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

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This paper presents experimental evidence showing that calcification (converting calcium ions inside the cell into solid CaCO3 coccoliths extruded onto the outside of the cell) may have helped coccolithophores outcompete competitors in the high-calcium oceans of the Cretaceous. The rate of growth of non-calcifiers is found to be considerably depressed by high calcium, whereas calcifiers are not greatly affected. This result is intriguing because it potentially offers an explanation for why so much chalk (fossil coccoliths) was deposited on the floor of the ocean during the Cretaceous, although, as the authors note, other explanations are also possible.

This paper is well written, is based on what seem to be reasonable experimental procedures, and makes a valuable and interesting contribution to the attempt to better

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understand the function of calcification in coccolithophores. I am happy to recommend it for publication.

A few fairly minor changes should be made:

1. The novel finding here is not that coccolithophores are tolerant of high [Ca]. This has been shown in several previous studies, albeit usually just for E. huxleyi. The key finding here is that there is a difference between calcifiers and non-cvalcifiers because non-calcifying phytoplankton are, conversely, not tolerant of high [Ca]. It would be useful if the authors could compare their results to the results of any earlier work growing non-calcifying phytoplankton at high [Ca], or state that they are not aware of any.

2. It should be acknowledged that the highly-controlled, highly-ornate physical architectures of most coccoliths make it unlikely that excretion of calcium is the sole function.

3. The authors may wish to compare their results to those of Maldonado et al (1999), who also obtained interesting results from growing present-day organisms in ancient seawater chemistry.

4. The paragraph (pg 12703, lines 15-20) on past ocean acidification events needs revising. Catastrophic ocean acidification appears not to have taken place at either the end of the Cretaceous (Tyrrell et al., 2015) or the PETM (Gibbs et al., 2011). And even if it did, the very long ($\sim$1 My) residence time of calcium in the ocean precludes the possibility of large and rapid changes to its concentration (see for example Merico et al., 2008).

5. It is unlikely (Conclusions) that there is a similar primary function of calcification in calcified cyanobacteria and coccolithophores, or at least not if the primary function is to excrete calcium. Calcification in the former group takes place at or near to the surface of the cell, using calcium from the surrounding seawater, and hence does not help the cell to rid itself of internal calcium (Riding, 2011)

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