STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
Lawrence H. Wickstrom, Chief

SURFICIAL GEOLOGY OF THE OHIO PORTION OF THE LIMA 30 X 60-MINUTE QUADRANGLE

by
D. Mark Jones, Richard R. Pavey, Glenn E. Larsen, Michael P. Angle, and Douglas J. Aden

GIS Database Administration by Joseph G. Wells
GIS Cartography by Dean R. Martin

Map SG-2-LIM
Prepared in cooperation with
the United States Geological Survey,
National Cooperative Geologic
Mapping Program (STATEMAP)
Grant No. G10AC00415
10/2011

MAPPING CONVENTIONS

This map provides a three-dimensional framework of the 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 extent of the deposits, indicated by map-unit area boundaries.
4. Vertical sequence of deposits, shown by the stack of symbols within each map-unit area.

Figure 1 illustrates mapping conventions. Letters, numbers, and modifiers are arranged in stacks that depict the vertical sequence of lithologic units for a given map-unit area. A single stack of symbols occurs in each map-unit area and applies only to the volume of sediments within that particular 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 (C), or a combination of related lithologies that are found in specific depositional environments, such as sand and gravel (SG) or ice-contact deposits (IC). 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 environment.
4. Geomorphology or geomorphic location.
5. Geographic location within the map area, if pertinent.

Numbers (without modifiers) that follow the lithology designator represent the average thickness of a lithologic unit in tens of feet (for example, *3* represents 30 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 up to 50 percent. For example, *T4* indicates an average thickness of till in a map-unit area is 40 ft, but that 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, *(T2)* indicates that till with an average thickness of 20 ft is present in only part of that map-unit area.

2. A minus sign (-) following a number indicates the maximum thickness for that unit in areas 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 *SG9-* map-unit area adjacent to a *SG3* area indicates a sand-and-gravel unit having a maximum thickness of 90 ft that thins to an average of 30 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.

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 1:100,000 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.

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 feet 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 change of deposits at depth, such as water-well logs from the Ohio Department of Natural Resources (ODNR), Division of Water and oil and gas well logs on file at the ODNR Division of Geological Survey (fig. 2); test boring logs provided by the Ohio Department of Transportation and Ohio Environmental Protection Agency (EPA) and county engineers offices (fig. 3); theses; and published or unpublished geologic reports, maps, and field notes (on file at 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 surficial deposits was calculated from ODNR Division of Geological Survey open-file bedrock topography maps, and bedrock units were summarized from ODNR Division of Geological Survey bedrock geology maps, all of which are available for each 7.5-minute quadrangle in the map area. Land-surface topography was derived from LiDAR data, collected as part of the Ohio Statewide Imagery Program, which were converted into a 12.5 x 12.5-ft-resolution digital elevation model (DEM) and shaded-relief model by the Ohio EPA. Detailed descriptions of 3-D mapping methods are described in Venteris (2007) and McDonald and others (2007).

UNIT DESCRIPTIONS

SURFICIAL UNITS

w — **Water.** Lakes and reservoirs generally larger than 20 acres and not appearing on basemap. Includes Grand Lake St. Marys along the southern margin of the map.

m — **Made land.** Large areas of cut and fill, such as dams, landfills, and urban areas; may include reclaimed strip mine areas. Underlain by bedrock or other lithologic units.

a — **Alluvium (Holocene).** Includes a wide variety of textures from silt and clay to boulders; commonly includes organic material; generally not compacted. Rarely greater than 20 ft thick; unit considered to thin to zero at contact with adjacent polygons. Present in floodplains of modern streams throughout entire map area or in human-made water retention features. Mapped only where areal extent and thickness are significant.

o — **Organic deposits (Holocene).** Muck and peat, may contain clay at depth. Generally less than 20 feet thick; considered to thin to zero at contact with adjacent polygons. Formed in undrained depressions. Organic deposits too small to map at 100K-scale indicated by an asterisk (*) and underlain by material shown in surrounding map-unit area. Occupies depressions between beach ridges, dunes, and on the lacustrine plain; occurs throughout the map area and is common in areas formally occupied by intermorainal marshes.

C — **Clay (Wisconsinan).** Massive to laminated; may contain interbedded silt and fine sand; clay content can exceed 80 percent. Laminated clay commonly contains thin silt or sand partings. Carbonate-cemented concretions occur in some areas. Distributed throughout the Lima map area as lowland surface deposits; terraces; and as deposits of larger, intermorainal lakes. Also associated with the deep water deposits of high, proglacial predecessors of Lake Erie.

