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ABSTRACTS OF PAPERS PRESENTED AT THE SYMPOSIUM BUT NOT PUBLISHED IN FULL IN THIS VOLUME

SUBGLACIAL, ENGLACIAL, AND SUPRAGLACIAL SEDIMENT DIFFERENTIATION AND EROSION IN GLACIAL BASINS

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ABSTRACT. If sediments being transported by glaciers in subglacial, englacial, and supraglacial situations can be differentiated on the basis of their textural characteristics, some potential exists for interpreting the relative importance of subglacial and sub-aerial periglacial processes in the excavation of glacial valleys, by examining the sediments in abandoned or active terminal moraines. Caution should be used with compound glacial valleys where subglacially eroded debris may become englacial as ice streams merge, be subsequently transported passively, and in terminal moraine deposits appear to represent sub-aerially derived sediments.

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THE NATURE OF THE ICE–ROCK INTERFACE: THE RESULTS OF INVESTIGATION ON 20000 m² OF THE ROCK BED OF TEMPERATE GLACIERS

By ROBERT VIVIAN

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ABSTRACT. This paper reviews the results of ten years study of the only four subglacial sites which are permanently accessible thanks to the work of hydro-electrical companies. All the sites occur beneath temperate ice. The first part is devoted to the study of the rock–ice interface as a glaciological phenomenon. The dynamic conditions for separation of the ice from the rock bed are considered. This cavitation phenomenon occurs when $\tan \alpha > V_i/H_i$. "Regressive cavitation" explains the existence up-stream of large permanent cavities and of a series of small cavities which, although they are not permanent, are fundamental because they control sub-glacial water drainage. The second part analyses the sliding movement of ice on a rock bed. Indeed the deformation of the cavities depends mainly on the variations in the velocity of the glacier. The sliding velocity measured at the interface accounts for 60 to 80% of the surface movement of the glacier. 80 to 90% of the surface velocity is attained a few metres above the glacier–bed interface. The third part describes the characteristics of subglacial drainage which are necessary to understand the nature of the ice–rock interface. The fourth part is devoted to the precise description of the different types of interface as they appeared in the subglacial sites.

This paper has been accepted for publication in full in a future issue of the *Journal of Glaciology*.

DISCUSSION

A. IKEN: You mentioned that, even though there is a strong relation between discharge of subglacial water and sliding velocity, the cavities were never completely filled with water. Could it not be that up-stream of the observation area, where the glacier is less steep and subglacial drainage less effective, the cavities are filled? There the sliding velocity could increase due to the action of water pressure. In the observation area the sliding velocity might then increase, because it is pushed from behind (and not directly by the action of water).

R. A. VIVIAN: Certainly it is possible to explain the sliding velocities of a down-stream part of the glacier by the up-stream behaviour of the glacier. I agree completely with this. But water pressure is not ubiquitously responsible and I think that it is necessary to look elsewhere for explanations.

T. STENBORG: I would suggest that you do not use the term "cavitation" which may lead to confusion, because it is used in engineering hydromechanics for quite different features, but simply call it cavity formation or flow separation.

You showed us one phase of *development* of a subglacial cavity. If that development continues—without being part of a "cyclic" process—all cavities of the kind you started from would successively have been deformed and removed. Your initial cavity is apparently unstable; have you any observations of its formation, or other phases of development?

VIVIAN: It is certainly necessary to be aware of the difference between hydraulic and glaciologic cavitation, but it is also obvious that this term has been in the glaciological literature now for ten years. Several papers of this symposium deal with the phenomenon. I feel this kind of separation between rock and ice should be referred to as "glacial cavitation".

In response to your second point, the cavities I have described are actually permanent. Indeed the contact between rock and ice down-stream from the cavities are such that they create large drag. From this point the regressive cavitation phenomenon affects the development of the subglacial cavity, being able to produce up-stream a series of temporary separations. So it is cyclic. A future slow-down in the velocities up-stream from the cavity (or a period of lower friction down-stream) will return the cavity to its initial shape.

MARKS AND FORMS ON GLACIER BEDS: FORMATION AND CLASSIFICATION

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ABSTRACT. Glacial erosion wears the bedrock grain by grain, that is it breaks free a multitude of little fragments. It also acts upon the bedrock to cause trains of concentric fractures and quarried surfaces. Since this type of erosion is selective in places of variable resistance, it brings about dug-out forms like grooved joints, or salient forms like veins carved out from up-stream down, it produces small-scale features like grooves or chattermark trains