CARBONATE PLATFORM DEMISE AND RECOVERY AT THE TOARCIAN OCEANIC ANOXIC EVENT: DATA FROM THE ADRIATIC CARBONATE PLATFORM

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ABSTRACT

Oceanic Anoxic Events (OAEs) have been shown to have a strong influence on the deposition of organic-rich (black) shales and the reorganization of carbonate factories throughout geologic time. The Lower Jurassic Toarcian OAE, in particular, was a geologically brief episode associated with globally enhanced organic carbon burial and the loss of approximately 5% of all marine families and 26% of genera. Major pulses of volcanism in the Karoo-Ferrar-Chon Aike Large Igneous Province are coincident with black shale deposition and environmental perturbations during the late Pliensbachian-early Toarcian. As such it is generally accepted as the trigger for both the OAE and the preceding late Pliensbachian-early Toarcian extinction event. Besides seeking to understand the intrinsic link between global tectonics, volcanism, and the biosphere, motivations behind OAE research include: the prolific source rock potential of the black shales deposited during these intervals; the analogue potential of some of these events for the effects of rapid global climate change; and understanding the magnitude of the sequence stratigraphic control that OAEs exert on platform evolution. Despite the broad reaching impacts that OAEs can have on the sedimentary rock record, the bulk of research has focused on their deep-water manifestation. Nevertheless, the sensitivity of neritic carbonates to changes in atmospheric and oceanographic conditions renders carbonate platforms potentially highly detailed archives of these past environmental perturbations.

The sedimentological, stratigraphic, and geochemical signature of the Toarcian OAE on a Bahamian-style carbonate platform of Southern Europe is examined here, specifically the Adriatic Carbonate Platform. New stratigraphic sections correlated to previously published data show that a healthy and diverse metazoan carbonate factory characterized the flat-topped platform prior to the onset of the OAE. Carbon isotopes of marine organic matter and bulk carbonate, as well as trace element data (V, Ni, Mo, Mn, Hg) were used to identify the stratigraphic location of the OAE on the outer platform. A negative carbon isotope excursion of -2.2 ‰ coincides with enrichments in Mo and Fe, and was used to correlate to time equivalent strata in both the inner platform and adjacent basin. The onset of the OAE heralded a carbonate factory collapse on the outer platform that was driven by deoxygenation, eutrophication, and possibly ocean acidification. At the same time, a shallow intrashelf basin developed, while the adjacent deep-water basin accumulated black shales. The cessation of carbonate production throughout the OAE yielded a significant drowning unconformity on the outer platform as sea-level continued to rise, while a thick section of restricted, organic-rich mudstones accumulated on the inner platform under a euxinic regime. Recovery of carbonate production is characterized mainly by calcitic fauna and ooids. By the Middle Jurassic, oolitic sequences prograded into the adjacent basin forming a thick deep-water oolitic fan, and to the inner platform, reestablishing a flat-topped carbonate platform.

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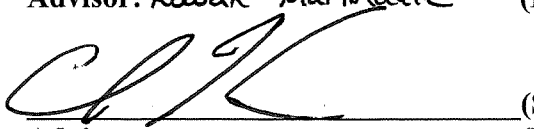

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