LC — **Silt and clay (Wisconsinan).** Laminated to interbedded, may contain thin, fine sand or gravel layers. Present as thick, deltaic deposits; outwash deposits in upland depressions; and intermorainal lake deposits. Also associated with deep water and deltaic deposits of high, proglacial predecessors of Lake Erie.

L — **Silt (Wisconsinan).** Massive or laminated, commonly contains thin sand partings. Carbonate-cemented concretions occur in some areas. May contain localized clay, sand, or gravel layers. Present throughout the map area as lowland surface deposits; terraces; and thick, deltaic deposits in intermorainal lakes. Also associated with moderate-depth water and deltaic deposits of high, proglacial predecessors of Lake Erie.

S — **Sand (Wisconsinan).** Contains minor amounts of disseminated gravel or thin lenses of silt or gravel; grains well to moderately sorted, moderately to well rounded; finely stratified to massive, may be cross bedded; locally may contain organics. In deep buried valleys, may be older than Wisconsinan age. Present in association with deltaic deposits, finer-grained ice-contact deposits, or outwash throughout map area. Also associated with nearshore dune and beach ridge deposits of proglacial predecessors of Lake Erie.

SG — **Sand and gravel (generally Wisconsinan).** Intermixed and interbedded sand and gravel commonly containing thin, discontinuous layers of silt and clay; grains well to moderately sorted, moderately to well rounded; finely stratified to massive, may be cross bedded; locally may contain organics. In deep buried valleys, may be older than Wisconsinan age. Present as valley wall terraces and in buried valleys throughout the map area and as beach ridge deposits of proglacial predecessors of Lake Erie.

IC — **Ice-contact deposits (Wisconsinan).** Highly variable deposits of poorly sorted gravel and sand; silt, clay, and till lenses common; may be partially covered or surrounded by till. Deposited directly from stagnant ice as kame or esker landforms. Commonly associated with large, deep buried valleys.

T — **Unsorted mix of silt, clay, sand, gravel, and boulders (Wisconsinan).** Variable carbonate content, fractures common. May contain silt, sand, and gravel lenses. Deposited directly from several separate ice advances. Undifferentiated and nonspecified age in buried valleys or where separated by intervening nontill units from an overlying, designated till. Surface may be wave planed or modified by lacustrine erosion and deposition.

CV — **Clay in Teays-age valleys (Early Pleistocene)**. Includes the Minford Clay. May contain interbedded silt and fine-sand deltaic deposits where main trunk valley joins tributary valleys. May fill main trunk valley to 800 feet mean sea level, slightly higher in tributary valleys. Unit up to 300 feet thick. Unit comprised of lacustrine deposits found only in the subsurface in the largest, deeply buried valleys of the classical Teays Valley System.

BEDROCK UNITS

S-L — **Interbedded shale, limestone, and dolomite.** Cincinnati group (Upper Ordovician). Shale is shades of gray, olive, red, and green; calcareous; dolomitic; locally silty. Limestone is shades of gray and olive; finely to coarsely crystalline; contains thin to medium, irregular, nodular to wavy bedding; argillaceous. Dolomite is shades of olive and yellowish gray; finely to coarsely crystalline; mostly in thin to medium beds; argillaceous. Sparse to abundant fossils. Unit not exposed. Occurs in deep buried valleys.

D — **Dolomite.** Dominant bedrock unit present in the map. Stratigraphic names of the dolomites in descending stratigraphic order: Salina Group undifferentiated, Tymochtee and Greenfield Dolomites, and Lockport Dolomite. Salina Group undifferentiated (Upper and Lower Silurian): shades of gray and brown; very finely crystalline; mostly in thin to medium beds and laminae; locally includes shale, anhydrite, and/or gypsum beds and laminae. Tymochtee and Greenfield Dolomites undivided (Upper and Lower Silurian): dolomite and shale. Tymochtee Dolomite; shades of gray and brown; very finely crystalline; occurs in thin to massive beds with carbonaceous shale laminae and beds. Greenfield Dolomite; shades of gray and brown; very finely to coarsely crystalline; occurs as massive beds to laminae; argillaceous; locally brecciated in lower portion. Lockport Dolomite (Upper and Lower Silurian): variegated white to shades of gray; finely to coarsely crystalline; mostly in medium to massive beds; fossiliferous; vugsy; locally cherty in lower portion of unit.

