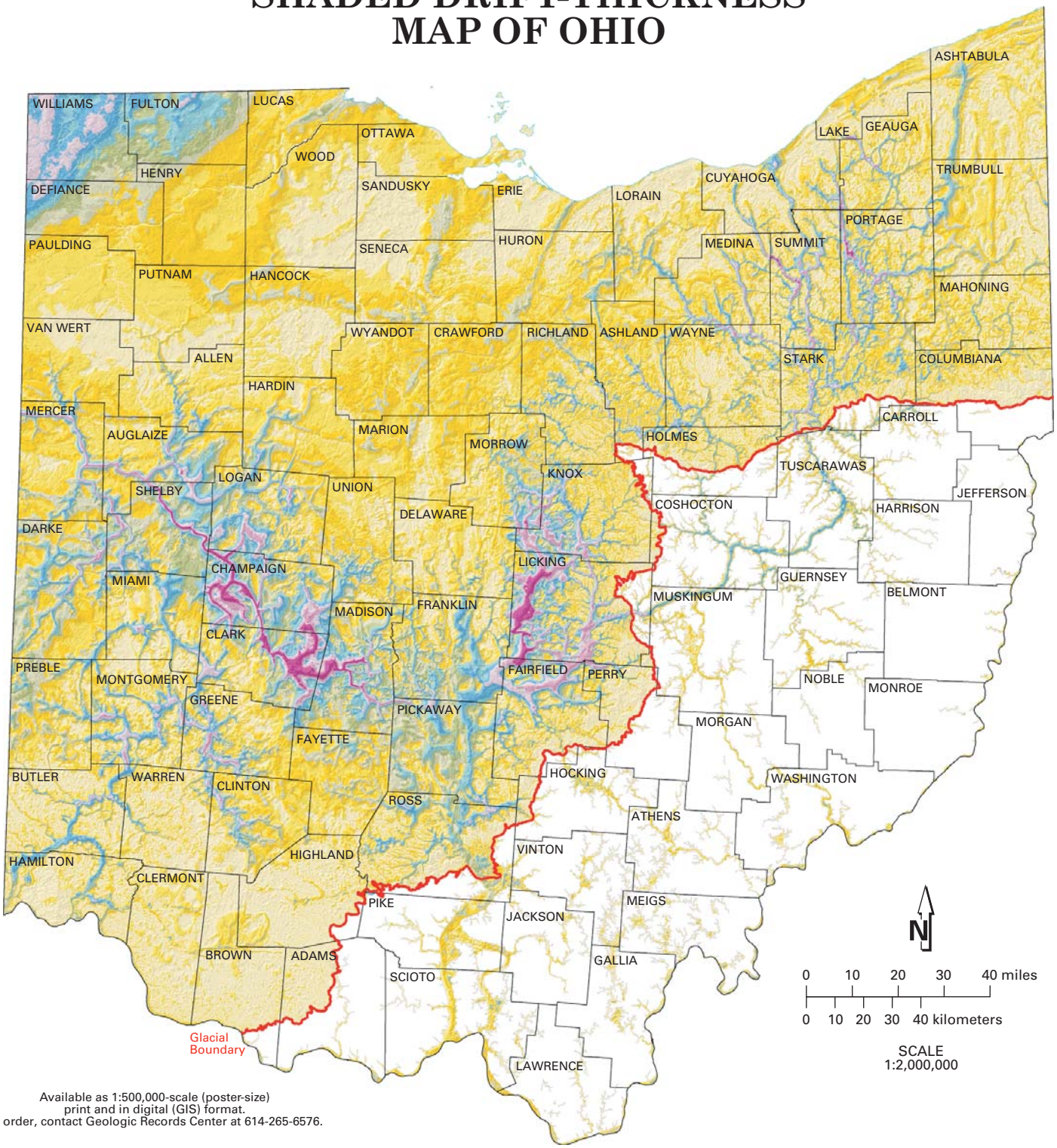
SHADED DRIFT-THICKNESS MAP OF OHIO



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EXPLANATION

Thickness (in feet) of drift in glaciated areas and some non-glaciated areas along glacial boundary, and of outwash and glaciolacustrine deposits in sediment-filled valleys beyond the glacial boundary.

