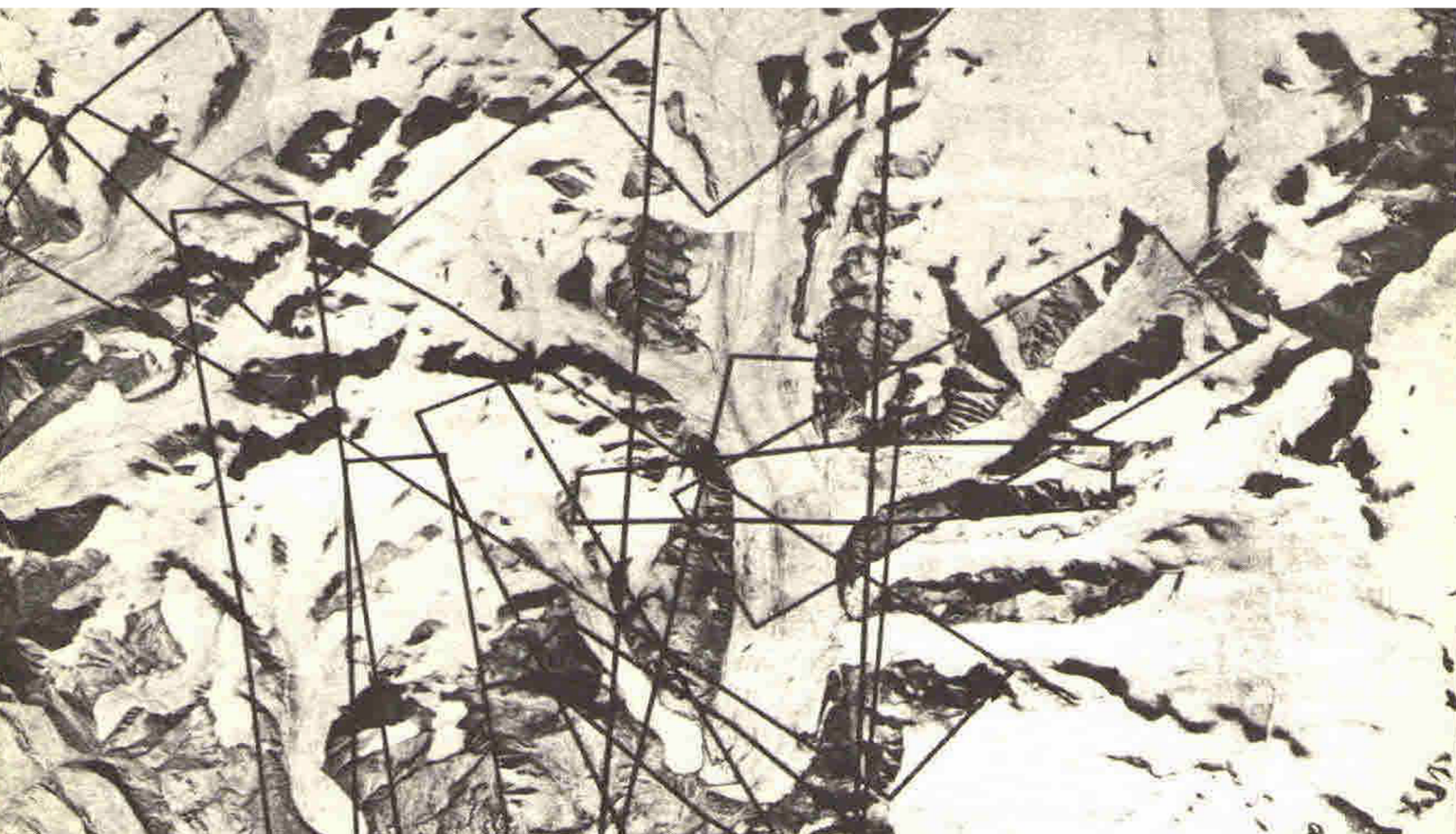
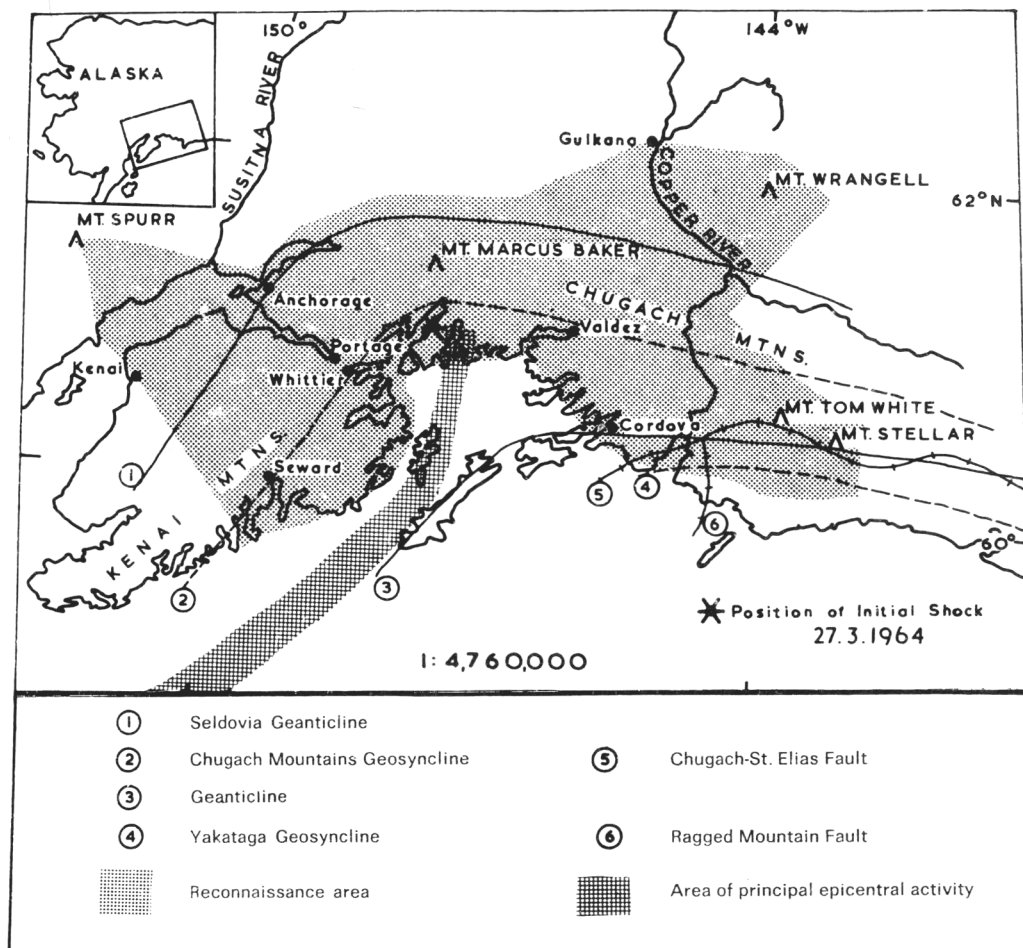


NUMBER 18

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ICE





South central Alaska — earthquake area March 1964

Area covered by the aerial reconnaissances of the Arctic Institute of North America
in April and September 1964 (see report on page 10)

Map based on one published in "Effects of the 1964 Alaska earthquake on glaciers and related features", by J. E. Sater, R. H. Ragle and W.O. Field. (A.I.N.A. Research Paper No.32, April 1965.)

ICE

NEWS BULLETIN OF THE GLACIOLOGICAL SOCIETY

August 1965

Number 18

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MEETINGS FOR MEMBERS. Two meetings for members of the Glaciological Society will be held in North America this summer. One will be held in Boulder, Colorado, U.S.A. during the 1965 Congress of the International Quaternary Association, and one in Ottawa, Canada during the Symposium on Glacier Mapping organized by the Commission of Snow and Ice and the National Research Council of Canada. Details of the subjects for discussion at these meetings were circulated to members in July 1965, and a report will be published in the next issue of Ice. We hope that as many members as possible will attend.

8 p.m. Tuesday 31 August: Meeting in the University of Colorado, Boulder, Colorado, U.S.A.

4.45 p.m. Tuesday 21 September: Meeting in the Division of Applied Physics, (Building M-36), National Research Council, Montreal Road, Ottawa, Canada.

SCOTT POLAR RESEARCH INSTITUTE. Members will be pleased to know that the Institute has been granted \$280,000 (£100,000) by the Ford Foundation for an extension building. With the addition of resources in the Institute's building account, sufficient money should now be available to meet the cost of the building which is proposed. The three storey extension is planned to occupy the ground at the back of the Institute's existing building, to which it will be connected by a two storey link. On the ground floor the link forms the entrance hall which also serves as an extension of the museum. On this floor of the extension building there will be a lecture-room, administrative offices, laboratory and research office.

The first floor will be largely devoted to an extension of the library, with offices and storage for archives and film. The second floor will consist of a map and drawing room, laboratory and eight research rooms.

In the basement there will be a workshop, two dark rooms, a cold room (provision is made for two more of these in the future) and storage.

The external walls will be of handmade bricks similar in colour to those of the existing building.

It is hoped that building will start in the spring of 1966 and be completed by the end of 1967.

COVER PICTURE. Low level flight lines for glacier mapping on Axel Heiberg Island. Royal Canadian Air Force aerial mosaic of the Axel Heiberg Expedition area from 30,000 feet. Approximate scale 1:300,000.

