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GEOPHYSICS SECTION

OPERATION "HAZEN-TANQUARY" 1965-68

by

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ABSTRACT

In the four summers from 1965 to 1968 an average of twenty-four scientists participated in field studies from Hazen and Tanquary camps, northern Ellesmere Island. The personnel with their affiliations are listed; the scope of the field work is briefly outlined under the headings of meteorology, physical oceanography and limnology, sea ice physics, glacier studies, marine and lake biology, terrestrial biology and archaeology. Movements of personnel are summarized, and the most recent publications on the work are listed.

PERSONNEL

1965 SEASON

Tanquary Fiord Area. The McGill University members of the party were working under Defence Research Board contracts and the University of New Brunswick members were working under a National Research Council grant:

G. Hattersley-Smith (Defence Research Board) in charge July-August, Glaciology
H. Serson (Defence Research Board) in charge April-June, Oceanography
K.C. Arnold (Department of Energy, Mines and Resources), Glaciology
C. Bacon (University of New Brunswick), Survey
D. Carruthers (University of New Brunswick), Survey
U. Embacher (McGill University), Glaciology
W. Faig (University of New Brunswick), Survey
A. Haller (McGill University), Oceanography
J.E. Keys (Defence Research Board), Oceanography
M.P. Langleben (McGill University), Ice physics
L.J. MacRae (McGill University), Glaciology
R.H. Murray (McGill University), Meteorology
G.H. Seibert (McGill University), Oceanography
D.A.G. Shanks (McGill University), Meteorology
P. Stalinski (McGill University), Ice physics
G.C. Wilmot (McGill University), Ice physics
R. Yank (Defence Research Board), Technician

Count Eigil Knuth and J. Møhl of Copenhagen, were afforded facilities at the camp while carrying out archaeological investigations at nearby Eskimo sites on behalf of the National Museum of Canada.

Hazen Camp. All members of the party were entomologists from the Entomology Research Institute, unless otherwise indicated:

D.R. Oliver, in charge
M.H. Colbo (University of Alberta), Parasitology
C. Lindsay
T.L. Pickett
U. Røen (Zoological Museum, København University), Freshwater biology.

1966 SEASON

Tanquary Fiord area. All university members of the party were employed under Defence Research Board contracts with McGill University:

G. Hattersley-Smith (Defence Research Board) in charge April-mid-May, Glaciology
H. Serson (Defence Research Board) April-August, in charge from mid-May, Oceanography
W.R. Anderson (McGill University), Meteorology
T. Badenduck (McGill University), Glaciology
M. Curtis (McGill University), Marine biology
U. Embacher (McGill University), Glaciology
C.I. Jackson (London School of Economics), Meterorology
P. Kerrigan (Defence Research Board), Tractor operator
A. Long (Smithsonian Institution), Radiochemistry
J.E. Mielke (Smithsonian Institution), Radiochemistry
R.H. Murray (McGill University), Meteorology
J. Robinson (McGill University), Oceanography
G.H. Seibert (McGill University), Oceanography
P. Stalinski (McGill University), Ice physics
G.C. Wilmot (McGill University), Ice physics

S. Evans and G. de Q. Robin (Scott Polar Research Institute, Cambridge University) were afforded logistic support and facilities at Tanquary camp while carrying out airborne radio depth-sounding measurements of a number of glaciers and ice caps north of lat 80°N. K.C. Arnold (Water Research Branch, Department of Energy, Mines and Resources) and L. Lundgaard (Polar Continental Shelf Project of the same Department) were based on Tanquary camp while resurveying the Per Ardua Glacier.

Hazen Camp. All members of the party were entomologists from the Entomology Research Institute of the Department of Agriculture, unless otherwise indicated:

P.S. Corbet, in charge
P.G. Kevan (University of Alberta), Entomology
W.J. Maher (University of Saskatchewan), Ornithology
D.N. Nettleship (University of Saskatchewan), Ornithology
J. Parkes
R.J. Williams
R.E. Leech.

1967 SEASON

Tanquary Fiord Area. The McGill University members of the party were working Defence Research Board contracts:

G. Hattersley-Smith (Defence Research Board), in charge April-June, Glaciology
H. Serson (Defence Research Board), in charge June-August, Oceanography
W.R. Anderson (McGill University), Meteorology
K.C. Arnold (Department of Energy, Mines and Resources), Survey and Glaciology
R.W. Blake (McGill University), Meteorology
G.R. Brassard (New York Botanical Garden), Botany
M.A. Curtis (McGill University), Marine biology
U. Embacher (McGill University), Glaciology
D.M. Farmer (McGill University), Marine biology
D.J. Finlayson (McGill University), Oceanography
O.M. Johannessen (McGill University), Oceanography
J.E. Keys (Defence Research Board), Oceanography
M.P. Langleben (McGill University), Ice physics
A. Long (Smithsonian Institution), Radiochemistry
J.E. Mielke (Smithsonian Institution), Radiochemistry
G.R. Schram (McGill University), Meteorology
P. Stalinski (McGill University), Ice physics
J.R. Stein (McGill University), Ice physics
J. van der Leeden (McGill University), Glaciology.

