STATEMAP
Frankfort-SG

Surficial Geology of Frankfort Quadrangle

Will and Cook Counties, Illinois

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2015

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Introduction

This surficial geologic map of the Frankfort 7.5' Quadrangle is a part of a long-term geological mapping project (Curry and Grimley, 2001; Curry and Bruegger, 2014) in Will County. This map continues ISGS efforts in northeastern Illinois to map deposits at the land surface and in the subsurface down to bedrock to gain a better understanding of the complex geology left behind by repeated glaciations and associated flooding events. The Frankfort Quadrangle is centered on the Valparaiso Morainic System, about 20 miles from the southern shore of Lake Michigan and southern Chicago (Figure M1 [map sheet 2]). The largest communities in the area include the villages of Monee and Frankfort with populations of 5,105 and 18,446, respectively (2014, United States Census Bureau). Interstate-57 traverses the south-east edge of the study area.

Setting

The landscape was constructed during the last glaciation (Wisconsin Episode) between about 22,500 and 16,000 cal yr BP (Curry et al., 2014). Four moraines constitute the Valparaiso Morainic System: the Westmont, Wheaton, West Chicago, and Manhattan moraines (Willman and Frye 1970). Shallow valleys trending northeast-southwest crosscut the moraines and were likely formed by subglacial meltwater channels that evolved near the ice margin during downwasting of the ice (Menzies 1995). Bedrock comprises largely low relief, gently dipping, and resistant Silurian sedimentary rocks.

Mapping Methods

The surficial geology map is based primarily on interpretation of aerial imagery, LiDAR elevation data, boring records archived at the Illinois State Geological Survey, new outcrop and hand auger descriptions, and the Will County soils map (Hanson, 2004). The soil survey map details soil parent materials in the upper five feet, which in Will County are glacial and post-glacial deposits. We verified geologic contacts at 56 sites by examining exposures along roads, creeks, and ditches, and by sampling with a hand auger. The subsurface data include detailed studies of one stratigraphic test hole drilled by the Illinois State Geological Survey (ISGS), 309 water well logs, 16 bridge and foundation (engineering) borings from the Will County Highway Department, and one mile-long electrical earth resistivity profile acquired by the ISGS. Positions of some map boundaries and descriptions of some units were modified based on geotechnical log and test hole descriptions, from the field sites, and from other archival data. Locations of the water well logs and geotechnical borings were confirmed by plat books of land ownership, aerial photography, tax records, and site visits. The records for all data sources are on file at the ISGS Geological Records Unit. The ISGS test hole was drilled by continuous coring with a CME-75 rig to a depth of 112 feet. Physical characteristics of the stratigraphic units were characterized by 14 particle size determinations from the test hole, supported by 28 determintations from samples of exposures and hand augers (Table 1). Sample testing was completed in ISGS laboratories. Particle size distributions were determined by hydrometer and referenced to USDA texture classes. The textural results were supported by 22 clay mineralogy determinations in a companion study. Clay mineralogy was determined by X-ray diffraction methods following Wickham et al. (1988). One electrical resistivity profile (8 ft nominal electrode spacing) totaling 1 mi in length was obtained across glacial till and outwash sequences (Fig. M2). The age of one sample from Hickory Creek (21 ka) was obtained by OSL methods for a companion study.

Geology and Surficial Deposits

Bedrock Surface

Silurian-age rocks at the bedrock surface are composed of light gray, fine-grained dolomite and limestone. Bedrock

Table 1 Summary of particle size of selected map units

Units	Sand (%)	Silt (%)	Clay (%)
Grayslake Peat, gp	7-10	47-52	38-42
Cahokia Formation, c	30-36	40-45	21-26
Equality Formation, e	6-9	55-62	31-35
Henry Formation	52-63	30-35	10-14
Henry underlying Wedron Group, h(Wu)	50-55	40-44	9-12
Henry underlying Yorkville Member, h(l-y)	55-65	22-30	9-13
Wedron Group, Wu	13-20	49-53	30-34
Lemont Formation, Yorkville Member, l-y	8-11	42-45	46-49
Silurian bedrock	ND	ND	ND

highlands mainly in the southeast descend gently from about 725–750 feet to 625–650 feet in the northwest (Fig. M3). North-south trending valleys with gradually sloping floors cut the highlands. The trend is not parallel to the later ice flow paths.

