

## ***Interactive comment on “Transport of branched tetraether lipids from the Tagus River basin to the coastal ocean of the Portuguese margin: consequences for the interpretation of the $MBT^1/CBT$ paleothermometer” by C. Zell et al.***

**Anonymous Referee #2**

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General comments: The study presented by Zell and co-authors is an attempt at understanding how a proxy signal (here, the  $MBT^1/CBT$  proxy and related indices) that is assumed to derive from river drainage area soils is transported to marine sedimentary archives, where these proxies are usually employed for the reconstruction of paleoenvironmental conditions. This is an important aspect in proxy development and understanding. The underlying assumption is that the terrigenous material transported by a river is representative of its entire drainage area. This assumption, however, is rarely tested and discussed. However, careful consideration of sedimentation processes sug-

C1452

gest strongly that it is highly unlikely that a river transports one single “average signal”. This should be considered in any study attempting a source-to-sink approach.

The major concern I have with the present study is with the comparability of soil samples and river SPM, marine SPM and marine sediments. The soil sampling was not described to have followed a special sampling strategy designed to ascertain that soils samples are accurate representatives of the soils of the Tagus drainage area. Instead, the sampling sites seem to have been chosen rather arbitrarily (or at least the reasoning for the site selection is not given). In spite of this, the soils are compared directly with SPM samples and rather far-reaching inferences are made based on this comparison. Moreover, since the river is regulated by dams it would make sense to compare SPM with only those soils that are collected near the sampling site for SPM (near the river mouth) and upstream only until the nearest dam. Processes of soil and river bank erosion would be worth considering when discussing how a soil signal is transferred to the ocean. Given that knowledge on these processes is rather complicated to obtain and likely not available for the Tagus system, I suggest reducing the detail with which the soil samples are discussed. Instead, the soil information should be treated as just an indication of a how a potential source signal could be like, and the emphasis should be placed on the comparison of the SPM and marine sediment data.

Overall, I think the manuscript should be acceptable after moderate revisions.

Specific comments: Page 3735, line 4: Typo in the name “Bendle”; line 7: drier (not dryer); Study area: It should be noted somewhere here that the Tagus river is regulated by dams; this is important information for interpretation of the data; line 23: insert semicolon or full stop after “wet seasons”; line 25: Change to “The Tagus River has one of the largest European estuaries. . . .”; line 27: 2 km in width? Page 3736, line 6: Typo in “shelf break”; paragraph starting line 7: I would like to see another map showing details of the shelf, i.e., locations of the depositional systems described here, isobaths, current directions, and the larger area (e.g., location of the Lisbon canyon); line 9: I am confused by the statement that an estuarine river should have a delta front

C1453

– please explain; Section 3.1, Sample collection: Please give details about the soil and SPM sampling. For soils: Which horizons were sampled? Which were the criteria for sampling site selection? Do the samples accurately represent the soil types present in the catchment? What are the distances to the nearest river or stream? For riverbank samples: Which horizons were sampled? Sampling depth? How does the sampled depth correspond with the entire height of the river bank (i.e., potentially eroded material)? For SPM: Which water depth was sampled at the river mouth? In the table, 0 m is given as the sampling depth: How do the authors make sure that this sample is representative of the SPM discharge of the river? Please refer to publications like Aufdenkampe et al., 2007 in OG, and Spencer et al., 2012 in GCA, where sampling of SPM is described and reasoned in detail. For marine SPM: Was salinity measured as well? This would be an important parameter to discuss water stratification and related sedimentation processes as well as flocculation in the “marginal filter”. Line 18 and following: please provide more detail regarding the pH measurement of the soils: How was the soil volume determined? For the mixture with distilled water, did you use 1 v of soil and 3.5 v of water, or vice versa? Page 3738: Paragraph starting line 21: It would be useful to give at least a brief summary of the BD method; line 25: activated at what temperature and for how long? Page 3741: Line 10: Typo in “compounds” (plural s). Page 3742: Line 14: normalized to OC (not “on OC”); line 18: insert comma after BIT and MBT; Page 3744: Line 6: typo in “close (or closest?) to the estuary”; section 5.1 (this page and following): What is the contribution of river phytoplankton? It cannot be assumed that the entire SPM is soil-derived, even though the  $\delta^{13}\text{C}$  values are very similar. The authors need to at least discuss the other potential source for river SPM. The soils and river bank  $\delta^{13}\text{C}$  values should be averaged and compared with an average SPM  $\delta^{13}\text{C}$  value (which seems to be more depleted than soils, another indication of a contribution from phytoplankton). Page 3746: Line 10: I disagree that a temperature range of 10-17°C is not substantial! Line 22: “soils are notoriously heterogeneous” – this is why it is necessary to characterize the general soil distribution in the water shed before sampling in order to make sure that the soil samples are

C1454

representative of the soils of the drainage area! Page 3747: Discussion in section 5.2: The entire discussion is based on the assumption that the soil samples are representative of the eroded material, which is not proven and also debatable, as indicated in the previous section. Therefore, the inferences are rather speculative, which should be acknowledged. For the calculation of weighted mean MBT' and DC ratios, can you give uncertainties? This would help evaluating the data. Page 3754: Line 12: “since the majority of brGDGTs in SPM from the Tagus River” (not just “in the Tagus River”, as this was not measured!) Page 3755: Line 16: “soil brGDGTs in dry environments” (plural s); line 26: “as close to the river mouth as possible”

Figures: Figure 2: This map is of rather poor quality. It should be larger and it would be worthwhile to show altitude just in contour lines and add a color code for soil type. Moreover, please show the location of the dams. Figure 5 B and C and 6: Can you add error bars to allow for evaluation of the significance of the variations? Figure 8 and 9 A, C, E: It does not make much sense to generate contour plots with so few data points. It would be preferable to present charts with color coded dots (like in 9B, D, and F).

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C1455