CORRESPONDENCE

The Editor,

Journal of Glaciology

SIR, *Depth of the "frost table" on Arctic beaches, Cornwallis and Devon Islands, N.W.T., Canada*

Although it seems unlikely that permafrost extends for any great distance offshore (Brewer, 1958), permanently frozen ground at shallow depth is encountered below the intertidal zone of Arctic beaches. Experience on the gravel beaches of southern Cornwallis and Devon Islands in the Canadian Arctic Archipelago (lat. 74°N.) indicates that the depth of the active layer, down to the frost table, in the contemporary beach zone reaches a maximum of 50–60 cm in mid- to late August. These values accord with those reported from engineering investigations at Milne Inlet in northern Baffin Island (Samson and Tordon, 1969).

The data on the depth of the frost table presented below were collected over three field seasons at three sites as part of a broader program of investigations of beach conditions (McCann and Owens, 1969, 1970; Owens and McCann, 1970). In each case the depths were determined by hand augering along a series of profile lines reaching from the lowest raised beaches to the intertidal zone. Figure 1 shows a typical frost-table profile from Radstock Bay, Devon Island, and the whole of the data are

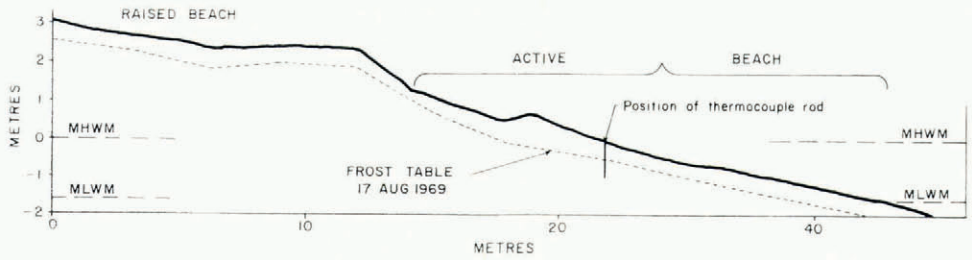

Fig. 1. Frost-table profile, Radstock Bay beach, 17 August 1969.

summarized in Table I. The depths recorded represent the depth at which very firm resistance was met in augering. If ice chippings were not brought up on the auger tip, a second boring was undertaken. Several trenches were also cut across the intertidal zone as a check to the auger figures. The actual beach surface profiles below which the depth of the frost table was measured remained almost static during the period of observations at the first two sites and, though there were changes on the Radstock Bay beach between 17 and 29 August 1969, these were not such as to affect the comparability of the two sets of figures. The data reveal a progressive increase in the depth of the active layer throughout the summer, from 0.25 m in late June–early July to 0.60 m in late August. There appears to be no significant increase in depth seawards across the intertidal zone.

TABLE I. DEPTH OF "FROST TABLE" ON THREE BEACHES ON CORNWALLIS AND DEVON ISLANDS, N.W.T.

Location	*Date*	*Average depth of frost table* m	*Remarks*
1. Allen Bay, Cornwallis Island	10 July 1967	0.25	At high-tide level
	21 July 1967	0.31	At high-tide level
	31 July 1967	0.40	At high-tide level
2. Cape Ricketts, south-west Devon Island	24 June 1968	0.25	At high-tide level
	6 July 1968	0.32	At high-tide level
	8 August 1968	0.50	At high-tide level
	8 August 1968	0.45	At mean sea-level
3. Radstock Bay, south-west Devon Island	17 August 1969	0.52	At high-tide level
	17 August 1969	0.51	At mean sea-level
	29 August 1969	0.58	At high-tide level
	29 August 1969	0.60	At mean sea-level

In 1969, a scheme was devised for recording sub-surface temperatures in the Radstock Bay beach down to depths of 1 m at high- and low-tide levels. Instrumentation involved the use of copper–constantan thermocouples mounted at 10 cm intervals along wooden dowelling rods, which were to be inserted into holes drilled into the beach gravels and permafrost by a petrol-driven drill. Unfortunately for the beach project, it proved too difficult to install a thermocouple rod at low tide due to pack-ice conditions, but a high-tide rod was successfully inserted on 31 July and readings were taken on that day and on 1, 4, 7 and 8 August. Somewhat unusual storm conditions of erosion, with large waves driving pack ice onto the beach smashed the rod on the night of 11 August and made it impossible to re-establish the position. However, the method of observation of sub-surface beach temperatures was shown to be viable and the five sets of readings plotted in Figure 2 are regarded as accurate to within 0.2°F (0.11°C)

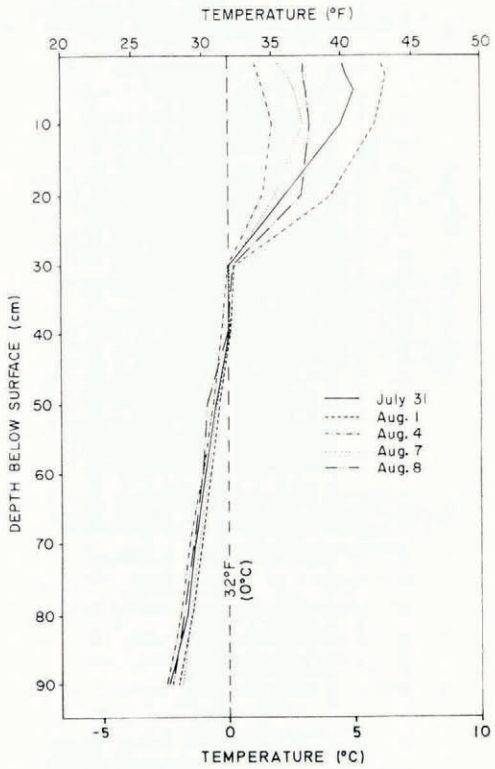

Fig. 2. Sub-surface temperatures, Radstock Bay beach.

Below a depth of 30–40 cm, sub-surface temperatures were below freezing point and remained relatively constant throughout the 8 d of observation, indicating that the frost table lies at this level and that little heat was passing downwards into the permafrost. Between 30 cm depth and the beach surface there is considerable variation in temperature from day to day. All the readings were taken at a similar time of day—late evening between 20.15 and 22.00 h—and these variations can be related to variation in daily weather conditions.

S. B. McCann
F. G. Hannell

Department of Geography,
McMaster University,
Hamilton,
Ontario, Canada
15 June 1970

https://doi.org/10.3189/S0022143000013149 Published online by Cambridge University Press

REFERENCES

Brewer, M. C. 1958. Some results of geothermal investigations of permafrost in northern Alaska. *Transactions. American Geophysical Union*, Vol. 39, No. 1, p. 19–26.

McCann, S. B., *and* Owens, E. H. 1969. The size and shape of sediments in three Arctic beaches, south-west Devon Island, N.W.T., Canada. *Arctic and Alpine Research*, Vol. 1, No. 4, p. 267–78.

McCann, S. B., *and* Owens, E. H. 1970. Plan and profile characteristics of beaches in the Canadian Arctic Archipelago. *Shore and Beach*, Vol. 38, No. 2, p. 26–30.

Owens, E. H., *and* McCann, S. B. 1970. The role of ice in the Arctic beach environment with special reference to Cape Ricketts, southwest Devon Island, Northwest Territories, Canada. *American Journal of Science*, Vol. 268, No. 5, p. 397–414.

Samson, L., *and* Tordon, F. 1969. Experience with engineering site investigations in north Quebec and north Baffin Island. *Canada. National Research Council. Associate Committee on Geotechnical Research. Technical Memorandum* No. 96.