Sharma, S., Zanazzi, A., Mora, G., Johnston, J. W., Thompson, T. A., and Baedke, S. J., 2003, **Assessment of the influence of climate on the water balance of Lake Superior during the late Holocene as inferred from stable isotope ratios in swale sequences**, *Geological Society of America Annual Meeting & Exposition*, November 2-5, Seattle, Washington, Abstracts with Programs, v. 34, no. 7., p.210.

Holocene sequences of beach ridges commonly present along the coastline of the Great Lakes provide a good avenue for long-term reconstructions of lake water levels. These reconstructions have indicated large and relatively rapid lake-level fluctuations for the past 4,000 years that resulted from the interplay of climate, differential isostatic rebound, and outlet dynamics. The goal of our study is to decouple the role of climate in controlling long-term lake levels. Our approach consists of analyzing peat sequences from three sites bordering Lake Superior. These sites were selected because relative lake level curves have already been produced using the internal architecture and timing of development of beach ridges. In particular, we use stable isotope ratios in detrital organic matter to assess changes in paleo-environmental conditions.

Peat samples were collected from the deepest point of swales with the aid of a wide-diameter piston corer and hand-augers. Terrestrial plant macrofossils and charcoal fragments were collected from the peat samples for radiocarbon dating. Obtained radiocarbon dates indicate that the peat sequences span the last 3,500 years. A sub-set of collected terrestrial macrofossils was used for isotopic analysis. The macrofossils were air-dried, powdered, homogenized, and washed with alkaline solutions to remove soluble organic acids. The carbon and nitrogen isotope ratios were determined for the macrofossils, resulting in values ranging from –28.7 to –27.0 per mil for carbon isotopes and from –2.5 to +2.1 per mil for nitrogen isotopes. There is a weak covariance between carbon isotope ratios and reconstructed lake-levels. Higher carbon isotope values correlate with relatively low lake levels. Under conditions of low humidity or water stress, plant stomata restrict the supply of carbon dioxide to the leaf, resulting in higher carbon isotope values. Based on these observations, we conclude that low lake-levels in Lake Superior are associated with drier conditions as inferred from the carbon isotope data. Diagenetic and inter-species isotope effects, however, are confounding factors in our interpretations. To further resolve the influence of climate, work is currently underway to determine the oxygen isotopic composition of cellulose extracted from the peat sequences.