Between late April and late June the Royal Air Force Ellesmere Island Expedition, 1967, of eight men under Wing-Commander D. le R. Bird, operated out of Tanquary Camp. The expedition received logistic support from the RCAF and engaged the DRB charter aircraft for support flying. From late June until late August, R.E. Longton (British Antarctic Survey botanist with the RAF expedition) worked out of Tanquary and Hazen camps.

Hazen Camp. The members of the party were entomologists from the University of Alberta:

B. Hocking, in charge early June
P. Kevan, in charge late June-August
K.W. Richards
J. Shorthouse.

1968 SEASON

Tanquary Fiord Area. The McGill University members of the party were working under Defence Research Board contracts:

G. Hattersley-Smith (Defence Research Board), in charge May, Glaciology
H. Serson (Defence Research Board), in charge June-August, Oceanography
K.C. Arnold (Department of Energy, Mines and Resources), Glaciology
W. Budd (Department of Energy, Mines and Resources), Glaciology
M.A. Curtis (McGill University), Marine biology
E. Dorrer (University of New Brunswick), Survey
U. Embacher (Department of Energy, Mines and Resources), Glaciology
D.M. Farmer (McGill University), Oceanography
D.J. Finlayson (McGill University), Oceanography
V.J.E. Jones (McGill University), Oceanography
J.E. Keys (Defence Research Board), Oceanography
M.P. Langleben (McGill University), Ice physics
S. El Masry (University of New Brunswick), Survey
S. Outcalt (University of British Columbia) Glaciology
R. Perrault (McGill University), Oceanography
D.B. Petrie (McGill University), Oceanography
R.B. Sagar (Simon Fraser University), Glaciology
R. Sherwood (Department of Energy, Mines and Resources), Glaciology
P. Stalinski (McGill University), Ice physics
J.R. Stein (McGill University), Ice physics
M. Steven (McGill University), Ice physics
R. Storm (University of New Brunswick), Survey
S.F. Strøm (Defence Research Board), Oceanography
J. Van der Leeden (McGill University), Oceanography.

Hazen Camp. The members of the party were entomologists from the University of Alberta:

P. Kevan, in charge
J.G. Bromley
S.F. Istvanffy.

SCIENTIFIC PROGRAMMES

METEOROLOGY

Routine meteorological observations were made at Tanquary and Hazen camps each summer. In 1966 two unmanned meteorological stations, with self-recording instruments for measuring wind speed and direction, temperature, pressure and humidity, were set up at Van Hauen Pass and Lake Tuborg, respectively 150 km west-south-west and 60 km south-south-west of Tanquary Camp. A five-year (1963-67) analysis of the summer climate of Tanquary Fiord was recently completed. In 1966 a detailed study of the microclimate, particularly the soil-surface temperatures, was carried out at Hazen Camp.

PHYSICAL OCEANOGRAPHY AND LIMNOLOGY

Oceanographic reconnaissance was conducted on extensive traverses by motor toboggan in continuation of the work in 1963-64. In 1965, a total of twenty-five physical oceanographic stations were occupied in Tanquary, Greely, Hare and Otto fiords on the west coast, and in 1966 a total of eleven stations were occupied in these fiords, and in Disraeli Fiord and M'Clintock Inlet on the north coast. The latter two fiords showed markedly different characteristics, which can be explained from the fact that the mouth of Disraeli Fiord is blocked by the Ward Hunt Ice Shelf, whereas M'Clintock Inlet is now open to the Arctic Ocean. Air observations showed recent disintegration of the M'Clintock and Ayles ice shelves to form new ice islands.

In 1967 the work was concentrated on the north coast of Ellesmere Island. During May and early June a two-man party occupied eight oceanographic stations between Clements Markham Inlet and Nansen Sound. From early May until early July another two-man party established a camp in Disraeli Fiord near the inner edge of the Ward Hunt Ice Shelf, where they measured temperature, salinity and current profiles. In the same period a third two-man party measured temperatures and salinity weekly in Hare Fiord and occasionally in Otto Fiord. In July and August oceanographic stations were worked in Tanquary Fiord, mainly in order to investigate effects near the pack-ice/water interface. Temperature and salinity measurements were also made in Lake Tuborg, a meromictic lake.

