Annals of Glaciology 11 1988

DENSITY–DEPTH PROFILE DETERMINED BY SEISMIC-REFRACTION STUDIES: ICE STREAM B, WEST ANTARCTICA

(Abstract)

by

S. Anandakrishnan, D.D. Blankenship, R.B. Alley and C.R. Bentley

(University of Wisconsin–Madison, Geophysical and Polar Research Center, 1215 W. Dayton Street, Madison, WI 53706–1692, U.S.A.)

ABSTRACT

Detailed seismic short-refraction profiling was conducted on Ice Stream B (UpB) during the 1983–84 austral summer. A new high-resolution data logger, developed at the University of Wisconsin, recorded both compressional- and shear-wave arrivals. We report here on P-wave and S-wave profiles recorded along a line parallel to the axis of the ice stream. Source-receiver separations up to 720 m yielded seismic velocity–depth curves to below the firn–ice transition zone (slightly greater than 30 m at UpB).

For the compressional-wave profile, geophones were separated by 2.5 m, which yielded a velocity–depth curve with a granularity of ~1 m. The corresponding density–depth curve agrees well with direct density measurements obtained from a core extracted nearby (Alley and Bentley 1988, this volume). Discontinuities in the velocity gradient do not appear at the "critical densities" as they did at Byrd Station, Antarctica, and elsewhere (Kohnen and Bentley 1973, Robertson and Bentley 1975).

Two shear-wave profiles were recorded, both with geophone spacings of 5 m, one with longitudinal polarization (SV) and the other with transverse polarization (SH). There is a marked difference in velocity between the SH and SV waves, particularly in the shallow firn. We suggest that a strong vertical shape-and-bonding fabric in the shallow firn, as observed in cores collected at UpB, would account for this disparity.

REFERENCES

Alley, R.B., and C.R. Bentley. 1988. Ice-core analysis on the Siple Coast of West Antarctica. *Ann. Glaciol.*, **11**, 1-7.

Kohnen, H., and C.R. Bentley. 1973. Seismic refraction and reflection measurements at "Byrd" station, Antarctica. *J. Glaciol.*, **12**(64), 101-111.

Robertson, J.D., and C.R. Bentley. 1975. Investigation of polar snow using seismic velocity gradients. *J. Glaciol.*, **14**(70), 39-48.