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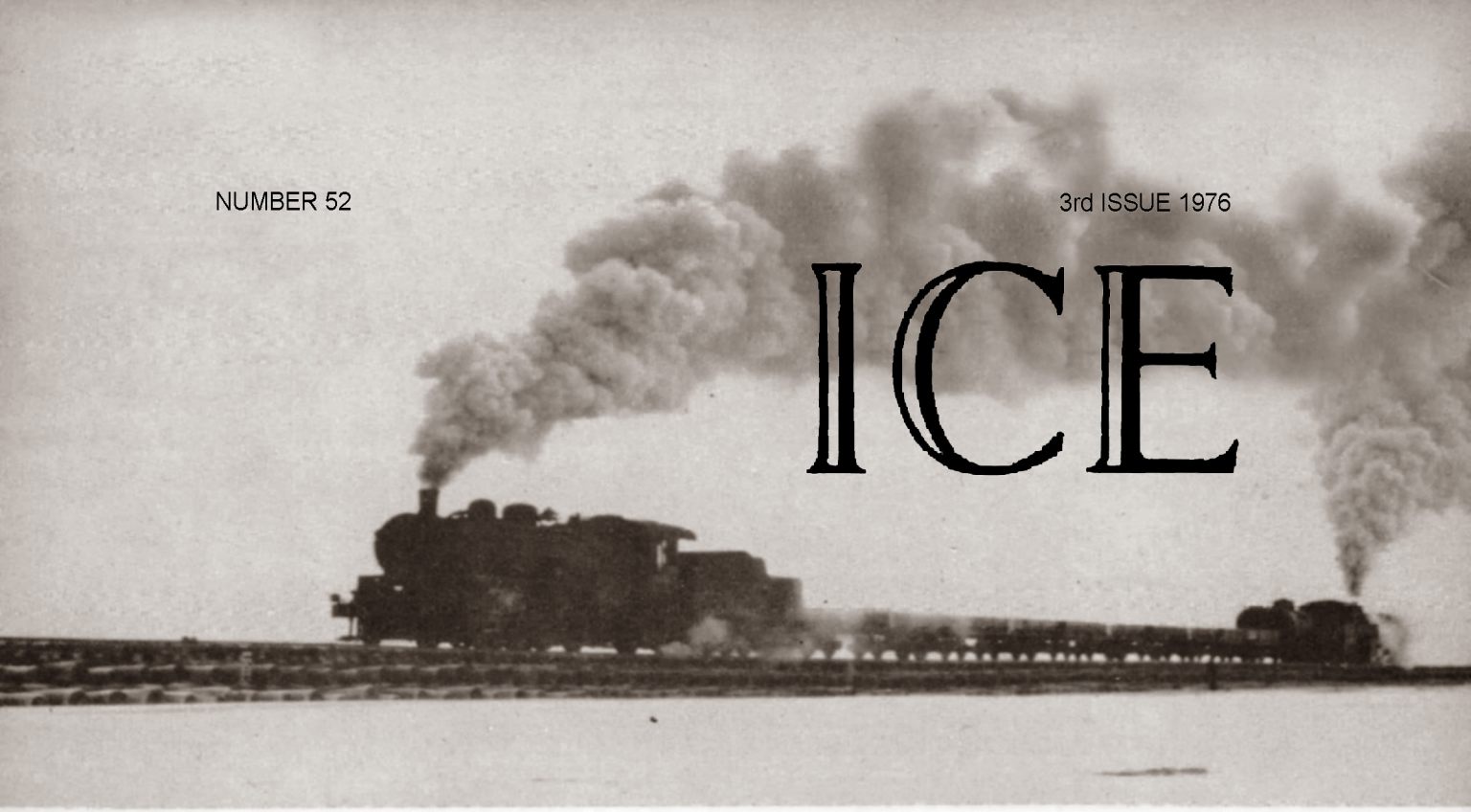

INTERNATIONAL GLACIOLOGICAL SOCIETY

1977 ANNUAL CONFERENCE & ANNUAL GENERAL MEETING

The Conference will take place on Wednesday and Thursday, 27 and 28 April, in Cambridge, England. Notices will be sent to all members in February, giving details of times and place.

The AGM will take place on Thursday 28 April at the conclusion of the afternoon conference session. The Annual Dinner will be held later the same evening. Details will be circulated in February.

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NEWS BULLETIN OF THE

INTERNATIONAL GLACIOLOGICAL SOCIETY

NUMBER 52 3rd ISSUE 1976

CONTENTS

AWARDS. We are pleased to announce the award of the Seligman Crystal to Dr Barclay Kamb and of Honorary Membership to Dr A. L. Washburn. Details are given on page 10 of this issue of ICE.

CONSTITUTION. Changes in the Society's Constitution have been proposed by the Council and ballot papers have been sent to all members. The final date for receiving your votes is 6 April 1977. The 1st issue of ICE 1977 will give the result of the ballot.

COVER PICTURE. The photograph shows an experimental length of railway track laid on the River Sungari in Manchuria in the winter of 1940-41. The rail was laid on sleepers supported by 4 rows of logs varying in diameter from 20-35 cm. The ice was 90-95 cm thick and the mean speed of the train was 10-20 km.h. The maximum deflection of the ice was 30 cm. These photographs and several more were sent to the Society by Dr Y. Kubo, 4-44-3 Minami-Ogikubo, Suginami-ku, Tokyo, Japan, who has much interesting information about the experiment.

RECENT WORK

NORWAY

MASS BALANCE STUDIES AT SELECTED GLACIERS 1974/75

The Norwegian Water Resources and Electricity Board (abbreviated: Vassdragsvesenet, NVE) performs glacier studies within selected watersheds to obtain data for hydrological calculations in connexion with evaluation of possible future hydro-electric power plants. The studies in 1975 were concentrated on 6 glaciers in Southern Norway and 3 glaciers in Northern Norway. These glaciers are situated in the following areas: Ålfotbreen, situated in a maritime area in Western Norway, Folgefonni, Jostedalsbreen, Jotunheimen (in Southern Norway), and Svartisen (in Northern Norway). In addition, some four glaciers in Southern Norway are observed by the Norwegian Polar Institute (Norsk Polarinstitutt).

The longest observation series has been made on Storbreen in Jotunheimen (by Norsk Polarinstitutt) and Nigardsbreen (by NVE). Results from earlier years' observations have been published in annual reports issued by NVE and Norsk Polarinstitutt. The methods used in the field work and in the calculations have been, in principle, unchanged since NVE started investigations at Nigardsbreen in 1962.

To increase the practical use of the mass balance data obtained by these studies some meteorological and hydrological observations were also made. The meteorological data are collected to form a base for short-term meltwater discharge forecasts. The actual discharge from the glaciers is also observed, in most cases by automatic recording devices, to check the water balance of each basin under study.

Ålfotbreen

The accumulation started relatively early on Ålfotbreen. Already at the first visit on 20 September 1974 the glacier had received 20-30 cm snow. Accumulation measurements were made at the end of April, when 50 snow depth determinations were obtained by conventional sounding and 9 corings made in the 8-9 m thick snow cover. The snow density was determined in a pit as usual.

In total, $22.2 \cdot 10^6 m^3$ water accumulated on the glacier, corresponding to no less than 4.64 m of water equivalent. This is almost a record for Ålfotbreen; a higher winter balance has been observed only once, in 1973. The result for 1975 is 30% higher than the average for the period 1963-74.

Due to the heavy snowpack and, consequently, a relatively high albedo throughout the summer, the melt was retarded significantly so that the summer balance became relatively small compared to glaciers farther east where less snow fell during the winter. Almost no exposed ice was visible at the end of the summer.

The summer balance amounted to $16.4 \cdot 10^6 m^3$ water, corresponding to 3.43 m of water equivalent. This is almost equal to the average for the period 1963-74. The net balance for 1975 amounted to $+5.8 \cdot 10^6 m^3$ water or +1.21 m of water equivalent. The equilibrium line was situated at 1050 m a.s.l.

Blomsterskardbreen

This south-facing outlet glacier from the Folgefonni ice cap has been expanding during the last few years and it is therefore an interesting glacier for mass balance studies. Only a few stakes are placed near the equilibrium line and the net balance is calculated from the assumption that the form of the net balance curve does not change from year to year: it is only shifting to the left or right in the diagram. This calculation method has been described previously. The studies of this glacier are financed by Norsk Polarinstitutt.

The net balance amounted to +1.7 m of water equivalent. The equilibrium line is assumed to be at an elevation of 1170 m a.s.l. The glacier has now had positive balances during 5 consecutive years and the increase in glacier thickness is calculated to more than 5 m of water equivalent.

Gråbreen

This glacier is a west-facing outlet glacier from Folgefonni. Snow depth observations were made at 144 points and the snow density was observed in a pit and by coring. In total the glacier received 2.62 m of water equivalent.

The beginning of September can be set as the end of the summer season because a thin snow cover had then arrived on the upper parts of the glacier. The summer balance amounted to 2.25 m of water equivalent. This resulted in a positive mass balance corresponding to 0.37 m of water equivalent. The equilibrium line was situated at 1375 m a.s.l.

Supphellebreen

An "abbreviated" programme of mass balance studies was made on this outlet glacier from Jostedalsbreen, according to a similar method as mentioned above for Blomsterskardbreen. Olav Orheim made more complete studies during the years 1963-68 and he resumed mass balance studies in 1973. His calculations indicate a positive mass balance amounting to 1.5 m of water equivalent for 1973 and a positive balance in 1974 amounting to 0.8 m of water equivalent. For 1975 the calculations also resulted in a positive balance, this time 1.0 m of water equivalent.

Nigardsbreen
Several winter visits were necessary to maintain the stake net on this large east-facing outlet glacier from Jostedalsbreen but the heavy snow accumulation, amounting to 6-7 m in the higher parts of the firn basin, made it impossible to keep all the stakes surviving throughout the entire winter. However, due to a very good summer surface developed in 1974, all the 270 snow depth soundings were regarded as reliable. The snow density was determined in three pits, each representing a certain height interval.

The winter balance amounted to 2.5 m of water equivalent. This is 10% more than the average for the period 1962-74. A higher winter balance was measured only in 1962 and 1967.

The observation hut at Steinmannen was manned in the period from 18 June to 1 September by two summer assistants who were responsible for all glaciological and meteorological observations.

The total ablation amounted to 2.23 m of water equivalent, which is 22% more than the average for the period 1962-74. This is almost a record—a higher summer balance was found only in 1970. The ice melt on the tongue amounted to approximately 14 m during the summer whereas approximately 3 m of snow melted in the higher parts of the firn basin.

