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GEOLOGY OF THE DICKINSON NORTH DAKOTA AREA

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LITHOLOGY

Intraformational (siltstone, chert, silicified wood) and volcanic and igneous gravels along the Green River northeast of Dickinson. This deposit also contains chunks of coal and clinker.

Qa1 Sand and gravel deposits are concentrated along the Heart and Green rivers in the Dickinson area. **QTa** The oldest gravels exposed at the surface tend to be the coarsest, likely deposited by rivers swollen by melting glacial ice, although some of these deposits may predate glacial events. The deposits along the Green River are extremely variable, ranging from well sorted sand to very poorly sorted gravels containing a wide variety of rocks including large chunks of coal and clinker. The coarser grained deposits are often cemented with iron.

Six feet of iron-stained, cross-bedded sandstone of the Camels Butte Member of the Golden Valley Formation.

Tgv The Camels Butte Member (upper member) of the Golden Valley consists of alternating beds of sandstone, siltstone, claystone, mudstone, and lignite. The Camels Butte Member is about 220 feet thick in the Dickinson area. These rocks are very similar in appearance to those of the Sentinel Butte Formation, but these rocks tend to be shades of brown rather than the grays of the Sentinel Butte. Rocks within the Golden Valley Formation are often very micaceous (contain glittering flakes of mica). The coals in the Golden Valley Formation are often very thin, generally less than five feet thick. Sandstones in this formation are often very thick, well cemented, iron stained, and form the caprock for many buttes in the area.

The Taylor Bed, a hard, resistant rock unit that is often present in this area at the top of the Bear Den Member of the Golden Valley Formation. The Taylor Bed is 18 inches thick at this locality.

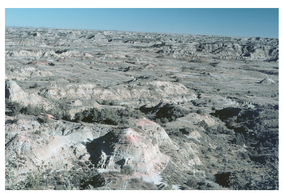
Tgv The Taylor Bed is a hard, silicious bed that occurs intermittently through this area at the top of the Bear Den Member. The bed was named for prominent outcrops around the town of Taylor. The Taylor Bed ranges in thickness from a few inches up to two feet and exposed surfaces are often highly polished. This gray, silicious rock generally contains plant molds, often molds of *equisetum* or horse tail. Chunks of the Tyler Bed are extremely resistant to erosion and are often found on surfaces where hundreds of feet of underlying rock was eroded while these rocks survived as float.

Outcrop of the Bear Den Member of the Golden Valley Formation (white claystone) along the Heart River valley southwest of Dickinson.

Tgv The Bear Den Member is the basal member of the Golden Valley Formation. It consists of 15 to 30 feet of brightly colored (white, orange, yellow, purple, and gray) claystone, mudstone, siltstone, and sandstone. This rock unit stands out in sharp contrast to the dull colored rocks that are above and below it. Clay from this horizon is greasy to the touch.

Coals, sandstones, mudstones, and claystones of the Sentinel Butte Formation exposed along the Heart River east of Lehigh. The Lehigh coal at the base of the outcrop is 10 feet thick.

Tsb The Sentinel Butte Formation consists of up to 600 feet of gray to brown siltstone, claystone, sandstone, and lignite that were deposited in river, lake, and swamp environments. Most individual beds are not well cemented and can commonly be dug into with a shovel. The well-cemented beds that are present typically are channel sandstones that, because they are harder than enclosing sediments, form resistant ledges and caprock on buttes. The Sentinel Butte Formation takes its name from Sentinel Butte, North Dakota, where, near the turn of the century, these rocks were first studied in detail. The photo was taken along the Heart River a few miles east of Lehigh. This is one of the few good exposures of the Sentinel Butte Formation in this area. Only about the upper 200 feet of the Sentinel Butte Formation is exposed in the greater Dickinson area.



Badlands topography developed on the Sentinel Butte Formation at Painted Woods overlook 25 miles west of Dickinson.

Tsb The Sentinel Butte Formation is the dominant rock unit in the greater Dickinson area. Although it underlies much of the surface in this area, it is not well exposed beyond a few limited areas. The best exposures are to be seen in the Little Missouri River badlands west of Dickinson. In the badlands, coal beds can be traced laterally for tens of miles indicating that the swamps that they formed once covered significant portions of western North Dakota.

