# GLACIAL OHIO 2002: THE LAST GLACIAL / INTERGLACIAL TRANSITION: THE RECORD FROM OHIO'S LAKES AND BOGS

**DON PAIR**
University of Dayton

**GREG WILES**
The College of Wooster

**TOM LOWELL**
University of Cincinnati

## PROJECT OVERVIEW

The ultimate goal of the Glacial Ohio Keck Project was to contribute to an understanding of the patterns, processes and causes of climate variability in the Great Lakes region of North America. Student research associated with the 2002 Glacial Ohio Project recovered nine sediment cores and furnished twenty five radiocarbon dates. Their results document the retreat of the Laurentide Ice Sheet, and provide a near-continuous record of environmental change through the last glacial/interglacial transition.

Students assembled in Dayton, Ohio for orientation and then traveled to the Canadian Rockies to study modern glacial and lacustrine systems within Banff Provincial Park. At each field stop students described the setting, used hand-held soil corers to sample basin sediments, and built facies models. These localities included many of the features that they would subsequently encounter on a continental ice sheet scale in Ohio. Observing the evolution of a series of lakes from kettles to bogs in the Canadian Rockies also provided the basis for interpreting sediment cores in Ohio. The group then returned to Ohio to extract cores in the field. Students stayed in dorms and conducted initial laboratory analyses at the University of Dayton's Keck Environmental Laboratory. The students then returned to their home institutions and performed additional analyses commensurate with their particular facilities and interests.

## BACKGROUND

Ice sheet advance and retreat patterns can provide important records of climate variability (Broecker and Denton, 1989). The low regional topography of the Great Lakes region allowed the Laurentide Ice Sheet to extend to its southernmost position during the Last Glacial Maximum. Subsequent ice retreat left a complex sequence of active and stagnant-ice landforms. Associated kettle and lake basins found adjacent to and on top of the glacial drift can also preserve a record of deglacial and vegetation history. Shane (1987) provided a general understanding of this history based on pollen analysis from four basins in western Ohio. Keck Glacial Ohio 2001 processed the records from nine other basins and greatly expanded the Ohio database (Figure 1).

## Methods

Both Keck Glacial Ohio 2001 and 2002 adopted a strategy successfully employed in the Lake District of Chile and in the Southern Alps of New Zealand (Moreno et al., 2001). In Ohio, a series of sediment cores were extracted along several of the classic nested

