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Jurassic palaeoenvironmental change and the broader context of the Toarcian Oceanic Anoxic Event

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Of Jurassic palaeoenvironmental change events, the Toarcian Oceanic Anoxic Event (T-OAE) stands out as being potentially the premier 'supergreenhouse' episode. In addition to clear carbon-isotope signatures, a range of other isotopic, elemental, sedimentological and palaeontological anomalies have been described by multiple authors over the last three decades. The T-OAE palaeoenvironmental changes clearly affected both marine and non-marine settings. Nevertheless, over recent years there has been continued controversy concerning the magnitude, the areal extent, and the causes of this environmental perturbation, largely as a result of early concentration of research efforts in marine sections from the European domain. Many proxy records of environmental change have now been generated from new locations with a global distribution, and also from more extended stratigraphic intervals. Such studies confirm both the global impact of the T-OAE on a multitude of Earth systems and also the unique magnitude of change represented by the event. On the other hand it is also becoming clear that several other times in the Jurassic are likewise characterised by repeated global carbon-cycle perturbations and associated palaeoenvironmental changes, these greater in magnitude than anything experienced by the planet during the Cenozoic. Of particular significance are a major black shale event at the Sinemurian–Pliensbachian boundary and also another within the Sinemurian. More uncertain are putative 'ice house' interludes in the Late Pliensbachian and during the Aalenian and Bajocian. New high-resolution and stratigraphically extensive elemental and isotopic datasets are now allowing us to place all these events firmly in a chronological context, and to determine relationships to other Earth system events such as LIPs more accurately.