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2021

GEOLOGY OF THE MAPLETON QUADRANGLE

The geology in the Mapleton area consists of flat lying offshore glaciolacustrine sediments deposited within the former Glacial Lake Agassiz along with recent fluvial and overbank sediments from along the Maple River and its tributary drainages. The Maple River flows from the southwest to the northeast across the southern half of the quadrangle along a circuitous 8.5 mile (13.7 km) route with several meanders, cutoffs, and oxbows. Topography is minimal in this quadrangle with local relief of twenty feet over 10.4 miles (16.7 km) from the northwest corner of the quadrangle to the southeast corner and is essentially flat to the ground observer. This area is subject to seasonal flooding from the Red River main stem.

In the shallow subsurface (i.e., the uppermost 100 feet (30.5 m) the Sherack and Brenna Formations are the two dominant glaciolacustrine units in the quadrangle. The Sherack Formation commonly consists of tan to gray laminated silts and clays which overlay the dark gray, soft and expansive clays of the Brenna Formation. The Brenna Formation contains smectic clays which have the capacity to incorporate water into their mineralogic structure resulting in a soft and expansive clay which is capable of flow when placed under load. Slumping along rivers and creeks is common within these units and within the slopes of man-made channels.

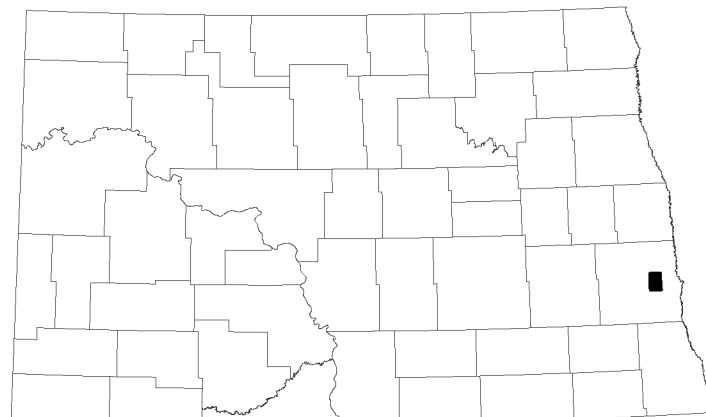
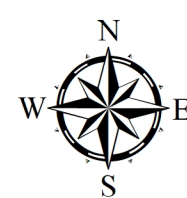
Depth and Isopach (thickness) contours drawn on the Brenna Formation are also depicted on this map. The Brenna Formation is generally between 21 and 27 feet (6.4 to 8.3 m) below land surface (bls), getting slightly deeper toward the west and ranges between 20 and 40 feet in thickness, generally thinning toward the west. The Brenna overlies subglacial diamicton of likely the upper Goose River Formation at depths of 39 to 59 feet (11.9 to 18 m) bls. Shale bedrock ranges in depth from 195 to 264 feet (59.4 to 80.5 m) bls. Depth to weathered granitic basement rocks of Precambrian age is generally over 300 feet (91.4 m) bls.

Gravel and sand deposits that may or may not be continuously interconnected can be found in the shallow subsurface at depths of around 100 feet. If laterally extensive, these deposits may be water bearing in sufficient quantities to supply local water well uses. Wells have been drilled to these depths in Mapleton for municipal and industrial uses in the past.

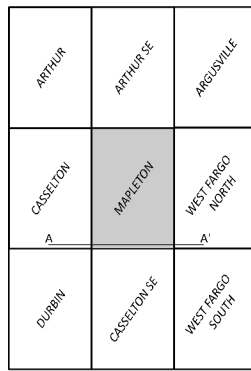
Glacial landforms in the quadrangle include compaction ridges and linear ice grooves. The Maple Ridge is a large glaciofluvial compaction ridge that traverses across the southern half of the quadrangle from the southwest towards the east that is readily mapped from high-resolution LiDAR topographic data. These ridges can contain water-saturated sand, which was deposited along ancient rivers flowing across the lake bottom after the recession of lake water. Some of the sand that comprise these ridges can flow when saturated and can be problematic during exploratory drilling and the construction of building foundations and structures as they may exhibit weak load-bearing characteristics.