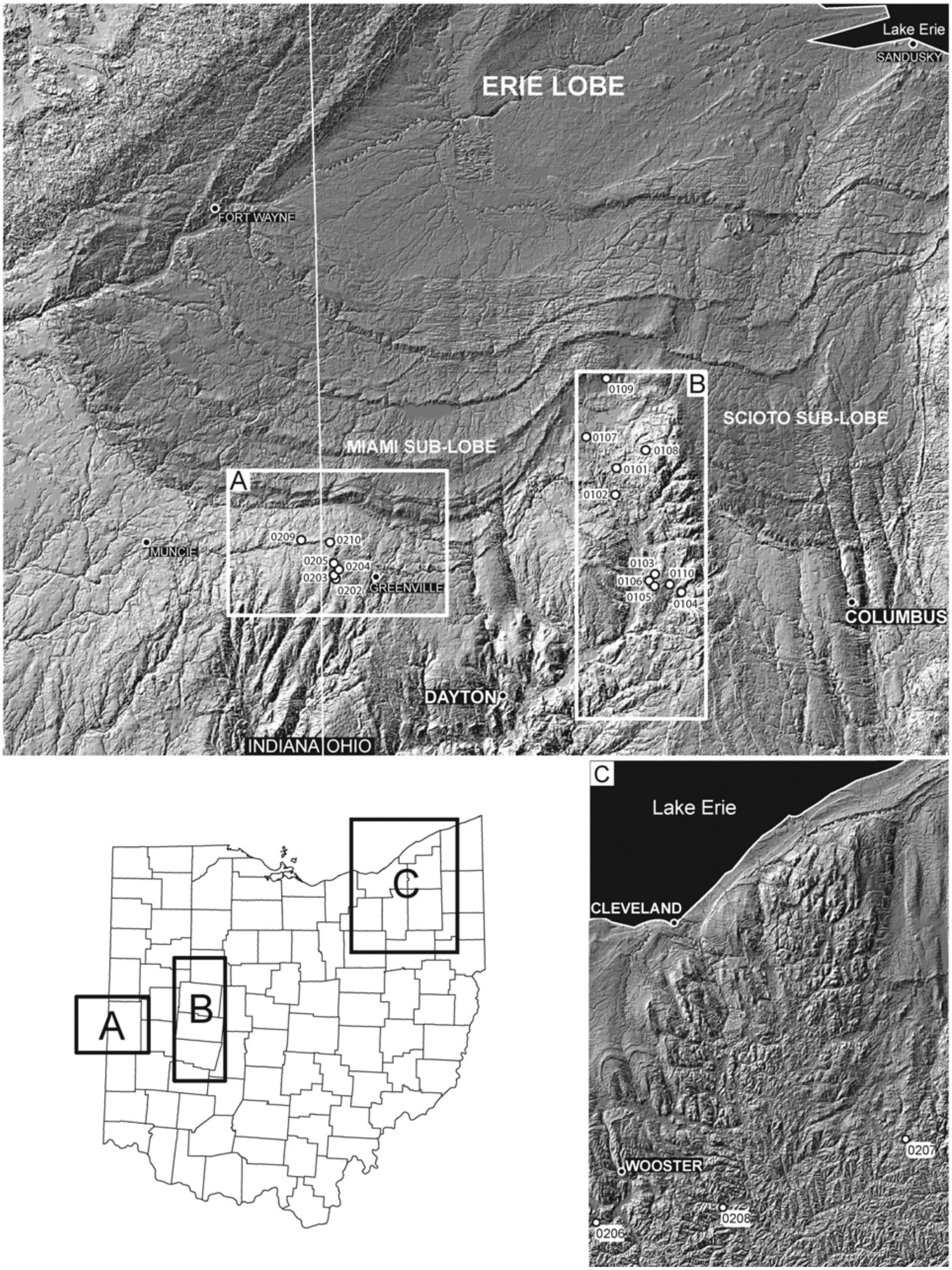


**Figure 1. Hillshade images of southwestern and northeastern Ohio. Numbers identify core site locations for the 2001 (B) and 2002 (A and C) Glacial Ohio Sites.**

moraine belts of Ohio. Each Keck participant experienced all aspects and methods of field mapping and coring, and the laboratory methods involved in core analysis and archiving. The lake and bog basins were surveyed using GPS. Sediment thickness was measured by tile probing along a grid. A GIS data set was prepared for each basin and location, and isopach maps were generated. Based on this information, coring sites were located at the deepest, accessible part of the basin. Two side-by-side cores offset by one meter were extracted with a modified Livingstone corer.

Each core was described and photographed, sampled for radiocarbon dating, and measured for magnetic susceptibility, total organic and carbonate content, and grain size. As many as three radiocarbon ages on each core were obtained from organic material submitted for Accelerator Mass Spectrometry (AMS). AMS dating was performed through the Limnological Research Center (LRC) at the University of Minnesota, where the samples were processed prior to submission at the accelerator facilities at the University of Arizona.

Toward the end of the project each participant wrote a proposal to analyze further one of the cores at his or her institution. Students performed additional analyses according to interests and available facilities.

## STUDENT PROJECTS

Specific projects focused on the analysis of the physical stratigraphy and the high-frequency climate signals preserved in sediments. The range of sediment types encountered at the sites was remarkably rich and included peats, marls, laminated and massive silts and clays, and gyttja (amorphous organic material).

Individual student projects used a wide range of tools to investigate the environmental records preserved in their cores. Patrick Applegate (University of Cincinnati) used chemical trends to explore basin exposure time. Nina Trautmann (Williams College) measured levels of Mn, Sr, and Fe and observed whether these parameters fluctuated with other indices. Kelsey McArthur (Colorado College) examined carbon isotope variability in peat bog sediments to investigate changes in aridity and concentrations of atmospheric $CO_2$. Clinton Bailey and James Martin (both at The College of Wooster) focused on the record of environmental magnetism using a suite of magnetic analyses in conjunction with physical sediment parameters. Sam Peterson (University of Dayton) used measurements of photosynthetic pigments and total organic carbon to reconstruct biologic productivity in his basin. Danny Lazzareschi (Pomona College) analyzed the pollen record and noted distinct changes in the dominant tree species. Jenn New (Whitman College) explored the statistical relationship of the physical parameters to climatic forcing. Eric Donaldson (Whitman College) used optical density measurements to study the sedimentology of his core.

At the close of the project each student will be expected to contribute their data to the NOAA/NGDC Paleoclimatology Program, Boulder Colorado, USA database for use by other climate researchers worldwide. Students are also required to supply the landowner at their site with the results of their projects.

## SUMMARY OF RESULTS

A synthesis of the AMS radiocarbon dates shows that ice withdrew from the study region about 16,000 years ago from the southernmost sites to 14,500 BP from the northern sites. This additional spatial and temporal coverage of Ohio improves our understanding of the deglacial history, and suggests a period of rapid deglaciation.

Some participants were able to suggest that changes in their cores may be linked to some of the well-documented, abrupt climate reversals that occurred during the glacial transition. These climate-driven changes include the Bølling – Allerød and Younger Dryas events (Yu and Wright, 2001). Other changes noted in the cores were attributed to the more local evolution of a particular basin. These local versus global questions are fundamental to studies concerned with reconstructing the environmental history of the Midwest during the last glacial transition.

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