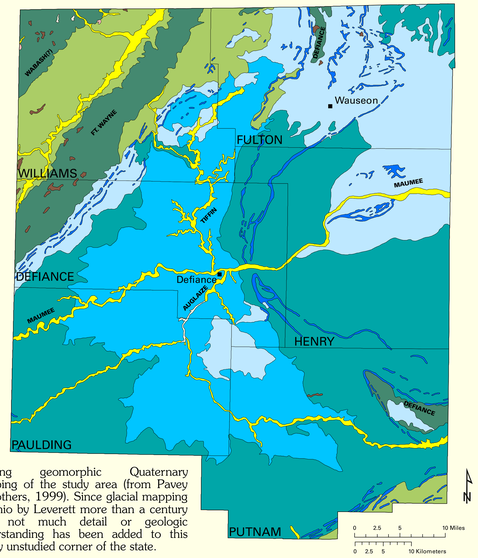
EVALUATION OF GLACIAL FEATURES IN NORTHWESTERN OHIO USING LiDAR DATA

Rick Pavey, Ohio Department of Natural Resources, Division of Geological Survey, Columbus, OH, Rick.Pavey@dnr.state.oh.us

Cartography by Dean R. Martin

ABSTRACT

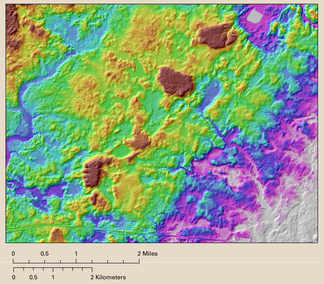
The Ohio Geological Survey's recent and current STATEMAP projects involve glacial mapping of the Defiance and Adrian 1:100,000 quadrangles in northwesternmost Ohio. Since Frank Leverett's mapping of a century ago, geologic understanding and glacial mapping of this area of the state has remained largely unchanged. Data preparation for the projects included mosaicking of LiDAR-derived, elevation raster data sets (or DEMs) for the six counties included in the mapping area, as well as a hillshade raster produced from the mosaic. Analysis of the resultant regional DEM revealed many landforms unusual for Ohio that require stratigraphic and depositional process interpretations. The northwest corner of the area includes the Wabash and Ft. Wayne Moraines, both deposited on the northwest side of retreating Erie Lobe ice. The highest features on the Wabash are flat-topped "plateaus" surrounded by closed depressions. Data from soils mapping indicate that the "plateaus" are primarily sand-filled and probably represent ice-walled lake plains. Many of the closed depressions contain bogs and/or lakes, with minimal integrated drainage. The St. Joseph River valley is between the Ft. Wayne and Wabash Moraines. Multiple, segmented linear depressions, perhaps interpreted as abandoned subice tunnels, are oriented subparallel to the moraine crests and river valley. Beach ridges mark the edge of the proglacial Maumee Lake Plain that dominates the rest of the study area. The final Erie Lobe ice in the area built the Defiance Moraine, most of which was submerged by proglacial lakes that occupied the Erie Basin. Parts of this moraine contain many small, raised sand flats, which are also probable ice-walled lake plains. West of the Defiance Moraine, the moraine-controlled Auglaize and Tiffin Rivers join the Maumee River at Defiance, Ohio. Above the confluence, the three rivers meander greatly. The river becomes much straighter downstream from the confluence; this is due to the Maumee being incised into bedrock. High-level cut terraces on the rivers above the confluence are graded to the elevations of the various high-level proglacial lakes that occupied the Erie Basin.



Existing geomorphic Quaternary mapping of the study area (from Pavey and others, 1999). Since glacial mapping of Ohio by Leverett more than a century ago, not much detail or geologic understanding has been added to this nearly unstudied corner of the state.

