Physical Properties in Thin Sections from WAIS Divide Core WDC06A; Fabric, Bubbles, Grains and More

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As part of the Physical Properties study (NSF 1043528) vertical thin sections from the WAIS Divide Core (WDC06A) were sampled in the field and thinned at the National Ice Core Lab (NICL).

Purpose: Coordinated interpretation of c-axis fabrics, grain sizes and shapes, and bubble characteristics are being used to learn about the history of ice flow, the processes of ice flow, and the softness of the ice for additional deformation. Bubble number-density is used to reconstruct temperature changes through the rest of the bubbly part of the core, providing important paleoclimatic data for earlier parts of the Holocene.

c-axis Fabric: Vertical thin sections were analyzed using the automated c-axis Fabric Analyzer (Wilen, 2000; Hansen and Wilen, 2002) located at Penn State University. The c-axis orientation at 420 meters depth is nearly random but by 965 m the c-axes have started to migrate until a very strong girdle fabric developes in the vertical plane. The presence of a persistent girdle fabric indicates stretching in the horizontal axis. The lack of a double girdle may indicate that the ice has undergone no strain induced recrystalization at these depths. This vertical girdle fabric persists to 3000 meters where the axes start to rotate towards the poles and the fabric begins to resolve into one indicating a regime of simple shear.

Bubble Number-Density: Bubble number-density measurements have been made from depths of 580 meters to 1120 meters in the WAIS Divide core. Notable variations are seen in the data, with interesting outliers that could be indicative of seasonal biasing. A depth-variable strain-rate model based on the most currently published depth-age scale is being employed to determine accumulation-rate history so that a paleoclimate reconstruction can be modeled and validated against recent ™18O data from the core. Ultimately, this reconstruction will also determine the viability of the bubble number-density technique through the brittle ice zone. To further investigate how seasonality affects the process of bubble trapping at WAIS Divide, bubble number-density is being measured along two continuous (~25 cm) ice samples that were recently prepared at NICL from the nearby WDC05A core. These samples represent at least two continuous seasons at the site.

Grain Growth and Zener Pinning: Grain geometry characterization has been completed for sections from the entire core as have area population statistics and 2-dimensional petrofabric analyses. Grain size and shape information are now being compared to other datasets, including data recovered from the drill system during drilling operations, to look for correlations and

trends as well as grain characterizations from other core sites. Comparisons of grain-size and impurity trends will assess controls on grain growth. Dual mapping of grains and bubbles allows improved assessment of their interactions, including the effects of Zener pinning.

Visual Stratigraphy of the Core: Visual examination and logging has been completed for the entire core and a summary of these data will be discussed.