Diagenesis of calcite in early Paleogene foraminifera: implications for Mg/Ca paleothermometry

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A primary consideration in the reconstruction of past ocean temperatures from stable isotope or trace element chemistry of foraminifera tests, is the extent to which diagenesis has affected the cation constituents of calcite. Mg/Ca-derived paleotemperatures may be biased towards higher values by the addition of secondary calcite from pore fluids post-burial, or by contamination from Mg-rich silicate minerals. Diagenetic processes may have the effect of altering the bulk elemental composition of foraminiferal calcite, and can be divided into three distinct categories; overgrowths, dissolution, and recrystallization. The mode of diagenetic alteration depends on a combination of several factors, including time, burial temperature and history, sediment composition, and pore water chemistry.

The paired application of laser ablation inductively coupled plasma mass-spectrometry and electron microprobe analysis has allowed for detailed, high-resolution, micro-scale assessment of diagenetic effects, including recrystalisation, dissolution, overgrowths and silicate contamination, on a selection of early Paleogene foraminifera from a variety of pelagic and hemipelagic settings. This assessment and quantification of diagenetic effects subsequently informs screening protocols applied to Mg/Ca data on a site by site basis, ensuring that calculated paleotemperatures are neither over- or underestimated as a consequence of alteration.