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SURFICIAL GEOLOGY OF THE LORAIN AND PUT-IN-BAY 30 X 60 MINUTE QUADRANGLES

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Map SG-2 Lorain/Put-in-Bay
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INTRODUCTION

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;
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 (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 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 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 feet 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, an SG9- 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 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. **Figure 1** illustrates mapping conventions.

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 described 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 indicated change of deposits at depth, such as Ohio Department of Natural Resources water-well logs, Ohio Department of Transportation and Ohio EPA 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. Land-surface topography shown on the basemap was prepared largely from data derived from the U.S. Geological Survey's National Elevation Dataset (30 meter grid spacing).

LITHOLOGIC UNIT DESCRIPTIONS*

SURFICIAL UNITS

w — Water, lakes larger than 20 acres.

m — Made land. Large areas of fill along the shore in the city of Sandusky.

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 map area. Mapped only where areal extent and thickness are significant.

o — Organic deposits, Holocene age. Muck and peat, formed in undrained depressions. Organic deposits too small to map at this scale are indicated by an asterisk (*) and are underlain by material shown in surrounding map-unit area. Found throughout map area.

om — Organic and marl deposits, Holocene age. Found only in the area north and west of Castalia, where groundwater rich in calcium carbonate discharges from springs at the base of the Columbus Limestone escarpment. Precipitation of carbonate [marl] around plants on poorly-drained Lake Plain sediments has constructed these "upland bogs".

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

Au — Alluvium and alluvial terraces, combined. Shown in areas where insufficient space is available to delineate separate units.

C — Clay, Wisconsinan age. Massive to laminated; may contain interbedded silt, and fine sand; clay content can exceed 80%. Laminated clay commonly contains thin silt or sand partings. Carbonate-cemented concretions occur in some areas. Commonly contains joints 6 to 12 inches apart. Distributed throughout 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 occur in some areas. May contain clay, sand, or gravel layers. Clay content commonly increases with depth. Found throughout area in lowland surface deposits, terraces, and as thick, deltaic 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 age. Found in terraces and in buried valleys throughout 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 age. Found in terraces and buried valleys throughout map area, and as beach ridge deposits of high, proglacial predecessors of Lake Erie.

G — Gravel, Wisconsinan age. Contains intergranular sand, some sand and silt beds and lenses; unit well to moderately sorted, subangular to well rounded; may be massive, cross-bedded, or horizontally bedded. Clasts vary in lithology, and are commonly derived from bedrock in immediate area. In deep buried valleys, may be older than Wisconsinan age.

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

GA — Basal gravel. Highly variable, poorly sorted gravel and sand, with significant amounts silt and clay. Found in the southwest part of map area; deposited at or near front of the ice sheet directly on bedrock. Presumably of Wisconsinan age, but may be older.

CG — Complexly interbedded deposits of clay, silt, sand, gravel, and till in the deeper part of the buried valley in southeast part of map area. Up to 275 feet thick, insufficient data are available for more detailed differentiation.

T — Till, Wisconsinan age. Unsorted mix of silt, clay, sand, gravel, and boulders. May contain silt, sand, and gravel lenses. Joints common. Deposited directly from ice of several separate advances. Near-surface clay percentage of till is as high as 50 percent, decreasing with depth to percentages in the mid-20s. Near-surface sand percentage of till is as low as 8 percent, increasing with depth to percentages in the mid-30s. Till in buried valleys and thicker areas may be older than Wisconsinan. Most common surficial unit in map area.

BEDROCK UNITS

SSh — Sandstone and shale, Mississippian and Devonian age. Cuyahoga Formation, Sunbury Shale, and Berea Sandstone and Bedford Shale. Cuyahoga Formation, the uppermost unit, is present in southeast portion of map area. Shale and siltstone dominate and rapidly change vertically and horizontally. Sunbury Shale, present in south central portion of the map, is black to brown, fissile parted, silty, carbonaceous shale. Berea Sandstone, a resistant unit that forms hills and cliffs at or near northern edge of study area, is light gray, medium- to fine-grained, and thin to massive bedded. Unit is generally 40 to 60 feet thick, but can vary from 0 to 230 feet in thickness because of an erosional surface at base of unit. Berea is thicker in central Lorain and western Medina Counties. Bedford Shale, exposed in the northern portion of the study area, is predominantly soft, red, clay shale which grades downward into a gray shale. Thick siltstone lentils are present. Bedford Shale ranges from 50 to 150 feet in thickness.

