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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

There is now ample experimental evidence that many calcifying organisms, including reef dwellers, and mesocosms are negatively impacted by elevated carbon dioxide. There is, however, little field data supporting this prediction. Retrospective approaches have so far failed to provide evidence that coral calcification has declined in the past 200 years (e.g. Pelejero et al., 2005). Additionally, few studies investigated the response of reef communities to natural changes in the carbonate chemistry. One may find this surprising as high rates of primary production, respiration and calcification in relatively shallow environments generate considerable diurnal changes in the $CaCO_3$

saturation state in some reef settings ($\Omega_{aragonite} \approx$ 2 to 5). This seems ideal to investigate the response of net calcification of natural communities to changes in the carbonate chemistry under unmanipulated conditions.

Yates and Halley (2006) therefore provide a much needed contribution. It is only the second report attempting to fill this gap and investigating the *in situ* response of three reef communities to natural changes in the carbonate chemistry. The first report, which is not cited in Yates and Halley's paper, that of Ohde and van Woesik (1999). Yates and Halley (2006) demonstrate that net calcification strongly depends on sea water saturation state and is lower at low than at high values of $CaCO_3$ saturation. This is in agreement with data collected on isolated organisms and enables the authors to provide, for the first time, much valuable information on the threshold values of $CaCO_3$ (and pCO_2) under (and above) which net community calcification becomes negative, that is when gross calcification becomes smaller than dissolution.

However a possible confounding parameter does not seem to have been considered, and was also not considered by Ohde and van Woesik (1999). On page 138, Yates and Halley (2006) rightly point out that several other ecological and environmental parameters also control calcification but light is not mentioned as one of them. I think that it should because calcification of corals and algae is well known to be strongly light-dependent. Gattuso et al. (1999) compiled literature data on corals and reported a median light:dark calcification ratio of 3.0. Yates and Halley's paper would benefit from a discussion of that issue in order to convince the readership that the thresholds proposed are not confounded by irradiance. It would also be useful to provide the average irradiance during each 4 h period in Table 1.

Specific comments

- The second line of the heading of Table 1 is shifted one cell to the right.
- Salinity has no unit and "psu" should therefore be deleted (see the interactive dis-

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cussion of Schouten et al. (2006; http://www.biogeosciences-discuss.net/2/1681)

- 10-mil should be replaced by 10 mm
- molar units should be used throughout the paper
- "high-mg" should be replaced by "High-Mg"
- there is a typo p. 136 l. 21: 10.3 mM

Literature cited

Gattuso, J.-P., Allemand, D. and Frankignoulle, M.: Photosynthesis and calcification at cellular, organismal and community levels in coral reefs: a review on interactions and control by carbonate chemistry, American Zoologist, 39(1), 160-183, 1999.

Ohde, S. and van Woesik, R.: Carbon dioxide flux and metabolic processes of a coral reef, Okinawa, Bulletin of Marine Science, 65, 559-576, 1999.

Pelejero, C., Calvo, E., McCulloch, M. T., Marshall, J. F., Gagan, M. K., Lough, J. M. and Opdyke, B. N.: Preindustrial to modern interdecadal variability in coral reef pH, Science, 309, 2204-2207, 2005.

Schouten, S., Ossebaar, J., Schreiber, K., Kienhuis, M. V. M., Langer, G. and Bijma, J.: The effect of temperature and salinity on the stable hydrogen isotopic composition of long chain alkenones produced by *Emiliania huxleyi* and *Gephyrocapsa oceanica*, Biogeosciences Discussions, 2, 1681-1695, 2005.

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Yates, K. K. and Halley, R. B.: CO_3^{2-} concentration and pCO_2 thresholds for calcification and dissolution on the Molokai reef flat, Hawaii, Biogeosciences Discussions, 3, 123-154, 2006.

Interactive comment on Biogeosciences Discussions, 3, 123, 2006.