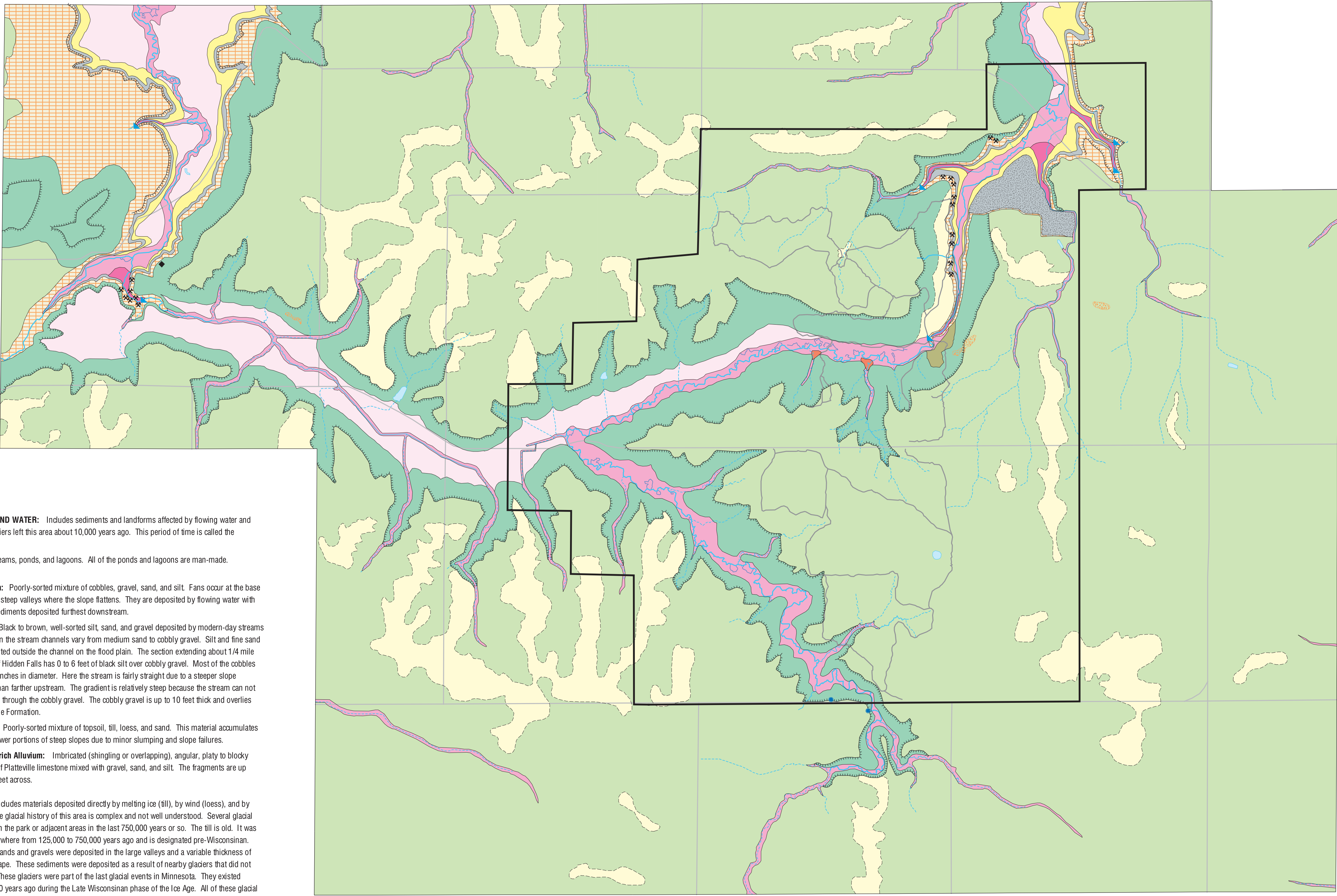


SURFICIAL GEOLOGY

NERSTRAND BIG WOODS STATE PARK, MINNESOTA

GLENN MELCHERT

2000



MODERN SEDIMENTS AND WATER: Includes sediments and landforms affected by flowing water and gravity since the last glacers left this area about 10,000 years ago. This period of time is called the the Holocene Epoch.

