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New carbon-isotope evidence from the Polish Basin for a major carbon-cycle perturbation at the Triassic-Jurassic Boundary

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Carbon-isotope analysis of fossil plant material from a Polish core provides new evidence of a perturbation to the atmospheric carbon-cycle at the Triassic-Jurassic boundary (∼201 Ma). The Triassic-Jurassic boundary was a time of extreme climate change which also coincided with the end-Triassic mass extinction. The new data will allow us to identify climatic changes in the Polish Basin across the Triassic-Jurassic boundary and evaluate these changes on a broader scale by comparison to data from other sites located around the world.

The Niekłan borehole core, located in the southern Polish Basin, provides a ∼200 metre-long terrestrial record spanning the Rhaetian and Hettangian, including the Triassic-Jurassic boundary (∼208-199 Ma). The Niekłan core consists of interbedded fluvial and lacustrine sediments containing preserved plant material and thus provides an excellent opportunity to study both terrestrial palaeoenvironmental changes in the Polish Basin and perturbations in the carbon-cycle more broadly.

Carbon-isotope analysis of macrofossil plant material and microscopic woody phytoclasts from the Niekłan core reveals a negative carbon-isotope excursion (CIE) of ∼-3‰ at the end of the Rhaetian, before a gradual return to more positive values thereafter. The negative CIE suggests an injection of isotopically-light carbon into the atmosphere occurred just before the Triassic-Jurassic boundary. Likely sources of this carbon include volcanogenic gases, methane released from gas hydrates, or a combination of the two.

The negative CIE seen in plant material at Niekłan is also recorded in a variety of geological materials from contemporaneous sites world-wide. These time-equivalent, but geographically separated, records indicate that the negative CIE recorded in the Niekłan plant material is the result of a regional or global carbon-cycle perturbation and is not merely a local signal.

Future work will focus on using a range of palaeoenvironmental proxies in order to produce a detailed record of climate change at the Triassic-Jurassic boundary to complement the new fossil plant carbon-isotope record from the Niekłan core. A new, detailed, multi-proxy record from the Polish Basin will allow us to quantify the climate changes occurring in the basin across the Triassic-Jurassic boundary.