The mass balance turned out to be positive also in 1975; this is the third consecutive year and the ninth since 1962. It amounted to +0.27 m of water equivalent. The equilibrium line was situated at 1450 m a.s.l. This is slightly below the average for the period 1965-75 which was 1490 m a.s.l. This again is 65 m lower than the theoretical altitude for the equilibrium line if the glacier is in balance (''steady state condition'').

The increase in volume which has taken place since 1962—more than 6 m of water equivalent—has not yet caused any advance observable at the tongue. It is expected, however, that the glacier front will start its advance in the next few years. A survey of glaciological investigations made at Nigardsbreen was recently published in Norsk Geografisk Tidsskrift, where also a new glacier map of Nigardsbreen was included.

The daily mean water vapour pressure was, on an average, 7.2 mb. Only during 15 days was the water vapour pressure less than 6.1 and at the same time the daily mean temperature above zero. This indicates that evaporation may have taken place during these 15 days but a significant water vapour condensation must have taken place on the glacier surface during the rest of the summer.

Hardangerjøkulen
The studies are concentrated on a west-facing outlet glacier, Rembesdalskåki, and are made by Norsk Polarinstitutt. Due to the unusually heavy winter accumulation most of the stakes disappeared and only three stakes were visible at the end of the accumulation season. The sounding operations were also difficult due to a weakly developed summer surface from the previous melt season.

The winter balance has been calculated as 2.25 m of water equivalent. The following warm summer resulted in a summer balance amounting to as much as 2.10 m of water equivalent, so that the resulting net balance turned out to be +0.15 m of water equivalent. However, due to difficulties in the field work and, consequently, many sources of error, it is anticipated that the accuracy is lower than normal. It is estimated at ±0.20 m of water equivalent. It may be more realistic to say that the Hardangerjøkulen ice-cap was nearly in balance in 1975. The height of the equilibrium line was approximately 1630 m a.s.l.

Storbreen
This glacier in Jotunheimen is also observed by Norsk Polarinstitutt. It has one of the longest series of mass balance observations in the world, as Olav Liestøl started these investigations in 1948.

The snow accumulation was larger than normal: 1.55 m of water equivalent compared to 1.36 m in an average year. The hot summer caused an ablation of 1.70 m of water equivalent so that the glacier Storbreen—in spite of the large accumulation—suffered a slightly negative net balance, amounting to −0.15 m of water equivalent in 1975.

Hellstugubreen
This valley glacier in Jotunheimen has been studied for several years. During the last few years the data have been used for hydrological purposes, due to the fact that part of Jotunheimen was considered for future water power development and the glacier's influence on the stream discharge variations was previously almost unknown.

The winter balance amounted to 0.91 m of water equivalent, which is 125% of the average winter balance during the period 1963-74; a higher winter balance was found only in 1967 and 1968.

The summer balance amounted to 1.71 m of water equivalent. The summer balance is also higher than the average (126% of the average for the period 1963-74) so that the glacier in 1975 reduced its mass corresponding to a net balance of −0.36 m of water equivalent. The equilibrium line reached a height of 1950 m a.s.l.

Gråsubreen
Similar to Hellstugubreen, this small glacier in the eastern part of the Jotunheimen area has been observed for a fairly long period (from 1963). The mass balance measurements are normally based on observations performed during visits throughout the year. In 1975

approximately 115 snow depth soundings were made and the snow density was determined in a pit at approximately 1960 m a.s.l. Data from this pit is regarded as representative for the entire glacier, due to its relatively small size.

The winter balance amounted to 0.91 m of water equivalent. Also on this glacier we found a 25% higher winter balance than the average for the period 1963-74.

The summer balance, calculated from readings on 19 stakes, amounted to 1.86 m of water equivalent which is almost a record for this glacier; it is 196% of the average summer balance for the period 1963-74—a higher summer melt was found only during the summer of 1969.

The unusually high summer balance caused a significant deficit in the mass balance—a larger deficit was found only in 1969. The net balance amounted to −0.95 m of water equivalent. The glacier lost mass all over its surface so that the equilibrium line reached an altitude of approximately 2300 m a.s.l., i.e. higher than the glacier's highest point (the altitude was determined theoretically and is thus only an artificial figure).

Høgtuvbreen

The winter season started very early on Høgtuvbreen, south of the Svartisen ice cap. Already on 10 October a snow layer of 3-4 m covered the glacier. In total 207 snow depth soundings were made along no less than 19 km of sounding profiles.

The winter balance amounted to $7.8 \cdot 10^6 m^3$ water or 3.0 m of water equivalent. The summer balance amounted to 2.27 m of water equivalent. Consequently, the glacier experienced a positive mass balance amounting to +0.73 m of water equivalent. This is the second time since 1971 that Høgtuvbreen has shown a positive balance; the first time was in 1973. The reason for the positive balance in 1975 is mainly a cool summer, when the ablation amounted to only approximately 65% of the average for the years 1971-74.

Engabreen

This is a west-facing outlet glacier from Svartisen. The snow survey was made 22-30 May, when a total of 280 snow depth soundings and 5 corings were made. The snow density was observed in pits and by corings at locations about 1000 and 1300 m a.s.l.

The large area (almost 40 km^2) and the very heavy snow cover always make snow inventories difficult on this glacier. We attempt, however, to distribute the observations as evenly as possible over the entire glacier surface. The winter balance amounted to 3.18 m of water equivalent.

The weather during the summer was fairly bad, with frequent snow falls and heavy winds. Consequently, the summer assistants experienced many difficulties in the completion of their tasks. The summer balance was 1.57 m of water equivalent. The net balance for 1975 turned out to be positive, amounting to +1.61 m of water equivalent. The equilibrium line reached an altitude of 960 m a.s.l. The year 1975 is the third consecutive year of positive mass balance for Engabreen.

The bad weather conditions during the summer may be best characterized by the mean cloud cover, which amounted to 8.7 (tenths) for the entire summer. July had no less than 23 days of complete cloud cover or fog. Only 9 days throughout the entire summer had less than 5/10 cloud cover. Maximum daily precipitation occurred on 19 June when 49 mm were observed. Only 13 days throughout the entire summer had no precipitation.

The mean water vapour pressure was 7.7 mb for the entire summer. Only 9 days throughout the summer had a water vapour pressure less than 6.1 mb. It is therefore quite obvious that water vapour condensation must have taken place at the glacier surface during most of the summer season 1975.

Trollbergdalsbreen

The mass balance investigations on the small valley glacier Trollbergdalsbreen (north of the eastern part of the Svartisen ice cap) were intended to last only five years, 1970-74. However, it was decided to read all stakes in 1975 and make some additional observations in order to calculate the net balance for the year 1975. These calculations indicate a mass deficit corresponding to a net balance of −0.28 m of water equivalent. The position of the equilibrium line was approximately 1070 m a.s.l.

Of the previous five years of observations a positive net balance was found only in 1973, and the total mass loss during the six years 1970-75 amounted to −3.94 m of water equivalent.

A COMPARISON OF THE MASS BALANCE ON INDIVIDUAL GLACIERS

The mass balance was investigated on 12 glaciers in 1975. Nine of these are situated along an east-west profile in Southern Norway and these glaciers are regarded representative for fairly large glacierized areas. In Northern Norway only glaciers in the Svartisen area are investigated, so little knowledge is obtained for the rest of the glaciers in that part of the country. The nearest location for detailed mass balance investigations is Storglaciären in Northern Sweden where continuous observations have been made since 1946.

A typical condition at glaciers in Southern Norway was a very heavy winter accumulation, particularly on the western side of the water divide. For all glaciers in Southern Norway the winter balance turned out to be between 10 and 30% larger than average. However, the summer 1975 was much warmer than normal

and caused a much greater ablation than the average. The heavy snow cover on the westernmost glaciers resulted in a positive balance there, whereas glaciers east of the water divide (generally in Jotunheimen) had a more or less negative mass balance in 1975.

Heavy snow accumulation was also experienced in Northern Norway and the glaciers under study received more snow than normal, particularly in the western part of the investigated area. A cool and moist summer caused less ablation than normal so the two glaciers Engabreen and Høgtuvbreen got a positive mass balance in 1975. The steep gradient in winter accumulation resulted in a markedly smaller winter balance on Trollbergdalsbreen (0.73 m of water equivalent) compared to Engabreen (1.61 m). This caused a slightly negative balance (−0.28 m) for Trollbergdalsbreen.

In general, the mass balance results show a marked gradient from west to east both in Southern Norway and Northern Norway. Observations made on a single glacier can therefore not be taken as representative for larger areas in an east-west direction, even when the distance is relatively small.

FRONT VARIATIONS

The best investigated glaciers concerning front variations are Engabreen and Nigardsbreen. At the beginning of this century the Engabreen outlet glacier covered the present lake Engavatn completely but started its retreat about 1930 and left the lake in 1944. The distance from the lake to the glacier front is now about 300 m. Norsk Polarinstitutt started distance measurements from one survey point to the glacier front in 1965. NVE started similar measurements in 1972, but used 11 survey points, distributed along the frontal part of the glacier tongue, ranging from 60 m a.s.l. to 275 m a.s.l. The *mean* retreat decreased from 19.2 m in 1973 to 2.6 m in 1974 and equalled zero in 1975 when some parts of the tongue in fact started to advance, the largest advance (18 m) was found at survey point K. After several years of positive mass balance it must be expected that the glacier tongue will soon start to advance significantly.

Similar measurements have been made at Nigardsbreen where several years of positive mass balance have been observed (more than 6 m of water equivalent in the period 1962-75) and it is therefore expected that an advance may start within the coming few years.

SEDIMENT TRANSPORT STUDIES IN NORWEGIAN GLACIER STREAMS 1975

The Department of Physical Geography at the University of Stockholm co-operates with the Norwegian Water Resources and Electricity Board (Vassdragsvesenet, NVE) to perform sediment transport studies in selected glacier streams in Norway. When glacier streams are utilized for water power production, the solid particles may cause particular problems: the fine material causes increased wear in turbines etc., whereas coarse material may accumulate in such quantities in reservoirs that this silting-up effect must be taken into account in the planning procedure. Also in cases of subglacial water intake (which is now implemented at one outlet glacier and is planned for several other glaciers in Norway) it will be necessary to make sedimentation chambers in the bedrock under the glacier. The size of these installations must be based on knowledge of bed load measurements in the glacier streams.

