Paired carbon isotope from three key intervals of the Turee Creek Group, Pilbara Craton, Australia

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Although strong links between the carbon biogeochemical cycle, the oxygen cycle and the climate are expected through Earth history, in the case of the Great Oxydation Event (GOE) and its succeding global glaciation, these links remain poorly constrained. The Turee Creek Group (TCG) has been identified as one of the best sedimentary sequence to study them because it is the only continuous stratigraphic sedimentary section worldwide hosting both the GOE and the first putative global glaciation.

Paired carbon isotope data ($\Delta^{13}C_{carb\text{-}org} = \delta^{13}C_{carb} - \delta^{13}C_{org}$) together with organic and inorganic contents were measured on three drill cores collected in key stratigraphic horizons of the TCG. They are from bottom to top: the transition between the Kungarra Fm. and underlying BIFs of the Boolgeeda Iron Fm. (TCDP1); the base of the Meteorite Bore Member glacial diamictites (TCDP2); the transition of the carbonate-bearing Kazput Fm. and underlying quartzites of the Koolbye Fm. (TCDP 3).

In a $\delta^{13}C_{carb}$ versus $\delta^{13}C_{org}$ diagram, samples from the different formations plot in distinct areas. $\delta^{13}C_{carb}$ values are comprised between -14 and 0.5‰. The carbonate-bearing Kazput Fm. (upper TCDP3) with $\delta^{13}C_{carb} \sim 0$‰ (and $\delta^{13}C_{carb} \sim$ -27‰) is probably recording primary $\delta^{13}C_{carb}$ values. All other formations are terrigeneous and carbonate-poor, and their $\delta^{13}C_{carb}$ seems to be diagenetic ($\Delta^{13}C_{carb\text{-}org}$ values are lower than 24‰ and strongly controled by $\delta^{13}C_{carb}$).

$\delta^{13}C_{org}$ values in the BIF (lower TCDP1) and in Kazput and Koolbye formations (TCDP3) range from -30 to -25‰, and are typical of photosynthesis from a dissolved inorganic carbon close to 0‰. In the diamictite (TCDP2) $\delta^{13}C_{org}$ values range from -31 to -36‰ and decrease with increasing TOC, pointing towards variable contributions in chemosynthesis derived organic matter. In the Kungarra Fm. (upper TCDP1), $\delta^{13}C_{org}$ values are close to -32‰ but do not show any relationship with strongly variable TOC, leaving open the possibility that it may record a minor global negative excursion in the immediate afterwath of the BIF deposition.