

SURFICIAL GEOLOGY OF ADAMS COUNTY, OHIO

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ADAMS COUNTY SURFICIAL GEOLOGY

Adams County is located in southern Ohio and contains a host of unique geologic features and landscapes. One of the most unique geologic features is found at the northern border of the county, near the town of Sinking Spring (Highland County). The Paleozoic impact structure, called the Serpent Mound Impact Structure (Fig. 1), has deformed, faulted, and partially metamorphosed the bedrock in the area (Mann, 2016). The impact structure derives its name from the Serpent Mound Native American petroglyph visible in the area (Mann, 2016). The impact structure is a circular structure that is about 1.2 kilometers in diameter and is thought to be about 50 million years old. The impact structure is a circular structure that is about 1.2 kilometers in diameter and is thought to be about 50 million years old.

Another important geologic feature, the Ohio River, has cut a large valley into the bedrock and marks the southern boundary of the county. The river flows to the west above a buried valley composed of sand and gravel and provides the drinking water for citizens of the county. However, before the modern configuration of the Ohio River during the preglacial Tapes Stage Drainage, a drainage divide in Monroe Township caused water in the eastern portion of the county to flow east into the Taps River and water in the western portion of the township to flow westward into the Kentucky River (Stout and others, 1943).

In addition to these distinctive features, there are three unique physiographic regions preserved in Adams County: the dissected Illinoian Till Plain, the Outer Bluegrass Region, and the Shawnee-Mississippian Plateau (Fig. 1, Brodman, 1998). These three regions each have distinguishing qualities that affect the typical surficial deposits found within them.

Dissected Illinoian Till Plain

During the height of the Illinoian Glaciation, ice covered the northeastern corner of Adams County (Pavey and others, 1999). The primary surficial sediment deposited during this time was Illinoian-aged glacial till (Tl). This till is typically massive with a loam matrix texture and has matrix-supported pebbles of varying erratic lithologies, though these coarse grains are predominantly limestone/dolomite from surrounding bedrock. Generally, the Illinoian till is thin (less than 50 feet) and tends to thicken in the uplands and become thinner in valleys where post-glacial erosion has exposed the underlying bedrock (Pavey and others, 2006). Glacial till deposits on the uplands between the towns of Cherry Fork and Seaman exhibit a slightly hilly landscape, which could indicate that the glacier was undergoing surging conditions while the till was being deposited beneath the glacier (Stout and Clark, 2002). Other glacially derived sediments, such as Illinoian-aged sand-and-gravel outwash (SG) and lake silts and clays (Lc), were transported by water away from the ice sheet and are now preserved in terraces along the major rivers, including Ohio Branch Creek, West Fork Ohio Branch Creek, and East Fork Eagle Creek. These sediments originated within the Illinoian Till Plain physiographic region but were also deposited in other regions due to this fluvial transportation.

Within this region, several bedrock hills and knobs were not overridden by the ice sheet during the Illinoian Glaciation. Cave Hill and Cave Hill are two prominent examples of bedrock knobs that were above the relatively thin ice near the margin of the ice sheet. During the Illinoian Glaciation, these hills would have been mantled, or shrouded, of rock sticking out from the surrounding ice. These hills are composed of Silurian-aged dolomite from the Peebles, Lilly, and Bisher Formations (Dla) and are more resistant to weathering than the surrounding East Shale (Sh) (Stucker and others, 2006). Investigation of soils developed on top of these mantles indicate that no till was deposited on these hills. These upland soils were developed beneath the Illinoian till, which is consistent with the Illinoian till being deposited in the valleys. The presence of well-developed sinkholes (among other karst features) at Cave Hill are another indicator that these hills remained unglaciated during the Illinoian Episode, as an overriding ice sheet would have buried and obscured these features.