The sediment transport studies have also a scientific purpose. The rate of glacial erosion has been discussed for several years but in most cases without too much "ground truth". A continuous sampling programme at various streams near the glacier front may provide valuable data for further discussions on the erosional effect of various glaciers.

The field work was in 1975 concentrated at the following three locations: Nigardsbreen and the Visa River in Southern Norway and Engabreen (an outlet glacier from the Svartisen ice-cap) in Northern Norway. Attempts were made in all cases to observe both the fine material in suspension and the coarse material carried as bottom load. The first mentioned material was determined by frequent water sampling throughout almost the entire melt season, whereas the bottom load was determined for the entire summer by delta growth measurements in lakes or similar basins.

Two observers were based at each location during the summer. The river water discharge was monitored by automatic water level recorders, whereas the samples were taken by one-litre plastic bottles in a turbulent reach of the stream, at least 5 times a day (between 0700 hrs and 2300 hrs). More frequent sampling took place during periods of rapidly rising water discharge, when hourly samples were taken.

Duplicate samples were taken at least once a day to test the reliability of single samples. The bottles were taken up from the river as soon as they were filled or almost filled and the total water volume in the bottle was measured for each single sample. Filtering was performed in the field and the filter paper was sent to the laboratory in Oslo for ashing and weighing.

Nigardsbreen

Studies of the sediment transport in the stream from the 47 km^2 large outlet glacier Nigardsbreen which drains eastwards from the Jostedalsbreen ice cap have taken place annually since 1968. In general, samples have been taken between the glacier front and the lake Nigardsvatn, which is situated only a few hundred metres from the ice front, and at the

lake outlet. This enables us to calculate the amount of fine sediment which is settling on the lake bottom. The bottom load was directly observed in 1969 when a large fence was constructed across the stream. Since then the annual increments of delta deposition has been surveyed and these observations form a base for calculations of the annual bottom load.

The total amount of suspended material carried by the stream into the lake amounted to 9500 metric tons during the period from 27 May to 14 September 1975. During the same time 2100 metric tons fine sediment left the lake. This means that 78% of all the fine material that was carried into the lake remained there and settled on the bottom.

From the water discharge observations, made before and after the field season proper, it is assumed that the unobserved sediment transport amounts to about 1500 metric tons. Thus, the total transport of suspended matter in 1975 is estimated to be 11,300 metric tons.

The amount of coarse material carried as bottom load, determined from delta increment studies made by S. R. Ekman, indicates that from the fall 1974 to the fall 1975 a total accumulation of 7800 m^3 has taken place. This material consists of particles larger than 0.5 mm in diameter and is estimated to correspond to 15,600 metric tons of coarse material. This means that in total approximately **27,000 metric tons** of solid particles have been removed from the Nigardsbreen drainage basin in 1975.

The relation between the river's transport of suspended material and bottom load has been calculated for the 7 years 1969-75. The amount of suspended material ranges from 41% to 73% of the total sediment transport from the glacier. The average value of these years is 50%. However, a part of the fine material (material carried in suspension) may have settled on the delta, so it is therefore assumed that the coarse material carried as bottom load amounts to approximately 40% of the total material transported. This percentage is thought to be valid also for other glaciers provided measurements are made close to the glacier front and provided similar geological conditions are present.

Visa

The observation point in the river Visa, draining parts of the Jotunheimen area, is located much farther from the glaciers than all other sampling places used during the last few years. The distance from the closest glacier is approximately 15 km, so it is anticipated that a certain part of the coarse material has been deposited along the stream between the glacier and the sampling point. The amount of suspended sediment, however, is thought to be relatively representative at the sampling point because the river is fairly turbulent all the way from the glaciers and particles will be held in suspension during normal summer discharge conditions.

To measure the bottom load, an artificial dam was constructed in 1974 across the stream, close to a bridge in the main valley where the river Visa joins the river Bøvra. This dam was only partly filled in 1974, so the experiments were continued in 1975 by frequent surveys of the accumulation of material on the upstream side of the dam. Water samples for the determination of suspended sediment load were taken from 10 June to 23 September. After the end of the field period a flood destroyed the dam. The maximum discharge was observed during a short period on 23 July, when it amounted to 142 m^3/s due to an unusual rainstorm. The sediment transport during this short period was much higher than during the rest of the summer. The highest concentration was then 2925 mg/l and the total daily transport amounted to 5600 metric tons which is approximately 20% of the total sediment transported during the entire summer. This confirms the assumption that the sediment concentration increases very rapidly with increasing water discharge so that most of the sediment transport occurs during relatively short periods of high water discharge. In total, it is assumed that the river moved approximately 30,000 metric tons of fine material during the summer.

The amount of bottom load as calculated from repeated surveys of the increasing accumulation in the artificial dam was 3750 metric tons.

The relation between bottom load and total transport of solid matter for the entire measuring period, i.e. September 1974—September 1975, is 11%, which coincides well with the 1974 figure of 13%. These figures differ greatly from the figures found at glacier fronts, for example at Nigardsbreen (40%), but this contrast is obviously related to the large difference in distance from the glacier—several kilometres opposed to a few hundred metres.

Engabreen

Water discharge and sediment transport observations have been carried out annually since 1969 at the front of Engabreen, a 38 km^2 outlet glacier from the Svartisen ice cap. The results have been published annually.

Water samples are taken routinely at the inlet and the outlet of the lake Engavatn (1.2 km^2) where water discharge is continuously recorded at an automatic water level gauge. Differences in water discharge into and out from the lake are observed by frequent water discharge measurements. The delta at the inlet was accurately surveyed in February/March 1976 when the lake was ice-covered. Similar surveys were made in the winter 1975 at points 5 m apart along 8 profiles across the delta.

In the period 3 June—16 September, a total of 14,150 metric tons of suspended material was transported into the lake and 1530 metric tons out of the lake. Thus, 89% of the suspended material settled in the lake. This is

slightly more than during previous years when the percentage has ranged between 75 and 88. An estimate was made concerning the amount of sediment moved by the stream before and after the field period proper. Taking this into account, the total transport of suspended sediment is estimated at 16,400 metric tons.

Surveys of the increments on the delta and subsequent calculations are considered good because both surveys were made from solid ice on the lake. If the density of the coarse material deposited on the delta is considered 2 g/cm^3, the increment on the delta (4325 m^3) amounts to 8650 metric tons. Consequently, in total approximately **25,000 metric tons** of solid material was moved from the Engabreen during the summer 1975. Of this amount the bottom load accounted for about 35% which is slightly less than the corresponding figure for Nigardsbreen.

The accuracy in the measurements at the delta in Engavatn is probably slightly less than the measurements at Nigardsbreen because the measuring cables cannot be stretched as well as can those at the lake Nigardsvatn. The measurements should therefore be repeated several years before conclusions can be drawn concerning the relationship between bottom load and suspended sediment at this location.

G. Østrem

SWITZERLAND

GRIESGLETSCHER, VALAIS

A detailed structure-strain analysis on the Griesgletscher, upper Valais, begun in 1974, is nearing completion. Although the glacier is simple in shape, it has a small ice-fall which produces a complex structural pattern. The main feature is an arcuate foliation apparently related to transverse crevassing at the top of the ice-fall. Associated with this foliation are numerous minor folds which appear to be derived from an earlier longitudinal foliation originating beneath firn above the ice-fall. Detailed mapping and measurements of c-axes are being carried out with a view to elucidating the origin of the foliation and the effects of progressive deformation.

Using velocity data obtained in previous years by H. Siegenthaler (VAW, ETH-Zürich) for Kraftwerke Aegina A/G, it has been possible to determine large-scale strain rates for most of the glacier surface. These show that the foliation does not form with a precise orientation with respect to the principal strain rate directions. For example, in the centre of the glacier the foliation is approximately normal to the direction of maximum compression, but at the margins, where the foliation trace is longitudinal, it forms an angle of about 45°. More detailed strain studies are under way to determine the structure-strain relationships more precisely.

The velocity data have also been used to estimate roughly the orientation and magnitude of cumulative ("finite") strain which the ice has progressively undergone in travelling between the ice-fall and the snout. In the centre the long axis of the cumulative strain ellipse remains approximately parallel to the foliation and at the snout attains an axial ratio of 3.4:1. Near one of the margins the long axis of the strain ellipse is initially orientated at a moderate angle to the foliation, but becomes rotated parallel to the foliation with progressive deformation; The resultant strain ellipse near the snout has an axial ratio of 69:1. These results may have some bearing on the origin of slaty cleavage and schistosity in deformed rocks.

M. J. Hambrey & A. G. Milnes

UNITED KINGDOM

NORWAY: QUEENS' COLLEGE, CAMBRIDGE, EXPEDITION TO SVARTISEN 1976

The 8-person expedition spent 3 weeks in July working on the ice cap. The excellent weather to some extent helped to offset the difficulties caused by the huge quantities of remaining snow, although the streams and rivers became very swollen with meltwater, making for hazardous crossings. From the base camp, exactly astride the Arctic Circle, three further camps were established to enable various projects to be undertaken. These activities will be reported in full detail in the main Expedition Report. The glaciological work included the following projects:

Plane-table survey maps were made of the lake, snout and moraines of the Flatisen glacier and the area ahead of the Kampliisen snout. The position of the Flatisen snout can be compared with several other records made this century, to

determine the rate of retreat of the glacier. A further comparison will be made using the moraine positions on the plane table map. Maximum lichen sizes (Rhizocarpum geographicum) were measured on these moraines, which should enable a realistic estimate to be made of the date of deposition. A mechanical glacier meter was placed in the ice above the Kamplii-sen icefall. This instrument, built in the University Engineering Laboratories, was designed to provide continuous records of glacier motion. The heavy snowcover over the glacier ice meant that the installation of the meter was delayed until a rather late stage in the Expedition and in an unfavourable position in a complex icefall region. Limited results were obtained, but the real gain was invaluable experience of field conditions which will lead to a much improved design for future expeditions. This experiment was rudely terminated by torrential rain which precipitated a hasty evacuation of Icefall camp and return to Base, marking the end of the field work.

R. Smith

CUCHLAINE KING

Cuchlaine King grew up in the academic atmosphere of Cambridge. Her father was a well-known geologist, William B. R. King, who taught in the University for many years and was appointed to the Woodwardian Chair of Geology in 1943, holding the professorship until his retirement in 1955.

