STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
Michael P. Angle, Chief

BEDROCK GEOLOGY OF THE RATCLIFFBURG 7.5-MINUTE QUADRANGLE, OHIO

by
Franklin L. Fugitt

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

Map BG-2-RAT
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MAPPING CONVENTIONS

Beginning in 2015, the Ohio Department of Natural Resources, Division of Geological Survey (Ohio Geological Survey) renewed its bedrock mapping initiative using modern methods and technology. Since then, the lithostratigraphy of nine 7.5-minute quadrangles along corridors of the Scioto and Ohio rivers were mapped. These maps detail stratigraphic correlations between the Cuyahoga and Logan Formations and the Borden Formation. During the 2018–2019 field season, the Ohio Geological Survey continued the initiative by mapping four additional 7.5-minute quadrangles. The Richmond Dale, Ratcliffburg, Londonderry, and Byer 7.5-minute quadrangles were selected by Ohio Geological Survey 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.
- Supplemental geotechnical data derived from highway construction.
- National defense and state security infrastructure and development presence.

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. Technological developments have improved the accuracy 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 Light Detection and Ranging (LiDAR) 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 2018–2019 field season, staff geologists intensively located, measured, sampled, described, and photographed outcrops, stream exposures, and road cuts. Additionally, 854 water well records, representing 3,587 lithologic contacts, were spatially rendered in 3D and evaluated for trends and variability. Staff also evaluated 276 new field-located lithology points, 203 existing measured sections, and 1 geologic core. 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 not address all geologic characteristics over the entire area because the descriptions were derived from the rock strata at point locations. An undivided Member is a group of Members, or group of Members and beds, that were mapped together as a single unit 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 map's extent, so the generalized description should be satisfactory. A description may not account for changes to lithology that vary locally or within a small vertical extent.

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Location of the Ratcliffburg 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.

DISCLAIMER

Recommended Bibliographic Citation for this Map

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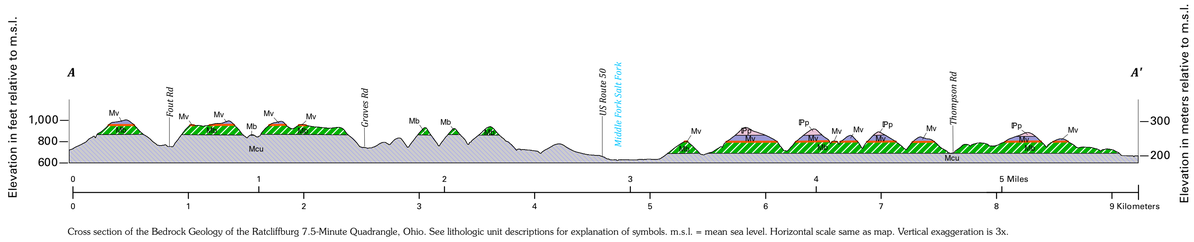
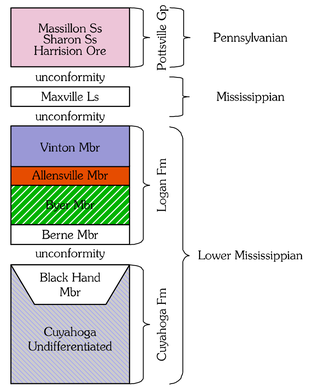
7°5' W
Magnetic declination
N
1:24,000

MILES 1 0 1
KILOMETERS 1 0 1
5,000 0 5,000 FEET
1,000 0 1,000 METERS



Cross section of the Bedrock Geology of the Ratcliffburg 7.5-Minute Quadrangle, Ohio. See lithologic unit descriptions for explanation of symbols. m.s.l. = mean sea level. Horizontal scale same as map. Vertical exaggeration is 3x.