Outer Bluegrass Region

Adams County is one of only five counties in Ohio to contain portions of the Outer Bluegrass Region. This region is defined by unglaciated areas of dissected carbonate rocks with moderate relief and abundant karst features (Brodman, 1998). In Adams County, this physiographic region is located centrally between the Illinoian Till Plain to the west, and the Shawnee-Mississippian Plateau to the east. The Ohio Branch Creek, which drains most of the surface water in the county, flows south through this region. Most of the unconsolidated surficial material within this physiographic region is concentrated within this specific valley system. The most common unconsolidated unit is alluvium (Al), which is primarily derived from the local Ordovician and Silurian bedrock that tends to erode into coarse silts. Glacial outwash and Quaternary alluvium are found only on terraces usually 20-50 feet above Ohio Branch Creek. These terraces are more abundant within the Outer Bluegrass Region, relative to the Dissected Illinoian Till Plain. Outside of these lowland areas, the primary Quaternary age surficial material within the region is loess (L). Loess within the region typically is thin and occurs in patches across the landscape but tends to be thicker along the eastern bluff of Ohio Branch Creek.

Karst features are commonly found across the region. The most common surficial karst features in this region are sinkholes (Aden and Patrick, 2018). These sinkholes frequently develop within the Silurian-aged Peebles, Lilly, and Bisher Formations (Dla) and are more resistant to weathering than the surrounding East Shale (Sh) (Stucker and others, 2006). In southeastern portions of the region, these sinkholes typically develop along stable ridges and uplands near areas with steep relief. Springs commonly occur on the steep hillsides below the elevations of the sinkholes. These springs are likely interconnected to the nearby sinkholes through underground networks of dissolved fractures. Natural bedrock outcrops are dominant in these karst landscapes, whereas soils and other surficial materials are typically thin to absent.

Shawnee-Mississippian Plateau

Along the eastern edge of Adams County, Silurian-aged dolomites dip into the subsurface and Devonian- and Mississippian-aged rocks begin to outcrop. The change between physiographic regions coincides with this change in bedrock geology and major topographic change. The more-resistant Devonian- and Mississippian-aged rocks compose hills that reach elevations about 500 feet higher than the lower plains of the Outer Bluegrass Region. This sharp increase in elevation is part of what is called the Allegheny Escarpment and is the major boundary between the Appalachian Plateau (east) and Central Lowland (west) across Ohio. The Shawnee-Mississippian Plateau is a subsection of the larger Appalachian Plateau Province and covers most of Pike and Scioto Counties, along with the eastern edge of Adams County and portions of Hocking, Ross, and Vinton Counties. The topographic relief on the plateau is very high with some of the most rugged terrain across the state.

Because of this high relief and rugged terrain, colluvium and residual are the most common surficial geology deposits in this physiographic region. Soils developed in weathered bedrock-derived soils on the stable ridge top of the region tend to be thin. On the less-stable slopes of hills, bedrock materials erode and are pulled downslope by gravity through the process of soil creep. In eastern Adams County, these generally colluvial deposits on hillside blocks move downslope relatively slowly, as there is little evidence for landslides. More minor surficial deposits include alluvium and loessite deposits. Alluvium (Al) in this region is sourced from the Devonian- and Mississippian-aged sandstones and shales (Sd) and therefore has a much different character from the karst-dominated Outer Bluegrass Region. The alluvium on the Shawnee-Mississippian Plateau is primarily composed of quartz sand, pebbles, and cobbles. These sediments erode off hillsides as colluvium and were gravitally into valleys and subsequently transported westward by water. Lacustrine deposits preserved in terraces on the plateau were deposited during the Pre-Illinoian Glaciation when the Ohio River was dammed, forming Lake Tigua. These lacustrine deposits (Lk), also referred to as Myford Silt, are finely-laminated gray silt-and-clay deposits and occasionally also include some coarser deltaic or littoral facies near the contact of bedrock hills and terraces.

MAPPING CONVENTIONS

This map provides a three-dimensional framework of the study area's surficial geology and depicts four important aspects of surficial geology:

1. Geologic deposits, indicated by letters that represent the major lithologies.
2. Thicknesses of the individual deposits, indicated by numbers and modifiers.
3. Lateral extents of the deposits, indicated by map-unit area boundaries (solid and dashed lines).
4. Vertical sequence of deposits, by the stack of symbols within each map-unit area.

Letters represent geologic deposits (lithologic units) and are described in detail below. Lithologic units may be a single lithology, such as sand (S) or clay (Cl), or a combination of related lithologies that are found in specific depositional environments, such as sand-and-gravel (SG) or ice-contact (IC) deposits. The bottom symbol in each stack indicates the bedrock lithologies that underlie the surficial deposits. The detailed lithologic unit descriptions below summarize:

1. Geologic characteristics, such as range of textures, bedding, and age.
2. Engineering properties or concerns attributed to the unit.
3. Depositional environments.
4. Cosmopolitan or geographic locations.
5. Geographic locations within the map area, if pertinent.

