

Ocean Acidification: Net Ecosystem Calcification Response to an Elevated pCO₂ Level

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Abstract

Ocean acidification is the lowering of seawater pH due to increased pCO₂ levels in the atmosphere brought about by human activities of fossil fuel burning and deforestation. As of 2005 atmospheric pCO₂ 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 pCO₂ 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 CO₂ lowers both the pH and saturation state of seawater with respect to different CaCO₃ minerals (Andersson et al., 2003, Morse et al., 2006). Calcification rates decrease as the saturation state of seawater with respect to CaCO₃ 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 pCO₂ 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 CO₂ level of 700 ppm (projected atmospheric CO₂ level by the year 2100) to those of tanks with ambient CO₂ 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 CO₂ level of ~700 ppm induced a significant reduction in net calcification rates compared to NEC in the tanks with

ambient CO₂ levels. The calculations of NEC showed average net dissolution rates over a diurnal cycle for tanks with elevated CO₂ levels.

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