Nitrogen Fixing Cyanobacteria: Future Prospect

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Abstract:

The nitrogen cycle of Earth is one of the most critical yet poorly understood biogeochemical cycles. Current estimates of global N2 fixation are approximately 240 Tg N y⁻¹ with a marine contribution of 100–190 Tg N y⁻¹. Of this, a single non-heterocystous genus, Trichodesmium sp. contributes approximately 100 Tg N y⁻¹ (Capone pers. comm.). Geochemical evidence suggests that, on a global scale, nitrogen fixation does not always keep pace with denitrification on time scales of centuries to millenia (Falkowski and Raven, 1997), yet it remains unclear what process(es) limits nitrogen fixation in the oceans. More importantly, given the potential for heterocystous cyanobacteria to outcompete organisms such as Trichodesmium, it is unclear why the apparent tempo of evolution of marine diazotrophic cyanobacteria is so slow. Diazotrophic cyanobacteria have effectively become the "gate keepers" of oceanic productivity, yet despite the rapid radiation of eukaryotic oxygenic photautotrophs throughout the Phanaerozoic eon marine cyanobacteria seem like living fossils (Berman-Frank et al., 2003). Finally, some Questions need answering. Are there N2-fixing picoplankton? What limits the growth of N2-fixing microorganisms in the open ocean? Is N2 fixation associated with zooplankton?

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