

CHANGES IN BIOAVAILABILITY AND CHEMICAL PROPERTIES DURING PHOTOLYSIS OF PONY LAKE DISSOLVED ORGANIC MATTER

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Photobleaching of the dissolved organic matter (DOM) in Pony Lake, a hypereutrophic coastal pond located on Ross Island, Antarctica, rendered a material less biologically available when exposed to Antarctic sunlight. Spectroscopic evaluation of photobleached Pony Lake whole water and reconstituted Pony Lake fulvic acid yielded insight into photochemical degradation pathways. Analysis of absorbance decay kinetics and spectral slopes demonstrated that reactive oxygen species (ROS) may mediate approximately one-third of the DOM photobleaching. Moreover, the hydroxyl radical accounted for approximately 70% of the ROS-mediated photobleaching. The decay kinetics measured for the fluorescent components identified in the DOM using parallel factor component analysis of fluorescence excitation emission matrices (EEMs) confirm these results. Losses in absorbance and fluorescence corresponded to losses in primary amines and reducing capacity. These results taken together suggest that photolysis under high intensity Antarctic sunlight photobleaches DOM predominantly through direct pathways. The loss of reducing capacity was correlated to decreases in relative concentrations of quinone-like moieties in DOM and suggests that photolysis destroys the electron shuttling properties of the DOM.