Preliminary Map Showing Quaternary Geology of the Cope 7.5-Minute Quadrangle, Indiana

By
Henry M. Loope and Robin F. Rupp

TODD A. THOMPSON, STATE GEOLOGIST

INTRODUCTION

The Cope 7.5-minute quadrangle is situated near the maximum limit of Wisconsin and Illinois Episode glacial deposits in southeastern Morgan County. Till and outwash of both Wisconsin and Illinois Episode age are present in the quadrangle, as well as Illinois Episode glaciolacustrine sediment and Wisconsin Episode colian sand, loess, and colluvium. Holocene (post-glacial) alluvium is found in the West Fork White River valley and tributaries. Mississippian Borden Group bedrock controls many aspects of the surficial geology of the southern and eastern sectors of the quadrangle. For much of this area, bedrock controls the topography and is less than 20 ft below the ground surface. It is mantled on the summits and shoulders of interfluvies mainly by Wisconsin and Illinois Episode till and minor amounts of sand and gravel (outwash). In the western third of the quadrangle, the depth to bedrock (Borden Group) increases significantly, to depths greater than 200 ft. This is the eastern portion of a bedrock valley oriented northeast-southwest through the Cope and adjacent Martinsville 7.5-minute quadrangles. The sediment fill of this bedrock valley is mainly Illinois Episode fine-grained glaciolacustrine sediment and outwash (sand and gravel). The Wisconsin Episode maximum limit crosses northwest-southeast across the quadrangle. A coring transect across the terminal moraine in the west-central part of the quadrangle provided verification of the maximum limit inferred from soils data and provided an age of 24,000 years ago for the timing of maximum Wisconsin Episode ice sheet advance in central Indiana. The Illinois Episode maximum limit is also likely located within the quadrangle, given available data, as suggested by the glaciolacustrine and outwash fill of the bedrock paleovalley and surface exposure of till beyond the Wisconsin Episode limit in the west-central part of the quadrangle. In the northwestern corner of the quadrangle, Wisconsin Episode outwash and colian sand flank the eastern side of the West Fork White River valley and Storts Creek valley, a major tributary in the northern third of the quadrangle.

This preliminary geologic map is an interim geologic map product that documents progress in mapping the Quaternary geology of Morgan County, Indiana. The lithologic classification of the Quaternary units of Indiana (Wayne, 1963) was used in assigning map units.

REFERENCES

Wayne, W. J., 1963, Pleistocene formations in Indiana: Indiana Geological Survey Bulletin 25, 85 p.

DESCRIPTION OF MAP UNITS

Martinsville Formation (Holocene)

- Qml Alluvium**
Silt/clay loam alluvium generally less than 10 ft thick. Alluvium of the West Fork White River is thicker, reaching up to 20 ft thick, and is generally more sandy. First- and second-order tributaries generally have alluvium less than 5 ft thick. Unit overlies Mississippian Borden Group bedrock over much of the eastern two-thirds of the quadrangle and sand and gravel (outwash) of the Atherton Formation (map unit Qao), diamicton (till) of the Trafalgar Formation (map unit Qt), sand and gravel (outwash) or fine-grained glaciolacustrine sediment of the Jessup Formation (map unit Qj2 and Qj3) in the western one-third of the quadrangle.

Atherton Formation (Wisconsin Episode)

- Qae Eolian sand**
Fine- to medium-grained sand greater than 5 ft in thickness, mainly as parabolic dunes and sand sheets. Located adjacent (eastward) to the major outwash plain in the West Fork White River valley.

- Qao Outwash**
Sand and gravel, up to 70 ft thick. Generally covered by less than 5 ft of loess (Peoria Loess Member, Atherton Formation).

- Qala Lacustrine**
Interbedded silt, clay, and sand up to 70 ft thick. Generally covered by less than 5 ft of loess (Peoria Loess Member, Atherton Formation). Associated with slackwater terraces in tributary valleys of the West Fork White River valley.

- Qcl Colluvium**
Clayey, sandy silt up to 15 ft thick found on footslope and toeslope positions on hillslopes. Derived from a combination of Jessup Formation outwash (map unit Qj2) and glaciolacustrine sediments (map unit Qj3), and reworked Peoria Loess (Peoria Loess Member, Atherton Formation).

