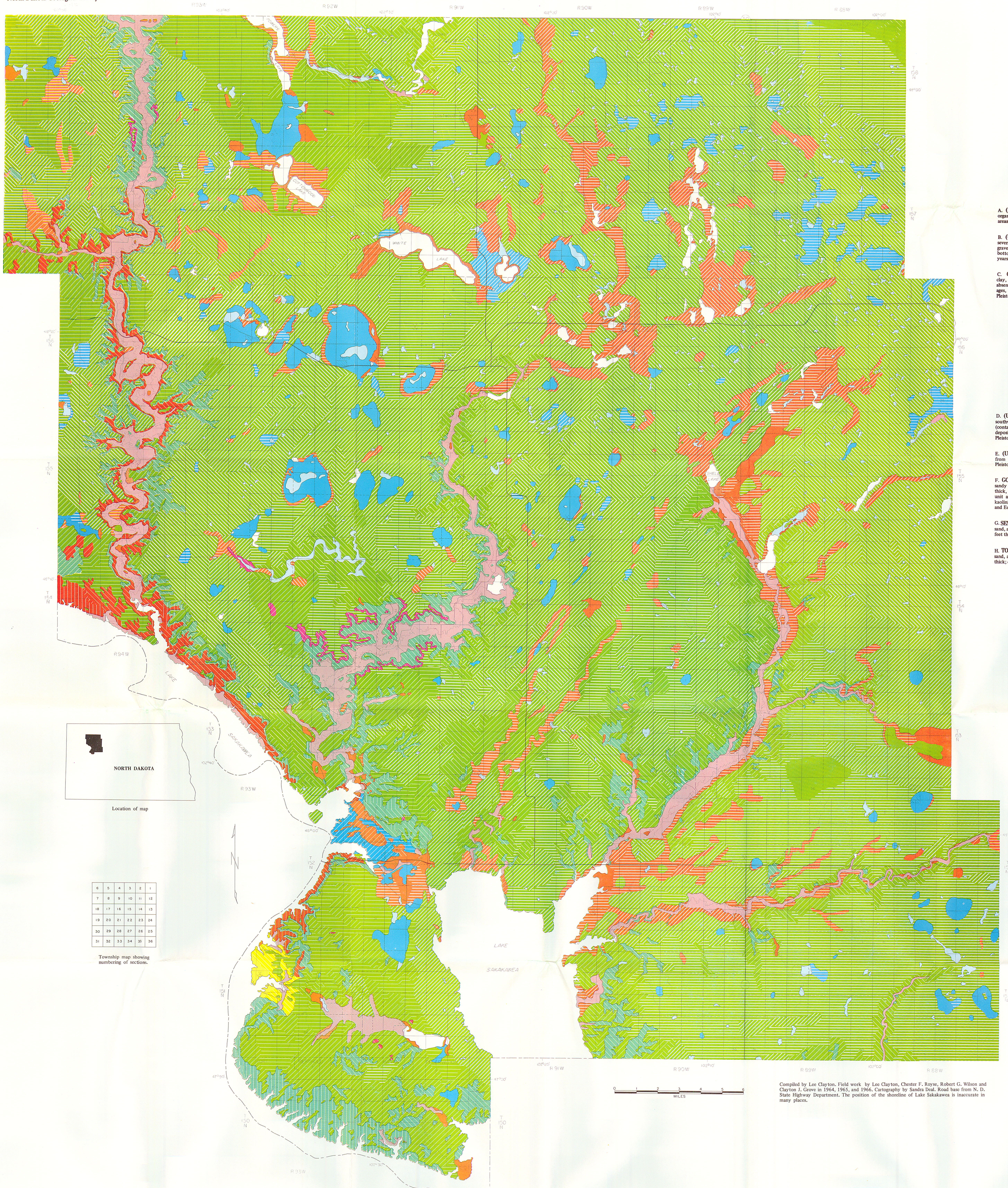


Location of map

Township map showing numbering of sections.

EXPLANATION

(See text of report for fuller explanation)

FORMATIONS

A. **(UNNAMED):** Black clay; contains several percent dispersed organic material; 3 to about 30 feet thick; fills bottoms of sloughs in areas of nonintegrated drainage; deposited during past 12,000 years.

B. **(UNNAMED):** Very dark brown sandy clayey silt; contains several percent dispersed organic material; contains layers of sand and gravel; 3 to about 50 feet thick; river sediment deposited in valley bottoms in areas of integrated drainage; deposited during past 9000 years.

