American Geophysical Union Fall Meeting, San Francisco, CA, Dec 15-19, 2014, *invited*.

Interpreting terrestrial organic carbon isotope records across natural and anthropogenic pCO_2 change

Brian A. Schubert[1] and A. Hope Jahren[2]

[1]University of Louisiana at Lafayette, School of Geosciences, Lafayette, LA 70504, USA
[2]University of Hawaii, SOEST, Honolulu, HI 96822, USA

Changes in the net carbon isotope fractionation ($\Delta\delta^{13}C$) measured in organic carbon from terrestrial substrates results from changes in climate, plant community shifts, and pCO_2 level, but separating out these effects in the geologic record can be difficult. Here we present a compilation of 614 $\Delta\delta^{13}C$ measurements on bulk terrestrial organic matter (TOM) and fossil leaves from 23 distinct records within 19 published studies that span the last 30,000 years up to the industrial revolution. To this dataset we add 2735 $\Delta\delta^{13}C$ measurements made on tree ring tissue from 51 records that extend from 1950 to 2010. These records together span the ~80 ppm rise in pCO_2 from the Late Glacial to through the Holocene (190-270 ppm; fossil leaves and TOM), and the ~70 ppm rise observed across the last 60 years (310-380 ppm; tree-ring tissue). We find a 2.0‰ relative increase in $\Delta\delta^{13}C$ value across Termination 1 (18,000-11,500 years BP) and a 1.0‰ increase in $\Delta\delta^{13}C$ value recorded in tree rings between 1950 and 2010. We use our recently developed relationship between pCO_2 and $\Delta\delta^{13}C$ to show that both increases in $\Delta\delta^{13}C$ value exactly match, in trend and absolute magnitude, the increase in $\Delta\delta^{13}C$ value we predict from our equations in response to rising pCO_2 levels. These results have significance for the interpretation of terrestrial organic isotope records spanning both natural and anthropogenic pCO_2 changes; we contend that environmental reconstructions based on long-term terrestrial $\Delta\delta^{13}C$ records cannot be accurately interpreted until the isotope data are adjusted for known changes in pCO_2 concentration.