In 1968, between mid-May and mid-June about twenty-four oceanographic stations were occupied at the mouth of Nansen Sound and at the junction of Eureka Sound and Greely Fiord. Current profiles were successfully taken daily with an Ekman current meter, but measurements with recording current meters were hampered by a number of equipment failures. Bathymetric profiles were taken across the mouths of Nansen and Eureka sounds, where tidal records were also made. A station in Disraeli Fiord was occupied during the month of July; temperature, salinity and current profiles were taken daily, and tide-gauge measurements were made from early May until the end of July. During August several shallow temperature-salinity-depth profiles were taken in Tanquary Fiord in an attempt to clarify the movements of the dead water beneath the ice with respect to meteorological parameters.

SEA ICE PHYSICS

A programme to measure energy fluxes at the air/sea-ice interface, at a station on the ice near Tanquary Camp, was completed in 1965. It was shown that the flux of radiative heat was the dominant factor determining the ablation rate and the change in thermal content of the sea ice cover. A programme to measure the acoustic attenuation in sea ice was started in 1966.

In 1967 an extensive series of acoustic attenuation measurements along horizontal transmission paths was completed, and an attempt was made to investigate attenuation in the vertical direction of the ice cover. An experiment was also designed to measure the albedo of a sea ice surface under melt and pre-melt conditions. It was recognized that albedo observations from radiometers at the surface are of limited value after melting starts, on account of the difficulty of selecting a representative ice surface. It was therefore decided to suspend radiometers at a height of 15 m between two towers anchored to the bottom of the ice cover; the average albedo of the surface was successfully measured with the instruments mounted in this way.

In 1968 albedo measurements of the sea ice surface near Tanquary Camp were continued under pre-melt and melt conditions until the middle of June. Further measurements of acoustic attenuation in sea ice were limited by an early thaw acting on first-year ice and causing rapid seepage of brine. Pulsed methods of measurement were used for the first time in parallel with standard CW transmission. Little success was achieved in studies of ground reflection at the sea-water/ice interface, principally because of unsuitable transducers.

RADIOCHEMISTRY

In 1966 water samples from Lake Tuborg were collected for tritium analysis, and dissolved bicarbonate was extracted for ^{14}C-analysis under a cooperative programme with the Smithsonian Institution. In 1967 this work was continued and extended to lakes Ekblaw and Rollrock (respectively 20 and 35 km north-east of Tanquary Camp) and to Disraeli Fiord.

GLACIER STUDIES

Maps of the Per Ardua and Otto glaciers were completed in 1965 after field work and air photography in 1964. For the Per Ardua Glacier, a map of the whole glacier at the scale of 1:10000 and of the ablation area at the scale of 1:2500 are available for mass balance studies. In 1965 the number of accumulation and ablation stakes was increased from 44 to 97. The equilibrium line was found at an elevation of 890 m and a slight net gain for the 1964-65 budget year was indicated. A total of 91 stakes were observed for movement; along a cross-profile of stakes at the 500 m level, where the glacier is 250 m wide, the movement was 18 to 22 m/yr. Mass balance and movement studies were continued in 1966, 1967 and 1968 under a cooperative programme with the Water Research Branch of the Department of Energy, Mines and Resources. Observations were also made of drainage phenomena of the ice-dammed Rollrock Lake; the level of the lake was shown to have been lowered by about 25 m between the spring of 1965

[illegible] down the valley.

[illegible] logical traverse by motor toboggan [illegible] Glacier to the snout of the [illegible] ice cap, accumulation measurements [illegible] stations up to an elevation of [illegible]. The main conclusion [illegible] was that the four summers had not [illegible] years in the last forty years. At the same time [illegible] Gilman Glacier to determine height changes over the [illegible] traverse profiles, originally [illegible] two highest peaks in northern Ellesmere Island, situated [illegible] the head of the Henrietta [illegible] Glacier, and theodolite [illegible] established on their summits. [illegible] gave the height of the [illegible] previously unclimbed and still [illegible] as 2605 m, and of [illegible] previously climbed by a RAF party in 1941 and identified as [illegible] Glacier) as 2560 m. These are [illegible] Rocky Mountains.

[illegible] Gilman Glacier in 1968. Data on ablation, snow [illegible] and stratigraphy [illegible] from more than seventy stations. Preliminary calculations [illegible] previous years' data for the Gilman Glacier indicate highly positive net budgets for the period 1962-67 (e.g. + 250 x 10^6 m^3) and for the year 1967-68 (+ 30 x 10^6 m^3). A report on the regime of the glacier for the period 1962-68 is in preparation.

In order to measure the strain rate at the surface of the Ward Hunt Ice Shelf, the quadrilateral laid out on the ice shelf to the west of Ward Hunt Island in 1964 was resurveyed by MSSL in September 1965. The resurvey showed that there was some internal movement in the ice shelf of the order of 3 to 10 m/yr over a distance of 1 km, but the movement had no special pattern. A mass shift of [illegible] crack between the ice shelf and the Ward Hunt ice rise was found to have a rate of [illegible] of 27 cm/yr. These measurements were repeated in 1968, and the results are being analysed.