C. **COLEHARBOR FORMATION:** Interlayered pebbly, sandy, silty clay, sand and gravel, and silt and clay; organic material scarce or absent; 3 to more than 300 feet thick; deposited mostly during the ice ages, several hundred thousand to about 9000 years ago (late Pleistocene Epoch).

PEBBLY, SANDY, SILTY CLAY: A mixture of about equal parts of clay, silt and sand plus a few percent pebbles and some cobbles and boulders as much as a few feet in diameter; makes up 87% of Coleharbor Formation; largely glacial till and till-mudflow deposits (flowtill).

SAND AND GRAVEL: Sandy gravel, gravelly sand, and dirty sandy gravel; makes up 8% of Coleharbor Formation; the mineralogy indicates that it was ultimately derived from the northeast in Canada; most was deposited by large rivers during glacial times, but not necessarily by meltwater rivers; some deposited on beaches of lakes.

SILT AND CLAY: Silty clay, clayey silt, and clay that is free of pebbles; makes up about 5% of Coleharbor Formation; deposited in lakes whose basins were at least in part enclosed by glacial ice.

D. **(UNNAMED):** Sand (containing a few pebbles derived from the southwest in the Black Hills or Rocky Mountains) and sandy silty clay (containing some lignite fragments); as much as 400 feet thick; deposited by rivers flowing northeastward in late Tertiary or early Pleistocene time.

E. **(UNNAMED):** Gravel; contains pebbles transported by rivers from the southwest (Rocky Mountains) during late Tertiary or early Pleistocene time.

F. **GOLDEN VALLEY FORMATION:** Bright-colored clayey and sandy layers, including an upper bentonite-rich unit about 80 feet thick, a middle micaceous-sand unit about 70 feet thick, and a lower unit about 30 feet thick containing a conspicuous white or orange kaolinitic-clay layer; deposited in lakes and rivers during the Paleocene and Eocene Epochs.

G. **SENTINEL BUTTE FORMATION:** Dull gray layers of silt, clay, and sand, and some sandstone, lignite, scoria, and limestone; as much as 300 feet thick; deposited in lakes and rivers during the Paleocene Epoch.

H. **TONGUE RIVER FORMATION:** Yellowish layers of silt, clay, and sand, and some sandstone, lignite, scoria, and limestone; about 600 feet thick; deposited in lakes and rivers during the Paleocene Epoch.

TOPOGRAPHY

(Figures indicate average maximum slope angles)

NONINTEGRATED DRAINAGE (Sloughs and Hills)			INTEGRATED DRAINAGE (Valleys and Divides)					
Hilly	Rolling	Undulating	Badlands	Hilly	Rolling	Undulating	Flat	Apron
7°-20° 12%-36%	4°-7° 7%-12%	1°-4° 2%-7%	25°-90° over 47%	7°-25° 12%-47%	4°-7° 7%-12%	1°-4° 2%-12%	0°-1° 0%-2%	1°-10° 2%-18%

