PP52C-0443 - High-Resolution Seasonal Climate Variation in Equatorial Africa Revealed by Modern and Fossil Primate Teeth

Friday, 16 December 2022

09:00 - 12:30

McCormick Place - Poster Hall, Hall A (South, Level 3)

Abstract

Variability in resource availability is hypothesized to be a significant driver of primate adaptation and evolution, but most paleoclimate proxies cannot recover environmental seasonality on the scale of an individual lifespan. Here, we report that oxygen isotopes ($\delta^{18}O$) sampled at high spatial resolution in the dentitions of modern African primates (n = 2352 near-weekly measurements from 26 teeth) track concurrent seasonal precipitation, regional climatic patterns, discrete meteorological events, and niche partitioning. We leverage these data to contextualize the first $\delta^{18}O$ values of two 17 million-year-old *Afropithecus turkanensis* individuals from Kalodirr, Kenya—from which we infer variably bimodal wet seasons, supported by rainfall reconstructions in a global Earth system model. *Afropithecus'* $\delta^{18}O$ fluctuations are intermediate in magnitude between those measured at high-resolution in baboons (*Papio* spp.) living across a gradient of aridity and modern forest-dwelling chimpanzees (*Pan troglodytes verus*). This large-bodied Miocene ape consumed seasonally variable food and water sources enriched in ^{18}O compared to contemporaneous terrestrial fauna (n = 66 fossil specimens). Reliance on fallback foods during documented dry seasons potentially contributed to novel dental features long considered adaptations to hard-object feeding. Ion microprobe sampling that is informed by developmental patterns in teeth recovers greater ecological complexity than conventional isotope sampling; the two Miocene apes (n = 248 near-weekly measurements) evince as great a range of seasonal $\delta^{18}O$ variation as more time-averaged bulk carbonate measurements from 101 east African Plio-Pleistocene hominins and 42 papionins spanning 4 million years. These results reveal unprecedented environmental histories in primate teeth and suggest a novel framework for evaluating climate change and primate paleoecology throughout the Cenozoic.