

Interactive comment on “Not all calcite ballast is created equal: differing effects of foraminiferan and coccolith calcite on the formation and sinking of aggregates” by K. Schmidt et al.

Anonymous Referee #2

Received and published: 9 December 2013

General comments:

The paper by Schmidt, De La Rocha, Gallinari and Cortese investigates the effect of different calcite particles on the formation and sinking properties of *Skeletonema* aggregates formed on a roller table. Most interestingly, different calcite particles have very different effects on the particle sinking properties, which can be of relevance when examining the processes that affect carbon flux and storage to/in the deep ocean.

The paper is well written, and the methods and results are described clearly and comprehensively. To my opinion, the results could be discussed a bit more before the background of other processes that might affect aggregate characteristics and sinking

C6271

properties (e.g., porosity). Also, given the potential importance of different calcifiers for organic matter transport to the deep ocean it might be worthwhile to extend the discussion a bit, and look at distributions and importance of coccolithophores vs. foraminiferans for transport of organic matter in different regions. Otherwise I consider this paper a useful contribution to some aspects of vertical carbon flux in the ocean.

Specific comments:

p. 14862, line 22: To my knowledge, the work by Parekh et al. (2006) refers mostly to eolian Fe flux and its effect on atmospheric pCO₂. Another reference, that directly relates atmospheric pCO₂ to organic particle flux would be the paper by Kwon et al. (2009).

p. 14863, lines 15-20 "Incorporation into aggregates of coccoliths, small scales surface ocean" - the meaning of this sentence is unclear to me. Better (?): "Incorporation of coccoliths (small scales of ...) into aggregates ..."

p. 14865, lines 24-26: What was the size of the glass cylinder, and (approximate) distance and time for aggregate sinking?

p. 14867, line 10 and elsewhere: sometimes the authors refer to "rolling table", sometimes to "roller table". I suggest to use just one name.

p. 14867, line 22: Insert point after "mm", and continue with new sentence?

p. 14864, lines 10-13: Include reference to fig. 6 somewhere in this sentence.

p. 14864, line 29 and caption to Fig. 8: Is the relationship between ESD and sinking speed really $21(ESD)^{0.54}$, as given by the authors? From what I can see in Fig. 8 (open circles for cocco), to me it rather seems to be $210(ESD)^{0.54}$.

p. 14869 ff: Another aspect that may be of importance for particle porosity (and thus sinking speed) seems to be the way the aggregates are formed (shear vs. settlement aggregation; see Engel and Schartau, 1999, or Lick et al., 1993).

C6272

p. 14872, lines 20-22: "This relationship between ESD and sinking speed for the Phyto and Foram (no foram) aggregates is steeper than measured for aggregates of *Skeletonema costatum* formed in notably smaller rolling tanks (1.15 L) by Iversen and Ploug (2010) (Fig. 8)." Note that the relationship between sinking speed and ESD of $w \sim \text{ESD}^{1.02}$ found in this study is very similar to the relationship found by Ziervogel and Forster, 2005, who also investigated *Skeletonema* aggregates formed on the roller table. Perhaps that study is more comparable with respect to the methods applied?

Figure 8: The two panels show essentially the same data set, the right one just adds the regressions by Iversen and Ploug. I suggest to only use the right panel B together with the legend of A, and explain the different lines in the caption.

Technical corrections:

p. 14863, line 3 "r" missing in replace "Kioboe".

p. 14863, line 3 replace "Giudi" by "Guidi" (also in References).

References:

Engel, A. and Schartau, M., 1999. Influence of transparent exopolymer particles (TEP) on sinking velocity of *Nitzschia closterium* aggregates. *Mar. Ecol.-Prog. Ser.*, 182, 69-76.

Kwon, E. Y., Primeau, F. and Sarmiento, J.L., 2009. The impact of remineralization depth on the air-sea carbon balance. *Nature Geoscience*, 2, doi: 10.1038/NGEO612.

Lick, W., Huang, H. and Jepsen, R., 1993. Flocculation of fine-grained sediments due to differential settling. *J. Geophys. Res.*, 98 (C6), 10279-10288.

Ziervogel, K. and Forster, S., 2005. Aggregation and sinking behaviour of resuspended fluffy layer material. *Cont. Shelf Res.*, 25, 1853-1863.

Interactive comment on Biogeosciences Discuss., 10, 14861, 2013.