With such a background, it was hardly surprising that Cuchlaine won a place at Newnham College, Cambridge, to read for the Geographical Tripos. This Honours Degree course in fact encompassed many of the studies which in many North American universities come under the aegis of Geology faculties. Under the leadership of Professor Frank Debenham, of Antarctic fame, and with specialists in geomorphology of the calibre of Vaughan Lewis and Alfred Steers, the Cambridge Geography Department developed a world-wide reputation for such work. In the 1930's, '40s

and '50s many people now well-known to the glaciological community, for example, received their specialist training in the Department, and Cuchlaine, who studied there from 1940-43 as an undergraduate, is one of the most eminent alumni.

After graduating, she served from 1943-46 in the Meteorological Branch of the Women's Royal Naval Service. On her return to Cambridge she studied for a Ph.D., which she obtained in 1949. The subject of her thesis was the movement of sand on beaches. Upon completion of this degree, she went to Durham University as a Demonstrator in the Geography Department but moved after one year to Nottingham University, where she has stayed ever since. Her first appointment there was as Assistant Lecturer 1951-53 in the Geography Department. In 1953 she became Lecturer, and in 1961 Reader. By this time her interests in geomorphology had shifted towards a glaciological emphasis, partly as a result of expeditions to Iceland and Norway. In 1969, in recognition of her work in many aspects of geomorphology, she was appointed to the newly created Chair of Physical Geography, a position that she still holds. For three years, 1973-76, she also served as Head of Department. From time to time she has given courses at universities in various parts of the world: at Canterbury University in New Zealand in 1956, at the Institute for Arctic and Alpine Research, University of Colorado in 1960, and at Binghampton Campus of the State University of New York 1972-73.

The inspiration that Cuchlaine received from teachers such as Frank Debenham and Vaughan Lewis has been passed on to many of her students, of whom three are of particular interest to glaciologists, for they are all internationally known for their work. Malcolm Mellor, Jack Ives and John Andrews were students at Nottingham University in the mid-1950s: all have distinguished themselves academically. Malcolm, an engineer with the U.S. Cold Regions Research and Engineering Laboratory, is also now the Secretary of the International Commission of Snow and Ice, while Jack and John have built up INSTAAR at the University of Colorado, with Jack as Director.

An undergraduate expedition from Nottingham to south-east Iceland in 1953, which began as a typical student event, was persuaded by Cuchlaine to become more serious and professional and to take along herself and another woman, newly graduated from Cambridge. Very unsure of their reception from a group of "ruffians" who were barely enthusiastic about having them, they quickly made the men look to their laurels. The leader, Jack, soon realised that the best way to make an expeditionary group work was to have the right mix of men and women. Cuchlaine gave the expedition a degree of scientific organization and surveying expertise that could never have been mastered among the students alone. Her insistence upon the utmost accuracy possible regardless of conditions was typical of her field work. Her physical endurance was formidable: even after long hours of surveying in heavy winds, sometimes blown off her feet, camp chores such as the bringing in, over several extra miles, of extra supplies would be accomplished without comment even if she were the only person willing to go.

Her quiet professionalism, persistence, imagination and quiet warmth were no less appreciated on the Austerdalabreen, Norway, expeditions initiated by Vaughan Lewis and joined by many well-known glaciologists during the period 1955-59: John Nye, John Glen, Bill Ward were among the experts who worked there during various summers. Field work in Baffin Island, with Jack Ives and John Andrews, who were now working for the Canadian Government, in the summers of 1965 and 1967 concentrated on deglaciation and sea level changes. Interest in till fabrics and glacial morphometry has taken her to areas around the Baltic Sea, but her main love is for glaciated mountain environments. She is motivated by this and has influenced others to be similarly motivated.

INTERNATIONAL GLACIOLOGICAL SOCIETY

AWARDS

SELIGMAN CRYSTAL

Seligman Crystals are awarded "from time to time to one who has contributed in a unique way so that the subject is now significantly enriched as a result of that contribution." The Council agreed at a meeting on 14 September 1976 that a Crystal be awarded to **Dr Barclay Kamb** (California Institute of Technology) for his outstanding and unique contribution in ice physics. The Council felt that an important aspect of his work is the inspiration he has given to the younger generation of glaciologists, especially through his field work on the glaciers of the Pacific Northwest. The Crystal will be presented to Dr Kamb in September 1977 at a special meeting of the Society in Cambridge, England, during the week of the Symposium on Physics and Chemistry of Ice.

HONORARY MEMBERSHIP

Under the Constitution of the Society, "Honorary Members shall be elected by the Council in recognition of eminent contributions to the objects of the Society". At its meeting on 14 September 1976, the Council elected **Dr A. L. Washburn** an Honorary Member in recognition of his important influence on the development of snow and ice science in the USA, his establishment of a Quaternary Research Center in Seattle, and his active research on permafrost processes.

The Honorary Members now number 10, the maximum allowed under the present Constitution: **A. P. Crary, W. O. Field, R. Haefeli, P. Kasser, R. F. Legget, M. de Quervain, R. P. Sharp, S. Thorarinsson, A. L. Washburn and Z. Yosida.** The Council has recommended that the number be increased to 12, the first increase since the Constitution was established in 1962; in this period the membership of the Society has increased significantly. A postal ballot has been sent to all members about this proposed change and the result will be reported in the next issue of ICE.

PRESENTATION OF SELIGMAN CRYSTAL 1976

On 15 September 1976 a special meeting of the Society was held in the Scott Polar Research Institute, Cambridge, to mark the award of the Seligman Crystal to Dr Willi Dansgaard of Copenhagen. The President of the Society, Dr Marcel de Quervain, spoke as follows:

"In 1963, on occasion of the retirement of Gerald Seligman, the founder of the International Glaciological Society, an award was established to be given to people who have made outstanding contributions to the science of glaciology. This award, the Seligman Crystal, is the only distinction of international character in the field of glaciology.

According to the rules connected with the allocation of the award, it is not possible to give it to someone just for reasons of policy, age or general activity. The statutes say: 'The Seligman Crystal shall be awarded from time to time to one who has contributed to glaciology in a unique way so that the subject is now significantly enriched as a result of that contribution.' Thus an individual spiritual achievement and a visible lasting effect on the science of glaciology are required.

The Society has the great pleasure, for the 7th time in its history, to award a Seligman Crystal. It is offered to the speaker of our special lecture to-night: Dr Willi Dansgaard, Director of the Geophysical Isotope Laboratory of the University of Copenhagen, Denmark.

Dr Dansgaard has related the composition in stable and also in radioactive isotopes of natural ice deposits to the condition prevailing when this ice was formed, applying an elaborate technique of extraction, analysis and interpretation, from which he was able to derive the age of these deposits. This was applied first to determine the age of the ice of icebergs and to trace their origin.

In a subsequent series of investigations he looked into the strata of polar ice masses, revealed by bore holes, and in analysing their isotope content he could read the history of their formation like a book. For the first time we were presented with a dated profile through the Greenland ice sheet from the top to the ground, and could see periods of ice ages. There is no need to say more about these findings, since Dr Dansgaard will explain them himself to us.

We recognize that by Dr Dansgaard a new page of glaciology was opened, and the subject has really been enriched.

On behalf of our Society I have now the pleasure and the honour of presenting you with the Seligman Crystal. May it be accepted as a token of our high appreciation."

Before giving the special lecture, which summarized the work done by his research group and the projects currently being studied, Dr Dansgaard made the following speech of acceptance.

"Mr President: Thank you for your words, they were much too kind.

I must admit that, a year ago, when I received your letter about the nomination of the Seligman Crystal my first feeling was pride. That is not a particularly humble feeling, but I am sure everybody will condone this as an understandable human weakness.

My next feeling was one of doubt. Looking down the awe-inspiring list of distinguished receivers of the award, I began to have certain fears that the Council had made a mistake, and to this very moment I have not been able to convince myself that it has not. Even within the limited area of this auditorium, there are several persons who would have got my vote if I had had one to give.

However, I keep telling myself that since we have hidden nothing the Council ought to know what it is doing. Consequently, I gratefully accept the Crystal in the hope that you will allow me to do so on behalf of my group in Copenhagen: Henrik Clausen, Niels Gundestrup, Claus Hammer, Sigfus Johnsen and Niels Reeh. They deserve at least half of it. If we have done some good work—and I think we have, like so many other people—one important reason is that all members of the group, while approaching the same object, the ice cores, from different angles, have displayed the same high standard of skill and enthusiasm. Another reason is that we were privileged in having access to the Camp Century ice core by courtesy of Chester C. Langway, who first perceived the many-sided aspects of ice core studies. We owe him many thanks for his excellent co-operation. Last, but not least—we are favoured by the fact that we work mainly in Greenland. There, many complications are overcome, because Nature is apt to behave as it is supposed to according to the text books.

So, we gratefully accept the Crystal. We welcome the inspiration and we accept the responsibility that goes along with it. Thank you."

SYMPOSIUM ON APPLIED GLACIOLOGY 1976

143 people, from 16 countries, and including 116 participants, attended the Society's Symposium in Cambridge, England, 12-17 September 1976.

The President of the Society opened the Symposium on Monday morning, 13 September.

"I welcome you on behalf of the IGS to the Symposium on Applied Glaciology. With this gathering of scientists and engineers the Society intends to get out of the ivory tower of pure science and to provide a link between practical problems related to snow and ice and theoretical work.

A first symposium of this kind has necessarily to be vast in its scope and should not be devoted to just one narrow field, although a practical problem is always something very special. So we expect to get a colourful display of specific subjects with many questions being raised—and probably many of them being left open. But once raised and discussed they may inspire new research and future solutions. And this is the basic idea of the symposium.

Among the great number of papers submitted, the Papers Committee had to select an appropriate number for presentation. Priority was given to those directly related to applied or engineering work. Thus, many contributions of fundamental character and high scientific quality had to stay back this time, but I hope they will reach the public through other channels.

A number of speakers have been invited to offer us a general survey on applied problems and to outline the scientific background. I wish to thank these speakers first for having accepted readily this difficult task, and next all others who have contributed to the Symposium in any form.

I shall have the opportunity to express the thanks of the Society in more detail later. Now I am very anxious not to consume any of the scarce time allotted to our speakers. In this respect I hope that the speakers and chairmen will follow me in watching strictly the time-schedule—which also implies that we start our sessions on time. I declare the Symposium opened."