0 - 20	51 - 80	121 - 160	211 - 260	331 - 440
21 - 50	81 - 120	161 - 210	261 - 330	441 - 726

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INTRODUCTION

The drift-thickness map of Ohio depicts the thickness and distribution of glacially derived sediments (called drift) and post-glacial stream sediments overlying the buried bedrock surface. This map was produced by subtracting bedrock-surface elevations from land-surface elevations to produce a residual map of drift thickness. Colors portray thickness intervals of glacial and modern sediments, which can range up to several hundred feet.

Prior to the onset of continental glaciation in the Early Pleistocene Epoch, approximately 1.8 million years before present, the Ohio landscape was dominated by rolling hills and deeply incised, mature rivers and streams. A reduced version of the Division of Geological Survey's Shaded-Bedrock Topography map of Ohio (fig. 1) reveals some aspects of this old land surface. Erosion and deposition by Ice-Age continental glaciers advancing into northern and western Ohio produced a low-relief land surface compared to the unglaciated, high-relief land surface of southeastern Ohio (fig. 2). Comparing the shaded elevation map (fig. 2) with the shaded bedrock-topography map (fig. 1) reveals the dramatic impact of glaciation on the state's current landscape.

Drift thickness in western and northern Ohio (fig. 3) is highly variable, a consequence of numerous geologic factors acting in combination or alone. In some areas, drift has been deposited on a relatively flat bedrock surface and changes in drift thickness are primarily the result of variations in the amount of glacial material deposited. In other areas, drift has infilled a deeply incised buried-bedrock surface, and changes in drift thickness are primarily the result of variations in bedrock-surface elevation. In still other instances, the drift surface parallels the underlying bedrock surface to produce areas of relatively uniform drift thickness.

Distinct, narrow linear patterns of thick drift in western and central Ohio are the result of deep incisions in the underlying limestone and dolomite bedrock by a large, northwest flowing drainage system, the Teays Valley system, that existed prior to and during early glaciations (fig. 1). The main Teays Valley entered the state at Wheelersburg (Scioto County), where remnants of the Teays Valley are still evident on the modern land surface. At Chillicothe (Ross County), the valley disappears under glacial sediments which cover western Ohio. However, the valley continues north, below the surface, to Circleville (Pickaway County) and then northwest to Mercer County where the valley exits the state into Indiana. Early southward-advancing glaciers blocked the north-flowing river system of the Teays and created immense lakes in southeastern Ohio.

In northeastern Ohio, narrow thick-drift areas south of Lake Erie were also preglacial bedrock valleys. These valleys were partially filled with thick deposits of till and glaciolacustrine (glacial lake) sediment and then re-excavated by later northward-flowing rivers such as the Cuyahoga River and the East Branch of Rocky River.

In northwestern Ohio, repeated scouring of the relatively soft bedrock surface by glacial ice flowing southwestward from the Lake Erie Basin destroyed most pre-existing drainage systems. In this part of Ohio, the bedrock surface is smooth and the upper surface of the drift has been planed off by wave action and deposition by a post-glacial, high-level ancestral Lake Erie. In the extreme northwest corner of Ohio, in Williams County and portions of Defiance County, drift thickens considerably because of numerous moraines that formed along the northwestern edge of the Erie Lobe.

In western Ohio, draping linear features of thick drift, called ridge moraines, formed along the temporarily stationary ice-front as glacial sediment was released from the ice. These ribbons of thick drift define the lateral dimensions of glacial ice lobes, particularly those of the last Wisconsinan ice sheet (figure 4). Many ridge moraines in western and northeastern Ohio have a draped appearance because south-flowing ice, impeded by bedrock highlands, moved more easily along major lowlands. The numerous resistant bedrock highlands in northeastern Ohio caused ridge moraines to be especially arcuate and closely stacked.

