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Interactive comment on "Assessing the potential of amino acid δ^{13}C patterns as a carbon source tracer in marine sediments: effects of algal growth conditions and sedimentary diagenesis" *by* T. Larsen et al.

Anonymous Referee #2

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Assessing the potential of amino acid d13C patterns as a carbon source tracer in marine sediments: effects of algal growth conditions and sedimentary diagenesis By Larson et al.

This paper reports carbon isotopic compositions of individual amino acids of diatoms cultured under various conditions and apply this knowledge to the sediment data to understand the contribution of autotrophs in the sedimentary amino acids. They concluded that the bacterial derived amino acids consist 10-15% of those from sediments deposited during the last 5000 years and the LGM sediments up to 35%. I surely think

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it an important report as an application of carbon isotopic composition of amino acids. I recommend this manuscript to be published in Biogeosciences after the revision of the following points.

1) I guess that the authors are well aware of the pitfall of the carbon isotopic measurement of individual amino acids from natural samples; I mean, isotopic fractionation associated with the acetylation. You may not meet serious difficulties when comparing the data from the samples whose amino acid composition is similar (like diatom samples). However, when comparing the diatom data with those of the sediment samples, you might be in trouble, because in case of acetylation, isotopic fractionation seems to depend on the composition of amino acids, fatty acids, etc. How did you overcome this issue? IF you think that you correctly overcome this issue, I strongly ask the authors to clearly describe the pitfalls of the measurement of d13C of amino acids to make a caution to the followers in the future.

2) How archaeal degradation can be assessed? In the subsurface water, archaea rather than bacteria are dominant microbes that catalyze the degradation of organic matter in the water column and subsurface sediments.

3) One of your conclusions is that ONLY 10-15% of sedimentary amino acids are contributed from microbes. For me, 10 to 15% is rather surprisingly small number. Does it mean 85-90% of organic matter produced in the surface water remain intact after many years?

4) Related to above comments. In the sediment, it has been known that the extractable form of amino acids substantially reduced ($\sim$10%) (e.g., Keil, R.G., E. Tsamakis, and J.I. Hedges. 2000. Early diagenesis of particulate amino acids in marine systems. In: "Perspectives in Amino Acid and Protein Geochemistry" (G. A. Goodfriend, M. J. Collins, M. L. Fogel, S. A. Macko, and J. F. Wehmiller, eds.). Oxford University Press). The degradation processes of amino acids in the water column seem to transform most of them to "amino acid complex" that cannot be extracted with the normal procedure.

BGD
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If this is the case, your conclusion was lead by the analysis of only a small portion of sedimentary amino acids. You need to point out this and should carefully discuss how the analytical result can be extended to the non-extractable amino acids.

Interactive comment on Biogeosciences Discuss., 12, 1613, 2015.

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