

GEOLOGY OF EMMONS COUNTY, NORTH DAKOTA
(Preliminary Maps)

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The investigation of the geology of Emmons County, North Dakota was made for the State Geological Survey during the summers of 1950 and 1951. The main purposes of this work were to study and map all surficial materials of the county, glacial cover as well as bedrock; to construct a structure map; and to make a cursory study of ground waters and gravel-sand deposits

The present set of maps are preliminary to a complete report; the geologic map is incomplete in several respects, particularly in the glacial areas. A final geologic map awaits further study of aerial photographs and water well data. The base maps used are modified from county road maps.

A complete report which will include other maps, cross-sections, measured sections, lists of fossils, and photographs will be published in the future.

I. About the Geologic Map

The three bedrock formations found in Emmons County are all of late Cretaceous age. Two, the Pierre shale and Fox Hills sandstone, represent the waning stages of a marine environment in this area, whereas the third, the Hell Creek beds, is the initial formation of the continental conditions which have prevailed to the present time with but one restricted exception.

A brief resume of each formation follows, from bottom to top:

Pierre Shale - Medium to dark gray, marine shale that weathers to small chips and erodes to grassy knolls. Grades upward into the Fox Hills sands. The contact in this area is best taken at a zone of prominent and fossiliferous concretions which mark a change from solid gray shale to a transitional sequence of thin olive shales and fine sands.

Aside from the Missouri bluffs in the southwestern corner of the county, Pierre outcrops are limited to the creek bluffs around Linton where as much as 125' of the shale is exposed.

Fox Hills Sandstone - Readily divided into a lower series of green-gray and brown, calcareous sands and sandstones, and an upper sequence of chiefly thin, olive sands and shales. All weather to a buff or brown color.

The lower sands contain from three of five cemented zones or ledges all of which are characterized by the seaweed Halymenites and shallow-water pelecypods. The topmost ledge is the most prominent and continuous, and forms a wide bench along the Missouri trough.

The upper series contains several sizeable sandstones among which are two green, laminated, and fossiliferous beds which create intermediate levels in the butte area around and northeast of Linton. Over most of the county the top of the Fox Hills is marked by a 4' to 17' thick, light to medium gray butte-capping quartzitic sandstone containing white or lavender wood fragments, and which often weathers to a rather metallic orange-brown color. In the northeastern corner of the county this sandstone changes to a yellow-gray, rather calcareous, lensing sandstone, whereas in the northwestern corner the top of the Fox Hills formation is marked by a very light gray sand that shows small but abrupt cliffs and is channeled and overlain by lignitic shale of the Hell Creek formation.

The Fox Hills sands vary in thickness from about 300' in the southwestern part of the county to only 140' in the vicinity of Linton.

Hell Creek Formation - Unlike the Fox Hills sands which commonly take the form of flat-topped buttes, the Hell Creek beds form the irregularly-topped hills found in the northwestern part of the area. These lensing, continental beds of lignitic shales, sands, lignites, clays, and bentonites range in color from white to dark gray and purple-brown. Fossils are limited to silicified tree fragments and a few reptile bones. The entire thickness of Hell Creek beds does not occur within the county. The greatest thickness measured was about 230'.

Glacial Cover - As the geologic map shows, much of the county is covered by glacial debris; till and outwash deposits. Actually patches of till can be found some miles farther to the west than indicated on the map, and glacial boulders are fairly common in some areas along the Missouri bluffs.

The areas mapped as "glacial" are those in which the cover is thick, over 5 or 10 feet, and in which bedrock outcrops are very limited or entirely lacking. Elsewhere, outcrops are plentiful, and the glacial cover, if present at all, is thin and the topography is bedrock controlled.

Glacial areas of this preliminary map are undifferentiated because all data available has not yet been evaluated. However, a few of the glacial distributaries and older valley channels are indicated.

Bedrock "contacts" beneath glacial cover are indicated by marked, dashed lines. Localities where data were obtained are shown by large dots. These data range from good but very small bedrock exposures and an old Hell Creek lignite mine locality to somewhat sketchy water well records and the approximate boundary between Fox Hills sand-till and Pierre shale-till.