CORRELATION OF MAP UNITS



UNIT DESCRIPTIONS

IPp — **Pottsville Group: Massillon Sandstone, Sharon Conglomerate, and Harrison Ore undivided (Pennsylvanian).** Massillon Sandstone: A well-sorted, sublithic arenite, with angular, equant-faceted grains diagnostic in hand specimen. Occurs as remnant knobs, isolated ridges, or slumped blocks along hillsides. These well-rounded exposures are honeycomb weathered with diagnostic dusky red (7.5YR 3/2) color. Well consolidated with tabular cross-beds and frequent truncating trough cross-beds ranging from an inch to 3 feet thick. Observed thicknesses range from 10 to 30 feet.

Sharon Conglomerate: Quartzite conglomerate to pebbly sandstone; bedded to very thickly 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. Color typically white (10YR 8/1) to light gray (10YR 7/1) with reddish hues where ferric oxide-cemented. Bedding thicknesses from 2 to 5 feet; may approach 40 feet. Thickest deposits exceeding 200 feet infill paleotopographic low areas incised along the Mississippian-Pennsylvanian unconformity. Frequently observed as remnant knobs or ridge lines. Sharon shale strata exist on Mississippian paleotopographic highs as fissile, dark-brown shale with maximum thickness of 35 feet. Where the shale is present the conglomerate is usually absent.

Harrison ore: Basal member of Pottsville Group. 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. Beds occur as a nearly continuous rind along Mississippian-Pennsylvanian unconformity or as discontinuous, convoluted beds folded within lower portions of overlying Sharon conglomerate or shales. Thicknesses range from 6 inches to 2 feet. Thicker ore deposits reported in the literature but not observed. Grades from conglomeratic to diamictitic. Where it occurs as an edgewise bedded conglomerate, lower beds are hematitic ironstone, and upper beds are typically poorly sorted, imbricated, quartzite pebbles having an interstitial hematite or limonite matrix. The extrabasinal material ranges from sand to small cobbles. Where diamictitic, the unit is typically matrix supported with unsorted sand grains to small cobble clasts and rock fragments that are typically highly-angular flints and cherts of intrabasinal origin. Clast color often nearly white (10YR 8/1) with dark-brown matrix (7.5YR 3/2). Well indurated in outcrop and resistant. Upper contact is variable, marked by carbonaceous sediments, thin coal strings, or plant fossils. Typically overlain by, or locally replaced with, thick 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.

Mv — **Vinton Member of the Logan Formation (Mississippian).** The Vinton Member is a variably-bedded sandstone, siltstone and shale member. Arenite to silty sandstone with minor shale partings. Sandstone and siltstone beds are lithic to sublithic arenites. Shales are silty to argillaceous. Lithologically similar to the Byer Member, the Vinton is distinguishable only by its stratigraphic position above the Allensville Member. Beds range from 4 inches to 6 feet thick; usually blocky, tabular to laminated; some locally massive. Beds are indurated, but some shale beds are poorly lithified. Locally, bed thicknesses were observed to increase up-section. Preserved sedimentary structures include hummocky cross-stratification, very fine parallel laminations, low-angle laminations, horizontal and vertical ichnofossils, and scours. Some beds weather along mud drapes, producing platy or discoidal clasts while other beds exhibit a more characteristic blocky fracture that develops blocky angular clasts sometimes distinguishing it from the Byer Member. Colors range from near white (10YR 8/2) to very dark gray (10YR 3/1). Observed thickness ranges from 10 feet to 80 feet, but total thickness is unknown because of its position below the erosion surface associated with the Mississippian-Pennsylvanian unconformity.

Allensville Conglomerate Member of the Logan Formation (Mississippian). Conglomerate with sandstone, siltstone and shale. Comprised of 6 to 8 fining upward beds. Each bed ranges in thickness from 12 to 18 inches, with the thickest bed being lowermost in the member. Bedsets thin upward. Each bed has a basal granule or pebble layer with sharp upper and lower contacts. The granule layers are 4 to 8 inches thick, composed of well rounded, very well sorted, mono and polycrystalline quartz grains ranging in size from 1 to 2 mm, grain supported, with a light gray (2.5YR 7/1) very fine-grained interstitial matrix composed of quartz silt, pyrite framboids, and authigenic clays. When above drainage has springs and sapping. Portions between the pebble layers are usually thinly-bedded sandstones grading to clay-shale laminae, occasional ripple crests and cross laminae are observed; portions above the pebble layer not exhibiting these features are indistinguishable from the underlying Byer Member. Where exposed along deep-stage topography, frequently only the granule layer is preserved as a 4- to 8-inch monomictic quartzite conglomerate that is thick, resistant, and well indurated. Weathers to dark reddish brown (2.5YR 3/3), when fresh is light red (2.5YR 6/8). Total thickness is 6 to 12 feet. May be thicker in some areas.

