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Biogeosciences Discussions

Interactive comment on "Bacterial carbon sources in coastal sediments: a review based on stable isotope data of biomarkers" *by* S. Bouillon and H. T. S. Boschker

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We're grateful to Referee #1 for his/her thoughtful comments. Overall, this referee is very positive about the manuscript and we mostly followed his/her suggestions. Below, we briefly discuss the issues raised, with the original referee comments preceding each response.

REF : The authors have brought together both previously published and new stable isotope data from various coastal environments, from mangrove systems to C3 and C4 marshes to seagrasses and unvegetated sites, to better generalize the source of carbon that is being remineralized by bacteria in these coastal systems. Phospholipid fatty acids (PLFA) were used as bacterial biomarkers; the isotopic composition of i+a 15:0 was compared to the isotopic composition of both bulk sedimentary organic carbon and macrophyte biomass. It was determined that in most settings, bacteria depend on

carbon from many different sources, and not just the dominant macrophyte present. The bacterial PLFA d13C values tend to be more 13C-enriched in C3 marshes (and mangrove sites) and 13C-depleted in C4 marshes (and seagrasses and macroalgae sites) relative to the dominant d13C of the macrophytes present. This is a nicely organized and written manuscript. The authors have also done a good job in describing how representative their data is of the various coastal environments and the veracity of the conclusions drawn. The main suggestion that I have would be to better incorporate the possibility that the bacteria are using specific components of the macrophyte biomass, which can have either 13C-enriched or 13C-depleted d13C values relative to the bulk plant material. Overall, this manuscript is a nice addition to field of estuarine/marine isotope biogeochemistry. I have only a few specific comments to add that the authors might want to take into consideration. Page 1628, lines 11-16: The isotopically-enriched source that the bacteria appear to be using could be either proteins or carbohydrates. Both components tend to have 13C-enriched isotope values relative to the bulk. Proteins and carbohydrates also tend to be more labile than other plant components.

RESPONSE: A sentence describing this possibility has been added to the discussion (page 18, line 10). However, we believe that the preferential use of an enriched fraction can not explain the relatively large shift that we found in Dd ratios (about 4 L') as the enrichment in carbohydrates is much smaller (0 to 2L'). As far as we know such is enrichment generally doesn't occur in proteins which usually have a similar ratio as the total biomass.

REF : Page 1628, lines 23-24: I am not familiar with a "cumulative sum analysis." Could the authors describe this?

RESPONSE: A brief description of the CUSUM approach has been added to the methods section.

REF : Page 1630, lines 3 on: Only if the isotopic composition of the input organic

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matter is different would differences in lability and degradability be seen in the isotopic composition of the bacterial fatty acids. Are the authors assured that the algae and the macrophyte derived materials are different at the various sites?

RESPONSE: This would only be a problem for sites were the d13C of the TOC or bacterial PLFA were the same as for the macrophytes. However, this is not what we found for the majority of the data that show more intermediate values than expected if bacteria were using macrophyte material, and therefore suggest that some other source probably algae was also used. The intermediate values are in agreement with the generally excepted ranges in phytoplankton. Although, phytoplankton 13C data were not available for all sites, the sites for which these data are available indeed show these intermediate 13C values in the plankton (e.g. the Westernschelde marshes (Boschker et al 2005, L&O), Parkers river estuary etc). In addition, the stable isotope ratios of C3 and C4 plants (salt-marshes and mangroves) are well constrained and show values at the extremes of the range with relatively little variation. However, seagrasses are much more variable making precise source assignments more difficult is some cases where the seagrass data approach the phytoplankton data as is discussed in the paper.

REF : Figure 3: When average values of isotope data were used to assign plant values, how many points made up these averages (what was the n?)? What was the error on the values?

RESPONSE: To assign average values for C3 marsh plants, C4 marsh plants and mangroves, we compiled d13C data that we had available, and we now mention the details in the revised manuscript: for C3 mashes, the averege is -25.9 ś 1.0 Ľ (n=44), for C4 marsh plants -13.2 ś 0.4 Ľ (n=21), and for mangroves -28.2 ś 2.0 Ľ (n=471). These have been added to the legend of Figure 3.

REF : Figure 5: I'm surprised that the standard deviation of Dd around the low %TOC values does not appear to be any larger than around the high %TOC values, yet the scatter in the data (5a) is so much greater. Is the standard deviation depicted the s.d.

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overall or was it binned?

RESPONSE: The presentation in Fig 5a at a first glance indeed seems to suggest that SD around the low % TOC values is higher, but this is mainly due to the larger number of samples at lower % TOC. The eye mainly catches the outliers and the ranges and misses the bulk of the data that cluster around the averages. This is why we also present averages and SD (Fig 5b) of binned data. It should be note however that the Schiermonnikoog data we not included in fig 5b (now indicated in the Fig legend), which may explain some of the confusion.

REF : Technical corrections: Table 1: The abbreviation for Delaware is DE, so Canary Creek should read Canary Creek (DE, USA).

RESPONSE: Correct, this has been changed.

Interactive comment on Biogeosciences Discussions, 2, 1617, 2005.