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Interactive comment on "Organic matter quality of deep permafrost carbon – a study from Arctic Siberia" *by* J. Strauss et al.

Anonymous Referee #3

Received and published: 19 December 2014

General comments

This manuscript presents a detailed analysis of cores sampled in the Buor Khaya Peninsula, for both Yedoma and thermokarst locations. As stated in the abstract, the study objective is to develop a stratigraphic classified OM quality characterization. The authors also want to investigate Holocene degradation of OM in thermokarsts. The method includes an original combination of indicators, including sedimentological and geochemical analysis and lipid biomarkers, and provides a novel OM characterization in this area. The results show no significant (although no statistical tests are applied) differences, based on the chosen analysis, between the two deposits. Although, the authors argue that a slightly better quality for the thermokarsts deposit is possible. The authors's conclusions about these results need to be clarified. As a whole, the authors

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should strengthen their statistical analysis, perform statistical tests to look for significant differences and modify the boxplot presentation (see detailed comments). The author's should also precise their hypotheses on why Yedoma and thermokarsts deposit should be different. It should be emphasize that both different transformation processes and different OM origin are expected.

Detailed comments:

Abstract:

- P15946, l16. Please define what a good (and therefore better) quality is. This is true for the whole manuscript.

- P15946, l19-20. Are the analyses in the two deposits different or not? The authors should chose based on statistical evidence.

- P15946, l25. Are different origins also an hypothesis?

Introduction

- P159448,l1. 83 +61/-57 is confusing

Material and methods

- P15950. Please comment on why different core depths were sampled. What about the active layer depth in the area?

- P15958. L5. How was the 1mg/l limit defined for acetate? L10. Please justify the log transformation of some of the data and the square root transformation of others.

Results

- P15960. L6-7 "Every radiocarbon-dated sample and additional samples were used for biomarkers analysis. In total 25 biomarker samples were analyzed." This sentence should be moved to the M&M section. Additionally, the authors should provide some details on how they chose the sampled to be analyzed for biomarkers.

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- P15963.l19. " is quite stable, between 0.1 and 4.9 μggTOCôÃĂĂ1wt%". This sentence is surprising. It would be more convincing to include mean and sdt.

- P15963.l25-27. The authors should comment the fact that only the peat samples (3-A-03, 2-D-20, 1-A-02) align with axis 1. Indeed, these samples present the high TOC, low d13C, high C/N values. It would be interesting to perform this analysis without these 'special' samples. Do these samples represent the untransformed OM state and could be used for reference?

Discussion

- P15966.L7. The Holocene OC input in the thermokarst deposit should be discussed. Possible origin? Influence on biomarkers analysis, radiocarbon dating..

- P15966.L19-20. Which signal? CPI, d13c or both?

- P15968.L28. Figure 7 should be greatly modified. The authors present boxplot with very limited data set (for biomarkers, n=2, 3, 4). A boxplot is designed to provide a synthetic 5-value-indicator for a population. A boxplot cannot be generated with less than 5 samples. I strongly suggest that the authors pool the yedoma and thermokarsts data before presenting the boxplots. Please refer to this publication: http://www.nature.com/nmeth/journal/v11/n2/full/nmeth.2813.html

- The authors should relate more clearly the potential fate of OM (what they call 'good quality', and seem to be bioavailability and the biomarkers analysis they have chosen.

Conclusion

- P15972.L28. The authors should be more specific in the conclusion. Do not leave vague evaluation :' perhaps', better ...

Figures:

- 3&4 : the quality should be improved for clarity

- 5. The relationships should be tested without the 'peat' samples. Please provide significance levels for correlations.

- 6. Same for figure 6 + improve clarity

- 7. See detailed comments on box plots.

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Interactive comment on Biogeosciences Discuss., 11, 15945, 2014.