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Supplement of

Mixing states of Amazon basin aerosol particles transported over long distances using transmission electron microscopy

Kouji Adachi et al.

Correspondence to: Kouji Adachi (adachik@mri-jma.go.jp)

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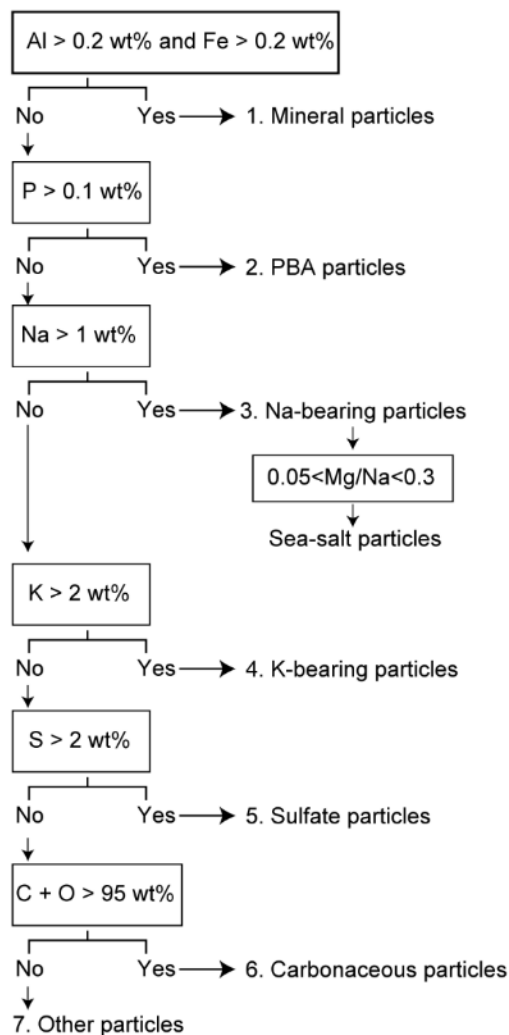
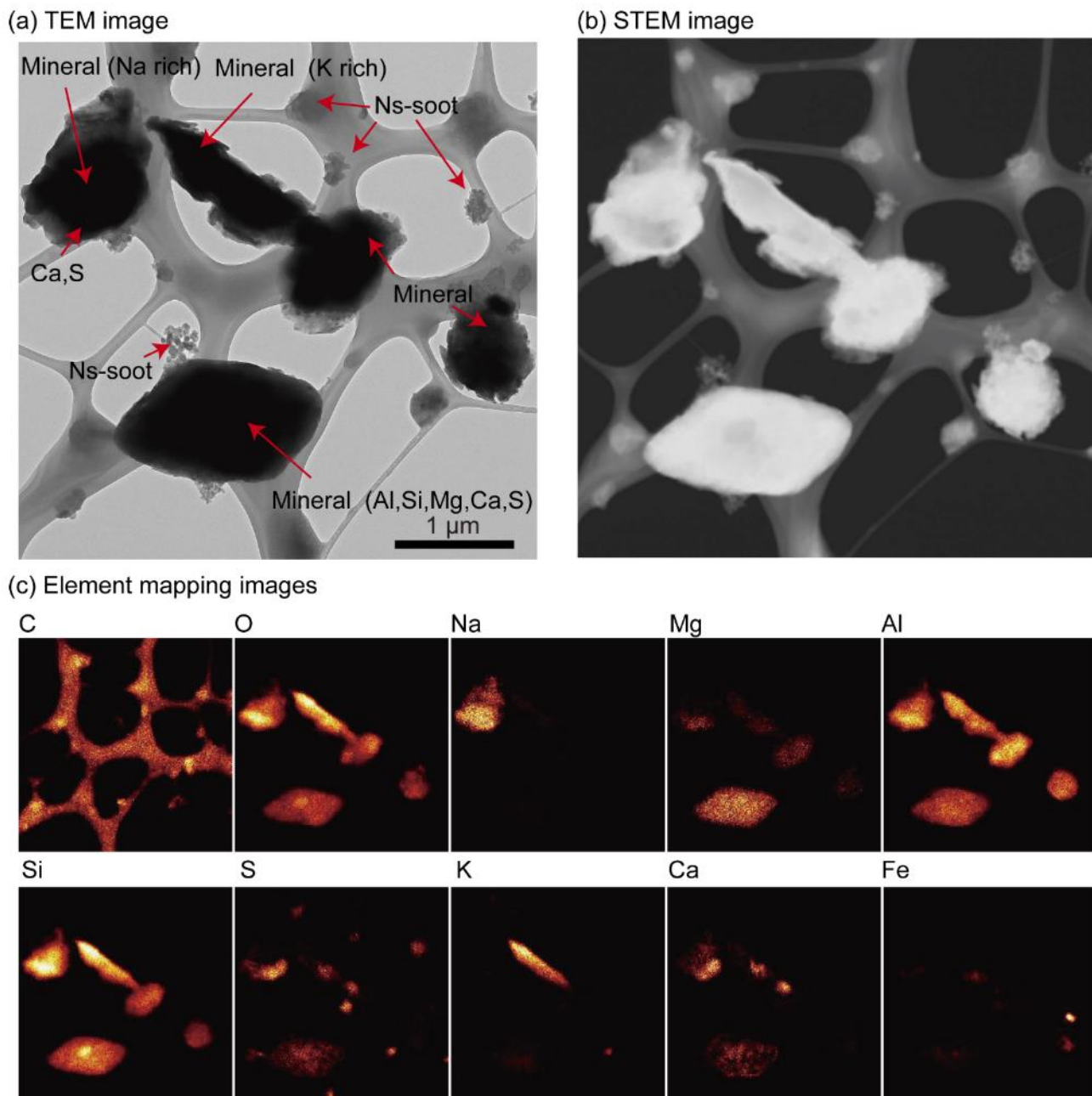
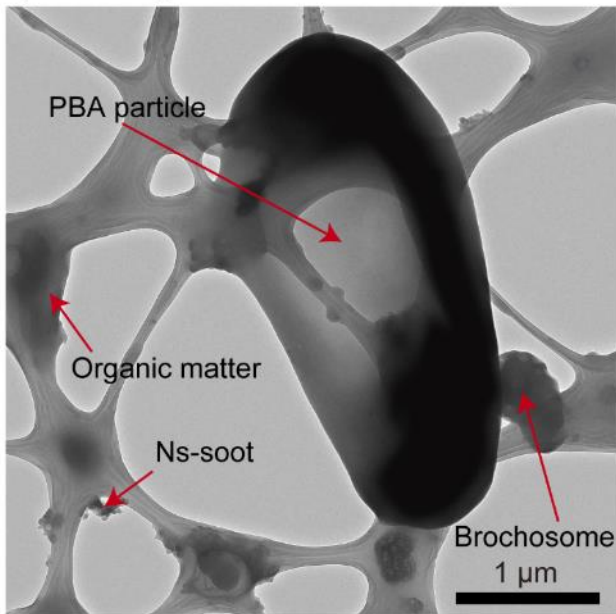