Mass balance studies at the surface of the Ward Hunt ice shelf and ice rise were made each season. Measurements at 12 stakes set on the ice rise showed an average net [illegible] for 1964-65 and 1965-66, but an average net deficit of [illegible] 1966-67; measurements at 19 stakes showed an average net deficit of [illegible] 1967-68. Measurements on the ice shelf showed a net deficit of [illegible] (mean at 25 stakes) in 1966-67 and of 212 kg m^{-2} (mean at 4 stakes) for the period 1964-67. A 1-km square grid of aluminum stakes was installed in the ice shelf in 1967, and measurements at these indicated a net deficit of 247 kg m^{-2} (mean at 96 stakes) for 1967-68.

MARINE AND LAKE BIOLOGY

Plankton collecting was continued in Tanquary Fiord during the four seasons 1965-68. From late June until August 1965, plankton was sampled at weekly intervals, and two series of collections were made through the ice by Petersen grab for comparison with collections of previous years. In 1967 two relict species of copepods were collected from the upper freshwater layer of Lake Tuborg, and plankton samples were taken on a weekly basis from there

and Otto fiords and from Disraeli Fiord.

A programme of sampling the benthos was undertaken at Hare Fiord from May to mid-July 1967 and continued at Tanquary Fiord for the remainder of the season. Several hundred samples were obtained with a 0.1 m^2 Petersen grab in depths from 5 to 100 m; a small dredge was also used in Tanquary Fiord at depths down to 60 m. From a camp on the ice of Eureka Sound, for three weeks in June 1968, benthos was collected with a Petersen grab at depths of 5 to 50 m. The samples differed markedly from previous samples in Tanquary and Hare fiords. Benthos was also collected with a small dredge hauled by canoe after the break-up of the ice in Tanquary Fiord. Stereomicroscopic observations were made in the field laboratory of the morphology, colouration, locomotion and behaviour of the living organisms.

An ecological and taxonomic study of the freshwater crustaceans was made at Lake Hazen in 1965, and specimens of molluscs and fish (including Arctic Cod) were collected from Disraeli Fiord in 1967.

TERRESTRIAL BIOLOGY

Entomological and other biological studies were continued at Lake Hazen, where insect traps have been operated for a number of years to provide information on the yearly and seasonal abundance of many insect species in relation to the annual conditions.

In 1965 and 1966 the entomological programme included: ecological and taxonomic studies of the spiders; experimental work on egg development in mosquitoes; an examination of the microclimate in various flowers in relation to nectar secretion and insect visiting; and a continuation of ecological and taxonomic studies of the chironomids. Other biological work included a study of endo- and ecto-parasites of the birds and mammals, and studies on the breeding behaviour of three species of birds, the Long-tailed Jaeger, Ruddy Turnstone and Knot. In 1967 and 1968, work continued on insect-flower relations and involved: spectral analysis of flower colours throughout the insect visual range (ultra-violet to red); observations of insect feeding habits and of insects as pollinators; and thermal measurements on insects basking in flowers. The physiological ages of various anthophilous insects was also examined in relation to their activities within flowers. A study of the nest ecology, life history, and development of colonies in the two species of bumblebee was completed. A total of 47 natural nests were found, mainly in sedge and moss areas. Vegetation and the protective wax cover insulated the nests so that temperatures were maintained at 25 to 30°C inside. Brood development was found to be rapid in comparison with species at lower latitudes, perhaps on account of feeding differences. The life histories, general ecology and parasites of the Lepidoptera were also studied. In 1968 numerous soil samples were collected for the extraction of soil arthropods.

The flora and fauna of the Hazen Camp study area have been collected probably more fully than those of any other station in Canada. The total number of species is small in comparison with numbers in temperate regions, and as a result information on the habitats, food habits and life cycles of the species is available in greater detail than for any other area in the country.

Botanical studies were carried out from Tanquary Camp, Van Hauen Pass and Hazen Camp in 1967. In Tanquary Fiord the vascular flora was raised from 107 to 116 species, the moss flora from 85 to about 105 species, with the addition of many genera. At Van Hauen Pass, not previously examined, 82 species of vascular plants and about 90 species of mosses were collected. At Lake Hazen, whose vascular flora was already well known, collecting was concentrated on bryophytes. At all three localities detailed studies were made on the phenology, microhabitat and reproductive behaviour of widespread moss species.

ARCHAEOLOGY

In 1965 detailed excavations of Palaeo-Eskimo sites near Tanquary Camp were made for the National Museum. In 1967, at Cape Gleason on Tanquary Fiord, photographs and measurements were taken of seven structures of believed Palaeo-Eskimo age discovered in 1966 at an elevation of 8-10 m above sea level. On the west side of the Air Force Valley, several flints were gathered from the surface of a Palaeo-Eskimo site, discovered in 1964 at an elevation of 71 m above sea level, and in Hare Fiord five new Eskimo sites were recorded. In 1968 numerous Eskimo tent rings and food caches were found near Iceberg Point on Fosheim Peninsula; several artifacts were also found, as well as remains of whale, muskox and caribou.

