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Reports - Open file series

Preliminary description of cores, chemical analyses of lignite beds, and map showing locations of holes drilled in Grant, Hettinger, Morton, and Stark Counties, North Dakota

By

H. L. Smith 1913 - Survey Canadian

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Open-file report
1970

This report is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards or nomenclature.

To accompany
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UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
Washington, D. C. 20242

For release September 1, 1970

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Preliminary description of cores, chemical analyses of lignite beds, and map showing locations of holes drilled in Grant, Hettinger, Morton, and Stark Counties, North Dakota, by H. L. Smith. 43 p.

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Nineteen exploratory holes were drilled in Grant, Hettinger, Morton, and Stark Counties, N. Dak. (fig. 1), for the U.S. Geological Survey from June 7 to September 15, 1966. This prospect drilling was undertaken to gather data on the thickness, quality, and extent of lignite beds and the lithologic characteristics of the rocks in the Sentinel Butte and Tongue River Members of the Fort Union Formation. This information is in support of geologic mapping and as part of a program of mineral land classification. A preliminary lithologic description of the cores, drill samples, and chemical analyses of the lignite beds sampled in each hole, drill samples, and chemical analyses of the lignite beds sampled in each hole are given.

Partial core and drill samples of the 19 holes drilled may be inspected at the North Dakota Geological Survey, Grand Forks, N. Dak.