Figure S1. Flow chart for the particle classification. All analysed particles were classified based on their compositions obtained using STEM-EDS. For Al, Fe, and P, we chose the threshold values that are just above their detection limits because they are unique but minor components within particles. For K and S, we used larger threshold values (2 weight %) than that of Na (1 weight %), as they have heavier atomic masses than Na.

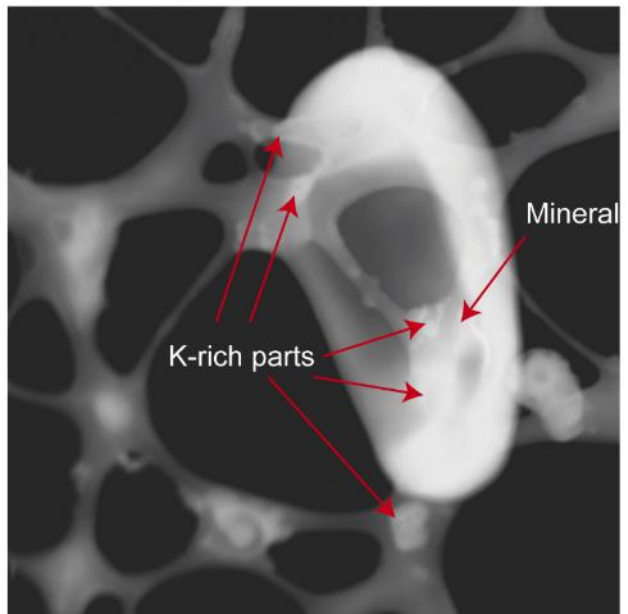


30 **Figure S2.** Shapes and compositions of mineral particles. (a) TEM and (b) STEM and (c) element mapping images of mineral particles. These mineral particles contain Al-Si-Mg-O-, Al-Si-Na-O-, or Al-Si-K-O-rich grains. There are Ca- or Fe-rich grains within the mineral particles. Ns-soot and sulfate particles also occur. The sample was collected from 12:00-12:30, 29 March, 2014.

