Organic and carbonate carbon burial through Earth's history

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The carbonate carbon isotope record is traditionally interpreted as providing evidence of remarkable stability in the globally integrated ratio of organic to total carbon burial from Earth's surface environments over the past ~3.8 billion years. Herein we use a terrestrial biogeochemical model coupled to a global carbon isotope mass balance to track organic carbon oxidation at varying atmospheric oxygen levels and the impact of this process on the sedimentary carbon isotope record. We provide support for the notion of extensive variability in the fraction of carbon buried as organic matter (f_{org}) throughout Earth's history. We propose that the carbonate carbon isotope record has been characterized by a relatively constant baseline value over time due to a fundamental mechanistic link between atmospheric O_2 levels and the carbon isotopic composition of net inputs to the ocean-atmosphere system. This view of the global carbon cycle is consistent with an emerging model of severe nutrient limitation, relative to the modern, for most of Earth's history.