Johnston, J.W., Thompson, T.A., and Baedke, S.J., 2002a, **Late Holocene quasi-periodic lake-level fluctuations in the upper Great Lakes**, *Geological Society of America Annual Meeting & Exposition*, October 27-30, Denver, Colorado, Abstracts with Programs, v. 34, no. 6., p. 550.

Sedimentological analysis of hundreds of beach ridges preserved in embayments along the upper Great Lakes coastline has greatly improved the understanding of past water-level fluctuations, vertical ground movement, and shoreline behavior over the past 5,000 years. Comparing several continuous overlapping relative lake-level records from multiple sites around a common lake permits the removal of vertical ground movement from each site to produce a combined hydrograph for the entire lake. The hydrograph provides a framework to study shorter-term fluctuations superimposed on longer-term fluctuations and, thus, a proxy for paleoclimate.

Three different superimposed quasi-periodic water-level fluctuations having average durations of approximately 33 years, 160 years, and 1,500 years have been identified in the hydrograph for Lake Michigan. Statistical analysis of 90 radiocarbon dates from five different study sites indicates that a 33-year water-level fluctuation forms a beach ridge and a 160-year water level fluctuation forms a group of beach ridges, commonly five in each group. The more qualitative 1,500-year water level fluctuation seems to correlate to the Nipissing II phase, Algoma phase, and an unnamed phase centered around 1,700 calendar years before present. Preliminary analysis of data from Lake Superior suggests these fluctuations also occurred in Lake Superior.

Evaluating past water-level fluctuations is difficult because of two complications: each water-level fluctuation is not equal in amplitude or period (quasi-periodic) and quasi-periodic fluctuations are superimposed on each other . These complications become very important when attempting to forecast water levels. A range in water-level amplitude and periodicity must be calculated to account for the quasi-periodic nature, and the interaction of multiple fluctuations superimposed on each other must be accounted for. The quasi-periodic fluctuations of 33, 160, and 1,500 years in duration provide a framework to properly evaluate shorter duration events. In the worst case scenario, if all three quasi-periodic high water-level fluctuations occur simultaneously, the effects would be additive and an even shorter-term fluctuation, such as an annual high water level event, would elevate water levels significantly higher.