

BEDROCK GEOLOGY OF THE WAVERLY SOUTH 7.5-MINUTE QUADRANGLE, OHIO

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

MAPPING CONVENTIONS

In 2015, the Ohio Department of Natural Resources, Division of Geological Survey (Ohio Geological Survey) completed a new set of detailed bedrock geologic maps. These maps were part of a renewed bedrock mapping initiative that takes advantage of modern methods and technology. Mapped areas included Ohio portions of four 7.5-minute quadrangles (Portsmouth, West Portsmouth, Friendship, and New Boston). During the 2016-2017 field season, the Ohio Geological Survey continued bedrock mapping of the Waverly South and Lucasville 7.5-minute quadrangles, which were selected by geologic staff and the STATEMAP Advisory Council based on the following criteria:

- Regional economic, transportation, and recreational importance.
- Major transportation corridor—U.S. Routes 23 and 32 and Ohio Route 823 (Southern Ohio Veterans Memorial Highway, under construction).
- Supplemental geotechnical data derived from highway construction.
- National defense and state security infrastructure and development presence.

Technological developments have improved the accuracy of geologic mapping. Historically, geologists struggled to calculate elevation and position and often spent more effort maintaining their spatial orientation than on the actual practice of geologic mapping. First, recent advancements of cellular and GPS technologies allow for unprecedented levels of location and elevation accuracy with the added benefit of data portability. Field observations, photos, and stratigraphic descriptions are precisely tied to their locations when electronic data-collection platforms are used. Six-inch elevation control on field observations is possible by combining digitally collected data with LIDAR (Light Detection and Ranging) elevation models. These data are easily stored, managed, and transferred as electronic datasets from handheld devices, allowing integration into computerized mapping. Second, computerized modeling of LIDAR data is used to generate representations of surficial patterns that correlate with lithologic properties, such as weathering and structural controls of dip, strike, and unit thickness. These advances are combined with fundamental geologic field mapping and desktop cartography to create detailed geologic map products.

During the 2016-2017 field season, staff geologists intensively located, measured, sampled, described, and photographed outcrops, stream exposures, and road cuts. Additionally, 249 water well records, 24 new and 20 existing measured sections, 136 oil-and-gas well logs, and 2 geologic cores were evaluated. The description of each member may include information on its stratigraphic position, thickness, bedding character, color, sedimentary structures, textures, and composition. Some of these values may have been generalized from notes made during field work. Greater significance was given to member boundaries based on LIDAR models where the critical geologic features were otherwise unobservable, concealed, or inaccessible. The lithologic descriptions accompanying this map are generalizations of the geologic strata mapped under the named members. These descriptions may fail to address all geologic characteristics over the entire area because the descriptions were derived from describing the rock strata at point locations. An undivided member is a group of members, or group of members and beds, that were mapped together under a single symbol but are fully described. Most commonly, this occurs where a member is too thin for vertical resolution at the map scale. Sometimes, a bed or member may have characteristics that vary over the rock extent so the generalized description should be satisfactory. If changes to lithology vary locally or within a small vertical extent, then a description may not account for these.

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Location of the Waverly South 7.5-minute quadrangle, Ohio.

Base map derived from Ohio Department of Natural Resources (ODNR), Ohio Department of Transportation (ODOT), and National Hydrography Dataset (NHD) data sets. Projection of data is Ohio coordinate system, south zone, North American Datum, 1983.

