



Chemical compositions of past soluble aerosols reconstructed from NEEM (Greenland) and Dome C (Antarctica) ice cores

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Polar ice core preserve past atmospheric aerosols, which is a useful proxy for understanding the interaction between climate changes and atmospheric aerosols. One useful technique for reconstructing past soluble aerosols from ice core is the determination of dissolved ion species. However, since salts and acids melt into ions, chemical compositions of soluble aerosols in the ice cores have not been cleared. To clarify the temporal variations in the chemical compositions of past soluble aerosols, this study investigated chemical compositions of soluble particles preserved in the NEEM (Greenland) and Dome C (Antarctica) ice cores using new method “ice-sublimation method”. The ice-sublimation method can extract soluble salts particles as a solid state without melting.

The ice core samples are selected from the sections from the last termination (the Last Glacial Maximum (LGM) to Holocene) of Dome C (inland Antarctica) and NEEM ice cores. Using ice-sublimation method, soluble salts particles were extracted. Chemical components of extracted particles were analysed by scanning electron microscope and energy dispersive spectroscopy, and micro-Raman spectroscopy.

The major components of soluble salts particles in the Dome C ice core are CaSO_4 , Na_2SO_4 and NaCl . The CaSO_4 and NaCl fractions were high in the first half of the last termination, whereas the Na_2SO_4 fraction is high in the latter half of the last termination. The major components of soluble salts particles in the NEEM ice core are CaCO_3 , CaSO_4 , NaCl and Na_2SO_4 . The fractions of CaCO_3 , CaSO_4 and NaCl were high in LGM, whereas those of NaCl and Na_2SO_4 were high in Holocene.

The changes in the salts compositions in Dome C ice core are mainly controlled by concentration of terrestrial material (Ca^{2+}). In the first half of the last termination, most of the terrestrial material (CaCO_3) reacted with H_2SO_4 but some of sea-salt (NaCl) was not reacted with H_2SO_4 due to high Ca^{2+} concentration. As a result, the CaSO_4 and NaCl fractions were high in this period. In the latter half of the last termination, reaction of NaCl with H_2SO_4 enhanced due to decreased in the Ca^{2+} concentration. As a result, Na_2SO_4 fraction increased. The changes in the salts compositions in NEEM ice core are also mainly controlled by Ca^{2+} concentration. In the LGM, some of CaCO_3 was reacted but some of CaCO_3 and most of NaCl were not reacted with H_2SO_4 due to too high Ca^{2+} concentration. As a result, CaCO_3 , CaSO_4 and NaCl fractions were high in LGM. In the Holocene, NaCl sulfatization increased due to reduction of Ca^{2+} concentration. However, some of NaCl was not sulfatized due to different seasonality of NaCl and H_2SO_4 , and increased in the NH_4^+ inputs originate from vegetation.