★ Small area of organic deposits.

Quarry, mine, or strip mine; floored in bedrock; may contain reclaimed areas.

× Sand-and-gravel pit. Pit bottom generally underlain by unconsolidated lithologic units of surrounding polygon(s). May contain reclaimed areas.

Clay pit.

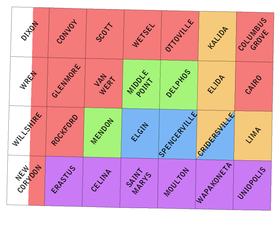
——— Boundary between map-unit areas having different uppermost, continuous lithologies or significant bedrock lithology change; underlying lithologies may or may not differ.

..... Boundary between map-unit areas having the same uppermost, continuous lithology but different thicknesses or different underlying lithologies.

KEY TO LITHOLOGIC COLORS*

- w — Water
- m — Made land, quarries, mines or large pits
- o — Organic deposits (Holocene)
- a — Alluvium (Holocene)
- C — Clay (Wisconsinan)
- L — Silt (Wisconsinan)
- S — Sand (Wisconsinan)
- SG — Sand and gravel (generally Wisconsinan)
- IC — Ice-contact deposits (Wisconsinan)
- T — Unsorted mix of silt, clay, sand, gravel, and boulders (Wisconsinan)
- D — Dolomite or Dolostone (Devonian and Silurian)

* The colors on the map correspond to the uppermost continuous map units and serve to assist in visualizing the geology of the area. Discontinuous units (in parentheses) and subsurface-only units are not assigned colors.



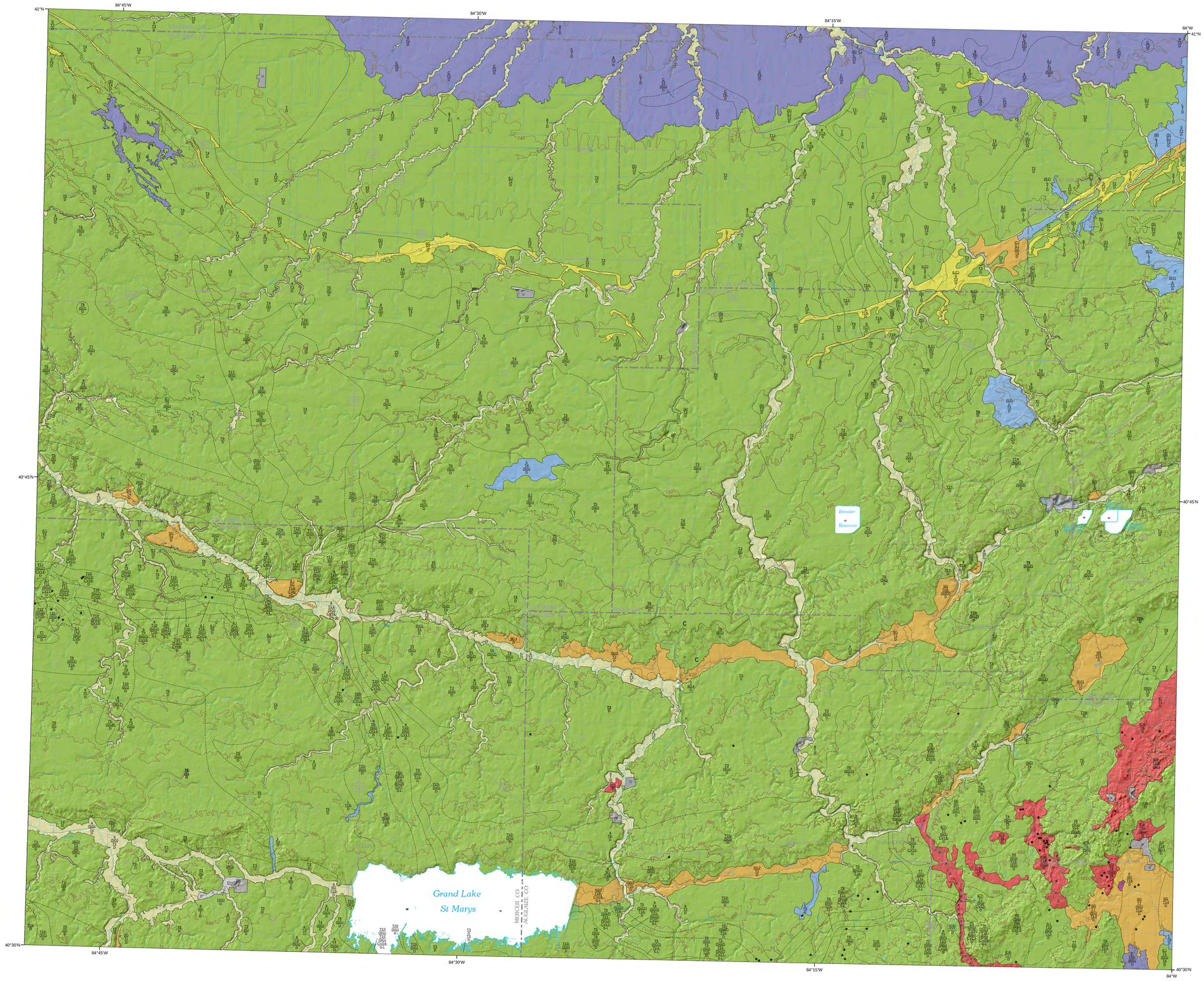
Mapping responsibility and index to the 7.5-minute (1:24,000-scale) quadrangles in the Ohio portion of the Lima 30 X 60-minute quadrangle. Mapping completed in 2011.

