Transformation of organic matter in Arctic ocean sediments across the redox interface

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Arctic continental shelves are a key focus for process-based marine sedimentary diagenetic studies, as a result of high primary productivity, strong benthic-pelagic coupling and the importance of benthic organisms for carbon burial and recycling. Ocean biogeochemistry is anticipated to change in the Arctic Barents Sea as sea ice losses and increased incursion of Atlantic-sourced water masses ('Atlantification') proceed [1]. As such, it is vital to understand the processes of early diagenesis which take place at and below the seafloor [2]. This study provides molecular organic, bulk inorganic and microbial (DNA-based) measures of sedimentary diagenesis across a successional redox profile in a sediment core from the north western Barents Sea. Directly beneath the sediment-water interface, marked changes in the reactivity of organic matter (evidenced by TOC, *n*-alkane, *n*-alkanol chain length, sterol ratios) are consistent with high abundances of aerobic bacteria and archaea. An age-depth model based on benthic foraminifera provides evidence that the core comprises deposits since ~5000 cal. yr BP. Below the upper oxic zone where carbon is processed more rapidly, microbes continue to transform the organic matter. This is evidenced by a succession of microbes involved in nitrate/nitrite, iron/manganese and sulfate reduction with depth. Additionally, a layer of pinkish clays likely sourced from Svalbard and high in Fe content influence the redox profile at this location. Understanding these successional changes in the reactivity of carbon and associated microbial processes is vital to help understand how future changes in ocean biogeochemistry and sea-ice extent might affect the quantity and quality of organic matter permanently buried at the ocean seafloor.

[1] Lind et al. (2018) Nat. Clim. Change 8, 634-639. [2] Stevenson & Abbott (2019) JAAP 140, 102-111.