CONTROLS ON MARINE ORGANIC CARBON BURIAL AND ITS IMPACT ON THE GLOBAL CARBON CYCLE DURING THE PALEOCENE-EOCENE THERMAL MAXIMUM

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The sequestration of organic carbon (C_{org}) in marine and terrestrial environments acts as a negative feedback within the global carbon cycle that may affect the lifetime of atmospheric CO_2. This mechanism may have contributed to the initially rapid recovery phase of the Paleocene-Eocene Thermal Maximum (PETM), an interval of rapid carbon release and warming ~56 Ma. As a result the PETM provides an excellent opportunity to study the mechanisms that can contribute to C_{org} burial and the subsequent climatic response. Here, we assess the degree, cause and impact of C_{org} burial in marine sediments during the PETM by combining geochemical sediment records with carbon cycle model simulations. New records of TOC, TOC/P_{tot}, Mo, Mn and Fe/Al are used to reconstruct bottom water redox conditions at sites from the open ocean, shelf, slope and Arctic basin. These data are combined with published records to provide insight in the distribution of C_{org} sequestration across the aforementioned basins and the European epi-continental seaway, as well as its relation with primary productivity, deoxygenation and sedimentation rates. We find that the Paleocene/Eocene shelf and the restricted basins of the Arctic and Europe were important sinks of C_{org} during the PETM, with major contributions from increased sedimentation rates and deoxygenation, respectively. Our model results, which include burial estimates for coastal areas, provide further constraints on the amount of C_{org} sequestration required to explain the rapid recovery of $\delta^{13}C$ at the end of the PETM, and the potential role of redox-driven changes in nutrient recycling and preservation of C_{org}. Finally, we use our model to investigate the impact of the duration of burial and its timing relative to the peak and the recovery of the $\delta^{13}C$ excursion.