DIARY

1965 Season

April

23 H. Serson, J.E. Keys and G. Wilmot arrived Eureka from Ottawa.

24-25 Party dug out 1964 cache, moved fuel to airstrip and sorted cargo.

30 RCAF DC-3 (Dakota) aircraft with crew of ten arrived Eureka.

May

1 DC-3 made return flight to Hazen Camp, landing Keys and cargo.

2 DC-3 made return flight to Tanquary Camp, landing Serson and cargo, and return flight to Hazen Camp with cargo.

3 DC-3 made flight to Hazen Camp with cargo, returning to Tanquary Camp where held by weather.

4 DC-3 returned to Eureka, then made two flights to Hazen Camp with cargo. Returned with Keys to Tanquary Camp where held by weather.

7 DC-3 returned to Eureka, then made return flight to Tanquary Camp with Wilmot and cargo.

8 Atlas Aviation Otter RWU (R. de Blicquy) arrived Tanquary Camp from Eureka with A. Haller, L.J. Macrae, R.H. Murray, G.H. Seibert, D.A.G. Shanks and P. Stalinski.

9 DC-3 made two return flights to Tanquary Camp with cargo. Otter made return flight to Eureka with cargo, and flight to Hare Fiord to lay food and fuel cache, returning via Eureka and Flora Island where a further cache was laid. Otter also made return flight to Rollrock Lake with Keys and Seibert who took soundings and established a bench mark.

10 Keys laid cache by snowmobile at Per Ardua Glacier camp.

11 Serson, Keys, Haller and Seibert left by Ski-dos on oceanographic traverse of Tanquary and Greely fiords.

23 Otter arrived Tanquary Camp from Eureka with M.P. Langleben, W. Faig, C. Bacon, D. Carruthers and U. Embacher. Otter made return flight to Ward Hunt Island with Faig, Bacon and Carruthers.

24 Otter returned to Eureka with Stalinski.

28 Serson, Keys, Haller and Seibert returned to Tanquary Camp from oceanographic traverse.

June

2 Otter arrived Tanquary Camp from Eureka, and left for Hazen Camp with H. Serson. Otter left for Alert, returning to Hazen Camp with D.R. Oliver and C. Lindsay, and to Tanquary Camp with K.C. Arnold. Otter left for Lake Tuborg with Keys and Haller for limnological station, then continued to Van Hauen Pass to lay cache, returning to Tanquary Camp. Otter then made flight to Hazen Camp returning with Serson, and flight to Lake Tuborg returning with Keys and Haller.

17 Otter arrived Tanquary Camp from Eureka with M.H. Colbo, T.L. Pickett, and U. Røen.

18 Otter left for Hazen Camp with Colbo, Pickett and Røen (who were landed there) and continued to Ward Hunt Island, returning to Tanquary Camp with Faig, Bacon and Carruthers.

25 Otter arrived Tanquary Camp from Eureka with A.H. Zimmermann, A.M. Pennie, W. Petrie, T.A. Harwood, and G. Hattersley-Smith, after flight to Expedition Fiord, Axel Heiberg Island.

26 Otter made return flight to Van Hauen Pass with Dr. Zimmermann and party. Otter made return flight to Lake Hazen with Dr. Zimmermann and party.

27 Otter made return flight to Alert with Langleben, Wilmot and cargo, and further flight with Zimmermann, Pennie, Petrie, Harwood, Hattersley-Smith, Serson and Keys.

July

20 Piper Cub (GSC) arrived Tanquary Camp from Alert with Hattersley-Smith, and left for Eureka.

31 Otter arrived Tanquary Camp from Alert with R. Yank, and left for Eureka with Arnold, Embacher and Macrae.

August

3 Hattersley-Smith, Haller and Yank left on foot for Ekblaw Lake via Air Force valley.

7 Ekblaw Lake party returned to Tanquary Camp.

9 Otter (GSC) arrived Tanquary Camp with E. Knuth and J. Møhl.

20 Otter arrived Tanquary Camp from Eureka, and left for Hazen Camp.

21 Hazen Camp party were evacuated to Alert, and Otter returned to Tanquary Camp and Eureka.

24 CCGS John A. Macdonald arrived from Eureka, landed supplies, and sailed with Hattersley-Smith, Knuth, Haller, Murray, Møhl, Shanks and Yank.

1966 Season

April

4 G. Hattersley-Smith, H. Serson, S. Evans, G. de Q. Robin, C.I. Jackson, P. Stalinski, U. Embacher, and G. Wilmot arrived Eureka from Ottawa via Resolute.

