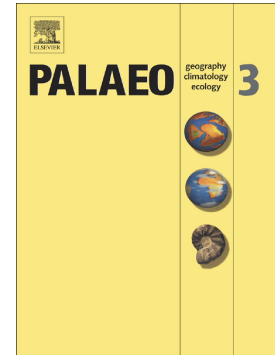


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Pieces of the Puzzle: Lack of Significant C₄ in the late Miocene of southern California

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Abstract

The stable carbon isotope ratios of tooth enamel from 89 herbivores from the Dove Spring Formation (DSF) of the El Paso Basin, western Mojave Desert, California were analyzed to determine if C₄ plants may have present in the late Miocene of southern California. Taxa analyzed include antilocaprids, castorids, camelids, equids, gomphotheriids, merycoidodontids, and rhinocerotids. The atmospheric CO₂-δ¹³C value has varied significantly in the geologic past, leading to changes in the δ¹³C values of plants and tooth enamel. The estimated δ¹³C value of atmospheric CO₂ in the middle to late Miocene is -5.8 ± 0.2 ‰, making the pure C₃ diet cutoff value higher than the modern by ~2 ‰. Given this, much of the evidence of an early spread of C₄, which inappropriately uses the modern C₃ diet cutoff value, may be a false signal from water-stressed C₃ plants and the amount of C₄ biomass in the geologic past may have been over-estimated. The enamel-δ¹³C values of all taxa sampled are -10.1 ± 1.1 ‰ (n=89). Accounting for the changes in the δ¹³C values of atmospheric CO₂, enamel-δ¹³C values from the DSF indicate that herbivores from that area had C₃ diets and lived in an environment dominated by C₃ plants.

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