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Threshold of carbonate saturation state determined by CO2 control experiment

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Acidification of the ocean by increasing anthropogenic CO2 will cause decrease of biogenic calcification and increase of carbonate dissolution. Previous studies suggested that carbonate dissolution occurs at polar region and in deep-sea where saturation state with respect to carbonate minerals is smaller than one, while carbonate in coral reefs distributed in tropical zone doesn't dissolve because saturation state with respect to aragonite, one of the most major carbonates, is larger than one. A few studies recently reported that carbonate actually dissolved in reefs during night-time despite aragonite saturation state > 1. Mg-Calcite dissolves in reefs because it has higher solubility than that of aragonite. However, whether or not these dissolution processes actually occur in natural condition have never examined. In this paper, we measured dissolution rates of Mg-Calcite and aragonite under aragonite saturation state > 1 conditions by pCO2 control. The experimental data suggests that bulk carbonate sediments sampled at Shiraho reef start to dissolve under aragonite saturation state=3.7 and dissolution rates increase with decrease of aragonite saturation state in the laboratory. Mg-Calcite derived from foraminifera and coralline algae dissolved under aragonite saturation state=3.4, on the other hand, aragonite derived from coral started to dissolve under 1.1<aragonite saturation state<1.5.

Keywords: coral, saturation state, dissolution, Mg Calcite