Geophysical Research Abstracts, Vol. 8, 08541, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08541

CO_3^{2-} concentration and pCO_2 thresholds for calcification and dissolution on the Molokai reef flat, Hawaii

K. Yates and R. Halley

U.S. Geological Survey, Center for Coastal and Watershed Studies, 600 Fourth Street South, St. Petersburg, FL 33701 (kyates@usgs.gov / Phone: 727-803-8747)

The severity of the impact of elevated atmospheric pCO_2 to coral reef ecosystems depends, in part, on how seawater pCO_2 affects the balance between calcification and dissolution of carbonate sediments. Presently, there are insufficient published data that relate concentrations of pCO_2 and CO_3^{2-} to in situ rates of reef calcification in natural settings to accurately predict the impact of elevated atmospheric pCO_2 on calcification and dissolution processes. Rates of net calcification and dissolution, CO_3^{2-} concentrations, and pCO_2 were measured, in situ, on patch reefs, bare sand, and coral rubble on the Molokai reef flat in Hawaii. Rates of calcification ranged from 0.003 to 0.23 g $CaCO_3$ m^{-2} h^{-1} and dissolution ranged from -0.005 to -0.33 g $CaCO_3$ m^{-2} h^{-1}. Calcification and dissolution varied diurnally with net calcification primarily occurring during the day and net dissolution occurring at night. These data were used to calculate threshold values for pCO_2 and CO_3^{2-} at which rates of calcification and dissolution are equivalent. Results indicate that calcification and dissolution are linearly correlated with both CO_3^{2-} and pCO_2. Threshold pCO_2 and CO_3^{2-} values for individual substrate types showed considerable variation. The average pCO_2 threshold value for all substrate types was 654 $\pm$ 195 μatm and ranged from 467 to 1003 μatm. The average CO_3^{2-} threshold value was 152 $\pm$ 24 μmol kg^{-1}, ranging from 113 to 184 μmol kg^{-1}. Ambient seawater measurements of $pCO_2$and CO_3^{2-} indicate that CO_3^{2-} and pCO_2threshold values for all substrate types were both exceeded, simultaneously, 13% of the time at present day atmospheric pCO_2concentrations. It is predicted that atmospheric pCO_2will exceed the average pCO_2threshold value for calcification and dissolution on the Molokai reef flat by the year 2100.