GEOFACTS
OHIO GEOLOGICAL SURVEY • DEPARTMENT OF NATURAL RESOURCES

Ice Age In Ohio—Evidence Below Our Feet

by Tyler A. Norris

Imagining ice thousands of feet thick trudging over much of Ohio's landscape during the ice age is overwhelming, especially because these ice sheets are completely absent from Ohio today. However, the debris left behind by glaciers informs us of not only the former presence of ice, but how the mass moved across the land. One way to visualize when and where ice advanced, retreated, or stagnated across the state is to study the distribution of glacial landforms in Ohio. Glaciers are not only composed of ice; rather, they contain significant amounts of rocks, wood, and other debris from the surrounding landscape. This mass of material is transported and eventually deposited directly by the ice (known as *till*) or can possibly be carried far away by discharging meltwater as outwash. Moraines are the most notable glacial feature created directly by ice movement and are composed of a mixture of till and debris. From flat till plains to morainal hills, much of the material we see on Ohio's surface today is a result of processes that occurred during several events in the Pleistocene, an epoch lasting from about 2.6 million until 11,700 years ago. Only materials deposited during the most recent Wisconsinan Glaciation (24,000–13,000 years ago) remain relatively well preserved compared to earlier events, such as the Illinoian Glaciation that began about 300,000 years ago.

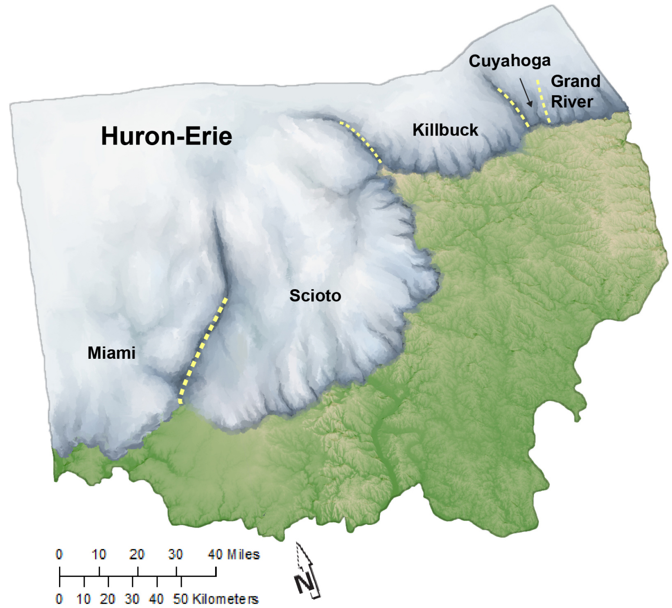

Figure 1. A generalized depiction of the Laurentide Ice Sheet over Ohio during the Late Wisconsinan (last glacial maximum position, approximately 21,000–18,000 years ago) with the associated sublobes of the Huron-Erie Lobe (yellow dashed lines) labelled. The Appalachian Plateau covers most of the unglaciated region in eastern Ohio. Illustration by Madison Perry.

Ice Lobes of Ohio

Glaciers expanded southward from northern Canada over two million years ago (mya), during the early Pleistocene. This expansion resulted in the formation of a continental ice mass known as the Laurentide Ice Sheet, which extended into the northern United States and eventually covered approximately two-thirds of Ohio. The ice sheet grew and advanced as the accumulation rates of ice exceeded ablation (ice removal or melting) rates. Physical ice movement was due to three factors: solid ice flowing from gravity pulling glacial material downslope; ice sliding at its base caused by lubricating meltwater beneath the glacier; and underlying soils being deformed as ice pushed across the landscape. Changes in climate caused the ice sheet to advance southward and retreat northward in cycles. During ice advance and retreat, zones within the ice would move more rapidly than others. Thus, the Laurentide Ice Sheet did not move as a massive, singular block, but rather as separate ice lobes. The last ice lobe to move through Ohio was the Huron-Erie Lobe (or Erie Lobe). The ice was about one mile thick towards present day Lake Erie and thinned to about 1,000 feet towards its southern margin. The speed at which lobes traversed the landscape varied significantly throughout the Pleistocene. Estimates of ice advance rates range from of tens to hundreds of feet per year during the Late Wisconsinan based on radiocarbon age dating organic material found in glacial sediment.

The Huron-Erie Lobe was further separated into the Miami, Scioto, Killbuck, Cuyahoga, and Grand River sublobes (fig. 1) as a response to varying conditions beneath the ice, such as bedrock geology and surface topography. These sublobes are named after modern water bodies located within the path of each ice sublobe. Each sublobe had unique thickness, flow direction, and movement. These sublobes moved almost independently of one another, which is evidenced by the intermingling of moraines and the results of radiocarbon age-dating methods. In eastern Ohio, sublobe positions were mainly controlled by the resilient Pennsylvanian-aged (323–299 mya) rocks, such as sandstones and shales, of the Appalachian Plateau. To the north of this barrier, ice near present day Lake Erie flowed south and split into the Killbuck, Cuyahoga, and Grand River sublobes. The boundaries between these three northeastern sublobes are not well defined in some places but can be estimated based on different types of till and other glacial deposits. To the west of the Appalachian Plateau, the Late Wisconsinan ice encountered less resistance from the carbonate rocks of lower elevations due to the work of earlier glaciations that travelled through these areas.