Geologic contact

Perennial and intermittent streams

Temporary streams

Perennial and intermittent lakes and ponds

Springs

Dams

Gravel and sand pits

Lignite pits and mines

Numbered highways

Graveled roads

Trails

Section boundary

Township boundary

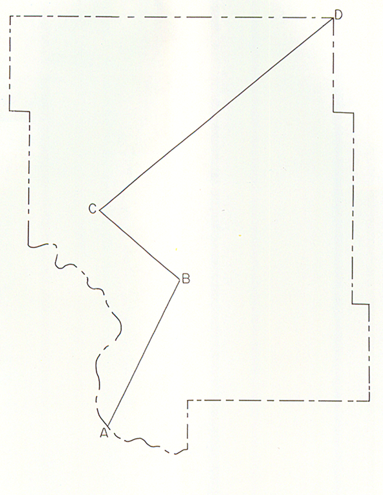
County boundary

DESCRIPTIVE GEOLOGIC MAP of Mountrail County North Dakota

LEE CLAYTON

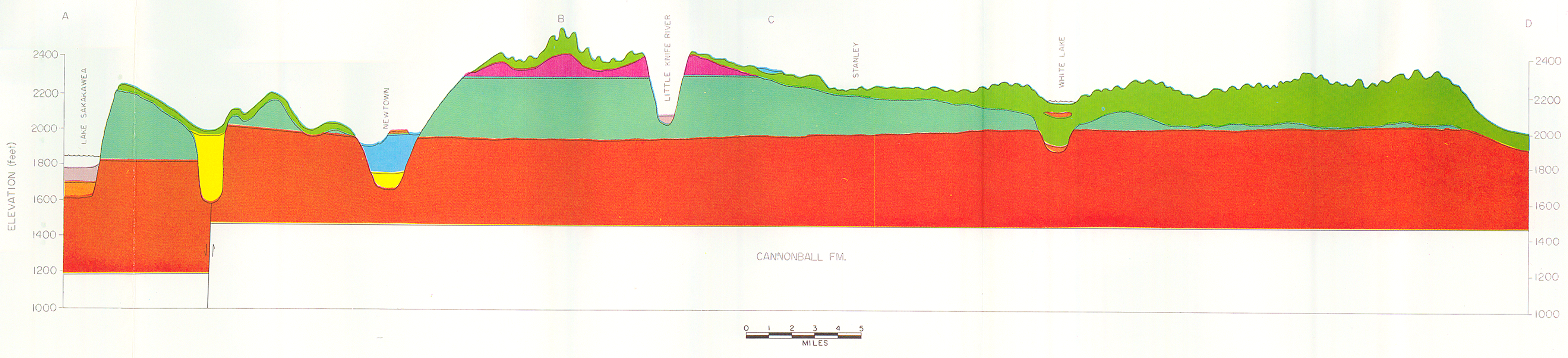
1972

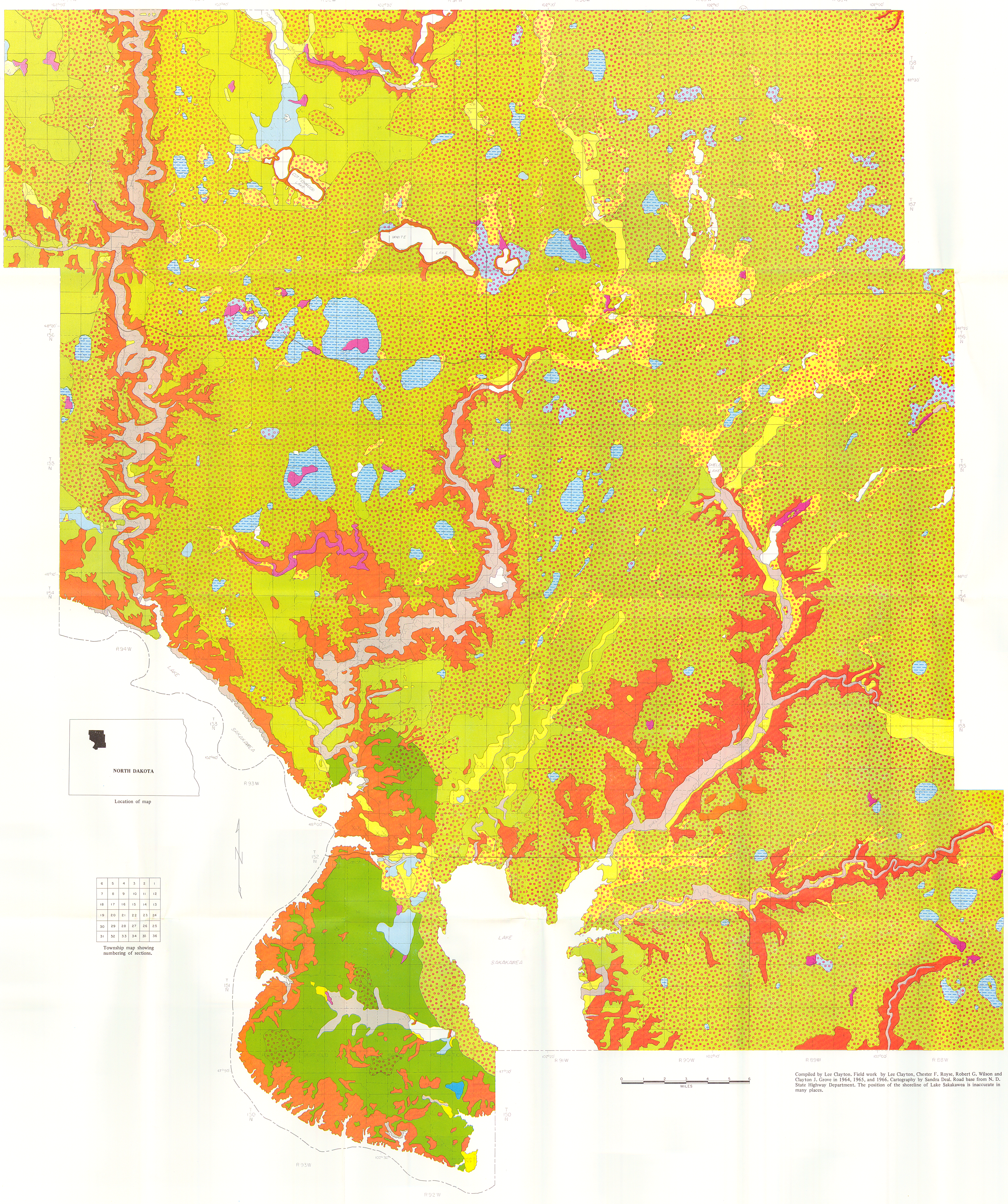
Compiled by Lee Clayton. Field work by Lee Clayton, Chester F. Royse, Robert G. Wilson and Clayton J. Grove in 1964, 1965, and 1966. Cartography by Sandra Deal. Road base from N. D. State Highway Department. The position of the shoreline of Lake Sakakawea is inaccurate in many places.