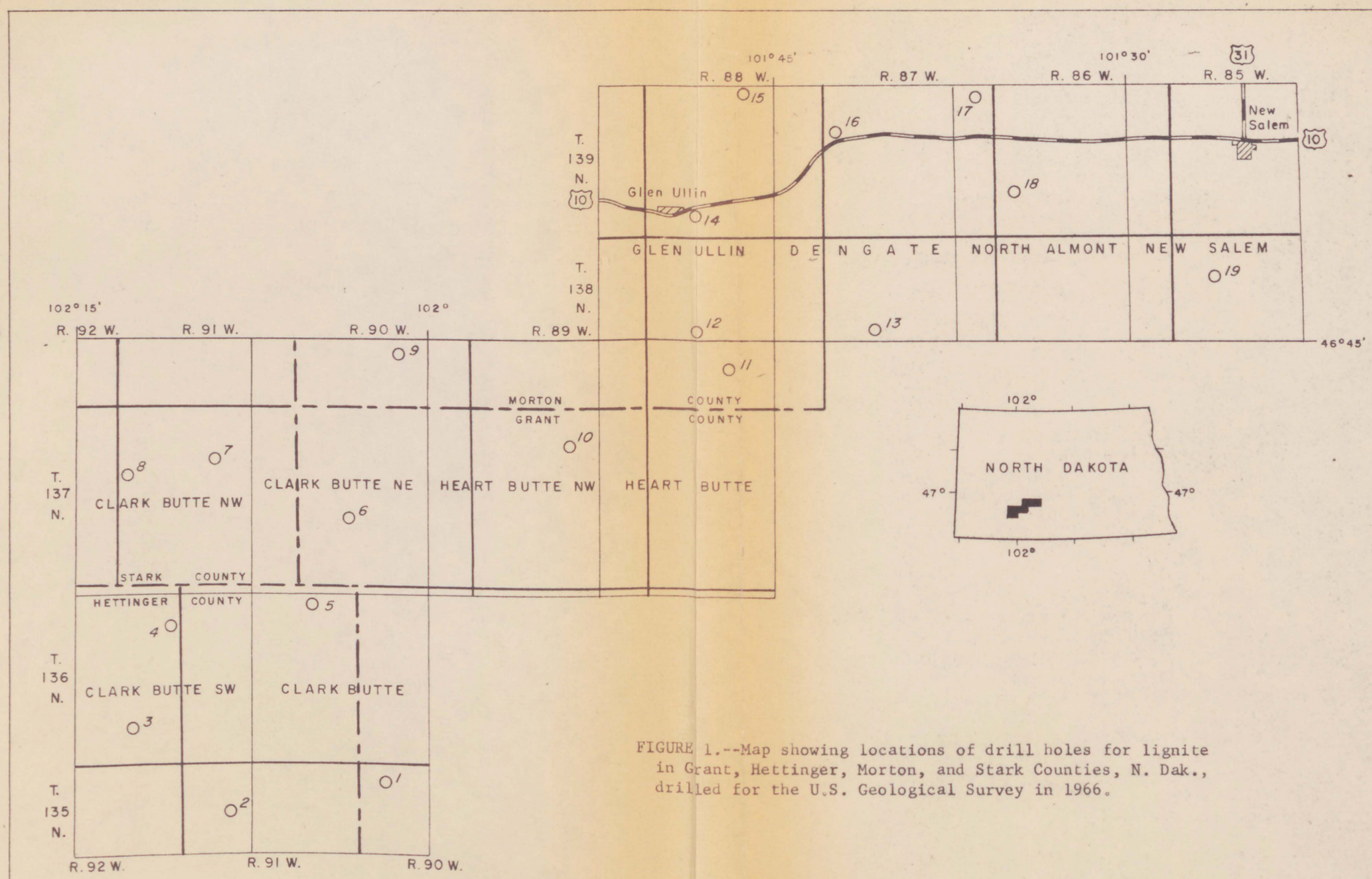

FIGURE 1.--Map showing locations of drill holes for lignite in Grant, Hettinger, Morton, and Stark Counties, N. Dak., drilled for the U.S. Geological Survey in 1966.

DRILL HOLE 1

NE¼SE¼SE¼ sec. 6, T. 135 N., R. 90 W., 5th principal meridian, Clark Butte quadrangle, Grant County, N. Dak.

Collar elevation: 2,395 ft. Begun 6/7/66; completed 7/18/66. Logged by H. L. Smith. Sampled by H. L. Smith and G. D. Mowat. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	5.0	5.0	---	Claystone, olive-gray, sandy.
5.0	10.0	5.0	---	Claystone, olive-gray, silty.
10.0	15.0	5.0	---	Claystone and siltstone, brown and gray; lignite stringer at 13.3-13.4 ft.
15.0	20.0	5.0	---	Sandstone, light-gray, fine-grained.
20.0	25.0	5.0	---	Claystone, shale, and sandstone, gray.
25.0	30.2	5.2	---	Claystone, tan and gray; shale, silty, carbonaceous.
30.2	35.2	5.0	---	Shale and claystone, silty.
35.2	40.2	5.0	---	Sandstone and siltstone; carbonaceous at 38.3 ft.
40.2	45.2	5.0	---	Shale, medium-gray.
45.2	50.2	5.0	---	Shale, medium-gray.
50.2	55.2	5.0	---	Shale, medium-gray, silty; lignite at 54.4-55.2 ft.
55.2	55.7	---	0.5	Shale, medium-gray.
55.7	60.0	4.3	---	Hole caving; fishtailed to 60.0 ft and set 10.0 ft of surface pipe.
60.0	65.0	5.0	---	Sandstone, gray, fine-grained.
65.0	100.2	35.2	---	Sandstone, light-gray, fine-grained.
100.2	115.0	14.8	---	Sandstone, tan, fine-grained.
115.0	120.2	5.2	---	Sandstone, light-gray; hole making water.
120.2	120.8	0.6	---	No sample.
120.8	125.1	4.3	---	No sample.
125.1	128.4	---	3.3	Sandstone and lignite stringer.
128.4	131.25	2.85	---	No sample; hole reamed, surface casing set.
131.25	134.25	---	3.0	Claystone, greenish-gray, silty.
134.25	137.15	---	2.9	Claystone; lignite stringer at 136.75 ft.
137.15	140.9	---	3.75	Sandstone and clay.
140.9	152.9	---	12.0	Shale and siltstone, gray; fossil shells at 148.5 ft.
152.9	155.7	---	2.8	Shale, siltstone, and sandstone.
155.7	172.9	---	17.2	Claystone, shale, and lignite; loss 3.5 ft in clay below lignite. Lignite at 165.65-168.70 ft. Chemical analysis I-42093.
172.9	175.3	---	2.4	Shale, gray.
175.3	183.3	---	8.0	Shale, gray.
183.3	202.8	---	19.5	Shale and claystone; gastropods in upper 5.0 ft. Loss 10.2 ft.
202.8	211.2	---	8.4	Siltstone, gray.
211.2	223.7	---	12.5	Siltstone and sandstone; loss 5.9 ft in ss.
223.7	236.9	---	13.2	Siltstone and sandstone; loss 2.2 ft in ss.
236.9	257.4	---	20.5	Siltstone and sandstone; loss 9.0 ft in ss.

