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Paleoenvironmental changes in NW Panthalassa through the Toarcian OAE: Stratigraphy and geochemistry of the Toyora area

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The early Toarcian (Early Jurassic) oceanic anoxic event (T-OAE) was a significant palaeoenvironmental perturbation that led to marked changes in ocean chemistry and climate, and which also had a severe impact on marine ecosystems. In addition, this event is characterized by the widespread occurrence of a ˜3?7 ‰ negative excursion in the carbon-isotope (δ^{13}C) composition of marine organic and inorganic matter and terrestrial plant material. This feature of the event indicates a pronounced perturbation to the global carbon cycle. Despite such global impacts of the event, the precise palaeoenvironmental changes during the event from sections outside of the Boreal and Tethys realms are uncertain. Thus, to resolve this issue and further expand our understanding of the nature of the event, here we investigated the Nishinakayama Formation of the Toyora area, southwest Japan, which represents shallow-marine strata deposited at the northwestern margin of the Panthalassa Ocean. First, we established high-resolution carbon-isotope chemostratigraphy. A characteristic δ^{13}C negative excursion was recognized around the middle part of the Nishinakayama Formation, allowing accurate international correlation. Then, we carried out geochemical analyses to reconstruct palaeoenvironmental conditions at the northwestern Panthalassic margin. Our results indicate that in the studied succession, organic-matter enrichment persisted through the early Toarcian, but elemental redox proxies and ichnofabrics do not support persistent bottom-water anoxia through the δ^{13}C excursion. Analysis of terrigenously derived major and trace element abundances and palynology, coupled with sedimentological observations, revealed an increase in coarse-grained sediment, phytoclast size, and terrestrial organic-matter close to the onset of the δ^{13}C negative excursion. These lines of evidence potentially suggest a marked strengthening of detrital sediment flux and hence hydrological cycling and continental weathering. This is consistent with previously published evidence from Boreal and Tethys realms.