Geologic Cross Sections of Quaternary Deposits Across the Manlove Gas Storage Field Area, Champaign County, Illinois

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Front cover: Area of northwest Champaign County depicting the topography of the bedrock surface across the Mahomet Dome, Mahomet Bedrock Valley, tributary bedrock valleys, and adjacent bedrock uplands. Also shown is the extent of the Manlove gas storage field area (dashed yellow line) and lines of geologic cross sections (see Figure 1 in text).
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OVERVIEW

This report was written by the Illinois State Geological Survey (ISGS) to assist the Prairie Research Institute’s Natural Gas Working Group (NGWG), the Illinois Environment Protection Agency (IEPA), and other stakeholder groups involved in studying the Manlove gas storage field gain a better understanding of the shallow subsurface geology in northwestern Champaign County. Interpretations made about the surface and subsurface geology are based on a conceptual geological model developed by Stumpf and Atkinson (2015) and Stumpf and Dey (2012). Their model is based on new studies of the Mahomet aquifer in the Champaign County area between 2007 and 2012 and previous lithostratigraphic classifications published by Hansel and Johnson (1996), Kempton et al. (1991), Willman and Frye (1970), and Willman et al. (1975).

The cross sections depict the geologic materials encountered between the land surface and the buried bedrock surface along transects A–A’ and B–B’ (Plates 1 and 2). Limited detailed information exists on sequences of Quaternary clayey till and deposits of glacial sand, gravel, and silt across the gas storage field area that were formed during multiple periods of glacial and postglacial deposition and erosion. These cross sections are the first detailed representations of the Quaternary deposits across the Mahomet Dome, the structure in which the Manlove gas storage field is developed.

The cross sections were made by correlating lithologic units interpreted from the geologic and geophysical logs.

Figure 1 Location of geologic cross sections across the Manlove gas storage field area. The cross section lines lie over a shaded relief map depicting the topography of the bedrock surface (data from Nelson, Bedrock geology of Champaign County, Illinois, ISGS Bulletin in preparation). Borehole locations are shown by the red dots, and those drilled by the ISGS are labeled (e.g., CHAM-03-03). The McCord, L #2 well (green dot) is also labeled. The Manlove gas storage field area is delineated by the dashed yellow line. The extent of the Mahomet Dome is delineated by the red arrows.
for water wells, natural gas injection/extraction wells, and coal and petroleum exploration test borings. These data are correlated with the geology and geophysical logs from four continuously cored stratigraphic borings completed by the ISGS and geophysical logs from two other water wells. These boreholes are located between 1 and 5 miles of the Manlove gas storage field (Plates 1 and 2). A customized tool for the ESRI ArcMap software programmed by the ISGS (Carrell 2015) was used to generate georeferenced cross sections from the lithologic data. Polygons for each geologic unit were outlined in ArcMap, but shapefiles of the cross sections were later imported into Adobe Illustrator (version CC 2015.3.1) for graphical editing using the MAPublisher plug-in by Avenza Systems Inc. (version 9.8). In Adobe Illustrator, the polygons were closed and symbolized, line segments smoothed, and surrounding elements added to create a standardized layout for publication.

In assembling the cross sections, it was necessary to undertake additional analysis to move point locations closer to the corresponding wellhead, specifically water wells located without a global positioning system (GPS). Prior to 2012, water wells were typically located by township, range, and section, the legal location, using the Illinois Public Land Survey System (PLSS). For constructing the cross sections, county tax parcel data (e.g., Champaign County GIS Consortium (http://www.maps.ccgisc.org) and public aerial and ground-based photography (e.g., Google Maps, https://www.google.com/maps) were used to obtain the most accurate point locations. The updated coordinates were added to the ISGS wells and borings database, which contains the records of wells drilled in the State of Illinois.

