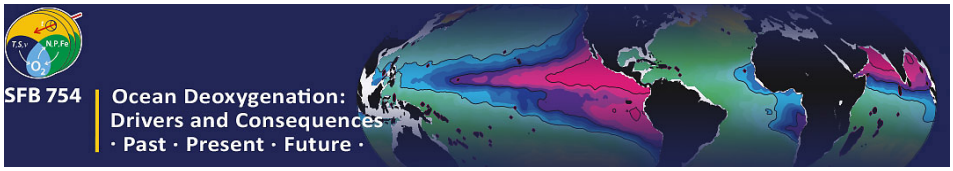

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Unravelling the cause of OAE 1a (~120 Myr), one of the largest ocean deoxygenation events of the last 200 million years

Oceanic Anoxic Event (OAE) 1a took place during the early Aptian (~120 Ma) and represents one of the largest disruptions in ocean oxygenation and biogeochemical cycles of the last 200 million years. So far it has been difficult to constrain the processes and mechanisms that drove this event, hindering a holistic understanding of the relative importance of external forcing and internal feedbacks during this perturbation. For the first time, we study changes in the global carbon cycle at the onset of OAE 1a combining proxy data and a global biogeochemical ocean model of intermediate complexity (cGENIE). In a series of experiments, cGENIE was forced to follow the atmospheric stable carbon isotope (δ13C) evolution obtained from proxy data throughout the onset of OAE 1a using a variety of timescale assumptions and CO2 change scenarios. Depending on the scenario, the model calculates for each experiment the magnitude and δ13C signature of carbon inputs required to reproduce the recorded δ13C excursion. Our results suggest that the majority of the deoxygenation was driven by emissions from sedimentary organic carbon reservoirs and volcanic sources and not biogenic methane. Also low emission scenarios comply with proxy data constraints, highlighting the potentially crucial role of internal feedbacks in the extreme ocean deoxygenation during OAE 1a.

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