Southeastern Ohio is unglaciated and devoid of ice-deposited sediment (glacial till). Many southeast Ohio valleys, however, carried

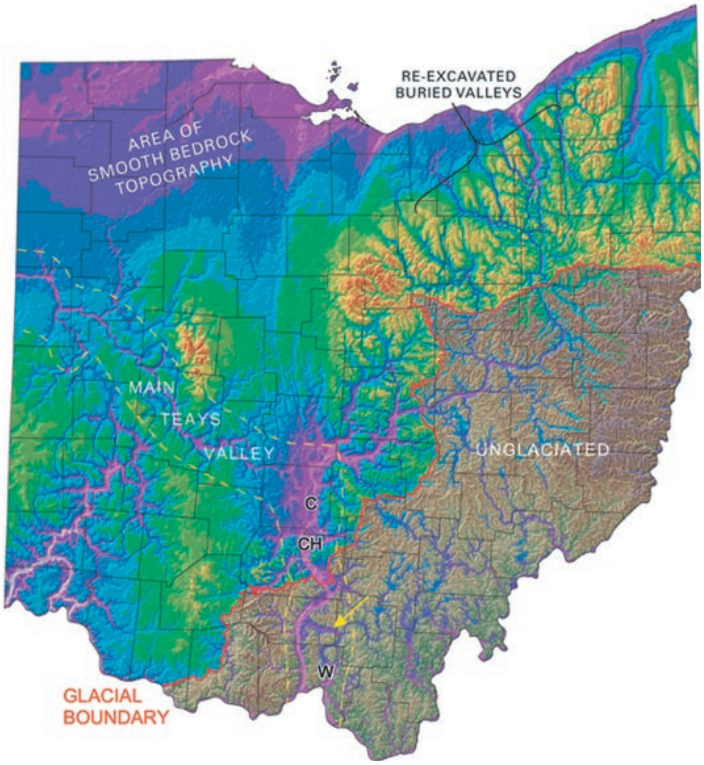

FIGURE 1.—Shaded bedrock-topography map of Ohio showing the sculpted bedrock surface that lies beneath glacial drift in northern and western Ohio and the land surface in unglaciated southeastern Ohio. Note the surface expression of the Teays Valley System south of the glacial boundary (arrow), the location of the main Teays Valley (between yellow dashed lines), the area of smooth bedrock topography, and the area of re-excavated preglacial bedrock valleys in northeastern Ohio. (**W** = Wheelersburg, **C** = Circleville, **CH** = Chillicothe) (modified from Ohio Division of Geological Survey, 2003).