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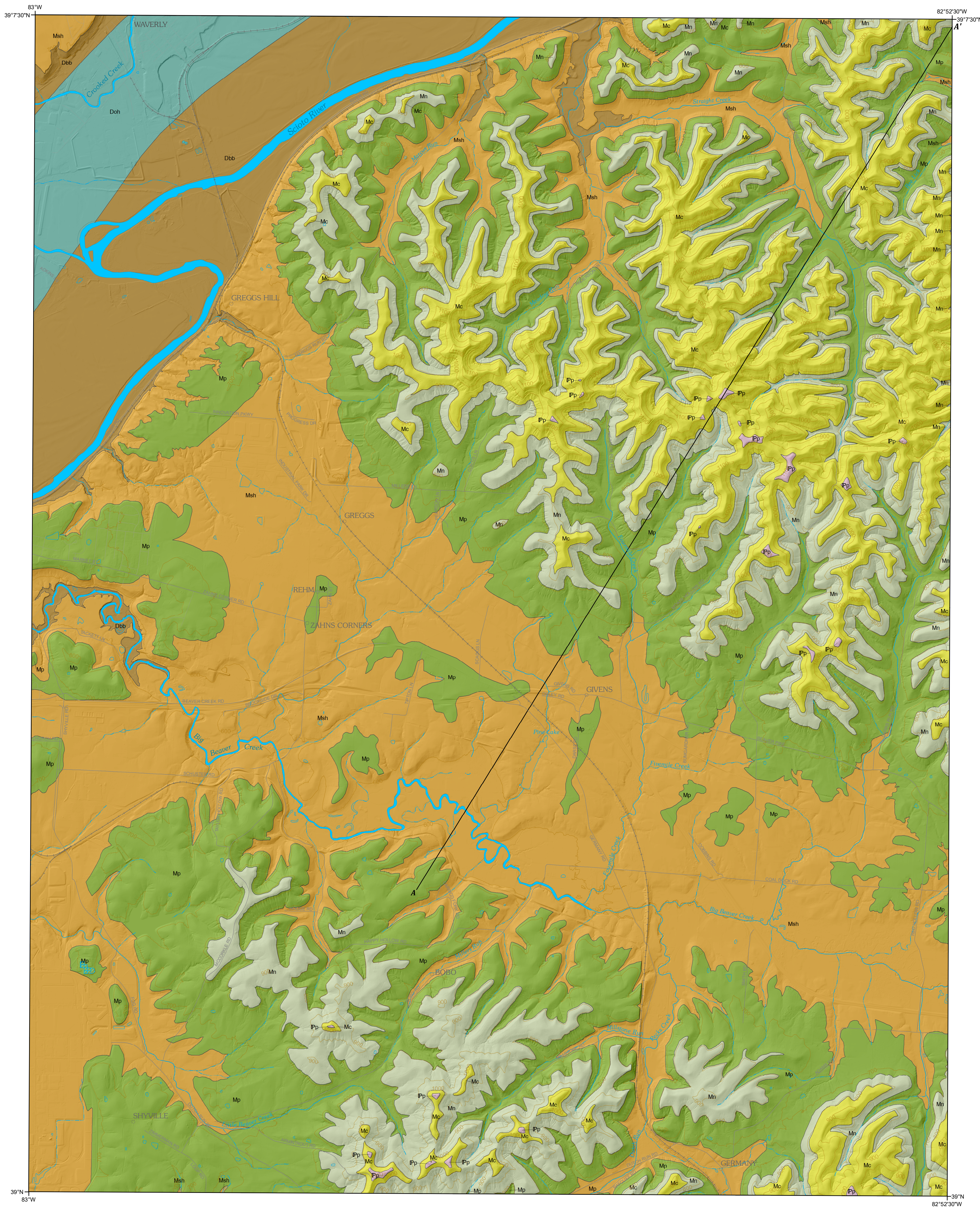
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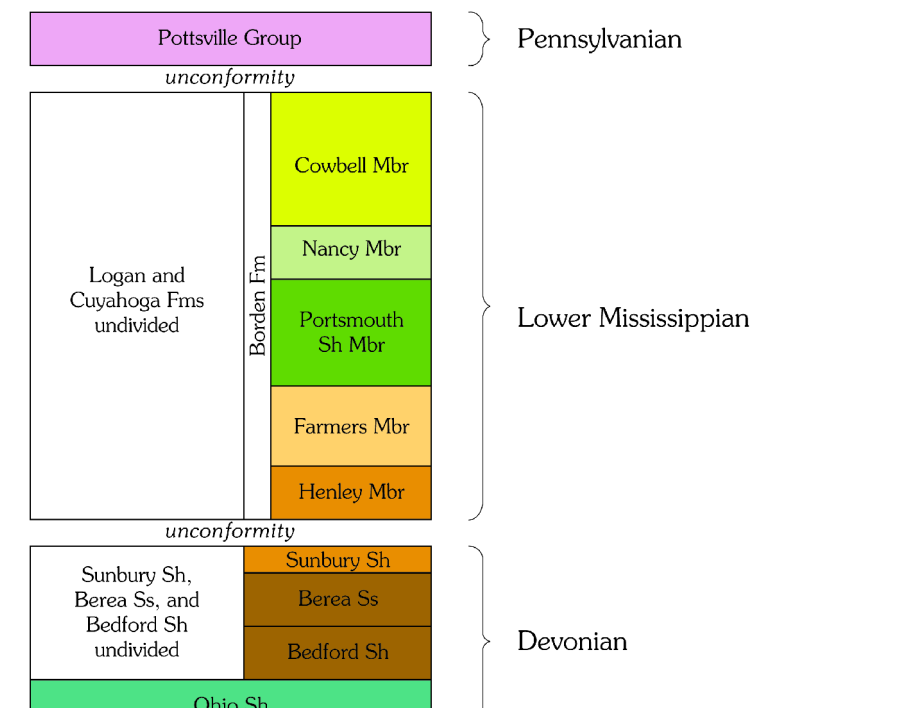
Fugitt, F.L., 2017. Bedrock geology of the Waverly South 7.5-minute quadrangle, Ohio. Columbus, Ohio Department of Natural Resources, Division of Geological Survey Map BG-2-WAV S, scale 1:24,000.

