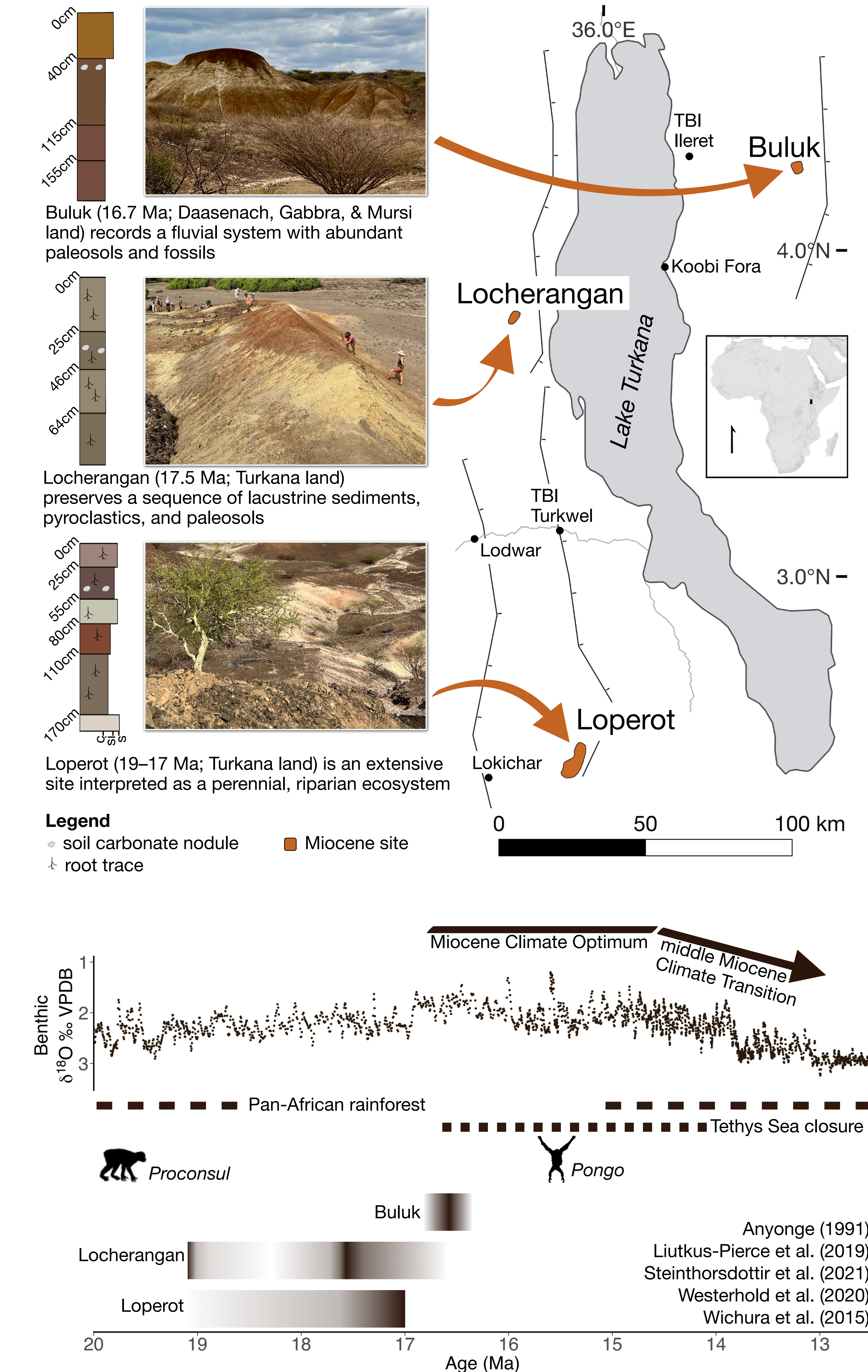


Soil carbonate stable isotopes reveal paleoenvironments characterized by hot temperatures and C₃ vegetation in the late Early Miocene, Turkana Basin, Kenya

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Key points

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, during which early hominids evolved

A new approach to sub-sampling soil carbonates reveals heterogeneity of calcite stable isotope ratios and accounts for diagenetic effects

Results indicate hot (30–35°C) and wooded ecosystems ($\delta^{13}\text{C} = -10 \text{ -- } -6\text{‰ VPDB}$) across the basin in the late Early Miocene

