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WATER-RESOURCES INVESTIGATIONS REPORT 85-4157
PLATE 2--SURFICIAL GEOLOGY

SURFICIAL GEOLOGY

Glacial History

The Allegheny River valley and the Olean and Fivemile Creek valleys contain ice-contact and outwash deposits of sand, gravel, silt, and clay that were the result of at least two major glaciations--the Illinoian and the Wisconsin. The Altonian time of the Wisconsin glaciation marks the southernmost extent of continental ice in this part of New York. The area west of Olean and principally south of the Allegheny River is known as the Salamanca reentrant and is the only part of New York that was not glaciated.

The Allegheny River valley contains as much as 300 feet of glacial and postglacial deposits consisting of silt, clay, sand, and gravels. The basal part of the valley contain mostly lacustrine silt and clay that were deposited when advancing glacial ice, possibly Illinoian or older (Calkin and Muller, 1980, p. 2), blocked the westward flow of the ancestral Allegheny River into the Lake Erie basin and formed a deep, tempus lake that occupied the Allegheny River valley and its tributaries. More than 200 feet of lacustrine silt and clay was subsequently deposited in this lake, and sand and gravel deltas developed where tributary streams entered the lake. This depositional phase ended when the lake spilled over a divide to the southwest near Kinzua, Pa., and drained, thus permanently rerouting the drainage from this area (Prinpter, 1974, p. 34-35).

Subsequent glacial advances into the valley partly eroded the previous sediments and emplaced both ice-contact kame deposits of sand, silt, and gravel, and well-sorted gravel outwash fans and terraces along the valley flanks (Muller, 1977). Valley-train outwash was deposited in the valley center where cumulative sediment thickness increased to more than 300 feet in places. The latter deposition took place near the terminal zone of the glacier during several small glacial retreats and advances. This terminal zone is indicated in well logs from North Olean and East Olean, which show till between the older lacustrine units and the younger overlying outwash deposits. Other ice-margin features included end-moraine deposits of ablation and lodgment till that flank the southern valley wall from Allegheny to Westons Mills, and isolated kame deposits of sand and gravel abutting the till on the valley sides. Additional drift was deposited as lateral moraines flanking the Olean, Haskell, and Fivemile Creek valleys.

Stream erosion subsequently dissected the ice-contact deposits and outwash, leaving several high terraces along the valley sides, such as the large terrace at Allegheny, which rises 120 feet above the present flood plain. This terrace is capped by a veneer of silty till several feet thick near the terrace edge that thickens to about 30 feet near the valley wall. This till unit may have been deposited by a late surge of ice (A. D. Randall, Geological Survey, written commun., 1984).

Subsequent postglacial stream deposition left alluvial deposits of silt, sand, and gravel from 10 to 30 feet thick over the valley flood plain and overlying the valley train outwash.

Areas north of the Allegheny River valley are characteristic of the well-rounded uplands and heavily scoured landscape of the glaciated northwestern Appalachian Plateaus physiographic province. A thin mantle of till generally covers bedrock in these areas. Areas south of the Allegheny River valley are mostly unglaciated and are characteristic of the steeper, highly dissected Allegheny Fifteens physiographic subprovince. Colluvial sediments and soils derived from weathered bedrock overlie bedrock in this region.

