Analysis of Dental Topography of the Early Eocene North American *Tetonius-Pseudotetonius* Lineage in the Bighorn Basin, Wyoming

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Introduction

- The late Paleocene-early Eocene site of the Bighorn Basin in Wyoming provides evidence of evolutionary change within mammalian species and lineages that once inhabited the area (Gingerich, 1980).
- One of the most significant influences believed to have driven these changes is the dramatic, rapid temperature increase of the Paleocene-Eocene Thermal Maximum (PETM; ca. 66 Ma) (Kraus and Riggins, 2007). This climatic event triggered the migration of a variety of taxa into North America, including omomyids, a group of early euprimates (Woodburne et al., 2009).
- The evolution of mammal species is influenced by both biotic and abiotic factors (Gingerich, 2006). This study aimed to determine how climate change may have affected the beginning of the omomyid radiation, specifically the *Tetonius-Pseudotetonius* lineage, in North America. In particular, change in the dietary niche of the *Tetonius-Pseudotetonius* lineage was examined.
- **Hypothesis: Shifts within relief index (RFI) values (a dental topographic measure that is a proxy for diet) within the *Tetonius-Pseudotetonius* lineage were correlated with changes in isotopic carbon (^{13}C) (a proxy for precipitation) and oxygen (^{18}O) (a proxy for temperature) during the earliest Eocene.**

Materials and Methods

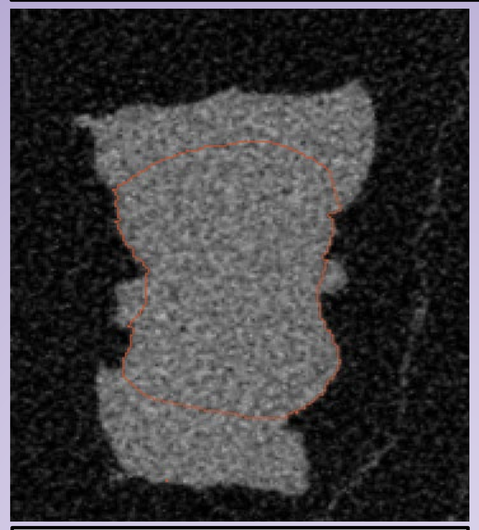

Figure 1. A single slice of the microCT scan of an omomyid specimen. Individual teeth were isolated mesially and distally with the use of Amira 5.2.0 software.

- This study contained 17 mandibular molars in the *Tetonius-Pseudotetonius* lineage from the Bighorn Basin ranging from time periods Wa2-Wa4.
- RFI values were compared with carbon (^{13}C) and oxygen (^{18}O) isotope values (Zachos et al., 2001).

Table 1. Specimens per time zone.

Time Zone	Number of Specimens	Species
Wa2	2	*Tetonius steini*
	1	*Tetonius matthewi*
Wa3	4	*Tetonius-Pseudotetonius*
	2	*Tetonius steini*
	1	*Tetonius sp.*
Wa4	7	*Tetonius-Pseudotetonius*
Total	**17**	

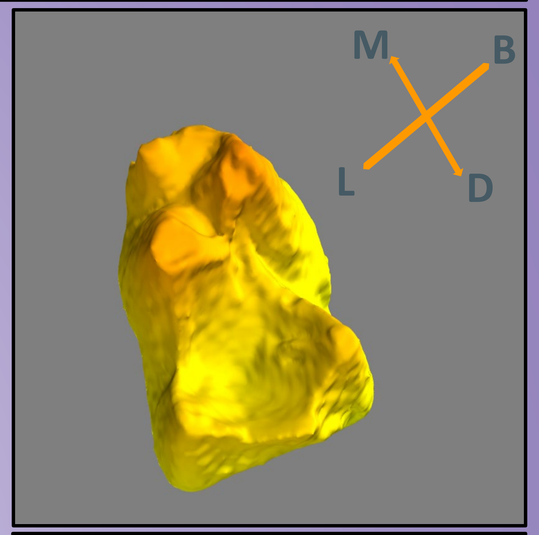

Figure 2. 3-D model of an omomyid molar. 3-D surfaces were reconstructed using Amira 5.2.0. RFI values were collected using MorphoTester. M=mesial, B=buccal, D=distal, L=lingual.

