terrain Research planning session.	November 1958	
U.S.S.R.:			
Antarctica Northern Hemisphere	Information Bulletins	1958-59	
lien Snan	Glaciological work at Zailiyskiy Alatau, 1959.	-	(Reprint: Vestnik Akademii Nauk S.S.R., no.7, 1959).

STATION

PROGRAMME

PERIOD

Zemlya Frantsa Iosifa, Novaya Zemlya, Urals, Santar Khayata, Glaciological studies. 1957-58 Altay, Tien Shan, Fedchenko Glacier, Elbrus

International Glaciological Summaries of field Expedition to Greenland activities, 1959. (E.G.I.G.)

Field Work

AUSTERDALSBRE, NORWAY, 1959. The group engaged in a study of the flow of the Austerdal glacier returned to their field work for the fifth consecutive summer.

One party, which included Dr J. W. Glen, Dr Cuchlaine King, Mr W.V. Lewis, Dr J.F. Nve, Dr R. Shreve (University of California) and a number of Cambridge students was led by Mr W.H.Ward. They carried out flow surveys below the icefall, in the centre of the glacier, and at the snout. Below the icefall the positions of the crests and troughs of the waves were resurveyed and the positions of a longitudinal line of stones running down to the snout were remapped. In the centre of the glacier where the 400-foot long pipe was sunk last year surface surveys on two transverse lines of stakes left from 1958 gave the forward velocity distribution, the longitudinal strain, the ablation and the strain tensor around the pipe. Exceptionally intense melting during the preceding year undermined many stakes. The pipe axis was resurveyed in detail and was found to have moved about 150 ft. almost parallel to its original position: a surprising result. An attempt was made to reach bedrock by electrothermal drilling at the original pipe position, but on account of extremely slow drilling in debris-laden ice for the last 60 ft. further boring was stopped at 516 ft. At the same transverse section another hole, 200 ft. away from the sheer valley wall, is believed to have reached bedrock through clean ice at 317 ft. depth. Seismic explosives were placed at the bottom of both holes. In this area side-slip measurements were made at several points; the speed was less than that measured higher up the glacier a few years earlier.

The snout had retreated 105 ft. in the year, the annual flow just above the snout being about 73 ft. On a flattish part of the snout the surface strain-rate tensor was determined. A promising trial was made of a new instrument which measures the bed-slip velocity directly at the bottom of the ice. The instrument was inserted in a borehole a few yards up from the snout and the bedslip velocity was found to be about 1 inch per day.

A plane table map was made of all the Forbes' bands and of the surface dip of their fine structure.

A second party led by Mr D. Taylor-Smith consisted of a group of geophysists and postgraduates from Imperial College, London, who made gravity and seismic surveys to determine the ice thickness. Torrential rain interrupted their programme, and the high activity of the ice and rockfalls made the glacier very "noisy" for seismic recording. Using very large charges a longitudinal refraction profile was shot, but transverse profiles will require a further visit with modified equipment.

As it is not intended to continue the flow surveys at regular intervals, all reference stations and a considerable number of stones on the glacier surface have been surveyed and clearly marked for perpetuity.

CAMBRIDGE COLOMBIAN EXPEDITION 1959. Three members of this eight .nan expedition carried out glaciological work. They were J. C. Rucklidge, C. R. Smythe, and D. R. Dare (surveyor). The expedition was based for seven weeks in the Sierra Nevada de Cocuy, a range of mountains 200 miles N.E. of Bogota, rising to 18,000 ft. and containing the greatest single area of snow and ice in Colombia. The three glaciologists camped at 14,000 ft. to carry out a survey of the San Pablin Glacier. Bad weather and lack of acclimatisation held up their work in the early stages but they were able, in the end, to produce some results. These included a plane-table map of the snout of the glacier, surface velocity and ablation/accumulation measurements, and photographic and meteorological records.

JACOBSEN - MCGILL ARCTIC EXPEDITION TO AXEL HEIBERG ISLAND, N.W.T., 1959-1961. The scientific expedition to Axel Heiberg Island, N.W.T., is a joint effort of the Department of Geography, McGill University, Dr F.Kenneth Hare, Chairman, and Dr George Jacobsen of Montreal, and will extend over a period of three years. Its aim is to study the Pleistocene and Recent evolution of this mountainous and strongly glaciated part of the Canadian Arctic. Investigations will cover the fields of glaciology, geomorphology, geology and allied sciences. The glaciological work will include glacial meteorology and ice thickness determinations by seismic and gravity methods. The depth of permafrost in this area will be established by deep drilling followed by a study of the temperature profile of the drill holes. Drill cores will be analysed geologically. Large scale glacier maps of selected areas will be produced using both aerial and terrestrial photogrammetry.

During the summer of 1959, the reconnaissance party comprised the following members in the field:

F. Muller-Battle, Leader, Glaciologist. G. Jacobsen, Permafrost Research. Professor E. H. Kranck, Geologist. W. P. Adams, Geographer.

Between July 13th and 21st, the party was flown to Eureka, a meteorological station on Ellesmere Island, by 426 Air Transport Command, Royal Canadian Air Force and a D C-3 from Nordair Ltd., Montreal. From Eureka, a Piper Super Cub ferried scientists and equipment over the ice-cap of Axel Heiberg Island to a camp near Cape Levvel, at the entrance of Strand Fiord on the west coast of the island. The Piper Cub was equipped with large balloon tires of five pounds pressure which enabled it to land and take off on unprepared terrain in a very short distance. *Fifty-eight landings were made on terrain ranging from soft beaches to rock outcrops and glaciers.

