TABLE 1. Hours of sunshine in summer at Isachsen and Mould Bay.

	1968			*1969*			*1970*		
	June	July	Aug.	June	July	Aug.	June	July	Aug.
Isachsen	279.3	287.5	124.9	283.6	137.4	?	77.5	295.3	192.9
Mould Bay	364.9	362.0	134.7	244.3	172.8	103.0	129.7	387.9	227.2
Mould Bay surplus (hrs.)	85.6	74.5	9.8	—39.3	34.4	?	52.2	92.6	34.3
Mould Bay surplus (%)	30.6	25.8	7.9	—13.8	25.7	?	67.2	31.3	17.8

must pass less sunlight than do sheets of high stratus and altostratus. The available data on cloud cover, which do not include cloud height and which are inevitably somewhat subjective, indicated no marked difference between the stations, and sunshine records were lacking for both.

With three years' bright sunshine data now available for Isachsen and Mould Bay, I have extracted the summer figures from the Monthly Record of Meteorological Observations in Canada (Table 1). The growth period at Isachsen extends from mid June to early August, and July is clearly the critical month. The Isachsen total for August 1969 is missing, but for the other 8 months Isachsen exceeded Mould Bay only once. The Mould Bay excess for July was 25 per cent or more in each year. Although soil surface and screen temperatures differ little at Isachsen on heavily overcast days, thermograph records kept by D. St-Onge showed[1] that on predominantly sunny days the soil surface maxima exceeded the screen maxima by 20-30°F. (11-17°C.). Thus modest differences in total bright sunshine can be very important to plant growth in this region where almost all activity is confined to the lowest 10 cm. of air and much of it to the lowest 3 cm. A longer record is needed before we can fully accept a higher July sunshine figure for Mould Bay; but if the three years of record are nearly representative they must go far in explaining the better growth at this station. However, there is a distinct possibility that diffuse sunlight through thin cloud, not registered by the Campbell-Stokes recorder, adds to Mould Bay's advantage.

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A Freshwater Budget of the Gulf of Boothia, Northwest Territories

A freshwater budget for the Gulf of Boothia (here considered to include Prince Regent Inlet) was estimated from oceanographic data available for the Canadian Arctic using a formula derived by Tully[1]:

$$C = 1 - \frac{\int_0^L S(z)\,dz}{S^*L}$$

where C is the fraction of freshwater to the depth L, L is the depth at which the salinity attained S* or the depth to the bottom if the salinity there was less than S*, S(z) is the salinity at depth z and S* is the base salinity, in this budget taken to be 33.8‰. For each station occupied in 1961 and 1962 the amount of freshwater in metres, CL, was obtained. The result for 1962 is shown in Fig. 1.

Sources of freshwater include direct precipitation, runoff, advection of less saline water and of ice, and condensation at the surface. It may be removed by evaporation and advection. We assumed that condensation is so small it may be neglected and that the rates of precipitation and evaporation are the same over the land as over the water. The mean precipitation in the region of the Gulf of Boothia is usually less than 20 cm./year[2,3] and in nearby Barrow Strait it was estimated[4] that the evaporation was about 8 cm./year in 1962. If the latter value is representative of the Gulf of Boothia and its drainage basin, the excess of precipitation over evaporation is about 12 cm./year. The estimate is supported by 1965 streamflow measurements of the Back River[5]; for this basin the excess of precipitation over evaporation is about 17 cm./year. It seems that the water surplus for the Gulf of Boothia drainage basin is somewhat less[6] so the estimate of 12 cm./year appears reasonable. As the area of the drainage basin is one and one quarter that of the gulf, runoff would add 15 cm./year to the freshwater of

