

The northeast African environmental context for *Ardipithecus*

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Recently a remarkably complete specimen of *Ardipithecus ramidus* was discovered in the Awash of Ethiopia dating to 4.4 million years [1]. Following that discovery, the interpretation of the habitat in the *Ardipithecus* bearing formation has been the subject of considerable debate. Here we provide evidence for the northeast African regional vegetation context from the wind-blown plant leaf wax carbon isotope record from Pliocene-age Gulf of Aden marine sediments. This record contextualizes the fossils in a regional history of vegetation trends and variability over time. Leaf wax $\delta^{13}\text{C}$ reveal a negative isotopic shift from 5 to 3.8 Ma spanning -24 to -29‰ , suggesting a trend of forest expansion that stands out from the open vegetation that has dominated the landscape for the last 12 million years [2]. This high-resolution marine record reveals that the Pliocene forest expansion trend was modulated by oscillations in leaf wax $\delta^{13}\text{C}$ on the order of $2\text{--}6\text{‰}$, perhaps equivalent to regional canopy cover ranging from $10\text{--}60\%$. The forest expansion trend follows global warmth, elevated greenhouse gas concentrations, and rising Indian Ocean sea surface temperatures. Pliocene forest expansion has been reported on land [3] and predicted by a dynamic vegetation model [4]. The wetter conditions required to develop substantial forest expansion in this region in repeated $\sim 10,000$ year pulses between 4.8 to 3.8Ma, would likely have influenced the habitats and range of *Ardipithecus* and other Pliocene fauna.

[1] White, *et al Science* (2009) **326**, 75-86; [2] Feakins, *et al Geology* (2013) **41**, 295-298; [3] Cerling *et al* (2011) *Nature*, **476**, 51-56; [4] Haywood and Valdes, *Palaeo3* (2006) **237**, 412-427.