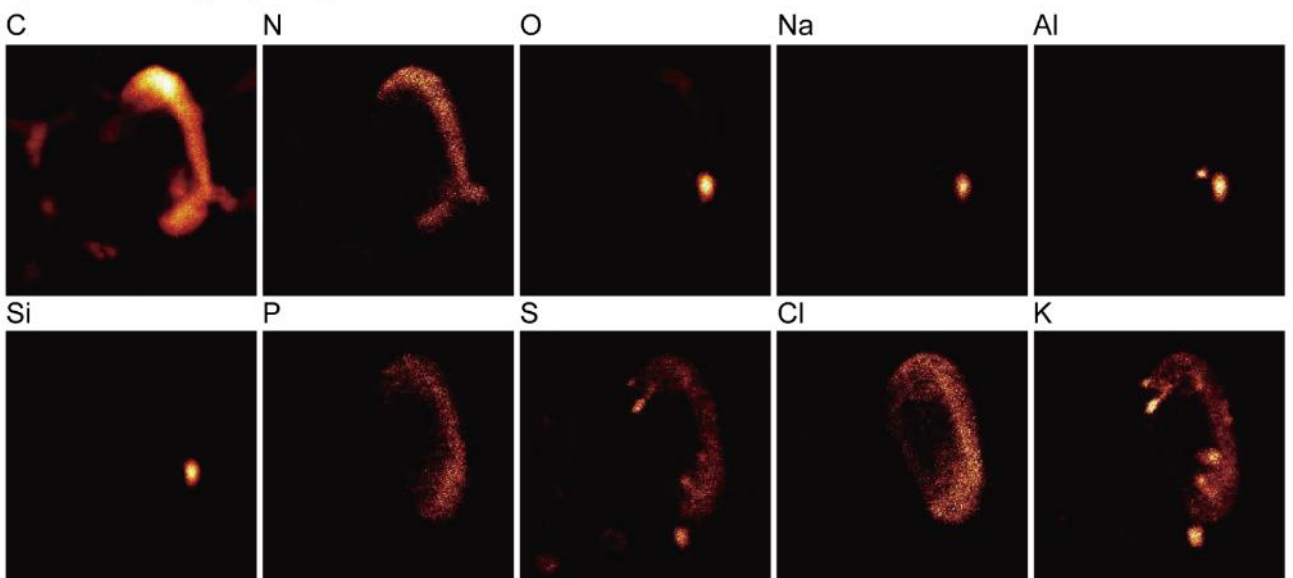
a) TEM image



b) STEM image



c) Element mapping images

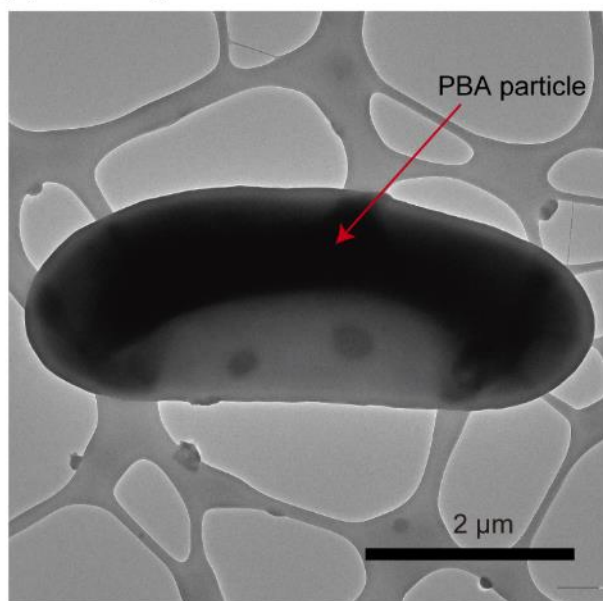


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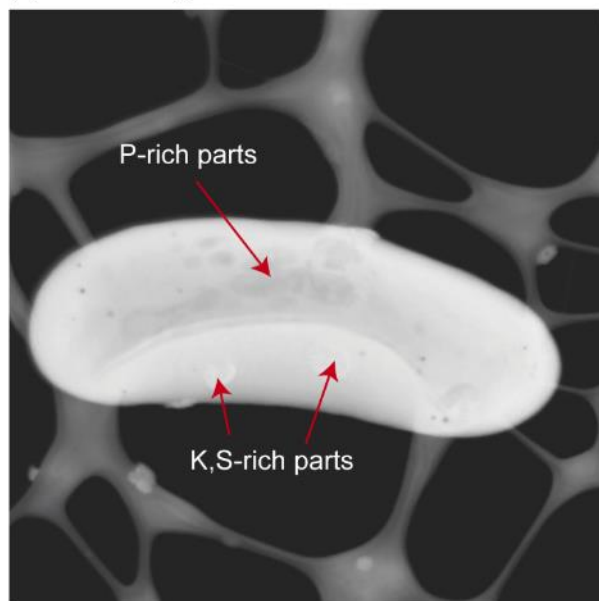
Figure S3. Shape and composition of PBA particle with K-rich grains. (a) TEM and (b) STEM and (c) element mapping images of the PBA particle. A mineral particle attaches to the PBA particle. The sample was collected from 3:00-3:30, 15 March, 2014.