Author Index

- Aden
- Angle
- Jones
- Larsen
- Pavey

ACKNOWLEDGMENTS

The geologists of the ODNR Division of Geological Survey, Mapping and Industrial Minerals Group used data from records obtained from the Ohio Department of Transportation, Office of Geotechnical Engineering Geotechnical Document Management System, available online at <http://www.dot.state.oh.us/Divisions/Engineering/Geotechnical/Pages/GDocMS.aspx#GRSR>.



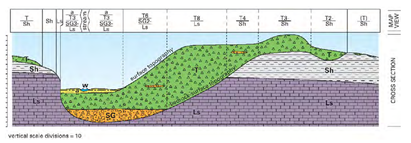
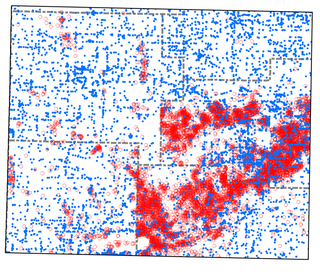
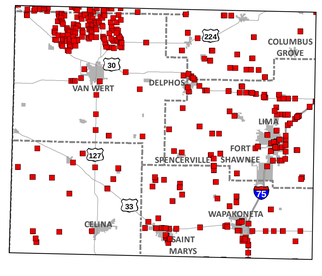


FIGURE 1.—Map view and cross section of a hypothetical stack-unit map. See lithologic-unit descriptions for explanation of symbols. In the map view (top), solid-line boundaries separate map-unit areas having different lithologic units at the surface; underlying lithologic units may or may not differ. Dashed-line boundaries separate map-unit areas having the same surface lithologic unit but different thickness or different underlying lithologic units. The cross section illustrates thickness and mapping conventions. Thickness values are in tens of feet. Values are gross averages that can vary up to 50 percent, except (1) those followed by a minus sign (-), which represent the maximum thickness of a thinning trough- or wedge-shaped sediment body, or (2) units in parentheses ( ), which indicate a discontinuous distribution of that unit. Precise surface topography can be determined from topographic maps that are available from the ODNR Division of Geological Survey at several scales; bedrock-surface topography and bedrock geology are available from the ODNR Division of Geological Survey as 1:24,000 scale quadrangle maps.



○ oil & gas wells • water wells

FIGURE 2.—Plot of oil and gas wells and water wells in the Ohio portion of the Lima 30 X 60-minute quadrangle. Oil and gas well logs on file at ODNR Division of Geological Survey. Water well logs on file at ODNR Division of Soil and Water Resources.



■ Soil Borings

FIGURE 3.—Plot of soil boring locations in the Ohio portion of the Lima 30 X 60-minute quadrangle. Test-boring logs provided by Ohio Department of Transportation, Ohio Environmental Protection Agency (EPA), and county engineers offices.

Location of the Lima 30 X 60-minute quadrangle

Base map derived from Ohio Department of Transportation data sets. Projection of data is Ohio coordinate system, south zone, North American Datum, 1983.

