Illinois County Geologic Map
ICGM Whiteside-SG

Surficial Geology of Whiteside County, Illinois

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Background and Methods

The surficial geology of Whiteside County initially was mapped in detail by the late Richard C. Anderson, professor at Augustana College, who was affiliated with the Illinois State Geological Survey (ISGS) primarily in the 1970s and 1980s. These 1:24,000-scale quadrangle maps were subsequently digitized and compiled by Barbara J. Stiff and staff at the ISGS. The compilation of this map, legend, and text were finalized by Xiaodong Miao, and sites of aggregate and peat production were added. The base map is from light detection and ranging (LiDAR) data, but LiDAR data were not used for mapping contacts. This map provides a general overview of the surficial geology. It does not replace the need for detailed investigation at specific sites.

This compilation contains major reinterpretations, such that multiple map units that referred to the same geological materials were merged as one unit. For example, the Parkland Sand facies of the Henry Formation was mapped by Anderson on various quadrangle maps as three separate units using four separate labels: the Parkland Sand, the Henry Formation (hp, pl), and dune facies of the Parkland Sand and Henry Formation (hp-d, pl-d). These are all labeled as h(p) on the present map.

Surficial Geology

Whiteside County, Illinois, contains a variety of geological deposits underlying floodplains, sloped valley sides, and level uplands. The landscape of the county has been shaped by three major geological agents: continental glaciers, rivers, and wind (Anderson and Miao 2011). These agents were all active during the Pleistocene and Holocene Epochs, together known as the Quaternary Period. Human activities (such as strip mining) also have modified the landscape of the county, but in minor roles. Bedrock consists of Silurian dolomite, and Ordovician dolomite and black shale (Anderson 1968, 1980; Larson et al. 1995; Kolata 2005).

The continental glaciers of the Pleistocene Epoch (from 2.6 million to 12,000 years before present) moved across Illinois several times. Although deposits of the oldest glaciations have been removed by subsequent erosion, deposits from the last two glaciations—the Wisconsin and the Illinois Episodes—are preserved. Glaciers of the Illinois Episode advanced from the east into Whiteside County and covered most of the county. During the Wisconsin Episode, glaciers did not reach the county; however, meltwaters from glacial retreat to the east deposited large volumes of sand and gravel in the Green River Lowland in southeastern Whiteside County.

The oldest Quaternary sediments exposed near the surface are mapped as the Glasford Formation and Pearl Formation, and were deposited during the Illinois Episode. The Glasford Formation is predominantly compact diamicton, composed mainly of poorly sorted sand, silt, and clay with gravel, and may include the underlying deposits of the pre-Illinois Banner Formation in places. The Glasford Formation is yellowish brown to dark gray and is calcareous, except for the uppermost 6 to 10 feet, where the Sangamon Geosol may be present. The Sangamon Geosol is clayey and reddish brown at many exposures, gray beneath flat interfluves, and up to 1 to 2 feet thick. Sediments deposited by glacial meltwater are referred to as glaciofluvial outwash. Such deposits usually consist of sand and gravel with less silt, and they become progressively finer grained in the downstream direction. The Pearl Formation is an outwash deposit and is composed of sand and gravel. Both the Glasford and Pearl Formations are exposed along the creeks in northeastern Whiteside County and in recently eroded gullies. Both formations are often buried by subsequent eolian deposits.

The Henry Formation is the Wisconsin Episode outwash counterpart of the Illinois Episode Pearl Formation. The thickness of the Wisconsin outwash ranges from 30 to 50 feet and can be up to 200 feet thick in some locations. The sand and gravel in this formation are a primary aggregate resource (Anderson 1967) that also serves as an excellent aquifer for groundwater. The Henry Formation generally overlies diamicton or bedrock but may interfinger with the fine-grained deposits of the Equality Formation.

