

## ***Interactive comment on “Distribution of PAHs and the PAH-degrading bacteria in the deep-sea sediments of the high-latitude Arctic Ocean” by C. Dong et al.***

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The objectives of this paper are to identify concentrations of PAHs and the presence PAH-utilizing bacteria in Arctic Ocean sediments and to evaluate the degradation potential of isolated PAH-degrading bacteria. PAHs were quantified with GC/MS and bacteria were identified with 16s rRNA gene sequencing using the Illumina HiSeq2000 platform. The manuscript has good potential, but significant improvement is necessary for publication.

I'm happy to hear that the authors plan to improve the manuscript by submitting it for 'writing improvement'. There are many cases throughout the manuscript where the

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language needs improvement. There are too many cases to cite in this review.

Authors discuss terrigenous and anthropogenic PAHs sources throughout the Introduction and Discussion. It is unclear how terrigenous sources relate to the present study. I encourage the authors to clarify their argument.

I disagree with author's generalized statement that polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants (POPs). Many PAHs are easily biodegradable. High molecular PAHs can be resistant to bioremediation, but I am highly skeptical that all PAHs found in petroleum are classified as POPs. I have not found any literature to support this claim and the authors have not provided any references to this statement.

Why were samples collected from the Chukchi Plateau Makarov Basin? Please include a statement of the significance of this location.

Were oxygen concentrations measured in the sediments during sampling? In the incubations? It is unclear what in situ conditions were represented in the incubations.

Pg 13987, line 25. Paragraph is about PAH contaminants, but it appears that references concerning terrigenous organic carbon are used (e.g. Yunker et al., 2011). Please clarify the source of the PAHs and be sure to not use references concerning terrigenous PAH distribution for proof of anthropogenic contamination.

Be sure to identify abbreviations at the first occurrence (e.g. dw).

Pg 13989, Sediment Collection. What was the water depth at these sampling locations? What was the temperature? Were in situ nutrient concentrations measured?

Pg 13990, line 10. Please describe the ONR7a enrichment medium.

Pg 13990, line 17. Were spiked surrogate standards used to calculate extraction efficiency? Additionally, please describe how PAHs were quantified with the internal standard method and identify the internal standard.

Pg 13991, line 1. Five grams of soil were spiked with a PAH mixture in addition to 1 mL

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of crude oil. The high concentration of oil added to the soil enrichment in addition to the PAH mixture may have caused the slow growth of PAH-degrading bacteria. Please comment on this.

Were oxygen concentrations monitored in the enrichments? Were the enrichments left open to the atmosphere? If oxygen was monitored, how do these levels correspond to natural concentrations? If oxygen was not monitored, discuss the limitations of the enrichments cultures.

Pg 13991, line 10. Explain 'repeated twice'. It is unclear what part was repeated twice. How do the nutrient concentrations in the mineral medium correspond to the natural conditions found in the sediments?

Pg 13991, line 20. It is unclear how PAHs were quantified. Please include a detailed description of quantification. Were abiotic losses of PAHs calculated in the incubations? It is unclear how the % losses of PAHs were calculated and if abiotic losses were accounted for.

PG 13993, line 10. Why were the bacteria isolated at 15°C chosen as the representative culture?

Could the concentration of PAHs measured in the sediments be the results of natural oil seeps?

Pg 14000, line 3. Please provide the concentration of phenanthrene.

Pg 14002, line 1. It is incorrect to say that the genus occupied 0.2-0.5% of the total bacteria in each sample. It is correct to say that the genus occupied 0.2-0.5% of the total bacteria sequenced. . . .

Pg 14002, line 11. 'The Cycloclasticus bacteria were found in all these samples.'

Please define 'these samples'. It is unclear what samples you are talking about.

Pg 14002, line 23. '...were also found as dominant members in some PAH-degrading

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consortia in this report'. Please describe where they were found.

Pg 14003, line 4. Please describe 'the first two bacteria'.

Pg 14003, line 12. Please insert 'sequenced' after 'total bacteria' or something similar.

Please discuss the relevance of incubating Arctic sediments at 15°C and 25°C.

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