The boreholes labeled on the cross sections are cataloged in the ISGS wells and borings database by the API well number, which is a “unique, permanent, numeric identifier assigned for identification purposes to a well” (American Petroleum Institute 1979). The ISGS also assigns the API number to geological data collected at point locations (e.g., field outcrops, geophysical soundings, shallow excavations, etc.). The 12-digit number consists of four parts (in this order): the state code (2 numeric digits), the county code (3 numeric digits), the unique well code (5 numeric digits), and whether the original hole has been redrilled, sidetracked, or directionally extended. The county code is sequentially assigned to borings as they are added to the repository. On the ILWATER (http://www.isgs.illinois.edu/ilwater) and ILOIL (http://maps.isgs.illinois.edu/ILOIL/) websites, the API well number can be searched under the FIND tab.

GUIDANCE FOR USE

1. General Information/Citation
a. Title—Geologic cross sections of Quaternary deposits across the Manlove gas storage field area
b. Project Citation—Data request from the Prairie Research Institute’s Natural Gas Working Group (NGWG) and the Illinois Environmental Protection Agency (IEPA), and provided to other stakeholder groups involved in studying the Manlove gas storage field.

d. Overview—See Overview section beginning on page 1.
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2. Metadata
a. Contacts—
   i. Same as author noted above
   b. Constraints—Non-disclosure
   c. Terms of Use—The ISGS should be contacted in advance to arrange ISGS review of planned presentations and publications using these data. Data usage must be approved in advance of presentation and publication. As appropriate, at least one ISGS project member should be included as a co-author in the publication(s) that use these data.
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   e. Status—Final analysis of the data has not been published, and as such, this data set is provisional and subject to change. Data have undergone standard project quality control review.

3. Resource
   i. Start Date—March 8, 2018

REFERENCES


Carrell, J.E., 2015, Create 2D and 3D geologic cross sections: Illinois State Geological Survey [includes user guide, tutorial data, and computer codes], http://www.arcgis.com/


GEOLOGIC CROSS SECTIONS OF QUATERNARY DEPOSITS ACROSS THE MANLOVE GAS STORAGE FIELD AREA, CHAMPAIGN COUNTY, ILLINOIS

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Legend for Cross Sections

- Glaciofluvial sediment (outwash) derived directly from an advancing ice margin; not consistently differentiable from underlying sand and gravel
- Till and associated sediment deposited by an ice stream and associated with the deglacial phase of the Illinois Episode glaciation
- Proglacial and ice-contact sediment derived directly from outflows from lakes ponded behind ice margins; contains the Sangamon Geosol in the upper part except where eroded (debris flows) along ice margins; contains the Roby Silt Member when intervening older tills and lake sediments are absent; includes deposits of sand and gravel or silt and clay; hard; ~40 feet thick
- Diamicton, sand and gravel, and silt and clay; well to poorly sorted; up to 25 feet thick
- Fine to coarse sand with gravel; to 70 feet thick
- Diamicton, sand and gravel, and silt and clay; 30 to 100 feet thick
- Sand, silt, clay, and gravel; to 25 to 175 feet thick
- Calcareous; contains beds of sand, silt, and clay; 25 to 175 feet thick
- Mainly sand; may contain some gravel or silt
- Pebbly to cobbly; brown; calcareous; contains beds of silt and clay; 10 to 30 feet thick
- Calcareous; contains beds of sand, silt, and clay; 25 to 175 feet thick
- Grayish brown to reddish gray; loam; very dark gray to greenish gray; sand, diamicton, and silt; up to 25 feet thick
- Light olive brown; calcareous; contains beds of sand, silt, and clay; ~20 feet thick
- Harmattan Member, Banner Formation
- Batestown Member, Cahokia Formation
- Vandalia Member, Henry Formation
- Platteville Group (pl-g2, pl-g1)
- Sangamon Group (g-v3, g-v2)
- Illinoian glacial deposits (g-v1)
- Maumee Bay (MBV) moraines
- Illinois Water (http://www.isgs.illinois.edu/ilwater) and ILOIL (http://www.isgs.illinois.edu/illinois-oil-and-gas-resources-interactive-map).

Note:
- For permission information, contact the Illinois State Geological Survey.

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