REFERENCES

Angle, M.P., 2005, Ground water pollution potential of Allen County, Ohio: 2005, Ohio Department of Natural Resources, Division of Water GWPPR Report No. 46, 45 p.

Angle, M.P., 2006, Ground water pollution potential of Putnam County, Ohio: Columbus, Ohio Department of Natural Resources, Division of Water GWPPR Report No. 68, 45 p.

Angle, M.P., 2007, Ground water pollution potential of Paulding County, Ohio: Columbus, Ohio Department of Natural Resources, Division of Water GWPPR Report No. 71, 41 p.

Angle, M.P., 2007, Ground water pollution potential of Van Wert County, Ohio: Columbus, Ohio Department of Natural Resources, Division of Water GWPPR Report No. 70, 44 p.

Angle, M.P., and Barrett, K., 2005, Ground water pollution potential of Auglaize County, Ohio: Columbus, Ohio Department of Natural Resources, Division of Water GWPPR Report No. 66, 50 p.

Bleuer, N.K., 1991, The Lafayette Bedrock Valley System of Indiana; concept, form, and fill stratigraphy, *in* Melhorn, W.N., and Kempton, J.P., eds., Geology and hydrogeology of the Teays-Mahomet Bedrock Valley System: Geological Society of America Special Paper 258, p. 51–77.

Brock, A.R., Cunningham, F.L., Rapparlie, D.F., and Thatcher, J.N., 1974, Soil survey of Putnam County, Ohio: U.S. Department of Agriculture, Natural Resources Conservation Service County Soil Survey, 112 p.

Brockman, C.S., Larsen, G.E., Pavey, R.R., Schumacher, G.A., Shrake, D.L., Slucher, E.R., Swinford, E.M., Vorbau, K.E., Powers, D.M., 2003, Shaded bedrock-topography map of Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map BG-3, scale 1:500,000.

Burger, A.M., Forsyth, J.L., Nicol, R.S., and Wayne, W.J., 1971, Geologic map of the 10 x 20 Muncie quadrangle, Indiana and Ohio, showing bedrock and unconsolidated deposits: Indiana Geological Survey Regional Geology Map No. 5, scale 1:250,000.

Cunningham, F.L., Priest, T.C., Brown, D.L., Alt, D.M., Tornes, L.A., and Siegenthaler, V.L., 1981, Soil survey of Auglaize County, Ohio: U.S. Department of Agriculture, Natural Resources Conservation Service County Soil Survey, 71 p.

Feuerer, M.M., Robbins, R.A., Glanville, J.A., and Miller, K.E., 2002, Soil survey of Paulding County, Ohio: U.S. Department of Agriculture, Natural Resources Conservation Service County Soil Survey, 273 p.

Forsyth, J.L., 1960, Correlation of tills exposed in Toledo Edison dam cut, Ohio: Ohio Journal of Science, v. 60, no. 2, p. 94–100.

Goldthwait, R.P., 1991, The Teays Valley problem; a historical perspective, *in* Melhorn, W.N., and Kempton, J.P., eds., Geology and hydrogeology of the Teays-Mahomet Bedrock Valley System: Geological Society of America Special Paper 258, p. 3–8.

Hull, D.N., 1999, Mapping Ohio's karst terrain: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Ohio Geology, 1999, no. 2, p.1-6.

Larsen, G.E., 1991, Development of Silurian and Devonian lithostratigraphic nomenclature, central-western and northwestern Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Open-File Report 91-1, chart.

McClure, D.N., Glanville, J.A., Robbins, R.A., and Allen, J.R., 2005, Soil survey of Allen County, Ohio: U.S. Department of Agriculture, Natural Resources Conservation Service County Soil Survey, 484 p.

McDonald, James, Pavey, R.R., Venteris, E.R., and Wells, J.G., 2007, GIS tools for 3-D surficial mapping in Ohio, *in* Digital Mapping Techniques '07—Workshop Proceedings, Columbia, South Carolina, May 20-23, 2007: U.S. Geological Survey Open-File Report 2008-1385, p. 109-121, last accessed September 23, 2010, at <http://pubs.usgs.gov/of/2008/1385/pdf/mcdonald.pdf>.

Melhorn, W.N., and Kempton, J.P., eds., 1991, Geology and hydrogeology of the Teays-Mahomet Bedrock Valley System: Geological Society of America Special Paper 258, 128 p.

