

Reconstructing phosphorus and carbon cycling during Cretaceous oceanic anoxic events: Why we need modern analogues

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Variations in marine phosphorus (P) cycling are known to strongly affect the marine carbon and oxygen cycles on geological time scales. For the Cretaceous, such changes are now well-documented for oceanic anoxic event 2 (OAE 2). In this talk, we will summarize recent modeling work suggesting that the event was triggered by an increased input of P to a sluggish, anoxia-prone ocean. Enhanced regeneration of P relative to carbon and N₂ fixation from the atmosphere likely provided the nutrients to sustain the event. The massive burial of organic carbon on the sea floor in turn affected atmospheric pO₂ and pCO₂, providing feedback mechanisms to terminate the OAE.

Further reconstructions of nutrient cycling for OAEs based on the geological record are hampered by post-depositional and post-sampling alterations in sediment chemistry. For example, hydroxyapatite from fish bones and scales will gradually convert to francolite during long-term burial, thus making it impossible to distinguish between biogenic and authigenic Ca-P forms. Pyrite oxidation in sediments sampled or stored open to the air, as is commonly done in the Integrated Ocean Drilling Programme (IODP), often dramatically affects sediment P speciation. As a consequence, studies of modern analogues for black shales are indispensable for a correct reconstruction of nutrient and carbon dynamics in the ocean during periods of anoxia. As an example, we demonstrate what can be learnt from a quantitative reconstruction of the formation and post-depositional oxidation of the most recent sapropel (S1) in the Mediterranean Sea using a reactive transport model.

Application of chromium and lead concentration changes to relative dating of floodplain deposits: Laboratory and field experiments

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The reason for undertaking the research was functioning of weaving industry in the Odra river valley, in period between the XVIth and the XIXth century, using Cr and Pb compounds in paints during process of dyeing textures and great variability of Cr concentrations in alluvial deposits [1].

Results of laboratory experiments of Cr and Pb vertical and horizontal migration has shown that studied chemical elements can be used to estimate the relative age of alluvial deposits. The highest concentrations (Cr: 550 mg kg⁻¹; Pb: 380 mg kg⁻¹) occurred in the surface layer of alluvial deposits placed in the column (fig.1). In the remaining part of the column, much lower Cr and Pb contents were noted (5-25 mg kg⁻¹).

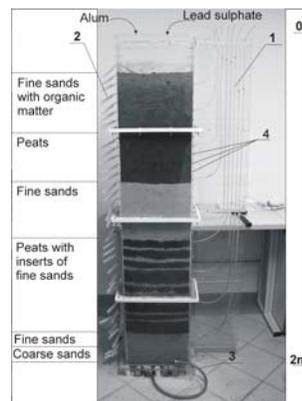


Figure 1. The column filled with alluvial deposits. 1–piezometers, 2–syringes for collecting water samples, 3–a tap for letting the water out, 4–holes for collecting sediment samples.

To verify laboratory results, field experiments were done using pipes tapped into floodplain deposits and then supplied with Cr and Pb compounds. The results has shown that trivalent Cr has, in comparison with Pb and hexavalent Cr, lower ability to migrate vertically in floodplain deposits.

[1] Młynarczyk *et al.* (2006) *Env. Geol.* **50** 423-429