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Excursions in Stable Carbon Isotopes at the End-Triassic Mass Extinction: Eastern North America and Morocco

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The end-Triassic mass extinction (ETE) at 201.4 million years ago is one of the five largest ecological disasters of the last 600 million years. Its cause is thought to be related to flood basalt eruptions of the Central Atlantic Magmatic Province (CAMP). In eastern North America, non-marine deposits recording this extinction occur below the oldest basalts (1), whereas in Morocco the extinction appears to be synchronous or possibly above the oldest basalt flow (2). In marine and paralic strata of Europe, the extinction is marked by a distinct negative carbon isotopic (δ13C) excursion (CIE) (3). This CIE is also apparent in organic carbon records from eastern North America (4,5). Here we present new δ13C data from organic carbon and terrestrial plant derived n-alkanes from the Central High Atlas and Argana basins [6] of Morocco). These data also suggest that the CIE is coincident with the ETE. In the Passaic Formation of the Newark basin, the negative excursion is associated with the palynofloral extinction level and a fern spore abundance anomaly (fern spike) (7). In the Silver Ridge core (B-2) from the Hartford basin (Connecticut), the negative excursion is also associated with an equisetalian spore spike. In the Fundy basin, at Partridge Island, Nova Scotia, the negative excursion occurs at the palynofloral extinction level, below the oldest basalts [here and (5)], and in Morocco it occurs just below the oldest basalts where Triassic pollen taxa are still present [here and 6)].

One interpretation is that the CIE is synchronous globally and reflects a major anomaly in the Earth's carbon cycle (e.g., 8). However, it is also possible that this pattern is a coincidence of artifactual enrichments of 12C in depositional and early diagenetic environments cut off from the exchangeable global reservoirs, such as in eastern North American lakes (4) and possibly in the canonical shallow marine sections from the UK. Distinguishing between these two classes of hypotheses is a major challenge to understanding the mechanisms of carbon isotopic excursions and the causes underlying one of the largest events in the history of life.

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