FIELD WORK

AUSTRALIA

During 1964 the main emphasis in the glaciological work at the Australian bases Wilkes and Mawson was on ice movement and deformation studies, but problems of ablation from blue ice slopes and local wind variations on undulating ice cap surfaces also received attention from the glaciologists of the ANARE.

At Wilkes Peter Morgan set up a 210 km triangular stake line on the northern side of the Wilkes ice dome. This stake line and a number of new strain rosettes were measured by tellurometer for the first time in April 1965 by Allen McLaren and are to be resurveyed repeatedly during the next few years. Together with ice thickness and precise surface height information these results should add up to very complete information about a medium scale ice cap.

At Mawson a comprehensive three-year survey of the Amery Ice Shelf was successfully completed last summer by an ANARE team led by senior glaciologist Bill Budd. This followed Ian Landon Smith's first survey in 1962 (which included a short-period strain measurement) and the establishment of movement and accumulation stake lines with three strain grids along the centre line of the ice shelf by Ted Wishart in 1963. The 1964 party completed strain measurements near the present front of the ice shelf and close to its junction with the Lambert Glacier, as well as half way in between the two limits, and set up additional stake lines and strain grids. Further accumulation and annual mean temperature estimates were also obtained.

The results of the Amery ice shelf survey are now being worked out by Budd, but it is already clear from a preliminary appraisal that the steady-state assumption used in previous ice shelf studies may be seriously at variance with reality and that the normal mode of mass loss is large-scale breakoff. A large portion of the Amery Ice Shelf was recently lost in this way and was encountered by the expedition ship, Nella Dan, off the coast of Kemp Land, in the form of two large icebergs, one of them measuring 90 x 30 miles approximately.

U. Radok

AUSTRIA

The position of the terminus was measured in relation to fixed points for numerous glaciers in the Austrian Alps during the summer of 1964. Traditionally the work was sponsored by the Österreichischer Alpen - Verein, and a summary report is to be published in one of the forthcoming issues of the Mitteilungen des Österreichischen Alpenvereins.

HINTEREISFERNER: Mass budget investigations were continued including measurements of winter- and net accumulation, and ablation at 70 stakes. Three of the older rain gauges were replaced by new models and four additional ones set up, bringing the number of rain gauges in the drainage area of the stream gauge near Vent to a total of twelve. The budget year was exceptionally dry and sunny; the old snow line retreated to about 3200 m a.s.l. and the mass budget therefore was strongly negative. In order to facilitate installation of ablation stakes, a new thermal, steam-operated ice-drill was designed and constructed by F. Howorka and was successfully tested in the field. A hole, 8 m deep and about 25 mm wide, could be lowered in an average time of about 30 minutes. A short note describing the new drill was published in the Journal of Glaciology, Vol. 5, No. 41, June 1965. Principal investigator: Institut für Meteorologie und Geophysik, Universität Innsbruck.

Seven new surveying points (stone cairns) were erected and triangulated in the vicinity of Hintereisferner. Transverse profiles No. 3 and No. 6 (see Bulletin IASH VIII^e Année No. 1, 94-96, 1963) were resurveyed, and the snout positions of Hintereisferner, Hochjochferner, Guslarferner and Vernagtferner, and several ablation stakes surveyed. Principal investigator: H. Schatz, Institut für Mathematik, Universität Innsbruck.

KESSELWANDFERNER: The deep pit at 3240 m a.s.l. was reopened in July and an ice core obtained from the bottom (i.e. 20 m below the firn surface) using a SIPRE auger. By pollen analysis (S. Bortenschlager, Institut für Botanik, Universität Innsbruck) yearly horizons could be determined in the ice prior to 1950. A new set of firn samples from a vertical profile was obtained and analyzed for alpha- and beta- activity, tritium, Sr 90, Cs 137, and Pb 210. E. Picciotto, Institut de Physique, Service de Géologie et Géochimie Nucléaire, Université Libre de Bruxelles, visited the field work and took part in the analysis. Six additional pits in the accumulation area were dug, down to the 1960 horizon. The pronounced increase in Cs 137 could be used for dating the 1961 horizon. Principal investigators: W. Ambach, H. Eisner, Physikalisches Institut, Universität Innsbruck.

SONNBLICK - KEES: (Granatspitzgruppe west of Gross-Glockner)

The programme of mass budget investigations which began in 1962-63 was continued. The data obtained for 1963-64 indicated a strongly negative mass budget. Transverse profiles were surveyed on Sonnblick-Kees and Ödenwinkel-Kees, retreat of terminus was also measured of Unteres Riffel-Kees. Studies in glacial morphology were made. Principal investigator: Heinz Slupetzky, Geographisches Institut, Universität Salzburg.

PASTERZEN-KEES: (Gross-Glockner-Gruppe)

Several transverse profiles and position of terminus were surveyed by staff members, Geographisches Institut, Universität Graz.

As in 1963, alpha- and beta- activity of ice- and snow-samples from surface layers of Pasterze as well as of water samples were measured by Bundesanstalt für Wasserbiologie und Abwasserforschung Wien - Kaisermühlen. Results for 1963 are published in Radioaktivitätsmessungen in Österreich, 4 Jahresbericht 1963, issued by Bundesministerium für soziale Verwaltung Wien 1964.

Net accumulation was measured not only for Pasterze but also for Eiserkees, Griesskogelkees, and Schmiedingerkees. Owing to the dry year and sunny summer only little old snow was left at the end of the budget year 1963-64. In addition, terminal retreat was measured for Karlingerkees, Schwarzköpfkees and Klockerinkees. A negative mass budget can be assumed for all glaciers in this area. Principal investigator: H. Tollner, Wetterdienststelle Salzburg.

GOLDBERG - GRUPPE (East of Gross-Glockner):

Retreat of terminus and net accumulation was measured for Kleines Fleisskees, Goldbergkees, and Wurtenees, in the vicinity of the Meteorological Observatory at Hoher Sonnblick (3106 m). All glaciers in this area apparently experienced a strongly negative mass budget. Investigator: H. Tollner, Wetterdienststelle Salzburg.

HISTORY OF CLIMATE: Investigations of soil profiles and moraines were extended to the Mont Blanc Group. Results of work carried out in 1963 in the Stubai Alps have been published by F. Mayr: "Untersuchungen über Ausmass und Folgen der Klima- und Gletscherschwankungen seit dem Beginn der postglazialen Wärmezeit", Zeitschrift für Geomorphologie, Neue Folge Band 8, Heft 3, 257-285, 1964. A paper has been prepared for the INQUA 1965 Congress by H. Heuberger and F. Mayer: "Type Areas of Late-Glacial and Post-Glacial Deposits in the Tyrol, Eastern Alps". Principal investigators: F. Mayr and H. Heuberger, Geographisches Institut, Universität Innsbruck.

GLACIOLOGICAL STUDY TOUR: From 20 to 30 August 1964, a glaciological study tour to the Swiss Alps was organized by Institut für Meteorologie und Geophysik, Universität Innsbruck, with the invaluable help and under the leadership of Swiss glaciologists and Power Plants. 20 participants, mostly students and scientific collaborators of the Institute, immensely enjoyed scientific explanations, wonderful hospitality and excellent weather on the following route: Steinlimmigletscher - Steingletscher - Grindelwald - Jungfrauoch - Grimsel - Unteraargletscher - Oberaargletscher (Leader R. Haefeli). Rhonegletscher - Griessgletscher - Aletschgletscher - Mattmark - Feegletscher (Leaders P. Kasser and H. Röthlisberger). Observatorio Ticinese, Locarno - Monti (Leader J. C. Thams).

H. Hoinkes

CHILE

UNIVERSITY OF CHILE EXPEDITION TO JUNCAL SUR GLACIER, CORDILLERA OF SANTIAGO, SUMMER 1965. A working group of the Geology School of the University of Chile, Santiago spent some weeks from 11 - 30 January and from 25 February to 3 March 1965 on the Juncal Sur Glacier which is situated on the south of Nevado Juncal, about 60 km northeast of Santiago. On this longest Chilean glacier outside Patagonia, ten measurements of velocity have been made successfully. From preliminary calculations it seems that the movement is very slow. There is some evidence that the Juncal Sur Glacier, composed of three ice streams, suffers perturbations in its mode of flow at the point of union. In a firm pit 4490 m a.s.l. determinations of density and other observations were made.

Hubert Miller

NEW ZEALAND

ANTARCTIC GLACIOLOGICAL PROGRAMME - 1963-64-65. During the 1962-63 summer an extensive glaciological programme was begun on the McMurdo Ice Shelf. With assistance from the U.S. Geological Survey, land survey stations were set up and accurately fixed by tellurometer and theodolite. In the 1963-64 season, a 10 km grid of stations was set out over the Ice Shelf, each station linked by survey to land stations around the perimeter.

The McMurdo Ice Shelf, about 20 miles east to west and 40 miles north to south, receives some ice from the Ross Ice Shelf to the east and some from two glaciers rising to twelve thousand feet to the north. In fact, Ross Island forms an 11-13,000 foot wall across the northern end of the Shelf; this area is the famous Windless Bight of deep accumulation (4 - 5 feet per year) which proved such an obstacle during Scott's Winter Journey of 1911. This was in fact "the worst journey in the world". To the south of the McMurdo Ice Shelf is Black Island. This island influences the climate of the Shelf to such a degree that there are 3- or 4- foot rivers along its edge during the summer.