Numbers (without modifiers) that follow the lithologic designators represent the average thickness of a lithologic unit in feet (for example, 3 represents 20 feet [ft]). If no number is present, the average thickness is implied as 1 (10 ft). These unmodified numbers correspond to a thickness range centered on the specified value but may vary ±50 percent. For example, Tl indicates an average thickness of till in a map-unit area of ft, but overall thickness may vary from 20 to 60 ft.

Modifiers provide additional thickness and distribution information:

1. Parentheses indicate that a unit has a patchy or discontinuous distribution and is missing in portions of that map-unit area. For example, (C2) indicates that till with an average thickness of 20 ft is present in only part of that map-unit area.
2. A negative sign (-) following a number indicates the maximum thickness for that unit in an area such as a buried valley or ridge. Thickness decreases from the specified value, commonly near the center of the map-unit area, to the thickness of the same lithologic unit and vertical position specified in an adjacent map-unit area. For example, a SG(-) map-unit area adjacent to a SG area indicates sand-and-gravel unit having a maximum thickness of 90 ft that thins to an average of 20 ft at the edge of the map-unit area. If the material is not present in an adjacent area, it decreases to zero at that boundary.

Boundary types reflect the relationships among uppermost continuous lithologies only, not patchy, discontinuous lithologies (in parentheses). The colors on the map correspond to the uppermost continuous units and serve to assist in visualizing the geology of the area. Discontinuous units (in parentheses) and subsurface units are not assigned colors on the map.

The small scale of this reconnaissance map generalizes the great local variability within surficial deposits. That variability is explained in the lithologic unit descriptions and by the use of thickness ranges. Some areas and lithologies are too small to delineate at 1:24,000 scale and have been included in adjacent areas. This map should serve only as a regional predictive guide to the area's surficial geology and not as a replacement for subsurface borings and geophysical studies required for site-specific characterizations.

UNIT DESCRIPTIONS

- Made land.** Large areas of cut and fill such as dams, landfills, and urban areas.
- Water.** Lakes generally larger than 20 acres and not appearing on the base map.
- Quarry.** Floored in bedrock; may contain reclaimed areas. Includes strip mine benches.
- Alluvium (Holocene).** Includes a wide variety of textures from silt to clay to boulders. Commonly includes organic material; generally not compact. Occurs in floodplains of modern streams and mapped only where small extent and thickness are noticeable. Also includes alluvial terraces, old floodplain remnants that are positioned near to free modern floodplains.
- Eolian silt (loess) and fine sand (unspecified age).** Deposited by wind, generally on bedrock. Mapped where thickness and areal extent noteworthy.
- Silt and clay; Minor Silt (predominantly pre-Illinoian).** Present on high terraces or as eroded remnants of lacustrine clay and silts, finely laminated, often covered with loess and/or colluvium, sometimes underlain by sand and gravel.
- Silt and clay with occasional sand-and-gravel interbeds (unspecified age).** Present as detrital deposits, outwash, deposits in related directions, and discolored lake deposits.
- Sand and gravel (predominantly Devonian).** Interbedded sand and gravel commonly containing silt, discontinuous layers or silts, clay, and silt. Grains well to moderately sorted, moderately to well rounded, finely stratified to massive, may be cross bedded, and locally may contain organic material. Well-sorted fluvial deposits in terraces and buried valleys. May be older in deeper buried valleys.
- Sand and gravel (predominantly Illinoian).** Properties similar to sand SG except upper part of deeply weathered and leached near surface.
- Loam till (predominantly Illinoian).** Generally overlain by loess that becomes thicker along bluffs bordering major rivers.
- Limestone and shale (predominantly Ordovician).** Interbedded limestone and shale of varying thickness with occasional thin beds of massive dolomite. Shale-rich lithologies prone to landsliding. Shale is gray, thin to thick bedded. Limestone is medium gray, thin to medium bedded, fossiliferous.
- Dolomite and limestone (predominantly Silurian and Devonian).** Carbonate bedrock dominated by dolomites with occasional limestones. Thin to massive bedded. Contains well-developed karst and solution features. Frequently fossiliferous, may be cherty.
- Shale (predominantly Devonian).** Clayey shale with limestone nodules and overlying organic-rich, hard, fissile shale.
- Sandstone (predominantly Mississippian).** Thin to massive bedded; fine to medium grained.
- Sandstone and shale (predominantly Mississippian).** Interbedded shale, siltstone, and sandstone and associated colluvium, with common vertical and horizontal changes in rock type.

