

## Artificially induced migration of redox layers in Adriatic sediment

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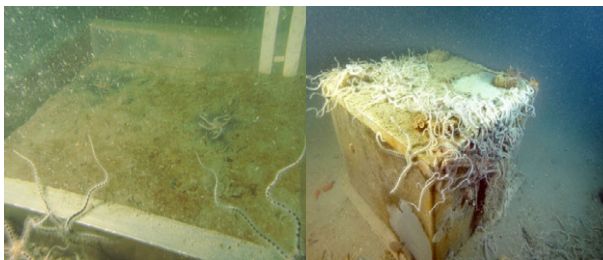
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Long term experimental studies suggests that, under anoxic transient conditions, redox fronts within the sediment shift upwards causing sequential rise and fall of benthic fluxes of reduced species (Mn(II), Fe(II) than S(-II)) (e.g; Kristiansen *et al.*, 2002). In order to study such processes in a more realistic system, benthic chambers were deployed on the seafloor of the Northern Adriatic and sampled after 9, 30 and 315 days of incubation. High resolution porewater profiles were sampled by DET probes and redox sensitive species were analysed (Alk, SO<sub>4</sub><sup>2-</sup>, Mn<sup>2+</sup>, Fe<sup>2+</sup>).

Results show that anoxia was reached after 7 days. Mn and Fe started diffusing towards the water column giving a rusty color to the seafloor. Infaunal species appeared at the surface. After 20 days (fig. 1), all macro-organisms were dead. Porewater chemistry showed expected redox shifts. However, bottom water chemistry followed a peculiar evolution: after 1 month, sulfide had a higher concentration in the overlying water than in the porewater leading to a diffusional flux into the sediment. The source of sulfide was attributed to the decomposition of dead macroorganisms laying on the seafloor. Our results suggest that the sulfide rise in the water column in coastal waters is strongly controlled by the biomass of benthic macrofauna and can be decoupled from sedimentary geochemical processes.



**Figure 1:** left: chamber after 20 days of incubation; right: chamber after 10 months of incubation.

## Lateral carbon isotope homogeneity in a Late Ordovician epeiric sea

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Carbon isotope ratios of marine carbonate rocks ( $\delta^{13}\text{C}_{\text{carb}}$ ) can be used to correlate coeval ancient strata. Detailed correlation requires that the carbon isotopes of the carbon source, the oceanic dissolved inorganic carbon pool ( $\delta^{13}\text{C}_{\text{DIC}}$ ), be homogenous on the mixing time of the ocean, (~1,000 years). Previous reports have suggested that apparent large ( $\geq 1.5\text{‰}$ ) offsets in  $\delta^{13}\text{C}_{\text{carb}}$  observed for Late Ordovician carbonate strata of North America are the result of large scale (i.e., 100s-1000s km) lateral gradients in the isotopic composition of DIC in the surface ocean (e.g., from the open Iapetus Ocean to shallow Laurentian epeiric seas [1,2]. An alternative interpretation is that apparent offsets in  $\delta^{13}\text{C}_{\text{carb}}$  are in large part the result of the differential admixture of secondary carbon incorporated into the rocks resulting in variable and lower  $\delta^{13}\text{C}_{\text{carb}}$  values in diagenetically altered locations [3].

Here, we present Late Ordovician  $\delta^{13}\text{C}_{\text{carb}}$  data covering >1,400 km and spanning multiple depositional environments, from shallow cratonic sea to deeper foreland basins. Multiple transects through the same interval across the study area reveal no systematic  $\delta^{13}\text{C}_{\text{carb}}$  gradients (maximum offsets between any coeval strata are ~0.6‰). Detailed sampling has identified discrete stratigraphic intervals with characteristic  $\delta^{13}\text{C}_{\text{carb}}$  values resolvable at sub-permil levels. The work discusses the stratigraphic as well as biogeochemical implications of these findings.

[1] Holmden *et al.* (1998) *Geology* **26**, 567-570. [2] Panchuck *et al.* (2006) *J. Sed. Research* **76**, 200-211. [3] Metzger and Fike (2013) *Sedimentology* **in press**; doi: 10.1111/sed.12033.