Results

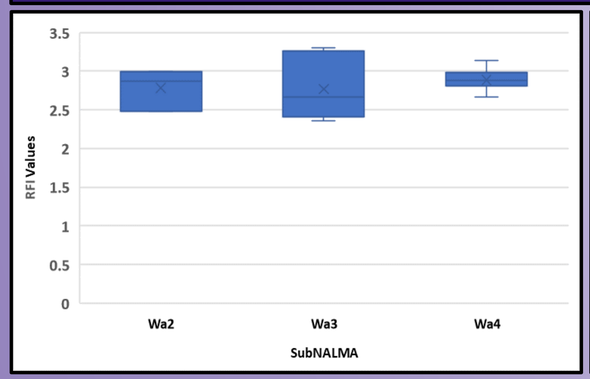

Figure 3. Box-and-whisker plot of RFI values for each time period.

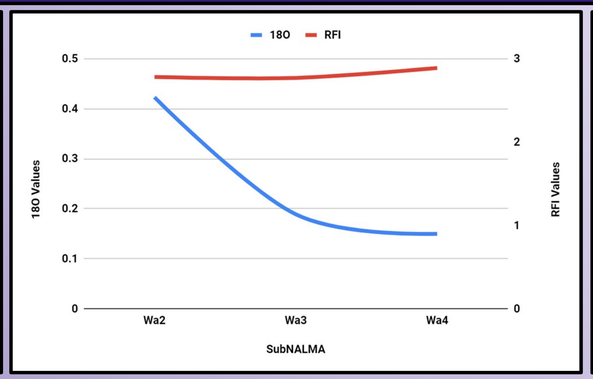

Figure 4. Correlation of isotopic ^{18}O with RFI (r=-0.540, p=0.637). The results indicate no correlation between these variables.

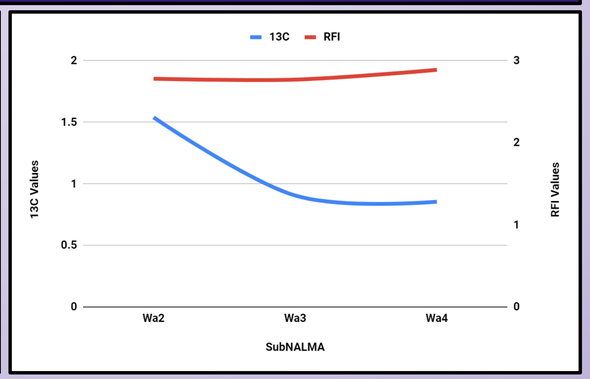

Figure 5. Correlation of isotopic ^{13}C with RFI (r=-0.483, p=0.679). The results indicate no correlation between these variables.

- An ANOVA was conducted to test for differences in RFI values among time periods (F=0.343, p=0.75). The results indicate no significant differences in RFI values across time periods.
- Pearson's correlation analyses were conducted between RFI values and both carbon and oxygen isotope data. The results indicate no correlation between RFI and either climate variable.

Discussion

- Results indicate that RFI values (and thus dietary niches) within the *Tetonius-Pseudotetonius* lineage did not change over time. This is surprising, as this lineage is often cited as a classic example of gradual evolution based on dental anatomical change. However, species delineations in this lineage are often defined by changes in premolar and incisor anatomy, while this study only examined changes in molar anatomy.
- Accordingly, there was also no significant correlation found between shifts in dietary niche and either climate variable. Thus, these findings suggest that the dietary niche of omomyids (at least within the *Tetonius-Pseudotetonius* lineage) did not respond to climatic changes following the PETM. This may indicate that even this soon after the PETM, these euprimates were successful and had established their ecological roles within their communities.
- Finally, it is possible that the small sample size of this study could contribute to the unexpected results. Increasing the sample size would mitigate the influence of randomness and provide a more accurate picture.

https://archive.org/details/ahistorylandmam00scotgoog

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