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Soluble component in individual Asian dust particles collected in southwestern Japan with seawater dialysis

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Dust particles are transported widely in the atmosphere. They influence various environments during their long-range transport and finally deposit to the ground or the ocean. Especially in the open ocean, dust particles are important source to provide some elements such as iron (Fe) and nitrogen (N). These elements are related to the marine productivity, and these interactions between the atmosphere and the ocean is very important for geochemical cycles. However, the effect of dust particles from the atmosphere to the ocean is not well understood. In this study, solubility of iron in individual Asian dust particles in artificial seawater was examined.

Asian dust particles were collected in southwestern Japan during a dust event on March 3 in 2008. The collected particles were analyzed individually with a scanning electron microscope (SEM) equipped with an energy dispersive X-ray spectrometer (EDX). Then, the particles were soaked into the artificial seawater (Daigo's artificial seawater SP) about 2 hours to remove the soluble component in seawater. This method is called seawater dialysis. The particles were analyzed with the SEM-EDX again. The elemental compositions before and after the seawater dialysis in the same particles were compared and the soluble components were investigated.

Dust particles were defined as the particles containing silicon (Si) and aluminum (Al) and/or Fe in this study. Total analyzed particles were 371, and 351 particles were detected after the seawater dialysis. In these particles, 305 particles were defined as dust particles before and after the dialysis, and only these particles were compared their relative weight ratios before and after the dialysis.

Before the seawater dialysis, most of dust particles contained Si and Al, and about 65 % of dust particles contained magnesium (Mg). Dust particles were mainly composed of these three elements in this sample. About 35 % and 45 % of dust particles contained sodium (Na) and sulfur (S), respectively. This indicates that the mixture with sea salt particles and S-containing components were not significant. About 20 % of dust particles were contained Fe. The relative weight ratios of Fe/Si in the same dust particles were compared before and after the seawater dialysis to investigate the solubility of Fe in each particle. The ratios of Fe/Si in most of dust particles were not changed, indicating that the Fe components in most of dust particles were not dissolved in artificial seawater.