AREA GEOLOGY OF THE MORRISTOWN QUADRANGLE

By
Robert E. Stevenson

INTRODUCTION
This quadrangle was mapped in the summer of 1952 as a part of the State Geological Survey coal resources program. Exploratory drilling for subsurface coal was done in 1953.

LOCATION
The quadrangle lies along the North Dakota line in eastern Mountrail Co. It is also in the Standing Rock Indian Reservation. The area is approximately 30 miles WNW of Pierre and 150 miles NE of Rapid City.

Geography
The area is a slightly populated region of rolling prairie lands with occasional badland topography along the major streams. The quadrangle lies entirely on the north side of the Missouri River which will drain into the Red River. The Grand interstream divide and all the larger youth streams drain directly south into the Missouri River, which is a few miles south of the area.

The area maximum relief is 250' and its approximate average elevation is about 2250' above sea level.

The only permanent water bodies in this area are artificial lakes formed by the railroad embankments and large, block dams.

The climate is semi-arid with an average rainfall of 12-14 inches. Dryland farming is practiced on the upland areas, and the badlands are used for livestock grazing.

The only towns in the area Morristown, with a population of 110, and Waties, with 170 inhabitants, are both on the mainline of the Chicago, Milwaukee, St. Paul, and Pacific Railroad and U. S. Highway 12. Numerous county and township roads make the quadrangle fairly accessible.

STRATIGRAPHY
The quadrangle has only Cretaceous, Tertiary and quaternary sediments exposed at the surface.

HILLTOP FACES

Forty-five plus feet of these strata crops out in the badlands in the southern part of the quadrangle. A variety of interbedded and lenticular lithologic types make up this members buff and white, medium to fine-grained arkose and gray-weathering sands with local siltstone interbeds. Calcareous "concretions"; white, medium to fine-grained arkose and grayaceous sand, and silt with plant fragments; brown-weathering gray with silt; brown-weathering gray with silt and clay; yellow clay with silt and sand; and brown-weathering gray with silt and sand. The Hilltop facies is locally present in the area and consists of 1 to 2 large seams (1' to 2' thick) and associated white, buff, gray, and brown-weathering gray with silt and sand. It is 2' to 7' thick in thickness.

HILLEN FACES

Scattered exposures occur on the grassed highlands in the northern half of the quadrangle. The Hilltop facies is locally present in the area and consists of 1 to 2 large seams (1' to 2' thick) and associated white, buff, gray, and brown-weathering gray with silt and sand. It is 2' to 7' thick in thickness.

JOSLYN FORMATION

Scattered outcrops are found on the grassed uplands in the northern half of the quadrangle. The Joslyn facies is locally present in the area and consists of 1 to 2 large seams (1' to 2' thick) and associated white, buff, gray, and brown-weathering gray with silt and sand. It is 2' to 7' thick in thickness.

LOWER HELL CREEK FORMATION

Scattered outcrops are found on the grassed uplands in the southern part of the quadrangle. The Lower Hell Creek facies is locally present in the area and consists of 1 to 2 large seams (1' to 2' thick) and associated white, buff, gray, and brown-weathering gray with silt and sand. It is 2' to 7' thick in thickness.

UPPER HELL CREEK FORMATION

Scattered outcrops are found on the grassed uplands in the southern part of the quadrangle. The Upper Hell Creek facies is locally present in the area and consists of 1 to 2 large seams (1' to 2' thick) and associated white, buff, gray, and brown-weathering gray with silt and sand. It is 2' to 7' thick in thickness.

ISABEL-FIRESTEEL FACES

Scattered outcrops are found on the grassed uplands in the southern part of the quadrangle. The Isabel-Firesteel facies is locally present in the area and consists of 1 to 2 large seams (1' to 2' thick) and associated white, buff, gray, and brown-weathering gray with silt and sand. It is 2' to 7' thick in thickness.

