

Supporting Information for

An early Pleistocene Mg/Ca- $\delta^{18}\text{O}$ record from the Gulf of Mexico: Evaluating ice sheet size and pacing in the 41-kyr world

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Introduction

This supporting information shows comparisons between ODP Site 625 foraminiferal trace metals (Mg, Al, Fe, Mn) to help evaluate diagenetic overprints, the *G. ruber* $\delta^{18}\text{O}_{\text{sw}}$ record using only Mg/Ca- $\delta^{18}\text{O}$ datapoints measured in this study at the same depth intervals, and the *G. ruber* Ba/Ca record.

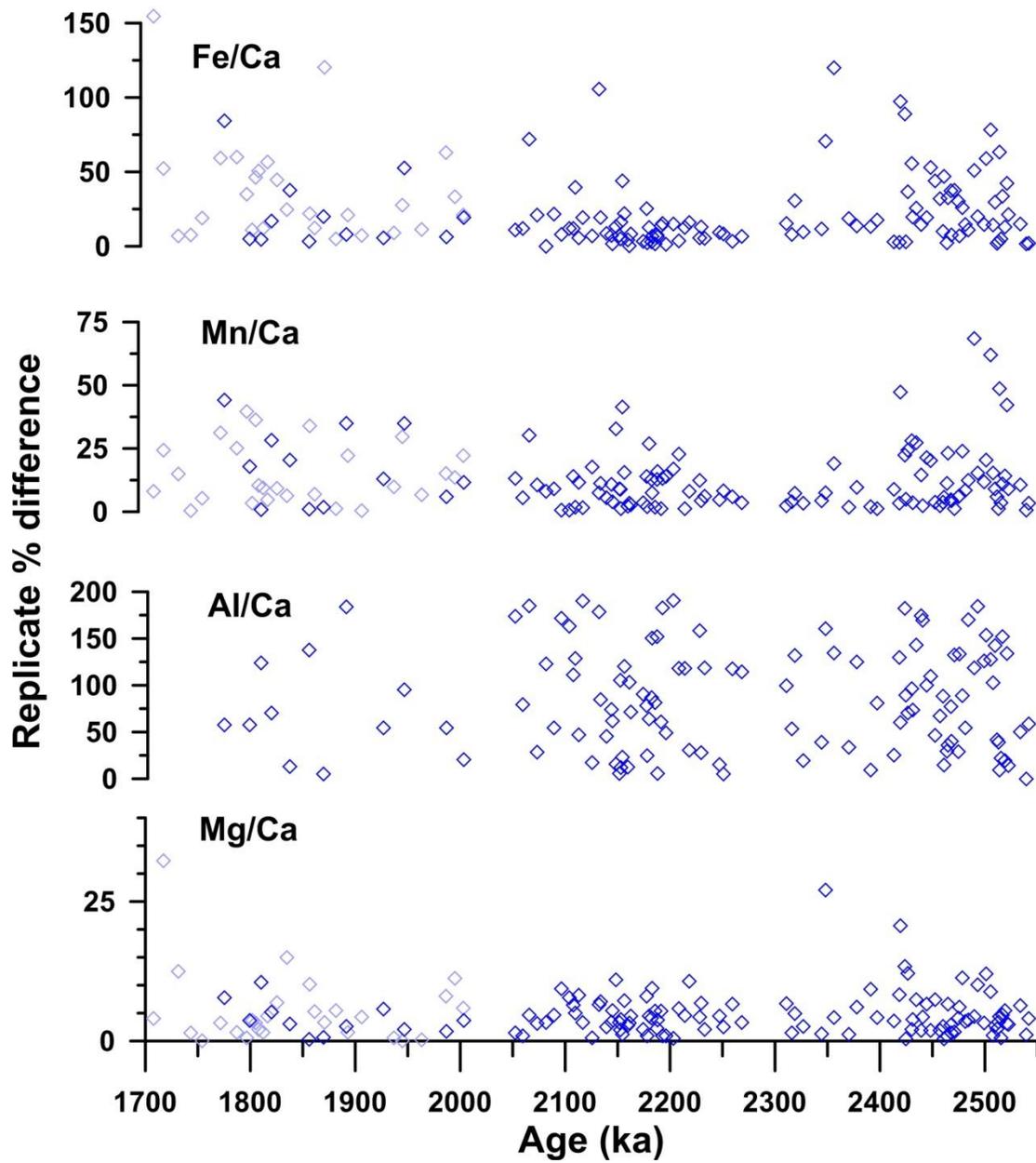


Figure S1. Reproducibility of 625B *G. ruber* trace metal ratios between splits of the same sample (forams were crushed and homogenized, and then split) measured by ICP-MS at UC-Santa Barbara (dark blue) and ICP-OES at Lamont-Doherty Earth Observatory (light blue).

