Climate change and planktonic foraminiferal evolution during the Late Cretaceous

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The Late Cretaceous greenhouse climate has been subjected to a number of studies with particular emphasis on the Cenomanian-Turonian and late Campanian–Maastrichtian intervals. By contrast, far less information is available for the Turonian–early Campanian, even though it encompasses the transition from the extreme warmth of the Cenomanian-Turonian greenhouse climate optimum to significant cooling throughout the early Campanian to Maastrichtian. This interval also includes a ~3 myr-long mid-Coniacian to mid-Santonian interval when planktonic foraminifera underwent a large-scale, but poorly understood, turnover. This variation in the assemblages was followed by the extinction of all pre-Campanian double-keeled taxa (*Marginotruncana* and *Dicarinella*) within the latest Santonian-earliest Campanian, whose cause(s) has/have never been established. This lack of understanding relates to the limited recovery of stratigraphically complete Turonian–early Campanian deep-sea records, as well as to the generally poor preservation of Turonian-lower Campanian microfossils from outcrop sections. Further uncertainty is introduced by the results of several studies that found the traditional morphology-based scheme for inferring Cretaceous planktonic foraminiferal paleoecology to be probably incorrect for many taxa (ABRAMOVICH et al., 2003; ANDO et al., 2010; FALZONI et al., 2013, 2014).

This study presents ~1350 $\delta^{18}O$ and $\delta^{13}C$ values of well-preserved benthic and planktonic foraminifera from the Exmouth Plateau off Australia (eastern Indian Ocean - ODP Leg 122, Hole 762C). These data provide: (i) the most continuous, highly resolved and stratigraphically well-constrained record of the long-term climate trend in the southern mid-latitudes during the Late Cretaceous, (ii) new information on the paleoecological preferences of planktonic foraminiferal taxa, and (iii) new insights on the mechanisms that controlled planktonic foraminiferal evolution.

The results indicate that the mid-Cretaceous climate optimum actually persisted until the mid-Santonian, while sea-surface cooling occurred from the mid-Santonian through the mid-Campanian, and short-term climatic variability dominated during the late Campanian–Maastrichtian (FALZONI et al., 2016). Moreover, our study suggests that whilst several keeled taxa (i.e., *Falsotruncana* and bi-convex *Dicarinella* species) were effectively deeper/cool dwellers, as recognized by the morphology model, many double-keeled species, for which few or no isotope data were previously available (umbilico-convex *Dicarinella*, most *Marginotruncana* and *Contusotruncana* species) yield an isotopic signature that suggests a shallower/warmer water-column habitat. Finally, we infer that the cause of Coniacian–Santonian turnover among planktonic foraminifera may have been the evolution of a temperature/salinity-tolerant genus (*Marginotruncana*) and the cause of the Santonian-early Campanian extinction of *Dicarinella* and *Marginotruncana* may have been surface-ocean cooling and competition with globotruncanids.

ABRAMOVICH, S. et al., 2003. Palaeogeogr. Palaeoclimatol. Palaeoecol., **202**, 1–29.
ANDO, A. et al., 2010. Paleobiology, **36**, 357–373.
FALZONI, F. et al., 2013. Marine Micropaleontology, **103**, 15–29.
FALZONI, F. et al., 2014. Cretaceous Research, **47**, 87–104.
FALZONI, F. et al., 2016. Geological Society of America Bulletin, **128**, 1725–1735.