

## Carbon pump dynamics and limited organic carbon burial during OAE1a

KOHEN W BAUER<sup>1,2,3</sup>, RYAN MCKENZIE<sup>1</sup>, CINZIA BOTTINI<sup>4</sup>, ELISABETTA ERBA<sup>4</sup> AND SEAN A. CROWE<sup>2</sup>

<sup>1</sup>University of Hong Kong

<sup>2</sup>University of British Columbia

<sup>3</sup>University of Victoria, Ocean Networks Canada

<sup>4</sup>Università degli Studi di Milano

Presenting Author: [kohenbauer@gmail.com](mailto:kohenbauer@gmail.com)

Oceanic Anoxic Events (OAEs) are conspicuous intervals in the geologic record that are associated with the deposition of organic carbon (OC)-rich marine sediment, linked to extreme biogeochemical perturbations, and characterised by widespread ocean deoxygenation. Mechanistic links between marine paleo-productivity, ocean redox conditions, and biogeochemical cycling during OAEs, however, remain poorly constrained. Here, we reconstructed paleo-productivity in the western Tethys Ocean across OAE1a (~120 Mya) using sediment geochemistry and OC mass accumulation rates. We find that OC accumulation rates were between 0.006 and 3.3 gC m<sup>-2</sup> yr<sup>-1</sup>, with a mean value of 0.79 ± 0.78 SD gC m<sup>-2</sup> yr<sup>-1</sup>—rates that are low and comparable to nutrient starved regions in the modern oceans. Numerical modelling of the marine biological carbon pump (BCP) reveals that such OC fluxes are only possible with either or both low to moderate OC export fluxes from ocean surface waters, with rates similar to oligotrophic and mesotrophic regions in the modern ocean, and stronger than modern vertical OC attenuation. The low OC fluxes thus reflect a relatively weak BCP. Low to moderate productivity is further supported by a combination of palaeoecological and geochemical evidence that imply nutrient limited ocean conditions. Without persistently high productivity, ocean deoxygenation across OAE1a was likely driven by other physicochemical and biological factors. Collectively, our reconstructions challenge longstanding assumptions that OC burial during OAE1a resulted from either high productivity (the “productivity” hypothesis) or a strong BCP (the “preservation” hypothesis).