# The Carboniferous carbon isotope record from sedimentary organic matter: can we disentangle the carbon cycle?

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Abstract

A comprehensive analysis of the $^{13}C$ composition of sedimentary organic matter from Euramerican Carboniferous successions indicates there are significant shifts in $^{13}C$ through this key time interval. Our studies have revealed that, at an individual location, the source and delivery mechanism of the sediment contribute to the type of organic matter preserved and, in turn this influences the measured $^{13}C$ values from bulk sedimentary organic matter of organic matter. In general, where marine-derived organic matter is dominant in these Carboniferous successions then $^{13}C$ values are characteristically lower compared to the higher values encountered where terrestrial plant-derived material is most abundant. The implication of these observations is that an apparent carbon isotope excursion identified from the bulk organic matter may reflect a change in transport processes, or depositional environment, rather than a perturbation in the global carbon cycle. In our most recent studies, however, we compare $^{13}C$ values from specific wood fragments and bulk sedimentary organic matter from non-marine, marine basinal, and marine shelfal successions from the earliest Mississippian through to the early Pennsylvanian. These data indicate that early Mississippian $^{13}C$ of organic matter is far less negative (around 22‰) than material of Late Mississippian age (around 26‰), however by the early Pennsylvanian, $^{13}C$ values return to 22‰. There are some $^{13}C$ data from brachiopod carbonate from this time interval and similar shifts are indicated. Our data are beginning to address whether we can identify a primary carbon cycle signal from the Carboniferous record using $^{13}C$ from a range of sedimentary environments. If we can, there are still questions around what the record is telling us about the global carbon cycle during a period when plant groups, including lycopods and seed ferns, rapidly diversified.