

Mg/Ca variation within the planktic foraminifer *Orbulina universa*

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Mg/Ca composition and test wall profile characteristics have been measured in a population of *Orbulina universa* (a symbiotic planktonic foraminifera) obtained from a core-top sediment sample from off the west Australian coast (20°04 S, 112°66 E). Laser ablation-inductively coupled plasma mass spectrometry (LA-ICPMS) and electron microprobe have been used to determine the distribution of Mg/Ca and other elements at micron/submicron-scale resolution within individual foraminifera shells. LA-ICPMS profiles and EMPA maps reveal the development of up to 6 alternating low and high Mg/Ca bands that increase in amplitude and Mg/Ca value toward the outer test surface. These results, together with the reported duration of test calcification (e.g. Caron et al., 1987), indicate the Mg/Ca composition of calcite precipitated by *O. universa* is strongly regulated on a diurnal cycle (Eggins et al., 2004). The development of Mg/Ca banding in *O. universa* can be linked to the day-time photosynthetic activity of algal symbionts and night-time respiration of both the host foraminifer and symbionts, which modulate the pH and calcite saturation state within the foraminiferal microenvironment (Wolf-Gleadrow and Riebesell, 1997). We attribute the high and low Mg/Ca bands to night-time and day-time calcification respectively based on previously documented increase in bulk test Mg/Ca composition with decreasing seawater pH (Lea et al., 1999).

'Vital effects' similar to those observed in *O. universa* may affect other symbiont bearing species, and could bias bulk test Mg/Ca compositions and thus derived estimates of palaeo-seawater temperature. Our results provide new insights into the potential importance of such 'vital effects' in controlling the Mg/Ca composition of foraminiferal calcite. They also emphasise the need for a more complete understanding of influences upon the Mg/Ca composition of foraminiferal calcite in order to evaluate both the precision and accuracy of Mg/Ca paleo-seawater thermometry based on bulk test compositions.

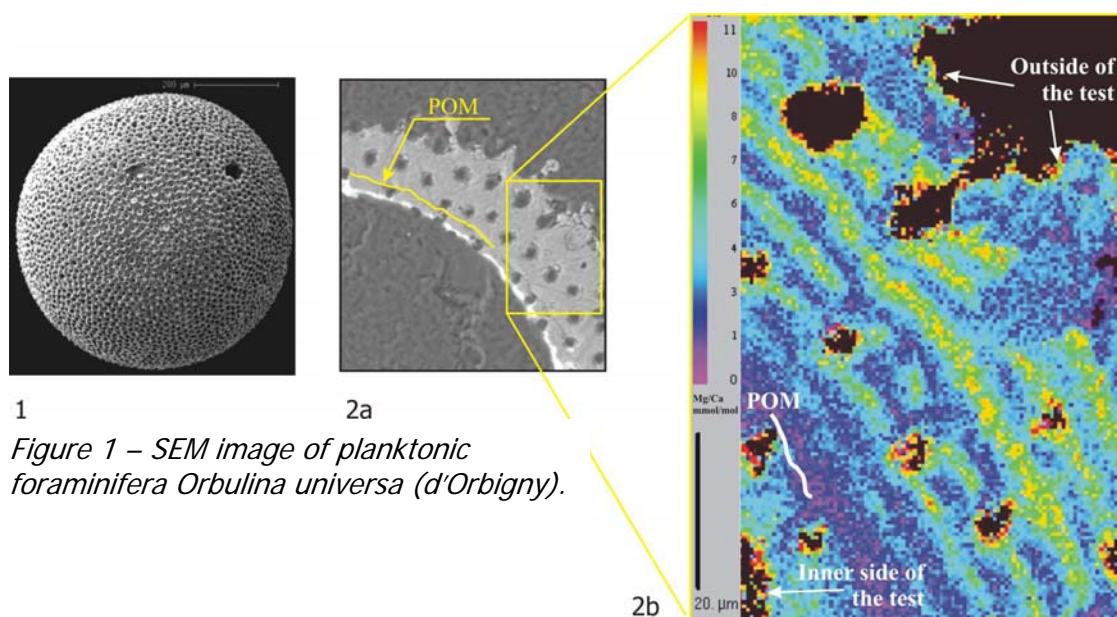


Figure 1 – SEM image of planktonic foraminifera *Orbulina universa* (d'Orbigny).

Figure 2a-b – SEM image and map of Mg/Ca ratio variation through a test wall cross-section of *O. universa* with 6 high Mg/Ca-bands (note Mg/Ca-colour scale and length scale). POM indicates the position of the primary organic membrane.

References

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