

# Clay mineralogy of dust particles

GI YOUNG JEONG

Department of Earth and Environmental Sciences, Andong National University, Andong 760-749, Republic of Korea (jearth@anu.ac.kr)

Mineral dust supplied to remote ocean regions stimulates phytoplankton growth through delivery of micronutrients, notably iron (Fe). Although attention is usually paid to Fe (hydr)oxides as major sources of available Fe, Fe-bearing clay minerals are typically the dominant phase in mineral dust. The mineralogy and chemistry of clay minerals in dust particles, however, are largely unknown. We conducted microscopic identification and chemical analysis of the clay minerals in Asian and Saharan dust particles. Cross-sectional slices of dust particles were prepared by focused ion beam (FIB) techniques and analyzed by transmission electron microscopy (TEM) combined with energy dispersive X-ray spectroscopy (EDXS). TEM images of FIB slices revealed that clay minerals occurred as either nano-thin platelets or relatively thick plates. The nano-thin platelets included illite, smectite, illite–smectite mixed layers and their nanoscale mixtures (illite–smectite series clay minerals, ISCMs) which could not be resolved with an electron microbeam. EDXS chemical analysis of the clay mineral grains revealed that the average Fe content was 5.8% in nano-thin ISCM platelets assuming 14% H<sub>2</sub>O, while the Fe content of illite and chlorite was 2.8% and 14.8%, respectively. In addition, TEM and EDXS analyses were performed on clay mineral grains dispersed and loaded on microgrids. The average Fe content of clay mineral grains was 6.7% and 5.4% in Asian and Saharan dusts, respectively. A comparative X-ray diffraction analysis of bulk dusts showed that Saharan dust was more enriched in clay minerals than in Asian dust, while Asian dust was more enriched in chlorite. The average Fe/Si, Al/Si and Fe/Al molar ratios of the clay minerals, compared to previously reported chemistries of mineral dusts and leached solutions, indicated that dissolved Fe originated from clay minerals. Clay minerals, in particular nanocrystalline ISCMs and Fe-rich chlorite are important sources of available Fe in remote marine ecosystems.