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(a) TEM image



(b) STEM image



(c) Element mapping images

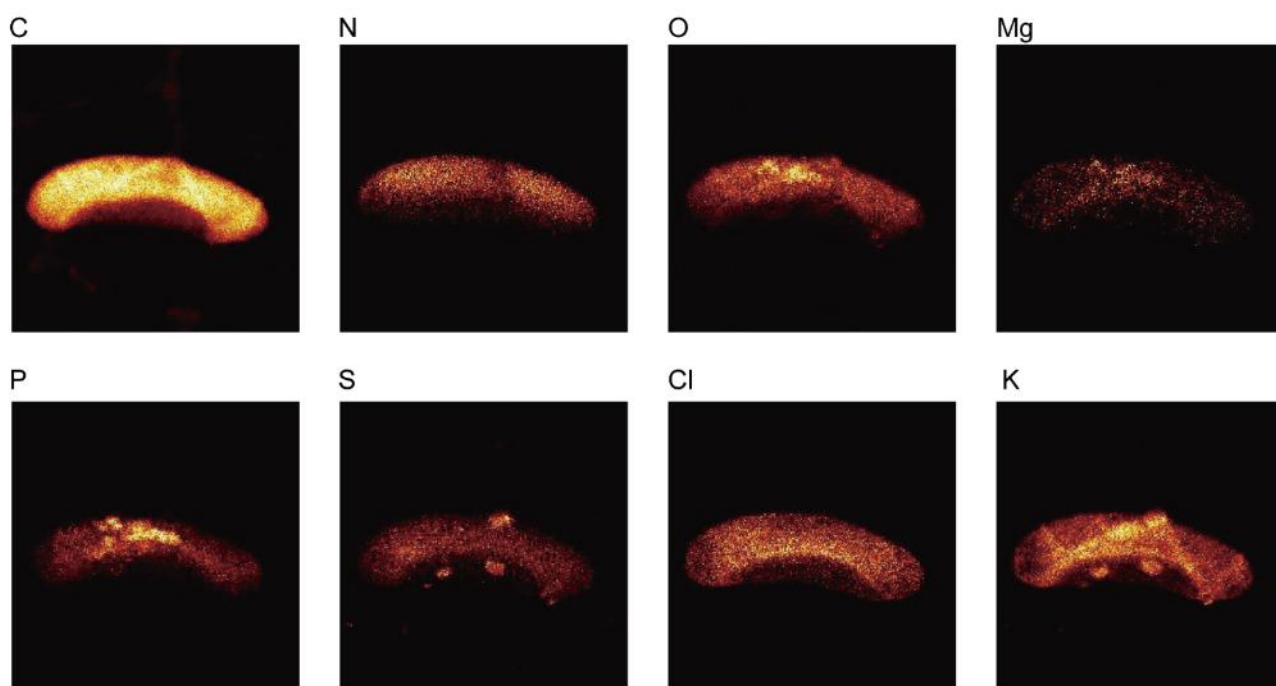
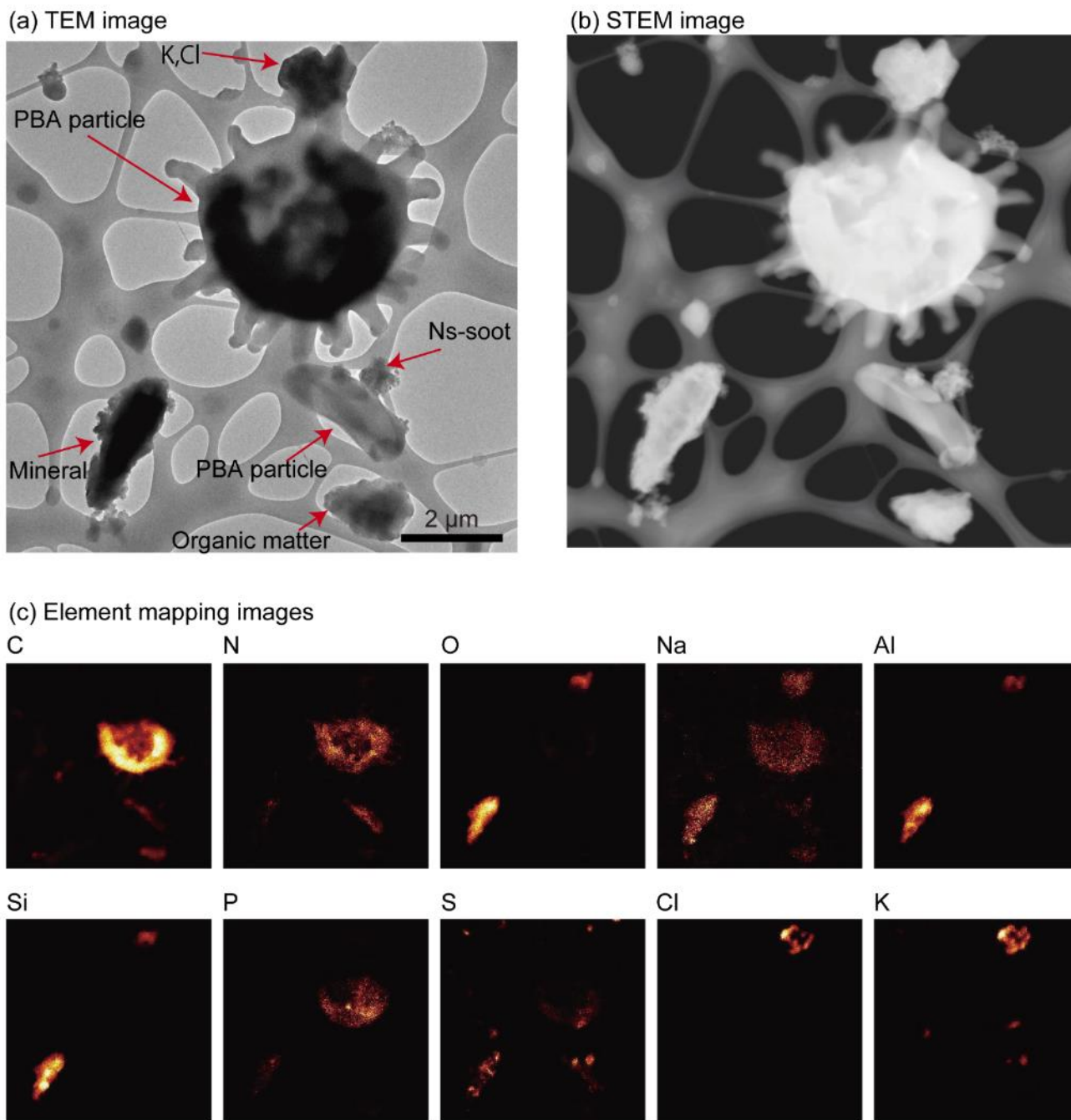
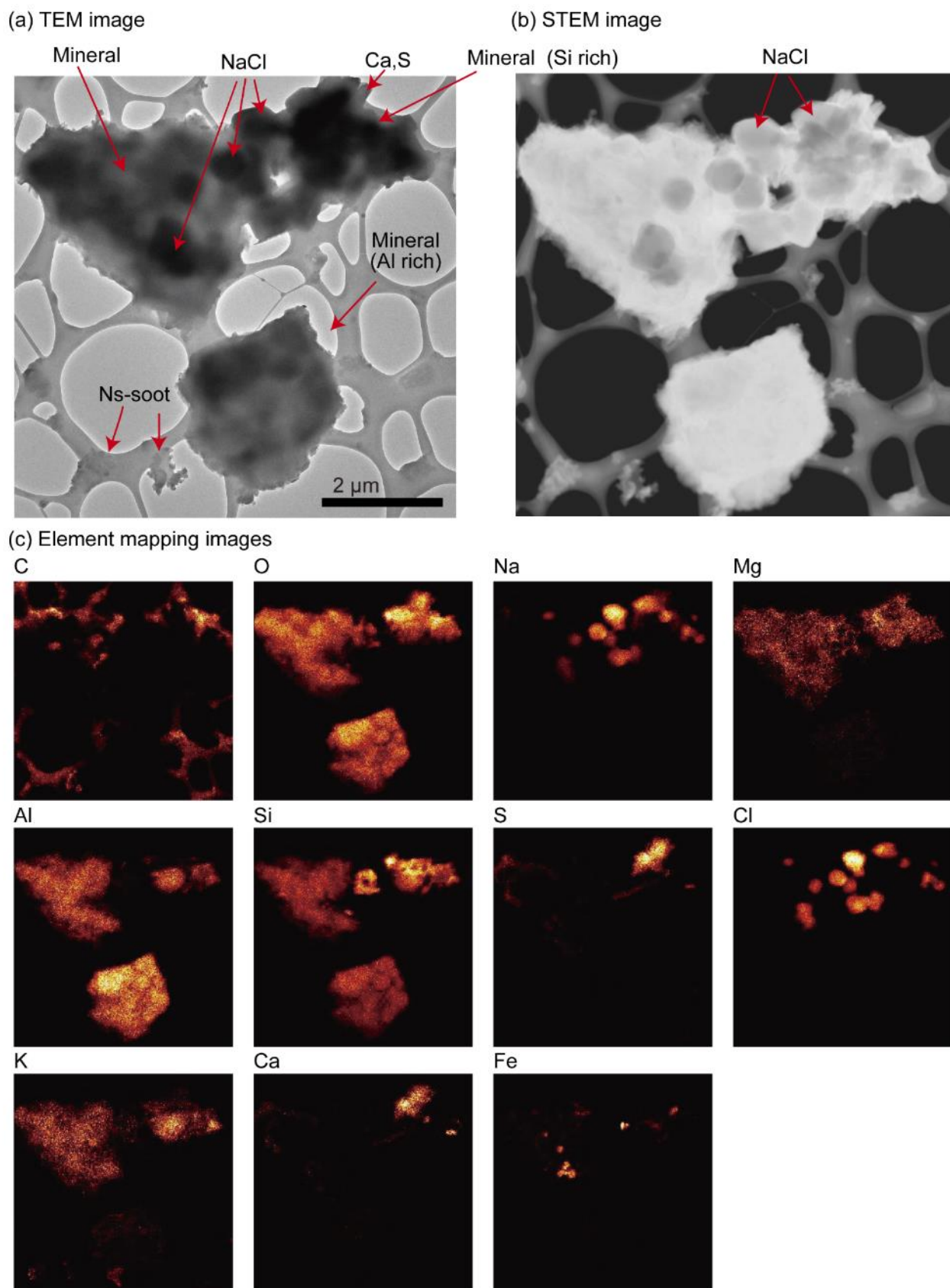


