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A dynamic explanation for the origin of the western Mediterranean organic rich layers

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The eastern Mediterranean sapropels are amongst the most intensively investigated phenomena in the palaeoceanographic record , but relatively little has been written regarding the origin of the equivalent of the sapropels in the western Mediterranean, the Organic Rich Layers (ORL's). ORL's are recognised as sediment layers containing enhanced Total Organic Carbon that extend throughout the deep basins of the Western Mediterranean, and are associated with enhanced total barium concentration and a reduced diversity (dysoxic but not anoxic) benthic foraminiferal assemblage. Consequently, it has been suggested that ORL's represent periods of enhanced productivity coupled with reduced deep ventilation, presumably related to increased continental runoff, in close analogy to the sapropels. We demonstrate that despite their superficial similarity, the timing of the deposition of the most recent ORL in the Alboran Sea is different to that of the approximately coincident sapropel, indicating that there are important differences between their modes of formation. We go on to demonstrate, through physical arguments, that a likely explanation for the origin of the Alboran ORLs lies in the response of the Western Mediterranean basin to a strong reduction in surface water density and a shoaling of the interface between intermediate and deep

water during the deglacial period. Furthermore, we provide evidence that deep convection had already slowed by the time of Heinrich Event 1, and explore this event as a potential agent for preconditioning deep convection collapse. Important differences between Heinrich-like and deglacial-like influences are highlighted, giving new insights into the response of the western Mediterranean system to external forcing.