GORDON AND BETTY MOORE FOUNDATION

Team Karl Highlight

Differential response to light intensity in ^{14}C-bicarbonate versus ^{3}H-leucine incorporation by *Prochlorococcus* at Station ALOHA

Submitted by: Karin M. Björkman, Joseph K. Doggett, Matthew J. Church, and David M. Karl

Light appears to have a fundamental effect on many processes in *Prochlorococcus* metabolism, other than inorganic carbon fixation by photosynthesis. *Prochlorococcus* has been shown to assimilate organic compounds, in particular amino acids, and this uptake is enhanced by light. However, it is not yet fully understood whether the enhancement by light is directly coupled to *Prochlorococcus* primary productivity (autotrophic growth) or is by an independent light energy mediated mechanism. We used in situ incubations throughout the euphotic zone (5-175 m) as well as photosynthetron experiments to elucidate rate responses of ^{14}C-bicarbonate assimilation (primary production/autotrophy) and ^{3}H-leucine incorporation (mixotrophy/photoheterotrophy) by *Prochlorococcus* at Station ALOHA in the North Pacific Subtropical Gyre.

Depth resolved (5-175 m) primary productivity (^{14}C-PP) and light enhanced ^{3}H-leucine uptake showed that the Leu:PP ratios were relatively lower in the upper water column, increasing with depth down to the DCM (Figure 1). In photosynthetron experiments, leucine uptake appeared to saturate at lower light intensities than ^{14}C-bicarbonate in deep chlorophyll maximum (DCM) populations (Figure 2). These results indicate that light enhanced leucine incorporation may not be directly coupled to autotrophic growth in *Prochlorococcus*.

This has implications for nutrient dynamics and estimates of both primary and secondary production in these oligotrophic environments.

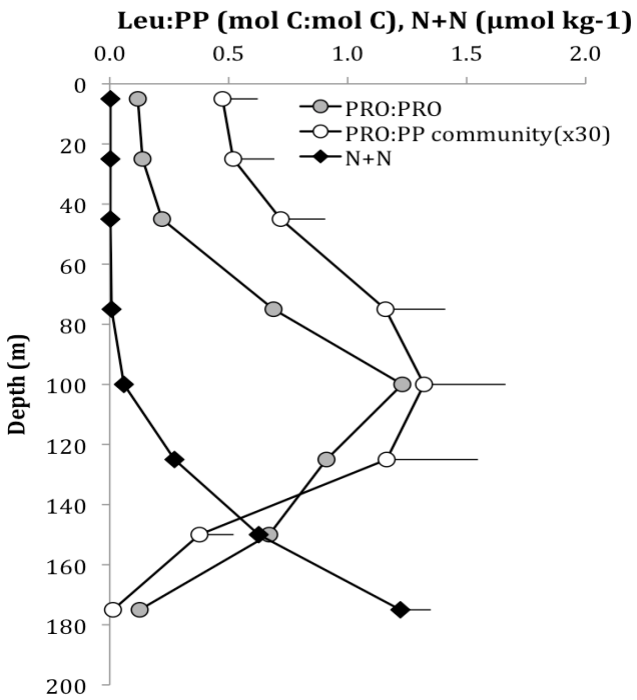

Figure 1: Relative contribution of ^{3}H-leucine to ^{14}C-bicarbonate incorporation (primary production PP) on a mol C to mol C basis in *Prochlorococcus* (PRO) versus whole water community PP and LeuPRO:PRO PP. Nitrate+Nitrate (N+N) concentrations are shown as a reference to the nutrient field. The deep chlorophyll maximum was located at ~ 125 m. Note that the PRO:PP community value is 30x smaller than what is on the x-axis.

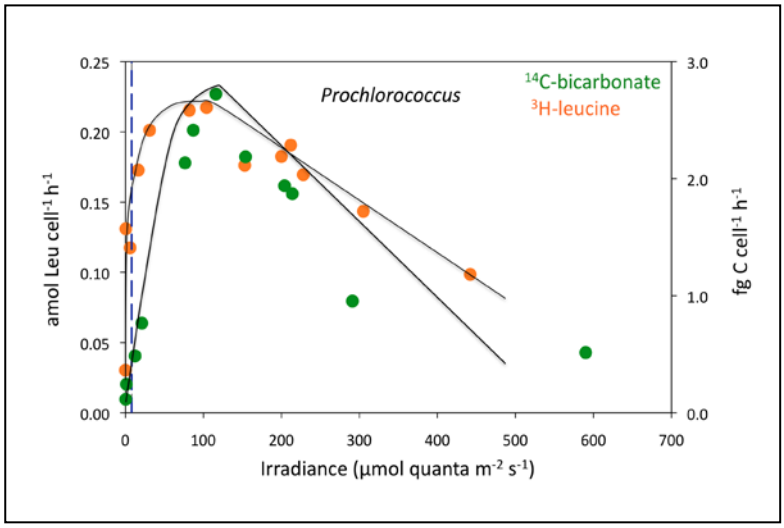

Figure 2. In corporation of ^{3}H-leucine and ^{14}C-bicarbonate in *Prochlorococcus* collected from 125 m (deep chlorophyll maximum) as a function of light intensity. The dashed line represents the approximate in situ light flux at 125 m at local noon during this experiment. The light intensity at which the maximum incorporation rate occurred (E_k) was 28±14 for leucine and 125±14 for bicarbonate incorporation.