Single-particle characterization of Antarctic aerosol particles collected at King George island using low-*Z* particle EPMA, Raman microspectrometry, and ATR-FTIR imaging

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Individual aerosol particles in two size fractions, i.e., $PM_{2.5\text{-}10}$ and $PM_{1\text{-}2.5}$, of two samples collected at King Sejong Korean scientific research station, Antarctica on Dec. 9, 2011 (in the austral summer) and on July 23, 2012 (in the austral winter) with high (123.0 μg/L) and low (6.3 μg/L) concentrations of chlorophyll-a, respectively, were investiga-ted to obtain their chemical compositions, molecular species, and mixing states using low-*Z* particle electron probe X-ray microanalysis (EPMA), Raman microspectrometry (RMS), and attenuated total reflection Fourier transform infrared (ATR-FTIR) imaging techniques. Particles containing non-sea-salt sulfate ($nss\text{-}SO_4^{2-}$) were more abundant in the summertime sample than the wintertime sample. RMS and ATR-FTIR imaging also confirmed higher amounts of Na_2SO_4, $CaSO_4$, and/or $(CH_3SO_3)_2Mg$ due to enhanced biological activity on the sea surface during the summer. Si was only observed in the summer sample probably due to the more abundantly present diatoms, a common type of phytoplanktons, although RMS and ATR-FTIR imaging could not provide Si speciation. Organic contents of individual particles increased with the decrease of particle size consistent with recent reports on sea-spray aerosols (SSAs) [1]. RMS and ATR-FTIR imaging results for individual SSAs suggest that most of the summertime SSAs contain inorganic salts and oxidized organic species like magnesium mono- and/or di-amino acid. On the other hand, for the wintertime SSAs, inorganic salts, aliphatic-rich organics like magnesium palmitate salt, and/or their mixtures were more frequently encountered.

[1] Quinn et al. (2015) Chem. Rev., **115**, 433-4399.