- Water:** Streams, ponds, and lagoons. All of the ponds and lagoons are man-made.
- Alluvial Fan:** Poorly-sorted mixture of cobbles, gravel, sand, and silt. Fans occur at the base of relatively steep valleys where the slope flattens. They are deposited by flowing water with the finest sediments deposited furthest downstream.
- Alluvium:** Black to brown, well-sorted silt, sand, and gravel deposited by modern-day streams. Sediments in the stream channels vary from medium sand to cobbly gravel. Silt and fine sand were deposited outside the channel on the flood plain. The section extending about 1/4 mile upstream of Hidden Falls has 0 to 6 feet of black silt over cobbly gravel. Most of the cobbles are 4 to 10 inches in diameter. Here the stream is fairly straight due to a steeper slope (gradient) than farther upstream. The gradient is relatively steep because the stream can not easily erode through the cobbly gravel. The cobbly gravel is up to 10 feet thick and overlies the Platteville Formation.
- Colluvium:** Poorly-sorted mixture of topsoil, till, loess, and sand. This material accumulates along the lower portions of steep slopes due to minor slumping and slope failures.
- Limestone-rich Alluvium:** Imbricated (shingling or overlapping), angular, platy to blocky fragments of Platteville limestone mixed with gravel, sand, and silt. The fragments are up to about 3 feet across.

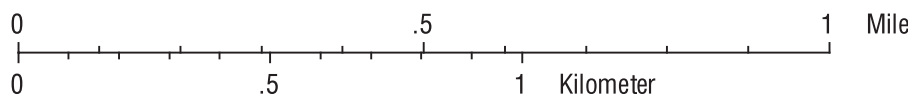
GLACIAL DEPOSITS: Includes materials deposited directly by melting ice (till), by wind (loess), and by meltwater (outwash). The glacial history of this area is complex and not well understood. Several glacial episodes have occurred in the park or adjacent areas in the last 750,000 years or so. The till is old. It was deposited by glacers anywhere from 125,000 to 750,000 years ago and is designated pre-Wisconsinan. More recently, outwash sands and gravels were deposited in the large valleys and a variable thickness of loess mantled the landscape. These sediments were deposited as a result of nearby glacers that did not actually cover the park. These glacers were part of the last glacial events in Minnesota. They existed between 10,000 to 30,000 years ago during the Late Wisconsinan phase of the Ice Age. All of these glacial phases occurred during the period of time called the Pleistocene Epoch.

- Loess:** Pale yellow to light olive brown, well-sorted, non-calcareous fine sand and silt that is greater than three feet thick. Grains larger than fine sand are rare. Loess was blown into this area by winds that carried fine sand and silt off of two separate glacers, known as the Moland and the Des Moines Lobe. The Moland glacer was older than the Des Moines Lobe and both were just a few miles west. Loess was deposited for a time after the last glacer melted and continued until vegetation stabilized the landscape. In this area, loess is the parent material of 1.5 to 2 feet of black fertile topsoil absent of pebbles.
- Outwash:** Black silt containing thin brown, calcareous sand layers overlying brown sand and coarse gravel. These sediments were deposited when flood waters from the melting Des Moines lobe or Moland glacer flowed through the large valleys. The flood waters probably widened and deepened the valleys. The silt is up to 10 feet thick and the underlying sand and gravel is 10 feet thick or more. These sediments overlie bedrock in places. Till that has slid down steep slopes may be incorporated in the outwash adjacent to valley walls. Modern streams flow over these sediments.
- Thin Loess over Till:** One to three feet of pale yellow to light olive brown, well-sorted, non-calcareous fine sand and silt (loess) that overlies yellowish brown to light olive brown, moderately calcareous, unsorted, pebbly, silty clay till. This till originally was gray, but is brown due to prolonged weathering. Other than color, this till is equivalent to the till described below. In some places a lag deposit less than 6 inches thick consisting of pebbles and cobbles occurs between the loess and the till. This lag deposit represents what remains due to erosion of the till before the loess was deposited.
- Till:** Very dark gray, moderately calcareous, unsorted, pebbly silty clay. The upper 15 to 30 feet (about 20 feet in the high elevations of the park) is weathered to yellowish brown to light olive brown color. Unweathered till is exposed in the deeper valleys along some stream channels, gullies, and valley walls. The contact between weathered and unweathered till is sharp in many places. Cobbles larger than 3 inches are uncommon. Some cobbles of granite and gneiss are highly weathered and crumble when removed from the till. Small lenses of sorted medium sand, often water-bearing, occur at various depths. Rare deposits of fine gravel are found near the surface. This till is often referred to as the "old gray till". It was deposited by glacers from the north or northwest. Maximum thickness is about 140 feet.

