Inter-disciplinary Effort Yields New Data on Lake Michigan Coastal Dunes and Archaeology

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The combination of archaeological expertise, geographic knowledge and new technology which lets scientists accurately date sand have come together in a new research study on the formation, age and life cycle of Lake Michigan coastal dunes and the archaeological sites found in them.

MSU Geography Chair Alan F. Arbogast has spent years studying the evolution of coastal dunes throughout the lower Lake Michigan basin. Meanwhile, William A. Lovis, curator at the MSU Museum and professor of anthropology has undertaken archaeological studies of human habitation along Lake Michigan. And finally, G. William Monaghan, a senior research scientist and associate director of the Glenn A. Black Laboratory of Archaeology at Indiana University was itching to test a new luminescence-based technology to find out the age of windblown sand deposits.

Together they have presented their results in a new book titled “The Geoarchaeology of Lake Michigan Coastal Dunes,” published this summer by the Michigan Department of Transportation through Michigan State University Press.

The research was funded by the Michigan Department of Transportation and the book series is edited by James A. Robertson, MDOT archaeologist.

“This is really filling a hole in the dune chronology that has been written previously,” said Dr. Arbogast.

Previously, Dr. Arbogast’s research in the southern dunes of eastern Lake Michigan has shown initial dune activity to take place in the mid-Holocene epoch – or about 5,000 years ago.

However, when exploring the dunes on the lake’s northern coast, the trio consistently found evidence that dune activity in this part of the basin apparently began between 3,500 and 2,000
years ago, and that a significant period of dune growth occurred as recently as 1,000 years ago. The later interval coincides with the Medieval Warm Period.

“We found more dunes becoming active across a larger area later than we expected,” said Dr. Monaghan. “There are very early dunes in that area but not as many as people thought and they are not as large or as extensive as people thought.”

The key to reconstructing dune histories in this part of the basin is a relatively new technology called Optically Stimulated Luminescence or OSL dating. Traditionally, researchers have used radiocarbon dating of the organic materials left in soils or archaeological sites buried within dunes to get a reasonably accurate idea of when those soils or sites were buried. However, soils buried within dunes are rare in the northern end of the Lake Michigan basin and dunes contain little to no organic material, making the utility of radiocarbon dating limited.

OSL dating is a technique that allows an estimation of when sand grains were last exposed to light as they were deposited. Dunes contain an abundance of quartz grains, which contain micro-fissures on their surfaces that trap electrons released through the decay of radioactive isotopes, such as potassium and uranium, that also occur in other minerals found within dunes. The trapped electrons are absorbed into quartz at known rates but are released instantaneously when exposed to light. By collecting buried quartz-rich sands and keeping them in the dark, scientists can re-expose the sample to light, measure the radioactivity in the quartz, and “date” how long the sand has been buried.

“This is a revolutionary application of a new technique. It just took getting together the right group of people to make it happen,” said Dr. Lovis. “This is both interdisciplinary and inter-institutional combined with some deeply applied science.”

While the new dating technology is important in dating the activity of the dunes, the archaeological sites remain invaluable in providing data and dates for times when the dunes were stable and able to host human settlements. By knowing the age and duration of human occupation, the researchers can determine how long dunes remain stable between periods of either growth or erosion.

The results of their study has not only given archaeologists insight into the way in which archaeological sites are buried and preserved along Lake Michigan but it also “provides a wealth of information for the understanding and managing of dunes through the Great Lakes.”

Now that Drs. Lovis, Monaghan and Arbogast have been able to date the northern dunes, they are turning their research to the question of why so few dunes exist from 5000 years ago, and why the dunes were active during that specific period 1,000 years ago. They believe there is a
combination of factors including lower lake levels at the time of the dune activity, increased wind activity and naturally occurring climate cycles.

“One question we’d like to answer is what we can expect as climate change moves forward,” said Dr. Monaghan. “It is far more complicated than we knew.”

The trio also hopes their research will be useful to the state in fulfilling its responsibilities to manage and preserve the dunes as well as preserving archaeological and cultural sites that lie within them.

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