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Interactive comment on "Provenance of branched GDGTs in the Tagus River drainage basin and its outflow in the Atlantic Ocean over the Holocene" *by* Lisa Warden et al.

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Warden and colleagues have applied a modern, novel technique for analysing branched GDGTs to an existing sample set, the Tagus River, Spain, which had previously been analysed using a more simplistic GDGT protocol. The new isomer-sensitive approach has the potential to improve the use of brGDGTs as molecular biomarkers, and therefore it is a worthwhile endeavour to perform this sort of repeat analysis. The methods used are novel and appropriate, and their explanation in the text is excellent. The study is a useful addition to the emerging literature on isomerised brGDGTs and I think that it should be published following revisions.

Major comments: 1) More information on the nature of the sediments used in this

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study would be useful. The conclusions reached are often dependent on the nature of the sedimentary material, yet there is little in the text or supplementary information to convey this information. I would suggest a supplementary table of sedimentary properties and/or a core description or core photograph and comments on the uniformity or bioturbation of the samples.

2) Line 573 talks about the correlation between BIT and 13C, and claims a moderate negative correlation. I feel that this correlation may be overstated. While it would be expected that 13C and BIT show similar trends, their relationship is not necessarily linear (see for example Sparkes et al., 2015, Biogeosciences). The offshore core samples all have very low BIT values, yet have outliers with very negative 13C values. The terrestrial core and soil/sediment/SPM samples have significantly higher BIT values, but overlapping 13C values. If the terrestrial samples are looked at on their own they have very poor/no correlation between the two measurements - within the terrestrial samples, r2 = 0.02. Within the offshore samples (mudbelt + canyon head + canyon) r2 = 0.1, and so what the graph is actually showing is that terrestrial and marine are different, but an r2 value is not showing much about the nature of that difference. I do not feel that this correlation plot adds any value to the argument, and if it is included for reference/information then perhaps the authors should comment on why the two measurements, which should correlate quite well, are actually a poor match.

3) Line 586 assumes that soil-derived brGDGTs from across the catchment are delivered through the river to the marine sediments. This is quite an assumption, since there is the potential for both deposition and degradation in the river and coastal systems, even before the river was dammed in the 20th Century. There is also the question of connectivity between the river and canyon. River outflows contain freshwater, which is buoyant above salty seawater. Unless the sediment load in the river is particularly high, the sediment will disperse as a plume above the seawater rather than running down the canyon itself. Therefore the majority of the brGDGTs delivered from the river will be spread over the shelf rather than following the canyon down to 4000m. Do the

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authors know the phase/grainsize in which brGDGTs are travelling? Are they associated with larger grains, that would deposit quickly beside the river mouth, or fine grains that will disperse across the ocean? In the conclusion the authors state that most terrestrial material is not making it out the the ocean, and therefore palaeotemperature reconstructions will be difficult with datasets such as this one. I agree.

4) Line 517 concludes that in-situ production is a problem for all sample sets. This could have profound implications for all brGDGT based proxies. The authors should expand on this point.

Minor comments / typographical errors:

Line 232 – ccolumn

Line 288 – Section numbering error

Line 344 – Figure 4c should be 5c

Line 360 – BIT is given as 0.1 $\pm$ 0.0. Would increasing the significant figures be helpful here?

Line 478 – Do the authors have p and n values for this correlation?

Table 3 sample Lisbon Canyon Head 1cm has a 13C value of 22.9, should be -22.9

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