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Interactive comment on “Quantification of the lithogenic carbon pump following a dust deposition event” by M. Bressac et al.

Anonymous Referee #2

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This is an interesting paper by Bressac et al., which focuses on the importance of lithogenic ballast minerals in enhancing the flux of organic carbon into the ocean interior. Efforts on this subject have mainly focused on the role of calcite and/or opal as ballast agent, however, lithogenic material and its ability to enhance carbon export is understudied. Because of the importance of the carbon pump and the atmospheric dust fluxes in the global carbon cycle, this study is very well within the scope of Biogeosciences. The authors examine the distribution of large particles, the primary productivity and the downward export of carbon in two artificial seedings performed in mesocosms. Methods and results are clearly presented or refer to companion papers of the special issue if not fully described. The paper diagnoses the biotic (fertilization) and abiotic (aggregation catalyst and ballast) effects of seeding of POC fluxes and particles dynamic. However, it is not clear how the authors come to their main

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conclusion (namely: “the lithogenic carbon pump could be considered as a pathway by which DOM could reenter the biological pump”) as the DOM data are not presented and not considered in the discussion. The authors base their argument on literature rather than actual data. Therefore, moderate revision is needed before publication.

Specific comments

Title The title needs to reflect the “artificial” nature of the study (artificial seeding in mesocosms).

Introduction P12642-L8: Please add [Hedges et al., 2000], key paper of the protection effect and [Engel et al., 2009] that demonstrate it in lab controlled experiments

Material Methods P13645-L5: How does that compare with a natural deposition event?

Results How did the PP evolved after both seedings? The PP is presented in an “in prep” paper but not available to the reader yet. PP data is presented vs POC flux in fig 5 but the paper would benefit of presenting a figure similar to fig 1 but for the PP data.

Discussion: P13653-L5: Add [Honda and Watanabe, 2010] for justification of considering an additional non-lithogenic associated fraction of the total POC flux. P13653-L5: Please provide equation, it will help understanding how you’ve worked out the carrying coefficients. P13654-L1: Specify by increasing particle sinking speeds or aggregating cells after ballasting. P13656- section 4.3.1. I found this section a bit weak as it is currently not supported by DOM data. The authors mentioned that “Dissolvedsubsequent POC export” and then conclude “While dust deposition In this sense, the lithogenic carbon pump could be considered as a pathway by which DOM could reenter the biological pump”. It is one of the main outcome of this paper. It therefore needs fully supported by data and requires more consideration in the discussion section. P13654-L28. Please add [Le Moigne et al., 2012] P13656-L28: Please add [Buesseler, 1998]

References Buesseler, K. O. (1998), The decoupling of production and particulate export in the surface ocean, *Global Biogeochemical Cycles*, 12(2), 297-310. Engel, A., L. Abramson, J. Szlosek, L. Zanfei, G. Stewart, D. Hirschberg, and C. Lee (2009), Investigating the effect of ballasting by CaCO₃ in *Emiliania huxleyi*: II. Decomposition of particulate organic matter, *Deep-Sea Research Part II-Topical Studies in Oceanography*, 56(18), 1408-1419. Hedges, J. I., J. A. Baldock, Y. Gelin, C. Lee, M. Peterson,

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and S. G. Wakeham (2000), Evidence for non-selective preservation of organic matter in sinking marine particles., *Nature*, 409, 801-804. Honda, M., and S. Watanabe (2010), Importance of biogenic opal as ballast of particulate organic carbon (POC) transport and existence of mineral ballast-associated and residual POC in the Western Pacific Subarctic Gyre, *Geophys. Res. Lett.*, 37(L02605). Le Moigne, F. A. C., R. J. Sanders, M. Villa-Alfageme, A. P. Martin, K. Pabortsava, H. Planquette, P. J. Morris, and S. J. Thomalla (2012), On the proportion of ballast versus non-ballast associated carbon export in the surface ocean, *Geophys. Res. Lett.*, 39, L15610.

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