Paleoenvironmental Interpretations of Stable Isotopes From Miocene Pedogenic Carbonates with Diagenetic Calcite Components

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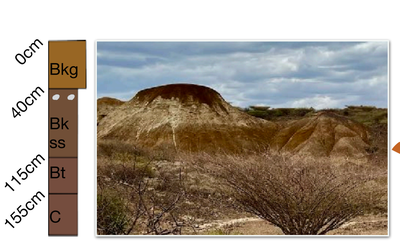
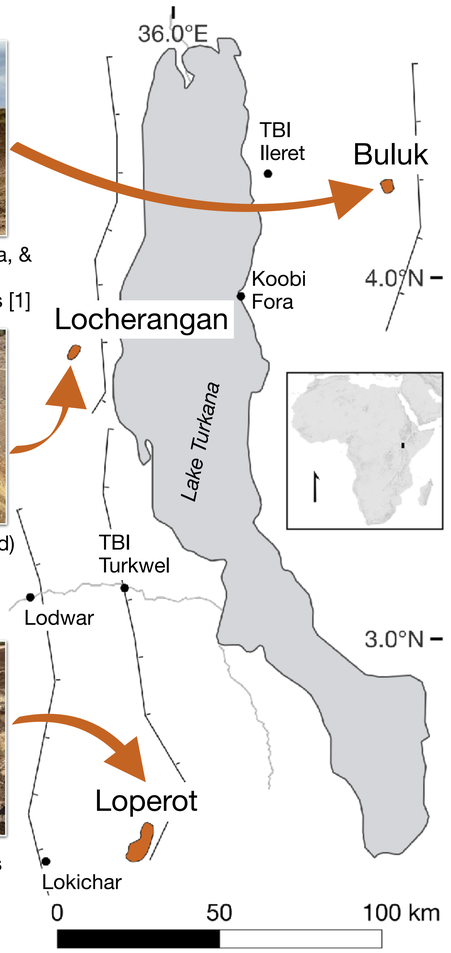


Buluk (16.7 Ma; Daasenach, Gabbra, & Mursi land) records a fluvial system with abundant paleosols and fossils [1]

Locherangan (17.5 Ma; Turkana land) preserves a sequence of lacustrine sediments, pyroclastics, and paleosols [2]

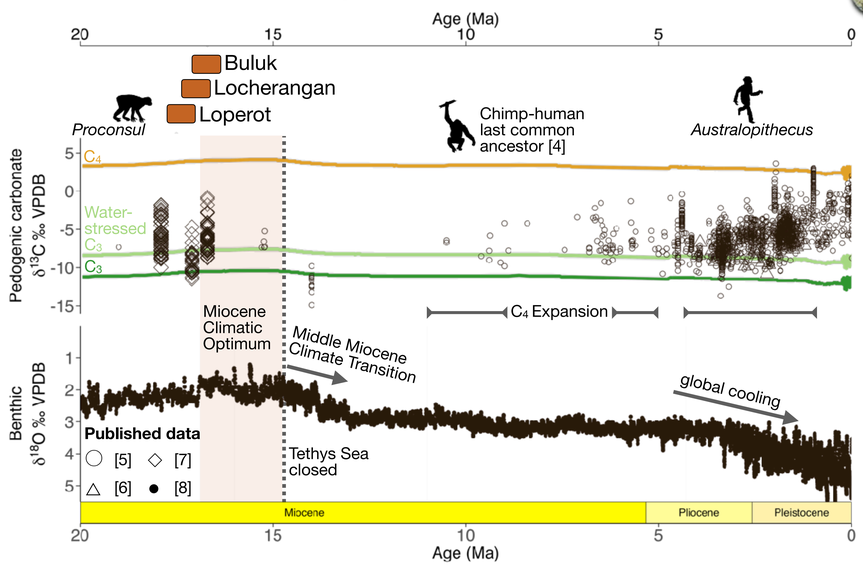
Loperot (19–17 Ma; Turkana land) is an extensive site interpreted as a perennial, riparian ecosystem [3]



Legend

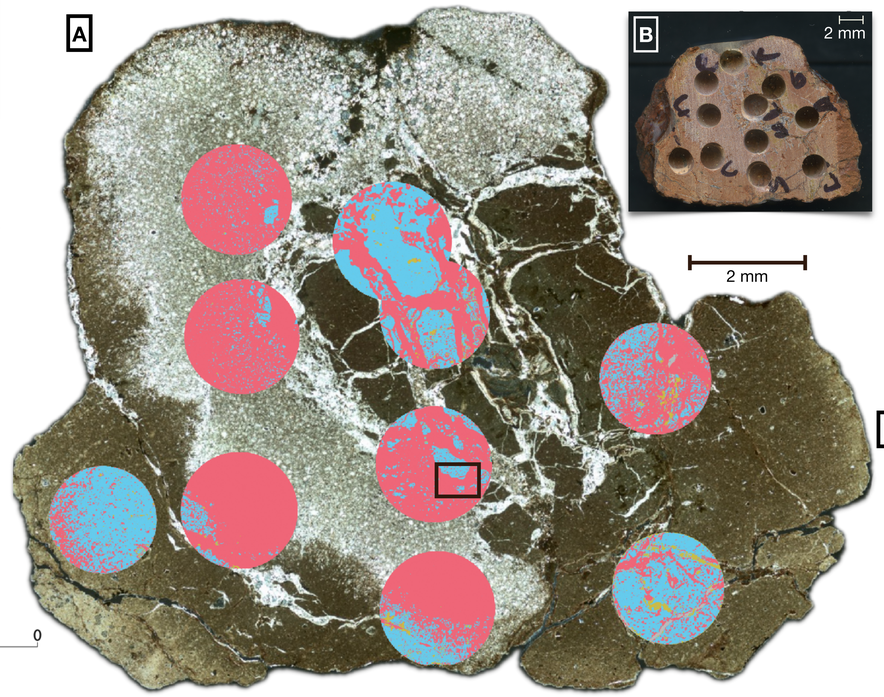
soil carbonate nodule · root trace · Miocene site

