NOTES

NEW MAP OF NORTHWEST TERRITORIES AND YUKON TERRITORY

A revised and much-needed map of northern Canada, produced and printed by the Surveys and Mapping Branch of the Department of Mines and Technical Surveys, Ottawa, was issued in March 1960. The map includes the northern parts of the provinces and extends to the Pole, using a Lambert conical projection with rectified meridians and standard parallels of 64° N. and 88° N. The use of seven colours allows the Yukon and the three districts in the Northwest Territories to be clearly differentiated. The use of a dark blue shading for existing glaciers is effective, although perhaps a trifle misleading as to their shape or vertical dimensions.

It replaces the 1939 map of the Northwest Territories and Yukon that covered approximately the same area, but at a scale of 80 miles to 1 inch. The extensive programme of air photography and mapping carried out since World War II has provided an accurate and detailed representation of Canada's northland and many of the newly adopted place-names have been added to the new map, as well as bird sanctuaries and game preserves. All-weather roads, both existing and under construction, and major tractor routes are shown by dark red lines. Symbols show establishments at the settlements, such as RCMP detachments, trading posts, meteorological stations, hospitals, schools, and nursing stations. Perhaps the most interesting new features of the map are the DEW Line and Mid-Canada Line airfields.

The map, "Northwest Territories and Yukon Territory", measures 36 inches by 47 inches and is drawn at a scale of 1:4,000,000 (1 in. = 63.13 mi.). It is available from the Map Distribution Office, Department of Mines and Technical Surveys, Ottawa at a price of 50¢.

J. Keith Fraser

PERIGLACIAL-GEOMORPHOLOGICAL INVESTIGATIONS AT RESOLUTE, 1959*

In 1959 the Geographical Branch of the Department of Mines and Technical Surveys instituted a long-term program of research in the area at Resolute, Cornwallis Island, N.W.T., into problems of periglacial geomorphology, a relatively new branch of study relating to certain soil and landform features produced in very cold climates. This note is a progress report on the field work of the first year carried out by the writer, assisted by Jacek Romanowski, a graduate of McGill University, Montreal.

The area was chosen as the site of investigations because it lies in an active periglacial region. Vegetation is almost absent, and the mechanical actions of frost are reduced to as simple a process as can be found in nature. On the large areas of barren land many periglacial features are revealed with remarkable perfection, especially types of patterned ground. Furthermore, Resolute is easily accessible by air; scheduled flights and many unscheduled flights offer opportunity for transport of personnel and equipment. The annual resupply by boat permits movement of large equipment into the area. Limited workshop and laboratory facilities are available for repair of equipment, sharpening of tools, etc., an important factor in permafrost work. The presence of a first-class meteorological station provides complete meteorological data, indispensable in the study of periglacial processes and phenomena.

Although in general the 1959 field season was intended to be of reconnaissance nature only, a number of studies were begun of which many are to be

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continued over a period of years. A great mass of quantitative data was collected, most of which remains to be processed. Detailed papers incorporating the results will be published later. Nevertheless, a few general observations on the various projects can be made at this time.

1. Freeze-thaw cycles

The frequency and amplitude of freeze-thaw cycles in the active layer of permafrost is a matter of interest to many workers in the field of periglacial geomorphological study. They are an important factor in most theories of frost-shattering, and many discussions of periglacial processes are based on freeze-thaw cycles. There are practically no quantitative data on the number or intensity of freeze-thaw cycles in the Canadian Arctic.

The writer gratefully acknowledges the kindness of the Pure Physics Division of the National Research Council for placing temperature measuring equipment at his disposal. An automatic Speedomax recorder and thermocouples were used, providing a continuous record of temperatures at several levels. Thermocouples were placed in a vertical line to provide a cross-section from the standard Stevenson screen to a depth of 6 inches in the ground. Individual thermocouples were placed in the standard screen, immediately above the surface of the ground, immediately below the surface of the ground, and at depths of 3 and 6 inches, respectively.

The following generalizations are made on the basis of data obtained. They apply to Resolute only and not to other parts of the Canadian Arctic without additional work in those areas.