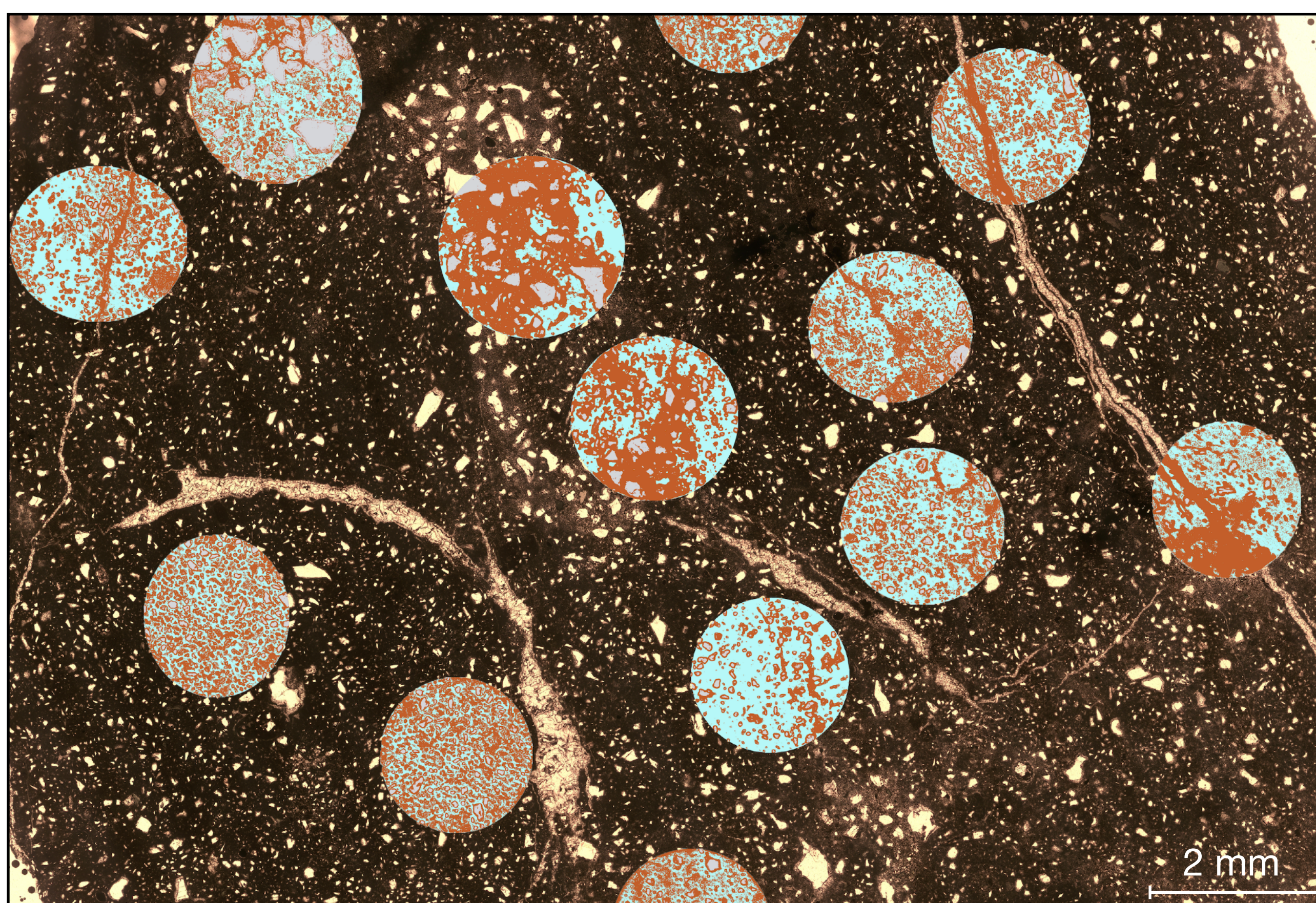
After this interval, proxies from eastern Africa show increasing temperatures, aridification, and grassland expansion