Linear glacial ice grooves and ridges, created by floating ice dragging on the lake bottom, are found in the northwest and central portions of the quadrangle and generally trend from the northwest to the southeast and southwest to the northeast, presumably along the flow path of the dominant paleo-wind directions after ice recession and break up on Glacial Lake Agassiz.

Drainage improvements and channel straightening along meandering natural drainage pathways have been completed in the northern and central portions of the quadrangle. Along the northern channel improvements on the Rush River slumping of the channel banks occurs frequently with numerous slumps appearing on both the north and south sides of the channel. Slumping also occurs along natural channels in the quadrangle where several slumps are mapped along the meandering bends of the Maple River.



Mapleton Quadrangle, North Dakota



Geology of the Mapleton Quadrangle, North Dakota

EXPLANATION

ANTHROPOCENE

- Asdc** **CHANNEL SLUMPS:** Areas of slumped material within artificially excavated slope faces along drainage channels of the Rush River.
- Af** **FILL DEPOSITS:** Cut and fill materials consisting dominantly of silts, clays, and sands from adjacent nearsurface formations placed by artificial means. Used in construction of highway crossover ramps, wastewater ponds and drainage improvement embankments.

QUATERNARY PERIOD

- Qls** **LANDSLIDE AREAS:** A mass of material that has moved downslope. Includes earth flows, riverbank slumps, and areas of soil creep.

HOLOCENE EPOCH

OAHE FORMATION

- Apso** **POND AND SLOUGH SEDIMENTS:** Dark brown to black obscurely bedded clay, silt, sand, and organic debris generally one to three feet in thickness. Modern pond and slough sediments in oxbow lakes and cutoff meanders created by anthropogenic channel modifications.

- Hal** **ALLUVIUM:** Clay, silt, sand, and disseminated organic debris, obscurely bedded, black to brown-gray, associated with sand and gravel of older river channel sediment. Glaciofluvial and modern fluvial deposits associated with the Maple and Rush Rivers and ancient rivers on the Lake Agassiz plain.

PLEISTOCENE EPOCH

COLEHARBOR GROUP

- Qs** **SHERACK FORMATION:** Glaciolacustrine, yellow gray, thinly laminated silt, clay, and silty clay. Deposited as offshore sediments of Glacial Lake Agassiz. Ranges in thickness from 20 to 28 feet (6.1 to 8.5 m).

- Qcr** **COMPACTION RIDGE:** Glaciofluvial compaction ridge (Maple Ridge) mapped from topographic expression in LiDAR surface model. Sand, silt, and clay of the West Fargo Member of the Poplar River Formation comprise the compaction ridge sediments in the shallow subsurface. Overlain by Qs.

- Qb** **BRENNA FORMATION:** Glaciolacustrine, brown (upper-weathered) to very dark-gray, slightly laminated to unbedded clay, and silty clay. Calcareous nodules present with slickensides common, soft to very stiff. Deposited as offshore sediments of Glacial Lake Agassiz. Commonly more than 30 feet (9.1 m) thick at depths ranging from 20 to 28 feet (6.1 to 8.5 m) below land surface.

- Qct** **SUBGLACIAL TILL:** Gray to dark-gray and olive silty clay with sand and coarse to fine gravel (undifferentiated). Sediment deposited by glacial ice of Late Wisconsinan age. Multiple tills (diamicton) are likely within this group. The Red Lake Falls /Goose River Formations are the uppermost tills in this area.

- Qcs** **SAND & GRAVEL:** Fine gravel to fine sand with shale pebbles and gray clay common. Deposited as ice-contact glacial outwash.

CRETACEOUS BEDROCK

- Ku** **SHALE (undifferentiated):** Dark-gray to gray-brown, clayey carbonaceous shale. Marine offshore sediment of the Belle Fourche, Mowry, or Skull Creek Formations.

