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Discussions

Interactive comment on "Comment on "The origin of methane in the East Siberian Arctic Shelf unraveled with triple isotope analysis", by Sapart et al. (2017)" *by* Katy J. Sparrow and John D. Kessler

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The comment by Sparrow and Kessler raises important concerns about the reporting and authenticity of methane radiocarbon (14C) data presented by Sapart et al. In the study, Sapart et al use 14C data from sediment and water column methane collected in the East Siberian Arctic Shelf to constrain the age of the organic matter from which the methane originated. Additional source information is provided with 13C and deuterium analysis of the methane that is interesting and informative without the 14C data, but as Sparrow and Kessler remark, the inclusion of 14C data has the potential to provide

additional insight into methane dynamics. Sapart et al. report exceptionally positive (14C-enriched) radiocarbon values from methane samples collected from sediments and the water column at one of the sites they investigated. They suggest the values represent an anthropogenic source present in the environment. Sparrow and Kessler contest it is a sampling artifact. Resolving this dispute is critical for how the community will utilize this study to interpret methane dynamics in the ESAS, and elsewhere.

The issues of data reporting raised by Sparrow and Kessler are that the procedures for collecting the samples are not sufficiently described, and that quality control data are absent. Their criticisms are meaningful. Given the challenges associated with collecting and measuring samples collected for natural abundance radiocarbon measurements, the authors of the study should be encouraged to submit a response in this regard. The expectations for proper documentation by Sparrow and Kessler are explicit and should receive careful consideration. Additionally, details about the application of the gas source analyzer should be included as this 14C analytical method is less common. What are the limits of detection and to what extent do the data reported in this study approach that? These details were not included in the manuscript.

Addressing whether or not the exceptionally (and unprecedented) 14C-enriched methane values from the non-ebullition site in Buor-Khaya Bay (ID-11) are an environmental contaminant or a sampling artifact is a more challenging task to manage. The authors of the study suggest it is a "local anthropogenic nuclear contribution. . ." that was "laterally transported. . .from the coastal terrestrial permafrost," while Sparrow and Kessler argue it is equally (if not more) likely to be a product of the "sampling equipment, vessel, and/or laboratory." Sparrow and Kessler raise excellent points in support of their argument (please refer to the comment) for which the authors should respond. They also ask why the relationship between lower concentration sediment samples showing a greater degree of 14C-enrichment is not also reported for the water column samples.

This reviewer would additionally like to know what mechanism would allow for radioac-

tive contaminant migration from the terrestrial to the permafrost sphere through (impermeable?) permafrost since the dawn of the nuclear age. That is (seemingly) a long way to travel through an uncertain conduit within a relatively short amount of time. Is this hydrological feasible?

An argument provided by the authors but not recognized by Sparrow and Kessler is that the 14C-elevated samples from the sediment and water column samples were not sampled in a similar manner. The sediment samples were drilled from ice in 2011 and the water samples were collected on a ship in 2012. What is the source of contamination affecting both expeditions? Also, samples from other locations sampled with the same equipment during the ship-board expedition and stored in the same manner during were not contaminated. How could contaminants have randomly only affected the samples from one site, especially given the extent of 14C-enrichment reported. A response from Sparrow and Kessler on this issue would be worthwhile and valuable to an objective evaluation of the age-based conclusions drawn from this study.

There is certain value in the 13C and deuterium data; therefore, knowing if the corresponding 14C data are acceptable for scientific interpretation merits debate.

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