An extensive programme was planned for the 1964-65 summer and was largely completed on schedule. One-kilometre strain triangles were laid out at 13 of the 32 resection stations. A number of snow pits were dug and several deep cores (up to 10 metres) were drilled. Resection stations set out in previous years were resurveyed and accumulation markers remeasured. New profiles totalling 75 miles in both east-west and north-south directions were set out.

The programme also included further analysis work on the "brine layer" near the edge of the Ice Shelf, and local deformation measurements across the pressure ridges to the east of Scott Base. During the 1961-62 summer, the first snow samples were returned to New Zealand for tritium determination and nuclear bomb fall-out measurement. A great deal of work has been done since that summer in obtaining a full profile of fall-out measurements back to 1942. Comparison with samples collected from Pole and Byrd Stations give a clearer picture of the regional distribution of fall-out debris.

The McMurdo Ice Shelf has features seldom found together in one ice shelf: deep accumulation in some areas, ablation and flowing rivers in others; fast moving ice on the eastern boundary (Ross Ice Shelf: 800 m/year) and stagnant ice in the west (10 m/year); and other puzzling features, such as brine layering and water layering under 2 feet of clear ice. Access to the Shelf is easy, as Scott Base (NZ Base) and NAF McMurdo (US Base) are situated on the western margin and are only eight hours' flying distance from New Zealand. The one and only Antarctic "international airport" of Williams Airfield is near NAF McMurdo and provides landing facilities for wheeled as well as ski-operated aircraft.

It has been our aim to set up the framework for an extensive study of the McMurdo Ice Shelf. This has now been done. The next stage is to begin investigations into aspects peculiar to the Shelf. This should prove a fertile field for glaciologists from many parts of the world.

A. J. Heine

NORWAY

In 1964, mass balance measurements were carried out on 10 glaciers by Norsk Polar-institutt and Norges Vassdragsog Elektrisitetsvesen. The accumulation was less than normal in southern Norway, but higher than normal in northern Norway. Due to the unusually cold summer, the ablation was less than normal over the whole of Norway. The result was a surplus for all glaciers, except for those in east Jotunheimen, where the accumulation had been unusually small. The following table illustrates the measured values:

Glacier	Position	Acc. gm/cm ²	Abl. gm/cm ²	Mass balance gm/cm ²
Folgefonn	W. Norway	201	163	+ 38
Hardangerjøkulen	"	185	141	+ 44
Alfotbreen	"	269	241	+ 28
Nigardsbreen	"	213	118	+ 95
Storbreen	Central Norway	116	95	+ 21
Hellstugubreen	"	71	83	- 12
Gråstubreen	"	39	71	- 32
Blåisen	N. Norway	230	167	+ 63
Storsteinfjellbreen	"	185	120	+ 65

The positions of the glacier fronts were measured at the following glaciers:

Jostedalsbreen	m	Jotunheimen	m
Austerdalsbreen	- 28	Storbreen	- 11
Nigardsbreen	- 55	Heilstugubreen	- 6
Fåbergstølbreen	- 60	Styggedalsbreen	- 8
Lodalsbreen	- 50	Mjøre	
Stegholdtbreen	- 41	Trollkyrkjebreen	0
Briksdalsbreen	- 7	Veslebreen	0
Folgefonn		Finnebreen	- 2
Bondhusbreen	- 6		

O. Liestøl

SWITZERLAND

1. ANNUAL SURVEY OF GLACIERS

Following the sudden death of A. Renaud on 5 June 1964 the responsibility for the survey was handed over to P. Kasser. Despite the fact that winter set in very early, approximately 80% of the 105 glacier tongues were measured in the autumn of 1964. The general tendency of retreat had increased still further. The revision of the base lines in front of the glaciers made further progress. Within the year the Eidg. Landestopographie completed the evaluations for the Gorner, Z'Mutt, Paradisino, Zuretta and Sesvenna glaciers. In August the survey flights deferred from 1963 for the glaciers Roseg, Tschierva, Morteratsch, Calderas, Cambrena, Palu and Paradisino were finally carried out.

2. JUNGFRAUJOCH ICE-CAP

At the southernmost stake of six aligned along a 100 m profile running approximately N-S an ablation of 50 cm had occurred, due to wind erosion; towards the north an average increase of 1.10 m was observed at the other five stakes. The greatest specific linear longitudinal expansion of the firn surface measured along this profile was about 6.5% per annum.

In March and October two complete longitudinal measurements were carried out along the deformation quadrilateral. In the ice tunnels attempts were made to count the fine layers deposited annually, so that subsequent comparisons could be made with the dating obtained by means of radio-active isotopes.

3. ALETSGLETSCHER

In addition to the normal seasonal work, during the report year the Abteilung für Hydrologie (VAWE, ETH) carried out in collaboration with the Gletscherkommission the following items of field work (P. Kasser):

- a) Geoelectrical soundings and accumulation measurements on the permanent snow-field (H. Röthlisberger).
- b) Permanent marking: the placing of 15 plates in the Grosser Aletsch and Grünegg-firns area (Aellen).
- c) Re-measuring of fixed points: check measurements in the Konkordia-Marjelen area (Widmer).
- d) Drilling expedition: installation of 11 stakes in the Konkordia-Marjelen area (Gnos).
- e) Ablation recordings: the installation and operation of a limnigraph station on the Rotloch.
- f) Experimental tests with 2 floating models to 2 ablatographs (Aellen, Gnos).
- g) Comparison of 2 types of ablatometer (Schönbächler, Osservatorio Ticinesi Locarno-Monti).
- h) Aerial photographs: Grosser Aletschgletscher from the firn-line to the tongue (Eidg. Landestopographie).

The results of the normal seasonal field work for the end of the report year are as follows:-

At stake 3 (Jungfraufirn, 3350 m a.s.l.) a maximum snow depth of only 3.90 m was recorded on 30 May, and on 31 July a minimum of 2.50 m. By the final date of 2 October the firn level had risen to 3.25 m at this stake. In September the water equivalent was 140 cm. The surface at the fixed point P (stake) 3 was 0.9 m lower on 15 September 1964 than on 17 September 1963. At stake 11 (Ewigschneefeld, 3440 m a.s.l.) the firn depth was observed to be 3.15 m on 19 September with a water equivalent of 151 cm.

During the course of the ablation investigations it was possible for the first time to obtain satisfactory limnigraphs which give the wasting rate in a glacial channel in the surface of the glacier during fine weather. It was observed that during clear nights difficulties could arise owing to the freezing of the overflow plate.

The experimental geo-electrical soundings made on the permanent snow field showed that in the firn region the surface, which is thick and a comparatively good conductor, acts too effectively as a screen to permit reliable depth soundings.

The copper wire experiments were continued, but owing to bad weather and frequent snow storms only a few recordings were possible. The position and depth of the wires from 1962 and 1963 were obtained in one place only for each year. This method proved to be practicable only under ideal conditions.

The monthly movement observations on the Konkordia have shown a definite seasonal variation, but it is much less pronounced than that recorded by Elliston on the Gorner-gletscher.

Aletsch Map 1: 10,000 1957

The work on this was completed with the publication of various articles.

Aletsch Map 1: 25,000 1926/7 and 1957

A multi-colour version of these was brought out in November 1964 and can be used to determine the changes in surface area and volume at different heights.

4. PLAN NEVE (CANTON VAUD)

The study of this small glacier was regretfully interrupted by the sudden death of A. Renaud and had to be temporarily abandoned.

5. STEINGLETSCHER

Since the completion of the special five-year project which is dealt with in several articles, the Steingletscher has been added to the list of glaciers which are measured annually for movement of their tongues.

6. STEINLIMMIGLETSCHER

On 22 May 1964 a slab avalanche of unusual proportions started on the Vordertierberg at about 3000 m and covered in its descent the whole of the Steinlimmigletscher as far as the letter 'f' of the word Schafberg (see Neue Landeskarte - 1:50,000) and ended about 50 m from the snout. As a result the equipment installed in the autumn of 1963 to measure the amount of slide suffered damage, and the winter sliding velocity could not be measured. The mean ablation reading obtained at the snout on 25 August was approximately 5.03 m. Early snow prevented subsequent measurements. The greatest specific rate of retreat along the longitudinal axis of the snout recorded along a 25 m section of the glacier surface was 5% per annum. This should mean, providing the strain is proved to be uni-axial (sinaxial), a longitudinal strain of approximately $1.3 - 1.4 \text{ kg/cm}^2$ or $13 - 14 \text{ t/m}^2$.

7. UNTERAARGLETSCHER

During the course of a special survey for the power stations in September 1964, the changes at the Unteraar snout and the changes of velocity that have occurred since the time of L. Agassiz (1840) were examined in the light of more recent findings concerning glacier movement.

8. GREENLAND

Expedition to Thule (U.S.A. - Switzerland)

In March 1964 a Swiss-American expedition to Thule in North Greenland was undertaken with the aim of dating ice obtained from drilling operations by means of radio-active isotopes (especially using the C 14 method). On this successful expedition, which was financed by Bern University, Switzerland was represented by A. Oeschger, A. Renaud and M. B. Alder.

