A statistical analysis of the carbon isotope record from the Archean to Phanerozoic and implications for atmospheric oxygen

J. KRISSANSEN-TOTTON[1]* AND DAVID C. CATLING[1]

[1]Dept. Earth and Space Sciences/ Astrobiology Program, Univ. of Washington, Box 351310, Seattle WA, USA (*correspondence: joshkt@uw.edu)

Organic and inorganic carbon isotope records reflect the burial of organic carbon over geological timescales. Permanent burial of organic carbon in the crust or mantle oxidizes the surface environment (atmosphere, ocean and biosphere) by removing reduced carbon. It is sometimes claimed that both organic and inorganic carbon isotope ratios have remained approximately constant throughout Earth's history, thereby implying that the flux of organic carbon burial relative to the total carbon input has remained fixed and cannot be invoked to explain the rise of atmospheric O_2 [e.g., 1, 2]. However, the opposite conclusion has been drawn from the same carbon isotope record [3, 4].

To test these opposing claims, we compiled an updated carbon isotope database and performed a much more rigorous statistical analysis of the carbon isotope records than has been done before. We applied both parametric and non-parametric models to the carbon isotope record to quantify trends and mean-level changes in organic carbon burial with associated uncertainties and confidence levels. These analyses also allow us to explore whether or not the carbon isotope record is too incomplete and noisy to definitively quantify the contribution of organic carbon burial to the rise of oxygen.

[1] Schidlowski M. (1988) *Nature* **333**, 313 [2] Holland H. D. (2009) *Geochim. Cosmochim. Acta*, **73**, 5241-5255 [3] Des Marais D. (1992) *Nature* **359**, 605 [4] Bjerrum C. J. & Canfield D. E. (2004) *Geochem. Geophys. Geosyst.* **5**.