After many reconnaissance flights, the permanent base was established at the head of South Fiord, 79° 25' N., 90° 30' W. This area has three types of glaciers in proximity to each other: (1) an outlet glacier from the central ice-cap (its tongue in apparent equilibrium) (2) a valley glacier of alpine character (in slight recession) and (3) a high altitude small corrie glacier (showing relatively strong recession in recent years). There are also many gypsum intrusions in this area.

During the summer a general reconnaissance was carried out and a theodolite survey of forty points was made using a Wild T2 instrument.

Glacier measurements for a long term study of accumulation, ablation and ice movement were initiated by inserting bamboo canes into the ice and surveying them. The canes were distributed in groups of five at different levels starting at the tongues of the three glaciers to altitudes of 1400 m.a.s.l. The firn line varies in this area from 950 to 1050 m.a.s.l. The annual layering of firn and ice and its crystal structures were studied to a depth of 1.8 m. in the accumulation area of both the valley and ice-cap glacier. Englacial temperatures were measured to a depth of 10 m. in the tongue area of the valley glacier.

Meteorological observations at the base camp below the glaciers (60 m.a.s. l.) were carried out at six hourly intervals from 24 July to 26 August.

The geological reconnaissance centred in the South Fiord area and extended northwest to Middle Fiord and east to Mokka and Gibs Fiord. Special attention was given to the numerous gypsum intrusions and domes. After careful investigation, the site for next year's deep rock drilling was chosen. The use of the Piper Cub, sometimes for twenty-four hours a day, enabled the geologist, Professor E.H. Kranck, to do his work far more quickly than would have been possible with conventional methods.

Field work ended on 26 August when two Piper Cubs made their final trip from Resolute.

In preparation for next year's larger party (fifteen to twenty members) which will be in the field from April to the beginning of October 1960, two fibreglass houses, including laboratory facilities, a plywood hut, food and most of the equipment were shipped this summer to Eureka by the Department of Transport ice-breaker "d'Iberville".

* See Polar Record, Volume 9 No.62, 1959, page 459.

BATURA MUSTAGH EXPEDITION - 1959. This was a six man expedition to the Batura Mustagh region of the western Karakoram. The main objective of the expedition was the first ascent of the principal peak of the Batura group (25,540 ft.). The programme also included some glacier research.

The glaciological programme of this expedition was disrupted by several factors, the major one of which was the accident which cost the lives of the five climbing members of the party. The expedition base camp was situated at 11,200 ft. at the junction of the Batura glacier and a large ice-fall which is the glacier's main tributary. Speed measurements, by triangulation with a theodolite, were made at points on the glacier before and after the junction, and at a series of points on a line across the bottom of the ice-fall. Measurements were also made of the contraction of a 500 ft. line, laid out in the middle of the ice-fall parallel to the direction of motion. A map of the junction was made with theodolite, range-finder, and plane table, supplemented by panoramic photographs. This will be compared with a similar map made by the 1954 German Karakoram Expedition. The photographs show clearly the ogive formation at the bottom of the ice-fall, and the way in which this is disrupted on coming into contact with the main glacier steam.

Ice drilling for temperature measurements was hampered by the fact that part of the drilling equipment was stolen by coolies during the march in. Some holes were drilled however, one to a depth of 7 metres, and temperature measurements were made at 1 metre intervals. Attempts at ablation measurements in ice and snow had to be abandoned as constant avalanches disturbed the marker stakes. The meteorological part of the observations remains. Attempts to measure the speed of the upper ice-fall were to have been made by the climbers but these results have been lost with them.

ARCTIC TERRAIN RESEARCH

(a) Ellesmere Ice Shelf, Northwest Territory, Canada.

Investigations on the Ellesmere Ice Shelf in the vicinity of Ward Hunt Island were in continuation 1 August 1959, including observations on meteorology, micro-meteorology, glaciology, and hydrology.

Early in August an arduous trip was made to the re-entrant area at the north-east edge of the ice shelf where thermopiles and ablation stakes were installed. It was while on this trip that Mr Paul Walker, the glaciologist, first became afflicted with a serious illness.

The glaciological programme was continued by completing surveys and making routine observations on the programme begun by Mr Walker who left on 10 August. Remaining members of the team continued to collect ablation data on the 70 station grid, the 35 station survey line west of Ward Hunt and the 4 station re-entrant survey line. Thermopiles have been installed on the grid and both survey lines to depths of about ten feet and temperature readings were continued at these locations. A thermopile set deep in the ice by members of the grid topography, elevation and location of each of the 70 grid ablation poles were determined, and a survey line was extended to a point of bedrock on Ward Hunt Island. Levels were run from this reference point to the water surface in the moat immediately north of Ward Hunt Island and subsequently referenced to tidal datum. Surface elevations were obtained at one foot intervals between poles set at a site on the ice rise and similar elevations were obtained for sites on the shelf to study surface changes, provided the lines are cancelled or postponed depending upon available time of personnel remaining at the site.

(b) Arctic Ocean: Fletcher's Ice Island, T-3.

