Electron spin resonance (ESR) signal intensity and crystallinity of eolian quartz from Asian deserts

Youbin Sun[1]; Ryuji Tada[2]; Jun Chen[3]; Huizhong Chen[3]; Shin Toyoda[4]; Atsushi Tani[5]; Yuko Isozaki[1]; Kana Nagashima[6]

[1] Earth and Planetary Sci., Tokyo Univ; [2] DEPS, Univ. Tokyo; [3] none; [4] Dept. Appl. Phys., Okayama Univ. Sci.; [5] Earth and Space Sci., Osaka Univ.; [6] JAMSTEC

To investigate the spatial difference of modern deserts in north China and specify the potential sources of eolian deposits preserved in terrestrial and marine sediments, we employ ESR signal intensity and crystallinity of eolian quartz as two indictors to trace the provenances of Asian dust. Surficial samples were taken from eight deserts in north China for ESR and XRD analyses. Five samples from each desert were selected for grain-size separation. The bulk samples were separated into 5 grain size fractions such as 0-16 micron, 16-32 micron, 32-63 micron, 63-125 micron and 125-500 micron. All the subsamples and bulk samples were pretreated by removal of organic matter, carbonate, and iron and manganese oxides using H2O2, CH3COOH and CDB-method, respectively, and then measured for the ESR signal intensity and crystallinity.

Estimated ESR signal intensity and crystallinity suggest an evident difference in the ESR signal intensity and a weak difference in the crystallinity among different size fractions. The ESR signal intensity of fine silt and clay fraction (0-16 micron) in all samples is higher (10-18) than that of coarse silt fraction (3-9 for 32-63 micron). The crystallinity of fine fraction is slight higher (10-12) than that of coarse fraction (8-10), except for the Taklimakan samples which have the same crystallinity values (8-9) for all grain size fractions. The fine fraction will be emphasized because fine fraction (0-16 micron) can be flowed great distance and thus has global impacts on climate change and ocean productivity. Based upon ESR signal intensity and crystallinity of fine quartz, the deserts in north China can be roughly divided into three key sources: Source I, deserts in northeast China with high ESR signal intensity (15-19) and high crystallinity (10-12); Source II, deserts in central north China including Gurbantunggut Desert with moderate ESR signal intensity (11-13) and high crystallinity (10-12); and Source III, Taklimagan Deserts with low ESR singal intensity (6-10) and low crystallinity (7-9). Difference in the ESR signal intensity and cystallinity among three sources indicates that fine-grained quartz particles in these deserts may be originated from different surrounding bedrocks.