Effect of dust mineralogy on Fe solubility and Fe bioavailability to marine phytoplankton

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Atmospheric deposition of continental dust to the surface ocean acts as an essential source of bioavailable iron (Fe) to Fe-limited marine phytoplankton. The potential of dust to alleviate Fe limitation is usually linked to Fe solubility and thus, to solid speciation/mineralogy. However, little information exists on the relationship between Fe solubility, and Fe bioavailability in dust. In this study, we performed dissolution and bioassay experiments to assess the effect of dust mineralogy on Fe solubility and Fe bioavailability. Three dust samples (Sahara, Sahel and Patagonia) with different Fe-bearing mineral assemblages, and three pure Fe-bearing mineral phases that represents the three different Fe pools of dust, including structural Fe (illite/smectite), defined as iron associated to the crystalline lattice of clay minerals, amorphous and crystalline Fe oxyhydroxde (ferrihydrite and goethite), were tested. The dust specimens were characterized in terms of total Fe content and Fe pools, the latter were quantified using selective chemical extractions. Total Fe, Fe(II) and Fe(III) releases from the dust were determined in artificial rainwater (pH 4.7) after 1 and 2 hours of contact time. The Fe solubility of the Sahara dust (SFe% = 0.02%) is significantly higher than that of the Sahel dust (SFe% = 0.006%). This is attributable to a larger content of structural Fe content in the former sample. However, a slight difference was observed between the ratio of total dissolved Fe to structural Fe in the Sahara dust (DFe/Fe_{str} = 0.05%) compared to the Sahel dust (0.03%). Both values were comparable to the corresponding ratio in the structural Fe model illite/smectite (DFe/Fe_{str} = 0.05%). we infer that soluble Fe originates primarily from the structural Fe fraction. This is further supported by the higher solubility of structural Fe measured for illite/smectite (0.015%) compared to that of oxyhydroxide. The results of bioessays in which Fe-stressed *Dunaliella tertiolecta*, a marine algae commonly found in high-nutrient, low chlorophyll waters, are subjected to Fe additions through wet deposition of the different dust and mineral specimens tested will be presented.