EXPLANATION OF MAP SYMBOLS

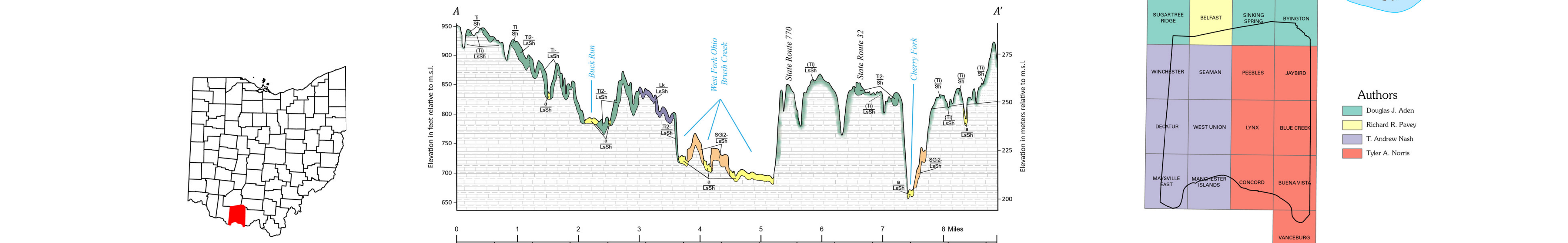
- Field data collection locality.** Includes soil borings and outcrops.
- Small sand-and-gravel pit.** Pit bottom generally underlain by unconsolidated lithologic units of surrounding polygons. May contain reclaimed areas.
- Small quarry.** Floored in bedrock; may contain reclaimed areas.
- Boundary between map-unit areas having different uppermost, continuous lithologies or significant bedrock lithology change; underlying lithologies may or may not differ.**
- Boundary between map-unit areas having the same uppermost, continuous lithology but different thicknesses or underlying lithologies.**



Location of Adams County in Ohio

This geologic map was funded in part by the USGS Great Lakes Geologic Mapping Coalition under cooperative agreement number G19AC00319.

Map data derived from various State of Ohio datasets. Property rights reserved by the State of Ohio. North American Datum 1983.



Cross section of the surficial geology of Adams County, Ohio. See lithologic unit descriptions for explanation of symbols. m.s.l. = Mean Sea Level. Horizontal scale same as map. Vertical exaggeration is 50x.

7.5-minute quadrangle with full or partial areas in Adams County. Mapping responsibility by author for each 7.5-minute quadrangle is denoted by color and selected legend.

