Phylogenic control on leaf wax hydrogen isotopic fractionation in modern vascualr plants and intra-leaf variations

YONGSONG HUANG

Department of Earth, Environmental and Planetary Sciences, Brown Univerisity, Providence, RI, USA 02912 (yongsong_huang@brown.edu)

Hydrogen isotopic ratios of terrestrial plant leaf waxes (δD) have been widely used for paleoclimate reconstructions. However, underlying controls for the observed large variations in leaf wax δD values in different terrestrial vascular plants are still poorly understood, hampering quantitative paleoclimate interpretation. Here I will discuss our recent study of a large collection of 102 plant species from New York Botanic Garden, chosen to represent all the major lineages of terrestrial vascular plants and multiple origins of common plant growth forms [1]. We found that leaf wax hydrogen isotope fractionation relative to plant source water is best explained by membership in particular lineages, rather than by growth forms as previously suggested. Monocots, and in particular one clade of grasses, display consistently greater hydrogen isotopic fractionation than all other vascular plants, whereas lycopods, representing the earlier-diverging vascular plant lineage, display the smallest fractionation. Data from greenhouse experiments and field samples suggest that the changing leaf wax hydrogen isotopic fractionation in different terrestrial vascular plants may be related to different strategies in allocating photosynthetic substrates for metabolic and biosynthetic functions, and potential leaf water isotopic differences.

I will also discuss results from anatomical analyses of plant leaf wax isotopic ratios from base to tip of leaves in various modern plants [2,3]. We found consistent trends of leaf wax hydrogen isotopic enrichment from base to tip of all plant samples examined. These results have implications on the timing of leaf wax production during seasonal growth cycles, and are important for interpreting leaf wax hydrogen isotopic records in sediment samples.

[1] Gao *et al*. (2014) *PLOS one* DOI: 10.1371/journal.pone.0112610. [2] Gao & Huang (2013) Oecologia **172**, 347-357. [3] Gao *et al* (2015) *Org. Geochem*. **78**, 144-152.