Benthic remineralization in the northeast European continental margin (northern Bay of Biscay)

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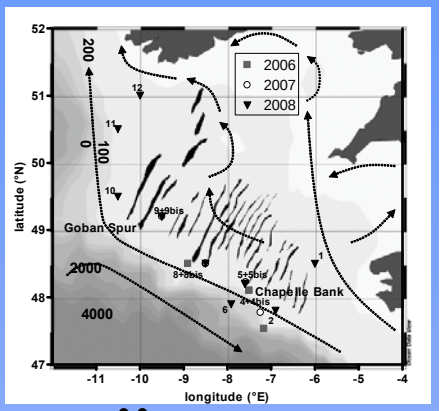
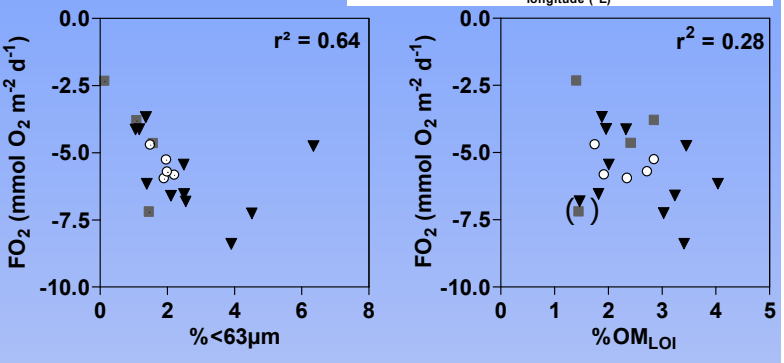
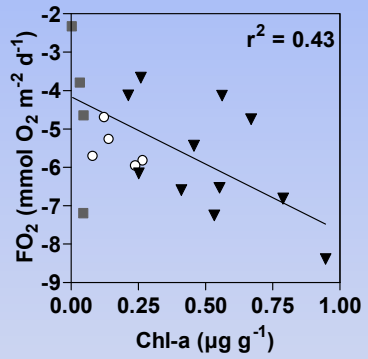


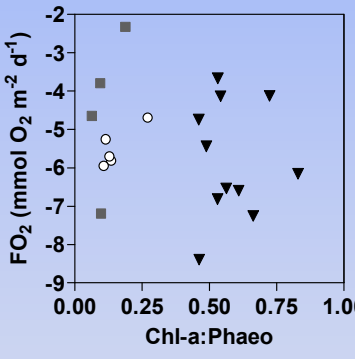
Sediment characteristics and biogeochemical fluxes at the water-sediment interface at the northeast European continental margin (northern Bay of Biscay) were investigated in June 2006, May 2007 and 2008, at 18 stations on the shelf break (120 to 180 m), and at 2 stations on the continental slope (520 m and 680 m). Water-sediment O_2 fluxes (-2.4 to -8.4 mmol O_2 m^{-2} d^{-1}) were low compared to other coastal environments, such as continental shelves and estuaries (-11.0 to -210.0 mmol O_2 m^{-2} d^{-1}). The relationships between water-sediment O_2 fluxes and the grain size content < 63 µm and Chl-a content of the top 1 cm of the sediments , as well as percent organic carbon (% OM_{LOI}) indicate that benthic organic carbon degradation rates were a direct function of the availability of organic matter. However, organic carbon degradation processes did not show a preference towards "fresher" phytoplanktonic OM as indicated by the lack of relationship between water-sediment O_2 fluxes and the Chlorophyll-a : phaeopigments (Chl-a:Phaeo) ratios.

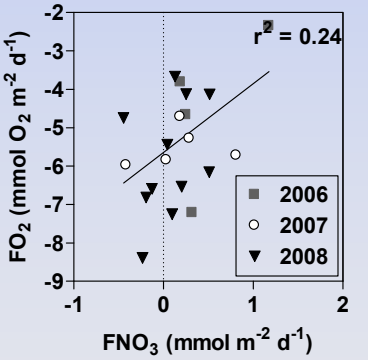
The correlation between water-sediment fluxes of O_2 and NO_3^- (FNO_3^-) indicated a close coupling of nitrification/denitrification and total benthic organic carbon degradation. The link between water-sediment fluxes of total alkalinity (FTA*) and O_2 indicated metabolic driven dissolution of calcium carbonates ($CaCO_3$) in the sediments (~ 0.33 ± 0.47 mmol m^{-2} d^{-1}) which represented ~ 1 % of the pelagic calcification rates due to coccolithophores measured during the cruises. These $CaCO_3$ dissolution rates were below those reported in sediments of continental slopes and of the deep ocean, probably due to the high over-saturation with respect to $CaCO_3$ of the water column overlying the continental shelf sediments of the northern Bay of Biscay.

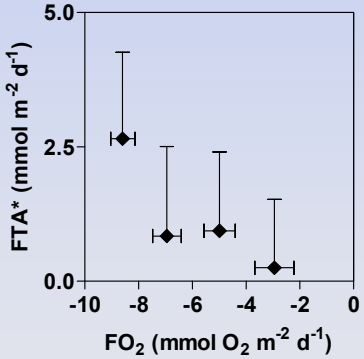
The overall average during the 3 cruises of benthic respiration was ~ -5.5 ± 1.5 mmol O_2 m^{-2} d^{-1} which represents ~ 8 % of the pelagic primary production measured during the cruises (70 ± 44 mmolC m^{-2} d^{-1}). The overall average of benthic respiration represents ~ 4 % of the pelagic respiration in the aphotic zone measured during the cruises (137 ± 60 mmolC m^{-2} d^{-1}). Rates of $CaCO_3$ dissolution averaged for the three cruises (~ 0.33 ± 0.47 mmol m^{-2} d^{-1}) represents ~ 1 % of the pelagic calcification rates due to coccolithophores measured during the cruises (~34 ± 32 mmol m^{-2} d^{-1}). This implies a decoupling of calcification by coccolithophores and the dissolution in the sediments of $CaCO_3$. Hence, PIC produced by coccolithophores is either stored in the sediments or exported out of the system, but does not seem to be significantly dissolved in the sediments.

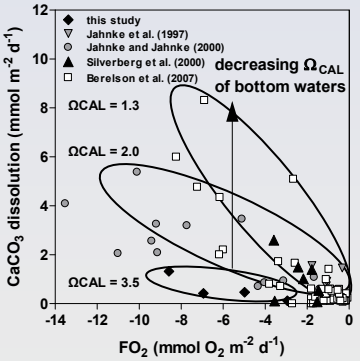












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