References:

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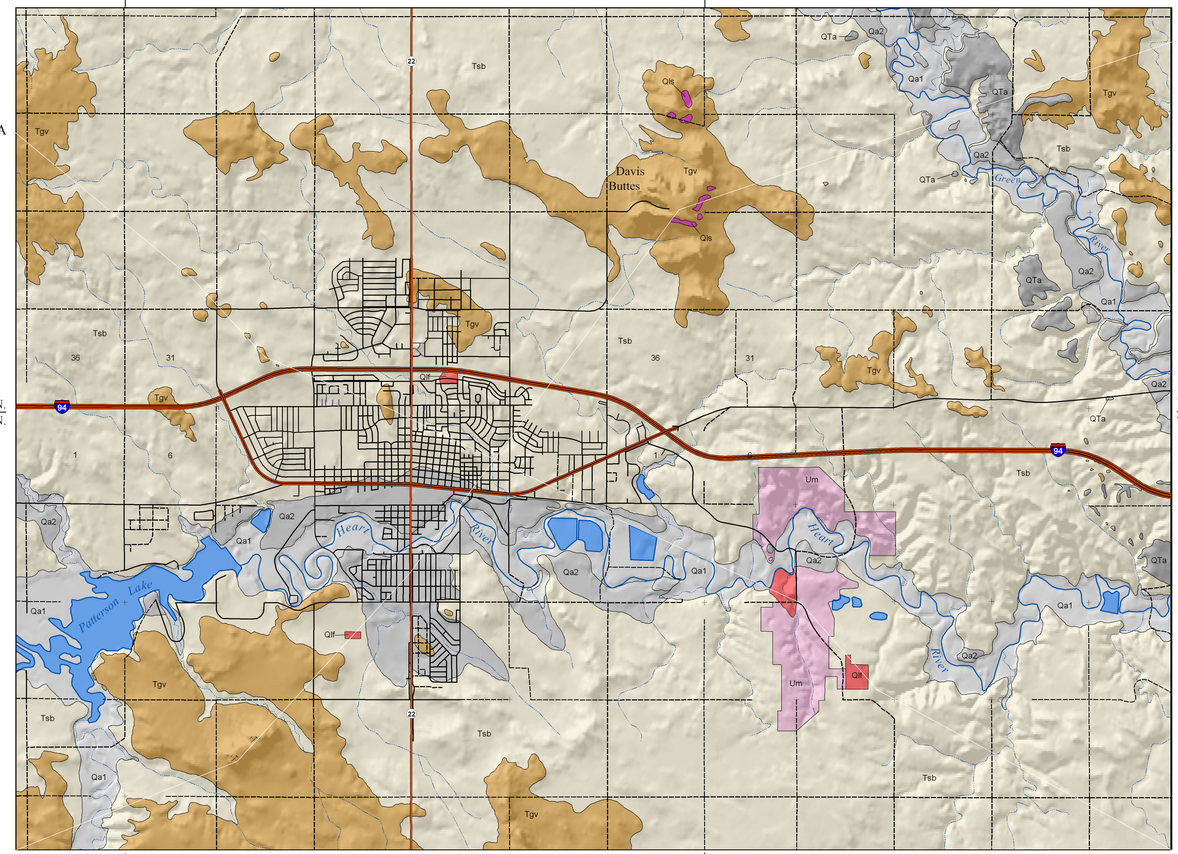