Location of cross section

GENERALIZED CROSS SECTION





Location of map

Township map showing numbering of sections

EXPLANATION

(See text for more complete explanations of the map units)

DEPOSITS ASSOCIATED WITH POST-LOSTWOOD EVENTS

ORIGIN	AGE	LITHOLOGY	TOPOGRAPHY
STREAM SEDIMENT overbank silt and lower-flow-regime channel sand of floodplains; flanked by small alluvial fans from small tributaries; commonly contains aquatic and terrestrial mollusk shells and mammal (especially bison and rodent) bones. (Commonly called "alluvium".)	Largely Holocene.	Largely formation B.	Floodplains are flat and alluvial fans are aprons at base of adjacent hillslopes; some flat stream terraces.
(a) **SLOUGH SEDIMENT**; several feet of sediment brought from adjacent hillslopes; in groundwater recharge areas; sediment partly oxidized; commonly underlain by (b) **POND SEDIMENTS**; a few feet thick; commonly unoxidized; commonly contains lacustrine fossils (such as fish, microcrustaceans, and mollusks) and fossils washed from adjacent forest (such as spruce wood and needles).	(a) Holocene (the middle Holocene sediment is coarser and has less organic material because of dryer climate and less stable hillslopes); (b) latest Wisconsinan (the climate was then cooler and moister than at present).	Largely formation A; thousands of small deposits are not shown on the map.	Flat.
SHORELINE SEDIMENT.	Largely late Holocene, early Holocene, and latest Wisconsinan.	Sand and gravel facies of the Coleharbor Formation.	Apron or ridge at base of hillslope around the largest lakes.
Probably in large part post glacial **WIND-BLOWN SEDIMENT**, though may include some superglacial or proglacial stream sediment of the Lostwood Glaciation.	Holocene and/or late Wisconsinan.	Sand facies of the Coleharbor Formation.	Nonintegrated drainage; undulating uplands south of Shell Creek.

EROSIONAL LANDFORMS ASSOCIATED WITH POST-NAPOLEON (?) EVENTS

ORIGIN	AGE	LITHOLOGY	TOPOGRAPHY
EROSIONAL TOPOGRAPHY; erosion on the hillslopes was largely by particle creep, overland flow, and various kinds of mass movement; sediment was removed from the area largely by streams.	Major valleys were eroded during the Pleistocene; most areas were probably eroded at least several feet during the Holocene, especially during the dry middle Holocene.	The units that underwent erosion include parts of the Coleharbor Formation and all of the exposed parts of formations D and E and the Golden Valley, Sentinel Butte, and Tongue River Formations.	Integrated drainage except for landslides; slopes range from 1 degree on pediments to 90 degrees in some parts of badland areas.

DEPOSITS ASSOCIATED WITH THE LOSTWOOD GLACIATION

SEDIMENT DEPOSITED ON SOLID GROUND, RATHER THAN ON GLACIAL ICE

ORIGIN	AGE	LITHOLOGY	TOPOGRAPHY
A thin blanket of **GLACIER SEDIMENT** ("till") draped over pre-Lostwood erosional topography; underwent enough post-Lostwood hillslope erosion to partly destroy the small-scale depositional landforms but not enough to remove the blanket of glacier sediment, though pre-Lostwood Pleistocene sediment may be at the surface in places. (Commonly called "sheet moraine" and "ground moraine.")	Largely late Wisconsinan.	Largely pebbly sandy silty clay facies of the Coleharbor Formation.	Largely integrated drainage; undulating to hilly.
STREAM SEDIMENT; (a) upper-flow-regime channel sediment (flat-bedded sandy gravel) deposited by glacial meltwater streams and (b) lower-flow-regime channel sediment(high-angle cross-bedded sand) deposited by non-meltwater streams. (Commonly called "outwash.")	Late Wisconsinan.	Largely sand and gravel facies of the Coleharbor Formation.	Integrated drainage; flat to undulating.
LAKE SEDIMENT of proglacial lakes.	Late Wisconsinan.	Largely sand and clay facies of the Coleharbor Formation.	Nonintegrated drainage; flat to undulating.
LAKE SEDIMENT of ice-walled lakes; offshore silt and clay surrounded in many areas by shoreline sand and gravel derived from the enclosing glacial ice; as the ice walls melted the margins slumped. (Commonly called "perched lake plains" and "moraine plateaus.")	Late Wisconsinan (about 13,000 to about 9,000 B. P.)	Largely silt and clay facies (and some sand and gravel facies) of the Coleharbor Formation.	Largely flat; in some areas has a marginal shoreline apron sloping down to the flatter central part of the lake plain; the entire lake plain is generally elevated above the surrounding topography.

