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Assessing the variation in mercury deposition around the North Atlantic during the Palaeocene-Eocene Thermal Maximum (PETM)

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The Palaeocene-Eocene Thermal Maximum (PETM) is a widely studied extreme global warming event that occurred ~55.8 Ma. The PETM is marked by a sharp and sustained negative δ13C excursion, indicating a voluminous and rapid release of isotopically light carbon to the ocean-atmosphere system. The source(s) of carbon that instigated this global warming event remain heavily debated. The PETM is broadly contemporaneous with the second major pulse of activity (56-54 Ma) from the North Atlantic Igneous Province (NAIP), suggesting a possible causal relationship. This may have been driven by direct volcanic degassing of carbon dioxide (CO_2) and/or thermogenic volatiles (e.g. CH4 and CO_2) through contact metamorphism of organic-rich sedimentary layers affected by igneous intrusions. An emerging field in geochemistry that could shed light on the possible link between large igneous province emplacements and hyperthermal events is the use of mercury (Hg) preserved in the sedimentary record as a far field proxy for periods of major volcanic activity. Significant emissions of Hg could be sourced from both volcanic gases and from contact metamorphism, which are transported globally prior to deposition if released directly to the atmosphere. In marine settings, organic matter and clay minerals scavenge Hg and bury it in sediments; spikes in Hg/TOC (total organic carbon) ratios represent increases in Hg loading. Therefore, this method may be able to differentiate between magmatic and other sources as triggers for the PETM and the general activity through time. Here we present new Hg and C data from selected cores around Europe and North America to assess the variability of Hg deposition across the PETM with geographic location. The results indicate that while there is a slight background increase in Hg deposition during the PETM, there is significant variability between cores and extreme peaks within individual sections. This suggests that the behaviour of the Hg cycle during the PETM is a complex one, and that local factors such as core lithology and post-depositional mobility may be a factor.