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Biogeosciences Discussions

Interactive comment on "Distribution and lability of land-derived organic matter in the surface sediments of the Rhône prodelta and the adjacent shelf (Mediterranean sea, France): a multi proxy study" *by* S. Bourgeois et al.

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In this manuscript Bourgeois et al described the composition of surface sediments collected off the Rhone river mouth. Specifically, via elemental, biomarkers, and compound specific isotope analyses the authors investigated the across shelf distribution of organic matter (OM). The authors identified numerous OM sources increasing the understanding of OM cycling in this French margin. Proxies used in this study indicated a strong gradient in the organic matter composition common to several river-dominated coastal margins and therefore results have a global relevance. The paper warrants

publication on BG and I believe such a study will be widely cited in the future. Methods used in this study are well described and pertaining. However, I found most of conclusions completely not coherent with the data presented. Therefore, I would suggest rewriting the conclusions from scratch keeping in mind the rationale (see page 3369 line 14). For example, the event-dominated supply in the Rhone falls behind the subject of the paper. Also, the first couple of sentences in the conclusions are not accurate at all. In the prodelta, nutrient supply does enhance primary productivity. Their sentence reads like river discharge is not important. Authors looked in the wrong place if they were really interested in phytoplankton as any suspended material was collected. Also, I suggest to do some reading about the fate of terrigenous OC in river dominated margins and rephrase the first sentence considering that Hedges et al 1994 is not the most appropriate paper to support their statements. Current budgets indicate that only a little terrigenous OM supply by river is buried in marine sediment. Please take a look at these papers:

- Hedges, J.I., Keil, R.G., Benner, R., 1997. What happens to terrestrial organic matter in the ocean? Org. Geochem. 27, 195– 212.

- Gordon, E.S., Goñi, M.A., 2004, Controls on the distribution and accumulation of terrigenous organic matter in sediments from the. Mississippi and Atchafalaya river margin: Marine Chemistry, 92,. 331–352

- Burdige, D.J., 2005. Burial of terrestrial organic matter in marine sediments: a reassessment. Glob. Biogeochem. Cycles 19, GB4011.

I also think there are a couple of uncited/unconsidered processes occurring in the prodelta.

1) Prodeltas are shallow features offshore river mouths that are characterized by significant mud accumulation below storm wave base. As a result, they are also affected by lateral transport and sediment sorting. As coarse material rich in vascular plant debris is trapped in shallow waters and fine sediment moves offshore (Tesi et al., 2007)

I would expect to see differences in FA as different proportion of fresh vascular plants vs humified soil-derived OM on surface sediments. Therefore in addition to diagenesis that likely occurs in sediments, sorting might explain the 13C across-shelf trend of long chain FA.

2) I am not convinced by the strict division between marine and fresh water phytoplankton. Algal material living in estuarine condition (like in the prodelta) are affected by the DIC coming from the river. Rivers are usually supersaturated in 13C depleted CO2 because of intense decomposition of terrestrial biomass and in river-dominated margins where the air-sea exchange cannot balance the influence of the river, you will end up with phytoplankton having an estuarine-like signature (something in between fresh water and marine phytoplankton). Please see these papers:

- Chanton & Lewis, Plankton and dissolved inorganic carbon isotopic composition in a river- dominated estuary: Apalachicola Bay, Florida, Estuaries, 22, 575-583, 1999

- Tesi T., Miserocchi S, Goñi M.A, Turchetto M., Langone L., De Lazzari A., Albertazzi S, Correggiari A., 2011. Influence of distributary channels on sediment and organic carbon supply in event-dominated coastal margins: the Po prodelta as a study case. Biogeosciences, 8, 365-385, 2011

Minor points: - As end-members were not analyzed it might be helpful to compare FA and THAA OC-normalized data of soil, plants, bacteria and phytoplankton from literature to have a semi-quantitative assessment of the influence of different end-members. For example, if terrigenous material is the major source of OC, as the author suggested, long chain FA should show unambiguous evidence such as high OC-concentrations as observed in soil-derived OC.

- There are many “submitted or in prep” papers throughout the text. I am not sure if this is fine with the journal. Please check with the editor.

- Page 3357 line 25. The GoL is probably one of the smallest margins in the Mediter-

ranean sea. Look at any bathymetry map.

- What does “ref-site” stand for in figure 7? I could not find it anywhere.

- What are BHT and IS in figure 7?? Maybe standards?

- Check the bibliography. Some references are missing or not properly cited (for example Tesi et al., 2007 is related to the Adriatic sea)

- What is the point of showing grain-size data in the results? They are not used in the discussion. Either incorporate these data in the discussion or remove them.

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