II. About the Structure Map

Elevations for the structure map were made with a Paulin aneroid altimeter reading to 2 feet. Readings were frequently checked against known points, and two or three separate readings were taken at each point on the mapping horizons. If two readings were within 6 feet of one another, the mean value was accepted. Otherwise a third reading was sought. Three lines of U. S. C. and G. S. bench marks offered easy reference points in the western half of the county and other bench marks were found all along the railroad. However, there are no bench marks in the county east of the railroad and temporary points were run in by altimeter.

The datum for the map is the base of the sandstone at the top of the Fox Hills formation. This bed is referred to as "D" bed on the map. A few points along the eastern boundary of the area are marked as the "X" bed but this is merely a lithologic variance in the "D" zone.

A few points were taken on other horizons within the formation and these elevations were raised to datum. One of these was the upper green laminated sandstone in the upper series of the Fox Hills. This bed is marked "C" on the Map and was utilized in an area extending from just south of Linton to Little Beaver Creek.

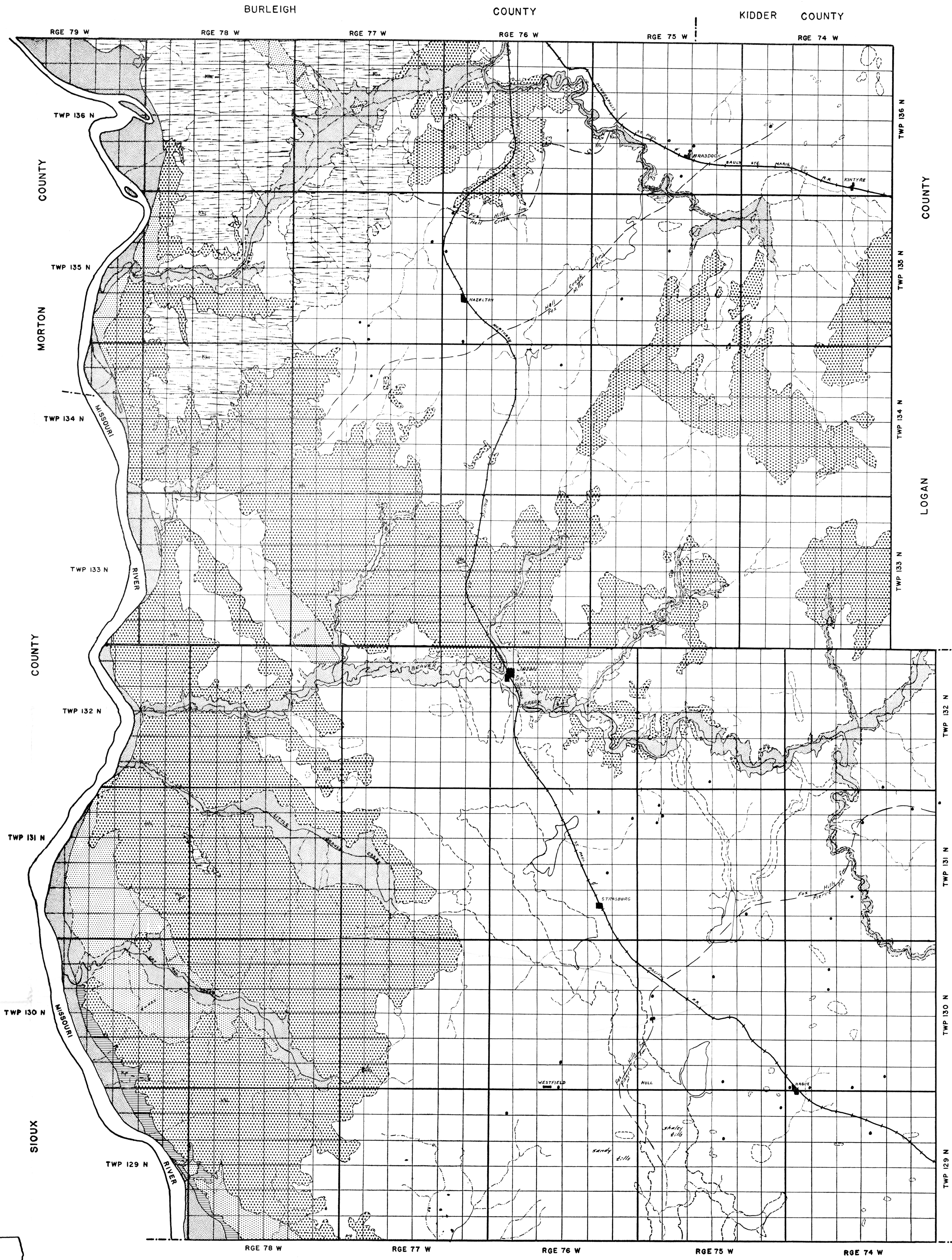
Along the Missouri River in the southern half of the area it was necessary to take elevations on the uppermost Halymenites ledge. This horizon is designated by "B" and may be considered the top of the lower Fox Hills series.

