

## ***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.***

**C. Dong et al.**

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Received and published: 23 November 2014

Dear Dr. Andrew Steen,

Thanks for your positive comments on our manuscript. Your questions were responded as follows:

R.: With respect to the writing, the manuscript is well-organized and the structure is logical, but there are quite a few superficial grammatical errors that should be fixed.

A.: The language and grammar of this manuscript will be edited by American Journal Experts Company before it is resubmitted.

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R.: P 13986 line 2: change to "tend to accumulate"

A.: We will change these words in the revised manuscript. Thanks.

R.: P 13986 line 13 change to "The potential degraders including..., with *Dietzia* as the most abundant, occurred in all sediment samples."

A.: Agree. Thanks.

R.: P 13987 line 1 change to "and is almost"

A.: OK. Thanks.

R.: P 13987 line 3 change to "Loading of terrigenous organic carbon through rivers into the Arctic Ocean, and the influence of that terrigenous organic matter on bacterial diversity in coastal water, have drawn attention". (Keep the same citations).

A.: Will be changed accordingly, thanks.

R.: P 13987 line 16: change to "have increased"

A.: Agree. Thanks.

R.: P 13988 line 5: Change to "Biotic and abiotic processes, as well as top-down processes (suspended particle absorption and sinking) and bottom-up processes (thermogenesis below the surface) are all believed to contribute to the accumulation of PAHs (reference)." \* Also: I am not aware of biotic processes that are known to produce PAHs. \* Also: to me, "top-down" and "bottom-up" processes are ecological terms referring to predator or prey/nutrient control over populations. The authors are using them here to refer to the physical top or bottom of the water column. I encourage them to find different terms.

A.: Thanks for your questioning. Here, we want to explain the PAHs sources in deep-sea sediment. According to previous reports, the main sources of PAHs are long-range atmospheric transport and abiogenic production in some specific deep-sea environ-

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ments, such as hydrothermal vent. So, we modified this sentence as "Long-range atmospheric transport and abiogenic production in deep-sea hydrothermal vent are all believed to contribute to the accumulation of PAHs (Friedman, C. L. et al., 2012; Proskurowski, G., et al. 2008; Simoneit, B. R. T., et al. 2004; Konn, C., et al. 2009)."

R.: P 13988 Line 28: Change to "To the best of our knowledge,"

A.: Revised, thanks.

R.: p 13991 \* Line 12: Is "consortia" the correct term here? I understand "consortium" to mean a well-defined association of a small number of species, for instance the association between archaea and sulfate reducers that drives anaerobic methane oxidation. The authors have more complex mixtures of microorganisms in which many of the species are probably involved in PAH degradation, but some may not be and it is possible that none are essential to PAH degradation. For that reason, I prefer a term like "enriched communities"

A.: We agree with your opinion and will change "consortia" to "enriched cultures" in the revised manuscript.

R.: p 13992 Line 22: The authors should post this script as a supplemental file as a service to other authors working on similar projects.

A.: This script,"combine.bipes.pl"(seeing the Supplement of this comment), is written by our co-author Ms. Huafang Sheng using Perl language. Also, this script will be added in the supplemental materials of the revised manuscript.

During our IHTS data analysis process, all clean reads of each sample were stored in an independent "fasta" format file. Before executing this script, user should build a file named "fa.list" for storing the file paths of all these "fasta" format files. Then, user can use the command "perl combine.bipes.pl fa.list outprefix" to execute the script. Finally, clean reads of each sample were combined into the file named "outprefix.combined.fa".

R.: p 14000 \* Line 22: I do not know what the theory of global distillation effects is. It

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must be cited, and the authors should briefly explain what it posits.

A.: First of all, you concern located in line 15. Wiki gives an explanation of the theory as follows:

Global distillation or the grasshopper effect is the geochemical process by which certain chemicals, most notably persistent organic pollutants (POPs), are transported from warmer to colder regions of the Earth, particularly the Poles and mountain tops. Global distillation explains why relatively high concentrations of POPs have been found in the Arctic environment and in the bodies of animals and people who live there, even though most of the chemicals have not been used in the region in appreciable amounts. ([http://en.wikipedia.org/wiki/Global\\_distillation](http://en.wikipedia.org/wiki/Global_distillation) ).

This theory was firstly proposed by Dr. Goldberg in 1975. Actually, we have cited relative references in line 17.

