Prokaryotic respiration and production in the meso- and bathypelagic realm of the eastern and western North Atlantic basin

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ABSTRACT: We measured prokaryotic production and respiration in the major water masses of the North Atlantic down to a depth of ~4,000 m by following the progression of the two branches of North Atlantic Deep Water (NADW) in the oceanic conveyor belt. Prokaryotic abundance decreased exponentially with depth from 3 to 0.4 x 10^5 cells mL^{-1} in the eastern basin and from 3.6 to 0.3 x 10^5 cells mL^{-1} in the western basin. Prokaryotic production measured via ^{3}H-leucine incorporation showed a similar pattern to that of prokaryotic abundance and decreased with depth from 9.2 to 1.1 µmol C m^{-3} d^{-1} in the eastern and from 20.6 to 1.2 µmol C m^{-3} d^{-1} in the western basin. Prokaryotic respiration, measured via oxygen consumption, ranged from about 300 to 60 µmol C m^{-3} d^{-1} from ~100 m depth to the NADW. Prokaryotic growth efficiencies of ~2% in the deep waters (depth range 1,200-4,000 m) indicate that the prokaryotic carbon demand exceeds dissolved organic matter input and surface primary production by 2 orders of magnitude. Cell-specific prokaryotic production was rather constant throughout the water column, ranging from 15 to 32 x 10^{-3} fmol C $cell^{-1}$ d^{-1} in the eastern and from 35 to 58 x 10^{-3} fmol C $cell^{-1}$ d^{-1} in the western basin. Along with increasing cell-specific respiration towards the deep water masses and the relatively short turnover time of the prokaryotic community in the dark ocean (34-54 d), prokaryotic activity in the meso- and bathypelagic North Atlantic might be higher than previously assumed.