A very few points were attempted in the southeastern part of the county where the change from Fox Hill to Pierre lithology could be noted in water wells. This contact horizon is called "A" zone.

The regional strike or trend of the beds is northeast-southwest and the dip is to the northwest. The surface structures are generally small and have shallow closures, usually not more than 60 to 80 feet. If the structures persist in depth, it is possible that they may serve as oil or gas traps. Two dry holes have been drilled on the two anticlines just northeast of Linton (The holes are located at NE SE 35, T. 133N., R. 76W. and at NW SW Sec. 35, T. 133N., R. 75W.)

It is of interest to note a pronounced change in the strike of the structures over the county. Several small noses in the southwestern area trend northwesterly whereas the two small anticlines in the vicinity of Linton strike northeasterly. But in T. 134N. R. 77W. the structures have again resumed a northerly or northwesterly trend.

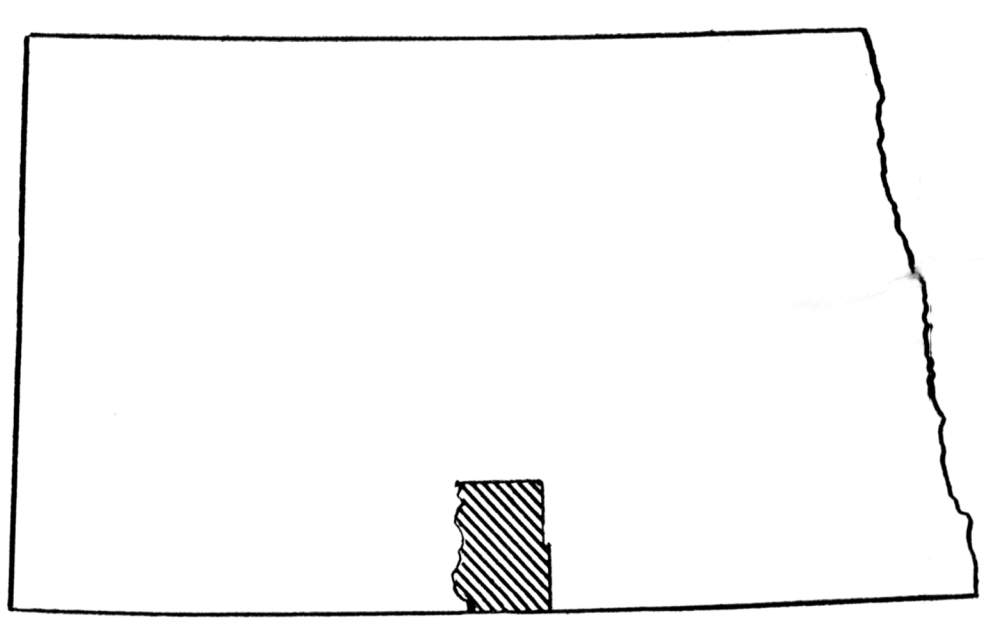
The origin of these surface structures and their importance as indicators of possible oil traps will be discussed in more detail in the forthcoming report.



LEGEND

- RECENT
 - River and stream alluvium.
 - Dunes (marked) and wash silts (higher terraces along rivers).
- PLEISTOCENE
 - Glacial cover, undifferentiated. (Some distributaries and stream terrace remnants indicated by dashed lines).
- UPPER CRETACEOUS
 - Hell Creek formation.
 - Fox Hills formation.
 - Pierre formation.

