

Interactive comment on “Phytoplankton calcification as an effective mechanism to prevent cellular calcium poisoning” by M. N. Müller et al.

Anonymous Referee #1

Received and published: 18 August 2015

I found this paper to be enjoyable to read and am glad to see that calcium ion concentrations across geological time have been examined as possible correlates to the evolution of calcifying phytoplankton. Figure 1 is really interesting, especially that it took 50My for the coccolithophores to catch up in terms of diversity at their peak following the peak of seawater Ca. I also found the taxon-specific differences in fitness responses to seawater Ca interesting. That the non-calcifying strains are induced to calcify at higher seawater Ca levels is fascinating.

All of the evidence in this paper provides clues for cellular mechanisms that must be involved, that must differ among diatoms and coccolithophores, and that may require cellular energy. Namely, there must be differential regulation of calcium transporters (i.e., Ca ATPases), calcium channels (i.e., voltage-gated or otherwise gated), and/or

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calcium binding proteins (e.g., calreticulin, myosin) among species and within strains across seawater Ca gradients. Some of those Ca-binding and transporting proteins are known. I think that this paper points the way to cellular physiology hypotheses that should be tested to better understand the cellular regulation of calcification as it relates to seawater Ca levels. I think that the manuscript should include a much more thorough discussion of what is already known about these cellular mechanisms within coccolithophores and across the other phytoplankton taxa. Where there are unknowns, potentially Ca regulation in ossifying tissues such as bone or in tightly regulated cytosolic locations such as mammalian muscle, may provide clues.

Interactive comment on Biogeosciences Discuss., 12, 12691, 2015.

BGD

12, C4414–C4415, 2015

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