PRECAMBRIAN BASEMENT

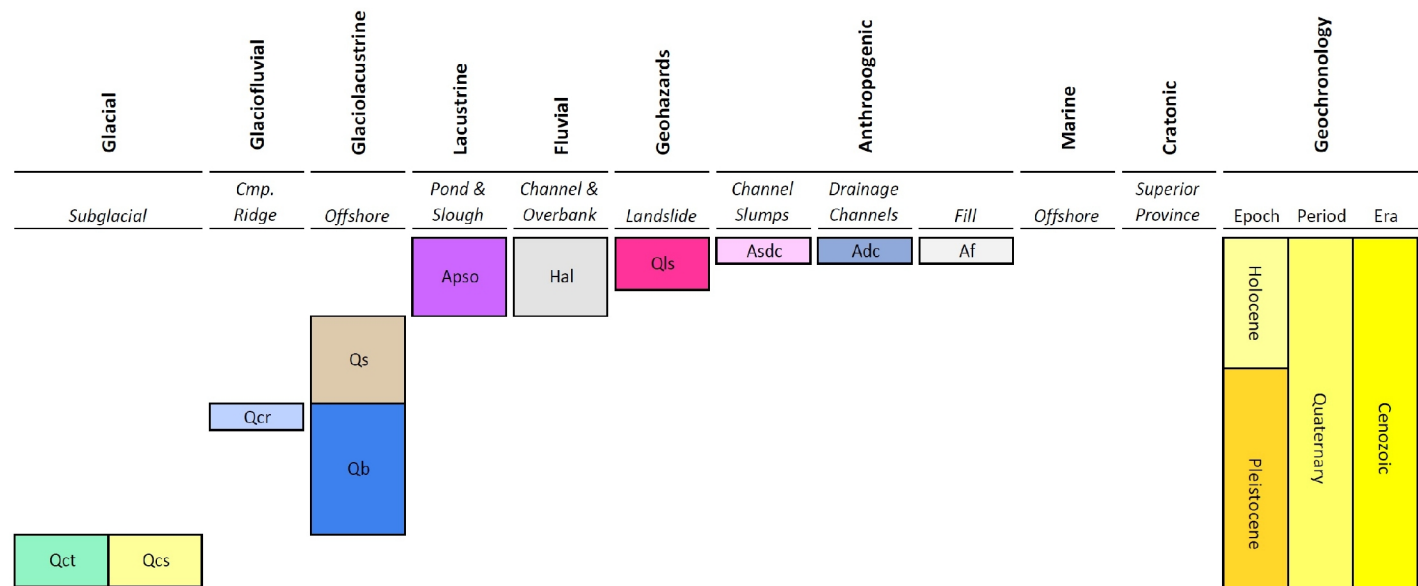
- pC** **WEATHERED GRANITE:** Green-gray to white, clayey with granite pebbles and fragments. Occasional angular quartz grains. Depth of weathered zone inferred from drillhole lithologic logs.

- pC** **GRANITIC ROCKS:** Archaean age basement rocks of the Superior Province.

- Ice-drag marks** — Established from aerial photographs and LiDAR. Low linear ridges and shallow grooves made by glacial icebergs or floating lake ice in contact with the lake bottom.
- Adc** **Drainage channels:** Reaches of paleochannels on the Lake Agassiz plain straightened by anthropogenic means for flow improvement.
- Geologic contact
- Geologic contact (inferred)
- Depth Contour(feet) on the top of the Brenna Formation
- Isopach (thickness) Contour (feet) on the top of the Brenna Formation

- Drillhole Location
- 195' Bedrock Depth (if available)
- 338' NA - Not Available
- Basement Depth (if available)

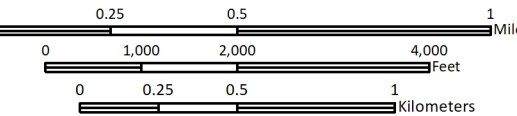
CORRELATION OF UNITS IN MAP AND CROSS-SECTION



ROAD CLASSIFICATION

- Expressway — Local Connector —
- Secondary Hwy — Local Road —
- Ramp — 4WD —
- Interstate Route — US Route — State Route —

Scale 1:24,000



Lambert Conformal Conic Projection

North American 1983 Datum

USGS 7.5 Minute Topo Map

Standard Parallels 46°52'30"N, 47°03'0"N

NOVD 1988

LiDAR Data Originator: International Water Institute, 2010,

Red River Basin Mapping Initiative 2008-2010.

2019 Magnetic North

Declination at Center of Sheet

CASSELLTON | MAPLETON

Mapleton City Limits

MAPLETON | WEST FARGO NORTH

