ORAL PRESENTATION

LAKE SENSITIVITY TO LATE HOLOCENE CLIMATE DRIVERS: A DIATOM-DEPTH MODEL FOR THE WESTERN GREAT LAKES REGION

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Pollen-based studies from the western Great Lakes region show that lakes provide excellent records of Holocene climate effects on landscapes. Less is known about the effects of climate on lakes in this region. The existing lake and landscape records show overall regional synchrony to major climate periods (Holocene Thermal Maximum), but less synchrony or regional and lake-landscape cohesiveness in response to shorter climate anomalies. In particular we lack records of lake response across parts of this region to Late Holocene climate periods such as the Little Ice Age. One such region, the northwestern Wisconsin Sand Plain, is positioned at the ecotone of the Great Plains and the eastern deciduous forest, and may be highly responsive to climate change. Here we examine a sediment core from a lake positioned high in the landscape and use diatoms to reconstruct historical lake depth for the last 4000 years.

A transect of sediment cores was collected in 2010 from Cheney Lake, Douglas Co., WI. Cheney Lake is a relatively small (<10 ha), seepage lake with a deep basin (~6 m) and simple bathymetry, surrounded by jack pine forest and no buildings or roads. To reconstruct historical changes in lake depth, a depth-diatom model was constructed based on diatom species-depth relationships from a set of 18 modern surface sediment samples (0-1 cm interval) collected in 2012 from Cheney Lake at depths of 0.5 to 5 m. A transfer function was developed using weighted-averaging (WA) regression techniques along with canonical correlation (CCA) and redundancy analysis (RDA) to test model error and variance explained.

A 92 cm long core recovered from 53 cm water depth was imaged and analyzed for loss-on-ignition, pollen, and diatoms at 1 cm resolution. The core preserved several sand lenses indicative of historically shallower lake conditions. A minimum of 300 valves per sample was counted to obtain a sub-century history of the diatom species assemblage in Cheney Lake. Historical diatom-inferred lake depth was estimated by applying weighted-averaging calibration (WA) techniques using each species depth optimum. Validity of model results was assessed with the modern analogue technique (MAT).

Model output suggests that Cheney Lake may have been almost 6 m deeper beginning around 4000 cal BP, nearly twice as deep as the modern lake. Deep lake conditions, which are reflected in the diatom species assemblages, persisted for several thousand years. The reconstruction also suggests a gradual shallowing of water depth

starting around 1500 cal BP, reaching minimal depths around 1100 cal BP. Lake levels rebound around 900 cal BP and remain ~4 m above modern lake level until around 250 cal BP. An abrupt shift in the moisture regime is evident around the time of European contact, when lake levels fell to current low levels, never to return to pre-contact lake levels.