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UNIAXIAL COMPRESSION TESTS OF SHALLOW ICE CORES FROM POLAR ICE SHEETS (ABSTRACT)

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Uniaxial compression tests were carried out on shallow ice core samples from G6, Antarctica (73°S, 40°E) and Site J, Greenland (67°N, 46°W) under constant load. Both firn and glacier ice samples were prepared for the tests to investigate firn densification processes and glacier flow behavior, respectively.

Six firn samples were obtained from depths of 8 to 9 m. Sample densities ranged from 0.433 to 0.521 g/cm^3. Uniaxial compression creep tests were done under a constant stress of 1 bar and constant temperatures ranging between -2 and -10°C in a cold room. Each sample was deformed for about 100 hours. Experimental results show relatively shorter transient creep regions and slight increase in steady-state creep rates compared with artificial firns sample tests. The densification processes were discussed in terms of bulk ice creep rates by introducing a stress factor, which is given as a ratio of the Fracture Stress (or Young's Modulus) between ice and firn.

Eight ice samples were obtained from depths between 99 and 197 m, including two samples from the Ice Layer. Experiments were done under constant stresses between 5.3 and 6.5 bars and a constant temperature of -15°C. Crystal orientation distribution for each sample was measured by conducting thin section analysis, and the average Schmid Factor was calculated. Experimental results show that ice layer samples are about 2 times softer than the other samples at the same Schmid Factor level. This softening, possibly caused by impurity enrichment, suggests that vertical perturbations in the ice strength may exist in the percolation and wet-snow zones in Greenland.

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