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Climate of the Past Discussions

Interactive comment on "Pliocene three-dimensional global ocean temperature reconstruction" *by* H. J. Dowsett et al.

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First we want to thank Dr. Williams for his helpful comments and suggestions. We list our responses to most of his comments in order:

Our abstract now provides a better description of the data set we are using. Our use of the word snapshot was meant to infer time, not spatial coverage. The changes suggested by Mark Williams will make for a better and more descriptive abstract of the paper.

We now emphasize the number of sites (27) used in this analysis and agree (as micropalaeontologists) that this does represent a large body of work. In fact, we believe we have more spatial temperature data from the deep ocean, for a focused stratigraphic

interval, than any other published reconstruction.

To the best of our knowledge, there are no direct comparisons of benthic foram based Mg/Ca temperature estimates and Krithe based Mg/Ca estimates. As other proxy methods become available we will be sure to make such a comparison. We do, however, know of three benthic foraminifer Mg/Ca-based bottom water temperature datasets covering our interval at DSDP Site 573 (Lear et al., 2000) and ODP Sites 747 and 757 (Billups and Schrag, 2003). These data fit reasonably well with our reconstruction but are at very low resolution during our interval.

We have revised and expanded our discussion of the temperature reconstruction. It is true that reconstructing the 3-dimensional temperature character of the ocean from 27 localities skewed toward the Atlantic basin is a bit tenuous. On the other hand, running a climate model experiment with "modern" ocean conditions we know to be wrong is of questionable value. We state that our reconstruction is one possible scenario based upon available data. There is no unique solution. Our requirements for trusting one locality estimate versus another have now been explicitly stated in the revision. In the case noted by Mark Williams, data from Site 659 were dismissed because the warmest 10% of the estimates were from a sample size of n = 7. Since we know that bottom water temperature is highly variable through this time interval (Dwyer and Chandler, 2009) we put less weight on the estimates from this site than we did on others. Our criteria is now based upon the number of samples used for the estimate compared to the number of samples available from the time slab at each site.

The PRISM Project has a long history and until recently "mid-Pliocene" was an accurate reflection of the interval of time we concentrate on. While the IUGS has approved a radical change in the definition of Pleistocene, to conform to a new concept of Quarternary, this has not yet been widely accepted by the marine community. However, mid-Piacenzian is a more accurate and more refined description of the PRISM focus. We will make minor changes to our Figure 1 to accurately portray the stratigraphy.

We thank Mark Williams for pointing our several mistakes regarding duplication of references and using “Stage” when we meant “Age.” These items will be fixed in our revised manuscript.

References:

Billups, K. and Schrag, D.P., 2003. Application of benthic foraminiferal Mg/Ca ratios to questions of Cenozoic climate change. Earth and Planetary Science Letters 209: 181-195.

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Lear, C.H., Elderfield, H. and Wilson, P.A., 2000. Cenozoic deep-sea temperatures and global ice volumes from Mg/Ca in benthic foraminiferal calcite. Science 287: 269-272.

Interactive comment on Clim. Past Discuss., 5, 1901, 2009.