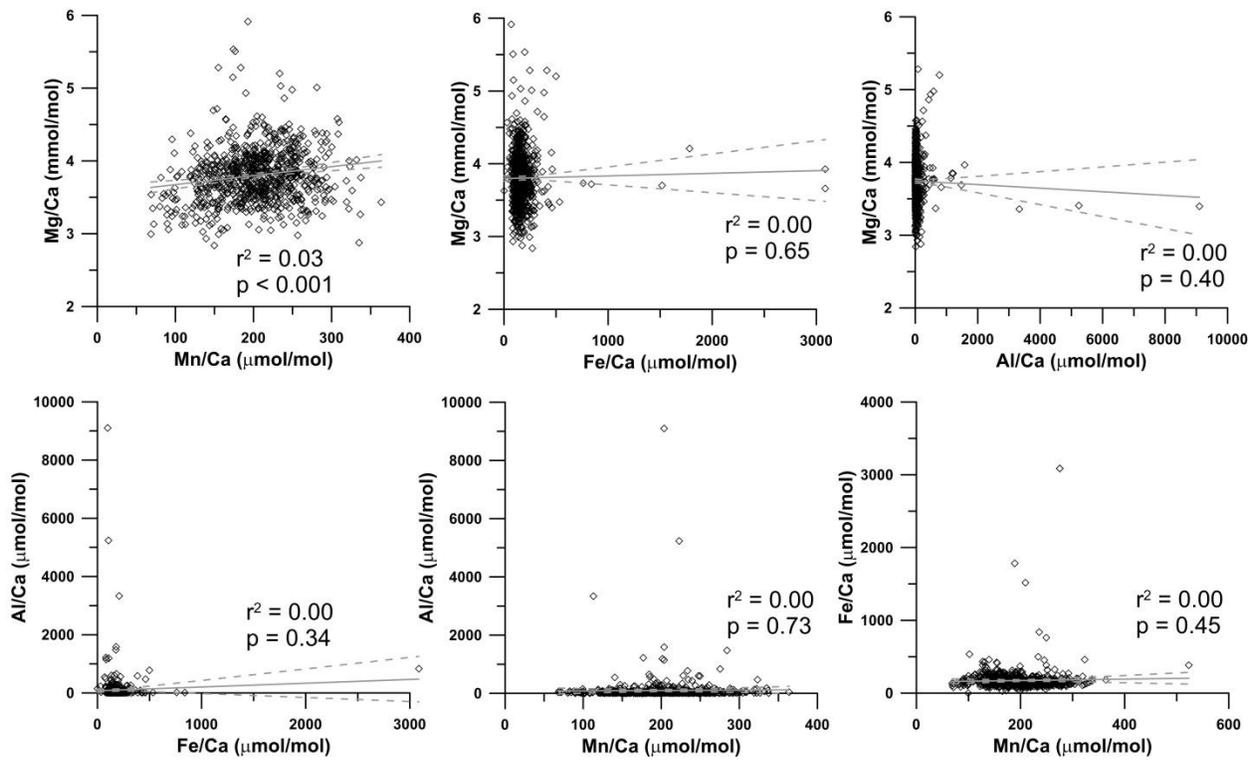


Figure S2. Regressions between 625B *G. ruber* trace metal ratios. Note the weak overall correlations.