The Equality Formation is primarily silt, with some fine-grained sand and clay that was deposited in glacial Lake Milan. It formed when glacial ice blocked the Mississippi River valley (Anderson 1968, 1999, 2005; Reinertsen et al. 1975). It is exposed at the surface only in terraces. Its maximum thickness is about 20 feet (6 meters).

The Parkland Sand is found in geomorphologically distinct sand dunes, in interdune areas, and as relatively flat sand sheets, mostly in the Green River Lowland south of the Rock River. The Parkland Sand is very well sorted, is medium to fine grained, and contains no gravel (Miao et al. 2010). Most dunes have a parabolic, compound-parabolic, transverse, or dome form and are stabilized by vegetation cover under the current climate regime. Trees and grass occupy the uplands. The dune orientation and internal cross-bedding structure consistently indicate that winds from the northwest-west were responsible for dune construction, similar to the current prevailing wind direction in this region. Optically stimulated luminescence ages (OSL or optical ages) from dune sand of neighboring Henry County indicate that a major dune construction event in the county occurred around 17,000 to 18,000 years ago, with some episodical reactivation in the Holocene, implying a high potential for future sand activation, regardless of human-induced climate changes and associated global warming (Miao et al. 2010).

The Peoria Silt and Roxana Silt, both eolian in origin, cover most of the county and constitute one of the major parent materials for the surface soils, especially on uplands. The thickness of loess is generally less than 20 feet (6 meters).

The Peoria Silt and Roxana Silt intermixed with the Parkland Sand, mapped as prh(p), have formed into elongated ridges that collectively are referred to as paha landforms. Paha landforms are well expressed and named in Iowa. Whiteside and Rock Island counties in Illinois are located at the eastern end of the Iowa-Illinois paha belt (Flemal et al. 1972). In Whiteside County, pahas occur with the greatest density on the Garden Plain Upland and with less density on the Union Grove Upland and Albany Upland. These pahas have a pronounced straightness and general parallelism of their long axes. Measurements taken from 261 of the best expressed pahas (Flemal et al. 1972) show a mean orientation of N66°W ($1\sigma = 8.3°$), paralleling the current prevailing wind direction. The paha landform is eolian in origin on uplands and cannot be found in lowlands such as floodplains.

The Cahokia Alluvium, material deposited on the floodplains by present-day streams, ranges in grain size from clay and silt to pebbly sand. Four varieties of Cahokia Alluvium are recognized: (1) alluvium and flood deposits in oxbows and abandoned channels; (2) alluvium deposits in alluvial fans; (3) alluvium and flood deposits in natural levees and backswamps; and (4) alluvium and flood deposits in point bars. Cahokia Alluvium is distinguished from the underlying Henry Formation on the basis of its finer grain size.

Grayslake peat consists of organic deposits that have accumulated in low-lying depressions, in drainageways, and on floodplains, and it may contain interbeds of silt, clay, and some fine sand. It is soft to firm, and snail shells are common. In Whiteside County, it is mainly deposited in lowlands along Cattail Creek between the Garden Plain Upland and the Union Grove Upland.

Aggregate Industry, Groundwater, and Peat Resources

Sand and gravel resources in Whiteside County are relatively abundant because of thick glaciofluvial deposits in the region, mapped as the Henry Formation and Pearl Formation. The Henry Formation constitutes the most important sand and gravel resource in Whiteside County. Because the county has no large metropolis, the current demand for aggregates can readily be met by the seven existing sand and gravel pits (Table 1), which may operate intermittently, and six stone quarries. The occurrences and thicknesses of sand and gravel are fairly well known across most of the county, although multiple layers of sand and gravel are sometimes interbedded with fine-grained diamicton.

Table 1 Location of active aggregate and peat producers in Whiteside County, Illinois[1].