International Glaciological Expedition to Greenland (EGIG)

The stakes placed along the E - W profile by EGIG in the summer of 1959 were, in places, in danger of being covered up by snow. In the summer of 1964 the Expéditions Polaires Françaises (Missions Paul-Emile Victor) lengthened the stakes and carried out various repeat observations.

a) Physics and chemistry of ice (A. Renaud)

The evaluation of data, including the dating of ice by means of radio-active isotopes, which was interrupted by the sudden death of A. Renaud, has been taken over by A. Oeschger together with the preparations for publication.

b) Surface studies (M. de Quervain)

During the 1964 summer expedition mentioned above, readings were taken from the temperature recording equipment at the main stations. An analysis of all the temperature readings taken hitherto showed signs of the possible existence of residual low temperature at depths of over 30 m.

c) Rheology (R. Haefeli)

Scientific analysis of the data obtained by EGIG 1 (1957-1960) was continued, as was the working out of the scientific programme for the EGIG 1967-68 expedition. At the beginning of the report year 16 chapters containing the complete data and the first evaluation were sent to 'Meddelelser om Grønland' for publication.

9. BASIC STUDIES ON ICE AND SNOW

(Eidg. Institut für Schnee- und Lawinenforschung, Gletscherkommission und Abteilung für Hydrologie und Glaziologie VAWE)

Measurements of the pressure set up by the weight of the snow cover were continued, and were presented at the Avalanche Symposium in Davos 1965 (M. de Quervain). Other studies include:

- a) The cultivation of pure ice crystals for the purpose of examining thermo-electrical effects (C. Jaccard).
- b) The development of an instrument for the continuous evaluation of thin sections of snow and ice (C. Jaccard).
- c) The development of an instrument to measure the plastic behaviour of ice under pressure (Haefeli, Jaccard, de Quervain).
- d) Theoretical investigations into the problems of pressure set up by the dead weight of snow, giving special consideration to the stresses in an inclined snow surface in avalanche formation and in horizontal layers of snow, firn and ice, with reference to Greenland's inland ice and the Antarctic (R. Haefeli).
- e) Investigations into the application of geo-electrical sounding techniques to glaciers, and the use of a geo-electrical device for the measuring of glacial accumulation (H. Röthlisberger).
- f) Further development of a klinometer for the measurement of creep in snow and ice (R. Haefeli).

10. HYDROLOGICAL DECADE

The Gletscherkommission of the S. N. G. has announced three projects as a contribution to the Hydrological Decade.

- a) Study of the annual variations of 80-100 glacier tongues in the Swiss Alps, and the changes in the glacier surface of certain glaciers.
- b) Glaciological observations and measurements on the Steinlammigletscher tongue. The study of the relationships between ablation, movement (including forward creep), deformation and strain conditions.
- c) The study of the volume change, deformation and accumulation of the Jungfrauoch, as a typical example of the regime of a cold ice-cap in the Swiss Alps.

11. MEETINGS AND CONFERENCES

The two main meetings of the year took place in Zürich on 26 June and 12 December. At the latter meeting M. de Quervain was elected to the position of vice-president following the death of Commission member Dr. W. Jost. With the unanimous approval of the Com-

mission P. Kasser succeeded A. Renaud as delegate for the Glacier Survey. Talks took place with the President of the Commission of Snow and Ice of the IASH (IUGG) - Dr. H. Hoinkes, Innsbruck - with a view to giving assistance in the organization of a world-wide glacier survey. P. Kasser was appointed by the Commission of Snow and Ice to work out a pilot study for the preparation of this survey.

U. S. S. R. ANTARCTICA

The tenth Soviet Antarctic Expedition included 140 winterers, led by I. G. Petrov, and a summer party led by M. Ye. Ostrekin. It went south in the "Ob" and the "Estoniya" in November - December 1964. Scientists from Czechoslovakia, East Germany, the United States and Japan accompanied the expedition. "Estoniya" left on 24 January, taking home most members of the ninth expedition, and also the two Japanese visitors who had come to inspect "Showa" station with a view to reopening it next season. "Ob" left for home in mid-March with the rest of the summer party, after visiting Molodezhnaya and Novolazarevskaya.

Mirny, Vostok, Molodezhnaya and Novolazarevskaya were occupied throughout the season. An overland supply convoy went from Mirny to Vostok, leaving on 16 October and returning on 13 January. Komsomol'skaya was reopened en route to serve as an intermediate base. Building work continued at Molodezhnaya, in order to prepare it for service as the main Soviet Antarctic station in succession to Mirny.

Scientific work was confined this year to observations at or near stations, and was principally concerned with programmes related to the International Quiet Sun Year. There were no scientific traverses.

Charles Swithinbank returned to the Scott Polar Research Institute in May 1965 after serving as exchange member of the 9th Soviet Antarctic Expedition at Novolazarevskaya in Queen Maud Land. In March 1964 he became the first non-Soviet member to visit all four Soviet wintering stations in the Antarctic: Mirny, Molodezhnaya, Vostok, and Novolazarevskaya. The Novolazarevskaya station is situated on a nunatak at the inland boundary of an ice shelf, a place of particular glaciological interest. Tidal studies can be combined with precise measurements of ice movement and deformation as the ice sheet flows from land on to the sea. Ice movement was measured over 9 months at 47 markers placed up to 26 km from the nunatak. By making angle measurements throughout the winter and summer season to an accuracy of $\pm 1''$ of arc it was possible to show that in spite of the presence of rivers of melt-water on the surface of the ice sheet, there were no seasonal differences ($\pm 1\%$) in the rate of movement. Although very gently sloping, extensive areas of the inland ice sheet were found to be moving at around 100 m/year. Continuous records of tides were taken over a six-week period in a fresh-water lake where the ice shelf abuts against the nunatak, and simultaneous measurements were made of the tidal rise and fall of the ice shelf in a place where it is 260 m thick. Dr. Swithinbank, who went south in 1963 in the Soviet ship "Estonia", returned to Leningrad in the "Ob" and spent some days visiting the Arctic and Antarctic Research Institute.

No glaciological work was done by other wintering members of the 9th Soviet Expedition, though a traverse inland from Mirny during the 1964-65 summer season succeeded in re-surveying a 100 km line of ice movement markers and also in experimenting with a 200 mc/s radar for ice depth sounding.

U.S.A.

EFFECTS OF THE 1964 EARTHQUAKE ON ALASKAN GLACIERS

Shortly after the initial earthquake on 27 March 1964, an Arctic Institute of North America field party made an aerial reconnaissance to determine any visible effects of the earthquakes on the glaciers of the region. From 4 September through 24 September 1964 the party made a second reconnaissance of many of the glaciers covered in April and new areas of interest. Many of the features obscured by fresh snow in the spring were clearly visible in the fall. The spring and late summer photographs, together with those from earlier years, make possible a comparative analysis of the visible effects of the earthquake and the associated aftershocks.

The earthquake visibly affected a large area in part comprised of glaciers, glacial lakes, and associated valley walls. The apparent effects photographed included the collapsed cover of some ice-dammed lakes, unusually severe cracks in lake ice surfaces, traces of seiches along lake shores, ice shaken from glacier termini into lakes, and avalanches and landslides, some of the latter having spread entirely across the glaciers on which they fell.

The scarcity of obvious change was surprising since the glaciers must have been shaken violently by the earthquake. There were few snow avalanches or snow slides in the glacier basins and none of them appeared to have added enough substance to affect glacier regimen appreciably. With a few exceptions, hanging glaciers did not appear to have been affected and there was no unusual calving of glacier termini into tidewater. However, the earthquake may have caused subtle changes which are not yet apparent, such as kinematic waves that may not be noticeable for years.

The effects of earthquakes on glaciers have been speculated upon since early in the century when Professors R.S. Tarr and Lawrence Martin first hypothesized on the results of adding great quantities of snow, ice, and rock to the accumulation areas of glaciers. After field studies conducted from 1906 to 1913, Tarr and Martin were satisfied that each glacier advance was a response to earthquake shaking.

The 1964 earthquake in south-central Alaska was the strongest ever recorded on the North American continent. The extremely violent initial shock followed by many more tremors of lesser intensity produced numerous avalanches of snow, ice, and rock in varying proportions to fall from valley walls. Some of these avalanches and landslides fell on glaciers and the landslide materials on the glaciers constitute one of the most conspicuous and impressive effects of the earthquake.

From the photographs studied there appears to have been more activity of glacier fronts terminating in lakes than those terminating in tidewater. The evidence, however, is not conclusive because there are no earlier descriptions or photographs to compare with the observations and impressions made in April 1964.

A very small amount of shattering and calving was apparent at the front of glaciers terminating in tidewater. This must be considered unusual since after earthquakes of comparable violence in 1899 and 1958 the bays and inlets near the epicenters were reported to be filled with bergs and floes, even to the extent of preventing navigation of steamships into Muir Inlet for six years after the 1899 shock.

Of all the ice-dammed lakes observed, the one in the south-western embayment of Columbia Glacier showed more evidence of having drained as a consequence of earthquake shaking than any other ice-dammed lake. The fact that there was no pronounced shoreline visible, which would be expected if draining were recent, may be explained by recent snow accumulation in the area.

Although the few snow avalanches or slides seen in the Kenai or Chugach mountains are not considered large or extensive enough to alter glacier regimen, nine landslides are believed to have been large enough to influence glacier regimen. All nine lie on or near a line normal to the principal line of epicentral activity and nearly parallel to the Chugach-St. Elias fault. Close examination of them is needed, however, and long term studies are necessary.

