

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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This paper provides an interesting compilation of data from a range of biomarkers in surface sediments of the Rhône prodelta. It is unusual to find data on amino acids, fatty acids and pigments in a single study as well as compound-specific isotope data on fatty acids. The authors attempt to disentangle the changes in sedimentary composition seen with distance from the river mouth in terms of changes in sources (mainly in terms of terrestrial plants vs. plankton-derived organic matter) and effects of biodegradation. They are not entirely successful in this attempt. This is partly because no samples

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of the proposed end-members were obtained (e.g. particles in the river as a proxy for terrestrial sources or marine plankton or suspended marine particles as a proxy for marine sources). Furthermore discussions about degradation are confounded because it is not clear whether this occurs mainly in the water column (so that transit time from the river would be important) or in the sediments. With regard to the latter, the top 0.5 cm of sediment was analysed at each site and yet the sediment depositional rates in the prodelta vary greatly so each represents a different amount of time available for degradation. Thus one might expect a greater extent of degradation at the further sites (as observed) simply because there has been more time available for this to occur in the sediment.

A major conclusion of the paper is that there has been preferential degradation of organic matter from terrestrial sources. The term “preferential” implies that the microbial populations prefer to mineralize terrestrial organic matter rather than marine organic matter, but the evidence for this seems quite weak. I do not doubt that there has been extensive degradation of the deposited organic matter as shown by changes in the amino acid profiles, high proportion of pigment degradation products and high abundance of bacterial fatty acids. However, the pigments are almost certainly derived from planktonic sources (despite some speculation about the source of chlorophyll b) and the source of the amino acids is not stated, but is also likely to be from planktonic sources. Thus neither of these data sets provides evidence for degradation of terrestrial-derived organic matter. Indeed, no data are presented on degradation products from plants to confirm that such processes are occurring.

The lack of data for bulk $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values is rather a surprise, especially since $\delta^{13}\text{C}$ data are provided for individual fatty acids. It would have been useful to use such isotope data and TOC values to do a simple calculation of the amount of marine and terrestrial organic matter at each of the sites assuming a simple 2 end-member system. While clearly this would have a large uncertainty it would help to constrain the source vs. degradation discussion. The C/N ratios all fall within a narrow

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range consistent with mixed marine and terrestrial organic matter sources rather than showing a trend to proportionally greater contributions of marine-derived organic matter with distance from the river mouth.

There seems to be an assumption throughout the text that most of the organic matter in the sediments is derived from the Rhône river and yet clearly there must be marine sources as well. The correlation between chlorophyll a and bacterial fatty acids (page 22) does not need to imply a coupling with Rhône river inputs if the chlorophyll is derived from marine inputs. Similarly, the suggestion that the organic matter delivered by the Rhône river is “well nutritionally balanced” (page 27) goes well beyond the normal meaning of the term “nutritionally balanced” which implies a good balance of all essential nutrients, not just the presence of polyunsaturated fatty acids (which are more likely to be of marine origin anyway).

The text contains a number of grammatical and stylistic errors and needs careful rewriting. The English expression needs to be checked by a native English speaker. Care should be taken with the number of significant figures being quoted. Note that the estimates for chlorophyll degradation (page 13) are minimum estimates since other degradation products (some of which are colourless) are not included in the calculation. It is not correct to state that biosynthetic pathways of some fatty acids are species-specific (page 5), but one could say that the pathways leading to double bond insertion do vary between some algal classes.

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