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CORRELATION OF MAP UNITS



UNIT DESCRIPTIONS

- Pp Pottsville Group:** Sharon conglomerate/Harrison ore undivided (Pennsylvanian). Sharon conglomerate, quartzite conglomerate to pebbly sandstone, bedded to very thick bedded, common tabular beds, and cross-beds; cross-beds can be steeply angled having thicknesses exceeding 4 feet. Typically grain supported clasts with iron-oxide cements, grains well rounded, equant to elongate, poorly sorted to well sorted, grain size varies from sand to very coarse pebbles, the largest of these occur in the capping ridge along the southern margin. Color typically white (10YR8/1) to light gray (10YR7/1) with reddish hues where ferric oxide cemented. Bedding thicknesses from 2 to 5 feet, may exceed 36 feet. Observed as remnant knobs where well indurated or as patches of discontinuous beds scattered along broader ridges. Thicker beds occupy areas in lower elevation where paleogeography is deeply incised at unconformity. Some beds very friable having total loss of lithification, making these ideal for mineral uses. Harrison ore, historically known as the Harrison iron ore, economically worked prior to 1900 as one of the principle iron-producing beds of the Hanging Rock Iron District. Basal member of Pottsville Group. Beds exist as nearly continuous ridg along Mississippian-Pennsylvanian unconformity or as a discontinuous, convoluted beds folded within lower portions of overlying Sharon conglomerate or localized black shales. Thicknesses 0.5 to 2 feet. Thicker deposits reported in the literature but not observed. Grades from conglomerate to diamictic. Where it occurs as an edgewise bedded conglomerate, lower beds are hematitic sandstone and upper beds are typically poorly sorted, imbricated, quartzite pebbles having an interstitial hematite or limonite matrix. These extrabasinal materials range from sand to small cobbles. Where diamictic, unit is typically matrix supported with sorted sand to small cobble grains and rock fragments that are typically highly angular flints and cherts of intrabasinal origin. Clast color often nearly white (10YR8/1) with dark brown matrix (7.5YR3/2). Well indurated in outcrop and resistant. Upper contact is variable, marked by carbonaceous sediments, thin conchoidal, or plant fossils. Typically overlain by, or locally replaced with, and to massive beds of finely laminated to laminated gray to black silty-shale. Shales persistent, tabular, and parallel; often infill deep incisions into underlying Mississippian strata.
- Mc Cowbell Member of the Borden Formation (Mississippian).** Sublithic arenites, siltstones, mudstones, and claystones. Beds are finely laminated to massive in appearance, moderately to completely bioturbated. Preserved structures include hummocky cross-stratification, fine parallel laminations, low-angle laminations, symmetrical ripple marks, sponges cracks, burrows, and scours. Bioclastic zones are rare, thin beds composed of crinoid stem fragments and rare brachiopods. Bed thicknesses variable. Colors variable, ranging from nearly white (10YR8/2) to very dark gray (10YR3/1). Fractures often have siderite rinds that impart a red-hued patina. Weathering produces spalling in some beds where massive character is a result of intense bioturbation. Thickness from 125 to 250 feet; thickness varies with depth of incision along the Mississippian-Pennsylvanian unconformity. Lower contact with Nancy Member is gradational.
- Mn Nancy Member of the Borden Formation (Mississippian).** Shaly siltstone. Grades from silty claystone at lower contact with the Portsmouth Shale to very fine-grained sandstone near overlying Cowbell Member. Historically, this contact separated the Cuyahoga and Logan Formations. Heavily bioturbated in zones with both horizontal and vertical infania; body fossils, such as brachiopods, are rare. Lower portions have siderite lenses and discoidal siderite concretions from 1 to 3 inches thick. Unit ranges in thickness from 40 to 90 feet. Fresh exposures range from gray (10YR5/1) to nearly white (10YR8/2); weathered surfaces are brown (10YR5/3). Fracture density increases upward along with silt content and makes unit prone to mass wasting. Upper and lower contacts are gradational.