9 Atlas Aviation Otter RWU (R. Parsons) arrived Tanquary Camp from Eureka with Serson, Jackson and Stalinski, and returned to Eureka.

10 Otter made return flight from Eureka to Tanquary Camp with Hattersley-Smith, Embacher and Wilmot.

14 Otter arrived Tanquary Camp from Eureka with Evans and Robin and radio depth sounding equipment mounted on aircraft. Evans, Robin and Hattersley-Smith left Tanquary Camp on radio sounding flight but returned owing to weather.

16 Evans, Robin and Hattersley-Smith made radio sounding flight over Antoinette Bay and d'Iberville Fiord area.

17 Evans, Robin, Serson and Embacher made radio sounding flight via Lake Hazen over Gilman Glacier, ice cap, Disraeli Glacier and Ward Hunt Ice Shelf, returning - after landing at Ward Hunt Island - over M'Clintock Glacier, ice cap and Air Force Glacier.

19 Evans, Robin and Hattersley-Smith made radio sounding flight over Turnabout Glacier and Grant Ice Cap to Alert, where Robin was landed. Return radio sounding flight to Tanquary Camp passed over Ward Hunt Ice Shelf, Milne Glacier, ice cap and Henrietta Nesmith Glacier.

20 Otter left Tanquary Camp for Eureka with Evans.

28 Hattersley-Smith, Serson and Jackson left Tanquary Camp for Lake Tuborg by motor toboggan.

May

2 Lake Tuborg party returned to Tanquary Camp.

10 Otter left Tanquary Camp for Alert with Hattersley-Smith, Jackson, Stalinski and Wilmot to meet RCAF flight.

12 Otter left Alert for Tanquary Camp with W.R. Anderson, T. Badenduck, M.A. Curtis, R.H. Murray, J. Robinson and G.H. Seibert. Otter left for Eureka and Resolute.

14 Otter arrived Tanquary Camp from Resolute via Eureka with A. Long and J. Mielke. Otter left for Tuborg Lake with Serson, Long, Mielke and Robinson, and continued to Eureka and Van Hauen Pass with Serson and Robinson, returning to Tanquary Camp. Otter left again for Eureka with Serson and Robinson.

16 Serson and Robinson left Eureka for Van Hauen Pass by motor toboggan.

19 Serson and Robinson arrived Van Hauen Pass from Eureka.

21 Curtis and Seibert left Tanquary Camp for Lake Tuborg by motor toboggan.

22 Curtis and Seibert returned to Tanquary Camp from Lake Tuborg.

31 Otter arrived Hazen Camp with P.S. Corbet [illegible] D.N. Nettleship, then flew to Alert returning to Hazen Camp with [illegible] Corbet, P. Kevan, R.E. Leech, J. Parkes and R.J. Williams.

July

6 Serson and Robinson returned to Tanquary Camp from Van Hauen Pass. Otter arrived Tanquary Camp from Resolute via Eureka with R.F. Chinnick. Otter left for Lake Tuborg, returning to Tanquary Camp with Long and Mielke. Otter took Chinnick to Alert, returning to Tanquary Camp and Eureka.

11 Otter arrived Tanquary Camp from Eureka, and continued to Alert with Long and Mielke to meet RCAF flight, returning to Tanquary Camp.

12 Otter took Serson and Robinson to Ward Hunt Island, returning to Tanquary Camp and Eureka.

July

8 Otter arrived Tanquary Camp from Resolute via Eureka with P. Kerrigan and R. Plaisted. Otter left for Ward Hunt Island with Plaisted, returning with Serson, Plaisted and Robinson. Otter with Serson, Plaisted and Murray made return flight to Lake Tuborg, then left for Eureka with Plaisted.

14 Serson left for Cape Gleason by canoe.

16 Serson returned from Cape Gleason.

21 GSC Otter arrived from Gilman River camp, and left for Alert with Kerrigan to meet RCAF flight.

22 GSC Otter arrived from Gilman River camp, and made return flight to Van Hauen Pass with Serson, Curtis and Murray. Otter left for Alert with Seibert to meet RCAF flight.

August

1 GSC Otter arrived from Gilman River camp, and made return flight to Lake Tuborg with Serson and Murray, returning to Gilman River.

2 Embacher, Curtis and Badenduck left for Rollrock valley.

4 Rollrock valley party returned to Tanquary Camp.

15 Atlas Aviation Otter (W.W. Phipps) arrived from Eureka, and left with Serson, Curtis and Murray for flight over Rollrock valley and ice caps east of Tanquary Fiord. Otter left for Hazen Camp, returning to Eureka via Tanquary Fiord with P.S. Corbet, P. Kevan, W.J. Maher, R.E. Leech, D.N. Nettleship, J. Parkes and R.J. Williams.

