Hydroclimatic modulation of continental carbon burial through the PETM

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Climatic wetness is a primary driver of variation in terrestrial carbon storage today, yet carbon cycle feedbacks involving the hydroclimate are poorly constrained for the future and practically unknown under warm climate conditions in Earth's past. We present records of paleosol wetness and organic and authigenic inorganic C storage from cores spanning the Palaeocene-Eocene thermal maximum in the Bighorn Basin (BHB), Wyoming, USA. Our qualitative reconstructions, based on paleosol carbonate colour and morphology, suggest generally drier conditions within the body of the PETM, consistent with previously reported outcrop evidence. Our data also show a ~2x decline in the total organic C content of BHB sediments during the PETM, similar to changes previously reported from other localities. During much of the PETM, however, preservation of authigenic soil carbonate increased by a factor of 2, such that the total C content of BHB sediments did not change substantially. If the BHB case can be used as a model, widespread changes in the ratio of organic to inorganic C burial in terrestrial sediments may be reflected in the anomalous, prolonged body of the PETM C isotope excursion, and global changes in net continental carbon burial may have played a modest role in modulating PETM carbon cycle change. These results suggest that authigenic soil carbonates are an important and climatically sensitive mode of continental C burial that should be considered in assessments of the response of continental biogeochemical cycling to global hydroclimatic change.