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Biogeosciences Discussions

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

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Coral Bleaching and skeletal dissolution

If indeed coral bleaching events are associated with dissolution of the coral skeletal matrix, then it is reasonable to expect that this will be evidenced by a detectable chemical signal in the surrounding reef waters. Most notably an increase in pH - since the dissolved CaCO3 will be acting as a base. So is there any precedence for this in the field? Indeed, two studies undertaken in Tahiti where in situ pH were measured before, during, and after a minor (Drollet et al. 1993) and major (Drollet et al. 1995) bleaching event confirms this to be true. For example, for the major coral bleaching event, Jacques Drollet writes, "pH remained constant, except in March 1994 when pH increased abruptly (i.e. from 8.18 to 8.33) coincident with the peak of a marked coral

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bleaching event; pH returned to 8.2 after the peak of bleaching".

So what is the significance of this dissolution?

Clearly, it is difficult to argue that the dissolution of the aragonite skeletons of corals @7.9 will be favourable to their survival prospects. However, this shallow water carbonate dissolution does have significant ramification for the future rate of increase in atmospheric pCO2 (and hence greenhouse warming rates). By raising ocean pH, the shallow water dissolution will aid increased sequestration of atmospheric CO2. This increased sequestration will act to slow the rate of CO2 accumulation in the atmosphere. To date, this process is not fully accounted for in the future CO2/warming scenarios (e.g. IPPC scenarios). For example, whilst current opinion suggests that rising atmospheric pCO2 will act to lower the saturation state of the upper ocean, and thus decrease calcification rates (somewhere on the order 15-30% by 2100), it is not predicted that actual dissolution will be triggered until the saturation state falls below 1. It is naïve to suggest that the dissolution of coral reefs (as mediated by such things as bleaching events) can ever be considered a good story. But it does highlight that current pCO2 projections are likely in error (future modelling is required to suggest by just how much). Of course, this line of thinking must also consider the possible mass loss of biological CO2 sequestration @ pH 7.9 (as predicted by the urease hypothesis), which would act as a major pCO2 'spike'. There is much work that the scientific community needs to consider. In all cases, time is not in our favour.

References

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