Trafalgar Formation (Wisconsin Episode)

- Qd Diamicton**
Silt loam till less than 30 ft thick. Generally covered by less than 5 ft of Wisconsin Episode loess (Peoria Loess Member, Atherton Formation). Center Grove Member of the Trafalgar Formation is the surface till of Wisconsin Episode age in the quadrangle. Maximum age for unit is 24,000 years old, based on radiocarbon dating of wood fragments found within till at the terminal moraine.

Jessup Formation (Illinois Episode)

- Qj2 Diamicton**
Silt loam till less than about 20 ft thick. Found on summits and shoulder slopes of bedrock-cored interfluvies in the south-central part of the quadrangle and adjacent to Jessup Formation outwash (map unit Qj2) in the west-central part of the quadrangle. Covered by less than 5 ft of Wisconsin Episode loess (Peoria Loess Member, Atherton Formation).

- Qj3 Outwash**
Sand and gravel, up to 250 ft thick. Thickest in west-central part of quadrangle where it fills a pre-Wisconsin Episode bedrock paleovalley. Thins to around 50 ft thick toward the southwestern corner of the quadrangle, where it is underlain by 75 ft of fine-grained glaciolacustrine sediment (map unit Qj3). In stable geomorphic settings, covered by less than 5 ft of Wisconsin Episode loess (Peoria Loess Member, Atherton Formation).

- Qj3 Lacustrine**
Silt and clay, up to 85 ft thick. Found in the southwestern part of the quadrangle, where it outcrops along backslope and footslope hillslope positions and is overlain by Jessup Formation outwash (map unit Qj2).

Quaternary (undifferentiated)

- Qr Residuum**
Weathered siliclastic Mississippian Borden Group bedrock generally less than 5 ft in thickness. Less than 5 ft of loess (Peoria Loess Member, Atherton Formation) can mantle or be incorporated into residuum, especially on hillslopes.

Disturbed or made land

- Includes quarries and excavation/fill associated with infrastructure.
- Contact concealed — Identity and existence certain, location concealed.
- Project-funded borehole with IGWS ID.
- Project-funded gamma-ray log with ID.
- Water-well data (Indiana Department of Natural Resources, Division of Water).
- Archived data (petroleum-well data, literature, test borings, and so on).

ACKNOWLEDGMENTS AND DISCLAIMER

This geologic map was funded in part by the Great Lakes Geologic Mapping Coalition program supported by the U.S. Geological Survey under Cooperative Agreement No. G18AC00240. The cooperative agreement requires the following statements: "this map and explanatory information is submitted for publication with the understanding that the United States Government is authorized to reproduce and distribute reprints for governmental use," and "the views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government."

This map was compiled by Indiana University, Indiana Geological and Water Survey, using data believed to be accurate; however, a degree of error is inherent in all data. This product is distributed "AS IS" without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of these data to define the limits or jurisdiction of any federal, state, or local government. These data are intended for use only as the published scale or smaller and are for reference purposes only. They are not to be construed as a legal document or survey instrument. A detailed on-the-ground survey and historical analysis of a single site may differ from these data.

LIMITATION OF WARRANTIES AND LIABILITY: Except for the expressed warranty above, the product is provided "AS IS", without any other warranties or conditions, expressed or implied, including, but not limited to, warranties for product quality, or suitability to a particular purpose or use. The risk or liability resulting from the use of this product is assumed by the user. Indiana University, Indiana Geological and Water Survey shares no liability with product users indirect, incidental, special, or consequential damages whatsoever, including, but not limited to, loss of revenue or profit, lost or damaged data or other commercial or economic loss. Indiana University, Indiana Geological and Water Survey is not responsible for claims by a third party. The maximum aggregate liability to the original purchaser shall not exceed the amount paid by you for the product.

BASE MAP INFORMATION

Digital cartography by Matthew R. Johnson.

Topographic shading based on 2011–2013 Indiana lidar data.

Transportation network from OpenStreetMap.org (© OpenStreetMap contributors).

Hydrography from U.S. Geological Survey National Hydrography Dataset (local resolution).

Projection: Universal Transverse Mercator (UTM), Zone 16N.

Horizontal Datum: North American Datum of 1983 (NAD83).

Loope, H.M. and Rupp, R.F., 2020, Quaternary geology of the Mooresville East 7.5-minute quadrangle: Indiana Geological and Water Survey, Indiana Journal of Earth Sciences, v. 2, scale 1:24,000.

CORRELATION OF MAP UNITS