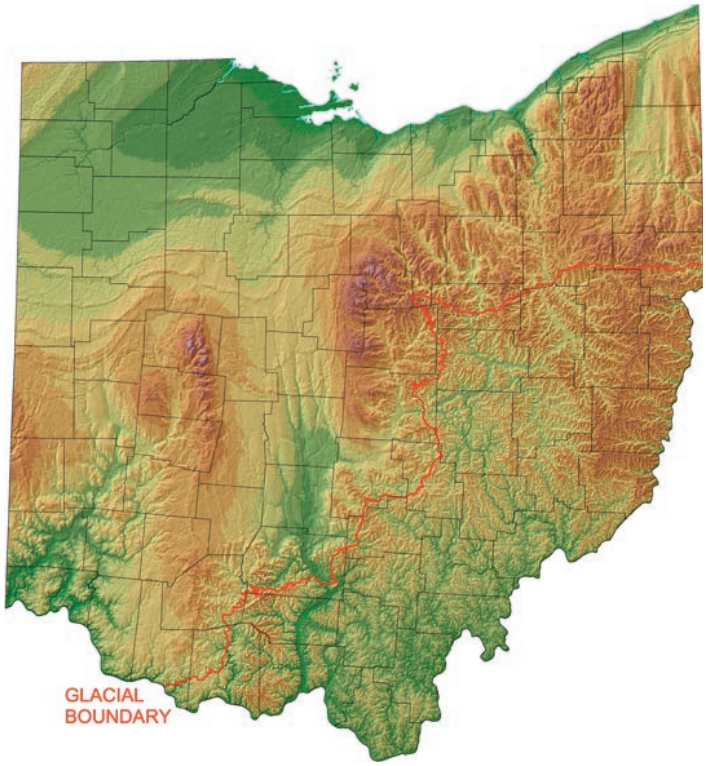

FIGURE 2.—Shaded elevation map of the land surface of Ohio with glacial boundary. Note the smooth landscape of glaciated northern and western Ohio compared to the high-relief landscape of unglaciated southeastern Ohio (modified from Powers, Laine, and Pavey, 2002).

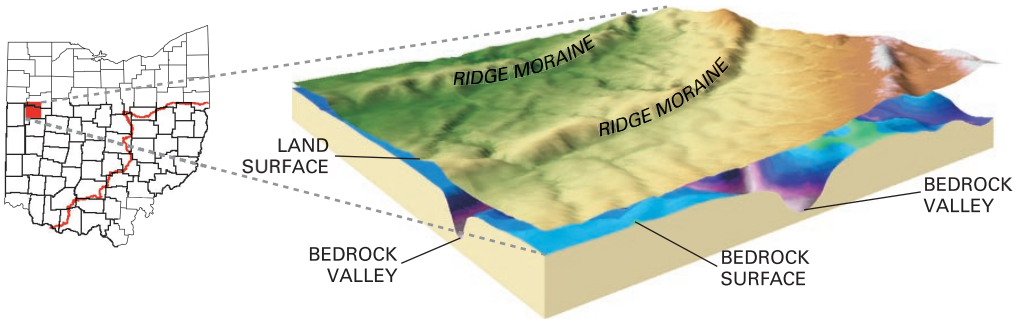

FIGURE 3.—Schematic cross section of glacial drift overlying the bedrock surface. Note areas where drift thickness is controlled by thickening of glacial sediment over a relatively flat bedrock surface, by drift infilling bedrock valleys, or by fluctuations in both the land surface and the bedrock surface. Also note areas where valleys in the buried-bedrock surface are not evident on the land surface (illustration by Donovan M. Powers).

huge volumes of glacial meltwater away from the ice front and toward the Ohio River. In the process, many of these valleys were at times made deeper by the erosive force of fast-flowing meltwater streams, and at other times were partially filled with sediment. Some valleys in unglaciated Ohio contain thick deposits of clay and silt that accumulated on the bottoms of lakes that formed when glacial ice blocked the flow of rivers or when rapidly accumulating meltwater sediments blocked the mouths of smaller tributaries.

METHODS

Two digital data layers are required to generate the drift-thickness map: the surface-elevation layer and the bedrock-topography layer. Drift thickness is calculated by subtracting the bedrock-topography elevation from the land surface elevation. The bedrock-topography component is one of the products resulting from a multi-year effort by the ODNR, Division of Geological Survey to map the bedrock geology of Ohio. Bedrock-topography maps are required to determine the relief on the bedrock surface beneath thick layers of glacial drift. Bedrock-topography maps were created by the Division of Geological Survey for all 788 7½-minute topographic quadrangles in the state as part of a process to produce accurate bedrock-geology maps for glaciated portions of Ohio and for those areas beyond the glacial boundary where valleys are infilled with sediment. Data concentration and contour intervals on the original, hand-drawn bedrock-topography maps vary widely across the state in response to changing geologic and topographic conditions. These data consist mainly of water-well logs on file at the ODNR, Division of Water, supplemented by outcrop data, Ohio Department of Transportation bridge-boring data, and oil-and-gas-well data. During the course of mapping, over 162,000 data points were interpreted for bedrock-surface elevation and in some cases drift thickness. These points were plotted on maps and used as control for the bedrock-topography lines. Individual 24,000-scale bedrock-topography maps are available from the Division's Geologic Records Center.