Figure S4. Shape and composition of PBA particle with P-rich grains. (a) TEM and (b) STEM and (c) element mapping images of the PBA particle. The sample was collected from 0:00-0:30, 27 February, 2014.

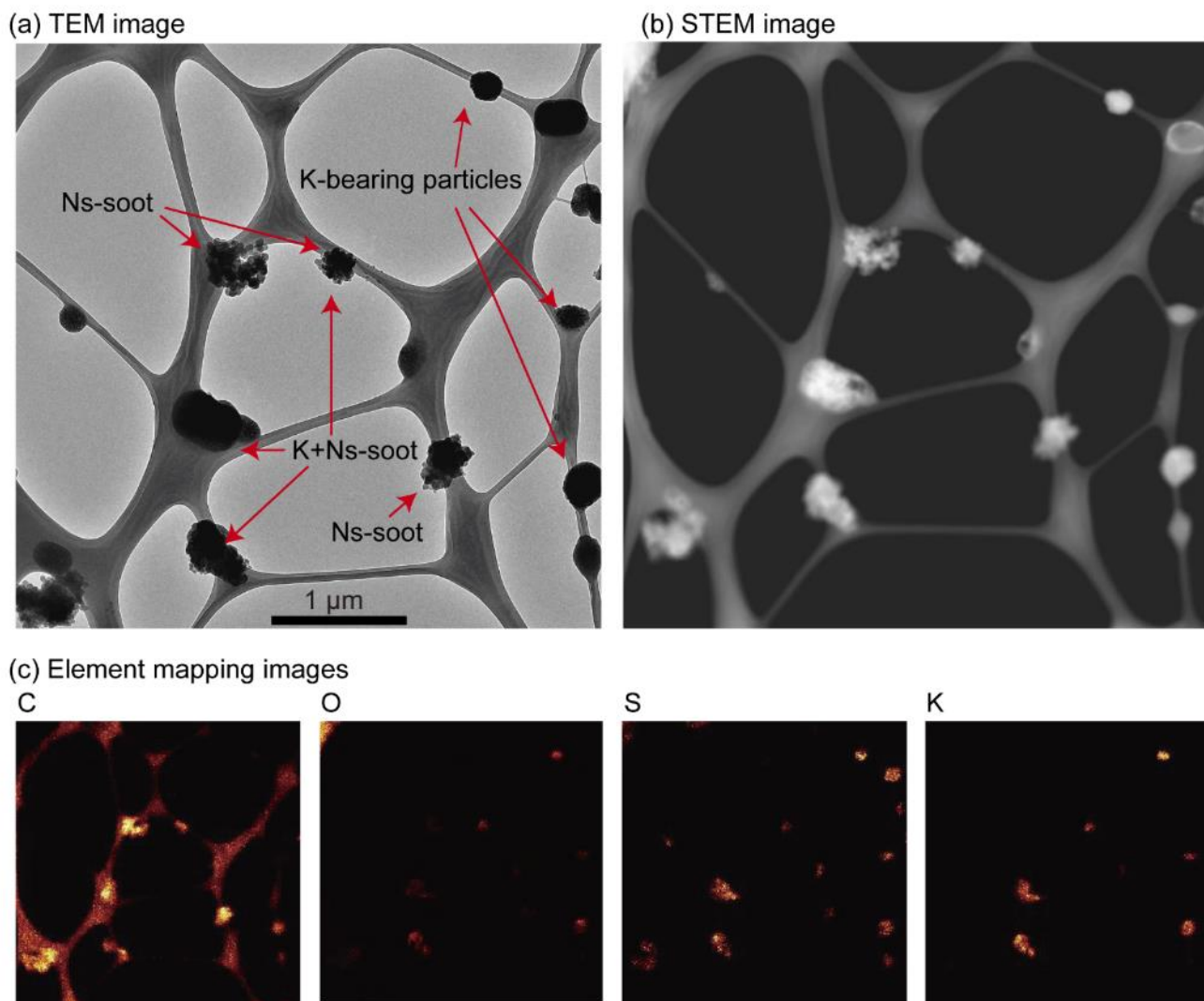


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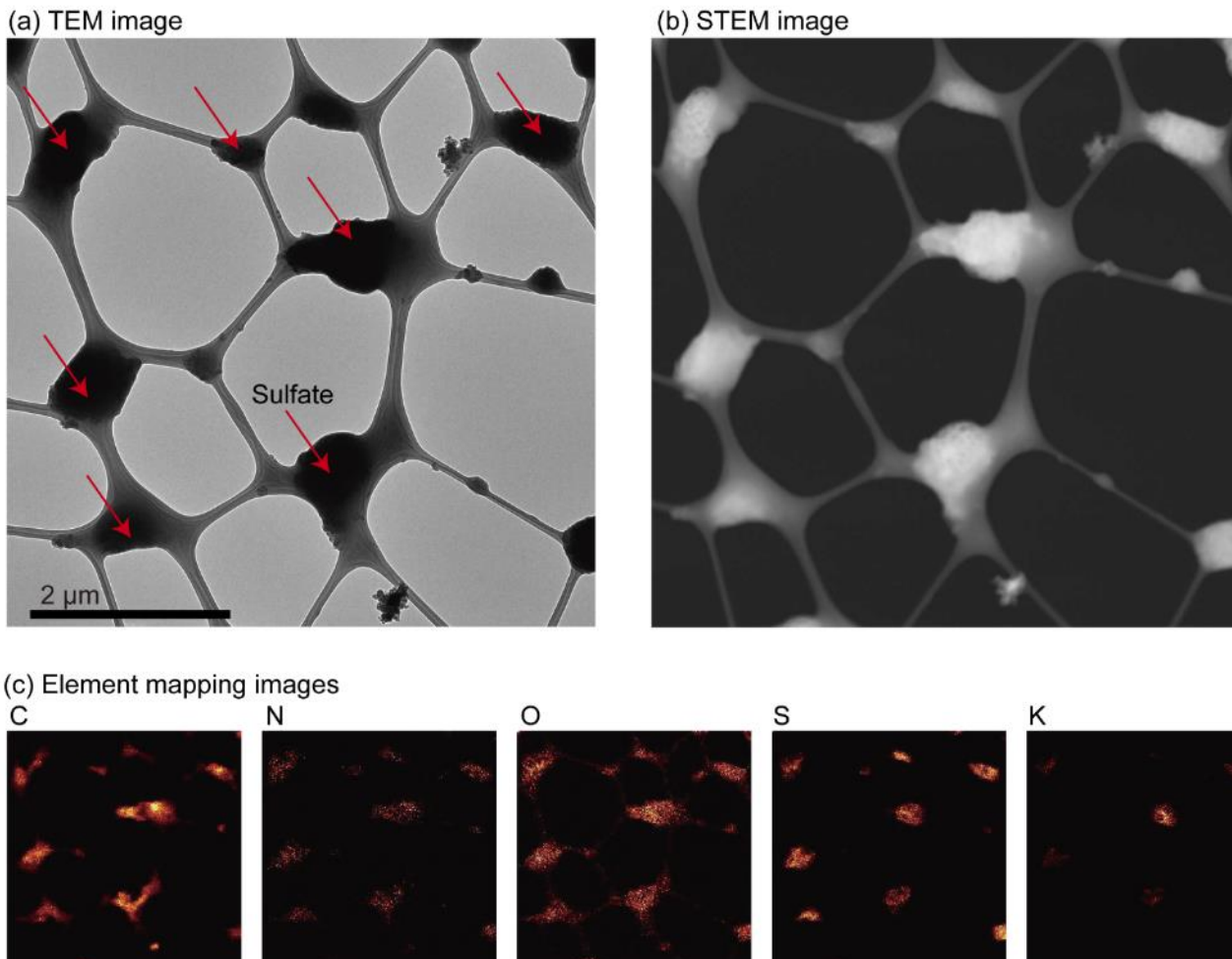
Figure S5. Shapes and compositions of PBA, mineral, and KCl particles. (a) TEM and (b) STEM and (c) element mapping images of these particles. The sample was collected from 0:00-0:30, 27 February, 2014.



