DISSERTATION ABSTRACT

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Interglacial Temperature Variability in the High-Latitude North Atlantic Region Inferred from Subfossil Midges, Baffin Island (Arctic Canada) and Iceland
Thesis directed by Professor Gifford H. Miller

Paleoclimate records provide our only empirical data regarding the long-term workings of Earth's climate, and as such play an essential role in understanding natural and anthropogenic climate change. This dissertation presents Holocene paleotemperature records from four lakes in the sensitive high-latitude North Atlantic region, and a pre-Holocene temperature record from one of these sites. Quantitative transfer functions are used to infer paleotemperatures based upon assemblages of subfossil midges (Diptera: Chironomidae) preserved in radiocarbon and luminescence-dated lake sediments.

Midge data from three Icelandic lakes indicate that the north Iceland coast was cooler than present throughout the early to middle Holocene. This contrasts with many sites on Iceland and across the Arctic that experienced an early to mid-Holocene "thermal maximum" in response to enhanced summer insolation forcing. Suppressed terrestrial temperatures along the northern coastal fringe of Iceland were most likely a result of sea surface conditions on the North Iceland shelf.

In contrast, peak warmth on northeastern Baffin Island occurred during the first millennia of the Holocene, roughly in phase with peak insolation forcing. The magnitude of early Holocene warmth at Lake CF8 (5ºC warmer than present) far exceeds hemispheric averages, and implies that powerful positive feedbacks enhanced radiative forcing in this region. Early Holocene warmth was interrupted by two cold reversals between 9.5 and 8 ka, which may correlate with the well-known "8.2 event" and widespread abrupt climate changes that occurred ca. 9.2 ka. Maximum last-interglacial temperatures at Lake CF8 were not significantly different from peak Holocene temperatures. This is surprising given that temperatures during the last interglacial period apparently exceeded peak Holocene temperatures at many sites around the high-latitude Northern Hemisphere.

This research adds to growing evidence for spatial heterogeneity in the climatic response to insolation forcing, as well as non-linear climatic and environmental responses to both abrupt perturbations and gradual changes in radiative forcing during interglacial periods. Climate is clearly modulated by local- and regional-scale factors that complicate the response to global- and hemispheric-scale forcings, and add to the challenge of forecasting future climate change.