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Redox-sensitive Element Uptake at the North-East Atlantic Benthic Boundary Layer Experiment Sites

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At two of the three Benthic Boundary Layer Experiment sites in the north-east Atlantic, regularly-increasing radiocarbon age/depth profiles demonstrate that sediment accumulation has been relatively constant during the late Holocene, at rates of 4.4 $cm.ky^{-1}$ (3.1 $g.cm^{-2}.ky^{-1}$) at site B on Rockall Bank and 6.5 $cm.ky^{-1}$ (4.4 $g.cm^{-2}.ky^{-1}$) at site C on Feni Drift. The composition of the sediments is near-constant with depth at both sites, although they are quite distinct from each other (mean $CaCO_3$ = 79.6% at site B and 54.0% at site C) as a result of contrasting particle size spectra. Under these two different but quasi steady-state depositional regimes, the geochemical behaviour of the redox-sensitive elements Cd, Mn, Mo, Re, Se and U in response to early diagenesis is readily discerned through down-core changes in elemental concentrations. Collectively, a colour change in the sediments, surficial MnOx enriched layers and ^{210}Pb excess profiles allow an estimate of the mean position of the oxic/post-oxic boundary in the sediments at both sites. This boundary is situated deeper than the ^{210}Pbexcess surface mixed layer and shallower than the ^{14}C surface mixed layer which represent mixing on 102- and 103-year time scales, respectively. This implies that the well-defined surface MnOx enrichment and its associated ^{226}Ra and Mo fractions must have been efficiently recycled by downwards bioturbative mixing into anoxic conditions, subsequent reduction and diffusive migration back up into oxic conditions. This process must have last occurred in <40 years at site C and in <103 years at site B. Authigenic enrichment of Se, Cd and U begins to increase immediately below the oxic/post-oxic boundary, although Re enrichment does not occur until a few cm deeper. The mean authigenic uptake enrichments of Se, Cd, U and Re are 0.15, >0.35, 0.4 and >0.0034 $\mu g.^{g-1}$ at site B and 0.75, >0.27, 0.98 and >0.0051 $\mu g.^{g-1}$ at site C.