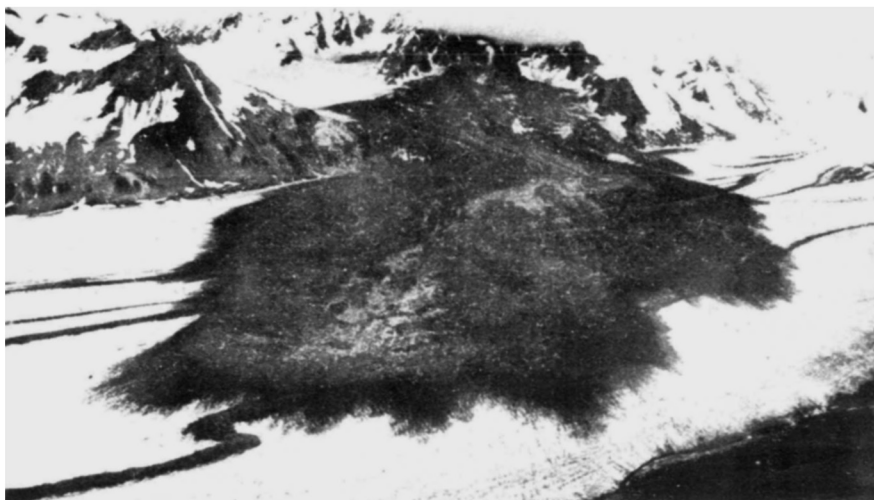
Note - The results of the April and the September missions are available to interested scientists in the form of colour slides and black-and-white prints. All pictures have been deposited at the American Geographical Society, World Data Center A Glaciology, Broadway at 156th Street, New York 32, N. Y., U. S. A.

(Summary taken, by kind permission of A.I.N.A., from Ragle, R.H., Sater, J.E. and Field, W.O., 1965, "Effects of the 1964 Alaskan earthquake on glaciers and related features", Arctic Institute of North America Research Paper No. 32. A.I.N.A., 3458 Redpath Street, Montreal 25, P.Q., Canada.)

A regional survey of coastal glaciers in southern Alaska, between Dixon Entrance (Lat. 55° N.) and Cook Inlet (Lat. 61° 31' N.) was conducted for the National Geographic Society during September 1964. Its purpose was to report on significant long-term effects of the 1964 Good Friday earthquake and to relate these observations to those of Tarr and Martin who, in 1914, reported excessive advances on the glaciers of Yakutat Bay, near the epicenter of the 1899 earthquake.

During this survey, 1400 aerial and ground photographs were obtained. The glaciers most extensively affected lie somewhat to the west and east of the 1964 epicenter, i.e., between College Fiord and Whittier in the Prince William Sound area, and in the eastern Chugach Range between Valdez and the Copper River. In the latter sector, some especially large earthquake-avalanches were observed, the most impressive being on Schwann Glacier, where slide detritus was found to cover 8 square miles of ice (see photograph). Other glacio-morphic results of the 'quake were extensive fissures in pro-glacial valley train deposits and river channels, and numerous cracks in beach and glacial forelands as far east as Icy Bay in the St. Elias district. The diastrophism even caused diversion of the Yahtse River, an outwash of the Malaspina Glacier near the entrance to this bay.

Effects were negligible in Yakutat Bay, except in Nunatak Fiord where the outwash fan of Orange Glacier was riven by cracks related to the 1964 tremors. A remarkable series of fresh fault scars and slides, however, was found on ridge flanks above Fourth Glacier in a tributary valley to Russell Fiord. Although these are attributed to the 1964 'quake, it is of interest that the fault zone extends southward to Lituya Bay, the epicenter of major tectonic displacement in 1958, and northward to Disenchantment Bay, which was the epicenter of the 1899 'quake. Fourth Glacier is also one of ten glaciers reported by Tarr and Martin which suffered catastrophic advance in the decade following the diastrophism of 1899. This locality lies 75 miles east of the area perimeter previously believed to have been influenced by the 1964 tremors.



Earthquake avalanche covering 8 square miles on Schwann Glacier in the Copper River region of Southeastern Alaska (M. Miller)



Geoffrey Hattersley-Smith

The only two British glaciologists who can really ski are Max Perutz and Geoffrey Hattersley-Smith, so it is not surprising that these two came together on the Jungfrauoch, with Max explaining: "it's just a matter of letting yourself go". To a casual observer Geoff has done exactly that, whenever there was an opportunity of going polewards.

He was born in London in 1923 and was educated at Winchester School and New College, Oxford, where he read geology. He was one of many who revelled in outdoor science, influenced by Dr. K.S. Sandford, Dr. Gerald Seligman and the Rev. W. L. S. Fleming (then Director of the Scott Polar Research Institute, now Bishop of Norwich). After graduating in 1948, an appointment with the Falkland Islands Dependencies Survey was a logical next step and he spent two years at Admiralty Bay, King George Island (Base G). In 1950 he again assisted Max Perutz and André Roch at the Jungfrauoch, before going to Canada to join the Arctic Section of the Defence Research Board.

From Ottawa, Geoff really let himself go, taking part in the Arctic Institute of North America's project "Snow Cornice" on the Alaska-Yukon Border, working for Bob Sharp on the Upper Seward Glacier, joining the Defence Research Board's Beaufort Sea expedition out of Esquimalt along the coasts of the Arctic mainland, Banks Island and Cornwallis Island, and climbing in the Rocky Mountains, where he made a traverse of Mount Assiniboine.

In 1953-54 Geoff organized with Bert Cray and led the Canadian/United States Ellesmere Ice Shelf investigations. He returned to Oxford in 1955 to write his doctorate thesis, and on its completion went back to Ottawa, taking with him a charming, tolerant Greek wife, Maria, who has been left smiling for many summers while Geoff has taken charge of "Operation Hazen" ("Operation Hazen-Tanquary" since 1963). "Operation Hazen" started as the Canadian I. G. Y. expedition in N. Ellesmere Island, and Geoff has spent 10 seasons there, responsible for the scientific programme on this, the first long-term study of a small ice cap in high latitudes in the Canadian north. Since 1957 about 65 scientists and assistants have taken part from six Canadian Government Departments and 14 universities in Canada, the United Kingdom and the U. S. A.

In these days of aviation and atomic submarines, he has a particular and marked reputation in the far north, arising from his great liking for dog teams. He has had dog teams on most of his expeditions and has proved by their successful use that they can be valuable under certain conditions even today. There is, however, a tale which relates that a dog team deserted their master on Ellesmere ice cap and scattered the mail over a wide area. His hobby on some of his expeditions was the collection of historical evidence of earlier expeditions.

The papers Geoff has written are primarily on the glaciology and geomorphology of N. Ellesmere Island, and will soon demand a summary of very much data. His help and encouragement, both scientific and personal, are valued by many people. It is, however, in his lectures that Geoff really twinkles with a dry humour and traditional understatement, though the wealth of detail and bright illumination of so many aspects of the polar surface is delightfully synthesised.

ANNUAL GENERAL MEETING, 1965

Minutes of the Annual General Meeting held at 5 p.m. on 6 May 1965
at the Imperial College of Science and Technology, London S.W. 7.

The President, Sir Vivian Fuchs, was in the Chair.

1. The Minutes of the 1964 Annual General Meeting, published in Ice 16, December 1964, were approved, and signed by the President.
2. The President made his report for 1964-65:

I am very glad to be able to report that expansion of the Society, in both membership and the size of the Journal, has continued in the past year. Membership in the last ten months has risen to 699, an increase of 21 - in spite of some twenty resignations which can be ascribed to the increase in membership fees in January 1965. The number of subscriptions from libraries has also risen, from 469 to 525. These are healthy signs, for they show an increasing interest in glaciology and also they are a measure of financial security. The Treasurer will be speaking about this later.

There seems to be no sign of abatement in the number of articles submitted to the Journal of Glaciology. The issue in press at the moment contains 240 pages. You will judge from this that the Editors are under great pressure on our behalf and we cannot thank them enough for all their efforts.

Ice, the Society's news bulletin, has also grown in the past year, with extra pages devoted to field reports, and a fifth of its space given to notices from the Commission of Snow and Ice of the International Association of Scientific Hydrology. It seems very appropriate for the Society to help in this way, and we are very pleased to be able to do so.

In 1964 we were able to meet these extra demands on our publication space because of a grant from the United States National Science Foundation and contributions in the form of page charges from organizations whose employees have had articles accepted for publication in the Journal. We are most grateful to the Foundation and to all the other organizations which have helped in this way, for they have enabled the Society to publish everything of sufficiently high standard which has been submitted to us.

In 1965 we shall not need to ask the National Science Foundation for a grant because in January we raised our subscription rates by 50%. This was the first increase for members since 1958. As I mentioned last year, the Journal is a "better buy" now, with between 500 and 600 pages published, than in 1958 when 178 pages were published. The increase in price does not seem to have deterred new members from joining us, nor to have scared away more than a few of our present members. Our 1965 income should be sufficient not only to meet expenditure but to provide a surplus for investment; you will hear more of this from the Treasurer.

Our thanks are due to all those friends, in many countries, who have helped in innumerable ways with the Journal - refereeing papers, preparing abstracts and generally giving the Society so much of their time, energy and advice. Once again I would particularly like to thank the Director of the Scott Polar Research Institute, Dr. Gordon Robin, for the assistance and facilities so freely provided throughout the year.

In my Report last year I suggested that the Society might well explore ways and means of meeting the needs of glaciologists; and that we should strive to achieve some corporate cohesion so that members would not feel that they were merely recipients of the Journal. To this end we have asked for and received suggestions and comments from several members, and the subject has been raised in Council. At the Council meeting held in Davos, Switzerland during the Avalanche Symposium of the Commission of Snow and Ice in April this year, we discussed at length the Society's possible role in training young glaciologists and the influence which the Society can exert on glaciological research. It was considered that research could certainly be influenced by selectiveness in the range of subjects accepted for publication and also by maintaining a high standard for papers accepted. It was also considered that the Society could benefit research if meetings were arranged by members locally, at any centre where there is a sufficient number to promote discussion.