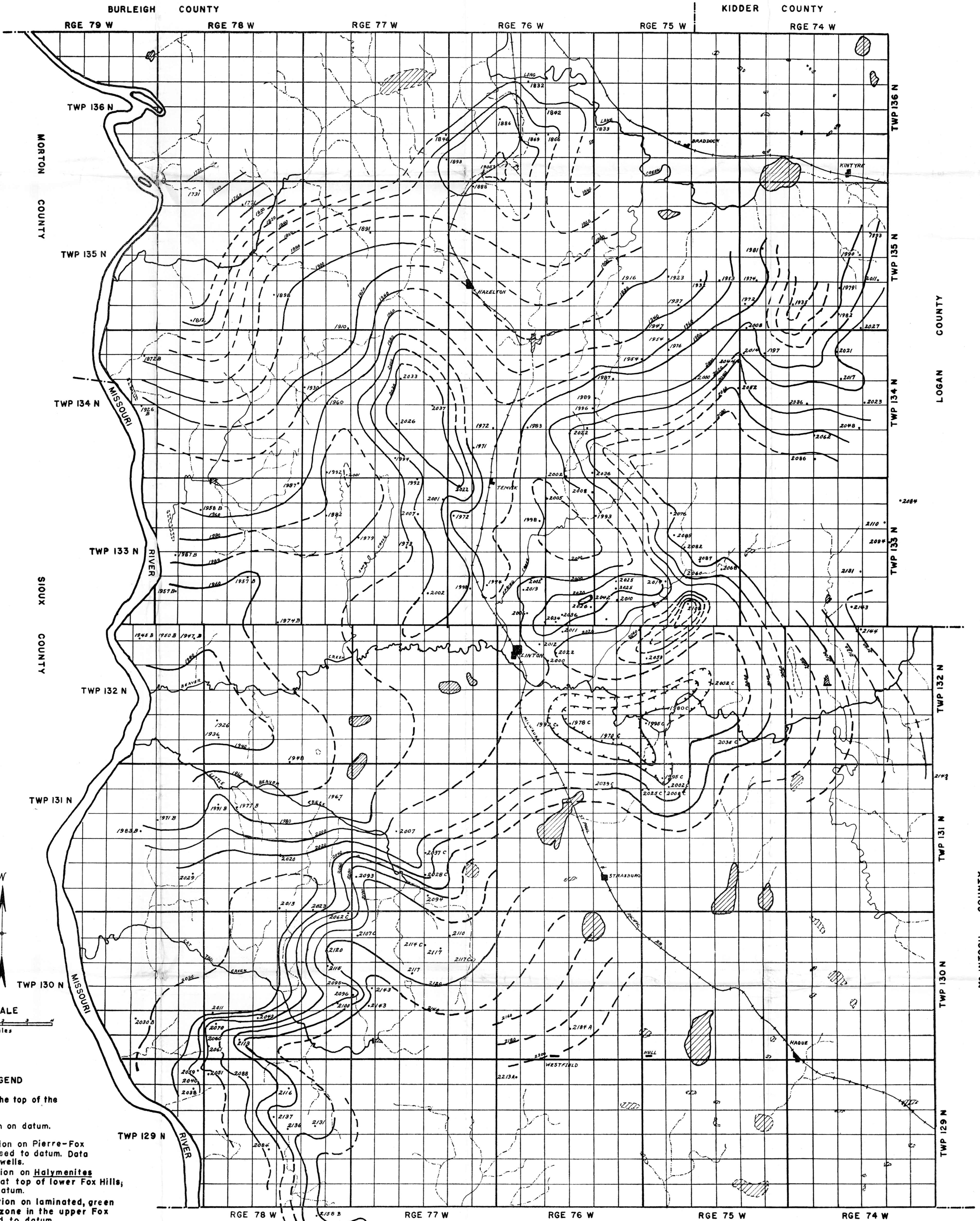
Bedrock "contacts" beneath glacial cover are indicated by marked, dashed lines. Localities where data was obtained are shown by large dots.



GEOLOGIC MAP OF EMMONS COUNTY, NORTH DAKOTA
BY
STANLEY P. FISHER

SURFACE STRUCTURE MAP EMMONS COUNTY, NORTH DAKOTA

by
S. P. FISHER



LEGEND

- Datum plane is the top of the Fox Hills.
- 2000 Elevation on datum.
- 2000 A Elevation on Pierre-Fox contact; raised to datum. Data from water wells.
- 2000 B Elevation on *Halymenites* sandstone at top of lower Fox Hills; raised to datum.
- 2000 C Elevation on laminated, green sandstone zone in the upper Fox Hills; raised to datum.

Contour interval 20 feet.

CAMPBELL COUNTY
SOUTH DAKOTA