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Toarcian OAE (Early Jurassic) in the northwestern Panthalassa: Did anoxia and negative CIE occur synchronously?

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The Early Toarcian oceanic anoxic event (T-OAE) is marked by the deposition of organic-rich black shales that indicates an abrupt negative carbon isotopic excursion (CIE) of carbonates, organic matter, and fossil wood. This characteristic carbon-isotopic perturbation has been well documented in selected sections in the European domain, which belonged to either Boreal or Tethys regions, but it has not yet been well recognized in the shelf setting of the northwestern Panthalassa. In this study, we present, for the first time, reliable data for carbon isotopic ratios of organic matter, total organic carbon (TOC), and lamina preservation index (LPI) from the shallow marine sequence of the latest Pliensbachian to the middle Toarcian age in the northwestern Panthalassa (Sakuraguchi-dani Valley section in Toyora area, west Japan). We recognized the T-OAE strata which indicate high TOC values and well preserved lamination. The LPI data suggest that the anoxia in the shelf setting of the northwestern Panthalassa was not a single event but was interrupted by episodic bottom-water oxygenation events. The characteristic CIE is recognized in the early Toarcian, and the obtained carbon-isotope profile of organic carbon matches well with those of the contemporaneous strata in the western Tethys and Boreal regions. In the study section, however, high TOC and well-preserved laminated strata occurred synchronously with positive shift of the carbon isotope values after the negative CIE. This evidence seems to suggest that the global warming, which occurred after the negative CIE, was the main cause of the T-OAE.

Keywords: oceanic anoxic event, Toarcian (Early Jurassic), carbon isotope, total organic carbon, lamination, Toyora area