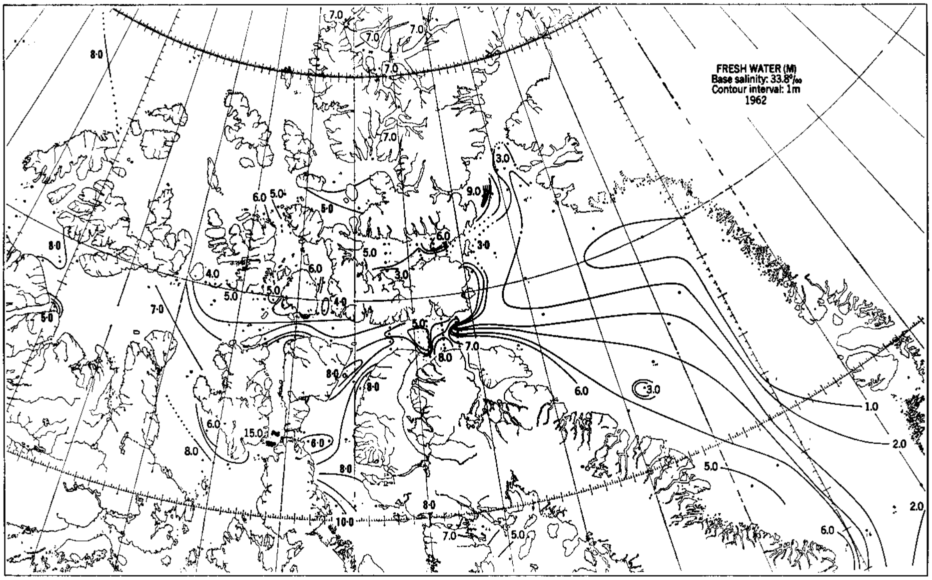

FIG. 1. The distribution of the depth of freshwater in and adjacent to the archipelago as determined from data observed in 1962[8,9,10].

the gulf. Combining the gains and losses we estimate the net annual input at the surface to be 27 cm./year.

If the 8 metres of freshwater estimated to occur in the gulf (Fig. 1) were due to the annual gain, it would represent an accumulation of close to 30 years. As free exchange with Lancaster Sound and beyond is possible, such a long period of accumulation seems unrealistic. There is no reason to believe that the accumulation is related to an excess of imported over exported ice, indeed export may exceed import, but data which would permit a quantitative assessment are not available. Examination of ice reconnaissance data in each year, for example that for 1967[7], indicates that, while movement of ice occurs from northern parts of the gulf to the south, the ice conditions observed within the system could be due entirely to ice formed there. It seems likely therefore that the accumulation is due to advection of low salinity water and that a direct relation exists between the depth of freshwater in the gulf and that calculated to occur in the archipelago to the west and in the Arctic Ocean (Fig. 1). It is generally considered that a net surface movement from west to east occurs through the archipelago; the freshwater budget provides support for this view.

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Historical Reference to Ice Islands

Some years ago M. Dunbar[1] gave a detailed account of earlier ice reports which could refer to ice islands, as distinguished by G. Hattersley-Smith[2] from other ice in the polar sea by their great unit area, thickness, structural strength and rolling relief. Among the old descriptions of 'floebergs' and 'palaeocrystic ice' some of Greely's[3] come closest to a description of an ice island. Another early report might be worth mentioning: Franz Boas, the German-born anthropologist and later professor at Columbia University states[4] that in October 1883 a huge iceberg drifted into Cumberland Sound, Baffin Island. It had a height of 15 m. to 20 m., a length of 14 km. and a width of 6 km. The total thickness of 100 m. to 150 m. could be seen when the ice broke into pieces. The estimated volume was 13 km.^{3} Similar ice formations of smaller size had been repeatedly encountered when approaching Cumberland Sound. The upper surface consisted of long low rounded parallel rolls with a wavelength of about 150 m. and extending over 1 km. to 3 km. The surface and the uppermost 2 m. of the ice contained stones; no stratification or crevasses were visible. The description fits that of a typical ice island. That ice islands from the northern coast of Ellesmere Island can reach Baffin Bay and Cumberland Sound is shown by the recent drift of ice island WH5[5]; a segment of at least 14 km.^{2} passed through southern Davis Strait.

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Reviews

ARCHEOLOGICAL INVESTIGATIONS IN THE GRAND RAPIDS, MANITOBA, RESERVOIR 1961-62. BY WILLIAM J. MAYER-OAKES with a Chapter on Faunal Materials by PAUL W. LUKENS, JR. *Winnipeg: University of Manitoba Press, 1970. 6 x 9 inches, 397 pages, 135 figures, 34 tables. $8.00 cloth, $5.00 paperbound.*

This is a report on the archaeological survey and excavations in the area to be affected by the Grand Rapids Hydro-electric Project in the lower reaches of the Saskatchewan river before it flows into Lake Winnipeg. The field work was done under the direction of William J. Mayer-Oakes in 1961 and 1962 but the report was not written until 1969 and may well be Mayer-Oakes' last major contribution to Manitoba archaeology.

Some 39 sites were located along 25 miles of the river and lake shore in the area to be flooded by the dam. Most of the sites, because of the physical conditions, rested on only a few inches of soil. Five sites had some depth and these were sampled by means of test pits. Mayer-Oakes identifies a sequence of five successive cultural phases beginning with 1) a Preceramic complex to be equated with the McKean period in the northern Plains of about 2500 B.C.; 2) the Laurel phase of about A.D. 1; 3) the Manitoba phase, followed by 4) the Selkirk phase which