its monograph series, it has published: *Eskimo Townsmen,* a study of Eskimo adaptation to town life at Frobisher Bay, Baffin Island, by John and Irma Honigmann; *The Metis of the Mackenzie District,* a study of people of Indian and White ancestry in the Northwest Territories by Richard Slobodin; and *Kabloona and Eskimo in the Central Keewatin,* by Frank Vallee. This latter book, originally issued in report form by the Northern Co-ordination and Research Centre, discusses White-Eskimo contact at Baker Lake, in the Barren Grounds of the Northwest Territories.

The first of the Centre's Document series dealt with "Community Development in Canada" and included reference to activities in northern Canada; it was written by Antony Loyd, now with the School of Social Work at the University of British Columbia. The Centre's Handbook series was initiated with Aleksandrs Sprudzs' *Co-operatives: Notes for a Basic Information Course,* which is a guide to establishing and running co-operatives, with particular reference to Eskimo co-operatives (see Review, p. 55).

The Centre issues a small bilingual monthly newsletter called "Information," which describes its activities.

The offices are at 40 Riverdale, Ottawa 1, Ontario, and visitors are always welcome. The mailing address is: St. Paul University, 223 Main Street, Ottawa 1, Ontario.

*Jim Lotz*
ASSOCIATE DIRECTOR
C.R.C.A.

# Research Projects at Resolute

## INTRODUCTION

In April 1967, an Arctic Research Group was formed within McMaster University's Department of Geography, with the object of undertaking closely integrated studies in all aspects of physical geography. As an introductory venture, a party of 3 professors, 2 graduate students, a photographic technician, and a seventeen-year-old Hamilton schoolboy who had been awarded a summer scholarship at McMaster arrived at Resolute on 29 June to undertake a 5-week program of research in coastal geomorphology, pedology, and sub-surface microclimatology.

Throughout the first half of July, the weather was remarkably poor, even for Resolute. Thick stratus cloud rolled inland from the south and west at ground level, and fieldwork within the study area of 100 square miles centred on the Resolute Air Base was impeded by visibilities which were only rarely as good as 500 feet. During the first 15 days of the month, there were only 2 without precipitation. On 12 of those days, minimum temperatures failed to rise above 32°F., and on 6 and 12 July, the minima of 30.9°F. and 29.7°F. respectively established new low records for those dates. Maximum temperatures were also low, reaching 40°F. on only 3 occasions. On 14 July, the snow gauge at Resolute's meteorological station recorded a fall of 2.15 inches, and winds gusted up to 65 m.p.h. It must surely have been on just such a day that the following description of Cornwallis and its neighbouring islands was written: "More desolate, miserable, uninteresting and frightful regions do not exist on the surface of the globe."[1]

The weather improved considerably throughout the latter half of July. Minimum temperatures were then above 32°F. on all but 6 occasions, and there was only 1 day on which the maximum failed to reach as high as 40°F. However, precipitation was still recorded on all but 5 of the last 16 days, and the total of 2.87 inches for the month was nearly 3 times the normal figure of 0.97 inches. On 24 July, when 0.81 inches of rain fell, one member of the party entertained some of his very wet companions by presenting an extensively revised version of one of his regular lectures on arctic desert conditions.

In spite of all, a very satisfactory measure of progress was achieved, and the members of the party flew southwards on 3 August more than ever firmly convinced of the benefits that will result from a continuing close integration of their research interests.

## GEOMORPHOLOGY

The party's 2 geomorphologists undertook a general study of the raised shorelines within a 5-mile radius of Resolute, together with a detailed examination of the modern beach forms at selected points between Resolute Bay and the mouth of the Allen River.

An earlier examination of air photographs had revealed that raised shorelines constitute the dominant element of the landscape. In the field, an attempt was therefore made to define the major sequential stages in the formation of these features, in terms of their height above present sea level and their depositional history. To this end, an understanding of the processes operating on and the depositional forms occurring within the modern shore zone was a prerequisite, and thus the two major tasks which were undertaken were closely linked together. In particular, long-profiles across the sequence of raised shorelines, which were surveyed by standard methods of levelling, were complemented by numerous shorter profiles across the modern beaches.