Scientific observations during August and September were a continuation of those in progress at the beginning of the summer.

It was noted, with considerable interest, that rapid rotation of the island which commenced with the melting of surrounding pack ice continued throughout the summer. At one period in August a clockwise rotation of 25° per day was reported. During the month of September, the total rotation was approximately 360° . Surface temperatures recorded averaged 37.5° F in August and 26° F in September with a high of 39° in August and a low of 5° in September. Seismic ocean depths ranged between 1700 and 4000 ft. in August and reached a maximum of 6092 ft. in September. On 28 September, the ice island was located at 71° 14.5' N, 137° 43.5' W.

(c) Arctic Ocean: Station Charlie.

Jointly sponsored operations at Station Charlie included meteorological observations by the U. S. Weather Bureau, and long range sound transmission studies by the U.S. Navy Underwater Sound Laboratory. The U.S. Navy Hydrographic Office continued relative ice motion studies and ice surface phenomena. Oceanographic and micrometeorological studies were carried out by the University of Washington for the Office of Naval Research. Studies sponsored by the Air Force Cambridge Research Center, and conducted by the Lamont Geological Observatory, included seismic reflection and refraction observations, and submarine geology investigations. In addition, a precision depth recorder was used to register ocean depth and bottom configuration. A continuous record of atmospheric pressure variation was made by a microvariobarograph and a magnetometer was operated continuously.

(d) Arctic Coast: Alaska.

On 27 July, U.S.G.S. geologists Lewis and Chase were airlifted by the Arctic Research Laboratory Floatplane from Barter Island to the Canning River near Shublik Springs to continue mapping surface materials of the arctic foothills. From 27 July to 7 August the party moved down the Canning by canvas boat to a point about 5 miles north of the Sadlerochit Mountains and made foot traverses from four separate camps. Poor weather during this period greatly limited field work. On 8 August camp was disrupted by a flash flood, and on 12 August the party was evacuated by helicopter. Owing to continued bad weather field work was not resumed for two weeks. At the end of the month, a small lake near Tamayariak Creek was visited. Field work ended on 7 September.

The chief results of the August and September field work was the delineation of two glaciations in the Ganning River area. During the older glaciation, ice moved down the valley of the Ganning and spread out around the front of the Sadlerochit Mountains in a large piedmont lobe that extended east to Tamayariak Creek and north to within 10 miles of the present coastline. This represents the farthest northern extention of glaciation in Alaska. Fresher glacial deposits mark a younger glaciation during which a glacier, more or less confined to the valley of the Canning, moved to within 15 miles of the present coast.

(e) Other Studies.

Various studies of sea ice solidification, snow and ice comminution and compaction, ice structure and effect of additives, and the strength and deterioration of ice were conducted at the Climatic Laboratory, Eglin Air Force Base by personnel of the Arctic Institute of North America. This work continued and supplemented the previous Pt. Barrow studies.

The research data are currently being analyzed, but preliminary results indicate that the thin layer flooding and melting techniques produce ice of superior qualities, the processing of very fine grain snow or ice produces excellent compaction properties, and the addition of a small amount of fibreglass to freezing ice increases its strength by a factor of 100. Detailed results and their significance to scientific production of ice and snow structures will be presented as soon as possible.

UNIVERSITY OF BRITISH COLUMBIA - UNIVERSITY OF ALBERTA EXPEDITION TO THE ATHABASCA GLACIER, JUNE - SEPTEMBER, 1959. The expedition was organized by Mr J.S.Stacey. Mr W.S.B. Paterson studied surface movement of the glacier.

Groups from the United States Geological Survey and the National Bureau of Standards, Boulder, Colorado, were associated with the expedition. Valuable help was also given by a survey party from the Federal Water Resources Board who set up survey stations and made arrangements for the glacier to be photographed from the air. A detailed map of the glacier area will be produced by them.

Work started on the glacier on 25 June and ended 10 September. Camp was established on the moraine on the east side of the glacier, 2 miles from the snout. Snow-mobiles brought all equipment to within 200 yards of the camp area. Scientific work began on 2 July, although progress was hampered by snow conditions on the glacier. There was up to 3 ft. of slush and snow over part of the area, and this did not altogether disappear until the end of July.

The surface survey received initial priority. Approximately one hundred 8 ft. stakes were set in one longitudinal and seven transverse lines. The Ward hand augers worked well after initial modification but the ice was so wet that only 7 ft. holes were drilled. This meant that the stakes on the lower part of the glacier had to be reset several times during the season. The maximum rate of surface ablation measured was about $3\frac{1}{2}$ inches per day. Tilting of the stakes caused by the ice melting around them was a serious problem which

was not completely solved. The re-drilling and survey work was a full time job for two people, Paterson being assisted by J. Fairley.

The depth of the glacier was determined by seismic means at over thirty points spaced along the longitudinal and two of the transverse survey lines. These data will be used to investigate the correlation between surface movement and ice depth. The maximum depth of the ice was about 1100 ft. The first site for thermal boring was eventually placed on a uniform slope about 2 miles up glacier from the snout. A second site was subsequently chosen 400 ft. east of the first. During the summer five holes were drilled, one of which was used for temperature measurement. In only one hole was bottom reached, at 1024 ft. In spite of the difficulties much useful experience was gained in techniques and in the design of drilling equipment.

