

Nitrogen isotope of nitrate in Arctic ice core and its relation to past anthropogenic energy shift

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Nitrate is one of the major anions found in snow. Nitrate (NO_3^-) deposition results from reactions between nitrogen oxides ($\text{NO}_x = \text{NO} + \text{NO}_2$) and atmospheric oxidants. Global main sources of NO_x are fossil fuel, biomass burning, biogenic soil emissions, and lightning. A recent increase in NO_3^- in ice cores has been associated with increasing anthropogenic emissions of NO_x . Based on the changes in NO_3^- concentration, however, it is not easy to identify specific sources of NO_x which takes into account for the changes in NO_3^- concentrations, hindering the development of mitigation policy of anthropogenic pollution and its effect on the environment.

Nitrogen and oxygen isotopic compositions of NO_3^- provide information on changes in the nitrogen source and its formation pathways, but ice core records for NO_3^- concentrations and its isotopic compositions are problematic because of post depositional loss of NO_3^- via photolysis. In this study, we analyzed isotopic compositions of NO_3^- preserved in the high-accumulation dome ice core, South East Greenland, which has a dome with high accumulation rate (about 1 m yr^{-1}) in water equivalent. In this study, $\delta^{15}\text{N}$ value of NO_3^- was measured by the bacterial method coupled with N_2O decomposition via microwave-induced plasma (MIP).

The nitrogen isotopic compositions for NO_3^- were generally lower than those reported in Summit, Greenland, suggesting that some extent of NO_3^- deposited in Summit is removed via photolysis. Based on the trend of reconstructed $\delta^{15}\text{N}$ values and NO_x emission inventory, switches from coal to oil combustion mainly in North

America was likely a factor changing the nitrogen cycle in the Arctic environments.

Keywords: isotope, nitrate, anthropogenic activity, nitrogen cycle, Nitrogen oxides