(a) There appears to be little correlation between number or intensity of freeze-thaw cycles in the standard Stevenson screen and those on the surface of the ground. As most previous work on freeze-thaw cycles has been based on standard meteorological data collected in the Stevenson screen, and as periglacial processes take place actually on or below the surface of the ground, this observation should be of rather wide interest.

(b) Freeze-thaw cycles begin at the surface of the ground some weeks before they are shown by the ambient air temperatures recorded in the screen.

(c) At Resolute freeze-thaw cycles do not penetrate deeper than about 3 inches into the active layer. The temperature at this depth rises above the freezing point in the spring when the ground thaws and remains above it until it drops below the freezing point again in the fall when the ground freezes.

(d) The minimum daily ambient air temperature in the Stevenson screen rarely crosses the freezing line during the summer. Once the daily minimum temperature rises above freezing in the spring, it generally remains above it until the fall, when it drops very rapidly to sub-zero levels. On the other hand, temperatures at the surface of the ground, responding to changes in solar insolation, radiation, wind velocity, etc., fall below freezing several times.

(e) It is apparent that the term "freeze-thaw cycle" should be redefined to include a time factor. A quick rise or fall in temperature across the freezing point means little unless it causes freezing of water or melting of ice. Previous studies have based cycles on daily maximum or minimum temperatures as recorded in the standard screen without consideration of whether or not the time was sufficient for the change in temperature to be effective.

2. Run-off characteristics of Mecham River

Few quantitative data are available on run-off characteristics in the Eastern Arctic. Detailed measurements involvnig rate of flow (as measured by a portable flow meter), as well as volume measurements, were recorded daily during the entire summer for the Mecham River, a small post-Pleistocene stream flowing into Resolute Bay. As in the study above, a great many data remain to be processed. A few generalizations agree with previous observations of other small rivers in the Resolute Bay area made by the writer in past years.

(a) The Mecham River was frozen

solidly to the bottom until June 20, when water started to flow. In a few days the volume of water increased from 95,000 cubic metres per day on June 20 to 4.5 million cubic metres on the peak day of July 2. It then fell rapidly and by July 20 the flow was about 100,000 cubic metres per day, the average flow for the remainder of the season. By September 10 all flow had ceased as the river was again completely frozen to the bottom.

(b) The flow is concentrated in a 10-day period during which perhaps 80 per cent of the yearly flow is discharged. During this time the Mecham is a wild impassable river, although during the remainder of the year it can be crossed practically anywhere without difficulty.

(c) The 10-day period coincides with the minimum daily air temperature rising above freezing, and the melting of the snow in the drainage basin.

(d) Considerable erosion takes place during the peak flow; the river carries a large load of sediment, and slope drainage channels (dry during most of the year) are filled with water. At other periods the river carries little sediment but much material in solution since it runs through limestone.

3. *Precipitation as an agent of erosion*

A detailed study of precipitation as an erosive agent in the Resolute area was continued. The writer made observations during four summers in the Resolute area, and has now analysed the daily records for the 11-year period 1948-58. Again it must be emphasized that these observations apply only to the Resolute area.

(a) It appears that rainfall is not an effective erosive agent at Resolute. The yearly total rainfall averages less than 3 inches and is of very low intensity. During the 11 years of records there were only 233 days of measurable rain, ranging from 16 days in 1954 to 28 days in 1948. The average rainfall per day of measurable precipitation was .12 inches, and 73 per cent were less than this amount. The greatest amount of rain to fall in any 24-hour period was .78 inches.

(b) It was observed that over .3 inches of continuous rain was needed to influence greatly the run-off characteristics of the Mecham River, either in volume or increased load of sediment. As there are no more than two or three rainfalls of this amount in any one year, it is suggested that rainfall, as such, is not an important erosive factor.

(c) Rill wash does not appear to be an important factor in erosion. In four summers the writer has observed a total of 14 occurrences of active rill wash, and these were usually slight.

(d) It is suggested that meteorological data do not give a true picture of the amount of precipitation in a high arctic area. A makeshift rain gauge, using 100 square feet of roof, collected measurable amounts of precipitation (i.e., .2 inches in some instances), whereas for the same period standard gauges recorded only a *trace*. As Resolute records show *a trace only* of rainfall for 19 days in a year on the average, the actual amount of moisture available may be larger than the approximately 3 inches of rain recorded. Although this additional moisture will affect water content of the soil and chemical action, it is not sufficient to act as an erosive agent in the form of running water.