Gravity measurements were made over the lower $2\frac{1}{2}$ miles of the glacier. The area was also mapped by plane table traverse to provide the necessary elevation and position control for the gravity survey. This survey extended along the Banff-Jasper highway and to the Maligne Lake area.

SOVIET WORK IN THE ANTARCTIC.

The main feature in the Soviet programme for the present Antarctic season is to be the overland journey along the track "Mirnyy" - "Komsomol'skaya" - "Vostok" - the geographical South Pole - "Polyus Nedostupnosti [Pole of Inaccessibility]", and then either back to "Mirnyy" or on to "Lazarev" in Dronning Maud Land, depending on circumstances. This is to be undertaken by three 34-ton "Khar'kovchanka" vehicles towing sledges. The first stage of the journey, as far as "Komsomol'skaya", was accomplished at the end of last season, and the vehicles were left there for the winter. The party that was to man them reached "Komsomol'skaya" in October, some overland in "Pingvins" and some by air. The main journey started on 6 November, with the vehicles hauling 400 metric tons between them. "Vostok" was reached on 29 November. The party left for the South Pole on 8 December which was reached on 25 December. It was then announced that the party will return to "Mirnyy". Among the sixteen men taking part in this trip is a glaciological detachment of five: B. V.Savelpyev (leader), A. P. Kapitsa, S. Ulchov, L. Khrushchev and N. Kazarin. The glaciological studies are regarded as the most important part of the programme.

SOVIET DRIFTING STATIONS IN THE ARCTIC OCEAN.

The ice island carrying North Pole 6 station drifted, as expected, into the Greenland Sea in September 1959. It was evacuated by the 15th at a position some 250 km. from the northeast tip of Greenland, nine flights being made to fetch equipment and personnel. The station had travelled over 8660 km. (2620 km. in a straight line) in three and a half years.

Meanwhile North Pole 8, which had been established on sea ice in April 1959 some 800 km. north-east of Ostrov Vrangelya, drifted west-north-west. By November it was about the same distance from the island, but due north of it. The summer melting on the floe was such that no aircraft could land at the station until September. Its starting place was close to that of North Pole 2 in 1950, but the present station is following a substantially different course to that of its predecessor, which moved northwards, and then eastwards and southwards to form a circle in clockwise drift.

Sea ice studies are being undertaken at both stations, in addition to many other geophysical observations.

INTERNATIONAL GLACIOLOGICAL EXPEDITION TO GREENLAND (E.G.I.G.)

Several members of the Society were active on the expedition during the summer of 1959. M. Paul-Émile Victor was the leader. The geophysical group working from the inland stations, measured the thickness of the ice. Some of the measurements made by A. Wegener's expedition in 1931 were repeated. Soundings were made along several traverse lines. Meteorological observations and névé temperatures were taken and the morphology of the surface of the ice sheet studied.

The glaciological group at Inlandsis, with Dr M. de Quervain and Prof. A. Renaud, studied accumulation and stratification in pits. Samples were sent to the research station at Davos. Evaporation measurements were taken, but because of the calm weather no snow transport measurements could be made. Névé temperatures were observed at 20 points by means of platinum resistances, which should last for 20 years. Blocks of old ice from Camp III were sent for rheological study to station Jarl-Joset and for petrographic study to Switzerland. Accumulation measurements by tritium dating will be carried out in Switzerland.

The coastal glaciology group, under Prof. A. Bauer, remeasured the stakes put in by Expéditions Polaires Françaises between Camp III and K3 in 1948-50. The preliminary results show that the ice thickness has increased over the 10 years. Ablation and run-off measurements were made, and data collected for the radiation balance programme.

Prof. R. Haefeli took iceberg samples for tritium and Si_{32} dating, and made observations on the glaciers entering the sides of Kangerdlugssuak Fjord and took velocity and other measurements on a 2 km. profile across the front of Kangerdlugssuak Glacier.

(For map and details of the 1959 plans, which have been completed in their entirety, according to a report received in September, see the Journal of Glaciology, Vol.3, no.26, p.542-46).

Future International Meeting

British glaciologists who are engaged in active research and who have published papers thereon are asked to take note that the Commission for Snow and Ice of the Association for Hydrology will be meeting as part of the Triennial Assembly of the International Union for Geodesy and Geophysics, at Helsinki, July 25 - August 1, 1960.

If British glaciologists wish to attend, and/or to present a paper in the field of glaciological studies at Helsinki, notice of their intention to do so, together with, if possible, a title, should be sent to Professor Gordon Manley (Bedford College, Regent's Park, London N. W. l.) as soon as possible, preferably before January 1 and in any event before February 1, in time for consideration by the National Committee for Hydrology. Such papers should be in typescript, double spacing, not exceeding 3000 words, diagrams suitably prepared; so that they can be sent to the General Secretary, Prof. L. J. Tison, before May 1.

Contributors are reminded that at the Toronto meeting in 1957 it was again decided that with regard to snow, ice and glaciers there will be no set problems for discussion

News

Alpine Research Course. The following members took part in the course at Obergurgl in August 1959: Professor R.Finsterwalder, Professor H.Hoinkes, Dr W.Kick, Dr F.Loewe, and Mr G.Elliston. Dr H.Kinzl and Dr N.Untersteiner were also present. There were 55 participants.

