Beeswax normal-alkane distributions and hydrogen isotope ratios as geo-location tools

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Recent awareness of the food industry's safety shortcomings has raise public concern about the lack of traceability of food products. Since organic material's hydrogen isotope composition (δ2H) directly relates to the 2H/1H ratio of local meteoric water, organic material's hydrogen isotope ratio record the spatial variations in meteoric waters that are characteristic to specific geographic areas. To test the applicability of geo-location based on compound-specific isotope ratios of food components, we studied forty-three beeswaxes collected from authentic producers at known locations within the United States, Australia, and New Zealand. We find Apis mellifera, the European honeybee, produces a unique and consistent hydrocarbon distribution with n-alkane δ2H values that ranged from -215 to 300‰. The n-alkane δ2H values are related to modeled-precipitation δ2H values for the commercial producers' location and these preliminary data indicate an apparent fractionation between precipitation and n-alkanes of -200 ± 22‰. Our isotopic and compound distribution data also suggest differences between interior honeycomb and comb caps may be related to temporal or spatial variations in hydrocarbon production. These preliminary data suggest beeswax hydrocarbon distributions and 2H/1H ratios can be use to elucidate the products source region precipitation δ2H value and may be applicable to other food products.