17 Otter arrived Tanquary Camp from Eureka, and made return flight to Van Hauen Pass with Serson, Curtis and Murray, before returning Eureka.

25 CCGS John A. Macdonald arrived off Tanquary Camp from Eureka, and evacuated Serson, Anderson, Badenduck, Curtis, Embacher, Murray and Robinson to Resolute.

1967 Season

April

12 Atlas Aviation single Otter (J. Strickland) arrived Tanquary Camp from Eureka with H. Serson and J.E. Keys. Otter returned to Eureka.

17 Serson and Keys left for Lake Tuborg by motor toboggan.

20 Serson and Keys returned to Tanquary Camp from Lake Tuborg.

23 Atlas Aviation twin Otter (W.W. Phipps) made two flights to Tanquary Camp from Eureka with K.C. Arnold, members of RAF party and cargo.

24-25 Otter completed airlift from Eureka to Tanquary Camp bringing in G. Hattersley-Smith, M.P. Lanleben, P. Stalinski, J.R. Stein, A. Long and J. Mielke.

May

6 Twin Otter (R. de Blicquy) arrived Tanquary Camp from Eureka. Otter landed Arnold, RAF officers P.G. Pinney and D. Drew, and cargo on Gilman Glacier, continued to Alert, and returned to Tanquary Camp with W.R. Anderson, M.A. Curtis, U. Embacher, D.M. Farmer, D.J. Finlayson, G.R. Schram and J. van der Leeden.

9 Otter landed Hattersley-Smith, Embacher and van der Leeden with dogteam and remaining cargo on Gilman Glacier in two flights.

10 Otter landed D. le R. Bird, members of RAF party and cargo on Gilman Glacier in two flights.

13 Otter landed Keys and Schram with cargo on Disraeli Fiord, and returned to Tanquary Camp.

14 Otter landed long and Mielke on Disraeli Fiord, and returned to Tanquary Camp.

16 Otter laid caches at Cape Woods and Yelverton Fiord on the north coast, then landed Serson and Finlayson on Disraeli Fiord. Otter returned to Eureka *via* Tanquary Fiord and Van Hauen Pass, where Curtis and Farmer were landed.

23 Serson and Finlayson left Disraeli Fiord to travel westward along the north coast by motor toboggan.

24 Twin Otter (R. de Blicquay) arrived Hazen Camp from Eureka *via* Tanquary Camp with B. Hocking, P. Kevan, J. Shorthouse and K.W. Richards, then left for Alert.

25 Otter arrived Disraeli Fiord from Alert with O.M. Johannessen, then left for Tanquary Camp. Otter left Tanquary Camp with Stalinski for Eureka *via* Otter Fiord.

June

5 Twin Otter (R. de Blicquy) arrived Hazen Camp from Eureka *via* Tanquary Camp, and left for Gilman Glacier with Hocking. Otter left Gilman Glacier for Disraeli Fiord with Hocking and van der Leeden. Otter left Disraeli Fiord for Alert with Hocking, Johannessen and Schram. Otter

left Alert for Gilman Glacier with Schram. Otter left Gilman Glacier for Tanquary Camp with Schram, Pinney and Drew. Otter took mail to ice cap party, then left for Eureka with Anderson via Otto Fiord, where an airdrop was made.

13 Hattersley-Smith, Arnold and Embacher reached snout of Air Force Glacier by dogteam from Gilman Glacier, after joining with three members of RAF party.

15 Arnold and Embacher returned to Tanquary Camp.

16 Hattersley-Smith returned to Tanquary Camp. Serson and Finlayson returned to Disraeli Fiord from north coast traverse.

17 Serson and Finlayson left Disraeli Fiord for Ward Hunt Island. Arnold, Embacher, Pinney and Drew left Tanquary Camp for Per Ardua Glacier. Twin Otter (R. de Blicquy) arrived Tanquary Camp from Thule Air Base with K.E. Longton and G.R. Brassard. Otter made return flight to Air Force Glacier to evacuate three members of RAF party; on second flight Otter went unserviceable on glacier.

19 De Blicquy and remaining two members of RAF party returned to Tanquary Camp from Air Force Glacier on foot. Atlas Aviation Beaver (Mrs L.V. de Blicquy) arrived Tanquary Camp from Eureka. Arnold, Embacher, Pinney and Drew returned from Per Ardua Glacier.

20 Beaver made three return flights to Eureka to take out Arnold, Embacher, members of RAF party and cargo. Beaver also brought in from Eureka C.A. Pope (DRB PRO), D. Spurgeon ("Globe and Mail" reporter), C.R. Yool (DRB photographer) and R.W. Blake.

21 Beaver (R. de Blicquy) left for Disraeli Fiord returning with Long and Mielke.

22 Beaver landed Long and Mielke at Lake Tuborg, returning to Tanquary Camp. Beaver made return flight to Hazen Camp with Hattersley-Smith, Pope, Spurgeon and Yool. Beaver took Brassard and Longton to Otto Fiord, then brought back Long and Mielke from Lake Tuborg.

