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BEHAVIOR OF WATER IN THE BRØGGER GLACIER, SPITSBERGEN (ABSTRACT)

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Measurements of the water permeability through glacier ice at Brøgger Glacier in Spitsbergen were carried out in August 1991. The melt-water permeating through a glacier body plays an important role in the glacier gliding and glacier surge. However, very few measurements have been made *in situ* on the behavior of melt-water in a glacier body. The measurements were at made four points on the glacier from the terminus to the upper part of the glacier. To study the behavior of melt-water through the glacier ice, an auger hole method was used. The melt-water oozed out from the entire wall of the bore-hole and gradually filled it. The water was bailed out of the hole and the ascending speed of the water level in the hole was measured. Kirkham's formula was used to calculate the coefficient of permeability, k, of glacier ice,

$$k=0.617\times(R/SD)\times(\mathrm{d}h/\mathrm{d}t),$$

where R is the radius of the hole, D is the depth of the hole from the final water level, $\mathrm{d}h$ is the increment of the water level within $\mathrm{d}t$ seconds, and S is a coefficient which is determined from the values of R, h and D. The calculated values of the permeability coefficient were 2×10^{-4} cm/s to 3.0×10^{-3} cm/s, equivalent to that of fine grained sand and in agreement with the values obtained from Mendenhall Glacier in Alaska.

Also, the flow speed of melt-water through the glacier body was directly measured by the "two-bore-holes method". About 100 g of NaCl was poured into the water in the upper hole and then the water was rapidly stirred by an auger-rod to make it homogeneous. The electric conductivity of the water taken from two holes was measured with time, so that the value of conductivity of the water taken from the upper hole decreased exponentially with time. On the other hand, the conductivity of the water in the lower hole increased suddenly when water saturated with NaCl in the upper hole reached the water in the lower hole. From this measurement the average flow speed of melt-water in the glacier body was estimated to be 8 cm/min to 50 cm/min, which was larger than the values obtained from Mendenhall Glacier in summer.

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