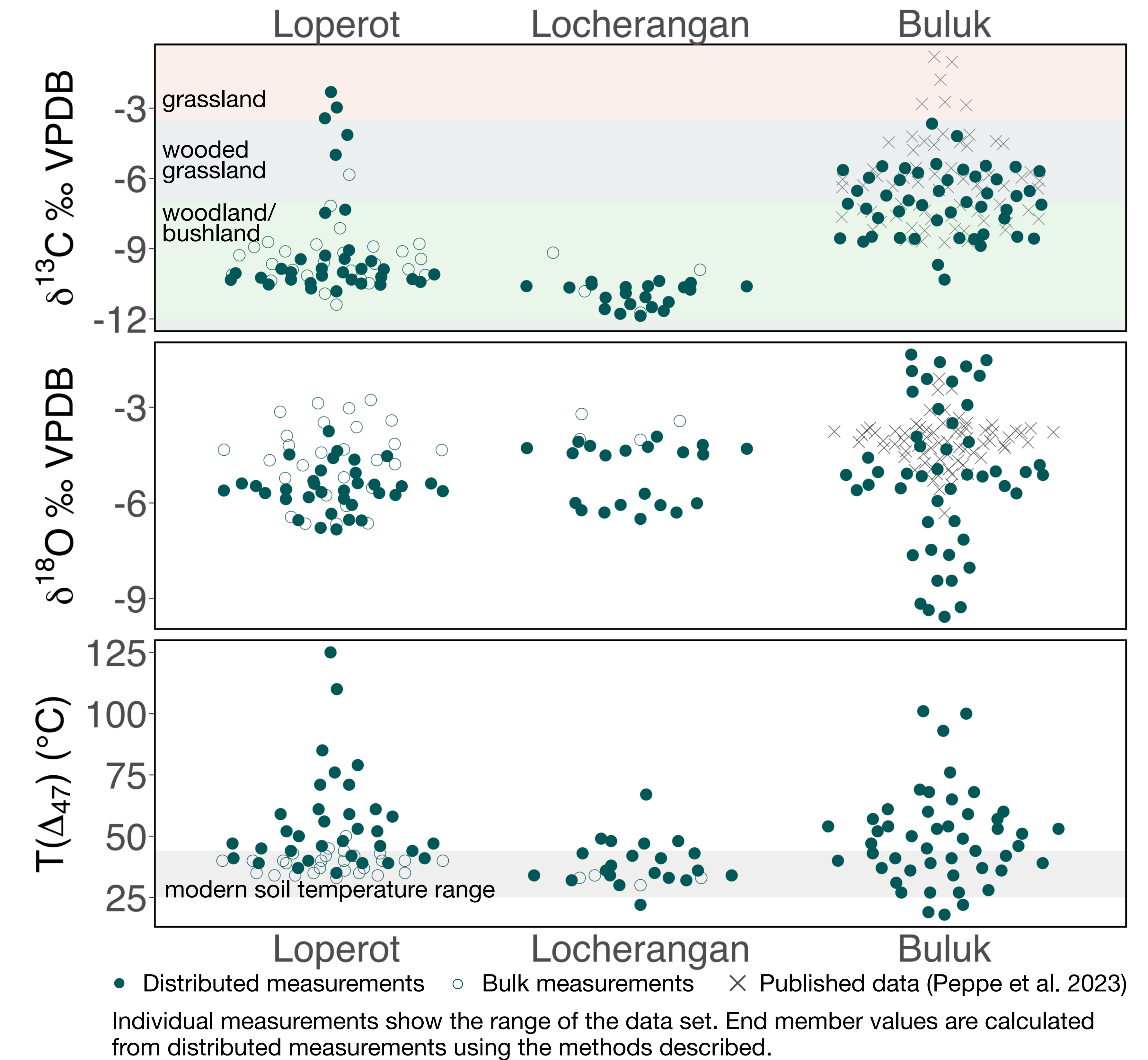
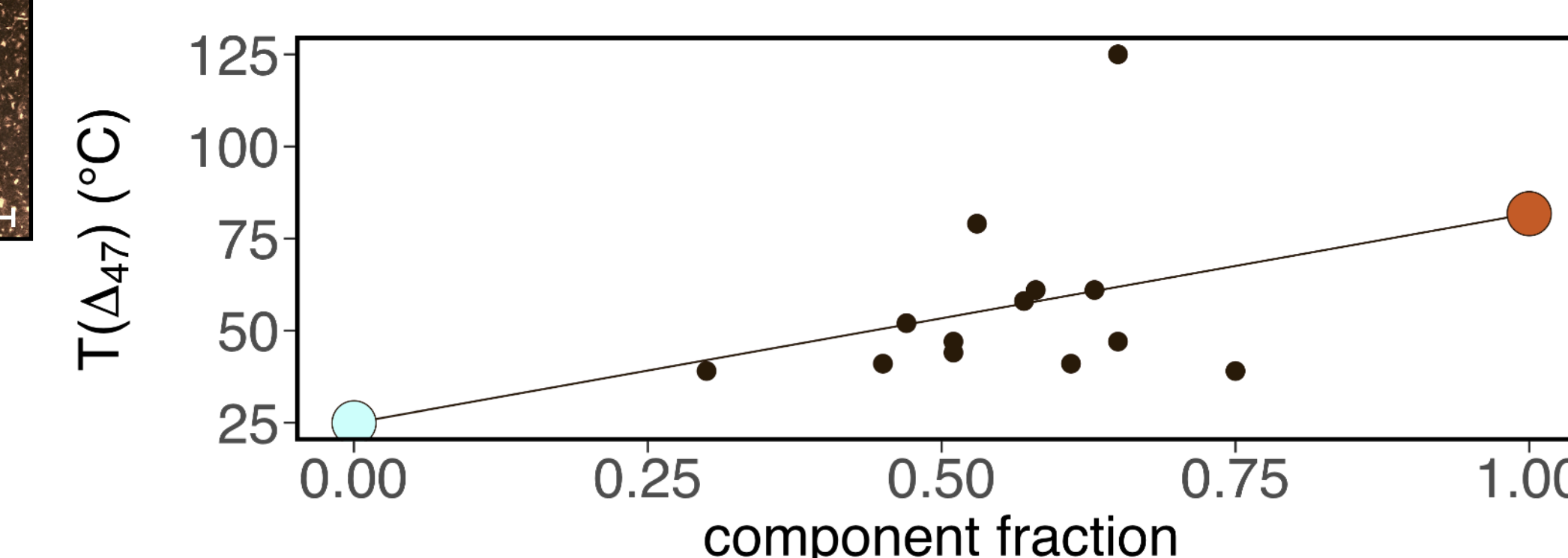
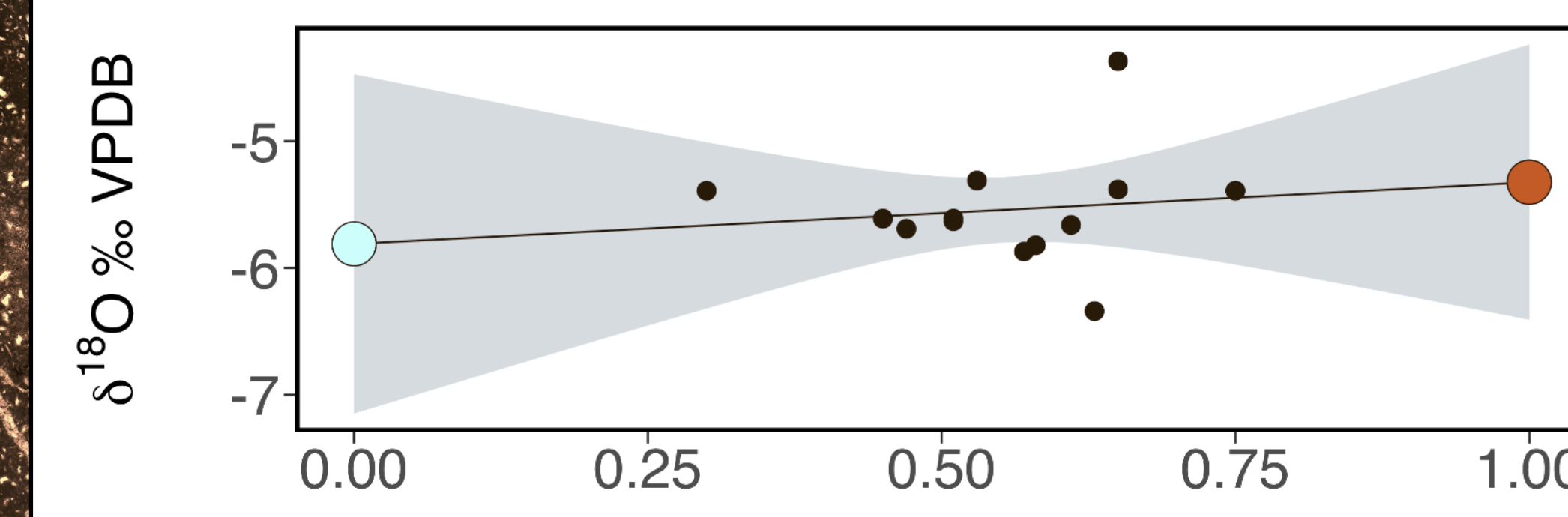
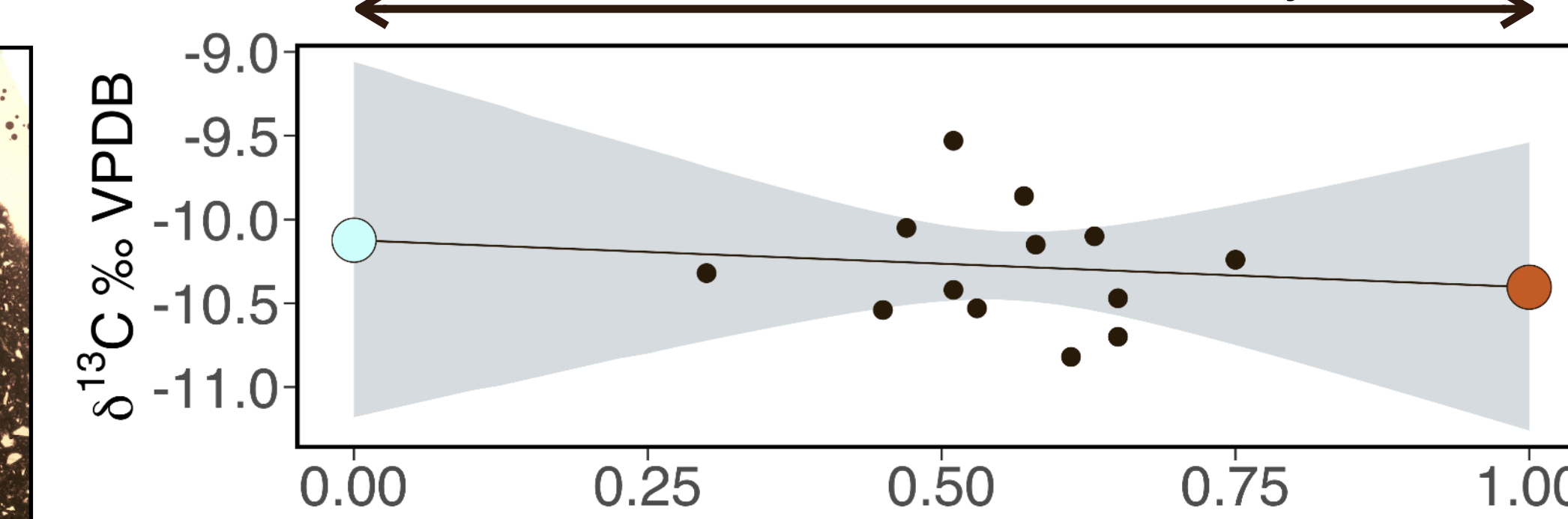
Methods

1. Nodule sub-sampled haphazardly
2. Thin section cut to correspond to sub-sampled surface
3. Trainable Weka Segmentation model developed using two texturally distinct calcite components and other material identified from petrography
4. Each sub-sample measured once for clumped isotope ratios using MAT253 Plus
5. Calcite component area percentages estimated for each sub-sample measurement and used to solve for end member stable isotope ratios

Sample shown is from a Btk horizon at Loperot



Top: Soil carbonate nodule with labelled sub-samples
Bottom: Thin section in plane polarized light, circles show sub-sampled regions with image segmentation applied. Micrite is blue, spar is orange, and other components (sand, clay, etc.) are gray
Right: Measurements of each sub-sample with linear un-mixing lines



Future work and collaborations

Interpretation of all measurements from late Early Miocene soil carbonates

Analysis of soil carbonates from Nakwai (22 Ma)

Comparisons with model results and other proxy data

See presentations by Turkana Miocene Project team members: Catherine Beck, Daeun Lee, Ruth Tweedy, and Kevin Uno

TURKANA MIOCENE PROJECT



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