GEOLOGY
The quadrangle contains a number of mineral resources of actual or presently-exploited potential value, but not in large quantities. These resources are coal, gravel, and clay. At the present time only gravel is being exploited.

Coal
There are three discontinuous coal facies in this area, the Isabel-Firesteel Facies of the lower Hell Creek, the Hillen and Shadetown Facies of the Luskow. None of these have present-day commercial potentiates except the Shadetown coal in a small area 1 mile NNW of Waties. The Luskow deposits is described as follows:

Thickness: The exposed thickness is 29 inches.

Physical Characters: Black, fissile, and blocky, soft, limy coal. It has a black streak, and exhibits poorly developed laminations. It contains occasional amber resin pellets and streaks of mica schist. It flakes moderately upon drying and is non-equalizing.

It has a 1-inch medium white sand parting and scattered thin lenses of white and gray medium sand and brown black-slate.

Chemical Characters: Chemical analyses provide a satisfactory basis for assessing the coal with other and determining its rank, grade and commercial qualities. The proximate analysis furnishes necessary data concerning the quantity and combustion properties of coal (moisture, volatile, or ash matter, fixed carbon, or the heat-producing content, ash, sulfur, and the heating value in Btu).

As an analysis of the Shadetown coal in the Waties area follows: Moisture 52.0%, volatile 40.9%, fixed carbon 13.9%, ash 19.1%, sulfur 0.70%, nitrogen 0.69%. It is to be noted that air drying will increase the heating value to about 8,850 Btu.

Geometric of Petrology: The overburden which is not a detrimental to strip mining consists of sands and clays. The sands may be indurated locally.

The average thickness in this area is 50 (plus or minus) feet. The average thickness in the Waties area on the basis of an average thickness of 2' and an area of 304 acres there is an indicated reserve of 1,033,600 tons.

Over the rest of the quadrangle the various coal seams of the different facies are not of present-day commercial thickness. Brief descriptions of the different facies follow:

1. Isabel-Firesteel Facies (Hell Creek Formation): Black, flaky and blocky, limy coal seams with ash spots varying in thickness from 1/4 to 2'. One-half mile south of the quadrangle is the Zabroad Mine with a 3' seam.

2. Shadetown Facies (Luskow Formation): Black, fissile, and blocky, sometimes banded, limy coal seams with varying thickness in terms of 1 to 2'.

3. Hillen Facies (Luskow Formation): Black, fissile, blocky, limy coal seams with varying thickness.

Following are coal analyses from the areas:

<table>
<thead>
<tr>
<th>Coal</th>
<th>Location</th>
<th>Moisture</th>
<th>Volatiles</th>
<th>Ash</th>
<th>Sulfur</th>
<th>Cal.</th>
<th>B.T.U.</th>
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<td>Isabel-Firesteel</td>
<td>Zabroad Mine</td>
<td>41.0%</td>
<td>35.0%</td>
<td>20.0%</td>
<td>5.0%</td>
<td>0.25%</td>
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<tr>
<td>Shadetown</td>
<td>Waties Area</td>
<td>45.0%</td>
<td>35.0%</td>
<td>15.0%</td>
<td>10.0%</td>
<td>0.5%</td>
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<tr>
<td>Hillen</td>
<td>Waties Area</td>
<td>45.0%</td>
<td>35.0%</td>
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<td>15.0%</td>
<td>0.6%</td>
<td>9,575</td>
</tr>
<tr>
<td>Hillen</td>
<td>Morristown</td>
<td>45.0%</td>
<td>25.0%</td>
<td>10.0%</td>
<td>5.0%</td>
<td>0.25%</td>
<td>9,195</td>
</tr>
</tbody>
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Gravel
Angular gravel deposits occur along Hay Creek and Red Willow Creek as terraces. These deposits contain a high percentage of silt and clay, but are still adequate for road metal. Estimated volumes for the larger deposits are given in the following tables.

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</table>

Clay
Many clay horizons in the Hell Creek formation contain a high percentage of bentonite and thus can be used as a sealer for apparel.