Sh — Shale, Devonian age. Ohio Shale, present along a 12 mile-wide north-south oriented belt in western Huron and central Erie Counties and along Lake Erie shoreline in Lorain County. Unit is black to brown, silty, carbonliferous, fissile parted shale, which contains gray to greenish-gray, soft, clay shale beds. Ohio Shale thickens from 350 to 500 feet from west to east.

SiL — Shale with minor limestone, Devonian age. Prout Limestone and Plum Brook Shale and their southern equivalent, Olentangy Shale, present in a one to three mile-wide, north-south oriented belt in western Huron County and central Erie County. Plum Brook Shale is gray to greenish-gray, soft, fossiliferous, calcareous, clay shale 50 to 80 feet thick. The unit is capped by Prout Limestone, a hard, siliceous, gray to brown limestone bed 3 to 10 feet thick. Prout Limestone pinches out in the southern part of the study area. Olentangy shale is greenish-gray, calcareous, sparsely fossiliferous, clay shale.

Ls — Limestone, Devonian age. Delaware and Columbus Limestones, present in a 10-mile wide belt in eastern Seneca, Sandusky, and Ottawa Counties, western Erie County and on Kellys Island. Delaware Limestone is medium brown, fine to medium crystalline, fossiliferous, and cherty containing shale laminae. Columbus Limestone is light to medium gray to brown, fine to coarse crystalline, fossiliferous, and cherty in the upper portion. The lower portion is light brown to gray, fine to medium crystalline, dolomitic, massive bedded, and contains quartz grains in the basal ten feet. The combined Columbus and Delaware units are 200 feet thick. This unit is susceptible to dissolution and contains significant areas of well-developed karst topography.

D — Dolomite, Silurian age. Undifferentiated Salina Dolomite, present in a northeast-trending belt in eastern portion of study area in eastern Sandusky County, on Marblehead Peninsula in eastern Ottawa County, and the Bass Islands of Lake Erie. Salina undifferentiated is brown to gray dolomite that is laminated, microcrystalline, argillaceous, and contains beds of gypsum, anhydrite or anhydritic dolomite. The upper portion can be light gray to medium brown, brecciated, and cherty.

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Mapping responsibility and index to 7.5-minute (1:24,000 scale) quadrangles in the Lorain and Put-in-Bay 30 x 60 minute quadrangles. Mapping completed in 1998.

Larsen — Pavey
Swinford & Larsen — Swinford

Location of the Lorain and Put-in-Bay 30 x 60 minute quadrangles.

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EXPLANATION

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

Quarry; floored in bedrock; may contain reclaimed areas.

Small Organic Deposits

Boundary between map-unit areas having **different** uppermost continuous lithologies; underlying lithologies may or may not differ.

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

note: Boundary types reflect the relationships among uppermost **continuous** lithologies only, not patchy, discontinuous lithologies (in parentheses).

KEY TO LITHOLOGIC COLORS*

Surficial Units

- w — Water
- m — Made land, pits, large quarries, or mines
- a — Alluvium
- Al — Alluvial terraces, Wisconsinan age
- Au — Alluvium and alluvial terraces
- o — Organic and marl deposits, Holocene age
- o — Organic deposits, Holocene age
- C — Clay, Wisconsinan age
- G — Gravel, Wisconsinan age
- IC — Ice contact deposits, Wisconsinan age
- L — Silt, Wisconsinan age
- S — Sand, Wisconsinan age
- SG — Sand and gravel, Wisconsinan age
- T — Till, Wisconsinan age

Bedrock Units

- SSh — Sandstone and shale, Mississippian age
- Sh — Shale, Devonian age
- SiL — Shale and Limestone, Devonian age
- Ls — Limestone, Devonian age
- D — Dolomite, Silurian age

* 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) and subsurface-only units are excluded in color assignments.

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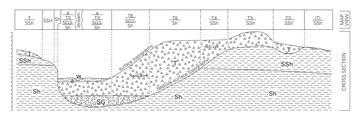

FIGURE 1. - Map view and cross section of a hypothetical stack-unit map. See lithologic-unit descriptions for explanation of symbols. In the map view (top), solid-line boundaries separate map-unit areas having different lithologic units at the surface; underlying lithologic units may or may not differ. Dashed-line boundaries separate map-unit areas having the same surface lithologic unit but different thickness or different underlying lithologic units. The cross section 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 from the Division of Geological Survey open-file maps as 1:24,000 scale quadrangle maps.

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
KILOMETERS 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

N

SCALE 1:100 000

5,000 0 5,000 10,000 15,000 20,000 25,000 30,000 35,000 40,000 45,000 50,000 55,000 60,000 65,000 70,000 FEET
1,000 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 11,000 12,000 13,000 14,000 15,000 16,000 17,000 18,000 19,000 20,000 METERS

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