4. Knowledge of soil characteristics of various types of patterned ground is inadequate. Forty-three individual soil samples were taken for mechanical analysis and sieved in the field for particle size distribution larger than 0.074 mm (No. 200 Sieve, U.S. Dept of Agriculture). The larger particles were then discarded, and the fines brought back to Ottawa for further analysis by hydrometer tests. The results of these are as yet incomplete.

5. One phase of the proposed plan for research into periglacial geomorphology involves the detailed description of the many different phenomena observed in the field. Connected with this work are photographic studies for illustrative purposes. A number of features in the Resolute area, including such forms as polygons, circles, stripes, nets, nivation hollows and solifluction forms were studied in detail.

6. In preparation for future studies, low level aerial surveys were flown by Spartan Air Services over the area in the immediate vicinity of Resolute. Flights were made at 5,200 feet above sea-level and the photographs will be a valuable help in future studies.
7. Some data on the preferred orientation of pebbles in various types of patterned ground, and in solifluction lobes were collected.

The program for the study of periglacial geomorphology of the Resolute area will be continued over several years and intensified as experience is gained, and equipment and instruments become available. Detailed reports will be published as the data are processed.

The writer wishes to thank members of the staff of the Ionosphere Station of the Telecommunications Division of the Department of Transport for assistance given in the field, as well as for laboratory, workshop and congenial living accommodation at that station. He would especially like to thank Mr. Donald Johnson of the National Research Council for invaluable technical assistance with instrumentation.

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VICTORIA LAND TRAVERSE, ANTARCTICA, 1959-60

Although the International Geophysical Year closed in December 1958, antarctic research and exploration did not. Through the Arctic Institute of North America and under the sponsorship of the United States Antarctic Research Program, antarctic science has continually developed since that time.

During the antarctic summer of 1959-1960, the Arctic Institute administered two ground traverses whose purpose was to penetrate unexplored regions of the continent and to gather as many scientific data as time, logistics, and nature permitted. The first of the two parties departed from New Zealand's Scott Base on October 16, 1959 crossing part of the Ross Ice Shelf toward the Skelton Glacier. (The second party started from Byrd Station in November 1959 and explored the region toward the Amundsen Sea.) Ten men drove three tracked Sno-Cats towing one 2½-ton sledge each. On October 27 the party reached 79°05′S. 162°15′E. at the foot of the Skelton Glacier. After traversing up glacier through heavily crevassed areas, they reached the first of three fuel caches laid down by U.S. Navy and Air Force planes. After continuing from the first cache at the edge of the Victoria Land Plateau, the traverse group began the journey to B-61, end station of the French traverse of 1958/9, over 600 miles to the west.

The journey to the French station and then east toward the head of Tucker Glacier covered much of Victoria Land and part of Terre Adélie. This part of the journey war largely at elevations well over 8,500 feet. Seismic soundings were made at regular intervals to determine ice thickness, and gravity and magnetic readings were taken.

On January 30, 1960 the party discovered a new range of mountains, first sighting them in the vicinity of 72°15′S. 159°45′E. This new range has been tentatively named the Arctic Institute Range, pending official acceptance. The mountains seen trend geographically from north to south, roughly parallel to the Ross Sea Coast in the east. Geological investigation revealed three groups of rocks: flat lying sediments, massive intrusives, and metasediments intruded by pegmatites.

On February 10, 1960 during aerial evacuation of the remaining eight men, a new and sizeable glacier was discovered between the party's last position at 72°38.0′S. 161°31.8′E. and Rennick Bay on the Oates Coast. This glacier is tentatively named Rennick Glacier. It is at least 160 miles long and between 20 and 40 miles wide.

The maximum elevation reached during the traverse was approximately 9,200 feet and the minimum daytime temperature −43°C. A total of 75 seismic reflection and refraction shots were made and over 450 gravity and magnetic stations established. The maximum ice thickness measured was over