Dynamics of ectoenzymatic activity in the deep water masses of the northeast Atlantic Ocean

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Ectoenzymatic activity is a critical step in the degradation of polymeric dissolved organic matter by prokaryotes. Most previous studies have focused on the epipelagic zone and only scarce information is available on ectoenzymatic activities of meso- or bathypelagic waters. We determined the distribution of α-glucosidase (AGase) β-glucosidase (BGase), leucine aminopeptidase (LAPase) and alkaline-phosphatase (APase) activities in the water column (100-4500 m depth) along two meridional sections (21.08ºN-4.91ºS) in the NE Atlantic Ocean. AGase and BGase activities ranged from 0-0.247 and 0-0.304 nmol L^{-1} h^{-1}, respectively, with higher lateral than vertical variability in the water column. LAPase and APase activities were generally higher (0-14.9 and 0-3.69 nmol L^{-1} h^{-1}, respectively) than AGase and Bgase particularly in the 100 m depth horizon decreasing, however, with depth in a more pronounced way that AGase and BGase. The decreasing ratio LAPase:BGase with depth reflects the increasing relative contribution of polysaccharides in DOM with depth. The Vmax for APase LAPase decreased with depth and was positively related to the amount of expressed APase and LAPase and with prokaryotic heterotrophic production (PHP; $r = 0.67$, $p < 0.00001$) and the microbial respiratory activity of the Electron Transport System (ETS; $r = 0.47$, $p < 0.00001$). Surprisingly, deep water APase activity was not inversely related to phosphate concentrations as one would expect, but rather to dissolved organic carbon ($r = 0.33$, $p < 0.001$), dissolved organic phosphate ($r = 0.25$, $p < 0.013$) and prokaryotic production ($r = 0.41$, $p < 0.00001$). Deep water bacterioplankton APase activity might therefore be a means to cleave carbon moieties of the DOM as generally, the availability of organic carbon is assumed to be limiting bacterial growth in the deep ocean.

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