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The influence of nutrient supply (N, P, Fe) on marine particle stoichiometry: a 30 day mesocosm study

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Deep ocean carbon sequestration is linked to the stoichiometric assimilation of carbon and essential nutrients such as N, P, and Fe by surface primary producers. Although the average stoichiometric ratio of marine plankton is represented by the Redfield ratio, species specific and environmentally controlled deviations have been described. For instance, nutrient availability dictates cyanobacteria cellular stoichiometry, but can lead to whole community shifts when drastically altered. Monitoring long-term impacts of altered nutrient supply is challenging *in situ* where nutrient manipulations are impractical, and *in vitro* because typical incubation volumes are too small and durations too short to capture community succession. To overcome these limitations, we employed a novel mesocosm (120L) design to evaluate how small but consistent changes to nutrient availability impacts production and element partitioning in the North Pacific Gyre. An oligotrophic surface community was collected ~18 miles SW of Honolulu and incubated for 30 days under 8 triplicated nutrient conditions (+nitrate and ammonium (+N), +phosphate (+P), +iron (+F), +NP, +NF, +PF, +NPF, and control). The mesocosms were sampled semi-continuously with large volume samples collected twice weekly (6% and 22% water changeover, respectively). A suite of biological and chemical samples were collected from the main reservoir as well as a settled particle trap. Biomass levels increased and stabilized in all treatments with added fixed N, and all +N treatments became more P limited by the second week of the experiment. Nitrogen fixation became an important source of fixed N in the +P, +PF, and +F treatments. In all treatments, the bulk particulate C:N ratio remained near 11, but N:P was highly variably. We will present synthesized results on the nutrient dynamics, community succession, nitrogen fixation, and other biogeochemical parameters from the incubation, all of which provide insight into the drivers of C, N, and P cycling in the oligotrophic surface ocean.