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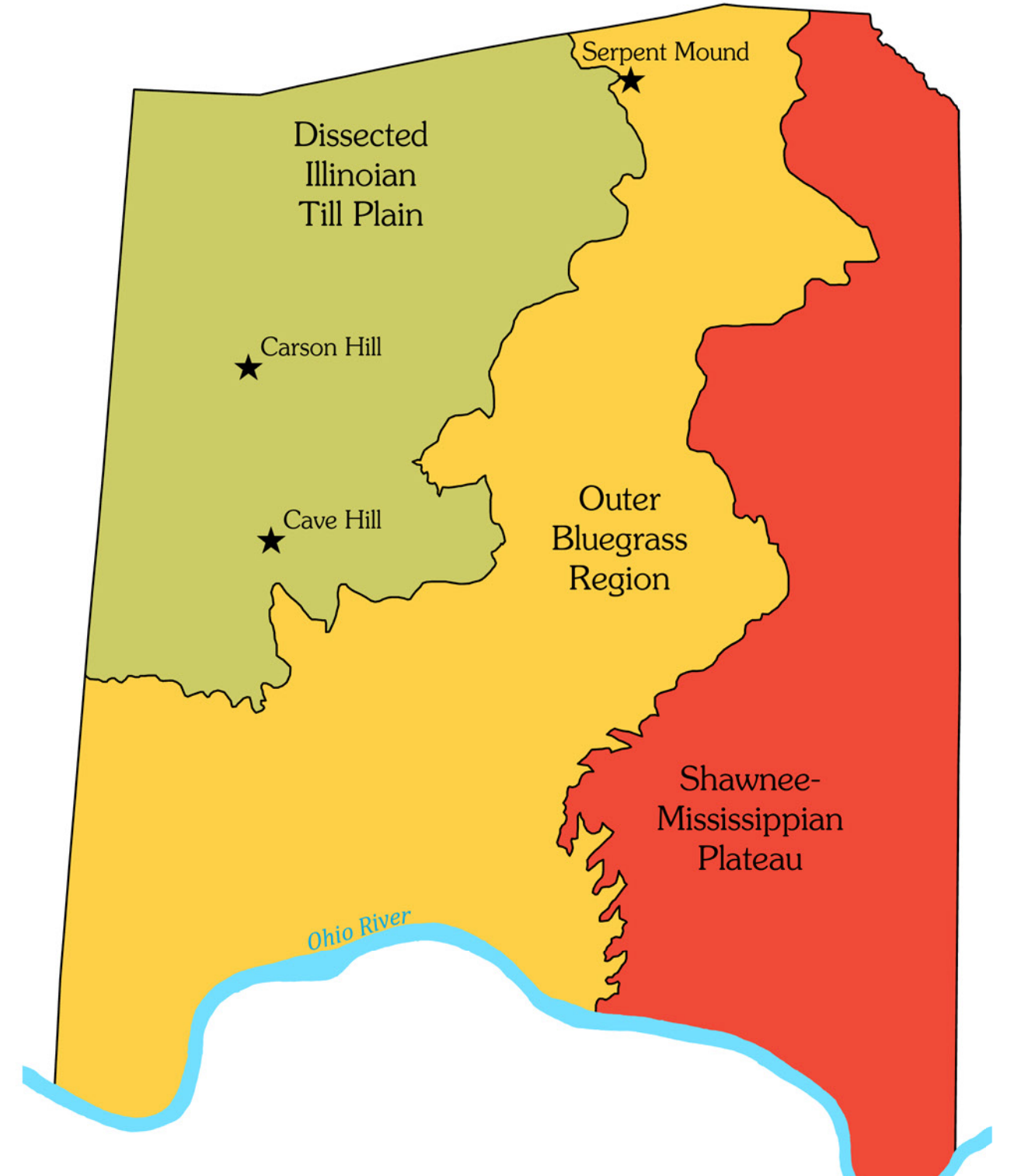


FIGURE 1. Physiographic regions and natural landmarks of Adams County (noted with black stars). The Ohio River (light blue line) lies at the county's southern border.