During the week of the Symposium, 62 invited and contributed papers were read, and some short presentations were made on work recently completed in the field. Many of the papers, and discussions summarised by rapporteurs for each session, will appear in Volume 19, Number 81 of the *Journal of Glaciology*. It will probably exceed 500 pages in length. We hope to publish this in September 1977, within one year of the event. Members of the Society will receive a complimentary copy. Individuals who do not hold membership of the Society may purchase the Volume for £20. Orders may be placed with the Secretary.

After the Symposium, 19 people joined the specially arranged tour of Scotland. A photograph appears on the next page.

Participants on the 1976 Post-Symposium Scottish Tour admiring some of Mikel Utsi's reindeer on Glen More. He introduced reindeer to Scotland from Sweden in 1952. The herd now consists of animals born in Scotland and numbers about 100, grazing freely over the uplands.

An open letter to "no-show" authors at conferences from the President of the International Glaciological Society.

October 1976

Dear Colleague,

The International Symposium on Applied Glaciology is over and has left strong traces of new ideas on old problems related to snow and ice engineering and it has created many new contacts and consolidated old friendship within the Society and toward new potential members.

We regret that you could not be with us and were not able to participate in the benefit of the event. The reasons were certainly imperative—we do not know them. We did not even know that you were prevented from coming until the moment when you were called to present your paper. Have you ever thought about the consequences of this unannounced abstention in a well arranged tight programme? The next speaker may be called on and if he is ready he may rush in. But the timetable is upset and some in the auditorium may miss a paper which they were interested in—and some may miss just your paper. Have you considered that other papers have been rejected, probably some valuable contributions among them, in favour of your offer? A few of these authors were put on a waiting list in case another speaker had to drop out: But he can only be "promoted" and asked to make his presentation if a paper is cancelled well in advance.

We realise that there can be instances of higher power, sudden illness, an accident, death, when human programmes are subordinated to higher directives. These are the cases we have to take without protest. Please pardon me if such a case has caused your absence.

Yours sincerely,
M. de Quervain
President

ANNUAL GENERAL MEETING 1976

President, M. de Quervain

Treasurer, J. A. Heap

MINUTES OF THE ANNUAL GENERAL MEETING OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY 16 SEPTEMBER AT THE CHEMICAL LABORATORY, CAMBRIDGE, ENGLAND

The President, Dr Marcel de Quervain, was in the Chair.

1. **The Minutes of the 1975 Annual General Meeting,** published in ICE No. 48, 2nd issue 1975, were approved and signed by the Chairman.
2. **The President** gave his report for 1975-76:

The period of the 18 months since our last Annual General Meeting about which I have to report is characterized by a steadily intensifying activity of the Society and also by an expansion of its field of activity. Whereas a decade ago the programme of the Society consisted of an annual meeting with an informal presentation of recent glaciological work and of the dissemination of written information by the ever growing *Journal,* the Society started in recent times to organize its own Symposia with subsequent publications of the proceedings in the *Journal.*

Beyond this production of its own, the Society has offered a publication service to other groups with glaciological interest, publishing their symposia papers as separate volumes of the *Journal.* I do not want to put these feathers in my hat: all this started well ahead of my term of presidency; but in the past year a remarkable cumulation of activities of this kind has occurred. The following projects had to be handled nearly simultaneously:

- Publication of the proceedings of the 1974 Symposium on Remote sensing in glaciology, organized by the Society.
- Publication of the proceedings of the 1975 Symposium on Thermal regime of glaciers and ice sheets, organized by the Canadian NRC.
- Preparation for the Society's present 1976 Symposium on Applied glaciology.
- Planning of the Society's 1977 Symposium on Physics and chemistry of ice, to be held in Cambridge.
- Preliminary planning of our 1978 Symposium on the Dynamics of large ice masses, to be held in Ottawa.

It may be noticed that in our efforts particular emphasis is given to introducing new techniques into old fields of research and to offering a survey on all aspects of our subject.

Our members benefit from this activity even if they cannot attend the symposia, because they receive free the extra volumes of the proceedings. These volumes are separately funded and are not charged to the account of the three regular issues of the Journal. On the contrary, the economic effect is expected to be beneficial for the Society as a whole.

Behind this service there is obviously a great amount of extra work for our editors and reviewers, and we have to recognize the need for more clerical assistance for the editors or even for a proper editorial office. Similar thoughts hold for the general work of the Society; our Cambridge headquarters is still operated by only 2 people, Mrs Hilda Richardson and her assistant Mrs Beverley Baker. Their work has increased in similar proportions to that of the editors, and shows the same need for extra personnel and space.

Looking at the statistics of our membership and library subscriptions, we note with satisfaction that the substantial increase of the subscription rate at the beginning of 1976 did not significantly affect the figures. The numbers of 1034 members and 661 libraries at the end of April 1976 are about the same as in the previous year. Resigning older people are replaced by many young ones. The libraries are buying the extra volumes of the Journal and do it willingly—and certainly with profit.

Our regional branches have a life of their own. The *Western Alpine Branch* met in Barcelonette last October. The *Nordic Branch* met in Finland in March of this year. Both these events were combined with field excursions. The *British Branch* organized a one-day meeting in Bristol in April 1976.

By decision of the Council and unanimous approval by the annual meeting of 1975, Honorary Memberships were given to: Dr A. P. Crary, Washington, DC, USA, and Professor Peter Kasser, Zürich, Switzerland. We had the pleasure of awarding the Seligman Crystal to Dr Willi Dansgaard, Copenhagen, Denmark. These outstanding members have expressed their joy and their devotion to the Society by letters recently received.

The total in awards of Honorary memberships was reduced on 1 November 1975 by the loss of Sir Charles Wright. He died at the age of 88 and belonged to the search party who found the three remaining bodies of the members of the British Antarctic Expedition led by Scott. He was a great exponent in the classical period of glaciology and glaciological exploration. His name will remain in the history of this science. Our new Honorary Member will be Dr A. L. Washburn, Seattle, WA, USA.

Before ending my short report I wish to thank all those who have contributed to the life and activity of our Society. First of all our Secretary, Mrs Hilda Richardson, has to be mentioned. With an everlasting drive she pursues the interests of the Society, meets people, raises financial contributions and guides the President in his duties if he gets lost sometimes. I can say we owe her the cohesion and stability of the Society. Her assistant, Mrs Beverley Baker, operating with growing competence and independence, is included in my thanks.

The important persons in our publishing activity are the authors and our editors, Dr John Glen, Miss Doris Johnson, Dr Ray Adie and Dr David Homer. The duplication of the output has been mastered—I do not know how. Dr Glen's precision and thoroughness provides to the Journal a high standard recognized worldwide. I wish to thank him, his colleagues and the many anonymous reviewing scientists all over the world.

A special thanks goes to the Scott Polar Research Institute and its Director Dr Gordon Robin and for the great hospitality offered to the Society for more than 20 years.

Finally, I wish to thank the members of the Council who have contributed excellent suggestions to the development of the Society. Among the retiring members of the Council are our Vice President, Dr A. Higashi, and the 4 Elective Members, Dr B. Kamb, Dr D. Kuroiwa, Dr H. Oeschger and Dr O. Reinwarth. But there is one who has to be provided with the most respectful thanks—Dr John Heap, our Treasurer. I have followed for many years with growing admiration his way of handling our complicated financial matters. His judgement as to what we could afford and where we had to pull the brakes never failed. And his way of expressing his balanced feelings was even more impressive.

3. **The Treasurer,** Dr J. A. Heap, gave his report:

My report to you last year followed your Council's decision that the payments from members and libraries to the Society should be steeply increased. My report was therefore largely aimed at showing why, in the Council's view, the increase was necessary and to this end I looked into my special Treasurer's crystal ball and forecast a heavy deficit for 1975. I stand before you now—fortunately you may say within minutes of retiring as your Treasurer—to state that not only did the Society fail to make a thumping loss in 1975 but succeeded instead in making a healthy profit.

I am entirely unrepentant! But we (that is your Council) do owe you an explanation of what has happened. (You will notice how, having bared my chest to the slings and arrows of outrageous fortune, I have conveniently adopted the cloak of the collective responsibility of the Council.)

In 1975 we embarked on the new experiment of publishing 2 volumes of the Journal in a year—three normal issues of the Journal making

up one volume and an additional volume comprising the Proceedings of the Remote sensing symposium. In doing this there were two financial uncertainties—the first was whether all the libraries would agree to purchase two volumes in a year instead of one, thus doubling their expenditure on the Journal in the year, and the other was the degree of support we would receive from page charges. As you know it is the, I hope unalterable, policy of your Council that the acceptance of papers for publication is not dependent on whether the author has access to funds for page charges. For both library purchase and for page charges we had to budget prudently. For libraries we estimated that 60% would take the second volume. In fact only 3 out of about 600 libraries failed to take the extra volume. Page charge support remained steady, and thus the Society made a surplus of income over expenditure of £1,103.

[The Treasurer then reviewed the 1975 Audited Accounts.]

What about the future?

The Society has moved from being just another learned Society doing what is proper for learned societies to do, to a position where the decisions of your Council have very considerable effects on the glaciological community. The organizers of other symposia know that if the Society publishes their proceedings they have an assured distribution of 1650 copies. Evidence suggests that symposia proceedings distributed unilaterally by the organizers have great difficulty in approaching even one third this figure. As a result, your Council is inclined to view this development in the Society as here to stay—at least for the forseeable future.

But the pressure such a development exerts on the Society's administrative and editorial work is enormous. I have therefore suggested to your Council that they should look to ways and means of relieving this pressure. We should bear in mind the market value of services rendered to the Society, the necessity for adequate space and for an adequate number of people to fulfill the tasks.

The crucial point in my view is that if the Society, by reason of its own virtues, comes to hold a position of dominant importance to the subject of glaciology and the glaciological community, it must have economically sound foundations. The Society has traditionally depended on the very great dedication of a few people and if one of these had fallen by the way the plight of the Society would have been grave.

We should not go on like this. The result may cost more to members but I submit that the members have a very great interest vested in the continued health of the Society.

4. **Election of auditors for the 1976 accounts:** Dr Heap proposed and Dr L. Gold seconded that Messrs Peters, Elworthy and Moore, of Cambridge, be elected auditors for the 1976 accounts. This was carried unanimously.
5. **Elections to the Council 1976-79:** After circulation to all members of the Society of the Council's suggested list of nominees, no further nominations had been received. The following people were therefore elected unanimously:

Vice-President	L. W. Gold
Treasurer	J. A. Jacobs
Elective Members	H. Clausen
	S. C. Colbeck
	E. Palosuo
	J. G. Paren

FORTIETH ANNIVERSARY BANQUET

A Banquet to celebrate the fortieth anniversary of the founding of the Society was held during the evening of 16 September 1976 in Newnham College, Cambridge, England. 144 members and visitors were present. The President welcomed everyone and then reviewed the history of the Society.

