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SURFICIAL GEOLOGY OF THE CLEVELAND SOUTH 30 X 60 MINUTE QUADRANGLE

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OHIO DIVISION OF GEOLOGICAL SURVEY
Map SG-1
Prepared in cooperation with the United States Geological Survey, National Cooperative Geologic Mapping Program (STATEMAP)

EXPLANATION

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

1) the geologic deposits, indicated by letters which represent the major lithologies,
2) the thickness of the individual deposits, indicated by numbers and modifiers,
3) the lateral extent of the deposits, indicated by map-unit area boundaries, and
4) the vertical sequence of deposits, shown by the stack of symbols within each map-unit area.

In effect, each stack represents a generalized cross section for each area.

Letters represent geologic deposits (lithologies) and are described in detail below. Geologic deposits 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 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 lithology in tens of feet (for example, 3 represents 30 feet). If no number is present, the average thickness is assumed to be 1 (10 feet). These unmodified numbers correspond to a thickness range centered on the specified value, but may vary up to 50 percent. For example, T4 indicates the average thickness of till in a map-unit area is 40 feet, but thickness may vary from 20 to 60 feet.

Modifiers provide additional thickness and distribution information:

1) Parentheses indicate that a unit has a patchy distribution and is missing in portions of that map-unit area. For example, (T2) indicates that till with an average thickness of 20 feet is present in only part of that map-unit area. If no number is present, the unit averages 10 feet or less in thickness, where present.

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 lithology and vertical position specified in an adjacent map-unit area. For example, an SG3- map-unit area adjacent to an SG3 area indicates a sand and gravel unit having a maximum thickness of 90 feet that thins to an average of 30 feet 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.

These letters, numbers, and modifiers are arranged in stacks that depict the vertical sequence of geologic 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. Figure 1 illustrates mapping conventions.

Erosion by modern streams has cut through the vertical sequences that surround them and may truncate one or more units in a sequence. The resultant valley sides, too small to delineate, are generally covered with thin, variable colluvium (weathered material that has moved downslope).

The reconnaissance scale of this map cannot accommodate the great local variability within surficial deposits. That variability is recognized in the unit descriptions and by the use of thickness ranges. Therefore, 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 is greatest near the surface and decreases 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 which indicate change of deposits at depth, such as Ohio Department of Natural Resources water-well logs, Ohio Department of Transportation test-boring logs, theses, and published or unpublished geologic reports, maps, and field notes. These data also provided the basis for lithologic unit descriptions, which summarize, as accurately as possible, recognized associations of genetically related materials. The total thickness of surficial deposits was calculated from Division of Geological Survey open-file bedrock-topography maps, which are available for each 7.5-minute quadrangle in the map area. The bedrock units were summarized from Division of Geological Survey open-file bedrock-geology maps, also available for each 7.5-minute quadrangle.

LITHOLOGIC UNIT DESCRIPTIONS

SURFICIAL UNITS

W — Water. Large lakes and reservoirs only.

m — Made land. Large cut and fill areas; includes quarries and pits.

a — Alluvium, Holocene-age. Includes a wide variety of textures from silt and clay to boulders, commonly with organics; generally not compact; rarely greater than 20 feet thick. Found within floodplains of modern streams throughout the entire map area. Mapped only where areal extent and thickness are significant.

At — Alluvial terraces, Wisconsinan-age. Old floodplain remnants along streams that flowed into high, proglacial predecessors of Lake Erie. Highly variable textures. Commonly found tens of feet above modern floodplains.

O ★ — Organic deposits, Holocene-age. Muck and peat, formed in undrained depressions. Small areas of organic deposits shown as an asterisk are underlain by material shown in surrounding map-unit area. Found throughout the map area.

C — Clay, Wisconsinan-age. Massive to laminated; may contain interbedded silt and fine sand; clay content may exceed 80 percent. Laminated clay commonly contains thin silt or sand partings. Carbonate-cemented concretions present in some areas. Joints 6 to 12 inches apart common. Found throughout the map area as lowland surface deposits, terraces, and as deep-water deposits of high, proglacial predecessors of Lake Erie.

L — Silt, Wisconsinan-age. Massive or laminated, commonly contains thin, sand partings. Carbonate-cemented concretions present in some areas. May contain clay, sand, or gravel layers. Clay content commonly increases with depth. Found throughout the map area in lowland surface deposits and terraces and as thick, deltaic deposits of high, proglacial predecessors of Lake Erie.

LC — Silt and clay, Wisconsinan-age. Laminated to interbedded, may contain thin fine sand or gravel layers. Found as thick lacustrine valley-fill deposits of high, proglacial predecessors of Lake Erie.

S — Sand, Wisconsinan-age. 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. Found in terraces and buried valleys throughout the map area and as nearshore, dune, and beach-ridge deposits of high, proglacial predecessors of Lake Erie.

SG — Sand and gravel, generally Wisconsinan-age. 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. Found in terraces and buried valleys throughout the map area and as beach-ridge deposits of high, proglacial predecessors of Lake Erie.

IC — Ice-contact deposits, Wisconsinan-age. Highly variable deposits of poorly sorted gravel and sand; inclusions of silt, clay, and till lenses common. Deposited directly from stagnant ice as kame or esker landforms. Found throughout the map area.

CG — Complexly interbedded deposits of clay, silt, sand, gravel, and till in deeper parts of buried valleys throughout the map area. Up to 320 feet thick. Data insufficient for more detailed differentiation.

