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## ***Interactive comment on “Spatial variability of diploptene $\delta^{13}\text{C}$ values in thermokarst lakes: the potential to analyse the complexity of lacustrine methane cycling” by K. L. Davies et al.***

### **Anonymous Referee #3**

Received and published: 4 October 2015

This manuscript looks at diploptene  $\delta^{13}\text{C}$  in two thermokarst lakes, uses these values to estimate methane oxidation activity and discusses the potential to use this method to reconstruct past methane dynamics. What the data shows is that diploptene  $\delta^{13}\text{C}$  is highly variable, both within and between lakes, and that there is no clear relationship between diploptene  $\delta^{13}\text{C}$  and thermokarst activity or methane ebullition. While this finding is useful and potentially publishable, the manuscript, particularly the abstract implies that the findings are much closer to the proposed goal of using diploptene  $\delta^{13}\text{C}$  to reconstruct past methane ebullition. While the authors offer explanations for this variability in the discussion, the manuscript needs to do a better job of addressing the limitations of drawing broader conclusions from such a small and highly variable

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dataset.

Specific Comments: 1. In the abstract diploptene is misspelled twice. 2. Page 12163 Line 4, What is a “bight” 3. Page 12164 Line 2-4, “potential confounding factor. . .” this seems potential pretty important, what impact could this have on your results 4. Introduction, it is not clear exactly what patterns you would you expect to see in diploptene  $\delta^{13}\text{C}$  under the scenarios discussed. Be more explicit about what specific diploptene  $\delta^{13}\text{C}$  patterns would tell you about methane dynamics. 5. Page 12168, Line 5, Any particular reason for using the 1-2cm sediment slice 6. Page 12167, Line 25, Don’t include the  $\delta\text{D}$  analytical error if you don’t include any  $\delta\text{D}$  data. 7. Page 12170 Line 11, You give a potential range of 0-30‰ what value did you use, is this the 10‰ you discuss earlier, please clarify 8. Overall the calculation of diploptene  $\delta^{13}\text{C}$  seems pretty vague with a lot of estimates, this is ok, isotopes can be messy, but the discussion of these choices and the variation/uncertainty they introduce could be more clearly discussed, especially give the high variability and inconsistency of your results and the claims that this method could be used to do historical reconstructions. 9. Line 12171 Line 6, How many bubbles were sampled for  $\delta^{13}\text{C}$ , there are no error values listed, which seems to suggest only a single sample was analyzed at each site. If that is the case, there is not much you can infer from this one number; especially considering how your diploptene  $\delta^{13}\text{C}$  data shows just how spatially variable  $\delta^{13}\text{C}$  is in this system. 10. Methods: Sample size, replication, sampling location information needs to be clearly covered in the methods section. This information needs to be included for all analyses, not just diploptene  $\delta^{13}\text{C}$ , although I couldn’t even find sample size information for diploptene  $\delta^{13}\text{C}$  in the methods section (it is mentioned later in the manuscript). 11. It looks like Ace lake was only sampled in the TK zone whereas Smith Lake was also sampled away from the TK zone. This is unfortunate, since it really limits the ability to distinguish potential impacts of thermokarst activity from other spatial differences within/between lakes. 12. The Figures & Results sections make it difficult to fully assess the variability of the diploptene  $\delta^{13}\text{C}$  data, in the text only the min/max values for each site is listed (no average  $\pm$  std dev so you can’t tell if there is just a few outliers

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or the data is evenly spread out) and then the figures just show 10‰ increments.

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Interactive comment on Biogeosciences Discuss., 12, 12157, 2015.

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12, C6168–C6170, 2015

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