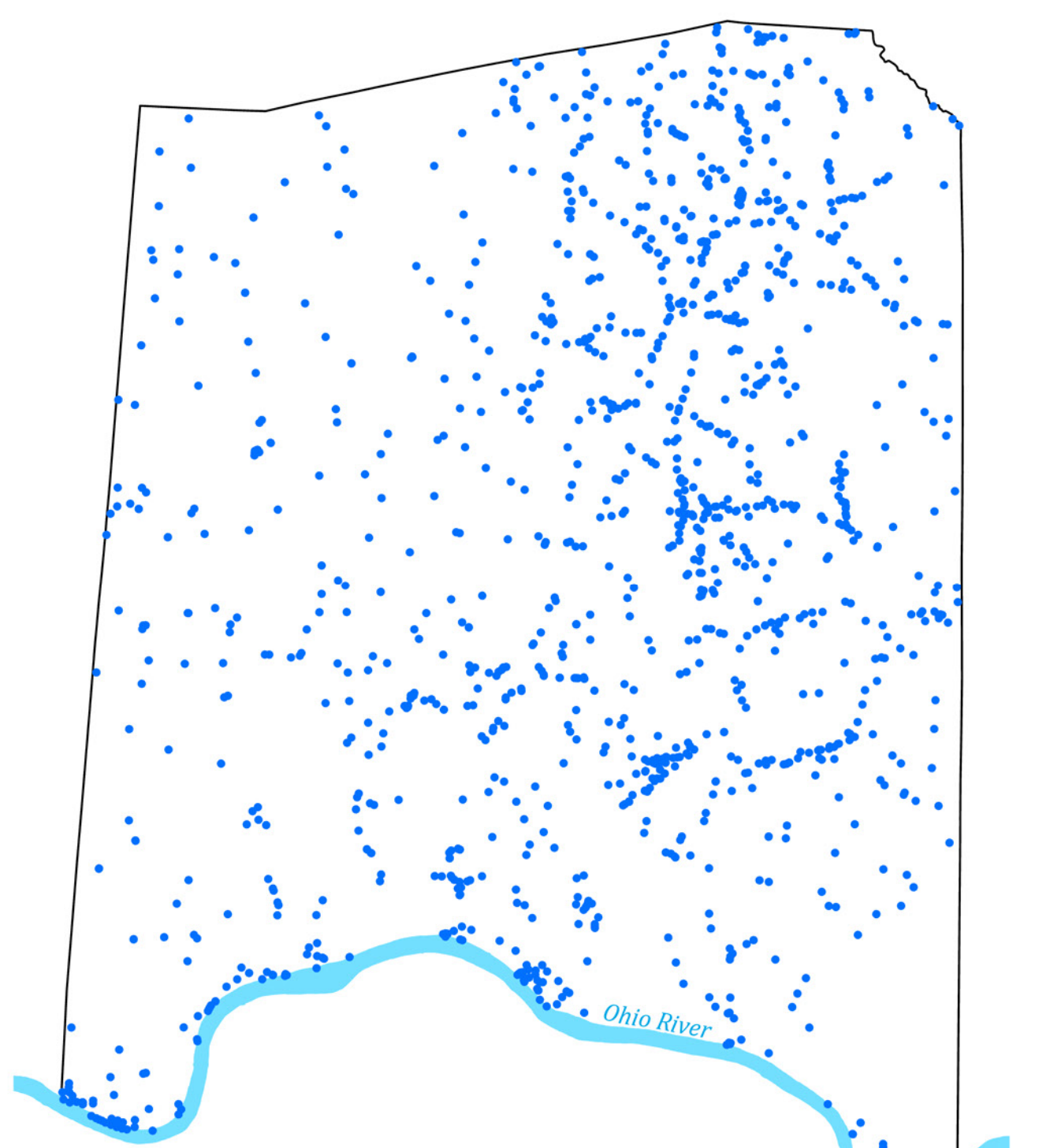


FIGURE 2. Location of water wells (dark blue dots) in Adams County. The Ohio River (light blue line) lies at the county's southern border.

DATA SOURCES

Data were collected from numerous sources (see "References"). The concentration of data was greatest near the surface and decreased with depth. County soil survey maps, which describe the top 5 ft of surficial materials, provided an initial guide to map-unit areas. These areas were modified through interpretation of local geomorphic settings and other data that indicated changes of deposits at depth, including water-table logs (Fig. 2) from the Ohio Department of Natural Resources (ODNR), Division of Water Resources, test-boring logs provided by the Ohio Department of Transportation, Office of Geotechnical Document Management system, water-table data at <https://data.ohio.gov>, and at Ohio Environmental Protection Agency and county engineers offices, sheets, and published or unpublished geologic reports, maps, and field notes (see the ODNR Division of Geological Survey). These data also provided the basis for lithologic unit descriptions that summarize, as accurately as possible, recognized associations of genetically related materials. Total thickness of each surficial deposit was calculated using ODNR Division of Geological Survey open file bedrock topography maps, and bedrock units were summarized from ODNR Division of Geological Survey bedrock geologic maps, all of which are available for each 7.5-minute quadrangle in the map area. The Ohio Statewide Inventory Program collected LIDAR data and converted it into a 2.5 x 2.5-m-resolution digital elevation model (DEM). Using this DEM, the ODNR Division of Geological Survey generated a shaded relief and a percent slope digital model of the land surface.

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Recommended Bibliographic Citation for this Map:
Nash, T.A., Norris, T.A., Aden, D.J., and Pavey, R.R., 2022. Surficial geology of Adams County, Ohio. Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map SG-5-ADA, scale 1:62,500.



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