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Changes in the form of iron oxides in Saharan dust resulting from simulated cloud evaporation and condensation processes.

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The atmosphere is recognized to be an important pathway for the transport of trace elements of continental origin to oceanic areas. The input of Iron (Fe), Nitrogen (N) and Phosphorus (P), which are essential nutrients for the biological growth of oceanic biota, is of particular interest, especially for oligotrophic oceanic areas and semi-enclosed seas. Atmospheric inputs may therefore stimulate the development of marine ecosystems, with implications for biological uptake of atmospheric carbon.

Sahara desert soils are an important source of iron containing atmospheric dust that can be deposited in adjacent ocean waters. FEGSEM (field emission gun scanning electron microscope) of Saharan desert soils showed that crystalline hematite (Fe_2O_3) and goethite (FeOOH) were the main forms of iron oxides present. These Saharan soil particles were then passed through a simulated cloud evaporation and condensation cycle. After this treatment the amorphous iron oxide fraction was much higher of the total iron oxides present. The amorphous form has a higher chemical reactivity in seawater relative to the other two species due to its large surface area, (individual particles in the nanometer size range), and its thermodynamic instability. These small particles if free in the water column, will be considered as dissolved i.e. iron that passes through a 0.2μm filter. This amorphous iron hydroxide may be an important source of bioavailable iron to the water column.

Images acquired from the FEGSEM showed changes in the form of the iron oxides in the dust that dust had been through cloud processes, from more crystalline to more

amorphous types. It was noted that after extended periods of storage (months to years) there was a conversion from the more amorphous back to the most crystalline forms. What these studies suggest is that cloud processing of dust has important implications for the form of iron oxides and possible environmental availability and fate of iron introduced into the ocean with dust deposition.