Operator	Mine site	Commodity	Location
1 Bob Propheter Aggregates, L.L.C.	Propheter Quarry	Sand and gravel	Sec. 25, T21N, R6E
2 Nelson Sand & Gravel	H. Hoffman Pit	Sand and gravel	Sec. 29, T21N, R7E
3 Rock River Ready Mix	Behrens Pit	Sand and gravel	Sec. 11, T20N, R6E
4 C.J. Materials, Inc.	Lyndon Pit	Sand and gravel	Sec. 20, T20N, R5E
5 Alliance Materials, Inc.	Kay's Corner Quarry	Sand and gravel	Sec. 25, T21N, R6E
6 Riverstone Group, Inc.	McMahon MC08	Sand and gravel	Sec. 11, T20N, R2E
7 C.J. Materials, Inc.	Zaagman Pit	Sand and gravel	Sec. 34, T21N, R6E
8 Fischer Excavating, Inc.	McFalls Quarry	Crushed stone	Sec. 22, T22N, R7E
9 Wendling Quarries, Inc.	Fulton Quarry	Crushed stone	Sec. 19, T22N, R4E
10 Alliance Materials, Inc.	Emerson Quarry	Crushed stone	Sec. 13, T21N, R6E
11 Wendling Quarries, Inc.	Garden Plain Quarry	Crushed stone	Sec. 21, T21N, R3E
12 Wendling Quarries, Inc.	Schultz Quarry	Crushed stone	Sec. 02, T22N, R5E
13 Alliance Materials, Inc.	Siers Quarry	Crushed stone	Sec. 16, T22N, R7E
14 Hyponex Corporation	Hyponex 1	Peat	Sec. 20, T21N, R4E
15 Hyponex Corporation	Hyponex 2	Peat	Sec. 33, T21N, R4E
16 Markman Peat Corporation	Markman Peat	Peat	Sec. 21, T21N, R4E
17 Mark Stichter Enterprises	Mark Stichter Peat	Peat	Sec. 20, T21N, R4E
18 Alan Dykastra	Alan Dykastra Peat	Peat	Sec. 33, T21N, R4E

[1]From the Illinois Department of Natural Resources (2012).

Sand and gravel deposits also constitute the two most important groundwater aquifers in Whiteside County. The Tampico aquifer, a surficial, unconfined aquifer in the Green River Lowland (Larson et al. 1995), contains outwash sand and gravel from the Henry Formation. It also includes the Parkland Sand where these eolian sediments are saturated. The thickness of this aquifer ranges from less than 10 feet to more than 100 feet and is generally about 50 feet. The potential for groundwater contamination is high because the top of the Tampico aquifer is located at the surface. The other major aquifer, the Princeton Bedrock Valley aquifer (Larson et al. 1995), is a deeper aquifer and consists of sand and gravel that directly overlies the Silurian and Ordovician bedrock. The thickness of this aquifer ranges from less than 50 feet to more than 200 feet. Because it is deeply buried, the Princeton Bedrock Valley aquifer is less likely to be contaminated. The sediments separating the Tampico aquifer and the Princeton Bedrock Valley aquifer consist mostly of thinly bedded lacustrine clay and silt (and may contain some very fine-grained sand); they also include diamicton in some places. This confining unit is an aquitard that is generally 25 to 50 feet, and its bottom defines the upper boundary of the Princeton Bedrock Valley aquifer. In areas where this confining aquitard unit is missing, such as in southwestern Whiteside County between Interstate 88 and Rock River, the two aquifers form one hydraulic unit, which makes it the thickest aquifer in Whiteside County.

Most of the public groundwater supply in Whiteside County is derived from sand and gravel aquifers. These aquifers are also tapped by many private wells for domestic and agricultural use—irrigated cropland is an important component of the agricultural economy in the county. With the increasing population and development of the land, it is anticipated that Whiteside County will have an increased interest in exploiting both aggregate and water resources in the future.

Because of the thick deposits of Grayslake Peat, Whiteside County is one of the two counties in Illinois with peat production (the other being Lake County). Currently, five peat mining operators are located in the county (Table 1). Peat is produced mostly for horticultural use, including that for general soil improvement, golf course construction, nurseries, and potting soils.

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