ANTARCTIC ANION GLACIOCHEMISTRY

(Abstract only)

by

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ABSTRACT

Snow and ice-core samples from a number of sites in Antarctica and Greenland have been analyzed for the major anions Cl^-, NO_3^-, and SO_4^{2-} by ion chromatography. Reproducibility on adjacent core or pit samples is ±10% at the 95% confidence level. Chloride is of marine origin except following some major volcanic eruptions. Chloride concentrations decrease exponentially with increasing site elevation with a scale height of about 1.5 km. For sites of comparable elevation, Antarctic Cl^- concentrations are only slightly higher than in Greenland. Sulfate concentrations, corrected for the marine aerosol contribution, show an inverse dependence on snow accumulation rate. For sites of comparable accumulation rate, Greenland concentrations exceed those in Antarctica by a factor of 2 to 3. Nitrate concentrations also decrease with increasing accumulation rate and for comparable sites Greenland NO_3^- concentrations are a factor of 2 higher than in Antarctica. There is no evidence of solar modulation or supernova perturbation of Greenland NO_3^- concentrations. The Byrd deep core is shown to have distinct seasonal variations in Cl^- and SO_4^{2-} that may be used for dating. In addition, the Byrd core contains volcanic signals similar to those found in Greenland. Recent Greenland snow contains about 4 times as much SO_4^{2-} and 2 to 3 times as much NO_3^- as is found in older ice due to modern fossil fuel combustion.

MECHANICAL TESTS OF FRESH ICE CORE

(Abstract only)

by

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ABSTRACT

Uniaxial compression tests (UCT) under constant cross-head speed and simple shear tests (SST) under constant load have been carried out in a snow cave at -16°C on ice cores within at most one month of extraction from depths of 235, 504, 708, and 896 m at Dye-3, Greenland, as part of the Greenland Ice Sheet Program (GISP), in order to improve understanding of flow behavior. UCT specimens had their stress axis at 45° from the core axis and SST specimens had their shear parallel to the horizontal plane of the core, so that in both cases maximum resolved shear stress was in the horizontal plane of the ice sheet.

Fracture stresses in UCT had characteristic values for each depth corresponding to core quality. When effective strain-rate was plotted against effective shear stress on a double logarithmic plot, (1) data from the same depth fell on the same straight line for both tests, (2) for a given stress, strain-rate varied with core-depth by less than half an order of magnitude, and (3) the stress exponent lay between 2 and 2.5, significantly less than the 3 to 4 reported for polycrystalline ice.

Values extrapolated from the present data agree quite well with those deduced from bore-hole tilting measurements at Byrd station, Antarctica, and Camp Century, Greenland.