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Isotopic evidence for palaeoclimate–sea-level linkages in the Mesozoic

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We have compiled records of key isotopic proxies through the Mesozoic in an effort to explore the relationship between global sea-level and Mesozoic palaeoclimate. Our interpretation of Mesozoic sea-level change is based on a global sequence stratigraphic model that manifests itself as a globally correlatable record of major stratal surfaces, such as maximum flooding surfaces (MFS) and sequence boundaries (SB). Our model is built from a database of $>$11,000 outcrop sections and wells which, by careful biostratigraphic correlation, demonstrate the synchronicity of $>$200 MFS and SB distributed across the globe and in basins of highly variable tectonic evolution. The rapidity, magnitude and global distribution of the Mesozoic sea-level changes inferred from our model precludes local tectonics as a driver.

Our work has revealed a close link between a number of Mesozoic transient carbon-isotope excursions and the timing of our stratal surfaces. Of further importance is that our results reveal a close link between the timing of some of our large-scale MFS events with known episodes of palaeoclimatic warming, as well as a similar link between our SB and palaeoclimatic cooling. Our findings are thus similar to those of Miller *et al*. [1,2], who married sequence stratigraphic evidence for sea-level change with geochemical evidence for correlatable climatic changes in the Late Cretaceous and Cenozoic. These authors, and subsequently others [e.g. 3], advocate the mediation of ice-sheets as the key Late Cretaceous and Cenozoic driver of eustasy. Having reviewed the evidence for Mesozoic ice across a number of our major sea-level change events we extend the thesis of Miller *et al*. further back through the Mesozoic and suggest that climate-driven glacioeustasy was a primary driver of Mesozoic sea-level.

What is clear is that climate has varied on rapid timescales in the Mesozoic, making terms such as “icehouse” and “greenhouse” redundant.

[1] Miller, K.G. *et al*., 2005a, *Marine Geology*, 217, p.215-231.

[2] Miller, K.G. *et al*., 2005b, *Science*, 310, p.1293-1298.

[3] Bornemann, A. *et al*., 2008, *Science*, 319, p.189-192.