

Assessing the most likely duration of the Toarcian Oceanic Anoxic Event using mass accumulation rates

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The Toarcian Oceanic Anoxic Event (T-OAE; Early Jurassic) was a time of marked environmental perturbations, which led to the widespread deposition of organic-rich strata known as 'black shales'. The estimated duration of the T-OAE, however, ranges from 200 to more than 1000 ky, greatly limiting the appreciation of its likely causes and impact on global biogeochemical cycles. All published age models of the T-OAE interval are invariably based on astronomical cycle counts recorded in shelf strata, which are complicated by the large spatiotemporal changes in accumulation rates that characterize such settings. In this study, we assess the most likely duration of the T-OAE using reconstructions of mass accumulation rates (MAR) of different sedimentary components (total organic carbon, CaCO₃, non-carbonate fraction) in various basins using existing age models and available chemo- and biostratigraphic constraints. We find dramatic and geologically improbable increases in NCF, TOC and CaCO₃ across the T-OAE using all age models attributing the main stratigraphic cycles to precession or obliquity. By contrast, age models assuming a short eccentricity forcing lead to more subdued and realistic changes in MAR that seem more compatible with sedimentological and paleontological evidence. We thus conclude that the T-OAE lasted more than 1000 ky rather than 200 ky.

Mots-Clés : Toarcian OAE, Mass accumulation rate, cyclostratigraphy