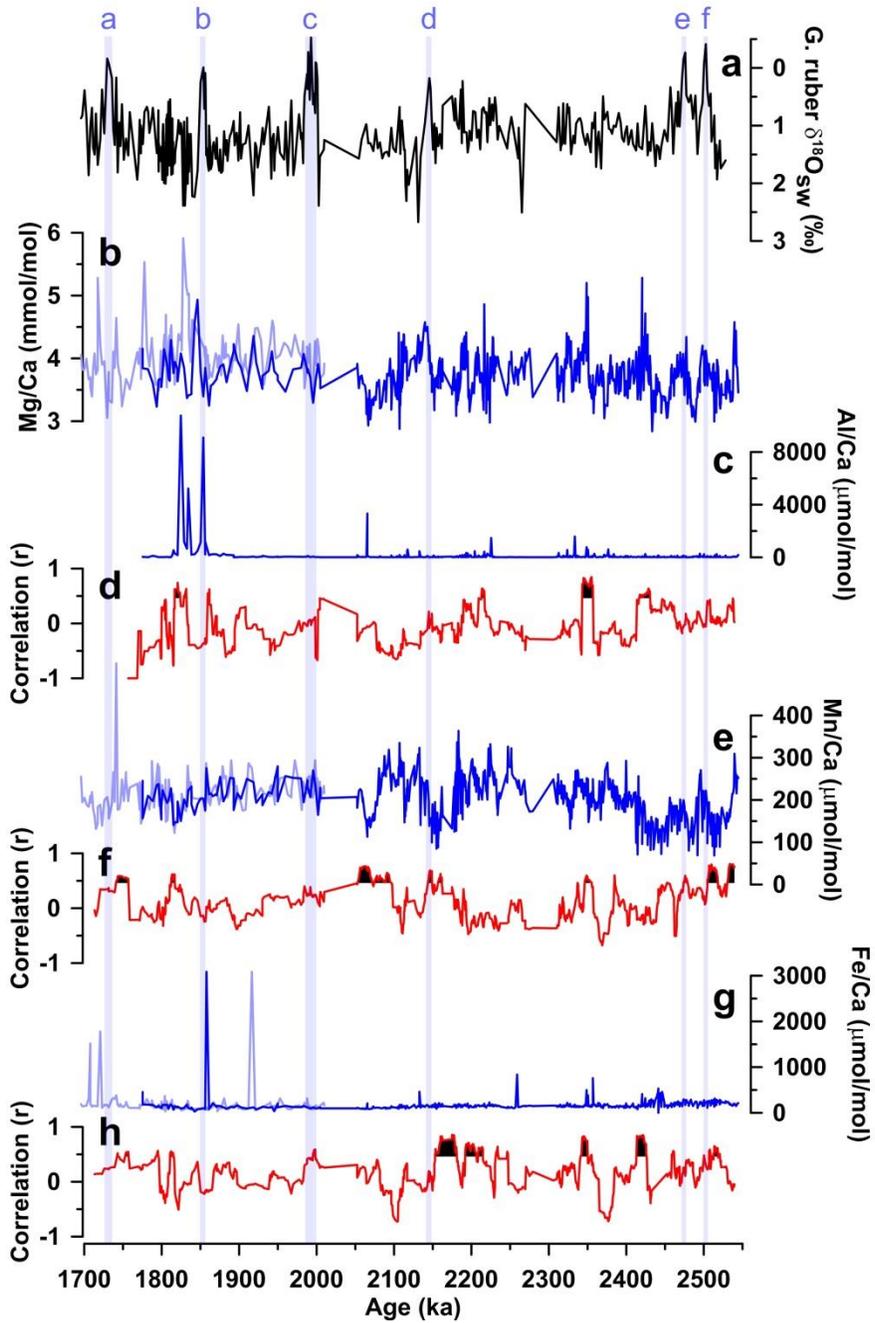


Figure S3. 625B *G. ruber* (a) $\delta^{18}\text{O}_{\text{sw}}$, and (b,c,e,g) trace metal records measured by ICP-MS at UC-Santa Barbara (dark blue) and ICP-OES at Lamont-Doherty Earth Observatory (light blue). (d,f,h) 19 point running correlations between each trace metal record and the Mg/Ca record. Inferred meltwater events are shown by the vertical blue bars. Correlations significant at the 95% level (assuming dof = 19) are highlighted in black. Correlations are typically rather weak, suggesting a generally modest role for diagenetic overprints in driving the Mg/Ca signal. This is not the case for a few intervals, however, such as from 1820-1860 ka when very high Al/Ca values and covariance with Mg/Ca indicate clay contamination, perhaps related to meltwater event 'b'.