The most notable obstacle affecting ice lobe movement west of the Appalachian Plateau was the Bellefontaine Outlier, located mostly in Logan and Champaign Counties. The Bellefontaine Outlier, the highest elevation in Ohio, is a glacial-sediment-covered series of uplands composed of Devonian-aged (419–359 mya) shales and limestones surrounded by older Silurian-aged (444–419 mya) carbonate rocks. The Bellefontaine Outlier may be an erosional remnant, or it may have formed as a result of deep, structural faulting. It separated the Miami Sublobe to the west from Scioto Sublobe to the east (fig. 2). During retreat, the ice became deeply lobed around this obstacle and created a complex terrain of deposits down ice of the Bellefontaine Outlier between the Miami and Scioto sublobes. This complex deposit of till and other glacial material created an area known as the interlobate region or zone.

Moraines of Ohio

Several types of moraines cover over half of the surface of Ohio and are composed of varying amounts of boulders, gravels, sand, silt, and clay (fig. 3). End (or terminal) moraines are ridges of mostly till that form at the edge of the glacier's maximum advance. Recessional moraines are similar to end moraines but were formed later, behind the end moraine as the ice lobe retreated and stagnated. In contrast, many flatter areas of till between end or recessional moraines are often ground moraines, which were deposited directly by the ice sheet as a widespread blanket of mixed material. Ground moraines were generally formed when the ice was rapidly retreating; otherwise, till was deposited within end or recessional moraines if ice was stagnating or slowly retreating. These moraines likely took decades to form, depending upon ice activity and debris supply. The assemblage of these moraines serve as geologic snapshots, indicating glacial lobe positions at a specific point in time.

The presence of moraine features is important when determining glacial chronology, soil characteristics, engineering properties, and aquifer potential. Moraines are often productive agricultural lands when they weather into mixed textured soils. Abundant clay material from till is sometimes utilized as a resource and is used in pottery, bricks, and construction purposes. Additionally, till is usually dense below the surface and is suitable for foundations or building material. Moraines may also contain layers of sand and gravel, which are typically not mined for aggregates but can contain abundant groundwater that can be pumped for development or irrigation purposes.

The deposits left behind by ice ages leave a lasting impression on Ohio's scenic landscape and influence the lives of many people. Understanding glacial deposits allows local governments, planners, and private citizens to properly utilize and protect our natural resources. Anyone can appreciate the geologic power of Ohio's ancient ice by studying detailed maps or by simply, and inquisitively, looking beneath their feet.

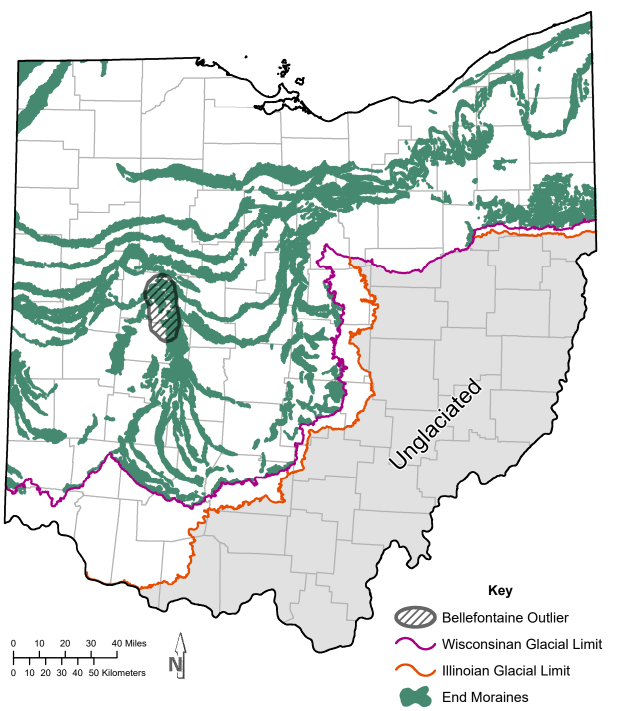

Figure 2. End moraines of Ohio with the last glacial limit (Wisconsinan) and an older glacial limit (Illinoian) denoted. Also marked is the location of the Bellefontaine Outlier uplands.

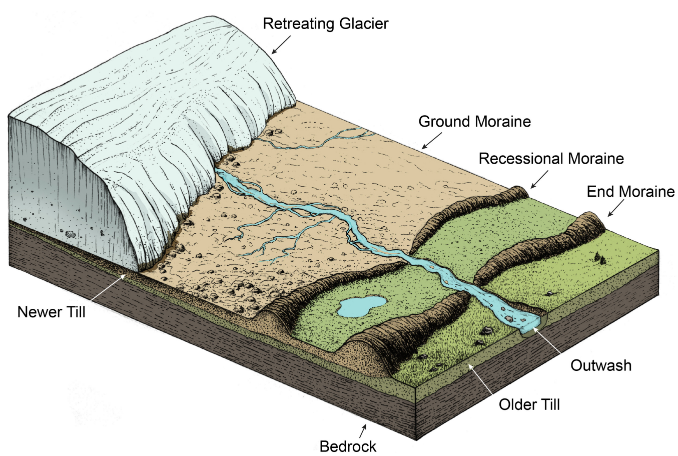

Figure 3. Conceptualized diagram of an ice sheet retreating across a land surface. Illustration by Madison Perry.

References & Further Reading

Goldthwait, R.P., 1959, Scenes in Ohio during the last Ice Age: The Ohio Journal of Science, v. 59, n. 4, p. 193–216.

Hansen, M.C., 2017, The Ice Age in Ohio: ODNR Division of Geological Survey, Educational Leaflet No. 7.