T — Till, Wisconsinan-age. Unsorted mix of clay, silt, sand, gravel, and boulders. May contain silt, sand, and gravel lenses. Joints common. Deposited directly from the ice of several separate advances. Near-surface clay percentage of till as high as 50 percent, decreasing with depth to percentages in the mid-20's. Near-surface sand percentage of till as low as 8 percent, increasing with depth to percentages in the mid-30's. Till in buried valleys and thicker areas may be older than Wisconsinan. Most common surficial unit in the map area.

BEDROCK UNITS

P — Sandstone, conglomerate, and subordinate amounts of shale, siltstone, clay, and coal, Pennsylvanian-age Pottsville Group. Present over eastern half of map area. Sandstone and conglomerate very light to light gray, medium to coarse grained, nonbedded to massive. Sandstone with abundant rounded quartz pebbles and quartz-pebble conglomerate common in basal portion; designated as Ss in some places. Interbeds of shale, siltstone, coal, and clay common in upper portion. Rapid horizontal and vertical changes of rock types. Average thickness of Pottsville Group 256 feet, but may be greater than 300 feet. Sandstone and conglomerate are resistant units forming hills and cliffs in map area.

Ss — Sandstone and conglomerate, Pennsylvanian-age Sharon sandstone in eastern portion of map area, and Mississippian-age Berea Sandstone in northwestern portion of map area. Sharon sandstone gray to white, coarse to medium grained, porous, and friable; weak silica and iron oxide cementation; conglomerate facies generally present at base of unit, consisting of well-rounded quartz pebbles and granules in a sand matrix; thin lens of fissile, gray to gray-black clay shale locally present; thickness of Sharon ranging from zero locally to 250 feet; resistant unit forming knobs and hills, particularly in Geauga and Portage Counties; basal contact unconformable with underlying Mississippian-age blue-gray shale and siltstone; relief at contact up to 200 feet in channel cuts; unit locally quarried and noted for its high silica content. Berea Sandstone light gray, medium to fine grained, and thin to massive bedded; generally 40 to 60 feet thick, but ranging from zero to 230 feet because of erosional surface at base of unit; resistant unit forming hills and cliffs in Cuyahoga County.

SSh — Sandstone and shale, Mississippian-age Cuyahoga Formation, Berea Sandstone, and Bedford Shale. Cuyahoga Formation (uppermost unit) gray to brown shale interbedded with minor sandstone and siltstone, present in southern and western portions of map area; rapid vertical and horizontal changes. Berea Sandstone, description as above under "Ss;" designated as Ss in some places; resistant unit forming hills and cliffs at or near the northwestern edge of map area. Bedford Shale predominantly soft, red clay shale grading downward into gray shale; thick siltstone lentils present; thickness ranging from 50 to 150 feet; exposed in northern portion of map area.

Sh — Shale, Devonian-age Ohio Shale. Present in east-west-oriented belt along Lake Erie shoreline in Cuyahoga County; locally present in buried valleys. Shale black to brown, silty, carbonaceous, fissile parted; containing soft, gray to greenish-gray clay shale beds; unit thickening from 1,000 feet to 2,000 feet from west to east across the map area.

——— Boundary between map-unit areas in which the uppermost lithologic units differ; lower lithologic units may or may not differ.

- - - - - Boundary between map-unit areas in which the uppermost lithologic unit is the same but underlying unit(s) differ in thickness or in lithology.

★ Small area of organic deposits.

⁂ Sand and gravel or other surficial pit.

⚒ Bedrock quarry or strip mine.

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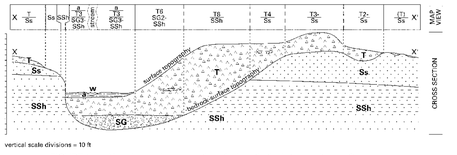


FIGURE 1. — Map view and cross section of a hypothetical stack-unit map. See lithologic-unit descriptions for explanation of symbols. In the map view (top), solid-line boundaries separate map-unit areas having different lithologic units at the surface; underlying lithologic units may or may not differ. Dashed-line boundaries separate map-unit areas having the same surface lithologic unit but different thickness or different underlying lithologic units. The cross section along X-X' 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 represents 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 Division of Geological Survey at several scales; bedrock-surface topography and bedrock geology are available as Division of Geological Survey open-file maps.

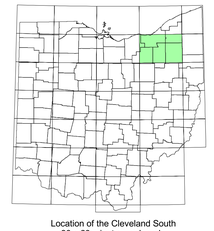
The information contained on this map can be used for many derivative environmental, resource, and geohazards applications. The colors on this map depict the uppermost continuous unit and are intended to assist in visualizing the geology of the area. Discontinuous units (in parentheses) were not included in color assignment.

- Water
- Made land, quarries, pits
- Alluvium
- Alluvial terraces
- Organic deposits
- Clay
- Silt and clay
- Silt
- Sand
- Sand and gravel
- Ice-contact deposits
- Till
- Bedrock

Index to 7.5-minute (1:24,000 scale) quadrangles in the Cleveland South 30 x 60 minute quadrangle and mapping responsibility:

- Larsen
- Pavey
- Schumacher
- Swinford

Base map preparation by Edward V. Kuehnle from Ohio Department of Transportation data. Digitizing by Kim E. Vorbau, Deborah E. Allan, and Noelle C. Logan. Digital-line quality control and editing by Kim E. Vorbau. GIS conversions by James McDonald. 1:100,000 compilation and design by Richard R. Pavey.



Location of the Cleveland South 30 x 60 minute quadrangle

Revised 3/2002

SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND

Projection: Ohio State Plane North NAD 1927

UTM grid convergence (GN) and magnetic declination (MN) at center of map. Diagram is approximate