However, in another sense, these modern beaches posed separate and interesting problems concerning the relationship between process and form in a particular coastal environment where the period of open water is severely limited. Observations on the nature of the beach were made, firstly, as the coastal snowbanks disappeared and, secondly, as the sea ice began to melt and the pushed shore ice retreated. The end of the period of observation coincided with the appearance of narrow stretches of open tidal water in some inshore areas, and this led to a modification in the form of certain beaches.

In addition to a consideration of seasonal and temporary changes in detailed coastal morphology, attention was also paid to certain larger-scale and longer-term changes in the coastal outline. The depositional history of the area as revealed by the raised shorelines and the study of changes within the modern beach zone made it possible to differentiate between areas where erosion was dominant and those in which deposition was taking place. There is considerable scope for investigations into the specific problems presented by arctic beaches, and detailed work along these lines is to be continued.

### PEDOLOGICAL INVESTIGATIONS

The pedological projects comprised both field and laboratory programs. The field program involved the examination and mapping of units of different surface material over an area of approximately 80 square miles around Resolute. A classification of 8 categories was established, and in most cases these were further subdivided on the basis of stoniness and degree of sorting. The criteria of classification were visible surface features, such as stone content, surface patterning and sorting of material, the proportion of fine earth present, wetness, stability, morphology, colour, and plant cover. On this basis, distinctive field units were identified and delineated on enlarged air photographs. The size of these units varied from small seepage patches and rock outcrops to those extensive areas of clay mantle with small stones which, in general, cover all reasonably level ground above the marine transgression level.

To supplement the more generalized information concerning the properties of surface materials, detailed analyses of specimens were undertaken in an improvised but well-equipped field laboratory. Samples of the active layer were taken at depth intervals of 2 inches, and determinations were made of the proportion of fine earth and the percentages of moisture and organic matter in each. The fine earth portion of each sample was then further examined to determine its pH value, Munsell colour category, and texture, based on hydrometer analysis of the sand, silt, and clay fractions. The number of field samples thus processed totalled 125, and these were obtained from 26 sites distributed thoughout the 8 principal categories of surface material. The field laboratory was operated in order to reduce the bulk of those soil samples which were eventually transported southwards for more complex chemical and mineralogical investigation. Samples of unconsolidated surface material and adjacent parent rock were also preserved for subsequent mineralogical comparison.

The main objectives of the pedological programs were to identify the field properties and physical characteristics of surface materials in a selected area of polar desert environment, and to measure the degree of chemical weathering in the unconsolidated surface materials. From the field experience gained in pursuit of the first objective and 2 complete transects by air, a generalized map of terrain units covering the whole of Cornwallis Island is to be prepared, while the laboratory investigations will contribute to an understanding of the nature and origin of that widespread and relatively deep clay mantle which covers the limestones of Cornwallis Island.

### MICROCLIMATOLOGY

The party's 2 microclimatologists were equipped to undertake two tasks: firstly, to determine the extent to which those areas of widely varying surface materials as differentiated by the party's pedologists were characterized by different subsurface microclimates and, secondly, to obtain quantitative data concerning the extent to which it might be possible to modify subsurface temperature and moisture values through the application of simple surface treatments.

After certain laboratory experiments which were designed to determine and permit due allowance to be made for the conduction of heat along the copper and constantan wires under steep temperature gradients, 40 wooden dowel rods of diameter 1 inch and length 5 feet were each equipped with thermocouples so that temperature readings could be taken at 14 depths. With the aid of a gas-driven drill and an assortment of tungsten-carbide bits, some of these rods were eventually inserted to a depth of 4½ feet in 5 areas of varying surface materials, and temperature profiles throughout the active layer and the topmost 2 or 3 feet of permafrost were measured under various weather conditions. There can be little room for doubt that the measured differences in these subsurface temperature profiles are of considerable importance in the elucidation of geomorphic processes, and a considerable extension of this investigation is to be undertaken in succeeding years.

