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# *Interactive comment on* "Inhibition of nitrogenase by oxygen in marine cyanobacteria controls the global nitrogen and oxygen cycles" *by* I. Berman-Frank et al.

**Anonymous Referee #2**

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This manuscript seeks to find magnanimous implications over the well-known fact that the enzyme nitrogenase is inhibited by oxygen. Since the physiology and molecular biology of nitrogen fixation relative to oxygen is so well-known, the contribution of this manuscript is in its attempts to find novel, amusing implications. The data included are not new (some of the data are two decades old (Fig. 1).

The combination Northern blot and Western blot is not high enough quality to really analyze regulation-but the point is that these mechanisms are known and previously published for a number of microorganiams already.

The "novel" implications: these are 1) that nitrogenase is "chronically crippled" and 2) that the oxygen sensitivity sets an upper bound on oxygen in the atmosphere.

First, it is unclear that nitrogenase is "chronically crippled" whatever that means, and there is no reason to assume that even if it is, that it really has any implications for constraining N or Fe cycling. The cited values for percent protein in nitrogen fixing microorganisms, with its implications for Fe requirements, is overstated and overestimated.

Second, with respect to the oxygen concentrations of the atmosphere: actually some models indicate that Earth's atmosphere has been substantially higher than present, and there are a plethora of mechanisms that would constrain it from becoming higher(including combustion!), but also Earth atmosphere chemistry, and on and on. Furthermore, ambient oxygen for cyanobacterial nitrogen fixers may or may not really be a global regulatory mechanism. Throughout evolution there has always been a diversity of habitats, oxic and anoxic, and our global biogeochemical cycles still depend on the fluxes of transformed compounds between them.

As this is an open forum, I have shared this with a nitrogenase biochemist, and a paleooceanographer. They concur with my assessment of these interpretations.

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Interactive comment on Biogeosciences Discussions, 2, 261, 2005.