Elevation contours and data points from the 788 bedrock-topography maps were digitized and compiled for the glaciated portions of the state and for the valleys beyond the glacial boundary containing significant accumulations of sediment deposited during and after glaciation. The bedrock-topography contours were digitally converted in an ArcGIS environment to create a continuous grid model (60 meter grid spacing). A statewide compilation map and digital dataset of the bedrock topography of Ohio (modified from Ohio Division of Geological Survey, 2003) are available from the Division of Geological Survey.

Uncolored areas of southeastern Ohio represent extensive portions of unglaciated Ohio where the land surface and the bedrock surface are essentially the same. On the original maps in these areas, bedrock-topography lines were restricted to the buried-valley portions of the map and were not drawn in upland portions.

The second component needed to create the drift-thickness map, the land-surface topography, is based largely on data derived from the U.S. Geological Survey's National Elevation Dataset (30 meter grid spacing). These data have been modified extensively by the Ohio Division of Geological Survey to replace some anomalous errors that are inherent in portions of the National Elevation Dataset. A statewide compilation map and digital dataset of the shaded elevation of Ohio (modified from Powers, Laine, and Pavey, 2002) are available from the Division of Geological Survey.

A grid of the digitized bedrock-topography contours was subtracted from a grid of the land-surface Digital Elevation Model to derive a third grid (60 meter grid spacing) representing the thickness of the drift. This grid surface was shaded from the northwest, slightly above the horizon, to produce the appearance of a three-dimensional surface.

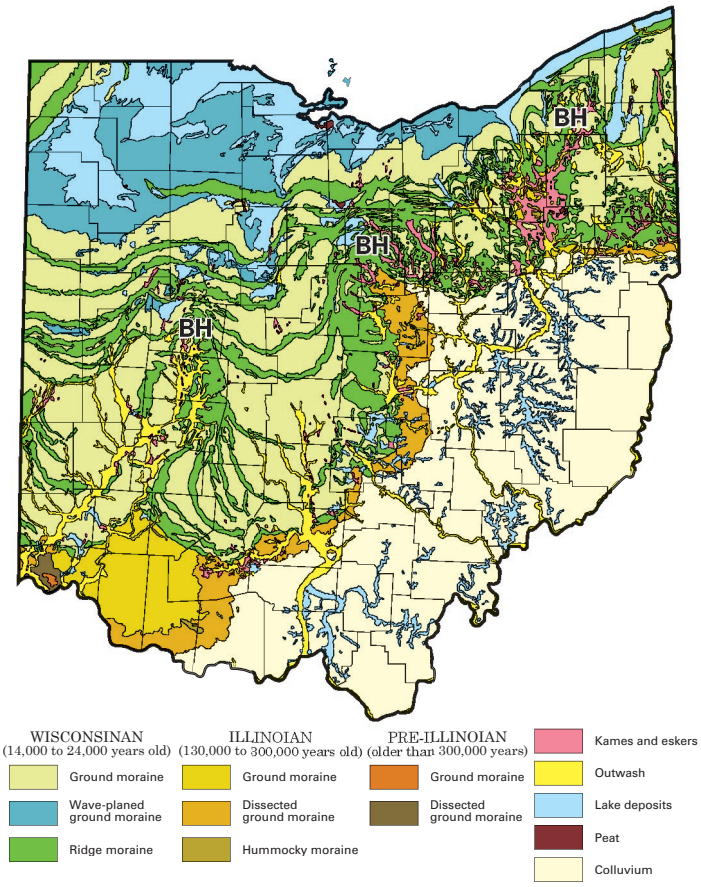

FIGURE 4.—Glacial map of Ohio showing the distribution of glacial sediments and their relative ages. Note glaciated northern and western Ohio, unglaciated southeastern Ohio, and the position of ridge moraines and the lake deposits and wave-planed ground moraine of the Lake Erie Basin. Bedrock highlands (**BH**) impeded the southward advance of glacial ice causing the moraines to form a lobate configuration (illustration by Lisa Van Doren; modified from Pavey and others, 1999).

REFERENCES

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