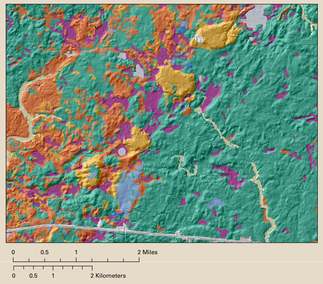
Quaternary units

- Water
- Alluvium and alluvial terraces
- Peat
- Beach ridges
- Lacustrine sand
- Lacustrine clay
- Outwash, undifferentiated
- Kames and kame terraces
- Ground moraine
- Lake-planed moraine
- End moraine



INSET MAP 1a.—This area is on the local crest of the Wabash Moraine complex. The highest features are small, flat-topped plateaus of up to 120 acres and are probable ice-walled lake plains. These are surrounded by a multitude of closed depressions typical of this morainic feature. Ongoing mapping of the region indicates that this collapse topography is a result of Erie Lobe ice overriding stagnant Saginaw Lobe ice and its deposits, which are primarily sand and gravel.

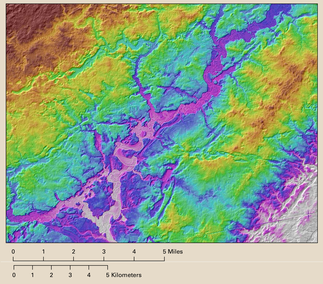
Elevation
Ft above sea level
High : 1035
Low : 910



INSET MAP 1b.—The NRCS soils data shown here for the same area indicates that the plateaus are primarily sand-filled. Data from water well logs show that the entire 20-plus feet of relief of these features is sand. Many of the closed depressions contain bogs and/or lakes, with minimal integrated drainage.

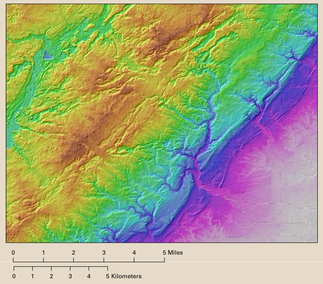
Soils

- Water
- Made land
- Gravel pit
- Alluvium
- Organics
- Clay
- Silt
- Sand
- Sand and gravel
- Till



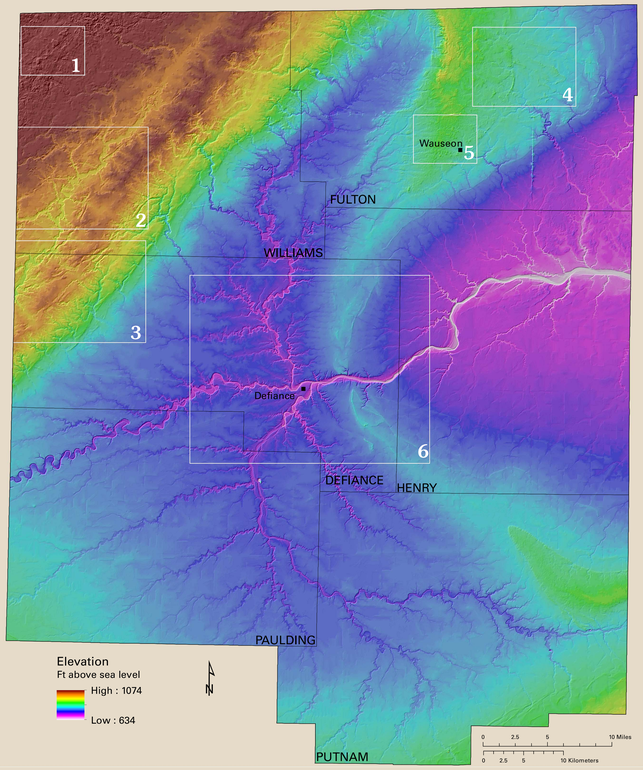
INSET MAP 2.—The St. Joseph River valley is between the Ft. Wayne and Wabash Moraines. Note the multiple linear depressions oriented subparallel to the moraine crests and river valley. These probable abandoned subice tunnels provide additional evidence for Erie Lobe ice overriding of stagnant Saginaw Lobe ice.

