

## 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 ( $\text{NO}_3^-$ ) deposition results from reactions between nitrogen oxides ( $\text{NO}_x = \text{NO} + \text{NO}_2$ ) and atmospheric oxidants. Global main sources of  $\text{NO}_x$  are fossil fuel, biomass burning, biogenic soil emissions, and lightning. A recent increase in  $\text{NO}_3^-$  in ice cores has been associated with increasing anthropogenic emissions of  $\text{NO}_x$ . Based on the changes in  $\text{NO}_3^-$  concentration, however, it is not easy to identify specific sources of  $\text{NO}_x$  which takes into account for the changes in  $\text{NO}_3^-$  concentrations, hindering the development of mitigation policy of anthropogenic pollution and its effect on the environment.

Nitrogen and oxygen isotopic compositions of  $\text{NO}_3^-$  provide information on changes in the nitrogen source and its formation pathways, but ice core records for  $\text{NO}_3^-$  concentrations and its isotopic compositions are problematic because of post depositional loss of  $\text{NO}_3^-$  via photolysis. In this study, we analyzed isotopic compositions of  $\text{NO}_3^-$  preserved in the high-accumulation dome ice core, South East Greenland, which has a dome with high accumulation rate (about  $1 \text{ m yr}^{-1}$ ) in water equivalent. In this study,  $\delta^{15}\text{N}$  value of  $\text{NO}_3^-$  was measured by the bacterial method coupled with  $\text{N}_2\text{O}$  decomposition via microwave-induced plasma (MIP).

The nitrogen isotopic compositions for  $\text{NO}_3^-$  were generally lower than those reported in Summit, Greenland, suggesting that some extent of  $\text{NO}_3^-$  deposited in Summit is removed via photolysis. Based on the trend of reconstructed  $\delta^{15}\text{N}$  values and  $\text{NO}_x$  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