For more accuracy, we will change this sentence to "According to the theory of "global distillation", in the revised manuscript.

R.: p 14001 Line 28: Omit "by"

A.: We will delete this word in the revised manuscript.

R.: p 14002 Line 2: "must" is too strong. Change this to something like "It seems likely that they play an important role"

A.: Thanks. We will change this sentence as your advice in the revised manuscript.

R.: p 14002 Line 11: Omit "The" before "Cycloclasticus"

A.: Deleted, thanks.

R.: p 14002 Line 29: Change "more kinds of carbon source" to "more distinct carbon compounds"

A.: These words will be changed in the revised manuscript.

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R.: p 14004 Line 7: Change to "It is worth mentioning that"

A.: Have changed in the revised manuscript. Thanks.

R.: Figure 2: Stacked bar graphs such as this one are common, but they are not the best way to display data such as these, because it is very difficult to assess changes in the height of the bars that are in the middle of the plot. A better way would be to make a separate panel for each genus, as, for instance, shown in the "panel bar chart". Examples of such a chart (with code using the open-source statistical platform R) is given here: <http://timotheepoisot.fr/2013/02/17/stacked-barcharts/>.

A.: First of all, we really appreciate you offering us a better way to display our data. We have redrawn this figure as below.

Figure 2 legend:

Fig. 2. The distribution and relative abundance of 16 EPA-priority PAHs in the sediments of the Arctic Ocean. For each of PAH, its relative abundance in all 12 samples was presented using different length of bars in a sub-plot. The longest bar in a sub-plot means this sample has the highest concentration value of a PAH in all 12 samples. And other bars' length was proportionately shorted according to the ratios of the concentration values of other samples divide by the highest one. Acenaphthylene, Acenaphthene and Anthracene were not presented in this plot, because their concentrations were below the detection limits in all sediment samples. U, M, and L in the sample names refer to the upper, middle, and lower layers of the sediments, respectively.

R.: \* Figure 4: "%" does not make sense as a unit for something labeled "removal rate": a rate needs to have units of something per unit time. Does it mean "% loss over the entire incubation"? Neither the main text nor the figure legend adequately explain this calculation. In any case, better units would be g PAH per liter per hour. Also, change "apt" to "high" in the figure legend.

A.: Yes, it dose. "%" just means that a certain of PAH consume percentage over the

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entire incubation.

As your advice, we added a description of the calculation of PAHs removal rate in Figure 4 legend as below:

The PAH-removal rate was calculated as follows: Removal rate (%)= $\frac{t\text{PAH} - (r\text{PAH}/R)}{t\text{PAH}} \times 100\%$

tPAH: total quantity of each kind of PAH before enrichment; rPAH: residual quantity of each kind of PAH after enrichment; R: recovery rate of each kind of PAH, and it was used to estimate the recovery efficiency during the extraction process.

Additionally, the word "apt" also changed into "high" in the revised manuscript.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/11/C6939/2014/bgd-11-C6939-2014-supplement.pdf>

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Interactive comment on Biogeosciences Discuss., 11, 13985, 2014.

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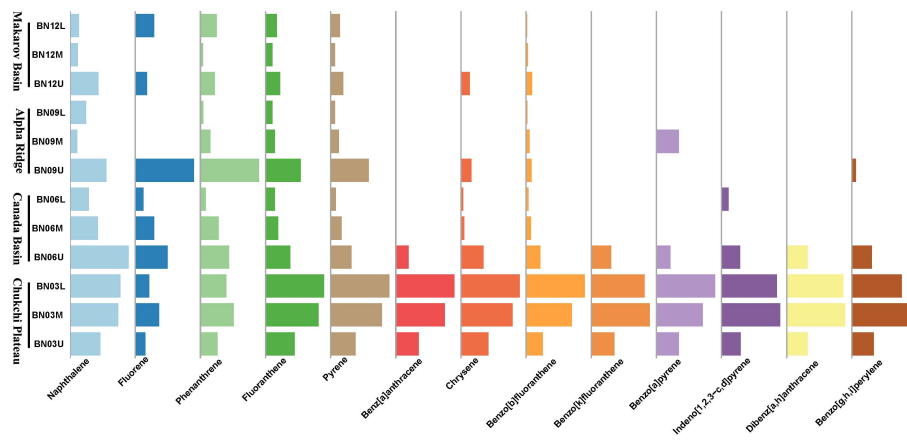


Fig. 1. Figure 2

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