



Do aeolian inputs alleviate nutrient limitation of primary productivity and nitrogen fixation in the North Atlantic?

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Identification of limiting nutrients is a necessary step towards evaluating the ecological constraints on the carbon cycle in the sea. The results of bioassay experiments demonstrating Fe limitation of primary productivity during the temperate North Atlantic Spring bloom and N limitation of primary production in the oligotrophic subtropical and tropical North Atlantic will be presented. Both Fe limitation in deep mixed regions during the spring bloom, and N limitation in the stratified waters are at variance with recent assertions or assumptions regarding limiting factors in the North Atlantic. We can reconcile in part the assertion that N is the proximate limiting factor for primary productivity in tropical waters with observations the inorganic P is in short supply in these waters through analysis of the response of three components of the picophytoplankton. Although primary productivity and net chlorophyll synthesis was significantly stimulated by addition of N alone, it was further stimulated by addition of P. Phosphorous was required for significant increases in net population size of the picocyanobacteria. Bioassays that provide evidence for Fe/P co-limitation of nitrogen fixation in the tropical Atlantic will also be described; as will the potential for Saharan derived dust to ameliorate this limitation. N limitation of primary productivity appears to be a prerequisite for significant rates of N_2 fixation to occur. We hypothesise that this is because N_2 fixing organisms are unable to compete effectively for P and/or Fe when primary productivity is not N-limited. The implications of these results will be discussed with reference to estimates of the aeolian supplies of Fe and P to the North Atlantic and variability in the elemental stoichiometry of phytoplankton growth.