Sir Edward Bullard has been elected a Foreign Associate of the National Academy of Sciences (U.S.A.).

The Right Rev. W. L. S. Fleming, Bishop of Portsmouth, has been elected Bishop of Norwich. The Bishop holds the Polar Medal for his services as geologist, glaciologist and chaplain to the British Expedition to Graham Land, 1934-7, and was Director of the Scott Polar Research Institute at Cambridge from 1947-49.

Joseph Halbert 1889-1959. We regretfully inform members of the death in August of one of our oldest members. Mr Halbert was the founder of the Kilfrost Company; he pioneered the work into industrial problems associated with ice and snow, particularly those concerned with icing problems on land, sea and in the air.

George J. Heinsheimer has been elected a member of the Academia Argentina de Geografia. Prof. N. E. Odell undertook a lecture tour for the British Council in Finland, Sweden and Denmark during the autumn of 1959. He was presented by the Rector with the bronze medal of the University of Helsinki, lecturing there and at many other places in all three countries. At Oulu, latitude 65° 3', has lately been established the world's northernmost university, exceeding the latitude of Alaska University at Fairbanks by 4'.

Dr Louis L. Ray has been appointed Visiting Professor of Geology at the College of Arts and Sciences, Cornell University, U.S.A., where he will be lecturing on glaciological geology and the Pleistocene period.

Dr B. B Roberts was a member of the U.K. delegation to the conference in Washington from October to December 1959 to negotiate the Antarctic Treaty, which freezes the present legal position regarding territorial claims so that research work can be conducted without political complications. The Treaty provides for freedom of scientific investigation in the Antarctic with international co-operation, and exchange of information about scientific programmes, observations and results.

Mr G.Seligman visited Professor Finsterwalder in Munich during July, and his visit coincided with that of Dr F. Loewe and Mr W. Kick. Mr Kick read a paper to the Technical High School, Munich, on recent work on the glaciers of Nanga Parbat.

Professor C. Troll has received the Eduard-Rüppel Medal of the Verein für Geographie und Statistik zu Frankfurt in 1959.

Dr C. Swithinbank and Dr J. H. Zumberge are working on the Ross Ice Shelf Deformation Project during the 1959-60 summer season.

Dr A. L. Washburn has left the U.S.A. to continue his research work in New Zealand for several years.

The Swiss glaciers commission reports that, in the glacial year 1957-58, 83 out of the 89 glaciers were receding, compared with 75 in 1956-57. The average decrease in length was 48 feet, against 30 feet in the previous year, and there was also a reduction in mass. The following glaciers advanced:- Allalin (6 ft.); Bella Tola (12 ft.); Martinets, Prapio and Paneyrosse (each 3 ft.); Damma (36 ft.). The retreating glaciers included the Morteratsch (135 ft.); Roseg (96 ft.); Aletsch and Gorner (60 ft.); the Fee Glacier has retreated a total of 1218 ft. in five years. Snowfalls had been under the average in the early winter, with the heaviest fall in the early spring, too late to form a layer thick enough and hard enough to resist the earliest summer sunshine. The numbers of hours of sunshine throughout the year was much higher than usual and ablation was correspondingly heavy. Professor P. L. Mercanton has calculated from maps that from 1876 to 1934 the glaciers lost 14.8 σ_0 of their area - over 68,000 acrees.

The Chinese Academy of Sciences sent teams of scientists to study the snow and ice on the Chilien Mountains in Kansu Province in June 1958 and March 1959. The purpose of the survey was to find the best way of providing increased melt-water in the spring for farms in the valleys, using artificial means. In one experiment, by spraying one square kilometre of the snow surface with charcoal ash or coal ash they derived 10,000 cubic feet of water within 24 hours.

It is reported from Scotland that in the warm summer of 1959 all traces of snow had disappeared from Ben Nevis and from Braeriach before 13 September.

The Lowell Observatory, Arizona, U.S.A., reports that during the last 5 years the sun has become 2% brighter and, probably, correspondingly warmer. This finding is contrary to the long held theory that the output of heat from the sun is fairly constant, and it may have an important bearing on the problem of causes of Ice Ages.

Award to Gerald Seligman. We have pleasure in printing here the text of the speech which Mr Seligman made at the presentation by the Royal Geographical Society of the Victoria Medal, as reported in Ice number 4.

"Mr President, I am delighted to receive the great honour which you have conferred on me, even though my work has been so essentially self-rewarding: more so, I think, than in many cases.

May I explain: My researches developed straight out of my play. In my youth I was a mountaineer and a ski-mountaineer, and I wanted to know more about the glaciers and the snow which were my delight. At that time glaciological research, which had been active earlier in this century, was flagging quite badly, especially in this country. By making the task of my later life an attempt to revive it over here, and to add to my own knowledge, I was often able to work in the most glorious conditions imaginable.

Picture to yourself, Sir, the mountain landscape, pure white in its mantle of snow. That was my laboratory, its roof a cloudless deep blue sky, its walls the high mountains, the sun-heated air dead calm, and when these conditions did not obtain I was still usually in the midst of the ice-covered mountains which had been my inspiration since early childhood. Can anyone think of more perfect conditions in which to work, if work it could be called?

If I have been able to stimulate others to follow me, and they in turn, have subsequently helped and encouraged me, which they have done to the full, that has only been an additional happiness. All these things make me say that my task has brought its own reward.