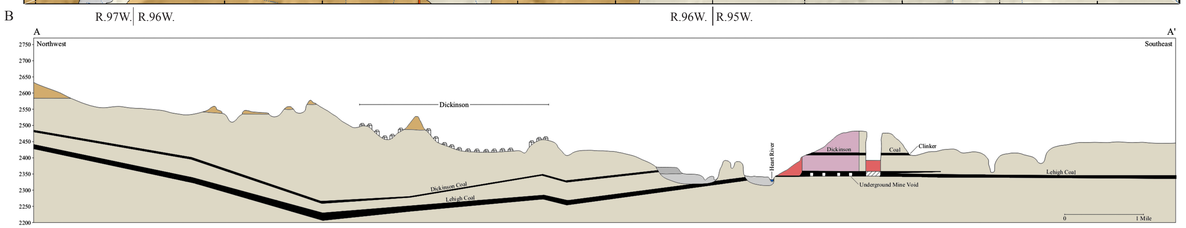

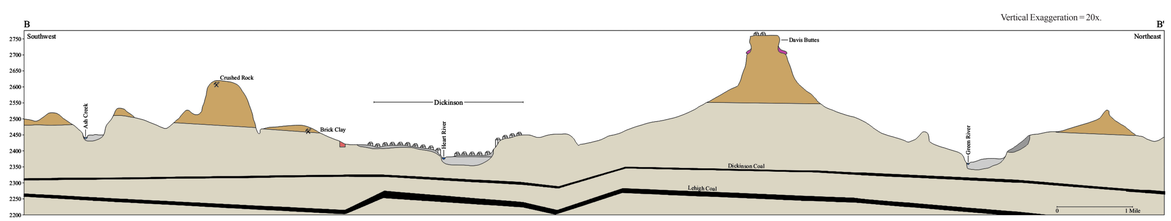

0 1 2 3 Miles
0 1 2 3 Kilometers

Map Scale 1:48,000
The map has been placed on a shaded relief background.

ECONOMIC ROCKS AND MINERALS

A twenty foot thick deposit of sand and gravel along the Green River northeast of Dickinson.

QTa and **Qa2** Sand and Gravel deposits are found as terrace deposits above the modern floodplain of the Green and Heart Rivers in the Dickinson area. They range from fine sand to cobbles and contain significant amounts of chert, chalcedony, and other undesirable minerals. The sand and gravel deposit in this photograph contains a one-to-three foot zone of weathered lignite fragments (black layer near top of deposit). These deposits are variable in age, ranging from Late Tertiary to Quaternary. Fisher Industries has mined these deposits for decades.

Crushed sandstone used as decorative rock in a planter surrounding a restaurant in Dickinson.

Tgv White and orange decorative stone, mined by Fisher Industries, has been utilized throughout the Dickinson area. The iron-stained (orange color), micaceous (sparkles) sandstone, from the Camels Butte Member of the Golden Valley Formation, was deposited in a large river system that flowed through the Dickinson area approximately 40 million years ago. This 20-to-30-foot thick sandstone caps Davis Buttes and an unamed butte one mile south of the golf course (T.139N., R.96W., section 20). It is from this latter, unamed butte that the decorative stone has been removed.

An abandoned clay pit in the Bear Den Member of the Golden Valley Formation.

Tgv This old pit was used by both the Dakota Land and Improvement Company and the Dickinson Fire and Pressed Brick Company that operated from 1893 to the late 1930s. This pit may also have been used in the 1960s by the Dickinson Clay Products Company. The white, kaolinitic claystone is 20 to 30 feet thick in the Dickinson area. The plastic clay is greasy to the touch and is an excellent source of brick clay. This same claystone horizon (Bear Den Member) is currently being mined in Morton County for brick manufacturing by the Hebron Brick Company.

Five circular depressions on a hillslope that resulted from the collapse of underground mine workings in the Lehigh area.

Um The collapse of underground mines can cause extensive damage to buildings, roads, railroads, and other forms of infrastructure. Over the past eight years, the North Dakota Public Service Commission has attempted to stabilize the Lehigh area by pumping approximately 70,000 tons of grout into underground mine workings that extend beneath roads and buildings in the area. Lignite was mined from the Lehigh and Dickinson beds in this area from the 1890s to 1990, underground mining ceased in the area in the mid to late 1940s.

Remains of the old Husky Briquetting plant at Lehigh.

Husky Briquetting, Inc. or Husky Industries, Inc. operated a briquetting plant in the Lehigh area from 1927 to 1990. The plant used lignite from the adjacent coal mines to initially produce domestic-heating briquettes and then switched to manufacturing barbecue briquettes in the early 1960s. The plant closed in 1990 due to the decrease in demand for briquettes created by the popularity of gas grills. Dickinson's current municipal landfill **Qlf** is located in an abandoned surface coal mine that was operated by Husky Industries, Inc. Municipal waste has been buried in at least four localities in the Dickinson area.

A "horse head" pump lifts oil from the Lodgepole Formation in the southwestern portion of the city of Dickinson.

In 1958, oil was discovered in the Dickinson area in the Tyler Formation at a depth of approximately 8,000 feet. Additional production has occurred from older and deeper rocks, the Interlake and Red River Formations at depths of 11,000 to 12,700 feet. In 1993, oil was discovered in carbonate mounds within the Lodgepole Formation at a depth of 10,000 feet in the Dickinson area. These wells were highly productive, with initial production of 2,000 barrels of oil per day, roughly 100 times the production of an average North Dakota oil well. Some oil wells have been drilled directionally beneath the city of Dickinson to intercept the carbonate mounds.

Bob Biek was a geologist with the North Dakota Geological Survey from 1991 to 1995. He currently works for the Utah Geological Survey. This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program.