All these suggestions are valuable and in the future we shall continue to hope for ideas from members, whether they are written or raised in conversation with members of Council who may be visiting a particular country.

We are always conscious of the preponderance of Council Meetings which take place in the United Kingdom, a course which is forced upon us by the need for continuity and the

necessary quorum. But you will have realized that every opportunity is taken of holding Council Meetings overseas when a sufficient number of members is attending an international meeting such as that at Davos. This is one way in which we try to keep in touch with needs, or indeed criticisms, arising in countries other than Great Britain.

3. The Treasurer, Dr. T.E. Armstrong, presented the accounts for 1964-65. He drew attention to the satisfactory position whereby the generous grants from the National Science Foundation and other organizations had helped the Society to stand on its own feet and improve its service to members. The raising of subscriptions from January last should mean that for a year or two there will be a surplus in the income and expenditure account. Some of this money, he suggested, might be used to set up a special fund, to be administered by the Society in support of any glaciological aim the Council thought desirable. One possibility, for instance, would be to set up a Research Fund, out of which payments could be made to young people with plans for glaciological work. Such a fund, separate from the ordinary finances of the Society, might in addition be a more attractive proposition to any who might wish to give or leave money to the Society.

4. Election of auditors for the 1964 accounts.
Dr. R.J. Adie proposed and Dr. J.W. Glen seconded that Messrs Peters, Elworthy and Moore, of Cambridge, be re-elected auditors, for the 1965 accounts. This was carried unanimously.

5. Elections to the Council, 1965-68.
After circulation to all members of the Council's list of nominations, one additional nomination for an Elective Member had been received in accordance with the Constitution. Ballot papers had been sent to all members and after the returned papers had been counted the following members were declared elected:

		Proposer	Seconder
Vice-President (1)	J. F. Nye	M. F. Meier	F. Müller
(1 nomination received)			
Elective members (4)	F. K. Hare	W. H. Ward	T. E. Armstrong
	E. R. LaChapelle	W. O. Field	H. Hoinkes
(5 nominations received)	M. de Quervain	H. Bader	F. Müller
	W. F. Weeks	J. W. Glen	M. F. Meier

6. Appointment to the Post of Founder
Under Rule 10 of the Constitution, the Council of the Society recommended that Dr. Gerald Seligman's name be put to the Annual General Meeting for appointment to this Post. The appointment was confirmed unanimously.

After the Annual General Meeting, Dr. S. Evans spoke on "Radio echo-sounding".

MEETINGS

INTERNATIONAL ASSOCIATION FOR QUATERNARY RESEARCH, 1965. The following outline of the INQUA Program includes those sessions which will be of particular interest to glaciologists. Registrations will be accepted up to 29 August. Papers will be accepted until program time is filled, and glaciological papers will be especially welcome. There are 8 vacant places on the field trip to the Pacific Northwest, which is recommended to glaciologists (see end of Program).

SUNDAY 29 AUGUST - All day: Registration

MONDAY 30 AUGUST - Morning:

General Assembly	9.00 - 12.00
Opening Ceremony	9.00 - 9.55
Plenary Session	10.00 - 11.30
Business Meeting	11.35 - 12.00
- Afternoon:	
Section Ib: The periglacial environment	2.00 - 5.30
- Evening:	
General Reception	8.00 - 10.00

TUESDAY 31 AUGUST - Morning:

Section IIk: Quaternary geomorphology	8.30 - 12.00
- Afternoon:	
Section IIk: Quaternary geomorphology II	2.00 - 5.30
Evening:	
Glaciological Society: Meeting for members	8.00

WEDNESDAY 1 SEPTEMBER - Morning:

Section Ia: Behaviour of glaciers	8.30 - 12.00
Symposium 3: Causes of climatic change	10.00 - 12.00
- Afternoon:	
Symposium 3: Causes of climatic change II	2.00 - 5.30
Meetings of National Delegations	5.30 - 6.30
- Evening:	
Symposium 3: Causes of climatic change III	8.00 - 10.00

THURSDAY 2 SEPTEMBER - All Day:

Field excursions	
- Evening:	
Outdoor barbecue and Koshare Indian Dancers	

FRIDAY 3 SEPTEMBER - Morning:

Section IIn: Quaternary periglacial environments	8.30 - 12.00
Symposium 7: Arctic and alpine environments	8.30 - 12.00
- Afternoon:	
Section IIk: Quaternary geomorphology III	2.00 - 5.30

SATURDAY 4 SEPTEMBER - Morning:

International Council	8.00 - 10.00
Executive Committee	10.00 - 10.45
Section IIn: Quaternary periglacial environments	8.30 - 10.45
Section IIc: Changes in Quaternary climates	8.30 - 10.45
Section IIe: Chronology and correlation of Quaternary events	8.30 - 10.45
General Assembly	11.00 - 12.30
- Afternoon:	
Free time in Denver	
- Evening:	
Banquet Hilton Hotel, Denver	7.00 - 10.00

5 - 17 SEPTEMBER CONFERENCE J - PACIFIC NORTHWEST

Organizer - Stephen C. Porter, Dept. of Geology, University of Washington,
Seattle, Washington.

Start - September 5, dinner at Multnomah Hotel, Portland, Oregon.
End - September 17, after breakfast in Seattle, Washington.
Cost - \$200.00. 8 places available.

GERMAN SOCIETY FOR POLAR RESEARCH. A Symposium on "Sea ice in polar regions" will be held in Hamburg, Germany, 30 September - 2 October 1965. Further details may be obtained from Dr. B. Brockamp, Institut für Reine und Angewandte Geophysik, Steinfurter Strasse 107, 44 Münster/Westfalen, Germany. Titles of papers and abstracts should be sent immediately to Dr. Brockamp.

BRITISH GEOMORPHOLOGICAL RESEARCH GROUP. The Group will hold a symposium on deglaciation, to be held in conjunction with the annual conference of the Institute of British Geographers in St. Andrews, Scotland, in January 1966. The following papers will be circulated prior to the meeting to interested members of the I.B.G. or the B.G.R.G. (details of cost, etc., will be circulated at a later date). It is hoped to print and circulate a summary of the discussion which takes place at the symposium. The Convenor is Dr. R. J. Price, Department of Geography, The University, Glasgow W.2, Scotland.

The fluvioglacial deposits associated with the Zone III Glaciation in the Western Highlands - S. B. McCann.
The deglaciation of part of the Usk drainage basin, South Wales - I. D. Ellis-Gruffyd.
Deglaciation of the East African snow peaks - J. B. Whittow.
Pattern of deglaciation in South Wales - D. Bowen.
Glacial landforms of the country around Market Drayton, Shropshire - E. M. Yates.
Glacial landforms and deposits of the Wheeler Valley, N.E. Wales - E. H. Brown and R. Cooke.
Ice-marginal lakes - R. J. Price.
Superimposed glacial drainage systems in the East Cheviot area - C. Clapperton.
The Plas Gwyn channel and its environs: a reassessment - R. Swann.

CANADIAN REGIONAL PERMAFROST CONFERENCE, EDMONTON, 1-2 DECEMBER 1964.
The conference was sponsored by the Associate Committee on Soil and Snow Mechanics, National Research Council. The following papers were read:

Distribution of permafrost in the discontinuous zone of Western Canada - R. J. E. Brown.
Distribution and character of permafrost in the discontinuous permafrost zone of Alaska - O. J. Ferrians, Jr.
Influence of surface conditions on the ground thermal regime at three Ottawa sites - L. W. Gold.
Engineering site investigations in the discontinuous permafrost zone - G. H. Johnston.
Seismic refraction and electrical resistivity measurements over frozen ground - S. D. Schwarz.
Review of construction techniques and maintenance problems in zones of discontinuous permafrost - R. M. Hardy.

Alaska District Engineers' experience in areas of marginal permafrost - E. L. Long
 Pile foundations in discontinuous permafrost areas - F. E. Crory.
 Frost thrust measurements on piles - R. E. Reed.
 Water and sewerage problems in discontinuous permafrost regions - D. R. Stanley.
 Public utilities problems in the discontinuous permafrost area of Uranium City and
 Thompson - H. P. Klassen.
 Location and construction of roads in the discontinuous permafrost zone, Mackenzie
 District, Northwest Territories - J. E. Savage.

INTERNATIONAL CONFERENCE ON CLOUD PHYSICS, TOKYO AND SAPPORO, JAPAN,
 24 MAY - 1 JUNE 1965. The Conference was sponsored by the International Association of
 Meteorology and Atmospheric Physics (IUGG), the World Meteorological Organization, the
 Science Council of Japan and the Meteorological Society of Japan. The programme was as
 follows:

TOKYO SCIENTIFIC SESSION

24 May	Session 1: Satellite meteorology and cloud dynamics Session 2: Cloud dynamics
25 May	Session 3: Aerosols and air chemistry Session 4: Cloud particles
26 May	Session 5: Atmospheric ice nuclei Session 6: Ice nucleation and crystal growth Session 7: Ice and snow crystals
27 May	Session 8: Precipitation physics Session 9: Hail studies Session 10: Radar meteorology
28 May	Session 11: Atmospheric electricity Session 12: Atmospheric radioactivity
29 May	Session 13: Cloud modification
30 May	Excursion to Nikko

SAPPORO SEMINAR

31 May	Visit to Hokkaido University
1 June	Seminar on precipitation physics

Papers of particular interest to glaciologists included:

Session 5: Atmospheric ice nuclei

The use of membrane filters in studies of ice nuclei - S. C. Mossop.
 Identification of ice nuclei in the atmosphere - H. R. Byers.
 Geographic distribution of ice nucleus concentrations - E. G. Droessler.
 Problems in the distribution of ice nuclei - E. K. Bigg.
 A mechanism for the formation of noctilucent clouds - R. K. Soberman.
 Variation of ice nucleus concentration in the atmosphere and its effect on precipitation -
 K. Isono.
 Ice nuclei, their physical characteristics and possible effect on precipitation initiation -
 A. Gagin.

