

Shallow-water records of environmental and ecological change at the Toarcian OAE

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Several ancient events are identified as good analogues for modern environmental deterioration (e.g. ocean anoxia, acidification, and warming), one of which is the Toarcian Oceanic Anoxic Event (T-OAE). Not only does the T-OAE have a significant influence on marine communities (e.g., extinctions), it also affects ocean chemistry and the nature of the sedimentary record. Nevertheless, there remains a gap in our knowledge about the shallow-water record of this event. Our research integrates interdisciplinary data from the Dinaric Carbonate Platform and the Moroccan High Atlas Mountains, which have high potential for combining sedimentological, geochemical, and paleontological records of shallow-water environments during the T-OAE.

The Dinaric Carbonate Platform in Slovenia captures an almost continuous shallow-water record of Pliensbachian and Toarcian strata with lithotid biostromes, coral reefs, and a diverse assemblage of carbonate producing fauna. Elemental and sedimentological data indicate a prolonged period of deoxygenation on the platform coincident with large igneous province activity (recorded in mercury concentrations) and the T-OAE. The Moroccan High Atlas Mountains record a thick mixed carbonate-siliciclastic shelf-to-ramp setting with sustained deposition through the Early Jurassic. Several key observations can be made in Morocco: there is no evidence for anoxia; the carbonate factory collapses multiple times; and the reef communities persist across the stage boundary through to the T-OAE with rapid recovery in the middle Toarcian. These data allow us to build a more nuanced understanding of the T-OAE, connect basinal and shallow-water records, and document the collapse and recovery of the shallow-water marine ecosystem.