Coral reefs may start dissolving when atmospheric CO2 doubles

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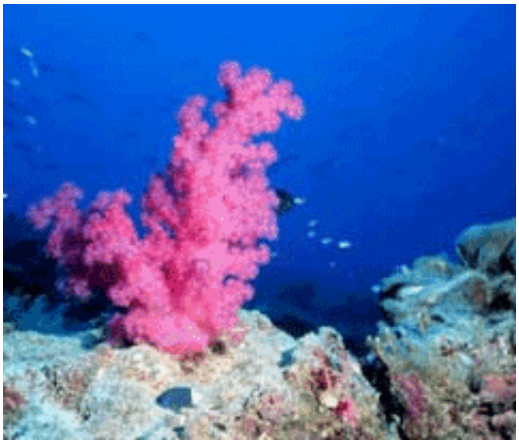

Rising carbon dioxide in the atmosphere and the resulting effects on ocean water are making it increasingly difficult for coral reefs to grow, say scientists. A study to be published online March 13, 2009 in *Geophysical Research Letters* by researchers at the Carnegie Institution and the Hebrew University of Jerusalem warns that if carbon dioxide reaches double pre-industrial levels, coral reefs can be expected to not just stop growing, but also to begin dissolving all over the world.

The impact on reefs is a consequence of both ocean acidification caused by the absorption of carbon dioxide into seawater and rising water temperatures. Previous studies have shown that rising carbon dioxide

will slow coral growth, but this is the first study to show that coral reefs can be expected to start dissolving just about everywhere in just a few decades, unless carbon dioxide emissions are cut deeply and soon.

"Globally, each second, we dump over 1000 tons of carbon dioxide into the atmosphere and, each second, about 300 tons of that carbon dioxide is going into the oceans," said co-author Ken Caldeira of the Carnegie Institution's Department of Global Ecology, testifying to the U.S. House of Representatives Subcommittee on Insular Affairs, Oceans and Wildlife of the Committee on Natural Resources on February 25, 2009. "We can say with a high degree of certainty that all of this CO_2 will make the oceans more acidic - that is simple chemistry taught to freshman college students."

The study was designed determine the impact of this acidification on coral reefs. The research team, consisting of Jacob Silverman, Caldeira, and Long Cao of the Carnegie Institution as well as Boaz Lazar and Jonathan Erez from The Hebrew University of Jerusalem, used field data from coral reefs to determine the effects of temperature and water chemistry on coral calcification rates. Armed with this information, they plugged the data into a computer model that calculated global seawater temperature and chemistry at different atmospheric levels of CO2 ranging from the pre-industrial value of 280 ppm (parts per million) to 750 ppm. The current atmospheric concentration is over 380 ppm, and is rapidly rising due to human-caused emissions, primarily through the burning of fossil fuels.

Based on the model results for more than 9,000 reef locations, the researchers determined that at the highest concentration studied, 750 ppm, acidification of seawater would reduce calcification rates of three quarters of the world's reefs to less than 20% of pre-industrial rates. Field studies suggest that at such low rates, coral growth would not be able to keep up with dissolution and other natural as well as manmade

destructive processes attacking reefs.

Prospects for reefs are even gloomier when the effects of coral bleaching are included in the model. Coral bleaching refers to the loss of symbiotic algae that are essential for healthy growth of coral colonies. Bleaching is already a widespread problem, and high temperatures are among the factors known to promote bleaching. According to their model the researchers calculated that under present conditions 30% of reefs have already undergone bleaching and that at CO2 levels of 560 ppm (twice pre-industrial levels) the combined effects of acidification and bleaching will reduce the calcification rates of all the world's reefs by 80% or more. This lowered calcification rate will render all reefs vulnerable to dissolution, without even considering other threats to reefs, such as pollution.

"Our fossil-fueled lifestyle is killing off coral reefs," says Caldeira. "If we don't change our ways soon, in the next few decades we will destroy what took millions of years to create."

"Coral reefs may be the canary in the coal mine," he adds. "Other major pieces of our planet may be similarly threatened because we are using the atmosphere and oceans as dumps for our CO2 pollution. We can save the reefs if we decide to treat our planet with the care it deserves. We need to power our economy with technologies that do not dump carbon dioxide into the atmosphere or oceans."

Source: Carnegie Institution