Profiles show one nodule-bearing paleosol from each site

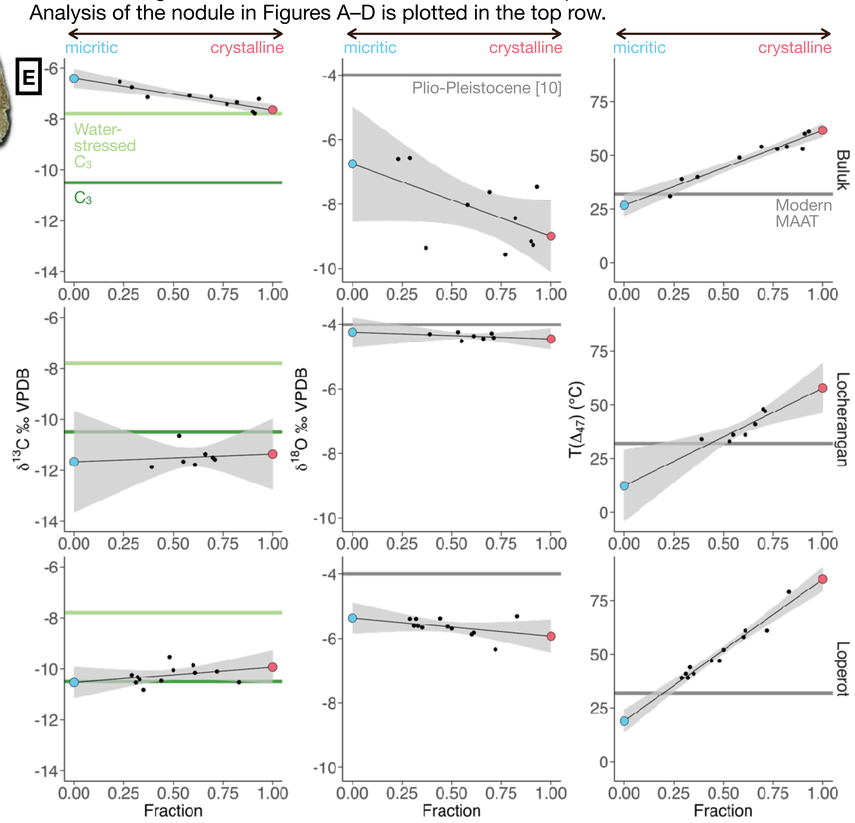


Summary

- ✦Paleoclimate proxies from Loperot (19–17 Ma), Locherangan (17.5 Ma), and Buluk (16.7 Ma) record conditions in the Turkana Basin through a period of topographical, hydrological, and biotic changes just prior to the Miocene Climatic Optimum
- ✦We interpret clumped isotopes of pedogenic carbonates using a two end-member mixing model incorporating micrite, which records paleotemperature, and diagenetic crystalline calcite with high (>50 °C) temperatures
- ✦Petrographic image segmentation and SEM analysis provide the basis for assigning calcite component percentages to each clumped isotope measurement
- ✦Results indicate warm paleotemperatures (23–27 °C) and wooded ecosystems (-11.7 – -6.4‰ $\delta^{13}C$ VPDB)
- ✦Future work includes integration with iCESM model results and proxy records from leaf waxes and teeth



A) Soil carbonate nodule in thin section in cross polarized light, circles show sub-sampled regions with image segmentation applied. Micrite is blue, spar is red, and other components (detrital quartz, clay, etc.) are yellow. B) Drilled nodule with labelled sub-samples. C) SEM image taken from outlined region of thin section. D) Spectra for spot analyses shown on grayscale image. E) Measurements shown with un-mixing lines and end-member values for one sample from each site. Analysis of the nodule in Figures A–D is plotted in the top row.



Methods

- Nodule sub-sampled haphazardly
- Thin section cut to correspond to sub-sampled surface
- Each sub-sample measured once for clumped isotope ratios using MAT253 Plus
- Trainable Weka Segmentation model [9] developed using two texturally distinct calcite components and other material identified from petrography
- Calcite components characterized using SEM, and area percentages estimated for each sub-sample measurement
- Inversion of two end-member linear mixing used to solve for stable isotope ratios

TURKANA MIOCENE PROJECT

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References **Contact**