Sea salt aerosols as a reactive surface for inorganic and organic acidic gases in the arctic troposphere

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Based on their morphology and composition, we can identify three types of SSA: fresh SSA, partially aged SSA, and fully aged SSA. Integrated observations of individual SSA through the TEM, STEM, and nanoSIMS provided direct evidence of the occurrence of sulfate and nitrate in aged SSA in the arctic atmosphere. Laskin et al. [1] showed that SSA effectively reacted with organic acids in polluted coastal air, leaving behind particles depleted in chloride and enriched in the corresponding organic salts. However, whether weak organic acids participated in the chloride depletion remains uncertain in the clean arctic air. Our results are shown in the figure 1-3 below.

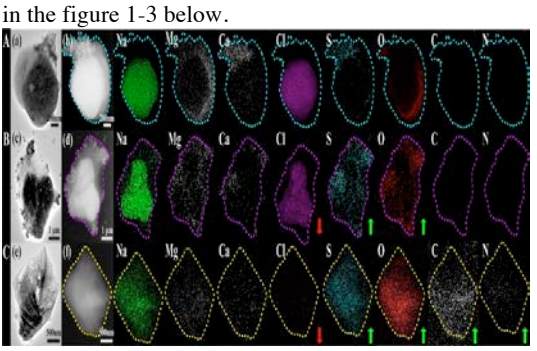

Figure 1. Bright and dark-field TEM images of the fresh, partially aged, and fully aged SSA and elemental mapping of Na, Mg, Ca, Cl, S, O, C, and N. (A) One fresh SSA particle, (B) One partially aged SSA particle, (C) One fully aged SSA particle. The dot intensity represents elemental concentration within an individual particle. The arrows in particles B and C represent increase or decrease of elemental concentration compared to the particle A.

The fresh SSA particles exhibited a single core-shell structure. Containing only Na and Cl, the core consisted of the cubic NaCl crystal with the coating of Mg, Ca, S, O and Cl, identified as $CaSO_4$ and $MgCl_2$. Individual partially aged SSA particles consisted of the single irregularly shaped NaCl core coated with Na, Mg, Ca, K, N, O, and S, with or without minor Cl, suggesting a single Cl-depletion phenomenon in the formation of partially aged SSA.