Oxidative weathering of ancient sedimentary organic matter (Eagle Ford and Pepper Fms. central TX, USA), genesis of modern soils, and implications for global biogeochemical cycles of C & O

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Ancient sedimentary organic matter (kerogen) represents the largest terrestrial organic carbon reservoir on earth and is vulnerable to remineralization upon exposure to earth's atmosphere during the oxidative weathering of sedimentary rocks on the continents. Despite the potential for large carbon-cycle implications, the mechanism of kerogen transformation by oxidative weathering and flux values are not well-constrained in contemporary models of the global carbon cycle. We used a combination of solid-state ^{13}C nuclear magnetic resonance (NMR) spectroscopy, and carbon isotope techniques to describe molecular and isotopic changes that occur throughout oxidative weathering of marine kerogens, and the subsequent formation of modern soils, in two outcropping Cretaceous mudstones of the Eagle Ford and Pepper Formations in central, Texas. A molecular mixing model and ^{14}C analysis demonstrated that in some cases ancient sedimentary C remains a profound component of the soil organic carbon pool. Gradational production of O-containing functionalities was observed, coupled with reductions in characteristically abundant polymethylenic components of type II kerogens. Organic matter structural parameters, derived from C-H dephasing NMR experiments, also provide the basis for a novel weathering index that accounts for the degree of diagenetic alteration of kerogen samples along the bedrock-soil continuum. Finally, kerogen oxidation flux was derived for these sites and is presented in the context of previously established flux values and the global C cycle.