

Prolonged anoxia across the Toarcian Oceanic Anoxic Event (T-OAE) within the European Epicontinental Seaway

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The Early Jurassic Toarcian Oceanic Anoxic Event or T-OAE (~183 Ma) represents an episode of severe environmental change that was associated with elevated marine extinction rates, disruptions to the carbon cycle, and marine deoxygenation. The stratigraphic interval assigned to the T-OAE, was originally identified using the occurrence of organic-rich marine and lacustrine strata globally. However, these strata are known to be deposited under a variety of water column redox conditions. Therefore, the precise geographic and temporal extent of marine anoxia related to the T-OAE, remains an open question. Here, we present a large iron speciation dataset that presents new and published data from nine localities within the European Epicontinental Seaway (EES) that represent some of the most extensively studied Toarcian successions containing organic-rich strata. These data suggest water column anoxia in this region developed well before, and persisted well after, the intervals commonly attributed to the T-OAE. However, euxinic conditions (sulfide-rich water columns) were more common in the stratigraphic interval traditionally attributed to the event. Local factors that controlled primary productivity and the supply of oxygen, iron, and sulfate likely affected where and when anoxia and euxinia developed within the EES. However, our data when combined with other global and local redox proxy data, suggest that global climatic changes were an overriding control on the conditions that promoted the widespread deoxygenation and the development of anoxia on a global scale across much of the Toarcian.