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A molecular view on an Oligocene lake from the Ethiopian Plateau

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In this study, paleoenvironments of the Ethiopian Plateau are reconstructed using plant biomarkers extracted from sediments of late Oligocene and early Miocene paleolakes and their stable carbon isotopic values. The overarching goal is to understand Ethiopian environmental dynamics prior to uplift of the Plateau. During the Oligocene and late Miocene, northeast Africa underwent dramatic climate change in-step with the evolution of the East-African Rift System (EARS) and the closure of the Neotethys. Previous studies based on plant fossils suggest that the region was covered by riparian and tropical forests amid this period, but then shifted to a much drier climate.

To further resolve regional Ethiopian climate change, we sampled Oligocene lake sediment from the northern Plateau (Mekele). Lake sediments were deposited between two basalt layers of the Adrigrat basalt traps estimated to have ages between 29 and 24 Ma. The sediments are composed of fine-grained clay to silt mixed with secondary ashes.

Carbon isotope analyses of plant biomarker *n*-alkanes reveal that, besides minor contributions of C_4-grasses, most lipid input is derived from C_3 plants ($\delta^{13}C$ vs. VPDB, nC_{31} ranges between -29.1‰ and -29.8‰). Based on *n*-alkane distribution patterns (n = 36), the environment was dominated by trees, as indicated by predominance of nC_{27} and nC_{29}. Although the samples are composed of fine-grained, well-sorted lake sediments, there is little to no indication of aquatic input (nC_{21-23}). In contrast, nC_{27} is abundant and shows a much higher variance of $\delta^{13}C$ values, ranging between -25.7‰ and -29.3‰. This variance indicates that the regional tree cover underwent strong perturbations while grasses and shrubs appear to be much more stable.