The Effects of Environmental Change on Plant Lipid Production

Dorthy Fang, Columbia University, Lamont-Doherty Earth Observatory Spring Intern Program
Advisor: Dr. William D'Andrea, Geosciences, Lamont-Doherty Earth Observatory

Introduction:

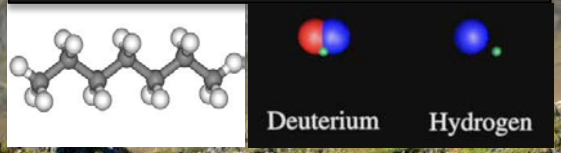
Remnants of leaf waxes extracted from sediments can be used as lipid biomarkers to reconstruct past environments and climate change over time. In particular, hydrogen isotope ratios in *n*-alkanes are reflective of factors such as temperature and moisture source, because the hydrogen comes directly from water in the environment. However, a better understanding of the mechanisms involved in plant production of waxes is needed in order to reconstruct ancient biogeochemical processes and environments, as theses processes are currently not understood very well.

The Arctic is an area which is currently undergoing dramatic climate change, and thus it is an area of particular interest for climate and environment reconstructions. This study will analyze and compare the waxes on the leaves of several terrestrial and aquatic plants collected on expeditions to the Arctic by creating chromatograms for carbon isotopes in the *n*-alkanes of the plant waxes. This study aims to better understand factors which affect the composition of plant waxes as well as the differences between waxes of different plants living in the same environment.

Study Area:

The plant samples being were collected from the north slope of the Brooks Range, in Alaska and the island of Bjornaya, in Norway, where sediment cores were also taken.

Important Compounds: An alkane, deuterium, and hydrogen molecule



Questions We Hope to Help Answer:

1. How do plant lipids change in response to environmental change?
2. How specific are leaf lipids to plants in one environment (ex: around the same lake)?
3. Are there any alkanes restricted to one type of vegetation? What is the variability of plant lipids in an environment?
4. Are leaf wax distributions determined by DNA or the environment?

Methods:

21 plant leaf samples, collected from Norway and Alaska as well as a blank to serve as a control were analyzed. They include two aquatic plants and 19 terrestrial plants.

- Recorded initial masses of plant samples.
- Solvent sonicated plant samples in hexane 3x to remove lipids.
- Transferred lipids into 4 mL vials for analysis.
- Used silica gel columns to perform column chromatography. Total lipid extracts were separated into different classes of compounds with hexane, dichloromethane, and methanol. The *n*-alkanes were collected with hexane.

Future Steps:

- Run the hexane fractions on a Gas Chromatograph-Flame Ionization Detector (GC-FID)
- Analyze the carbon isotope amounts in different plants by comparing the chromatograms
- Measure deuterium to hydrogen ratios in lipids