

Title: Validating the MBT/CBT paleotemperature proxy in a lacustrine setting and extending the record of temperature variability in the Northeast USA

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Purpose: Maintain sediment traps in Basin Pond, ME, and study the seasonal production of organic compounds used as proxies for past climate changes.

Introduction and Background: Branched glycerol dialkyl glycerol tetraethers (brGDGTs) are widely used to reconstruct past temperature in lakes, but little is known about their production. A major source of uncertainty is the *seasonality* and *depth* of in-lake brGDGT production. In 2014 we designed and deployed five sediment traps in Basin Pond, ME to address two questions:

(1) What time(s) of year are brGDGTs produced?

(2) What is the depth of maximum brGDGT production?

We collected data over an entire year (see Table 1). In June 2015, we removed the sediment traps from Basin Pond for repairs and alterations in anticipation of future re-deployment.

Broader Impacts and Outreach: Our work on Basin Pond generated considerable local interest and we personally engaged with community members during each of our visits, showing them how the sediment traps worked and responding to questions about the geological history of the lake. In addition, photos and information about the project were distributed to community members via the Basin-David-Tilton Pond Annual Newsletter in September 2015.

Results: We were awarded \$900 for the second year of this project. Funding was spent on material needed for fieldwork (cord for more stable lines for temperature loggers) and laboratory analysis (filtration system equipment). In June 2015, samples were collected from the sediment traps and sediment traps were pulled from Basin Pond after being in operation for one year. At this time, temperature loggers were deployed to record measurements at 1 hour intervals throughout the water column, as well as one temperature logger to measure surface temperature of the catchment area. In October, the catchment area temp logger was collected, water column hydrolab profiles were taken, and catchment area plant samples were collected. The water column temperature loggers could not be located.

Major laboratory analysis was completed over the summer, including the filtering of all 20 water column samples. Samples were then prepared and run on a High Performance Liquid Chromatograph coupled to a Mass Spectrometer (HPLC-MS) for GDGT analysis. From these samples, variability between water depths and time of year were clearly seen (Table 1).

Ongoing and Future Work: To continue work on the Basin Pond Project, we will analyze the remaining soil samples from around the catchment via HPLC-MS to determine what brGDGTs are produced in soils. We will also rerun each of the sediment trap samples at higher concentrations to confirm our initial results (Table 1) and verify where and when the brGDGTs are being produced in the water column. We will thereby determine the season of greatest production for GDGTs in Basin Pond. This information may be widely applicable to studies of other small lakes in the mid-latitudes. We will also compare the MBT/CBT brGDGT temperature reconstructions from the soil, core top, and sediment trap samples with temperatures recorded by a local weather station to determine whether the GDGTs are accurately recording temperatures.



Photos from Basin Pond. Collecting the sediment traps at Basin Pond in June 2015. The sediment traps were cleaned, repaired and improved for future deployments.

Sed trap samples			IV	III	IIIb	IIIc	II	lib	lic	I	Ib	Ic
Collection	trap											
Date	depth (ft)		1292	1050	1048	1046	1036	1034	1032	1022	1020	1018
8/16/14	100	n.d.	-	-	-	-	-	-	-	-	-	-
8/16/14	80											
8/16/14	60											
8/16/14	40											
8/16/14	20											
9/14/14	100											
9/14/14	80											
9/14/14	60											
9/14/14	40											
9/14/14	20	n.d.	-	-	-	-	-	-	-	-	-	-
6/4/15	100											
6/4/15	80	n.d.	-	-	-	-	-	-	-	-	-	-
6/4/15	60											
6/4/15	40											
6/4/15	20	n.d.	-	-	-	-	-	-	-	-	-	-
Soil samples												
5/28/14	BPS 331											
5/28/14	BPS 333											
5/28/14	BPS 338											
5/28/14	BPS 341											
5/28/14	BPS 348											

Table 1. Presence of branched GDGTs in Basin Pond sediment trap samples (upper rows) and Soil samples (lower rows). N.d. indicates that the samples have to be re-run because the instrument was not functioning properly during the initial injection.