Glacial

Based on a LiDAR-derived DTM, the Frankfort 7.5' Quadrangle can be divided into five sediment landform assemblages that were mapped in upland areas. The lowermost unit is an unnamed tongue of sand and gravel below the Yorkville Member, h(l-y). This outwash unit consists of interbedded brown to gray fine gravel to sandy gravel, and it is typically less than 20 feet thick. The Yorkville Member (Lemont Formation; l-y) is a gray, fine textured diamicton that contains lenses of gravel, sand, silt, and clay. It is typically 45 feet but up to 80 feet thick. Upland diamicton units Wu and l-y are separated by a middle outwash unit, h(Wu), composed primarily of sand and gravel. This middle unit is typically 25 feet but up to 75 feet thick. On the quadrangle, the uppermost diamicton unit (Wedron Group, Wu) has a heterogeneous lithology that is locally consistent with either the Wadsworth Formation or the Haeger Member of the Lemont Formation. The Wadsworth Formation is an extensive surficial clay-rich stratigraphic unit in northeastern Illinois and certainly comprises the surficial unit. It is interpreted commonly as interstratified clayey till and lacustrine sediment (Hansel and Johnson, 1996). In Will County, this unit is greater than 100 feet thick. By contrast, the Haeger Member is coarse textured and is uppermost unit of diamicton in the Lemont Formation (Hansel and Johnson, 1996). The extent and the thickness of this diamicton is difficult to identify beneath the southwestern Lake Michigan area because of limited exposure, but there is some evidence for a gravelly diamicton underlying the Wadsworth Formation along the Des Plaines River. However no evidence of the Haeger Member was clearly identified in the Frankfort Quadrangle in archived well and boring records. It is this difficulty in clearly defining the subsurface units that lends us to map the uppermost unit as Wu.

Postglacial sediment

Deposits of silt and clay, peat, sandy gravel, and sand overlie the glacial units, filling the valleys throughout the mapped area as well as many low spots scattered across the uplands. Alluvium comprised of fine-grained floodplain and coarser-grained active channel deposits are here undifferentiated within the Cahokia Formation (c). Bridge boring data indicate that the floodplain unit is generally <15 feet thick but is as much as 20 feet thick in some places. The Grayslake Peat (gp) consists of peat, muck, organic silt and clay, and interbedded sand, and is less than 10 feet thick. The Grayslake Peat was deposited in depressions and at the toes of slopes. The silt and clay glaciolacustrine sediment (glacial and post-glacial) is assigned to the Equality Formation (e). These deposits are composed primarily of finely stratified, laminated or massive, fine-grained, moderately to well-sorted clay, silt, and fine sand. The deposits are relatively thin (less than 10 feet thick) and are typically discontinuous in Will County. However, in the Frankfort Quadrangle, Equality Formation deposits are quite extensive in the Hickory Creek and the Butterfield Creek valleys north of Monee.

Important Findings

- In the Frankfort 7.5' Quadrangle, the bedrock surface slopes from 750 to 600 feet from southeast to west-northwest (Fig. M3). A subtle north-south trending bedrock valley is mapped in the western portion of the quadrangle. Sediment is thickest under the crest of the Valparaiso Moraine (Fig. M4).

- Two glacial diamicton units were identified: the Yorkville Member of the Lemont Formation and the Wadsworth Formation. The Yorkville Member is a clay and silt-dominated diamicton that occurs extensively throughout northeastern Illinois, but is quite variable in thickness. This unit is buried by the fine-grained Wadsworth Formation diamicton. The Wadsworth Formation forms the Valparaiso Morainic System and is characterized by its high silt content, moderately high clay content, gray color, interbeds of silt and silty clay, lithologic variability, and association with the moraines (Curry, 2015). West and north of the mapping area, the Wadsworth and Yorkville units are separated by the sandy-silty diamicton of the Haeger Member (Lemont Formation (Hansel and Johnson, 1996). Because the Wadsworth Formation has variable lithology, and the Haeger unit cannot be definitively identified, the upper diamicton beds are here mapped as the Wedron Formation, undifferentiated.

- A thick unnamed tongue of outwash was consistently found between the Wadsworth Formation and the Yorkville Member. Although the available well records are sparse, they indicate that none of the significant deposits of saturated glacial sand and gravel in the mapping area are used as a source of drinking water. Instead, most private wells draw groundwater from the uppermost Silurian dolomite bedrock just below the glacial drift. More detailed subsurface investigations may reveal the outwash tongue as a potential groundwater resource. If the basal part of the undifferentiated Wedron Formation included the Haeger Member of the Lemont Formation, this sand and gravel unit would be correlated with the Beverly Tongue of the Henry Formation.

- Much of the land surface of the Frankfort Quadrangle is characterized by glaciolacustrine sediments that were deposited in moraine-dammed lakes during glacial retreat phases. Throughout this area, surficial deposits of the Equality Formation are generally less than 10 feet thick. Most of the northeastern portion of the quadrangle is covered by the Equality Formation. They mostly

occur in the elongated depression of the Valparaiso Morainic system. They reach 8,000 feet long and 2,000 feet wide. Many of the lake deposits were unrecognized before the mapping project.

Acknowledgements

We would like to thank numerous local land owners and municipalities for access to their property, data, and services. We are grateful to ISGS staff - D. Grimley, and B. Curry - for helping greatly with geologic interpretations. The earth electrical resistivity data was acquired by T. Larson and his team. The ISGS Drill Team completed the test hole. We thank D. Lund and J. Carrell for map production. This mapping was funded by the State Map award number G14AC00328.

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