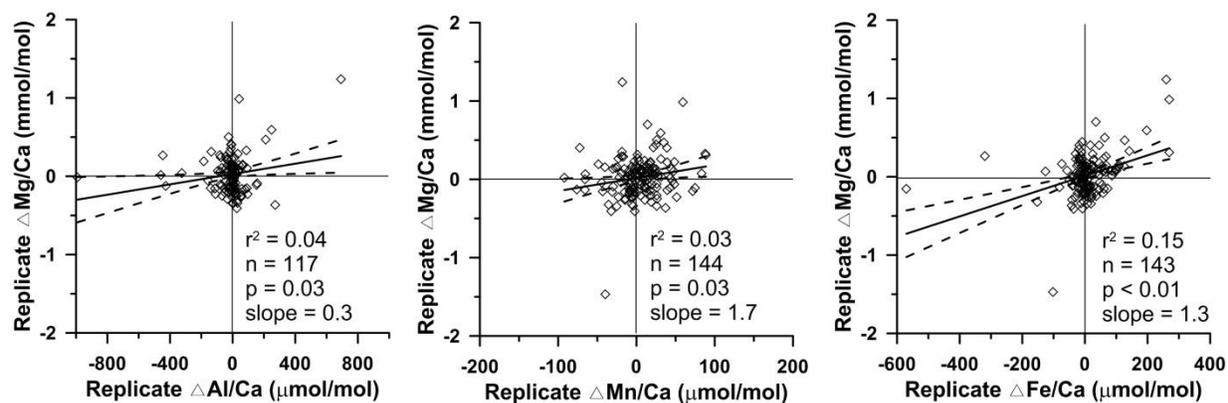


Figure S4. Differences in trace metal ratios between splits of the same 625B *G. ruber* samples. Mg/Ca is nearly uncorrelated with Al/Ca and Mn/Ca in replicate samples. Mg/Ca exhibits a stronger correlation and relatively high slope with Fe/Ca, suggesting that Fe-Mg-rich diagenetic overprints might substantially influence the Mg/Ca signal over select intervals where Fe has large variability.

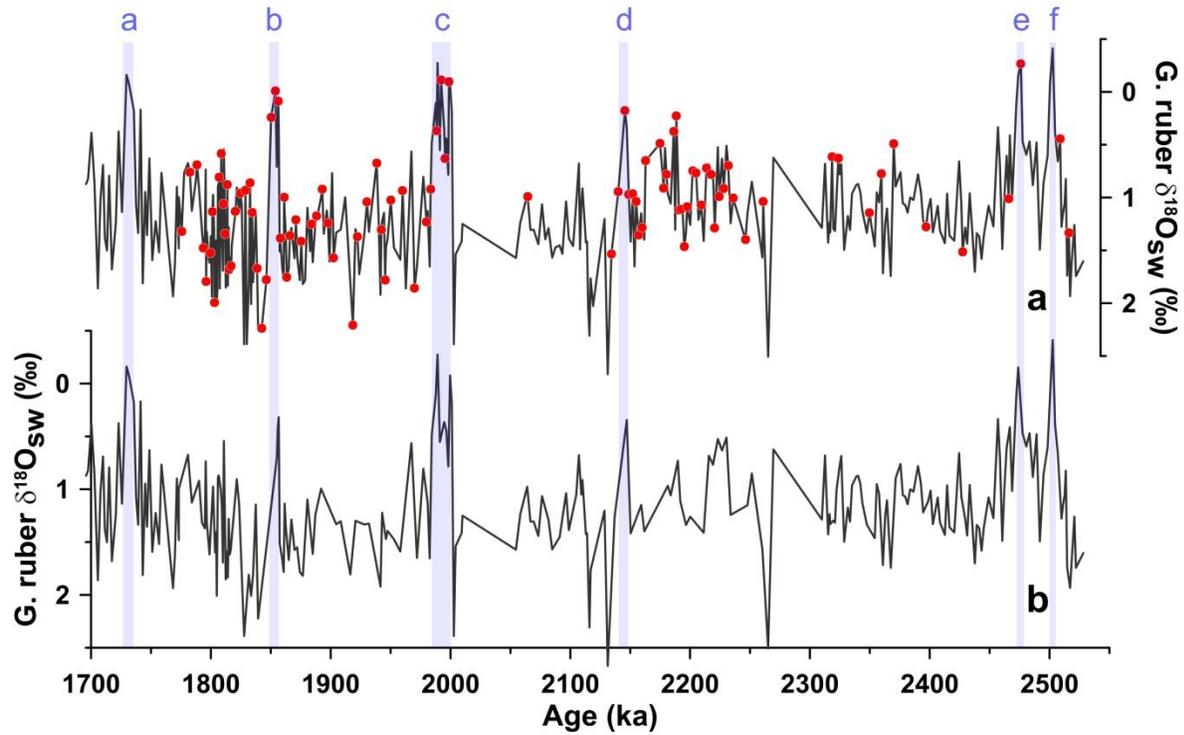


Figure S5. (a) The 625 *G. ruber* $\delta^{18}O_{sw}$ record shown in the main paper, highlighting datapoints (red) using Joyce et al.'s [1990] *G. ruber* $\delta^{18}O$, or Mg/Ca and $\delta^{18}O$ measurements from offset (though overlapping) depth intervals. (b) The 625 *G. ruber* $\delta^{18}O_{sw}$ record excluding these datapoints (i.e., using only Mg/Ca and $\delta^{18}O$ measured in this study and at the same depth interval). The six $\delta^{18}O_{sw}$ anomalies interpreted as meltwater events persist (vertical blue bars), though some appear reduced in magnitude or duration.