23 Beaver made return flights to Rollrock and Ekblaw lakes with Long and Mielke for limnological work.

25 Single Otter (W.W. Phipps) arrived Tanquary Camp from Eureka, and left for Air Force Glacier with de Blicquy. Single Otter and twin Otter returned to Tanquary Camp.

26 Twin Otter (W.W. Phipps) left Tanquary Camp for Eureka. Single Otter left for Ward Hunt Island, and brought back Serson and Finlayson. Beaver (Mrs L.V. de Blicquy) left Tanquary Camp for Eureka with Pope, Spurgeon, Long and Mielke.

27 Single Otter (R. de Blicquy) left Tanquary Camp for Eureka with Hattersley-Smith.

July

16 Single Otter arrived Tanquary Camp, and left for Van Hauen Pass returning with Curtis, Farmer, Brassard and Longton.

20 GSC Otter took Longton to Hazen Camp, returning to Tanquary Camp.

August

4 GSC Otter took Serson to Hazen Camp, returning to Tanquary Camp.

8 Serson returned to Tanquary Camp from Lake Hazen by GSC Otter.

11 Longton returned to Tanquary Camp from Lake Hazen by GSC Otter.

27 CCGS John A. Macdonald arrived off Tanquary Camp.

28 John A. Macdonald sailed for Resolute with Serson and remaining members of party.

1968 Season

May

5 Atlas Aviation Otter (R. de Blicquy) arrived Tanquary Camp from Eureka with J.E. Keys, M.P. Langleben, P. Stalinski, S.F. Strøm, J.R. Stein, M. Steven, V.J.E. Jones, J. van der Leeden, E. Dorrer, S. El Masry, P. Kevan and R. Sherwood. Otter made second return flight from Eureka with U. Embacher and cargo.

7 Otter arrived Tanquary Camp from Eureka with H. Serson and R. Storm and cargo.

8 Otter landed Keys, Strøm and Kevan at Disraeli Fiord, returning to Tanquary Camp.

10 Otter left Tanquary Camp for Alert returning with F.T. Davies, G. Hattersley-Smith, D.J. Finlayson and R. Perrault. Otter left for Ward Hunt Island with Hattersley-Smith, Dorrer, El Masry, Finlayson and Storm returning to Tanquary Camp with Keys, Strøm and Kevan.

11 Otter made two return flights to mouth of Nansen Sound to land Serson, Strøm and van der Leeden. Otter left for Eureka with Keys, Curtis, Farmer and Perrault, who were landed at the north end of Eureka Sound on the way, and Davies who returned south.

29 Otter arrived Tanquary Camp from Eureka, and left for Ward Hunt Island, returning with Hattersley-Smith, Dorrer, El Masry, Finlayson and Storm. Otter left for Nansen Sound with Hattersley-Smith and Finlayson, returning with Hattersley-Smith and Strøm.

30 Otter made return flight to Alert with Hattersley-Smith, Dorrer, El Masry, Finlayson, Storm, Strøm, Embacher and Sherwood to meet RCAF flight, then returned to Tanquary Camp with R.B. Sagar and S. Outcalt. Otter took Sagar and Outcalt to Gilman Glacier, then left for Eureka.

June

20 Otter arrived Tanquary Camp from Eureka via Eureka Sound with Keys, Curtis, Farmer and Perrault.

21 Otter left for Nansen Sound returning with Serson, Finlayson and van der Leeden. Otter left for Alert with Stalinski and Stein, returning to Tanquary Camp with B. Petrie. Otter made return flight to Disraeli Fiord, where Finlayson, Perrault, Petrie and van der Leeden were landed,

then made flight to Gilman Glacier returning with Sagar and Outcalt.

22 Otter left Tanquary Camp for Eureka and Resolute with Serson, Keys, Sagar, Steven and Outcalt.

August

2 Otter arrived Alert from Eureka returning with Serson, Keys, K.C. Arnold and W. Budd to Tanquary Camp.

3 Otter left for Disraeli Fiord returning to Tanquary Camp with Finlayson, Perrault, Petrie and van der Leeden. Arnold and Budd left for Per Ardua Glacier.

15 Arnold and Budd returned to Tanquary Camp from Per Ardua Glacier.

17 Arnold and Budd left Tanquary Camp by PCSP Otter for Meighem Island.

27 Otter arrived Tanquary Camp and left for Alert with Curtis, Finlayson, Perrault, Petrie and van der Leeden to meet RCAF flight. Otter returned to Eureka.

30 CCGS John A. Macdonald arrived off Tanquary Camp.

September

1 John A. Macdonald sailed for Resolute with Serson and Keys.

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