Byer Member of the Logan Formation (Mississippian). Fine grained sandstone or shale. Laterally equivalent to the Cowbell Member of the Borden Formation. The basal contact of the Byer is gradational with the underlying Nancy Member of the Borden Formation but disconformable with underlying Cuyahoga shale. Above the basal contact, two laterally continuous siltstone beds exist. These may represent a facies variant of the Berne and Black Hand members. The Byer Member siltstone includes arenites, sublithic arenites, and shales. Bed thicknesses range from half an inch to 6 feet. Beds are finely laminated to massive, poorly indurated to indurated. Locally, banded ferruginous cemented. Sedimentary structures include: hummocky cross-stratification, very fine parallel laminations, low-angle laminations, symmetrical ripple, horizontal ichnofossils, and scours. Weathers along mud drapes, producing platy or discoidal clasts. Colors range from near white (10YR 8/2) to very dark gray (10YR 3/1). Fractures are often cased in siderite rinds with siderite imparting red-hued patina. Thickness ranges from 15 to 150 feet but may be less where deep incision removed some or all the Member along the Mississippian-Pennsylvanian unconformity.

Mcu — **Cuyahoga Formation Undifferentiated (Mississippian).** Shale and interbedded sandstones, siltstones, shales, and clays. Usually thinly bedded with occasional thicker beds; often capped by two fine-grained, tabular, massive arenite beds. Lower portion predominately interbedded, gray shales with laminated, waxy clays occasionally broken by thinly bedded siltstones or tabular arenite sandstone. Laterally and vertically gradational; shale portions become siltier, shales grade to very fine-grained sandstone in uppermost portions. Siltstone and sandstone contain plant fragments and occasional fossiliferous zones with crinoid and brachiopod assemblages. Weathers from gray to bright tan (10YR 5/1 to 10YR 7/6). Weathered surfaces are typically yellowish brown (10YR 5/4); shale partings gray with siderite rinds (10YR 6/1). Fresh exposures are white (10YR 8/2). Irregularly-occurring siderite nodules coincide with color change from gray to yellow. Upper portions have tabular bedded arenite sandstone beds ranging from 1 inch to 1.5 feet thick, occasionally rippled. Gradational contact with overlying Cowbell Member of Borden Formation but disconformable with overlying Byer Member of the Logan Formation; basal portion laterally correlates with the Portsmouth Shale, Farmers, and Nancy Members of the Borden Formation. Thickest portions exceed 340 feet in the Londonderry quadrangle.

West of a north–south strike originating at Ponetown Hollow on the Ratcliffburg and Byer quadrangles, the Cuyahoga undergoes significant lateral facies change. Here, the uppermost 60 feet of Cuyahoga strata occurs as a massive bedded, very-fine grained, light greenish gray (Gley 1 7/1). Arenite grains are well rounded, very well sorted, uniform, and closely packed with minimal pore space and well cemented. Outcrops developed on these rocks form thin beds of hackly-fractured discs or lenses that have wide apertures along both vertical and horizontal planes. Exposures cut by streams, roads, or rail-lines; lack horizontal aperture development, weathering

■ **Field data points.** Shows the locations of key outcrops, cuts, exposures, or contacts that were used during mapping to describe and measure lithologic thicknesses, structures, and properties.

1	2	3
4	**5**	6
7	8	9

1 Hallsville
2 Laurelville
3 South Bloomingville
4 Londonderry
5 Ratcliffburg
6 Allensville
7 Richmond Dale
8 Byer
9 Hamden

Adjacent 7.5-minute quadrangles