

Interactive comment on “Dissolved Pb and Pb isotopes in the North Atlantic from the GEOVIDE transect (GEOTRACES GA-01) and their decadal evolution” by Cheryl M. Zurbrick et al.

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This paper by Zurbrick and co workers describes a study of Pb and Pb isotopes in the North Atlantic from the GEOVIDE transect and their decadal evolution.

The results confirm recent findings within the community regarding the sources of Pb in the NAO in a post gasoline world, i.e. the suggestion that “natural Pb is coming back” and the high concentrations in subsurface Mediterranean water near the coast of Portugal. There is also an important observation re the homogenous isotopic composition of NA seawater.

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The analytical data is of good quality. The data set is extensive and critical to the field in that it allows to assess the temporal evolution of lead in the marine environment since the out phasing of leaded gasoline. It is also a great joy to see how the long-standing efforts of the MIT group and their collaborators to study the marine lead cycle enables us to get unprecedented insights into the global geochemical cycle of lead. This work is as such invaluable and unique and instrumental to push the boundaries of marine chemistry and global geochemical cycles.

I have no hesitation to recommend the paper for publication but would like to add a few reflections that the authors might wish to consider.

First, it would be helpful and good to formulate a proper hypothesis and describe better the aim and objectives of the study. At the moment the authors state that the study evaluates current sources and relative quantities (not sure if that is correct as you determine relative contributions but not quantities as a quantity is defined as amount or number of a material) but I think it would be helpful to be more hypothesis driven and test a specific process or mechanism.

Second, I can understand that the authors want to discuss outliers given the amount of work that goes into getting samples and data – nevertheless, I do wonder what the contribution/value is to publish that ‘negative’ data. The careful assessment of the data done by the authors suggests that there are contamination issues. If so – why publish? Is the idea of such an assessment not to identify the problems and then report the valid and acceptable data? I have no strong feelings, but I think that chapter (3.1 Outliers) does not add to the paper. If the authors want to keep that chapter, then maybe it would be beneficial for the reader to make clearer what we have learnt from it and how we can prevent it in future.

Third, if feel the authors do not really push the source assessment to the point they could. There is important recent isotope data out on key ‘new’ potential sources of lead in the atmosphere such as coal, non-combustion vehicle exhausts, diesel etc for

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North America and Europe. (Various papers published in EST). I think that data should be added to the source discussion. To this end, it would also be good to be more clear when talking about emissions from what segment they come. I don't think that data is presented or discussed. To this end, I am not sure if the statement re the return of natural Pb is so clear cut. Various studies have shown that coal, tires and brake abrasion etc play a key role as novel source of Pb in the (urban) atmosphere and as the Pb enrichments are still significant in the NA atmosphere, I feel that this needs to be more critically discussed. It is clear to me that this discussion is very difficult and there are many arguments for one or the other, however, I think modern new anthropogenic sources have not been so well included. One question to me seems – how do we reconcile the 10 fold enrichment in the atmosphere with 30 to 50 % natural Pb in the surface waters? I am aware Pb concentrations have come down ... But are they half way back to 'normal'? Do we have a number for pre-anthropogenic Pb concentration?

Forth, I am not sure how much mineral dust is really a source of natural lead given the very low solubility of silicates. With respect to present days, we know that anthropogenic particles are much more soluble (see various recent Nature Geoscience papers) and hence could possibly control the dissolved Pb budget even with a small enrichment. With respect to pre-anthropogenic times, I wonder if we can ignore the importance of passive volcanic degassing. A series of papers have shown that passive degassing of volcanoes can be a very important source of trace metals to the atmosphere and given that in this case Pb is either in gas phase or a more soluble silicate phase, that could be an important source too.

Finally, a more editorial point. I think the amount of figures can be reduced

I hope my comments are helpful and wish the authors only the best. A very fine contribution.

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