

Interactive  
Comment

***Interactive comment on “Effects of an iron-light co-limitation on the elemental composition (Si, C, N) of the marine diatoms *Thalassiosira oceanica* and *Ditylum brightwellii*” by E. Bucciarelli et al.***

**Anonymous Referee #1**

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Bucciarelli et al. present an interesting study, investigation the effect of iron and iron-light co-limitation on marine diatom growth rates and elemental composition. This topic is of high importance and the results are interesting and well presented. The authors provide a very helpful comparison of their data with field data from in situ iron fertilization experiments, which is a major strength of this manuscript. I only have a few questions and comments, mainly about a possible change in cell size during the experiment which should be discussed. Apart from that I recommend publication of this manuscript.

General comments:

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It would be good to include a table with the  $[\text{Fe}']$  used or the mention the concentrations in the material and methods section. From figure 1 it is not possible to tell the difference in  $[\text{Fe}']$  for the Fe-limited treatments (below about  $100 \text{ pmol L}^{-1}$ ) and since this is where the main change in growth rate was observed it would be very helpful for the reader to have the exact concentrations.

#### Material and methods:

The authors should mention the size of the diatom species used. Later in the manuscript the authors discuss the difference between large and small diatoms (page 7182 line 18) but a reader who is not familiar with marine diatom species might not know that *D. brightwellii* is much bigger and how important this can be.

#### Results:

page 7180 line 16: the authors state: At a given growth rate, the C content was higher under LL than under HL. . . this is not obvious to me from figure 2. As far as I can see there are only three HL data points within the range of the LL data points (between about  $0.25$  and  $0.75 \mu$ ). These three data points are indeed in the lower range of the LL data but from the figure it seems that they never have exactly the same growth rate as any LL data point. I therefore question if such a statistic comparison can be made.

#### Discussion:

The authors only briefly mention the importance of cell size in their discussion. If possible the authors should show the concentration of C, N and BSi per cell volume instead of per cell since a change in cell volume with iron and light limitation was found in some diatom species (e.g. (Hoffmann et al. 2007; 2008; Timmermans et al. 2001). If this is not possible the authors should carefully discuss the matter and the possible effects of changing cell size on their results. Some differences in cellular C, N and BSi between the different light and iron treatments are relatively minor and changes in cell volume could easily affect the results and the outcome of the statistical analysis. This is

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especially important in the BSi section, where a change in silicification of diatom cells under Fe and light limitation is discussed. If cell size changes with limitation, changes in Si/N and Si/C can not be directly taken as changes in cell wall silicification.

The work of (Strzepek and Price 2000) on Fe and light and of (Hoffmann et al. 2008) on Fe, light and Si co-limitation should be included in the discussion.

Page 7183, line 6-9: The study by Sunda and Huntsman cited here showed that a decrease in photoperiod from 14 to 7 h resulted in an increase of the specific C-fixation rate. A decrease in the duration of the photoperiod is often directly compared to a decrease in light intensity in the literature. I am very sceptic that these two processes can be directly compared and and I doubt that they will result in the same type of light limitation. I think it should at least be mentioned here that the cells in the Sunda and Huntsman study were not acclimated to low light but to a shorter photoperiod. As mentioned above, the possible effect of changes in cell size on cellular C should be mentioned/discussed here.

Specific comments:

page 7178 line 7: change “xenic” to “axenic”

page 7181 line 15-16: I think the names of the two species were mixed up here

page 7183 line 24: ... exclude that singular point. ... it is two and not one data point

page 7186 line 23: what do the authors mean by “limited cells” Fe limited?

Page 7188 line 6: change fertilized to fertilized

Table 1 and Figures 1-6: I think the use of Fe lim and Fe-L co-lim throughout the manuscript is very confusing for the reader, especially in this table 1. The maximum growth rate is certainly not reached under Fe or Fe-L co-limitation but under Fe-replete growth conditions. I suggest that the authors use HL and LL instead and only use the term Fe lim Fe-L co-lim in those treatments where a clear limitation was observed.

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Hoffmann LJ, Peeken I, Lochte K (2007) Effects of iron on the elemental stoichiometry during EIFEX and in the diatoms *Fragilariopsis kerguelensis* and *Chaetoceros dicaeta*. *Biogeosciences* 4:569-579

Hoffmann LJ, Peeken I, Lochte K (2008) Iron, silicate, and light co-limitation of three Southern Ocean diatom species. *Polar Biology* 31:1067-1080

Strzepek RF, Price NM (2000) Influence of irradiance and temperature on the iron content of the marine diatom *Thalassiosira weissflogii* (Bacillariophyceae). *Mar Ecol-Prog Ser* 206:107-117

Timmermans KR, Davey MS, van der Wagt B, Snoek J, Geider RJ, Veldhuis MJW, Gerringa LJA, de Baar HJW (2001) Co-limitation by iron and light of *Chaetoceros brevis*, *C. dicaeta* and *C. calcitrans* (Bacillariophyceae). *Marine Ecology Progress Series* 217:287-297

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