Ocean Acidification: Net Ecosystem Calcification Response to an Elevated pCO_2 Level

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We certify that we have read this thesis and that, in our opinion, it is satisfactory in scope and quality as a thesis for the degree of Bachelor of Science in Global Environmental Science.

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Abstract

Ocean acidification is the lowering of seawater pH due to increased pCO_2 levels in the atmosphere brought about by human activities of fossil fuel burning and deforestation. As of 2005 atmospheric pCO_2 levels had reached 380 ppm (IPCC, 2007), the highest level for the last 640,000 years (Petit et al.,1999; Barnola et al.,2003, Siegenthaler et al., 2005, IPCC, 2007). The increase in pCO_2 in the atmosphere is an immediate concern because of its direct relationship with ocean chemistry. The change in ocean chemistry due to the addition of CO_2 lowers both the pH and saturation state of seawater with respect to different $CaCO_3$ minerals (Andersson et al., 2003, Morse et al., 2006). Calcification rates decrease as the saturation state of seawater with respect to $CaCO_3$ decreases, hence producing weaker skeletons for calcareous organisms. The weaker coralline structures lead to greater vulnerability to physical and biological erosion.

A diurnal study of the effects of increased pCO_2 levels in the atmosphere on calcification rates of corals was done using a flow through mesocosm in which the coral *Montipora capitata* was grown. The experiment quantitatively compared the calcification rates of corals in tanks with an elevated CO_2 level of 700 ppm (projected atmospheric CO_2 level by the year 2100) to those of tanks with ambient CO_2 levels (380 ppm). Net ecosystem calcification (NEC) rates were calculated using total alkalinity (TA) and pH measurements of water flowing in and out of the tanks. The results of this experiment showed that an elevated CO_2 level of ~700 ppm induced a significant reduction in net calcification rates compared to NEC in the tanks with

ambient CO_2 levels. The calculations of NEC showed average net dissolution rates over a diurnal cycle for tanks with elevated CO_2 levels.

Table of Contents

List of Table and Figures