DRILL HOLE 1--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42093

Core from 165.65 to 168.70 ft

Gross weight 2½ lbs.
Net weight 915 grams.

Date of sampling: 7/1/66
Date of Lab. sampling: 8/15/66

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	37.9	----	----
	Volatile matter[1]	26.5	42.7	48.6
	Fixed carbon	28.1	45.2	51.4
	Ash	7.5	12.1	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.0	1.6	1.9
British thermal units		6720	10810	12300

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone, carbonaceous[1]	0.4
2	Lignite	3.05
3	Underclay[1]	0.65
	Total thickness of bed	3.05
	Thickness of sample	3.05

[1] Excluded from sample.

DRILL HOLE 2

SW¼SW¼SE¼ sec. 8, T. 135 N., R. 9i W., 5th principal meridian,
Clark Butte SW quadrangle, Hettinger County, N. Dak.

Collar elevation: 2,561 ft. Begun 6/20/66; completed 6/22/66. Logged by H. L. Smith. Sampled by H. L. Smith and G. D. Mowat. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	37.8	37.8	---	Sandstone and claystone.
37.8	48.0	---	10.2	Lignite at 37.8-45.55 ft. Chemical analysis I-42081.
48.0	49.0	---	1.0	Claystone; loss, 0.4 ft.
49.0	77.2	---	28.2	Claystone.
77.2	80.9	---	3.7	Lignite at 77.15-80.15 ft.
80.9	82.4	---	1.5	Claystone; loss, 0.6 ft.
82.4	115.5	---	33.1	Claystone, silty.
115.5	116.6	1.1	---	Claystone with lignite stringers.
116.6	140.0	---	23.4	Claystone, gray, silty.
140.0	160.0	20.0	---	Claystone; lignite estimated at 147.0-149.0 ft.
160.0	170.0	10.0	---	Claystone, light-gray.
170.0	190.0	---	20.0	Lignite at 185.0-186.0 ft. Sandstone; loss, 10.8 ft.
190.0	210.0	---	20.0	Sandstone, light-gray, fine-grained; loss, 10.4 ft near top.
210.0	217.0	---	7.0	Sandstone and siltstone, light-gray.
217.0	220.8	---	3.8	Sandstone and siltstone, light-gray; ironstone concretions; loss, 2.7 ft.
220.8	237.5	---	16.7	Sandstone and siltstone, greenish-gray; loss, 8.9 ft in sandstone.
237.5	253.0	---	15.5	Siltstone and sandstone, gray; loss, 9.8 ft in sandstone.
253.0	273.0	20.0	---	Sandstone; no recovery.
273.0	293.0	20.0	---	Sandstone; no recovery.
293.0	313.0	20.0	---	Sandstone; no recovery. Lignite, 0.5 ft thick, at 305.0 ft.
313.0	332.6	---	19.6	Shale and sandstone, and 5.5 ft of lignite at 326.9 ft.
332.6	352.6	---	20.0	Sandstone and shale; loss, 4.5 ft in unconsolidated sandstone.
352.6	362.8	---	10.2	Sandstone, medium-grained, soft; loss, 6.9 ft.
362.8	383.0	---	20.2	Sandstone, soft; loss, 14.8 ft.
383.0	403.0	---	20.0	Sandstone, gray, medium-grained; loss, 0.3 ft.

DRILL HOLE 2--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42081

Core from 37.8 to 45.55 ft

Gross weight 2½ lbs.
Net weight 1051 grams.

