# Mineralogical iron species in clay-sized fractions of the Chinese deserts: Implications for iron bioavailability to the North Pacific Ocean

WANCANG ZHAO[1,2] , WANYI LU[1], JUNFENG JI[1]

[1] Key Laboratory of Surficial Geochemistry, Ministry of Education, School of Earth Sciences and Engineering, N anjing University, Nanjing 210046, China, e-mail:jijunfeng@nju.edu.cn

[2] School of Geographic and Oceanographic Sciences, Nanjing University, China, e-mail:wancangzhao@nju.edu.cn

Long-range transported mineral dust from deserts is potentially an important source of micronutrient iron, which has been shown to be the main limitation factor for phytoplankton growth in the High Nutrient Low Chlorophyll (HNLC) areas. Soluble iron in seawater depends on dust mineralogy, particle size and atmospheric chemical processes. The mineral dust from northern Chinese deserts may play a key role in supplying bioavailable iron to the North Pacific Ocean and particularly influencing the global carbon cycle (mitigating the warming caused by rising levels of carbon dioxide). We investigate mineralogical species of iron in the clay-sized fractions (< 2 μm) from the northern Chinese deserts by sequential chemical extraction, X-ray diffraction and diffuse reflectance spectrometry. Our results show that Fe in amorphous phases (FeA), iron oxides, and chlorite are 0.81%, 2.39%, 3.15%, and contributed 10%, 31%, 44% for the total Fe (FeT), respectively. The iron oxides are mainly hematite (Hm) and goethite (Gt), with weight content of 0.5% and 3.5%, respectively. The dominant Fe species in clay-sized fractions from Chinese desert soils are Gt and chlorite. The clay-sized fractions of soils from Taklimakan, Qaidam, and Badain Jaran deserts in northwestern China show higher values of FeA/FeT than the others deserts from China, probably resulting from the unearthing of more fresh Fe(II)-containing minerals that derived from easily weathered silicates, and ultimately from the uplift-weathering of the Tibetan plateau. Overall, chlorite is potentially the main source of bioavailable Fe to the Pacific Ocean. About 85% of total Fe from the clay-sized fractions could be bioavailable Fe to the oceans. This dataset of the Fe species in Asian dust source areas may not only contribute to the ultimate goal of quantifying the bioavailable Fe supply to the oceans, but also provide insight into evaluating the continentally-derived iron weathering processes within marine biogeochemical iron cycle.