Hydrogen isotopic composition of *n*-alkanes from leaf waxes: An empirical evaluation of environmental controls

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The primary objective of this work is to evaluate the environmental controls on the hydrogen isotopic compositions of *n*-alkanes from higher plant vegetation. Our goal is to establish the foundation of a new proxy that can be used to assess regional changes in evapotranspiration and effective moisture. We are in the process of collecting leaves from trees throughout strong climatic gradients in Hawaii, California, and the Yucatan Peninsula, Mexico. These data will be interpreted in the context of environmental parameters (such as precipitation, temperature, altitude, and the isotopic composition of precipitation) in order to assess their relationship with D/H ratio of leaf *n*-alkanes. δD and $\delta^{13}C$ compound-specific measurements are being conducted on *n*-alkanes from 70 samples of *Metrosideros polymorpha* in Hawaii and 150 samples of *Quercus kelloggii* in California. Preliminary *n*-alkane isotopic data from *Quercus kelloggii* show a clear separation between leaves in the relatively wet northern California (δD -188 to -216‰) and leaves in the relatively dry southern California (δD -156 to -184‰). Differences in the amount of precipitation between these two regions could be one of the factors that resulted in these isotopic differences.

Furthermore, we are assessing the application of this methodology to paleorecords by using lacustrine sediment cores from three lakes on the Yucatan Peninsula. Initial results from isotopic measurements of D/H ratio of *n*-alkanes in lacustrine organic matter show enrichment/depletion patterns (δD variations up to 50‰) similar to those observed in $\delta^{18}O$ of ostracod and gastropod shells ($\delta^{18}O$ variations up to 5‰). This similarity indicates that regional changes in the paleohydrological balance had comparable effects on the isotopic composition of terrestrial and aquatic biota in or near these lakes.

DNA from fossils: Lake embedded plant and sediment remains

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About 20 years ago, DNA sequences were separately described from the quagga (a type of zebra) and an ancient Egyptian individual. What made these DNA sequences exceptional was that they were derived from ancient and extinct species. However, ancient DNA research, defined broadly as the retrieval of DNA sequences from museum specimens, archaeological finds, fossil remains, and other unusual sources of DNA, only really became feasible with the advent of techniques for the enzymatic amplification of specific DNA sequences. Today, reports of analyses of specimens hundreds, thousands, and even millions of years old are almost commonplace. Despite repeated claims of the isolation of DNA from lake embedded fossil remains, up to several millions of years old. None to date have been replicated independently, an essential criteria of authenticity for all ancient DNA research today. While million year old DNA from lake embedded plant remains has not be replicated, recent results from moderately aged beech and hemlock fossils from similar settings, appears to be reproducible. Thus the question remains, how old can one go in lake sediments? Theoretical and emperical results on this possibility will be discussed. I will also highlight some significant results and areas of promising future research.