Date of sampling: 7/1/66
Date of Lab. sampling: 8/15/66

	Air-dry loss	Coal: As received	Coal: Moisture free	Coal: Moisture and ash free
Proximate analysis	Moisture	40.5	----	----
	Volatile matter[1]	26.1	43.8	50.1
	Fixed carbon	26.0	43.7	49.9
	Ash	7.4	12.5	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.0	1.7	1.9
British thermal units		6280	10570	12070

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone, silty[1]	7.0
2	Lignite	3.0
3	Siltstone, carbonaceous[1]	0.75
4	Lignite	4.0
5	Underclay[1]	3.0
	Total thickness of bed	7.75
	Thickness in sample	7.0

[1] Excluded from sample.

DRILL HOLE 3

SW¼SE¼SW¼ sec. 26, T. 136 N., R. 92 W., 5th principal meridian,
Clark Butte SW quadrangle, Hettinger County, N. Dak.

Collar elevation: 2,530 ft. Begun 6/24/66; completed 6/29/66. Logged by H. L. Smith. Sampled by H. L. Smith and G. D. Mowat. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	9.5	9.5	---	Claystone and siltstone.
9.5	10.2	---	0.7	Lignite.
10.2	20.0	9.8	---	Claystone.
20.0	40.0	20.0	---	Claystone and siltstone, gray.
40.0	60.0	20.0	---	Siltstone and sandstone, fine-grained.
60.0	80.0	20.0	---	Sandstone, gray, fine-grained.
80.0	94.0	14.0	---	Sandstone; lignite at 93.04-94.0 ft.
94.0	96.6	---	2.6	Lignite; loss, 0.6 ft.
96.6	102.6	---	6.0	Claystone, green-gray; set surface casing.
102.6	112.6	---	10.0	Siltstone and claystone.
112.6	120.3	7.7	---	Claystone, gray, sandy.
120.3	123.3	---	3.0	Lignite and silty claystone; loss, 2.6 ft.
123.3	140.0	16.7	---	Siltstone and claystone, gray; fossil shells at 135.0 ft.
140.0	146.6	6.0	---	Siltstone.
146.0	151.0	---	5.0	Lignite; loss, 0.8 ft in sandstone at base.
151.0	160.0	9.0	---	Sandstone, gray.
160.0	162.5	2.5	---	Siltstone and sandstone; probably drilled 0.5 ft into lignite.
162.5	177.2	14.7	---	Lignite at 162.5-164.4 ft and 174.6-176.5 ft; siltstone and claystone.
177.2	189.0	---	11.8	Claystone; loss, 0.4 ft; lignite at 181.4-182.6 ft.
189.0	203.8	---	14.8	Siltstone, claystone, and sandstone; loss, 1.5 ft in sandstone.
203.8	222.7	---	18.9	Sandstone and siltstone.
222.7	234.7	---	12.0	Claystone; lignite at bottom.
234.7	252.7	---	18.0	Sandstone, siltstone, and lignite; loss, 3.4 ft in sandstone.
252.7	259.3	---	6.6	Lignite and claystone; lignite at 254.5-257.8 ft. Chemical analysis I-42089.
259.3	275.3	---	16.0	Sandstone.
275.3	285.3	---	10.0	Sandstone, gray, fine-grained.
285.3	305.3	---	20.0	Sandstone; loss, 11.5 ft in upper sand.

DRILL HOLE 3--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42089

Core from 254.5 to 257.8 ft

Gross weight 2½ lbs.
Net weight 896 grams.

Date of sampling: 7/1/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	38.9	----	----
	Volatile matter[1]	26.9	44.0	50.0
	Fixed carbon	26.9	44.0	50.0
	Ash	7.3	12.0	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.6	1.0	1.1
British thermal units		6600	10810	12280

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist coal

No.	Section of bed	Feet
1	Claystone[1]	2.0
2	Lignite	2.35
3	Pyritic lens[1]	0.05
4	Lignite	0.9
5	Underclay[1]	1.1
	Total thickness of bed	3.3
	Thickness of sample	3.25

[1] Excluded from sample.

DRILL HOLE 4

NE¼NE¼NE¼ sec. 12, T. 136 N., R. 92 W., 5th principal meridian,
Clark Butte SW quadrangle, Hettinger County, N. Dak.