BEDROCK UNITS: These rocks originated from sediments deposited as a warm, subtropical sea encroached upon and covered this area from the south. First sands were deposited in a beach-type environment to form sandstone. As the sea deepened, muds settled out to form shale. For a time, the water was clear, which allowed shell fish to thrive and allowed calcite to precipitate out of the sea water to form limestone. Then the sea became muddy again, depositing silts that became the youngest shale exposed in the mapped area. These sediments were deposited 440 to 500 million years ago, during the period of time called the Ordovician Period.

- Decorah Shale:** Olive gray calcareous shale. This formation contains thin layers of very fossiliferous (bearing fossils) limestone. One outcrop was found in the north part of the park and only the lower 3 feet are exposed.
- Platteville Formation:** Blue gray to grayish brown, shaley, fossiliferous, dolomitic limestone. The upper 9 feet has thin to thick olive gray, calcareous shale partings and the limestone typically breaks up into 2 to 4 inch slabs. This portion is usually eroded and removed in stream valleys, and where the limestone forms the tops of bluffs. The basal 7 to 10 feet is fairly massive and forms ledges or terraces along valley walls. Waterfalls form on this portion. The massive portion eventually weathers into irregular platy slabs that are 1/2 to 3 inches thick. Maximum formation thickness is 19 feet. The massive portion is exposed or intermittently exposed in most of the mapped area at an elevation between 1040 and 1080 feet. Mapping unit is covered by up to 9 feet of soil and sediment.
- Glenwood Formation:** Three feet of light greenish gray noncalcareous siltstone to fine sandstone grading up into dolomitic siltstone, dolostone, and calcareous shale, all overlying a prominent, massive dolostone about 9 inches thick. Below this is dark greenish gray shale. Occasional rusty-iron colored pyrite concretions (nodules) occur in the lower part. Total formation thickness is 11 feet. This formation erodes easily, is usually covered by soil, and is exposed in only a few places.
- St. Peter Sandstone:** Pale yellow to light gray, slightly porous, non-calcareous, weakly cemented, very clean, fine to medium grained sandstone. The sand grains are rounded to subrounded and frosted. This formation erodes fairly easily resulting in subtle outcrops. Only the upper 27 feet are exposed.

Scale 1:15,000



GEOLOGIC CONTACTS, LANDFORMS, WATER, LOCATIONAL REFERENCE

- Geologic contact - well defined boundary between mapping units.
- Geologic contact - gradational contact between the loess and thin loess over till units.
- Scarp - a steep slope along the margin of relatively flat terrain.
- Major stream
- Minor stream
- Intermittent stream - stream that contains water for only part of the year.
- Meander scar - abandoned segments of stream channel.
- Statutory State Park boundary
- Road
- Park trail

GEOLOGICAL AND CULTURAL FEATURES

- Old small-scale limestone quarry workings
- Large-scale limestone quarry
- Gravel pit
- Glacial erratic - large boulder comprised of a rock type not normally found in the area, indicating it was transported and deposited here by a glacer.
- Waterfall
- Seep - a spot where ground water flows from the ground for all or most of the year.