50 **Figure S6.** Shapes and compositions of mineral particles that attach sea-salt (NaCl) particles. (a) TEM and (b) STEM images and (c) element mapping images of these particles. The sample was collected from 18:00-18:30, 2 February, 2014. Mg distributes over the upper particle, suggesting that hydrate Mg salt coated the particles.



55 **Figure S7.** Shapes and compositions of K-bearing particles that attach ns-soot particles. (a) TEM and (b) STEM and (c) element mapping images of the particles. These particles consist of K and S, suggesting that they are potassium sulfate. These K-bearing particles occur either with or without ns-soot particles. The sample was collected from 0:00-0:30, 25 February, 2014.



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Figure S8. Shapes and compositions of sulfate particles. (a) TEM and (b) STEM and (c) element mapping images of these particles. These sulfate particles include N, O, S, and K, implying that they are ammonium or potassium sulfate. Carbon occurs around the sulfate, showing that the sulfates are coated by secondary organic matters and have ns-soot inclusions. Sulfate particles deform over the substrates and decompose after intense electron beam irradiation. The sample was collected during 12:55-13:25, 26 March, 2014.

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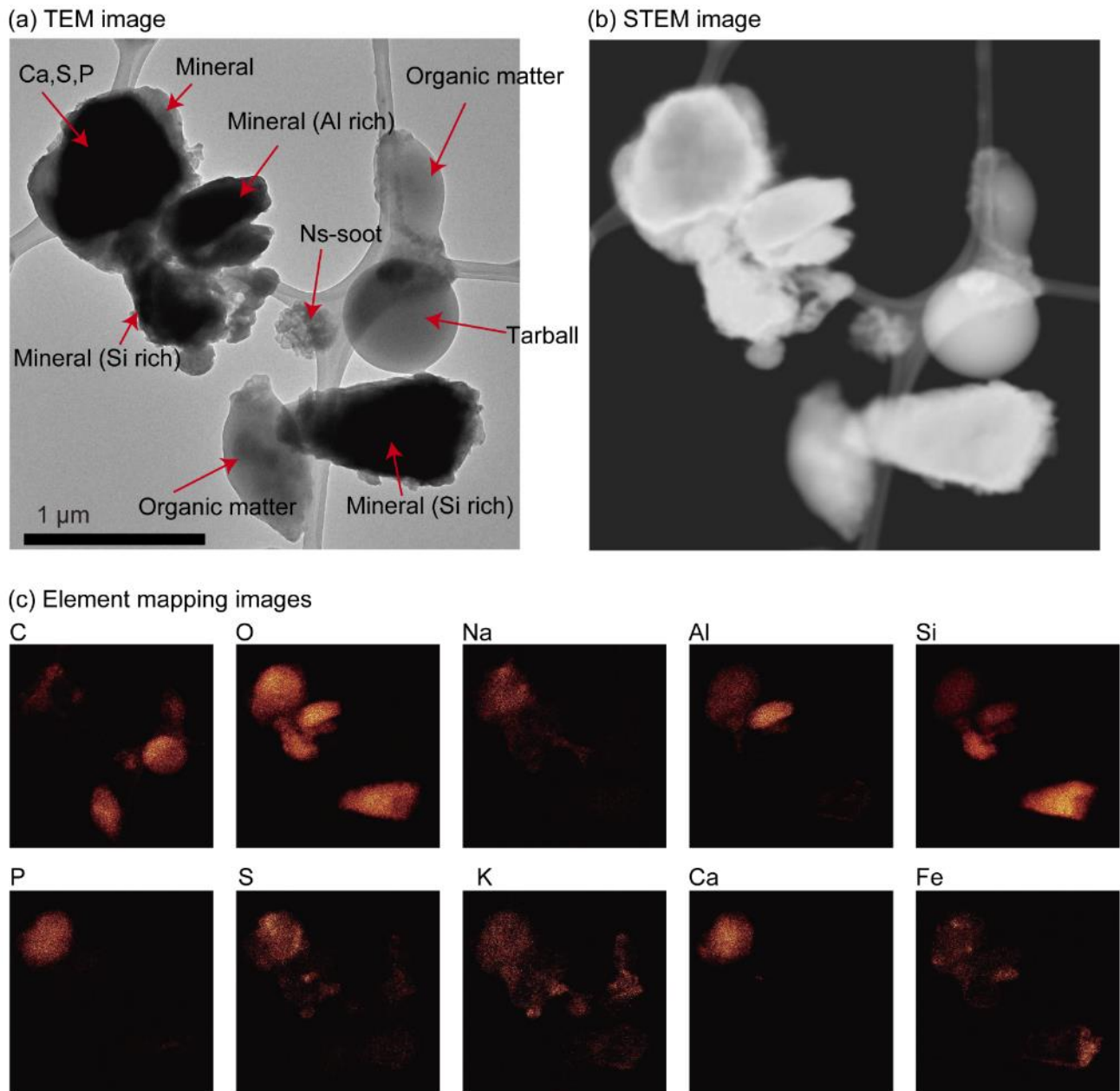
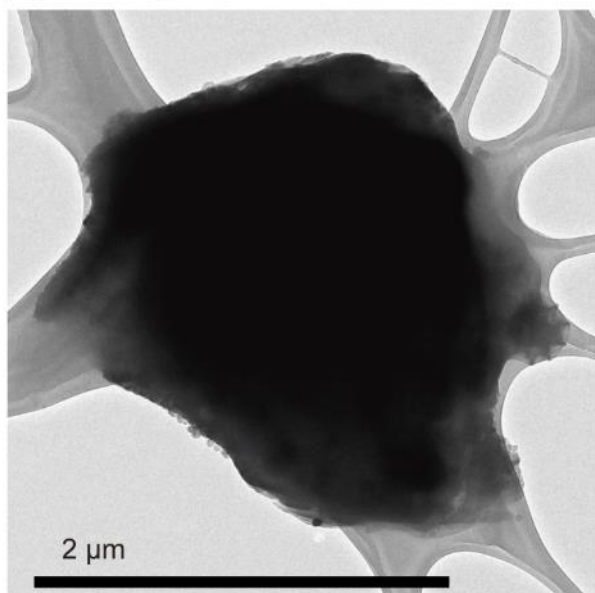
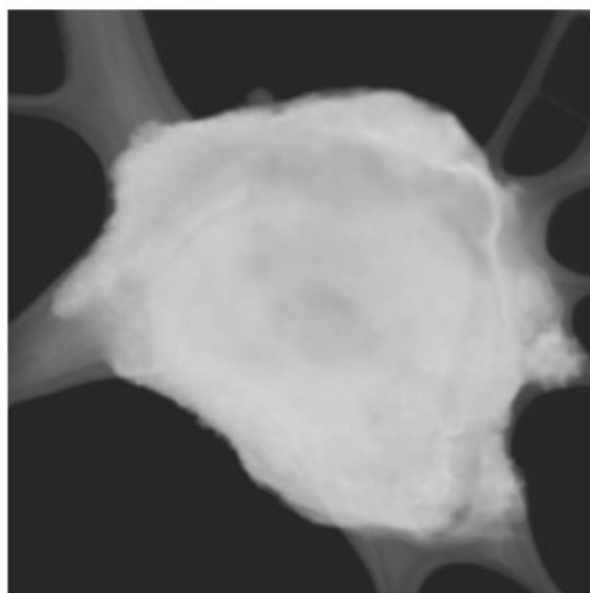