Collar elevation: 2,401 ft. Begun 7/1/66; completed 7/9/66. Logged by H. L. Smith. Sampled by H. L. Smith and G. D. Mowat. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	5.0	5.0	---	Claystone, buff.
5.0	10.0	5.0	---	Claystone, buff, weathered.
10.0	11.4	1.4	---	Claystone, dark-gray; 0.9 ft of lignite fragments.
11.4	12.4	1.0	---	Claystone, buff-gray, carbonaceous.
12.4	15.0	2.6	---	Claystone, gray, weathered; lignite stringers, 0.10 ft thick, at 13.8 ft.
15.0	20.0	5.0	---	Claystone, buff-gray.
20.0	25.0	5.0	---	Claystone, dark-gray, carbonaceous.
25.0	30.0	5.0	---	Claystone, dark-gray, carbonaceous.
30.0	35.0	5.0	---	Claystone, dark-gray; sandstone, light-gray, silty, at 34.0-35.0 ft.
35.0	40.0	5.0	---	Sandstone and siltstone; lignite stringer at 39.8-40.0 ft.
40.0	45.0	5.0	---	Sandstone and siltstone, light-gray.
45.0	50.0	5.0	---	Sandstone, light-gray, fine-grained.
50.0	55.0	5.0	---	Sandstone, light-gray, fine-grained.
55.0	60.0	5.0	---	Sandstone, light-gray, fine-grained.
60.0	65.0	5.0	---	Sandstone, light-gray, fine-grained.
65.0	70.0	5.0	---	Sandstone, light-gray, fine-grained.
70.0	75.0	5.0	---	Sandstone, light-gray, fine-grained.
75.0	80.0	5.0	---	Sandstone, light-gray, fine-grained.
80.0	85.0	5.0	---	Sandstone, light-gray, fine-grained.
85.0	90.0	5.0	---	Sandstone, light-gray, fine-grained.
90.0	95.0	5.0	---	Sandstone, light-gray, fine-grained.
95.0	100.0	5.0	---	Sandstone, light-gray, fine-grained.
100.0	112.7	12.7	---	Sandstone, light-gray, fine-grained.
112.7	131.5	---	18.8	Sandstone, light-gray, fine-grained; ironstone concretions; loss, 16.3 ft in sandstone.
131.5	143.5	---	12.0	Sandstone, light-gray; lignite at 141.9-142.1 ft.
143.5	146.5	---	3.0	Loss, 1.9 ft in claystone.
146.5	157.5	---	11.0	Claystone and sandstone; loss, 7.3 ft.
157.5	170.3	---	12.8	Sandstone and siltstone; loss, 2.1 ft.
170.3	176.8	---	6.5	Sandstone and siltstone; loss, 0.5 ft.
176.8	191.8	---	15.0	Sandstone and lignite; lignite at 178.2-181.75 ft. Chemical analysis I-42092.
191.8	203.8	---	12.0	Lignite and claystone; loss, 2.1 ft.
203.8	218.4	---	14.6	Sandstone, siltstone, and lignite.
218.4	232.9	---	14.5	Sandstone and siltstone; loss, 3.6 ft in ss.

DRILL HOLE 4--continued

Feet				Lithologic description
From	To	Drilled	Cored	
232.9	250.9	----	18.0	Sandstone and claystone; loss, 8.0 ft in sandstone near top.
250.9	260.0	----	9.1	Shale and lignite; lignite at 258.4-266.8 ft. Chemical analysis I-42090.
260.0	263.8	----	3.8	Lignite; loss, 1.0 ft.
263.8	266.1	----	2.3	Lignite; loss, 1.4 ft.
266.1	268.8	----	2.7	Lignite, 0.7 ft; claystone.
268.8	274.5	----	5.7	Claystone; loss, 2.5 ft.
274.5	290.0	----	15.5	Sandstone; loss, 7.0 ft.

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42092
Core from 178.2 to 181.75 ft

Gross weight 2½ lbs.
Net weight 989 grams.

