Isotope schlerochronology and tropical seasonality during the Mid Miocene Climatic Optimum

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During the Mid-Miocene Climatic Optimum (MMCO), global mean temperatures were ~3°C above present, similar to predicted changes in temperature for the next century [1]. Currently, there is limited paleotemperature data from the tropics from the MMCO, and local variations in $\delta^{18}O_{water}$ can obscure the use of the traditional oxygen isotope paleothermometer to assess temperature changes. We perform high-resolution sub-annual sampling on 27 *Turitella* (7 spp.) shells from the Castilletes Formation of the La Guajira peninsula, Colombia (12°N), dating from 14.9 to 17.4 Ma, within the MMCO. All samples were analyzed for $\delta^{13}C$ and $\delta^{18}O$, and a subset were analyzed for their clumped isotopic composition (Δ_{47}). The large range in $\delta^{18}O$ found in the sub-annual time series is more than can reasonably be explained by changes in temperature, given the small seasonality typical of the tropics. This is supported by clumped isotope analysis on bulk samples spanning the widest range in $\delta^{18}O$, which return similar temperatures but wide-ranging $\delta^{18}O_{water}$ values. Our results suggest that the large sub-annual change in $\delta^{18}O$ is the result of seasonal changes in $\delta^{18}O_{water}$. The interpreted seasonal changes in $\delta^{18}O_{water}$ suggest the presence of substantial riverine input and reflect a much wetter, perhaps estuarine, climate, with fluvio-deltaic plains and channels, in contrast to the semi-arid conditions present today. This finding is corroborated by other studies of the region that find flora and fauna evident of wetter climates [2,3].

[1] You, et al., 2009 Geophys. Res. Lett.; [2] Hendy, et al., 2015 Swiss J. Paleontol; [3] Moreno, et al., 2015 Swiss J Paleontol