

Interactive comment on “Is dark carbon fixation relevant for oceanic primary production estimates?” by Federico Baltar and Gerhard J. Herndl

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One very brief comment on an angle that doesn't appear to be mentioned in the manuscript at present, and which might be relevant for biogeochemical budgeting. While the “dark fixation” of carbon via nitrification is not directly fed by solar energy, it relies on the availability of a substrate (ammonia / ammonium) that itself is a break-down product of organic molecules that were originally fashioned using solar energy. If, instead of carbon, biogeochemical transformations are viewed through the prism of energy, this dark fixation is part of the dissipation / remineralisation loop rather than

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a truly new source of biomass. In particular places, or at particular times, it may look like dark fixation is providing a quantitatively significant alternative to the “mainstream” photoautotrophic pathways, but ultimately it is really spun off the back of earlier (and potentially unobserved) sunlight-driven primary production. A clear exception is around systems such as hydrothermal vents, where the chemical substrates driving dark fixation do not have a solar source, but these are a minor component at the global scale. This is not, of course, to dismiss dark fixation. It is an important process (or series of processes), the understanding of which is critical if we are to fully understand biogeochemical cycles in the ocean. Particularly so, as here, where the details of measurement require a proper accounting of its operation. But in tracing the details of these cycles, it is important to still recognise the underlying drivers, even if these are indirectly coupled through long chains of chemical transformation.

Response: Thank you for your comment. We now mentioned this aspect in the manuscript (p.2, l.65-67); it reads: “Yet, while the dark DIC fixation via nitrification is not directly fed by solar energy, it relies on the availability of a substrate (ammonia / ammonium) that itself is a break-down product of organic molecules that were originally fashioned using solar energy.”

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