About 5 miles north of the Resolute Air Base, there is an area of surprisingly good, fine sandy loam which is closely interbedded with layers of humus, and this was the area selected for the modification experiments. Eight plots each 10 feet square were marked out, and a rod carrying 14 thermocouples was drilled down into the centre of each. The thermocouple wires from each rod were then led to a centrally placed instrument tent which housed the switching gear and a battery-operated potentiometer, by means of which temperatures could be determined to the nearest 0.2°F. One of the plots was left completely undisturbed to act as a control, but the surfaces of the other 7 were variously treated in an attempt to induce changes in the subsurface temperatures. For example, to investigate such changes as might be induced by altering the thermal conductivity of the soil, the surface of one plot was flattened and compacted by heavy treading, while that of another was dug to a depth of about 9 inches and broken into a reasonably fine tilth. To induce changes in subsurface temperatures by altering the albedo or reflective power of the surface, a third plot was dusted with a thin layer of white talc powder, while a fourth was similarly treated with carbon black. In an effort to increase surface and subsurface temperatures by reducing wind speed and evaporation rates, a fifth plot was dug, dusted with carbon black and then covered by a polyethylene cloche whose dimensions were such as to enclose 100 cubic feet of air. Temperature profiles in each plot were measured at about 2:30 P.M. on most days, which time coincided with the attainment of maximum temperatures at the ½-inch depth, and moisture values were determined by the gravimetric method. During one 24-hour period, readings were taken every 2 hours to provide information concerning the diurnal range of temperature at each of the 14 depths on all plots.

Several of the surface treatments produced very significant changes in both subsurface temperature and moisture values; as visual integrators of such changes, small cabbage plants and sprouted potato chits were planted on selected plots. Those planted on each of the unprotected plots died within the course of a few days, which was no surprise, particularly in view of the weather conditions. However, those planted beneath the polyethylene cloche flourished quite remarkably, due to uninterrupted photosynthesis and to the fact that they were subjected to a much more favourable microclimate. Thus, on the afternoon of 30 July, the temperature of the soil surface beneath the cloche rose to no less than 79°F., a figure 26 deg. in excess of the corresponding value for the control plot. At depths of 4, 8, and 12 inches, the excess was 13 deg., 11 deg., and 8 deg. respectively, and it was only at depths below 16 inches that it fell to about 1.5°F., becoming zero at 32 inches. So favourable were its effects that the cloche drove the permafrost down an additional 4 inches in only 16 days, and future experiments with polyethylene greenhouses are to be undertaken to show that when the eventual development of the Canadian Arctic necessitates a certain measure of horticultural self-sufficiency, this can be attained at low cost. The party's 2 microclimatologists agree that "a prerequisite to the solution of the problem of arctic agriculture is the inexpensive raising of the summer ground temperature by a few degrees,"[2] and they wholeheartedly support the view that "we should begin with the scientific groundwork without delay."[2] Moreover, they see no reason why such efforts should be restricted to Canada's western Arctic.

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[1] *Arctic Miscellanies, A Souvenir of the Late Polar Search,* by the officers and seamen of the expedition, 1852. London: Colburn and Co. p. 319.

[2] John C. Reed, 1962. Scientific research and northern development. *Arctic,* 15: 3-8.

# Devon Island Programs, 1967

### INTRODUCTION

The Arctic Institute's facilities on Devon Island were again used during the summer of 1967 by field parties studying glaciology, glacio-isostatic geomorphology, periglacial geomorphology, ornithology, and botany. In addition, an expedition photographer recorded the summer's activities with still photographs and on 16 mm. colour film. Field camps were established at various locations and the studies were pursued from these as well as from the Base Camp close to Cape Sparbo. Each investigator worked with one assistant; in W. Barr's case, one of the 3 members of the camp staff worked with him, as the assistant originally recruited was unable to join the group.

Local transportation was provided in the early part of the summer by a vessel, later by two Massey Ferguson diesel tractors in the Base Camp lowlands area, and by a Polaris motor toboggan on the ice cap. After