"The IGS is, as you all know, celebrating its 40th birthday! On this occasion we may recall a few facts about the history of the Society.

The IGS has a brother, the ICSI, which is connected to us through common interests, common members and sometimes, as usual among brothers, some tensions. I did not realize until recently that this brother is actually our father.

It happened in 1936 that British Snow and Ice scientists gathered in London under the chairmanship of Gerald Seligman to inaugurate the British national counterpart to the International Commission of Snow, following the rules of this commission. At this time there was also an independent International Glacier Commission dating way back into the last century.

At the meeting of 1936 in London it was decided to join snow, ice and glaciers and to form a British 'Snow and Ice Association' and this was the start of our Society.

Between 1936 and to-day a number of important steps were made. From the very beginning this Association was a free group, accessible to professionals and amateurs in the field of snow and ice, and this fact marks the basic difference between the Society and the International Commission of Snow and Ice. One of the rules of 1938 says: 'Membership shall be open to all who are interested in the study of snow and ice.'

When the 2nd World War came the series of meetings was interrupted until 1945.

At this time the name 'British Glaciological Society' was adopted, still with Gerald Seligman as President. I may recall that he was originally a business man with a particular enthusiasm for snow and ice and an astonishing gift for observing and describing phenomena about snow and glaciers. As a skilled skier and mountaineer he spent many seasons in the Alps and as a product of his investigations he published the famous classic book: *Snow structure and ski Fields.*

In 1947 the essential bench mark was set on the way toward international reputation: Number 1 of the Society's publication the *Journal of Glaciology* appeared.

By 1952 the Society had grown to over 600 members, including many names from foreign countries, and it was in this year that the Secretariat was installed in the premises of the Scott Polar Research Institute and still is privileged to be there thanks to the kindness of its director, Dr Gordon Robin. Important changes also took place during the next year in the personal sector:

— Gerald Seligman resigned as the active leader of the Society and Vivian Fuchs took over the management;
— John Glen appeared on the editing board; and
— Hilda Richardson was appointed as Secretary of the Society.

These 3 people are here with us and the latter two are the most important and efficient exponents of our present activity.

I should have mentioned many other names but in doing so I might have missed one or the other and this would have been worse.

In order to reflect the international character of the *Journal* and the fact that the majority of the members were from non-British countries, the constitution was changed and the new name, The Glaciological Society, was adopted. This happened in 1962. Ten years later the word 'International' was added to the name, to reflect even more accurately the international status of the organization.

In 1963 Gerald Seligman retired also as President after 30 years of leadership. On this occasion the premier award of the Society, the Seligman Crystal, was created. The first one was given to Seligman and the latest one awarded, as you know, yesterday to Willi Dansgaard.

After 1963 the 3-years term of presidency was introduced. Sir Vivian Fuchs and John Nye, the first two Presidents, still rooted in the British tradition of the Society, gave the new era an excellent start, and then the post flew out to other countries, to Sweden with Valter Schytt and to the USA with Willy Weeks; but continuity in all our doings was granted here in Cambridge, our home base, by our Secretary, Hilda Richardson, up to the present day.

The statutes and the officers are containers only of an organization. The content and the true history of the Society lie in the work that has been achieved, in the publications contributed to the community of glaciology, the talks and discussions presented during symposia; and something else, very important, belongs to the values of the society.

It is a medium for establishing personal contacts and maybe friendship within this so badly tortured world.

I hope that this symposium is offering facilities to all these values, and is opening the doors toward applied glaciology.

Now I have the pleasure to give the word to our senior past president and outstanding member, Sir Vivian Fuchs."

Sir Vivian Fuchs proposed a toast to the Society.

"From what our President has said, you will have realized that our Society has come a long way in the last 40 years. Among those present tonight there are a number, like myself, who have memories of the early days in the 1930s.

Today the Old Guard look back with admiration on our Founder, Gerald Seligman, who steered the fortunes of the early Association, and later the Society, during the difficult times when all the work was voluntary, and little or no money was available even for publication—not perhaps surprising when I remind you that the subscription was only five shillings (25 pence in modern money)! Nevertheless, by 1939 members were receiving an internal record of meetings under the title 'Papers and Discussions'. Here I may add that, I believe, it was 20 years ago this year that our President of today first addressed the Society —his subject was 'Avalanches and Avalanche Defence'.

Although the war brought an end to regular meetings in 1940, Gerald Seligman was still able to read a paper, 'The structure of a temperate glacier', in March 1941. And it was with surprising speed after the end of hostilities that he called a meeting of the Committee on 16 July 1945.

From this time onward the Society went from strength to strength. In 1941 there had been 113 members, in 1946 only 128. But after the first issue of the *Journal of Glaciology* the number of members and subscribers rose steeply, in 1947-448, in 1948-504, 1949-603, 1951-646, by 1954-737, 1956-825, 1957-881. Today it is 1050, with 650 library subscribers. Have we reached saturation point? I very much hope not. It seems to me that the steady advance and improving quality is largely due to flexibility of outlook and constant adjustment to the thinking of the times.

As early as 1948 thought was given to limiting the scope of the *Journal.* Although guide lines were adopted, such as limiting papers to those

dealing with the effect of glacierization, as opposed to those concerned with rocks of glacial origin, it was decided that the exact scope of the *Journal* should not be defined. Similar problems arose in relation to other subjects, notably meteorology, but—wisely—no rigid rules have been adopted, and the Society has retained that flexibility which is essential to the success of any evolutionary line.

So, looking through the pages of our publications, we see a steady change from relatively simple, theoretical and practical studies such as glacier movement, sea ice formation, snow accumulation etc., to more sophisticated work on the physics of ice and its behaviour. All too seldom has there been discussion of the practical application of the growing knowledge of ice in various fields of engineering, construction and shipbuilding—even biological growth.

In this week's symposium on engineering problems there have been wide-ranging expositions, showing the ways in which existing knowledge can be applied, and the opening of doors to new forms of glaciological research. So, the Society again broadens its outlook, and in the future we can see *Journal* including original work in the fields you have been discussing.

In the past, glaciology has recruited its devotees from renegade geologists, geographers, physicists—even mathematicians. In the future I visualize a widening interest which will draw more and more people from other disciplines. Theoretical studies fulfill an academic need, but if they then lead to practical application, both the subject and our Society will flower indeed.

Ladies and Gentlemen, I give you the toast:

THE INTERNATIONAL GLACIOLOGICAL SOCIETY."

The evening concluded with a lively and amusing speech from Willi Dansgaard. No text is available, but the speech depended so much on the way it was spoken (and the editor would have to cut so many sections) that our readers will have to remain in ignorance, for once.

BRANCH NEWS

NORTHEAST NORTH AMERICAN BRANCH

A meeting of the NENA Branch will be held in the Macdonald Physics Building, McGill University, Montreal between the evening of 11 February (Friday) and noon on 13 February (Sunday) 1977.

Details of the papers presented will be given in the next issue of ICE. In addition to paper sessions, the social aspects of previous meetings will be preserved, with an opening cocktail party, hosted by the McGill Centre for Northern Studies and Research, a banquet, and cross-country skiing. The meeting is organized by the Vice President of the Branch, Dr M. P. Langleben, who will become President at the end of the meeting.

BRITISH BRANCH

The Branch will hold a business meeting on Wednesday 27 April 1977, at the conclusion of the afternoon session of the IGS Annual Conference. Details will be sent later to IGS members resident in the United Kingdom.

JOURNAL OF GLACIOLOGY

The following papers have been accepted for publication in forthcoming issues of the Journal of Glaciology:

R. Bindschadler, W. D. Harrison, C. F. Raymond and R. Crosson:
Geometry and dynamics of a surge-type glacier.

L. Lliboutry, B. Morales, A. Pautre and B. Schneider:
Glaciological problems set by the control of dangerous lakes in Cordillera Blanca.

(4 authors) Part I:
Historical failures of morainic dams, their causes and prevention.

(Lliboutry) Part II:
Movement of a covered glacier embedded in a rock glacier.

(Lliboutry, Morales, Schneider) Part III:
Study of moraines and mass balance at Safuna.

H. J. Zwally:
Microwave emissivity and accumulation rate of polar firn.

M. Ricq:
Migration of insoluble and soluble impurities in temperate ice: study of a vertical ice profile.

M. E. R. Walford, P. C. Holdorf and R. G. Oakberg:
Phase-sensitive radio-echo sounding at the Devon Island ice cap, Canada.

J. K. Maizels:
Experiments on the origin of kettle-holes.

Short notes

T. S. O. Sanderson:
An error in ice temperature measurement.

W. L. Graf:
The distribution of glaciers in the American Rocky Mountains.

INTERNATIONAL GLACIOLOGICAL SOCIETY

SYMPOSIUM ON DYNAMICS OF LARGE ICE MASSES — FIRST CIRCULAR

Ottawa, Canada, 21—25 August 1978

The Society will hold a symposium on Dynamics of large ice masses in Ottawa, Canada, in 1978. Registration will take place on Sunday 20 August and sessions will be held from Monday 21 to Friday 25 August.

PARTNER SYMPOSIUM

During the previous week, a symposium on "Glacier beds: the ice-rock interface" will be held in Ottawa, organized by the National Research Council of Canada Sub-Committee on Glaciers. The organizers of both Symposia hope that the planning of these two meetings will prove valuable and that participants will be able to attend both of them. Circulars about the Glacier beds Symposium may be obtained from:
C. S. L. Ommanney, Glaciology Division, Environment Canada, Ottawa, Canada K1A 0E7.

TOPICS

The Dynamics Symposium will be concerned with the dynamics of ice sheets past and present, ice caps, large valley glaciers, floating ice.

PAPERS

The Papers Committee will be happy to consider any paper that provides new information on the above topics. Details about the submission of summaries and final papers will be given in the Second Circular, to be published in the summer of 1977. Dates for submissions are firm ones and must be adhered to.

PUBLICATION

The Proceedings of the Symposium will be published in a special issue of the *Journal of Glaciology*. Papers will be refereed according to the usual standards of the *Journal of Glaciology* before being accepted for publication.

(The Proceedings of the partner Symposium on Glacier beds will also be published in a special issue of the *Journal of Glaciology*, with the same refereeing procedures.)

