

Stable nitrogen isotopic chemistry of nitrate in GISP II ice

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We have analyzed twelve GISP II ice core samples for $\delta^{15}\text{N}$ of nitrate. Samples range from ~460 years to ~110,000 years BP in age. To our knowledge these samples represent the oldest precipitation samples ever analyzed for $\delta^{15}\text{N}$ in nitrate. The $\delta^{15}\text{N}$ values vary between 14.3 and 27.4‰. The mean isotopic value for Holocene age samples was lighter than the older samples (16.5 vs. 23.6‰). When compared to recent snow data from central Greenland, it is clear that the $\delta^{15}\text{N}$ of nitrate in the snow has decreased from 37,000 years BP through the Holocene into the anthropogenic period. These results may suggest that during glacial times a stronger stratospheric source of nitrate existed, or stratospheric photolysis rates were increased, or there was a change in the tropospheric nitrate source mix. However, as observed in previous ice core studies, the $\delta^{15}\text{N}$ values are inversely proportional to the snow accumulation rate. The results may indicate a preferential loss of the ^{14}N from the snowpack via post-depositional losses, especially at times of lower accumulation rates. There is no relationship between $\delta^{15}\text{N}$ and nitrate concentration. Further analysis should be undertaken in order to determine the exact cause of the $\delta^{15}\text{N}$ variation.