Eocene and Miocene planktonic foraminiferal palaeoecology: do trace elements and stable isotopes tell the same story?

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Planktonic foraminiferal palaeoecology is commonly interpreted using stable isotope and trace element signatures, for example, utilising the Mg/Ca geochemical proxy to study palaeo-depth habitats via Mg/Ca derived palaeotemperatures or combining $\delta^{18}O$ and $\delta^{13}C$ data. However, different ecological proxies may not always agree. Modern planktonic foraminifera exhibit cyclic Mg/Ca banding in their shell walls. We investigate this feature in well preserved Eocene and Miocene symbiotic and asymbiotic taxa by studying the presence of Mg/Ca banding and the relationship it has with data obtained from size restricted $\delta^{13}C$ analyses.

We present electron microprobe, $\delta^{13}C$ and $\delta^{18}O$ data for surface dwelling species *Globigerinoides subquadratus* & *Acarinina praetopilensis* and deep dwelling species *Dentoglobigerina tripartita* & *Parasubbotina hagni*. These species have previous $\delta^{13}C/\delta^{18}O$ derived palaeoecologies.

Our results indicate that distinct ecological preferences between species are preserved in the geochemistry of these samples. All surface dwelling species exhibit thick, 3-4 µm Mg bands, whilst in thermocline dwelling species thinner, 1-2 µm Mg bands were present. The spatial distributions of the $\delta^{13}C$ and $\delta^{18}O$ data on a carbon-oxygen cross-plot also correlate with the occurrences of Mg banding observed in the microprobe maps. Surface dwellers were $\delta^{13}C$ enriched, whilst thermocline dwellers were $\delta^{18}O$ enriched.

Having established this relationship, the evolution of photosymbiosis in middle and late Eocene hantkeninids was explored. Preliminary microprobe and $\delta^{13}C$ data suggest an asymbiotic ecology in the middle Eocene but a symbiotic ecology in the late Eocene, which correlates with current understanding of hantkeninid depth habitat migration. By combining different geochemical proxies together, more can be understood about extinct planktonic foraminiferal palaeoecologies.