Nevertheless, that reward has been made all the sweeter by the recognition of any services I may have rendered to the science of glaciology - recognition embodied in this valuable and beautiful medal, for which I thank you, Mr President, and the Council of the Royal Geographical Society with all sincerity."



Richard Finsterwalder

Professor Dr Richard Finsterwalder, son of the well-known mathematician and glaciologist Professor Sebastian Finsterwalder, was born on 7 March 1899 in Munich, Germany. When still a young man he was taken by his father to make glacier measurements in the Eastern Alps, and thus has experience of the last great glacier advance which took place in the Alps about 1920. In the 1920's he studied construction engineering and survey at the Technical High School at Munich, and since 1924 has been responsible for the photogrammetry for tourist maps of the German and Austrian Alpenverein. These maps are serviceable not only for tourists but also for scientists, in particular glaciologists, for they are on a scale of 1:25,000 with the glaciers clearly marked. The maps were checked by well-known glaciologists, including the famous glacial geologists Penck and Brückner, who gave much valuable help to the Finsterwalders.

In 1928 Finsterwalder took part in the German-Russian expedition to the Alay and Pamirs led by W.Rickmer. He applied in the N.W. Pamirs and Zaalay the high mountain survey techniques developed in the Alps, using a light field photo-theodolite. The entire drainage area of the newly discovered Fedchenko Glacier was surveyed, and the first photogrammetrical velocity measurements were carried out. This work also helped Finsterwalder to establish his concept of "blockschollen" movement.

In 1930 Finsterwalder became a University lecturer and was dozent and later professor at the Technical High School at Hannover. In 1934 he was leader of the scientific group of the expedition to Nanga Parbat in the Himalaya. On this expedition a map of the Nanga Parbat group on a scale of 1:50,000 was produced. Special glaciological work at the Rakhiot Glacier showed that the "blockschollen" movement of ice on quickly moving glaciers with a relatively small cross section has a pulsating movement, which is still not fully investigated. In 1937 Finsterwalder worked with Dr Pillewizer on Jostedalsbre in Norway, concentrating on Nigardbre and Tunsbergdalsbre, but could not produce his report on this until after the war.

Since 1948 Finsterwalder has been active at the Technical High School in Munich, his home town, and has worked on all the glacier fluctuations in the nearby Alps. He has tried to clarify numerically the retreat of the glaciers since 1850, to investigate their behaviour from year to year, and to correlate this with climatic fluctuations. He has held every two years since 1951 courses in glaciology and mountain research, with participants from many countries.

At the Institute for Photogrammetry, Topography and Cartography, in Munich, of which Finsterwalder is the Director, photogrammetric results are currently being studied from mountain expeditions to South America, North America, the Himalaya, the Karakorum and Africa. The Institute is also a centre for polar research. Finsterwalder has played a part in the International Glaciological Expedition to Greenland 1957-60 (E.G.I.G.) as president and later vice-president of the Committee of Management. He is President of the Commission on Snow and Ice of the International Association of Scientific Hydrology.

Reviews

LOS GLACIARES DE MEXICO. JOSÉ L.LORENZO. Universidad Naccional Autonoma de Mexico. Monagrafias del Institute de Geofisica, No.1 1959. 114 p. (English transcription p. 91-109), illus., 22.5 cm.

This work, undertaken by the Glaciological Section of the Mexican National Committee of the I.G.Y., was in charge of a small party headed by Dr J. Lorenzo and describes principally in geographical detail the many glaciers on Citlaltepetl, Popocatepetl, and Iztaccihuatl. All these mountains exceed 5,000 m. in height. The regions are shown on excellent maps and 29 first-rate photographs; captions in the two languages add clarity to this important preliminary account.

THE PHYSICAL GEOGRAPHY OF GLACIERS AND GLACIATION. R. K. CRESSWELL. London, Hulton Educational Publication. 128 p., 124 illus., 22 cm. 7s.6d.

This small book provides a satisfactory introduction to the nature of ice cover and to the action of ice upon the landscape. Intended as a very elementary treatise it nevertheless contains material which could be of value to an advanced student. It does carry oversimplification a little too far, but perhaps in an introductory work this can have advantages. There is unfortunately no distinction in the text between glacierization (present ice cover) and glaciation (evidence of past ice cover) as, for instance, on p.84. There are many good diagrams and photographs.

THE PLEISTOCENE PERIOD. FREDERICK E. ZEUNER. Its Climate, Chronology and Faunal Successions. Hutchinson Scientific & Technical, London, 1959. 447 p., 23.5 cm. 42s.0d.

The original limited edition of this book, issued by the Ray Society, appeared at the end of 1945. It brought into perspective the vast amount of research into Pleistocene chronology which had been carried out prior to 1939, particularly in Europe. The present edition is essentially a reprint of the original volume with the addition of a chapter which brings up to date studies in which the author himself has largely been engaged - glacio-fluvial terraces, eustatic oscillations and periglacial phenomena.

The principles which the author enunciated 20 years ago are still valid and form the most interesting part of the volume.

THE WONDER OF SNOW. CORYDON BELL. New York, Hill and Wang. XI + 269 pages, 12 plates, 31 text figures, 21.5 cm.