Figure S9. Shapes and compositions of mineral and carbonaceous particles, including tarball, ns-soot, and organic matters (primary organic aerosol (POA) particles). (a) TEM and (b) STEM and (c) element mapping images of these particles. The mineral particles include those with Al- and Si-rich particles. The sample was collected from 12:00-12:30, 14 February, 2014.

(a) TEM image



(b) STEM image



(c) Element mapping images

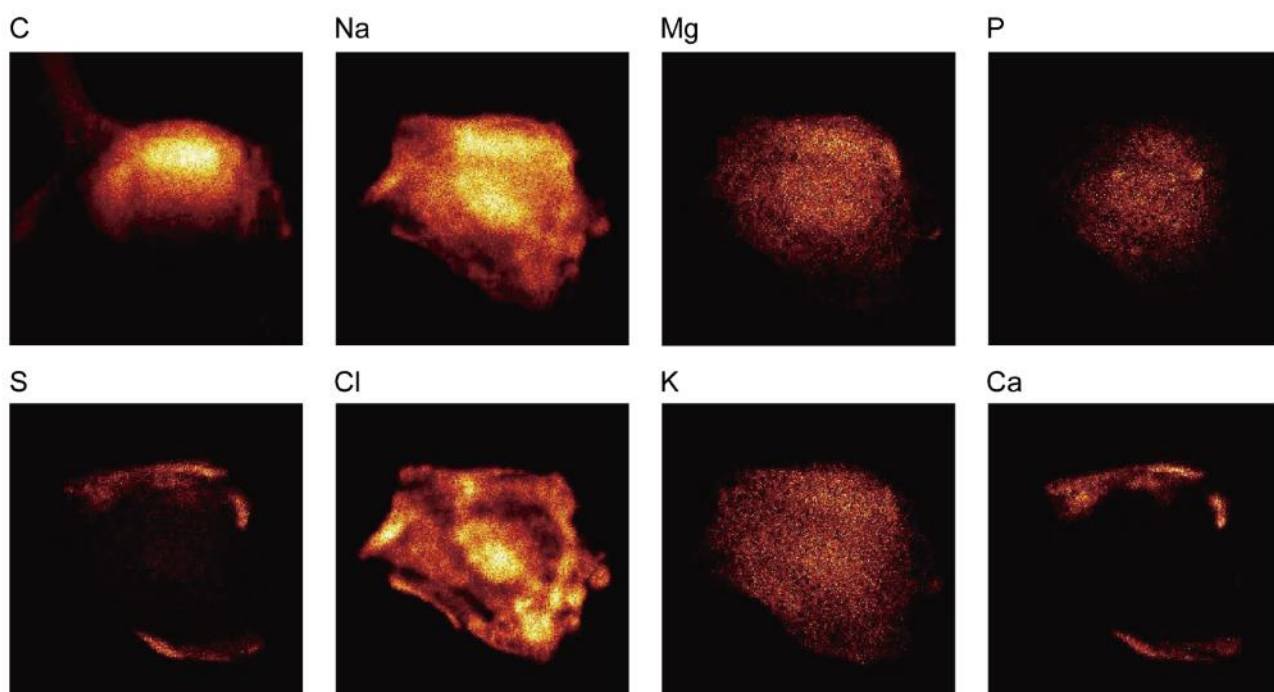


Figure S10. Shapes and compositions of PBA particles coated with sea salt. (a) TEM and (b) STEM and
75 (c) element mapping images of these particles. The sea-salt coating mainly consists of NaCl with a thin sulfur layer. PBOA is characterized by C and P. The sample was collected from 12:00-12:30, 2 February, 2014.