Elevation
Ft above sea level
High : 935
Low : 776



INSET MAP 3.—More linear depressions (abandoned subice tunnels) on the Ft. Wayne Moraine, on both sides of and crossing the crest. Beach ridges at the edge of the lake plain in the southeast part of the view mark the shores of proglacial Lakes Maumee II (elevation ~780'), Maumee III (elevation ~780'), and Maumee I (elevation ~800').

Elevation
Ft above sea level
High : 884
Low : 715



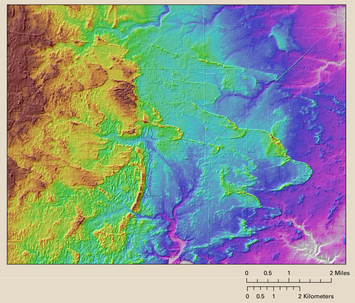
Elevation
Ft above sea level
High : 1074
Low : 634

Part of the Ohio Geological Survey's data preparation for the previous and current STATEMAP projects involved the mosaicking of LiDAR-derived elevation raster data sets (DEMs) for the six counties included in the mapping areas as well as deriving a hillshade raster for the mosaic. The original county DEMs are 12.5-ft cell rasters, resampled from the original 2.5-ft data.

Location of Study Area

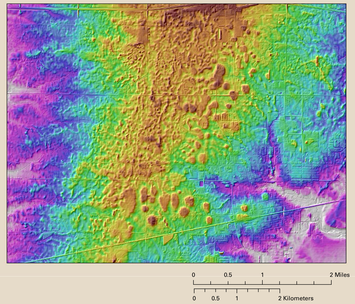
INSET MAP 4.—A large offshore sand deposit below the proglacial Lake Maumee III beach (elevation ~780') was the source for these impressive parabolic dunes, which were blown several miles out onto the lower lake plain. Joseph Blockland, a graduate student from the University of Toledo, mapped a portion of this area, which was funded through EDMAP with the assistance of the Ohio Geological Survey.

Elevation
Ft above sea level
High : 804
Low : 719



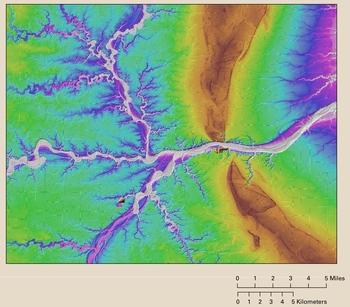
INSET MAP 5.—This area on the northwest side of Wauseon is on the Defiance Moraine, and contains many smaller-scale raised flats, which also largely consist of sand. These features may also be ice-walled lake plains. Part of this area was also in the EDMAP project area, which provided assistance for the Ohio Geological Survey's current STATEMAP project.

Elevation
Ft above sea level
High: 812
Low: 788



INSET MAP 6.—Broken only by the Maumee River, the drowned remnants of the Defiance Moraine are clearly outlined by proglacial Lake Whittlesey beaches (elevation ~738'). The moraine-controlled Auglaize and Tiffin Rivers join the Maumee River at Defiance, Ohio. Note that the three meandering rivers join to become a much straighter mainstem downstream from the confluence, where the course of the Maumee is controlled by bedrock. Also note the much straighter high-level cut terraces above the tightly meandering rivers, which are graded to the various higher level proglacial lakes that were in the Erie Basin. Abandoned high-level channels are common on these terraces.

Elevation
Ft above sea level
High : 825
Low : 639



REFERENCES

Pavey, R.R., Goldthwait, R.P., Breckman, C.S., Hull, D.N., Swinford, E.M., Van Horn, R.G., 1999, Quaternary geology of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map SG-1, scale 1:500,000.

This project is made possible in part by funding from the Great Lakes Geologic Mapping Coalition.
Prepared for the Geological Society of America North-Central Section Annual Meeting, Kalamazoo, MI, May 2–3, 2013.