

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.

Anonymous Referee #1

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General comments

Zurbrick et al present an impressively large dataset of dissolved Pb concentrations and isotope compositions from the North Atlantic, spanning both a large geographic region and documenting temporal changes over the past few decades. This allows novel insights into how the sources of this pollutant have changed over time, which will be of interest to a broad group of oceanographers and geochemists alike. The paper is well written and the interpretations and conclusions are generally well supported by the dataset, I therefore recommend its publication in Biogeosciences.

I have just a few recommendations for minor revisions.

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One of the main conclusions is that, as of 2014, there is evidence for natural Pb sources to surface seawaters of this region (page 12, lines 22-25). This is based on both the isotopic results of this study and the results of aerosol samples collected during the same cruise presented by Shelley et al. (2017, cited in article). Specifically, Shelley et al., (2017) attributed 60% of the Pb in the atmosphere to be associated with natural mineral dust, and 40% to be from anthropogenic sources (page 10, lines 24-25). The authors then suggest that this ratio of these Pb sources is observed in the dissolved phase of their surface seawater samples (page 10, lines 28-30).

A problem with this line of logic is that it fails to account for the solubility difference between these two atmospheric Pb sources. Lead from anthropogenic emissions is considered to be far more soluble than that associated with mineral dust. This means that deposition of mineral dust derived Pb needs to far exceed that of anthropogenic Pb to produce a ~1:1 ratio of these Pb sources in the dissolved phase of surface seawaters. In other words the roughly 1:1 ratios of natural to anthropogenic Pb determined in aerosols is expected to be substantially modified in surface waters due to solubility differences, resulting in predominantly anthropogenic Pb occurring in the surface waters. This discrepancy needs to be addressed to support the conclusion that naturally sourced Pb is now prominent in surface waters of this region.

Specific comments

Page 4, line 33; What statistic is the ‘~200ppm’ reproducibility of the Pb isotope ratios based on, 2sd? Likewise for the quoted ‘1000ppm’ and ‘~500ppm’ reproducibilities quoted in lines 34 and 36.

Page 6, line 11; what is this ‘moderate range in [Pb]’? It would be helpful to include specific values here.

Page 8, lines 12-15; both of these cruises have detailed Optimum Multi-Parameter water mass analyses so presumably this interpretation can be verified.

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Technical corrections

Page 3, line 19; specify 'samples were analysed for Pb concentrations'

Page 6, line 21; 'Schepanski et al., 2009' is underlined

Page 8, line 31; change 'heavier' to 'higher'

Sections 3.5 and 3.6; references to the appropriate figures become rather sparse in these sections

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