The Acidifying Ocean's Effect on Protease Activity in Alteromonas

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The breakdown of carbon from complex organic polymers to abiotic carbon populations is a known function of metabolic pathways in oceanic decomposer microorganisms, such as the dominant proteolytic catabolism of eubacteria Alteromonas. The efficiency of this extracellular process depends on the external environment; falling ocean pH driven by anthropogenic carbon pollution and climate change may now endanger microdecomposer protein catabolism that helps stabilize the oceanic carbon cycle. The purpose of this experiment was to employ innovative spectrophotometric techniques to determine if acidified environments impacted growth or proteolytic activity of Alteromonas. It was hypothesized that Alteromonas grown in an acidic environment would have slower growth and lower proteolytic activity than samples grown in an environment at or above natural ocean pH. To analyze bacterial growth, a spectrophotometric plate reader measured kinetic optical density in a series of pH-adjusted marine environments containing Alteromonas inocula. To measure the activity of bacterial proteolytic catabolism, fluorescent proteolysis assay was conducted on Alteromonas samples in pH-adjusted environments exposed to fluorophore-tagged casein BODIPY. Consistent Alteromonas growth (.099+/–.002^h-1) was observed across an extensive pH range of 6.4-8.0, and proteolytic activity surged in the most acidic environments (5.6-6.8) tested. Thus, the hypothesis was not supported. However, the results analyzed imply that strong Alteromonas growth in generally lethal acidity (6.4) is supported by pH-insensitive proteases designed to capitalize on denatured substrates in acidic environments, suggesting that acidifying oceans will minimally impact this marine decomposer’s role in the global carbon cycle.