WATER MOVEMENT AT THE BASE OF ICE SHEETS

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ABSTRACT. Flat-surfaced subglacial lakes, such as those discovered by Oswald (1975), can form where basal sliding velocities are low. As the glacier moves onto a subglacial lake, its underside retains the shape of the vertical relief at the lake edge. Differential heat transfer from the lake into high and low points in the interface flattens the surface by extra melting of the downward projections or freezing in the high areas. A time of the order of 10^3 years is required to flatten the fluting, and the down-glacier part of a subglacial lake can be flat-surfaced if the glacier takes longer than some 10^3 years to traverse the lake. Such a slow traverse time is expected near ice-drainage divides, and it is there that flat-surfaced lakes were discovered by radar sounding.

A map of subglacial water potential for the Byrd Station strain-network area demonstrates the direction of subglacial water flow. There are closed contours that suggest the presence of lakes far from the ice divide.

These lakes may be very important to the dynamics of the large ice sheets and to subglacial erosion.

REFERENCE

Oswald, G. K. A. 1975. Investigation of sub-ice bedrock characteristics by radio-echo sounding. *Journal of Glaciology*, Vol. 15, No. 73, p. 75–87.

DISCUSSION

L. A. LLIBOUTRY: Have you any idea about the origin of these overdeepenings? They are generally found near the front, in areas repeatedly free of ice. This is not the case here.

I. M. WHILLANS: No, I do not know what geologic process is responsible for the form of the bottom.

D. J. DREWRY: Reflection coefficients for an ice/water interface range between −1 and −3 dB. Typical rock boundaries are −10 to −25 dB. We do observe on Antarctic radar records zones between −3 and −10 dB with surfaces slightly rougher than specular. This could result from some perturbation in the ice roof over lakes generated by undulations or debris entrained within basal layers.

WHILLANS: That is a good point. That approach could be complementary to the one that I have used.