Hyperthermal-associated North Atlantic silica burial throughout the Lower Eocene

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The Early Eocene carbon cycle was repeatedly perturbed by transient hyperthermal events characterized by negative carbon isotope excursions (CIE's), global warming, and deep-sea carbonate dissolution. They range in size from the Paleocene-Eocene Thermal Maximum (PETM, ~56 Ma, a >2‰ CIE lasting ~150,000 years) to smaller (<1‰ CIE) orbitally-paced events throughout the Early Eocene Climatic Optimum (50-53Ma). Enhanced weathering of terrestrial silicate rocks under elevated surface temperatures is thought to provide a significant negative feedback on global warming during these events which drives their terminations and leads to their transient nature. The elevated weathering of silicate rocks necessary to sequester masses of carbon consistent with estimates for hyperthermal carbon release should also liberate a significant (relative to background levels) quantity of dissolved silica to the oceans. Due to the relatively short residence time of Si in the oceans (<20,000 years), this elevated Si delivery would likely be taken up by siliceous organisms and buried as opal within tens of thousands of years following each hyperthermal. We present a new deep-sea record (IODP Site U1409) spanning the Lower Eocene that contains silica-rich facies (porcellanite, chert) with coincident benthic CIE's marking at least the two largest of these events (the PETM and ETM2). Sedimentology and high-resolution X-ray fluorescence scanning also indicates numerous peaks in silica abundance occuring throughout the early Eocene as well. Forthcoming benthic stable isotope records over such siliceous intervals will allow us to test the hypothesis that these similar silica-rich facies correspond to the younger hyperthermals.