Corrected ^{210}Pb based estimations of sediment accumulation rates in a marine area contaminated by legacy oil derived NORM discharges

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In recent years, the lead-210 (^{210}Pb) geochronological tool has been extensively applied to help determine the accumulation and burial rates of Blue Carbon in various marine environments via the radiometric analysis of sediment cores. Numerous physical disturbances, originating from both anthropogenic and natural sources, can influence the results obtained using this tool.

Additionally, the presence of NORM derived ^{210}Pb and radium-226 (^{226}Ra) can present another challenge if sediment cores are collected in areas that have been or are affected by NORM industrial activities. More worryingly, heavy metals associated with NORM discharges can severely impact the direct measurement of ^{210}Pb via gamma spectrometry, subsequently affecting ^{210}Pb-based estimations of sediment accumulation rates (SARs).

In this study, several sediment cores were collected in proximity to a decommissioned oil and gas platform located offshore in the UK North Sea (North West Hutton (NWH), 61.11N, 1.31E). Elemental and radioelemental signatures from legacy NORM discharges were observed in the sediment cores collected within 200 m North and South of the former NWH platform and were thoroughly characterised using ICP-MS and gamma spectrometry, respectively. This enabled the forensic differentiation of the NORM-derived ^{226}Ra fraction from the natural background and the generation of relative factors based on bulk elemental composition analysis to correct ^{210}Pb results obtained from initial gamma spectrometric analysis. This corrective approach was validated by measuring polonium-210, a decay product of ^{210}Pb, via alpha spectrometry, and allowed the estimation for the first time of Blue carbon accumulation and burial rates in sediment cores using different modelling ^{210}Pb modelling approaches (CIC, CFCS, CRS, and rplum).