This "popular" account of the snow cover was written by an artist who has clearly been stimulated to enquire into what causes snow to form and fall; and what happens to it after it has fallen. The author has obtained the personal guidance of such authorities as V. J. Schaeffer and J. E. Church. He also refers to works by U. Nakaya, T. Bergeson, W. Bentley (the author of "Snow Crystals") and many others. The search for knowledge has been extremely thorough and many scientists should profit by reading the book.

ANTARCTICA: THE STORY OF A CONTINENT. FRANK DEBENHAM. Herbert Jenkins, London, 1959. 264 p., plates, illus., 22 cm. 25s.0d.

Even though but little glaciology finds place in this work it should be welcome to glaciologists the world over; for it gives, in a unique manner, the little known story of a region where so much glaciological investigation has been, and is being, made.

It recounts the discovery of the continent, its early exploration and the inevitable attempts at exploitation in the form of whale and seal hunting, which in turn led to further exploration.

The chapters "A look at the Continent" and "What's the good of the Antarctic" should be of particular interest to those who have not been there. The chapter dealing with the political aspects involved admirably sums up the situation as it was prior to the discussions which took place at the Antarctic treaty conference in November 1959. Reading the book was thrilling, even to one who has watched the progress of exploration in Antarctica since the early days of the present century; seldom has a book, which the author calls a story and not a history, been more graphically and excitingly written.

AMERICAN JOURNAL OF SCIENCE, RADIOCARBON SUPPLEMENT. Vol. 1, 1959. 218 p.

This new publication, at present planned to appear annually, is intended "to serve henceforth as the medium for primary publication of all radiocarbon measurements, or at least of radiocarbon date lists". This first volume contains fourteen papers that are primarily carefully annotated date lists (though one of these consists only of samples of known date used to study the carbon isotope ratio in different substances), and these certainly give a good indication of the problems at present being solved using this method. It also includes an extensive bibliography on radiocarbon dating, and a list of laboratories known to be, or to have been, using the method. Naturally many of the dates are of interest to glaciologists; besides those concerned with Pleistocene chronology there are, for example, measurements from wood recently uncovered by the Grosser Aletschgletscher. The publication will be valuable in drawing together information previously to be found only in many different journals belonging to various scientific disciplines.

The Society's Library

Works received for the Society's Library since June 1959.

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.

> Auer, V. (3 papers) Bauer, A. (5 papers) Manley, G. Mason, B.J. Brockamp, B. (? papers) McConnell, R.B Bull, C. Meier, M.F. Case, J.B. Monnet, P. (5 papers) Fristrup, B. Müller, F. Niewiarowski, W. Gosselink, J.G. Haefeli, R. (5 papers) Oulianoff, N. (4 papers) Hamilton, R.A. (3 papers) Philberth, B. Swithinbank, C.W.M. Higuchi, K. Hoinkes, H. (7 papers) Taylor, R.S. Lliboutry, M.L. (2 papers) White, S.E. American Alpine Club American Geographical Society American Journal of Science American Meteorological Society Argentine Inst. de Fisiografia y Geologica, Rosario Defence Research Board of Canada (6 items) Department of External Affairs (Antarctic Div.), Melbourne Department of National Defence, Ottawa Department of Physical Geography, N. Copernicus Univ., Poland Directorate of Overseas Surveys, London Expédition Polaires Françaises (2 items) Geophysics Research Directorate, Air Research & Development Command, U.S.A. Hydrologische Kommission der S.N.G. (? items) International Association of Scientific Hydrology Meteorological Office, London (? items) Ministry of Education (Antarctic Office), Tokyo National Research Council of Canada (13 items)

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The Society is also grateful for all the valuable publications sent in exchange for the Journal of Glaciology.

Other Books Received

Donor	
Cambridge Univ. Press	Food for survival after a disaster. Published by Melbourne University Press, Australia, 1959. 90 p., 13s.6d.
Pal'gov, N.N.	Rivers of Kazakhstan (in Russian). Published by Publish- ing House of the Academy of Sciences of the Kazakhskaya S.S.R. Alma Ata 1959. 98 p., illus., map, 20 cm.
(Purchased)	Avalanche. Joseph Wechsberg. Published by Weidenfeld and Nicolson, London, 1958. 190 p., 22 cm. 15s.0d.
Hydrographer of the U.S. Navy	Oceanographic Atlas of the Polar Seas. H.O. Pub. No. 705. Published by U.S. Navy Hydrographic Office, Washington, 1957-1958. Part I - 70 p., Part II - 149 p., 41 cm. \$9.00.

