Miocene-Pleistocene paleoclimate and paleoenvironment in the Meade Basin, Kansas

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The Meade Basin in southwestern Kansas preserves a unique record of paleovegetation and small mammal faunal change from the Miocene to the Pleistocene. Many of the paleosols preserved in this basin contain paleosol carbonate nodules, thick calcretes and abundant organic-rich horizons, which makes it ideally suited for a multiproxy study that explores the role of paleoenvironmental change in driving floral and faunal change. Prior work in this region revealed an increase in the $\delta^{13}C$ values of the paleosol carbonates, which is though to reflect an increase in C_4 vegetation in the Great Plains during this time; the driver(s) of this vegetation change remain uncertain however [*Fox et al.*, 2012].

To investigate the drivers of ecological change during this time, we characterized paleoenvironmental changes preserved in the Meade Basin sedimentary record using a variety of proxies, including carbonate clumped isotope paleothermometry, compound-specific isotope analysis of organic matter, as well as elemental and magnetic proxies for ancient precipitation from paleosol samples. Here, we focus on the carbonate samples where we measured carbon and oxygen isotopes ($\delta^{13}C_c$ and $\delta^{18}O_c$, respectively); used clumped isotope thermometry (Δ_{47}) to estimate soil temperature and soil water $\delta^{18}O$; and assessed the preservation state and additional paleoenvironmental features of the samples using optical and cathodoluminescence (CL) microscopy. The carbon isotope record matches previous studies from the region and shows an increase in the relative abundance of C_4 biomass on the landscape since the late Miocene. The Δ_{47} temperatures and the $\delta^{18}O$ of soil water, while variable, show no significant change in average values through time. The textural and luminescence characteristics suggest some samples have undergone moderate to extensive diagenetic alteration from groundwater fluids, perhaps causing some of the variability in the geochemical records. Soil depth may also account for some of the variability. Overall, these data suggest that temperature is unlikely to be the dominant factor driving paleovegetation and faunal change in this region from the Miocene to Pleistocene. In addition, these data highlight the importance of assessing preservation for all carbonate samples, regardless of whether or not the samples have been deeply buried.

Fox, D. L., et al. (2012) Pedogenic carbonate stable isotope record of environmental change during the Neogene in the southern Great Plains, southwest Kansas, USA: Carbon isotopes and the evolution of C_4-dominated grasslands. *GSA Bulletin*, v.124, 444-462.