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Elevated nitrogen-containing particles observed in Asian dust aerosol samples collected at the marine boundary layer of the Bohai Sea and the Yellow Sea

H. Geng^{1,2}, Y. Park¹, H. Hwang³, S. Kang¹, and C.-U. Ro¹¹Department of Chemistry, Inha University, Incheon, 402–751, Korea²Research Center of Environmental Science and Engineering, Shanxi University, Taiyuan, 030006, China³Korea Polar Research Institute, Incheon, 406–840, Korea

Abstract. Low-Z particle electron probe X-ray microanalysis (low-Z particle EPMA) shows powerful advantages for the characterization of ambient particulate matter in environmental and geological applications. By the application of the low-Z particle EPMA single particle analysis, an overall examination of 1800 coarse and fine particles (aerodynamic diameters: 2.5–10 μm and 1.0–2.5 μm , respectively) in six samples collected on 28 April–1 May 2006 in the marine boundary layer (MBL) of the Bohai Sea and Yellow Sea was conducted. Three samples (D1, D2, and D3) were collected along the Bohai Bay, Bohai Straits, and Yellow Sea near Korea during an Asian dust storm event while the other three samples (N3, N2, and N1) were collected on non-Asian dust (NAD) days. Based on X-ray spectral and secondary electron image data, 15 different types of particles were identified, in which soil-derived particles were encountered with the largest frequency, followed by (C, N, O)-rich droplets (likely the mixture of organic matter and NH_4NO_3), particles of marine origin, and carbonaceous, Fe-rich, fly ash, and (C, N, O, S)-rich droplet particles. Results show that during the Asian dust storm event relative abundances of the (C, N, O)-rich droplets and the nitrate-containing secondary soil-derived particles were markedly increased (on average by a factor of 4.5 and 2, respectively in $\text{PM}_{2.5-10}$ fraction and by a factor of 1.9 and 1.5, respectively in $\text{PM}_{1.0-2.5}$ fraction) in the MBL of the Bohai Sea and Yellow Sea, implying that Asian dust aerosols in springtime are an important carrier of gaseous inorganic nitrogen species, especially NO_x (or HNO_3) and NH_3 .

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