Session 6: Ice nucleation and crystal growth

The nucleation of ice under pressure - L. F. Evans.
Ice in the capillaries of solid particles and its effect on their nucleating ability - K. Higuchi and N. Fukuta.
Studies on the process of ice nucleation - A. Ono.
The crystallization velocity of ice in pure water and aqueous solutions - H. R. Pruppacher.
The structure of ice grown in supercooled water - W. C. Macklin and B. F. Ryan.
On the structure of precipitation elements formed by the freezing of supercooled water - J. Hallett.

Session 7: Ice and snow crystals

Vapour growth of ice crystals between -40° and -90° C - T. Kobayashi.
The growth of negative ice crystals - C. Knight.
Etching of snow and hoar crystals - D. Kuroiwa.
A theoretical study of the variation of ice crystal habits with temperature - P. V. Hobbs and W. D. Scott.
The movement of ice particles in the atmosphere - J. Podzimek.
Observations of snow clouds by means of "snow crystal sondes" - C. Magono and S. Tazawa.

Sapporo Seminar on precipitation physics

The theory of ice crystal nucleation - N. H. Fletcher.
The ice nucleation and snow crystal habit - B. J. Mason.
The mechanism of hailstone formation - R. List.
The aerial observation of snow and rain clouds - R. R. Braham.
The snowfall in the winter monsoon season of Japan - C. Magono.
On the equations of kinetics of precipitation formation - V. I. Belyaev.



Present and past officers of the Commission of Snow and Ice,
at the Avalanche Symposium in Davos, April 1965

Dr. W. H. Ward
Secretary

Prof. G. A. Avsyuk
Vice-President
Dr. H. Hoinkes
President

Prof. R. Haefeli
Past-President
Prof. L. J. Tison
Secretary of the
I. A. S. H.

Dr. W. O. Field
Past Vice-President
Dr. M. de Quervain
Organizer of the
Symposium

COMMISSION OF SNOW AND ICE

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

SYMPOSIUM ON GLACIER MAPPING, OTTAWA, 20-22 SEPTEMBER 1965

(in association with the Sub-Committee on Glaciers, of the National Research Council, Canada)

SECOND CIRCULAR

1. Introduction

The general arrangements for the Symposium remain as outlined in the First Circular, which was distributed to all intending participants and published in the IUGG Chronicle and in Ice 16. Hotel accommodation in Ottawa has been reserved for all who have requested it. The present circular amplifies the instructions to authors and to exhibitors of maps.

2. Instructions to authors

Papers for the Symposium will be subject to screening; those accepted will be published in the Canadian Journal of Earth Sciences. Authors should therefore follow the "Notice to Authors" put out by that Journal. It is important to keep to the subject of "Glacier Mapping" and to hold the article to the limit of 15 double-spaced typewritten pages including diagrams, tables and photographs, i.e. 4,500 words or the equivalent. The editors reserve the right to shorten articles which are too long. A condensed version of the papers for oral presentation is strongly advised; there will be facilities for the projection of 2" x 2" and 3½" x 4" slides. If a special map is to be included with the paper as published in the Journal, 2,500 unfolded maps must be provided by the author. Each author will be entitled to receive 100 copies of his paper free of charge; additional copies should be ordered at the time of submission.

3. Instructions to contributors to the map display

Contributors are asked to bear the following points in mind:

- (a) Limitations of space impose careful selection of maps for display.
- (b) A limited number will be chosen for their historical interest.
- (c) The majority will be chosen to illustrate modern mapping techniques.
- (d) Pertinent information on location, techniques, etc. should be included for display with the maps.
- (e) The Sub-Committee on Glaciers reserves the right to decide which maps to exhibit.
- (f) Contributors are requested to forward their maps for receipt in Ottawa not later than 1 August, which is also the deadline for papers. They are asked to indicate whether the maps may be retained in Ottawa for a month after the end of the Symposium to enable the display to be seen by a wider public.

4. Enquiries

Enquiries about the Symposium should be addressed to the Chairman, Sub-Committee on Glaciers, Liaison Office, National Research Council, 100 Sussex Drive, Ottawa, which is also the address for the receipt of papers and maps.

G. Hattersley-Smith
Chairman
Sub-Committee on Glaciers

Extracts from "Notice to Authors", Canadian Journal of Earth Sciences

Articles may be written in English or French. General style and spelling should conform to the usage in current issues of the journal.

General - Manuscripts should be typewritten, double-spaced, on 8½ by 11 in. paper. The original copy and one carbon copy are required. References, tables, and legends for illustrations should be typed on separate sheets, double-spaced, and placed after the text. The originals of line drawings and one set of clear copies are required. Photographs are to be submitted in duplicate.

Abstract - An abstract of not more than about 200 words, indicating the scope of the work and the principal findings, is required.

References - References should be listed alphabetically by authors' names, unnumbered, and in the form used in current issues of this journal. In references to papers in periodicals, the authors' names should be followed by the year of publication, title of article, name of journal, volume, and initial page number.

Tables - Tables should be numbered in Roman numerals and each table referred to in the text.

Line drawings - Drawings should be carefully made with India ink on white drawing paper, blue tracing linen, or coordinate paper ruled in blue only; any coordinate lines that are to appear in the reproduction should be ruled in black ink. Originals should not be more than 2 or 3 times the size of the desired reproduction.

Photographs - Prints should be made on glossy paper, with strong contrasts. They should be trimmed, so that essential features only are shown, and mounted carefully, with rubber cement, on white cardboard.

PROGRAMME OF THE SYMPOSIUM

Place: National Research Council
Division of Applied Physics
Montreal Road (Building M-36)
Ottawa, Canada

Monday, 20 September

- | | |
|---------------|--|
| 8.30 - 9.30 | Registration |
| 9.30 - 10.00 | Prof. J. Tuzo Wilson, Canada (Past-President, IUGG) - Address of welcome.
Dr. Mark F. Meier, U.S.A. (Vice-President, Commission of Snow and Ice) - Opening Address. |
| 10.00 - 10.45 | Dr. V. Schytt, Sweden - The purpose of glacier mapping. |
| 11.00 - 11.45 | Mr. T. J. Blachut and Dr. F. Müller, Canada - Some fundamental considerations on glacier mapping. |
| 11.45 - 12.30 | Dr. Melvin G. Marus and Miss K. Ewing, U.S.A. - Methods of cartographic representation and symbolization in glacier mapping. |
| 14.00 - 14.45 | Colonel J. V. Helk, Denmark - Glacier mapping in Greenland. |
| 14.45 - 15.30 | Dr. W. Pillewizer, E. Germany - The use of terrestrial stereophotogrammetry in mapping high mountain glaciers. |
| 16.00 - 16.45 | Dr. W. Kick, W. Germany - Measuring and mapping of glacier variations. |
| 16.45 - 17.30 | Dr. G. Konecny, Canada - Applications of photogrammetry to surveys of Arctic glaciers. |

Tuesday, 21 September

- 9.00 - 9.45 Mr. P. Kasser and Dr. H. Röthlisberger, Switzerland - Some problems of glacier mapping experienced with the 1:10,000 map of the Aletsch-gletscher.
- 9.45 - 10.30 Dr. Mark F. Meier, U.S.A. - Some glaciological interpretations of re-mapping programmes on South Cascade, Nisqually and Klawatti Glaciers, Washington.
- 11.00 - 11.45 Dr. William O. Field, U.S.A. - Mapping glacier termini in Southern Alaska, 1931-1964.
- 11.45 - 12.30 Mr. G. Petrie and Dr. R. J. Price, Britain - Photogrammetric measurements of the ice wastage and morphological change near the Casement Glacier, Alaska.
- 14.00 - 14.45 Prof. G. A. Avsyuk, Dr. O. W. Vinogradov, and Mme. V. I. Kravtsova, U.S.S.R. - Experience in the U.S.S.R. in complex glaciological mapping of inland and mountain glaciers.
- 14.45 - 15.30 Prof. A. J. Brandenberger and Dr. C. Bull, U.S.A. - Glacier surveying and mapping programme of the Ohio State University, U.S.A.
- 16.00 - 16.45 Prof. A. Kosiba, Poland - Photogrammetric surveying and mapping of glaciers in West Greenland and Spitsbergen.
- 16.45 - 17.45 Meeting of members of Glaciological Society.
- 19.00 Dinner.

