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Interactive comment on "CO_3^{2-} concentration and pCO_2 thresholds for calcification and dissolution on the Molokai reef flat, Hawaii" *by* K. K. Yates and R. B. Halley

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General comments

The paper by Yates and Halley reports on some valuable measurements of carbonate precipitation and dissolution in an enclosure placed over three different types of substrate (10-20% live coral cover, bare sand, coral rubble) on the Molokai reef flat in Hawaii. The partial pressure of CO2 tends to build up over time in the enclosure. The authors have taken advantage of that fact to generate relationships between precipitation/dissolution and pCO2 for each of the substrate types. From these data they have generated some useful statistics on pCO2 level at which dissolution would balance precipitation. This threshold ranged from 467 to 1003 uatm. The average for all

substrate types was 654+/-195 uatm. They also present time series data of carbonate data collected summer (July 20-29, 2001 and June 16-19, 2003) and fall (Oct 13-14, 2000). They find that conditions favorable for dissolution equaling or exceeding precipitation would occur 13% of the time. They suggest that by the year 2100 conditions would be favorable for dissolution>precipitation 100% of the time.

Even under the highest pCO2 conditions encountered in the enclosure the water is greater than 150% supersaturated with respect to aragonite and 220% with respect to calcite. The authors discuss the possibility that this is due to dissolution of high magnesium calcite sediments. They point out that there is considerable disagreement in the literature on the solubility of biogenic high-magnesium calcites. Another possibility is that processes in the pore waters are elevating the pCO2 and lowering the [CO3=] to the point that aragonite and even calcite will dissolve. Another possibility is that bioerosion by endolithic organisms is causing a significant amount of dissolution. The present experiments can not discriminate between these various possibilities.

Specific comments

Page 125 line 3 The citation of papers showing a decrease in coral and coral reef calcification with increasing pCO2 is incomplete. Marubini et al. 2001, 2002 Reynaud et al. 2003 Langdon et al. 2003 Langdon and Atkinson 2005 Ohde and Hossain 2004 Renegar and Riegl 2005

The results presented in Langdon et al. 2000 are relevant to the discussion of the importance of high-magnesium calcite dissolution. The sediments in that experiment were dominated by tests of the red coralline alga Amphiroa which was determined to be 22% Mg-calcite. Table 4 in that paper shows that net system dissolution was only observed when the aragonite saturation state was less than 1.3. The fact that Yates and Halley observe considerable dissolution at aragonite saturation states in the 1.5 to 2.4 range suggests that other processes such as pore water dissolution and bioerosion may be important on the Molokai reef flat.

BGD

3, S14–S16, 2006

Technical corrections

Page 136 line 21 should be 10.3 mM

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