FURTHER INFORMATION

You are invited to attend the symposium and to return the attached form as soon as possible. The Second Circular will give information about accommodation, general programme, preparation of summaries and final papers, and group travel from Europe to North America.

Requests for copies of the Second Circular should be addressed to:

The Secretary, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, England.

COMMITTEES

Papers committee

J. T. Andrews
W. F. Budd
C. B. Bull
G. K. C. Clarke
W. D. Hibler
I. Zotikov
M. de Quervain (Chairman)
J. W. Glen (representing Editors of the *Journal of Glaciology*
H. Richardson (Secretary IGS)

Organizing committee

L. W. Gold (Chairman)
J. P. Johnson
R. M. Koerner
O. Løken
C. S. L. Ommanney
M. de Quervain (President IGS)
J. A. Jacobs (Treasurer IGS)
H. Richardson (Secretary IGS)

INTERNATIONAL GLACIOLOGICAL SOCIETY
SYMPOSIUM ON DYNAMICS OF LARGE ICE MASSES 1978

Family name .....

First name ..... Title .....

Address .....

.....

*I hope to participate in the Symposium, 1978 ☐

*I am interested in group travel from Europe to N. America ☐

*I expect to submit a summary of a proposed paper ☐

*I hope to attend the partner symposium on Glacier beds ☐

*without obligation

TO BE SENT AS SOON AS POSSIBLE TO:
The Secretary, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, England.

FUTURE MEETINGS (of other organizations)

SYMPOSIUM ON GLACIER BEDS: THE ICE-ROCK INTERFACE — FIRST CIRCULAR

Ottawa, Canada 16—19 August 1978

SITE

A symposium on "Glacier Beds: The Ice-Rock Interface" will be held at Carleton University, Ottawa, Canada, in 1978. Registration will take place on Tuesday, August 15, and sessions will be held from August 16 to Saturday, August 19. The Symposium is sponsored and organized by the National Research Council of Canada Subcommittee on Glaciers.

Following the Symposium the International Glaciological Society is sponsoring and organizing a symposium on "The Dynamics of Large Ice Masses" at Carleton University from August 21 to August 25, 1978. It is expected that many will wish to attend both symposia.

ACCOMMODATION

Accommodation will be available in student residences or, if preferred, in nearby hotels.

TOPICS

The prime concern of the Symposium is the interaction between land ice and the subglacial bed. Among the topics that will be discussed are: the nature of the ice-rock interface; subglacial hydrology; thermal conditions at the ice-rock interface; the sliding boundary condition; remote sensing of bed characteristics; erosion processes at the bed; physical and chemical properties of subsurface debris-laden and basal ice; physical and chemical processes at the glacier bed; conditions at the base of Pleistocene ice sheets.

PAPERS

Those who would like to contribute to the Symposium are requested to submit the titles of their proposed papers and extended summaries (two to three pages) by December 1, 1977, to:

C. S. L. Ommanney, Glaciology Division,
Environment Canada, Ottawa, Canada K1A OE7.

Titles and summaries should be in English or French. The summaries will be mailed to all participants before the symposium.

The Proceedings will appear in the Journal of Glaciology. Papers presented at the Symposium will be considered for publication in these Proceedings provided they have not been submitted for publication elsewhere. Further details concerning the preparation of typescripts will appear in the Second Circular.

SECOND CIRCULAR

A second circular with details regarding the submission of final papers, registration fees and prices of accommodation, along with a reservation form, will be distributed in July 1977. Individuals wishing to ensure that they receive this circular should complete the following form and return it to C. S. L. Ommanney.

**SYMPOSIUM ON GLACIER BEDS:
THE ICE-ROCK INTERFACE**

Family Name .....

First Name ..... Title .....

Address .....

.....

☐ Please place my name on the Symposium mailing list.

☐ I hope to participate in the Symposium.

☐ I hope to present a paper at the Symposium.

☐ I hope to participate in the partner symposium on the Dynamics of Large Ice Masses.

RETURN AS SOON AS POSSIBLE TO:
C. S. L. Ommanney,
Glaciology Division,
Environment Canada,
Ottawa, Canada.
K1A OE7

CONFERENCE ON PORT AND OCEAN ENGINEERING UNDER ARCTIC CONDITIONS

September 26-30, 1977 Memorial University of Newfoundland, Canada

This will be the fourth international conference concerned with coastal engineering in high latitude waters and will be held in the Province of Newfoundland and Labrador, Canada, at a time when there are unique problems and opportunities relating to human activity in arctic and sub-arctic waters. The exploration and development of hydrocarbon resources in the Arctic Islands and the Labrador Sea present an engineering challenge of immense magnitude. The traditional fishery, long an economic mainstay of the region, is entering a new era with the establishment of a 200 mile fishing zone, bringing with it the need for more and better management information and harvesting technology.

The Faculty of Engineering and Applied Science at Memorial University has made Ocean Engineering its particular focus, with concentration on ice and related problems. The Centre for Cold Ocean Resources Engineering (C-CORE) is a research institute established within the University, and the Newfoundland Oceans Research and Development Corporation (NORDCO) is a crown corporation providing research and development services to industry and government. All three organizations have a high level of involvement in the areas of interest to POAC-77.

The conference will be held on the campus of Memorial University in St. John's, capital of the Province of Newfoundland and Labrador. St. John's is perhaps the oldest port in North America, having been occupied by European fishermen since the sixteenth century. Today, St. John's is a modern city with a population of about 100,000. Daily flight connexions operate between St. John's and the International Airports at Gander, Newfoundland; Halifax, Nova Scotia; and Montreal, Quebec.

Programme

While the central theme of the conference is a concern for engineering problems under Arctic conditions, basic science and environmental topics related to this area will also be included. Within this northern and Arctic context, subjects to be covered at the conference will include: coastal zone management, ocean engineering education, environmental and regulatory considerations, harvesting and management of fisheries, harbours and terminals, marine transport and logistics, meteorology, oceanography, offshore structures, hydrocarbon exploration and development, remote sensing, seabed and sub-bottom science, sea ice.

Submission of papers

The previous conferences were all marked by a particularly high standard in the papers presented. The success of POAC 77 will depend upon a continuance of this tradition. Therefore, original contributions concerned with those topics listed in the Programme are solicited.

The title and a one-page abstract are to be received by the Chairman of the Organization Committee before 31 March 1977. Authors of papers selected for presentation will be notified and requested to submit a copy of their complete paper by 25 July 1977. The language of the conference will be English.

Proceedings

Edited versions of papers presented at the conference will be published in one or more proceedings volumes at a later date.

Registration

Participants will be able to register on Sunday 25 September 1977 or on the first day of the conference. The registration fee will be $150 (Canadian) before 1 August 1977. After that date, the fee will be increased to $175. Students will not be required to pay for registration.

Information

Further information may be obtained from: Dr G. R. Peters, Chairman—Organizing Committee, POAC 77, Faculty of Engineering and Applied Science, Memorial University of Newfoundland, St. John's, Newfoundland A1C 5S7, Canada.

GLACIOLOGICAL DIARY

1977

11–12 February
Northeast North American Branch of IGS, Montreal, Canada. (P. Langleben, Department of Physics, McGill University, 809 Sherbrooke St. W., Montreal, P.Q., Canada H3A 2K6.)

25–29 April
Symposium on Remote Sensing of Environment, Ann Arbor, Mich., USA (University of Michigan, Extension Service, Conference Department, Ann Arbor, Michigan 48104, USA.)

27–28 April
Annual Conference & General Assembly of IGS, Cambridge, England.

16–18 May
Canadian Symposium on Remote Sensing, Quebec City, P.Q., Canada. (J. Kruus, Canada Centre for Remote Sensing, 2464 Sheffield Road, Ottawa, Ontario K1A 0E4, Canada.)

16–24 August
International Union for Quaternary Research, 10th Congress, Birmingham, England. Sponsored by the Royal Society. (Dr J. W. Jardine, Dept. of Geology, University of Glasgow, Glasgow G12 8QQ, U.K.)

22–27 August
3rd Symposium on Antarctic Geology and Geophysics, Madison, Wisconsin, USA. Sponsored by Scientific Committee on Antarctic Research, Int. Union of Geological Sciences, & Inter-Union Commission on Geodynamics. Organized by US National Research Council (Polar Research Board of U.S. National Committee for SCAR). (Dr C. Craddock, Dept. of Geology and Geophysics, University of Wisconsin, Madison, WI 53706, USA.)

4–9 September
Symposium on Sea ice — processes and models, Seattle, Washington, USA. Joint AIDJEX and ICSI symposium. (M. Mellor, Secretary ICSI, CRREL, Hanover, NH 03755, USA.)

6–9 September
Symposium on Dynamics of temperate glaciers and related problems, Munich, Germany. European Geophysical Society. (L. Lliboutry, Laboratoire de Glaciologie, 2 rue Très-Cloîtres, 38031 Grenoble cedex, France.)

11–16 September
Symposium on Physics and chemistry of ice, Cambridge, England. International Glaciological Society. (Mrs H. Richardson, Secretary, International Glaciological Society, Cambridge CB2 1ER, England.)

21–27 September
Conference on Atmospheric aerosols, condensation and ice nuclei, Galway, Ireland. International Commission on Cloud Physics and Commission on Atmospheric Chemistry and Global Pollution (both of Int. Ass. of Met. and Atmos. Physics). (A. F. Roddy, Department of Physics, University College, Galway, Ireland.)

26–30 September
POAC-77 — Conference on Port and ocean engineering under Arctic conditions. (G. R. Peters, Chairman, POAC-77 Organizing Committee, Faculty of Engineering and Applied Science, Memorial University of Newfoundland, St. John's, Newfoundland, Canada.) (See p. 20 of this issue of ICE.)

1978

10–13 July
Third International Conference on Permafrost, Edmonton, Alberta, Canada. National Research Council of Canada. (M. K. Ward, c/o National Research Council of Canada, Ottawa, Ontario K1A 0R6, Canada.)

15–19 August
Symposium on Glacier beds: the ice-rock interface, Ottawa, Canada. Sub-Committee on Glaciers of the Canadian National Research Council. (C.S.L. Ommanney, Glaciology Division, Environment Canada, Ottawa K1A 0E7, Canada.) (See p. 19 of this issue of ICE.)

21–25 August
Symposium on Dynamics of large ice masses, Ottawa, Ontario, Canada. International Glaciological Society. (Mrs H. Richardson, Secretary, Cambridge CB2 1ER, England.) (See p. 18 of this issue of ICE.)