Wednesday, 22 September

- 9.00 - 9.45 Prof. R. Haefeli, Switzerland - Some notes on glacier mapping and ice movement.
- 9.45 - 10.30 Prof. Richard P. Goldthwait, U.S.A. - Surveys of an ice cliff in Northwest Greenland.
- 11.00 - 11.30 Dr. G. Østrem, Canada - Surface colouring of glaciers for air photography.
- 11.30 - 12.00 Dr. Ambrose O. Poulin, U.S.A. and Mr. T. A. Harwood, Canada - Infrared detection of Arctic thermal anomalies with reference to use in glacier mapping.
- 12.00 - 12.30 Mr. Amory H. Waite, U.S.A. - International experiments on glacier sounding, 1963-64.
- 14.00 - 14.45 Dr. G. de Q. Robin, Britain - Mapping the Antarctic ice sheet by satellite altimetry.
- 14.45 - 15.45 Mr. P. G. Mott, Britain and Dr. F. Müller, Canada - Films of Graham Land and Axel Heiberg Island.
- 16.00 - 17.00 Closing Session.

Thursday, 23 September

- 09.00 Excursion to Upper Canada Village, Morrisburg. Pleistocene geology on route. Total cost, including lunch, about \$6.00.

14TH GENERAL ASSEMBLY OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

The Commission decided at the last General Assembly in Berkeley in 1963 that the subjects for discussion at the 14th General Assembly, which is to be held in Switzerland in late September 1967, shall be:-

- a) One session devoted to a discussion of the measurement of the mass-budget of very large ice sheets and their variations.
- b) Papers of high quality on any glaciological subject, especially on the physical properties of snow and ice, and on phenomena occurring at the bed of a glacier.

An announcement about the procedure for submission of papers for the Assembly will be made in due course.

It is anticipated that the SCAR Working Group on Glaciology will meet with the Commission during the Assembly.

INTERNATIONAL HYDROLOGICAL DECADE

In recent months the President and the Secretary of the Commission of Snow and Ice have been actively concerned with plans for the international organization of three glaciological projects for the Hydrological Decade in co-operation with UNESCO. These were considered by the Coordinating Council for the Decade at their first meeting 24 May - 3 June 1965 and were further considered at the first meeting of the ICSU Committee for the Hydrological Decade on which the President serves.

The Coordinating Council made resolutions adopting the following major glaciological projects to be undertaken with the Commission of Snow and Ice acting as Scientific Advisors:

- 1) World inventory of perennial and annual ice and snow masses.
- 2) Measurements of glacier variations on a world-wide basis.
- 3) Combined water, ice and heat budget measurements at selected representative glacier basins (N-S, E-W chains of glacier stations around the world).

In the first project the Council recommended that in the first years of the Decade the activity should be limited to mapping the areas of permanent snow and ice, invited the member states to participate fully and urged them to compile and assemble for publication data on all significant areas of permanent snow, glaciers, ice caps, shelf ice, etc. They invited the Commission to prepare a list of observations to be made for this inventory for distribution by the Secretariat of UNESCO to the member states, and directed the Secretariat to maintain close contact with IASH, SCAR and other groups engaged in snow and ice work.

On the second project, for which a pilot study is at present being carried out by Ing. P. Kasser in Zürich in co-operation with the Commission and FAGS, the Coordinating Council encouraged all member states to participate, urged UNESCO to continue to assist the Commission in implementing the activity and recommended the National Committees for the Decade to use the Commission's check list of glacier variations as a guide for the organization of their national measurements. (The list was published in Ice 13)

For the third project, the Council encouraged all member states located in the proposed chains of stations to participate, invited the Commission of Snow and Ice to prepare in consultation with the Secretariat an international programme of co-operation and encouraged member states in which this type of investigation is highly developed to join with other countries in order to obtain the observations and co-operate in the measurements by providing some personnel, instruments and possibly financial support.

These projects provide glaciologists with scope to expand their activities on an even greater scale than during the I.G.Y. and the Commission encourages everyone to make the best use of the opportunity. Having examined the various national programmes submitted for the Decade it is quite clear that there are many countries, for example, in the Middle East, South America and the Himalaya, where it will be necessary to encourage a greater interest in snow and ice in order to complete a world-wide coverage for these three projects.

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

THE SOCIETY'S LIBRARY

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

We thank the following authors or donors of papers and pamphlets, and regret that it is impossible to acknowledge them individually. The glaciological works, with their complete references, will be listed in the "Glaciological Literature" at the end of the Journal of Glaciology, and bound in the Society's collection of glaciological papers.

Ambach, W (4 items)	Lemans, A.
Gold, L. W.	Lorius, C.
Hamelin, L. -E. (5 items)	Miller, M.M. (5 items)
Havens, J. M. (2 items)	Okamoto, Y.
Heinsheimer, G. J.	Østrem, G. (5 items)
Higashi, A.	Philberth, B. & K.
Hofmann, W. (2 items)	Schytt, V. (2 items)
Holmes, G. W. (3 items)	Shumskiy, P.A.
Hyde, L. J.	Van Autenboer, T.
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Akademische Sektion München des Deutschen Alpenvereins
Antarctic Division, Department of External Affairs, Melbourne, Australia
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Division of Building Research, National Research Council, Canada (5 items)
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Expéditions Polaires Françaises (4 items)
Hydrographische Zentralbüro im Bundesministerium für Land- und Forstwirtschaft,
Vienna, Austria (2 items)
Institute of Low Temperature Science, Hokkaido University, Japan
Institute of Polar Studies, Ohio State University, U.S.A. (5 items)
Institute of Science & Technology, University of Michigan, U.S.A.
Instituto de Geologia, Universidade de Parana (2 items)
Lapin Tutkimusseura, Finland
National Research Council, Canada (5 items)
National Science Museum, Polar Section, Tokyo, Japan
Polish Academy of Sciences
Polish Cultural Institute
Republique Populaire Roumaine
Rocky Mountain Forest & Range Experimental Station, Fort Collins, U.S.A. (2 items)
Schweiz Meteorologie Zentralanstalt
Société Hydrotechnique de France (2 items)

REVIEW

MARTIN SCHWARZBACH. CLIMATES OF THE PAST. AN INTRODUCTION TO PALEO-CLIMATOLOGY. (Translated and edited by Richard O. Muir). London, New York, Toronto, D. van Nostrand Co. Ltd., 1963. 328 p., illus., 25 cm. 63s.0d.

This work, translated from the German by R. O. Muir, Lecturer in Geology at Chelsea College of Science and Technology, London, deals with the earth's climatic history over the last thousand million years. Much of the work will be of interest to glaciologists.

Chapter 5 deals fully with present day evidence of cold climates and shows excellent photographs of roches moutonnées, glacial striations, erratics, permafrost, stone circles, ice wedges and many plant remains.

Chapter 14 describes the Eo-Cambrian glaciations, also well illustrated, and Chapter 16 includes the Permo-Carboniferous glaciation and Chapters 18 and 19 the Tertiary and Quaternary re-development of the ice after warmer eras. The last part of the book includes a chapter on polar wandering and continental drift.

The book has been well translated and is eminently readable.

BOOKS RECEIVED

- L. B. QUARTERMAIN. South from New Zealand. Wellington, Antarctic Division, Department of Scientific and Industrial Research, 1964. 78 p., illus., 5s.0d. (Paperback).
- Soviet Antarctic Expedition, Vol. 3. (Information Bulletin) Amsterdam, London, New York, Elsevier Publishing Company, 1965. 377 p., illus., 23 cm. 80s.0d.
- GWEN SCHULTZ. Glaciers and the Ice Age. Earth and its inhabitants during the Pleistocene. New York, Holt, Rinehart and Winston Inc., 1963. 128 p., illus., 20 cm.
- SIR DAVID BRUNT (Ed.) The Royal Society International Geophysical Year Antarctic Expedition, Halley Bay, Coats Land, Falkland Island Dependencies, 1955-59. London, The Royal Society, 1964. 414 p., illus., 32 cm. (Vol. 4, Meteorology, Glaciology p. 269-347, and Appendixes). £7.0s.0d. (\$23.00).
- MELVIN GERALD MARCUS. Climate-glacier studies in the Juneau Ice Field Region, Alaska. Chicago, University of Chicago, Dept. of Geography, Research Paper No. 88, 1964. 128 p., 23 cm. \$4.00.
- KIRTLEY F. MATHER. The Earth beneath us. London, Thomas Nelson and Sons Ltd., (New York, Chanticleer Press), 1964. 400 p., illus., 29 cm. 84s.0d.
- HERFRIED BERGER. Vorgänge und Formen der Nivation in den Alpen. Klagenfurt, Verlag des Landesmuseums für Kärnten, 1964. 88 p. + illus., 28 cm. öS.210.-
- RAYMOND PREISTLEY, RAYMOND J. ADIE AND G. de Q. ROBIN (Eds.) London, Butterworths, 1964. 360 p., illus., maps, 29 cm. £10.10s.0d.

NEW MEMBERS

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- Sharma, Mrs. Usha, c/o Mr. V. D. Sharma, 2 Alok, Hapur, India.
- van Arkel, N. A., Mathematical Institute, Stationsweg 46, Leiden, Netherlands.

THE GLACIOLOGICAL SOCIETY

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

President: SIR V. FUCHS

Secretary: MRS. H. RICHARDSON

DETAILS OF MEMBERSHIP

Membership is open to all who have scientific, practical or general interest in any aspect of snow and ice study. Members receive the **Journal of Glaciology** free. Forms for enrolment can be obtained from the Secretary. No proposer or seconder is required. Annual subscription rates are as follows, from 1 January 1965:

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(The dollar rates include Bank conversion charges)

Further details may be found in the **Journal of Glaciology**,
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ICE

Editor: MRS. H. RICHARDSON

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