

167-2 - Booth No. 99: INSIGHTS FROM ~17 MA SOIL CARBONATE STABLE ISOTOPES AND GCM RESULTS IN THE TURKANA BASIN, KENYA



Tuesday, 17 October 2023



8:00 AM - 5:30 PM



Hall B (2, David L Lawrence Convention Center)

Booth No. 99

Abstract

Soil carbonates provide records of terrestrial climate conditions in arid to sub-humid regions and enable reconstruction of the past environment through interpretation of $\delta^{13}\text{C}$, $\delta^{18}\text{O}$, and Δ_{47} . New stable isotope measurements from samples collected at three late early Miocene fossil localities in the Turkana Basin — Buluk (~16.7 Ma), Loperot (~17 Ma), and Locherangan (~17.5 Ma) — reflect heterogeneous pedogenic carbonate formation and diagenetic overprinting that complicate our interpretation of the paleoclimate signals preserved in the primary carbonate. We propose a new soil carbonate sub-sampling approach that accounts for alteration after nodule formation by “un-mixing” the micrite precipitated in equilibrium with Miocene soil conditions from the crystalline calcite with high (50-100°C) formation temperatures. Analysis of three soil carbonate nodules from Loperot and five from Buluk show distinct calcite components in each sample, as measured in multiple sub-samples and as seen in petrographic and SEM imagery. We present these data along with results from paleoclimate simulations using the water isotope-enabled Community Earth System Model (iCESM1.2) with Miocene boundary conditions for geography, elevation, vegetation and soil properties, and atmospheric composition. Both soil carbonate clumped isotope temperatures ($T(\Delta_{47})$) and the model indicate hotter (~2°C) soil temperatures on the west side of the basin (Locherangan and Loperot) than the east side (Buluk), and the least negative $\delta^{18}\text{O}$ of soil water estimated from calcite $\delta^{18}\text{O}$ and $T(\Delta_{47})$ are similar to model predictions for the dry season at both sites. Today, the isotope ratios of precipitation in Turkana are the product of extraordinarily hot and dry conditions, and mean annual precipitation (MAP) is far lower (200–300 mm/yr) than what the model predicts for the mid-Miocene (1100–1300 mm/yr). Dramatic changes have occurred on the landscape in Turkana over the past 17 Ma— uplift of the East African Plateau, aridification, and the subsequent spread of grasslands. Our data show $\delta^{13}\text{C}$ values consistent with C3 ecosystems (-10.49 – -5.69‰ VPDB), a reflection of the environment as it was just prior to the MMCO. Comparisons between Miocene soils and soil carbonates, climate modeling, and present day conditions improve the paleoecological reconstructions that refine our understanding of this critical time.

Geological Society of America Abstracts with Programs. Vol. 55, No. 6, 2023
doi: 10.1130/abs/2023AM-394790

© Copyright 2023 The Geological Society of America (GSA), all rights reserved.

Author



Mae Saslaw

Stony Brook University

Authors



Daeun Lee

University of Michigan



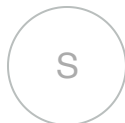
Chris J. Poulsen

University of Oregon



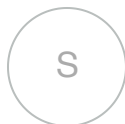
Cynthia Liutkus-Pierce

Appalachian State University



Gary E. Stinchcomb

University of Memphis



Sara Shedroff

University of Massachusetts Amherst



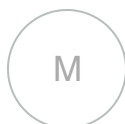
Catherine Beck

Hamilton College



Craig Feibel

Rutgers University



Ellen Miller

Wake Forest University



Gregory Henkes

Stony Brook University

View Related