EXPLANATION

- **af** ARTIFICIAL FILL
- **alsc** ALLUVIAL SILT AND CLAY--postglacial rivers and stream flood-plain deposits consisting predominantly of fine sand, silt, and clay. Low to moderate permeability.
- **al** ALLUVIAL SILT, SAND, AND GRAVEL--postglacial rivers and stream flood-plain deposits consisting of silt, sand, and gravel with some clay. Permeability varies according to size fraction and sorting. Includes alluvial-fan deposits that are generally more permeable.
- **pm** PEAT AND MUCK--postglacial organic swamp deposits of generally low permeability, occupies kettlehole depressions in kame sand and gravels.
- **ksg** KAME SAND AND GRAVEL--ice-contact stratified drift including kames and kame terraces, and consisting of interbedded coarse sand and gravel with zones of silt and clay. Moderately well-sorted deposits ranging from clay to boulder gravel, and moderately to highly permeable, especially in coarser fractions. Deposited by meltwater streams atop or against stagnant glacial ice, which later collapsed as the ice melted and locally formed characteristic "knob and kettle" topography.
- **osg** OUTWASH SAND AND GRAVEL--well-sorted sand and gravel deposited by meltwater streams from glacial ice, generally highly permeable but may contain less permeable silty or clayey zones. Deposited as outwash terraces and aprons near the receding ice front, and as valley-train outwash by meltwater streams. Outwash aprons that were subsequently downcut by the Allegheny River appear as prominent terraces. These deposits form the principal stratified-drift aquifer in the area.
- **ucg** CLAYEY GRAVEL (UNDIFFERENTIATED)--Pleistocene clayey or silty gravel of uncertain origin. Where clayey fractions may be correlative with adjacent till; more silty fractions may be silty facies of adjacent outwash or kame deposits. Generally low permeability.
- **ld** INTERBEDDED LACUSTRINE-DELTAIC DEPOSITS--deltaic sand and gravel interbedded with and grading into lacustrine sand, silt, and clay. Permeability generally low but may be higher in coarser, well-sorted fractions. These deposits are generally found within small tributary valleys where streams deposited their sediment loads into the glacial lakes that once occupied the present Allegheny River valley.
- **t** TILL--an unsorted mixture of clay, silt, sand, and gravel deposited beneath the ice (lodgment till) or at the edge of the ice sheet by melting ice (ablation till) during an advance or pause, respectively, in glacial movement. Deposited as ablation or lodgment till over more permeable deposits, as till shadows against bedrock hillsides, or as ground moraine over bedrock uplands. Generally low permeability.
- **emt** END-MORAINE TILL--end-moraine deposits of ablation till. Composition ranges from silty clay till to sandy till, including mixtures of poorly sorted gravel and cobbles. Permeability generally low but locally variable where gravel zones occur. Marks the furthest extent of glaciation during Altonian time of the Wisconsin glaciation.
- **lmt** LATERAL-MORAINE TILL--lateral moraine deposits of till that flank the sides of larger tributary valleys, such as the Olean Creek, Fivemile Creek, and Haskell Creek valleys. Deposited by tongues of glacial ice advancing through these valleys. An unsorted mixture of sand, silt, clay, gravel, and rock fragments abraded or plucked from the valley wall by glacial ice. Generally low permeability.
- **c** COLLUVIAL SOILS--deep, clayey mixed deposits developed from underlying bedrock or washed from upland soils. Permeability is typically low.
- **w** OPEN WATER--small ponds and lakes developed in kettleholes. Does not include rivers and streams.
- **r** BEDROCK--undifferentiated Devonian-age siltstone, sandstone, and shales that may include a thin mantle of soil.
- **t/osg** MAP SYMBOL NOTATION--denotes nature of material immediately beneath a relatively thin surficial unit. Surficial unit is left of klamath mark (/), underlying unit is to right. Example denotes till that overlies outwash sand and gravel. Other units occur at depth; stratigraphic relations are shown in geologic sections (pl. 3).
- GEOLOGIC CONTACT--denotes contact between morphostratigraphic units; dashed where inferred.
- GLACIAL MARGIN--denotes approximate extent of the furthest advance of glacial ice during Altonian time of the Wisconsin glaciation (Bryant, 1955; Muller, 1977). Hachures toward glaciers. Glacial margin may also denote contact between morphostratigraphic units.
- A——A' TRACE OF GEOLOGIC SECTION--geologic sections are shown on plate 3.
- WELL OR TEST HOLE--source of information for construction of geologic sections (pl. 3). Well identification may be obtained from trace of section on plate 1.

SELECTED REFERENCES

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NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Mean Sea Level".

HYDROGEOLOGY OF THE OLEAN AREA, CATTARAUGUS COUNTY, NEW YORK

by
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SURFICIAL GEOLOGY

Base from New York State Department of Transportation, 1:24,000 series: Olean, N.Y., 1975; Knapp Creek, N.Y., 1975; Portville, N.Y., 1976

Surficial Geology modified from Muller, 1977; glacial margins modified from Bryant, 1955