



Tropical Climate Variability during the Cretaceous Thermal Maximum

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The Cretaceous Thermal Maximum (KTM) lasted from the latest Cenomanian to the Santonian (~94 to 83.5 Myrs), and is considered to represent the warmest period during the last 200 Myrs. Reliable $\delta^{18}\text{O}$ paleotemperature estimates for the KTM are rare, because most studies are either based on bulk-rock records with an unknown diagenetic overprint or have a low resolution. In fact, only few sedimentary successions are known that had continuous records through this interval and that provide excellently preserved fossils or other proxies that can be employed to reconstruct paleotemperatures, therefore the detailed structure of the KTM is still unknown. We present a first detailed sea surface temperature (SST) long-term record of the KTM based on $\delta^{18}\text{O}$ measurements from well preserved planktic foraminifera and crenarchaeol derived TEX_{86} temperature estimates at a lower resolution from ODP Site 1259 (tropical Atlantic, Demerara Rise). Both proxies revealed the same long-term trend and similar absolute temperatures. Highest temperatures have been observed during the Turonian, with conservatively estimated tropical peak SSTs above 35°C , which were substantially warmer than modern tropical temperatures. Despite these proposed greenhouse conditions some authors invoked glaciation events to explain high amplitude sea-level changes and $\delta^{18}\text{O}$ excursions during the early Late Cretaceous (e.g. Miller et al., 2005). Our record also displays a short-term shift to heavier $\delta^{18}\text{O}$ values during the Turonian, which may correspond stratigraphically to an interval that is characterized by a widespread relative sea level fall according to Haq et al. (1987). The $\delta^{18}\text{O}$ shift is partly caused by a slight cooling ($\sim 1.5^\circ\text{C}$) based on the TEX_{86} data. The resulting

residuum of -0.54% , in the $\delta^{18}\text{O}$ of seawater can be explained either by changes in salinity or by the formation of continental ice as suggested for Antarctica during parts of the early Late Cretaceous, or by a combination of both. A gradual cooling of about 1.5 to 5°C through the Coniacian and Santonian marks the end of the KTM, suggesting that the stratigraphic range of the “real” KTM is limited to the Turonian.

References: Haq, B.U., Hardenbol, J., Vail, P.R., 1987. Chronology of fluctuating sea levels since the Triassic. *Science* 235:1156-1167. Miller, K.G., Wright, J.D., Browning, J.V., 2005. Visions of ice sheets in a greenhouse world. *Marine Geol.* 217:215-231.