Miller, K.E., Miller, S.A., and Balduff, D.M., 2001, Soil survey of Van Wert County, Ohio: U.S. Department of Agriculture, Natural Resources Conservation Service County Soil Survey, 285 p.

Norris, S.E., 1975, Geological structure of the near-surface rocks in western Ohio: Ohio Journal of Science, v. 75, p. 225–228.

Norris, S.E., and Spieker, A.M., 1966, Ground-water resources of the Dayton area, Ohio: U.S. Geological Survey Water-Supply Paper 1808, 161 p.

Norris, S.E., and Spicer, H.C., 1958, Geological and geophysical study of the preglacial Teays Valley in west-central Ohio: U.S. Geological Survey Water-Supply Paper 1460-E, p. 199-232.

Ohio Division of Geological Survey, 1998, Physiographic regions of Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,100,000.

Pavey, R.R., Goldthwait, R.P., Brockman, C.S., Hull, D.N., Swinford, E.M., and Van Horn, R.G., 1999, Quaternary Geology of Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map 2, scale 1:500,000.

Pavey, R.R., Hull, D.N., Brockman, C.S., Schumacher, G.A., Stith, D.A., Swinford, E.M., Powers, D.M., Sole, T.L., Vorbau, K.E., Kallmi, K.D., Evans, E.E., Slucher, E.R., and Van Horn, R.G., Powers, D.M., 1999, Known and probable karst in Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map EG-1, scale 1:500,000. [Revised 2002, 2004, and 2007.]

Powers, D.M., Laine, J.F., and Pavey, R.R., 2002, Shaded-elevation map of Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map MG-1, scale 1:500,000. [Revised 2003.]

Powers, D.M., and Swinford, E.M., 2004, Shaded drift-thickness of Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map SG-3, scale 1:500,000.

Priest, T.C., Brock, A.R., Cunningham, F.L., Brown, D.L., Tornes, L.A., and Siegenthaler, V.L., 1979, Soil survey of Mercer County, Ohio: U.S. Department of Agriculture, Natural Resources Conservation Service County Soil Survey, 64 p.

Slucher, E.R., Swinford, E.M., Larsen, G.E., Schumacher, G.A., Shrake, D.L., Rice, C.L., Caudill, M.R., Rea, R.G., Powers, D.M., 2006, Bedrock geologic map of Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map BG-1, scale 1:500,000.

Stout, Wilber, Ver Steeg, Karl, and Lamb, G.F., 1943, Geology of water in Ohio: Columbus, Geological Survey of Ohio, Fourth Series, Bulletin 44, 694 p.

Sugar, D.J., 2004, Ground water pollution potential of Allen County, Ohio: Columbus, Ohio Department of Natural Resources, Division of Water GWPPR Report No. 5, 33 p.

Venteris, E.R., 2007, Qualitative and quantitative 3D modeling of surficial materials at multiple scales, *in* Digital Mapping Techniques '06—Workshop Proceedings, Columbus, Ohio, June 11–14, 2006: U.S. Geological Survey Open-File Report 2007-1285, p. 129–150, last accessed September 23, 2010, at <http://pubs.usgs.gov/of/2007/1285/pdf/Venteris.pdf>.

This product of the Ohio Department of Natural Resources (ODNR), Division of Geological Survey is intended to provide a broad surficial-geology framework and general information only and should not be used for any other purpose. It is not intended for resale or to replace site-specific investigations. These data were compiled by the ODNR Division of Geological Survey, which reserves the publication rights to this material. If these data are used in the compilation of other data sets or maps for distribution or publication, this source must be referenced.

Recommended Bibliographic Citation for this map:

Jones, D.M., Pavey, R.R., Larsen, G.E., Aden, D.J., and Angle, M.P. with GIS production and cartography by Martin, D.R. and Wells, J.G., 2011, Surficial geology of the Ohio portion of the Lima 30 x 60-minute quadrangle: Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map SG-2-LIM, scale 1:100,000.

The information contained herein may be updated or edited in the future. Future releases of this material, if altered, will display a revision date. Users should check to ensure they have the latest version and reference the appropriate revision date if it is being used in other works.

Neither the Ohio Department of Natural Resources, nor any agency thereof, nor any of their employees, contractors, or subcontractors, make any warranty, expressed or implied, nor assume any legal liability or responsibility for the accuracy, completeness, or usefulness of this product. Any use thereof for a purpose other than for which said information or product was intended shall be solely at the risk of the user.