NEWS

AWARDS AND APPOINTMENTS

Dr V. M. Kotlyakov has been elected a Corresponding Member of the Soviet Academy of Sciences—a great honour for Soviet glaciology and one that will please his many friends in the Society.

Dr Johannes Weertman has been awarded the Mathewson Gold Medal of the Metallurgical Society (of the American Institute of Mining, Metallurgical and Petroleum Engineers), for his distinguished record of accomplishments in metallurgy and, in particular, for his outstanding contributions to the theory of high temperature deformation and fracture of solids.

Dr Robert Vivian has been appointed Director of the Institut de Géographie Alpine in Grenoble, France.

Dr Svenn Orvig has been appointed Dean of the Faculty of Science of McGill University.

Dr Olav Løken has left the Glaciology Division (Environment Canada), of which he was Chief, to become Chief of the Environment Division in Indian and Northern Affairs.

MOUNTAIN RESEARCH STATION, UNIVERSITY OF COLORADO, INSTITUTE OF ARCTIC AND ALPINE RESEARCH

The Mountain Research Station (MRS) is a University of Colorado field research and teaching facility located 41 km west of Boulder on the eastern slope of the Colorado Front Range at 2925 m elevation. The MRS, administered by the University's Institute of Arctic and Alpine Research (INSTAAR), consists of a complex of buildings including 29 two-person summer cabins, 7 winterized family cabins, a winterized shower and laundry facility, classrooms, summer dining hall, various support buildings and the winterized Alpine Laboratory. The Alpine Laboratory contains 502 m^2 of laboratories, offices, library, darkroom, herbarium, and museum. Some general scientific equipment (balances, glassware, etc) and field gear (snowshoes, tents, etc) are available. The MRS also maintains a fleet of snowmobiles, tracksters, a weasel, and four-wheel-drive vehicles for a year-round access to the adjoining research area.

INSTAAR holds a specific-use permit from the United States Forest Service for some 1200 hectares of the Roosevelt National Forest, commonly known as the Niwot Ridge area, adjacent to the Station property. This research area encompasses a wide variety of landforms: alpine glaciers; rock glaciers; active and dormant patterned ground; a variety of periglacial geomorphic forms; and biotic communities such as ponderosa pine, lodgepole pine, spruce-fir forest, glacial lakes, mountain streams, subalpine meadows, and a large alpine area of considerable diversity. The forest-tundra ecotone along Niwot Ridge is extensive.

The MRS is active year-round with approximately 15 faculty, graduate students, and support staff residing at the station. In summer there are 60 to 70 residents when the dining hall is in full operation.

Current research activities include (1) remote sensing studies of natural hazards to include delineation, analysis, and mapping of avalanches and other geological phenomena using LANDSAT satellite imagery; (2) multiple-use evaluation and inventory of United States Forest Service land using satellite-collected multispectral data.

Three graduate-level courses—Mountain Ecology, Mountain Geomorphology, and Mountain Climatology—are offered during the summer at the MRS. These courses are heavily field-oriented and focus largely, but not exclusively, on the Colorado Front Range.

Further information may be obtained from Dr Michael C. Grant, Director, Mountain Research Station, Box 389, Nederland, Colorado 80466, USA.

C-CORE

Harold L. Snyder, Director of C-CORE, wrote as follows in the first issue of *C-CORE NEWS*:

"C-CORE came into being as a result of a concern shared by many that Canada has a resource potential in its northern regions the development of which is impeded by our inability to function in ice-abundant oceans on a year-round basis. These resources will be essential within a decade if we are merely to maintain the level of prosperity to which we have become accustomed. Besides the desire to participate fully in these developments, it is necessary that we understand the technology and the environment and most important that we have people interested and skilled to be able to solve the particular problems associated with cold oceans. C-CORE is specifically charged to conduct research into new concepts for the orderly, safe, reliable and economic future development of natural resources lying adjacent to, in and under the northern oceans. It will identify some of the problems and hopefully offer practical alternatives as a result of its research.

Newfoundland and particularly the community of St. John's is the logical place for Canada to focus much of this research because cold oceans, icebergs and sea ice are part of its natural environment.

C-CORE is a natural extension of Memorial University's interest in the cold ocean environment. The history of this interest began about seven years ago when the Faculty of Engineering expanded to degree-granting status. It developed a strong ocean-related research programme and undertook some of the original work on iceberg towing. Aided by a National Research Council five-year development grant, it established the Ocean Engineering Research Group to provide the core personnel necessary to mount field operations.

As a result of the University's ocean engineering research programmes, it was proposed that the Centre for Cold Ocean Resources Engineering (C-CORE) be established at Memorial. The Centre would examine existing patterns of development of resources in any way related to the ocean and undertake research designed to reveal alternative development technologies. It would operate essentially in the public domain, publishing the results of its work and it would restrict itself to no more than two major areas of research at any one time.

In 1974, a commitment was made by the Devonian Foundation of Calgary to provide one million dollars for the initial establishment of C-CORE. C-CORE represents its first venture

into the technical field, and its first funding in Eastern Canada.

The Foundation has provided the core funding to get C-CORE established and to assure its ability to initiate research. It is expected, however, that C-CORE will from an early stage attract financial support and practical assistance from organizations in government and industry that have a direct interest in its work.

In putting together the C-CORE team the need was recognized for a multi-disciplinary group. The challenges of resource development engineering require contributions from and the involvement of people in many disciplines. Consequently, there is a group with a majority of engineers, with expertise in geology, biology, mining, electronics, remote sensing, ice, construction, transportation, as well as management and administration.''

News of C-CORE glaciological projects will be published in ICE.

FIELD COURSE IN GLACIAL HYDROLOGY

The course arranged for last summer was cancelled because of lack of interest. If anyone would be interested in such a course another year, please write to Dr J. P. Johnson, Department of Geography, Carleton University, Ottawa, Ontario, Canada.

THE FUCHS FOUNDATION

The Fuchs Foundation is a newly registered charitable Trust which was conceived and organized by members of the 1973 British Antarctic Survey base on South Georgia. It was set up as a practical gesture of thanks and respect for their former Director, Sir Vivian Fuchs.

The object of the Foundation is to enable young people, who would not otherwise have the means, to take part in adventurous and educational outdoor activities. It is administered by a Committee of eight Trustees chaired by Sir Vivian and including three representatives of the 1973 South Georgia party.

More than £2,000 has already been contributed by members of the British Antarctic Survey, but this is only a start. In order to make the Foundation increasingly effective the Trustees invite further donations. Contributions may be made by completing the Form of Donation below and sending it, with a remittance, to the Treasurer. If you would like further details of the Foundation, please apply to:

The Secretary, The Fuchs Foundation, c/o British Antarctic Survey, Madingley Road, CAMBRIDGE CB3 0ET.

THE FUCHS FOUNDATION

FORM OF DONATION

Contributors to the Fuchs Foundation are requested to complete this form and forward it with their remittances to:

The Treasurer, The Fuchs Foundation, c/o British Antarctic Survey, Madingley Road, CAMBRIDGE CB3 0ET, England.

I enclose herewith a remittance of £.....being a donation to the Fuchs Foundation.

NAME (CAPITALS) .....

ADDRESS .....

.....

SIGNATURE .....

Note: Cheques should be made payable to The Fuchs Foundation.

NEW MEMBERS

Blatter, H., Stuedlerweg 5, CH -4800, Zofingen, Switzerland.

Braslau, D., David Braslau Associates Inc., 2829 University Avenue S.E., Suite 342, Minneapolis, MN 55414, USA.

Brown, R. L., Department of Civil Engineering, Montana State University, Bozeman, MT 59715, USA.

Danys, J. V., Ministry of Transport, Canadian Coast Guard, Marine Aids, Ottawa, Ontario K1A ON7, Canada.

Davis, P. T., INSTAAR, University of Colorado, Boulder, CO 80309, USA.

Haynes, F. D., US Army CRREL, Hanover, NH 03755, USA.

Inoue, Motoya, Snow and Ice Section, Japan Highway Public Co-operation, 1789 Yamazaki-cho, Machida City, Tokyo, Japan.

Johnson, J. B., Geophysics Program, AK-50, University of Washington, Seattle, WA 98195, USA.

Kubo, Y., Japan Bridge & Structure Institute Inc., 4-12 5-chome, Minami-Aoyama, Minato-ku, Tokyo, Japan.

Lárusson, E., 31 Kepier Court, Durham, England.

Mahaffey, M. A., 1362 Sage Loop, Los Alamos, NM 87544, USA.

Mountain, K. R., Department of Geography, Condon Hall, University of Oregon, Eugene, OR 97403, USA.

Nakajima, H., No. 2 Design Department, Nippon Kokan K.K., Tsurumi Shipyard, 1-2 Suehiro-cho, Tsurumiku, Yokohama 230, Japan.

St. Lawrence, W., Department of Earth Sciences, Montana State University, Bozeman, MT 59715, USA.

Schwarz, J., Hamburgische Schiffbau-Versuchsanstalt, Bramfelderstrasse 164, 2000 Hamburg 60, Germany.

Schwarz, W., Renggliweg 3, 3800 Interlaken, Switzerland.

Sydow, U. von, University of Stockholm, Department of Physical Geography, Glaciological Division, Box 6801, S-113 86 Stockholm, Sweden.

Vittoratos, E., Department of Chemical Engineering, University of Toronto, Toronto, Canada.

INTERNATIONAL GLACIOLOGICAL SOCIETY

Cambridge CB2 1ER, England

DETAILS OF MEMBERSHIP

Membership is open to all individuals who have scientific, practical or general interest in any aspect of snow and ice study. Payment covers purchase of the Journal of Glaciology and Ice. Forms for enrolment can be obtained from the Secretary. No proposer or seconder is required. Annual payments 1977:

Private members	Sterling:	£10.00
Junior members	Sterling:	£4.00 (under 25)
Institutions, libraries	Sterling:	£20.00 for Volume 18 (Nos. 78, 79, 80) £20.00 for Volume 19 (Number 81)

Note—Payments from countries other than Britain should be calculated at the exchange rate in force at the time of payment. If you pay by bank draft, rather than by personal cheque, please ensure that sufficient money is included to cover the bank charges of £0.50p per cheque. Thank you.

I C E

Editor: Hilda Richardson

This news bulletin is issued to members of the International Glaciological Society and is published three times a year. Contributions should be sent to Mrs H. Richardson, International Glaciological Society, Cambridge CB2 1ER, England.

Annual cost for libraries, &c, and for individuals who are not members of the Society: Sterling £3.00

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