New Members

New members of the Society since 1 July 1959 are: Aitkenhead, N., 17 Denewell Avenue, Newcastle upon Tyne 7. Ardus, Dennis A., 3 Castleside Road, West Benwell, Newcastle upon Tyne 5. Arnold, K.C., 159 Oakridge Boulevard, Ottawa 5, Ont., Canada. Bentley, Charles R., University of Wisconsin, Antarctic Research Center, 2544 University Avenue, Madison 5, Wisc., U.S.A. Everest, The Rev. M.R., Ampleforth Abbey, Yorks. Frost, Dr Michael J., Department of Geology, University of Canterbury, Christchurch, New Zealand. Fryxell, Roald, Department of Geology, Washington State University, Pullman, Wash., U.S.A. Gittins, J.W., 45 Bishton Road, Albrighton, Wolverhampton, Staffs. Gregory, K.J., Norwood, 77 Far Laund, Belper, Derbyshire. Jangpangi, B.S., Geological Survey of India, 27 Chowringehee Road, Calcutta 13, India. Landauer, Dr Joseph K., University of California, Radiation Laboratory, Livermore, Calif., U.S.A. Lauritzen, Knud, Hammerensgade 1, Copenhagen, Denmark. MacDowall, J., O.B.E., 21 Raisins Hill, Pinner, Middx. Owen, M.D., Eustace Percy Hall, Freeman Road, Newcastle upon Tyne 3. Shôda, Dr Mikio, Snow Experiment Station, Japanese National Railways, Shiozawa-Machi, Niigata-Ken, Japan. Smith, David D., Coastal Studies Institute, School of Geology, Louisiana State University, Baton Rouge 3, La., U.S.A. Smith, Peter, 106 Ramsden Road, Wardle, Nr. Rochdale, Lancs. Sticht, Prof. John H., Geology Department, College of the Pacific, Stockton 4, Calif., U.S.A. Twidale, C.R., Department of Geography, The University, Adelaide, S.Aust., Australia.

Wright, I.M., St. John's College, Cambridge.

Wright, R.G., 21 Burnmill Road, Market Harborough, Leics.

CHANGES IN MEMBERS' ADDRESSES

The following addresses replace those given in the List of Members published in March 1959, and in the list of new members in Ice no.4.

Bailey, Major Dana K., c/o Dr R.J.Slutz, 745 Mapleton Avenue, Boulder, Col., U.S.A. Baird, P.D., Mont St.Hilaire, P.Q., Canada.

Blackwelder, Prof. Eliot, P.O. Box 6506, Stanford, Calif., U.S.A.

Bonacina, L.C.W., 67 Fitzjohn's Avenue, London N.W.3.

Bratt, G. 327 Elizabeth Street, North Hobart, Tasmania, Australia.

Case, James B., c/o Broadview Research Corporation, 2139 Wisconsin Avenue, Washington 7, D. C., U.S.A.

Crary, Dr A. P., Apt. 204, 2400 19th Street, N. W., Washington 9, D. C., U. S. A. Fleming, W. L. S., The Right Reverend the Lord Bishop of Norwich, Bishop's House,

Norwich, Norfolk.

Ford, D.C., Department of Geography, Hamilton College, McMaster University, Hamilton, Ont., Canada.

Ford, V.C.R., Department of Geography, The Queen's University, Belfast, N. Ireland. Gillis, J.E., Jr., ?21 Gibbon Street, Alexandria, Va., U.S.A.

Giovinetto, Mario B., Department of Geology, Ohio State University, Columbus 10, Ohio, U.S.A.

Harrison, W., Department of Geology, Dartmouth College, Hanover, New Hampshire, U.S.A.

Hattersley-Smith, C., D. Phil., 137 Southern Drive, Ottawa, Ont., Canada. Havens, J.M., Department of Geography, Dartmouth College, Hanover, New Hampshire,

U.S.A.

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Keeler, Charles M., USS Edisto (AGB-2), Fleet Post Office, New York, N.Y., U.S.A. Lawrence, I., N.Z.Broadcasting Service, P.O.Box 275, Timaru, New Zealand. Marston, T., 427 Alder Street, North Vancouver, B.C., Canada. Mellor, M., U.S.Army, S.I.P.R.E., 1215 Washington Avenue, Wilmette, Ill., U.S.A. Merrill, Dr W.M., Department of Geology, Syracuse University, Syracuse 10, N.Y.,

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Müller, Dr Fritz, 6660 McLynn Avenue, Montreal 29, P.Q., Canada. Paige, R.A., 2307 N.E. 51st Street, Vancouver, Wash., U.S.A.

Peters, Miss E., 184 Shaftesbury Avenue, South Harrow, Middx.,

Proudfoot, V. Bruce, Department of Geography, Durham Colleges, University of Durham,

Science Laboratories, South Road, Durham.

Paterson, W.S.B., Department of Geophysics, University of British Columbia, Vancouver 8, B.C., Canada.

Ragle, Richard H., RFD 1, South Royalton, Vermont, U.S.A. Schneider, Allan F., Indiana Geological Survey, Indiana University, Bloomington, Indiana,

U.S.A. Shumskiy, Prof. P.A., Institute Merzlotovedenia, B. Cherkasskiy 2/10, Moscow K-12, U.S.S.R.

Soper, Mrs Valerie, (née Burns), Apt. 201, 135 Lawton Boulevard, Toronto 7, Canada. Smith, P.M., 2900 Adams Mill Road, N.W., Washington 9, D.C., U.S.A.

Stephenson, P.J., Department of Geology, University of the Panjab, Lahore, W. Pakistan. Taylor, P.F., 41A Montserrat Road, Putney, London S.W.15. Washburn, Dr A.L., Department of Geclogy, University of Canterbury, Christchurch, New

Zealand.

Weertman, Dr Johannes, Metallurgy Department, Northwestern University, Evanston, Ill., U.S.A.

Weidick, Anker, Jacob Appels Alle 91, Kastrup, Copenhagen, Denmark.

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

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U.S. dollars:	\$7.30
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(The dollar rates include Bank conversion charges)

Further details may be found in the Journal of Glaciology, published in March and October.

ICE

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