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The European 'initial' negative carbon isotope excursion did not record the onset of the end-Triassic marine mass extinction

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At present, Earth is fast-tracked into a state of greenhouse gas emission-induced rapid warming, ocean deoxygenation and acidification and accelerated biodiversity loss. Studying similar events from the geological past is essential to our understanding of the mechanisms of these environmental changes.

The end-Triassic mass extinction (ETE, ~201 million years ago) is associated with a disruption to the global carbon cycle triggered by CO_2–degassing of gigantic fissure eruptions linked to the opening of the Atlantic Ocean and preserved over 11 million square kilometres from central Brazil to western Africa, eastern North America, Iberia and northwestern France. The large magnitude (~5 ‰) negative carbon isotope excursion (CIE) that characterises the bulk organic carbon isotope record in ETE sections across the Central European Basin has been designated in the literature as the 'initial' CIE. It has been interpreted to reflect a substantial input of isotopically light carbon to the atmosphere via volcanic-induced outgassing or methane clathrate dissociation, and has been used as a chemostratigraphic marker for the beginning of the ETE in the marine realm.

We used hydrocarbon biomarker analyses, bulk $\delta^{13}C_{org}$ data and previously published palynological and invertebrate data to reconstruct environmental and ecological changes in the latest Triassic and earliest Jurassic at Lavernock, South Wales, and Felixkirk, North Yorkshire, England. Our data show that sea level drop along with invasion of fresh water produced a localised turnover of marine taxa that could have produced highly ^{13}C-depleted carbon, creating the 'initial' CIE – not a change in atmospheric CO_2 concentration.

A rise in sea level and return to fully marine conditions in the European region resulted in the brief return of Triassic-aspect marine fauna followed by the real mass extinction, a lower magnitude CIE (~3 to 4 ‰). This more protracted isotopic excursion may be what is recognised in more pelagic sequences globally.