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Controls on the termination of OAE2 in the Tarfaya Basin, Morocco

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Black shales deposited during Cretaceous oceanic anoxic event 2 (OAE2, ~94 million years ago) record major perturbations to biogeochemical cycling (e.g., Fe, S and C). The subtropical shelf of the Tarfaya basin, located on the NW margin of Africa, documents anoxic water column conditions before the onset and after the end of OAE2, as indicated by multiple, independent redox proxies. During the *onset*, euxinic conditions dominated but were periodically interrupted by the development of ferruginous episodes linked to orbitally-driven changes in weathering inputs of reactive Fe and sulfate. Extensive recycling of phosphorus (P) from the sediments back to water column maintained strongly reducing conditions by promoting primary productivity in the surface waters, which resulted in an enhanced export of organic matter to the sea floor[1].

To understand the controls behind the *termination* of the event, we have performed a high resolution study of the recovery phase, utilising a combination of multiple redox-proxies, carbon isotopes ($\delta^{13}C_{org}$) and phosphorus phase partitioning. Iron-sulphur systematics and high uranium enrichments point to prevailing anoxia during the recovery phase. However, the redox chemistry fluctuated between ferruginous/weakly euxinic and strongly euxinic conditions on short time scales, as indicated by variations in molybdenum enrichments linked to the availability of dissolved sulphide. These dynamics emphasise a high degree of instability during the recovery phase, at least on a local scale. However, global instability during the recovery is also indicated by the occurrence of the Holywell Event, a $\delta^{13}C$ excursion, representing a short-lived episode during which strongly reducing conditions and increased P recycling transiently returned. Towards the end of the recovery phase, however, redox proxies point to the progressive development of less reducing conditions, which is further reflected by a decrease in P recycling. This progressive decrease in the bioavailability of P, which was exacerbated by intervals of extensive P drawdown evident on the Tarfaya shelf, likely drove the global recovery from water column anoxia.

1. Poulton, et al. 2015. *Geology.*