- Mp Portsmouth Shale Member of the Borden Formation (Mississippian).** Claystone. Weakly indurated, massive beds of laminated to finely laminated, waxy, cohesive claystone that exhibit conchoidal fracture on freshly broken surfaces. Weathered surfaces vary from gray to bright tan (10YR5/1 to 10YR7/6). Weathers to rutted, badland-type landscape. Upper portions contain thin to very thin-bedded siltstones, having sparse and irregularly occurring siderite nodules which coincide with color change from gray to yellow. Upper portions have occasional siltstone or arenite beds 1 to 1.5 inches thick, with approximately 200 feet thick. Gradational contact with overlying Nancy Member. The basal unit of the Portsmouth Shale Member is a siltstone to fine-grained sandstone bed with thin shale partings. This siltstone and shale range in thickness from 0 to 6 feet; bed is bioturbated on upper surface and contains abundant flute and groove casts on the basal surface. Weathered surfaces typically yellowish brown (10YR5/4); shale partings gray (10YR6/1) with siderite rinds; unweathered member is white (10YR8/2). Bed thickens to the south and is correlative with Farmers Member of the Borden Formation in Kentucky.
- Msh Henley Member of the Borden Formation and Sunbury Shale, undivided (Mississippian).** Henley Member, clay-silty shale; fissile, laminated, irregularly bedded, laminations, fractures, and parting surfaces typically covered by thin siderite rinds. Fresh exposures dark-gray (5Y4/1) to olive gray (5Y5/2) to brown (7.5YR4/3) with increased fissility. Upper beds more uniformly bedded where blocky siltstone becomes nearly white (10YR8/2) when weathered. Claystones have greasy texture. Upper portion increasingly tabular as beds increase in thickness and frequency. Grain size increases upward to siltstone at the upper contact. Total thickness not observed; well records suggest a range of thickness from 0 to 40 feet. Sunbury Shale Member, silty shale; fissile, laminated, organic, massive. Weathers dark gray (7.5YR4/0) to black (7.5YR2/0). Subsurface logs record thickness ranging between 10 and 40 feet. Complete exposure of the unit was not observed during field work. Unit occurs near drainage elevation, often concealed by colluvium. Recognized by its black color, organic content, weathering characteristics, and position above the Berea Sandstone.
- Ddb Berea Sandstone and Bedford Shale, undivided (Devonian).** Berea Sandstone, siltstone to very fine-grained sandstone; bedded to thickly bedded with well-developed fractures and joints, and fissile silty shale interbeds. Siltstone-to-shale ratio is 3:1 with minor carbonaceous detritus and siltclastic clay. Individual bed thicknesses may decrease upward; total unit not observed during field work; observed thickness was less than 35 feet. Basal bed is convoluted with flow-ripped structures. Fresh surface color light gray (7.5YR7/0); weathers to pale brown (10YR6/3). Upper beds have pyrite zones. Shares a sharp contact with the overlying Sunbury Shale and a gradational lower contact with the Bedford Shale. Bedford Shale, silty shale; fissile, dark-gray to black shale interbedded with thin siltstones in upper portions of unit. Lower portion has thin layer of siderite nodules. Oscillatory wave ripple marks common. Thickness ranges from 35 to 50 feet. Fresh surface color is gray (2.5Y5/0); weathers to light-brownish gray (2.5Y6/2). Poorly exposed in deepest cuts at stream floor elevation. Interbedded siltstones increase in frequency and thickness upward, grading into the overlying Berea Sandstone.
- Doh Ohio Shale (Devonian).** Shale; typically comprised of Cleveland, Chagrin, and Huron Members and Three Licks Bed. Massive bedded, black; subcrop in Scioto River Valley. In outcrop, very fissile, finely laminated, and heavily jointed. Weathers from black to dark brown; petrolierous; carbonaceous. May exhibit papery weathering. On freshly exposed surfaces, banding can be observed but may be limited to specific members. Macrofossils rarely observed. Thickness in map area unlikely to exceed 400 feet; thickness increases eastward.