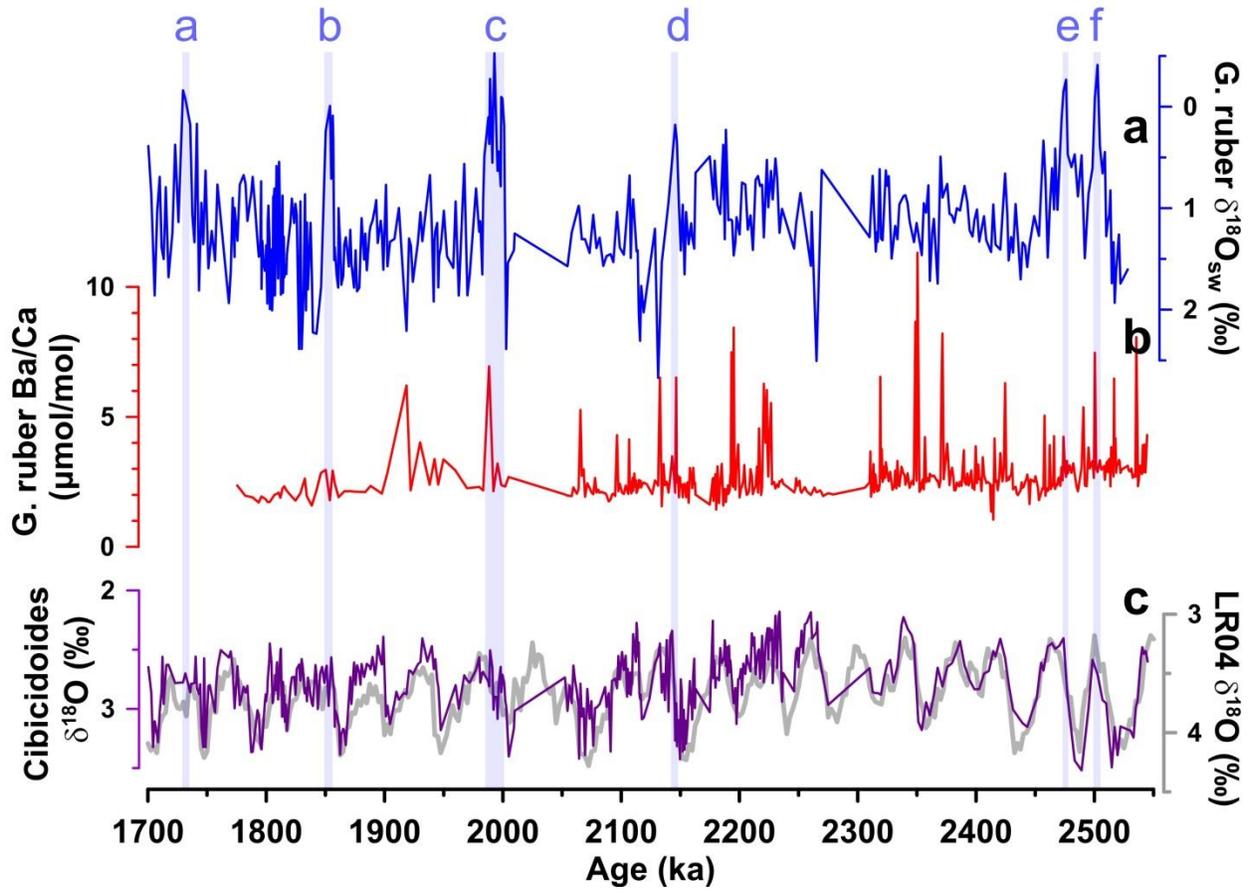


Figure S6. The Site 625 (a) *G. ruber* $\delta^{18}\text{O}_{\text{sw}}$, (a) *G. ruber* Ba/Ca, and (c) benthic $\delta^{18}\text{O}$ records. The Ba/Ca at 625 is too high to reflect seawater values [Hönisch *et al.*, 2011], and thus likely is related to contamination and not useful for reconstructing freshwater input at this site.