its discharge. This can be by any number of mechanisms involving its own shape (slope, width, and thickness), as well as the shape of Crary Ice Rise. We observe that the separation of the raft has served to make the ice rise more streamlined to the discharge of Ice Stream B. This streamlining may be a direct result of the interaction between an accelerating ice stream and a forming ice rise.

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SEISMIC EVIDENCE FOR A THIN BASAL LAYER AT A SECOND LOCATION ON ICE STREAM B, ANTARCTICA

(Abstract)

by

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Seismic experiments have shown that a meters thick layer of unconsolidated sediment exists beneath Ice Stream B at a location that is several hundred kilometers up-stream from the grounding line. In previous work, we have proposed that a "coupling" line exists about 100 km up-stream from the grounding line. Above the coupling line, we believe that the dynamic behavior of Ice Stream B is dominated by deformation within the basal sediment layers and that erosion is taking place at the bottom of this layer. Below the coupling line, we believe that sliding on a lubricating water film becomes increasingly important and that the subglacial sediments are deposited as a delta. Preliminary results from a 30 km seismic profile near the coupling line of Ice Stream B show a prominent horizontal reflector several meters below the base of the ice; this reflector is underlain by a sequence of reflectors, each with a down-stream dip of about 1%. We believe that the horizontal and dipping reflectors represent, respectively, the topsets and foresets of the hypothesized delta.

DERIVATION OF FLOW-LAW PROPERTIES FROM BORE-HOLE TILT DATA: DISCUSSION OF THE DYE 3, CAMP CENTURY, AND BYRD STATION BORE-HOLE RESULTS

(Abstract)

by

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Derivation of flow properties from bore-hole tilts is a popular way of determining flow properties of "real" glacier ice. Many interpretations have been made of the measurements from the Camp Century bore hole (Paterson, 1983; Wolff and Doake, 1986), the Byrd Station bore hole (Paterson, 1983; Doake and Wolff, 1985), and the Dye 3 bore hole (Dahl-Jensen and Gundestrup, 1987; Pimienta and Duval, 1987) where the flow-law exponent in Glen's flow law has values ranging from 1 to 3. The great allowance for variations in the exponent is primarily due to the experimental error in the tilt measurements.

The high-quality bore-hole tilt data from the 2037 m deep Dye 3 bore hole are used to illustrate some of the difficulties which are connected with the use of field measurements to determine flow-law parameters. In the 250 m thick bottom layer of Wisconsin ice, where 80% of the deformation occurs, the deformation rates are enhanced by the varying impurity concentrations and crystal sizes.

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The data from this region cannot be used to determine flow-law properties until the enhanced flow is quantitatively explained. In the remaining 1785 m of ice, the experimental error on the tilting rates in the upper 890 m are of the same order of magnitude as the measurements themselves. This leaves us with 900 m of ice, in which only 20% of the deformation occurs, to determine the flow-law parameters. In this region, the importance of including the longitudinal stress deviators and using stress fields that include variations due to the rough bedrock are discussed.

The experience from the Dye 3 bore-hole tilt data is used to discuss the Camp Century and Byrd Station bore-hole results.

One of the most obvious suggestions for future work is the need for re-surveying the existing bore holes. This would allow determination of significant tilt rates in the upper parts of the ice even though the lower part of the bore hole is inaccessible.

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DYNAMICS OF JAKOBSHAVNS ICE STREAM, WEST GREENLAND

(Abstract)

by

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Jakobshavns Isbræ is a fast-moving outlet glacier draining a significant part of the Greenland ice sheet. This glacier extends nearly 100 km into the ice sheet as a well-defined ice stream. The lower glacier moves at speeds of over 7 km/year below the grounding zone, with a gradual decrease in speed inland into the ice sheet. This glacier moves at these high speeds continuously. Such high speeds are comparable to average velocities observed on surge-type glaciers during periods of peak surge, when basal sliding has been shown to be the dominant flow mechanism. An important question is whether or not the high speeds on Jakobshavns Isbræ are due to a large sliding contribution or to some other mechanism such as an ice-flow instability near the base, and, if it is sliding, what causes these high slip rates?

A major field program was undertaken on Jakobshavns Isbræ during 1984–87 to address these questions and others relating to ice-stream dynamics. Measurements have included spatial and temporal variations of the surface-velocity field, mass balance, ice temperature, seismic activity, calving rate and terminus position, ice-fabric analysis, and ice thickness.

Measurement of surface velocity throughout the year shows no seasonal variation in velocity. Production of large amounts of melt water at the surface in the ablation zone (lower 75 km of the ice stream) does not appear to influence the speed directly. Calculations show that basal shear stresses along the ice stream are large. If there is a basal zone of favorably oriented ice (and therefore a weak layer), then ice deformation under the large stresses may account for the fast motion in the ice stream rather than basal sliding or deformation of basal debris, as has been proposed for the Antarctic ice streams.

At and below the grounding zone, short-interval ($\frac{1}{2}$–1 h) surveys show that the velocity varies by as much as 35% with the level of the tide in the fjord. The phasing of this harmonic speed variation with the tide shows that basal sliding is occurring at the grounding zone and that this sliding is directly affected by subglacial water.

Observations of ice temperature strongly show the effects of melt-water refreezing in the percolation zone. These and other interesting results from the extensive field program are discussed, giving further insight into the dynamics of this fast-moving ice stream.

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