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Biomarker reconstructions of northeast African vegetation

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High resolution paleovegetation records are needed to reconstruct the environmental context of hominin evolution and in particular the question of orbital-timescale environmental variability. Various proxies have documented C_4 expansion in northeast Africa during the past 10 Ma including soil carbonate $\delta^{13}C$, fossil tooth $\delta^{13}C$ and faunal assemblages. Pollen and plant macrofossil records have provided details of vegetation communities and their change across orbital transitions. Although marine sediments have revealed large amplitude orbital frequency environmental variability, it is unclear how this variability is expressed in terms of northeast African vegetation. Novel organic geochemical techniques have enabled orbital-resolution vegetation reconstructions from terrestrial plant biomarkers in both lacustrine and marine sediments that reconstruct northeast African vegetation variability during the late Neogene.

We have recently published a record of northeast African vegetation for intervals of the late Neogene based on wind-blown biomarker deposits to marine sediments in the Gulf of Aden (Feakins et al., 2005). Molecule-specific $\delta^{13}C$ of leaf wax biomarkers allow reconstruction of orbital-scale C_3/C_4 vegetation change. We find that C_3 vegetation dominated the northeast African landscape during the early Pliocene, consistent with soil carbonate and fossil tooth isotopic data. Biomarker $\delta^{13}C$ show large-amplitude vegetation variability as early as 3.8 Ma, prior to the onset of Northern Hemisphere Glaciation, with most C_4 expansion occurring after 3.4 Ma. We sampled orbital-scale oscillations of up to 5‰, almost as large as the observed late Neogene range of 7‰, suggesting that large and repeated oscillations between more open and more closed landscapes were an important aspect of northeast African vegetation change during the last 4 Ma.

In a new study we assess terrestrial plant biomarkers in lacustrine sediments in the Turkana Basin. Lacustrine and marine deposits of plant biomarkers are compared for sediments of known equivalent age, corresponding to a ‘wet’ event prior to the Tulu Bor eruption at ca. 3.34Ma. This study helps to integrate terrestrial and marine records in order to build a more complete picture of the northeast African environments in which hominins evolved.

Feakins S., deMenocal. P., and Eglington T. (2005) Biomarker records of Late Neogene Changes in East African Vegetation. Geology 33, 977-980.