The triple isotopic composition of oxygen for sulfate and nitrate in surface snow in a latitudinal transect in East Antarctica

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The isotopic compositions of sulfate (SO₄²⁻) and nitrate (NO₃⁻) reflect their sources and oxidation pathways. In particular, triple oxygen isotope compositions (Δ¹⁷O) are potential tool to reconstruct how the oxidants work in past and present atmosphere. Antarctica is an ideal place to investigate the past proxy, because the ice core preserves in past hundred thousands Earth’s history. However, recently we found the annual mean Δ¹⁷O values for atmospheric SO₄²⁻ at coastal Antarctica is not matched with the Δ¹⁷O values preserved in the inland Antarctic ice core records. In addition, the lack of observation, spatial variations of Δ¹⁷O values are limitedly reported.

In order to test spatial variation of isotopic compositions, especially for the difference in Δ¹⁷O values between coastal site and inland site, here we present latitudinal variation of Δ¹⁷O value and conventional isotopic compositions (δ³⁴S, δ¹⁵N, and δ¹⁸O) of SO₄²⁻ and NO₃⁻ in surface snow in eastern Dronning Maud Land, East Antarctica. Snow samples were collected from the surface at low- and high-elevation sites during the 54th and 57th Japanese Antarctic Research, respectively. Δ¹⁷O values of non-sea-salt (nss)-SO₄²⁻ at the East Antarctica ranges from 2.2 to 3.3‰, and the Δ¹⁷O value of nss-SO₄²⁻ for coastal site was lower than those for inland site. Thus, this result suggest that oxidizing chemistry for biogenic sulfur is different among coastal and inland sites, although small sulfur isotopic variations are observed and source of sulfur is biogenic and homogeneous. For the isotopic compositions of NO₃⁻, considerably increasing values of δ¹⁵N of NO₃⁻ are observed from coastal to inland sites. The δ¹⁸O and Δ¹⁷O of NO₃⁻, on the other hand, decreases with increasing of δ¹⁵N values, indicating the secondary formation of NO₃⁻. Thus, spatial variations of isotopic compositions of NO₃⁻ reflect the post-depositional processes on the East Antarctic snow.

Keywords: stable isotope, triple oxygen isotopes, sulfate, nitrate