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Quantitative reconstruction of past seawater oxygen concentrations (OxyQuant)

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Their sheer size and tight coupling to the atmosphere render the oceans a pivotal climate regulator. Their interaction with climate is associated with physical processes on the one hand, such as ocean circulation redistributing heat, freshwater, and carbon around the globe. On the other hand, biogeochemical processes ultimately control the strength of the biological carbon pump, and by inference the storage of remineralised carbon in the ocean interior.

Seawater oxygen concentrations are intimately linked to both types of processes and are thus a crucial parameter for assessing the state of the oceans today and in the past. While paleoceanography offers a unique opportunity to observe the state and behaviour of the oceans under different boundary conditions, the quantitative reconstruction of past bottom water oxygen concentrations (BWO) remains a major challenge.

Here we present the project OxyQuant, within which we aim to develop and calibrate an innovative proxy toolkit to reliably reconstruct past BWO. The proxies we focus on are based on redox-sensitive metals in sediments, on iodine associated with sedimentary organic matter, and on the stable isotope composition of the oxygen-sensitive rare earth element cerium. For their calibrations we rely on a global suite of 25 sediment cores from diverse geochemical environments. We outline the project and invite the community to use these calibration sediments for collaborations on further proxy developments, in particular those related to BWO or biological productivity.