Biogeosciences Discuss., 5, S1342–S1344, 2008
www.biogeosciences-discuss.net/5/S1342/2008/

Biogeosciences
Discussions

Interactive comment on “Mass extinctions past and present: a unifying hypothesis” *by* S. A. Wooldridge

S. Wooldridge

s.wooldridge@aims.gov.au

Received and published: 2 August 2008

I thank J. P. Gattuso for his constructive comments. Upon reflection, it is apparent that I should have been more selective with my wording in regard to the potential for a "dark dissolution" phase in symbiotic reef corals - since my inference most specifically applies to seasonal periods (or specific events) where the respiration rates of corals are significantly elevated. In an excellent series of experiments, Coles and Jokiel (1997) were first to demonstrate that major reductions in the P:R ratio are formally tied to thermal stress in symbiotic reef corals (i.e. bleaching events). More recently, Al Horani (2005) used micro-sensors to demonstrate that this thermal erosion of P:R was (at least in the first instance) driven by a significant increase in respiration. It stands to reason that if the urease hypothesis has merit, it would predict that "dark dissolu-

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

tion" will be most prevalent during the thermal extremes of the summer months. So is there any precedent for this in the field? A quick search of the literature does not deny its likelihood. For example, Conand et al. (1997) report net dissolution during the summer months in the back reef zone of a fringing reef in La Reunion (Indian Ocean); the result being reversed in winter with a return to net carbonate deposition. It would be interesting to know if ocean alkalinity measurements around low-latitude reef areas indicate any significant seasonal signal i.e. raised alkalinity towards the maximal summer temperature period. Care would be needed here however, because in the early stages of summer (i.e. before any thermal stress is potentially triggered) the increased temperature and P:R would actually aid high rates of calcification.

I understand the need for caution and further testing here. The potential for significant CaCO3 dissolution whilst the bulk surface ocean waters remain supersaturated (wrt aragonite and calcite) has considerable implications for future ocean chemistry scenarios in a world with rising atmospheric CO2 levels. Given the current theory and thinking on carbonate dissolution, it has been appropriate for most researchers to adopt the constant-alkalinity model of seawater acidification for decadal-century scale projections (e.g. Caldeira and Wickett 2003, 2005). However, relaxation of this constraint would allow for considerably more carbonate ion buffering, thus reducing the extent of future declines in ocean pH. It is absolutely critical that these issues are resolved. And thus in my opinion, the urease hypothesis deserves the immediate consideration of the scientific community.

References

Al-Horani F. (2005) Effects of changing seawater temperature on photosynthesis and calcification in the scleractinian coral Galaxea fascicularis, measured with O2, Ca2+ and pH microsensors. Sci. Mar. 69, 347-354.

Caldeira K. & Wickett M. E. (2003) Anthropogenic carbon and ocean pH. Nature 425, 365-366

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

Caldeira K. & Wickett M. E. (2003) Ocean model predictions of chemistry changes from carbon dioxide emissions to the atmosphere and ocean. J. Geophys. Res., 110, C09S04

Coles S. L. & Jokiel P. L. (1977) Effects of temperature on photosynthesis and respiration in hermatypic corals. Marine Biology 43, 209-216.

Conand C., Chabanet P., Cuet P., & Letourneur Y. (1997) The carbonate budget of a fringing reef in La Reunion Island: sea urchin and fish bioerosion and net calcification. Proc. 8th Int. Coral Reef Symp. 1, 953-958.

Interactive comment on Biogeosciences Discuss., 5, 2401, 2008.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper