Microbial degradation of peptidoglycan in seawater

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ABSTRACT: A constituent of the bacterial cell wall, peptidoglycan, has been suggested to be a significant fraction of marine dissolved organic matter, but little is known about its turnover. We measured hydrolysis and remineralization rates of peptidoglycan in surface waters by using radiolabeled peptidoglycan that was extracted from a Gram-negative bacterium. Polysaccharide (N-acetyl-glucosamine and N-acetyl-muramic acids) and peptide (D-glutamate) components of peptidoglycan were specifically radiolabeled. Purity of the preparations and specificity of labeling were ascertained by high-performance liquid chromatography. First-order kinetic constants of peptidoglycan remineralization were 2-21 times lower than those of proteins. The turnover time of peptidoglycan was estimated to be 10-167 d, indicating its semilabile nature. The two main components of peptidoglycan are degraded differently; the remineralization rate of the peptide component was three times greater than that of the polysaccharide moiety. Chemically modified, low-molecular-weight material was produced during the degradation of the polysaccharide component, but not during degradation of protein. These results indicate that peptidoglycan is less degradable than proteins in marine environments and are consistent with observations that D/L-isomer ratios of amino acids increase during early diagenesis.

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