SEDIMENT ON STAGNANT GLACIAL ICE AND COLLAPSED WHEN THE ICE MELTED

ORIGIN	AGE	LITHOLOGY	TOPOGRAPHY
GLACIER SEDIMENT ("flowtill"); thickness of superglacial sediment was a few feet where the topography is flat, a few feet to a few tens of feet where the topography is undulating, a few tens of feet to several tens of feet where the topography is rolling, and several tens of feet to at least 150 feet where the topography is hilly. (The flat topography has commonly been called "ground moraine"; the undulating topography has been called "ground moraine" and "low-relief dead-ice moraine"; the rolling topography has been called "dead-ice moraine" and, in some places, "end moraine,".)	Late Wisconsinan (originally sheared by active ice into the superglacial position about 15,000 to about 13,000 B. P.; collapsed from stagnant ice about 13,000 to about 9,000 B. P.).	Largely pebbly sandy silty clay facies of the Coleharbor Formation.	Nonintegrated drainage; flat to hilly.
STREAM SEDIMENT; largely upper-flow-regime channel sediment (flat-bedded gravel); as the underlying glacial ice melted it underwent considerable gravity faulting; the thickness of superglacial sediment is related to hillslope steepness, as in collapsed glacier sediment, but the slopes are considerably steeper. (Commonly called "collapsed outwash" and "kame complex.")	Late Wisconsinan (about 13,000 to about 9,000 B. P.).	Largely gravel and sand facies of Coleharbor Formation.	Nonintegrated drainage; undulating to hilly.
LAKE SEDIMENTS; largely offshore silt and clay but includes some shoreline sand and gravel; as the underlying glacial ice melted it underwent considerable folding; the thickness of the superglacial sediment is related to hillslope steepness, as in collapsed glacier sediment, but the slopes are slightly less steep. (Commonly called "collapsed lake sediment.")	Late Wisconsinan (about 13,000 to about 9,000 B. P.)	Largely silt and clay facies of the Coleharbor Formation.	Nonintegrated drainage, undulating to rolling.

DEPOSITS ASSOCIATED WITH THE NAPOLEON (?) GLACIATION

SEDIMENT DEPOSITED ON SOLID GROUND, RATHER THAN ON GLACIAL ICE

ORIGIN	AGE	LITHOLOGY	TOPOGRAPHY
A thin blanket of **GLACIER SEDIMENT** ("till") draped over pre-Napoleon (?) erosional topography; underwent enough post-Napoleon (?) erosion to partly destroy the small-scale depositional landforms, but not enough to remove the blanket of sediment. (Commonly called "sheet moraine" and "ground moraine.")	Early Wisconsinan (?).	Largely pebbly sandy silty clay facies of the Coleharbor Formation.	Integrated drainage; undulating to rolling.
STREAM SEDIMENT channel sediment deposited, at least in large part, by glacial meltwater streams. (Commonly called "outwash.")	Early Wisconsinan (?).	Largely sand and gravel facies of the Coleharbor Formation.	Flat.
Proglacial **LAKE SEDIMENT.**	Early Wisconsinan (?).	Largely silt and clay facies of the Coleharbor Formation.	Flat.

SEDIMENT DEPOSITED ON STAGNANT GLACIAL ICE AND COLLAPSED WHEN THE ICE MELTED

ORIGIN	AGE	LITHOLOGY	TOPOGRAPHY
Collapsed **GLACIER SEDIMENT** ("flowtill") a few tens of feet thick at most. (Commonly called "ground moraine.")	Early Wisconsinan(?).	Largely pebbly sandy silty clay facies of the Coleharbor Formation.	Nonintegrated drainage; undulating.

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Temporary streams

Perennial and intermittent lakes and ponds

Springs

Dams

Gravel and sand pits

Lignite pits and mines

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INTERPRETIVE GEOLOGIC MAP of Mountrail County North Dakota

LEE CLAYTON

1972