Date of sampling: 7/6/66
Date of Lab. sampling: 8/15/66

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	35.9	----	----
	Volatile matter[1]	24.0	37.4	49.8
	Fixed carbon	24.1	37.6	50.2
	Ash	16.0	25.0	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	2.0	3.1	4.2
British thermal units		5790	9030	12030

[1] Determined by modified method.

SAMPLE REPORT
Sample from moist coal

No.	Section of bed	Feet
1	Claystone[1]	1.4
2	Lignite	1.15
3	Claystone[1]	0.50
4	Lignite	1.90
	Total thickness of bed	3.55
	Thickness in sample	3.05

[1] Excluded from sample.

DRILL HOLE 4--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42090

Core from 258.4 to 266.8 ft

Gross weight 2½ lbs.
Net weight 997 grams.

Date of sampling: 7/10/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	36.6	----	----
	Volatile matter[1]	24.9	39.2	49.0
	Fixed carbon	25.9	40.9	51.0
	Ash	12.6	19.9	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.0	1.5	1.9
British thermal units		6220	9810	12250

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Shale with shells[1]	1.1
2	Lignite	8.4
3	Underclay[1]	1.3
	Total thickness of bed	8.4
	Thickness of sample	8.4

[1] Excluded from sample.

DRILL HOLE 5

SW¼SE¼SW¼ sec. 2, T. 136 N., R. 91 W., 5th principal meridian, Clark Butte quadrangle, Hettinger County, N. Dak.

Collar elevation: 2,280 ft. Begun 7/9/66; completed 7/9/66. Logged by H. L. Smith.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	5.0	5.0	---	Claystone, silty.
5.0	10.0	5.0	---	Claystone, sandy.
10.0	14.5	4.5	---	Claystone, sandy; trace of lignite at 14.5 ft.
14.5	16.0	---	1.5	No recovery.
16.0	20.0	4.0	---	Claystone; 0.15 ft of lignite at 16.5 ft.
20.0	25.0	5.0	---	Claystone.
25.0	28.5	3.5	---	Claystone; trace of lignite at 28.5 ft.
28.5	30.7	---	2.2	Top, claystone; 1.9 ft of lignite; bottom, underclay.
30.7	52.7	22.0	---	Claystone.
52.7	54.0	---	1.3	Claystone.
54.0	60.0	6.0	---	Claystone.

DRILL HOLE 6

NW¼NW¼NE¼ sec. 29, T. 137 N., R. 90 W., 5th principal meridian, Clark Butte NE quadrangle, Grant County, N. Dak.

Collar elevation: 2,125 ft. Begun 7/9/66; completed 7/12/66. Logged by H. L. Smith.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	25.0	25.0	---	Sandstone.
25.0	40.0	15.0	---	Sandstone and gravel.
40.0	55.0	15.0	---	Sandstone and gravel.
55.0	100.0	45.0	---	Sandstone and gravel.
100.0	140.0	40.0	---	Sandstone, fine-grained.
140.0	145.0	5.0	---	Sandstone; calcareous layer at 143.5 ft.
145.0	175.0	30.0	---	Sandstone.
175.0	190.0	15.0	---	Sandstone and claystone.
190.0	195.0	5.0	---	Claystone.
195.0	200.0	5.0	---	Sandstone and claystone; calcareous layer at 199.0 ft.
200.0	205.0	5.0	---	Sandstone and claystone; calcareous layer at 201.5 ft.
205.0	220.0	15.0	---	Claystone.
220.0	230.0	10.0	---	Sandstone.
230.0	240.0	10.0	---	Claystone.
240.0	450.6	210.6	---	Sandstone and claystone; soft sandstone at 443.0 ft; waterflow at 450.0 ft.
450.6	460.8	---	10.2	Sandstone, soft; loss, 6.0 ft.
460.8	480.8	---	20.0	Sandstone, fine-grained, calcareous; 0.15 ft of lignite.
480.8	488.3	---	7.5	Sandstone and siltstone; 0.15 ft of lignite.
488.3	503.6	15.3	---	Claystone and siltstone.
503.6	509.3	5.7	---	Claystone and siltstone.
509.3	521.3	12.0	---	Sandstone, fine-grained, hard.

DRILL HOLE 7

NW¼NW¼ sec. 10, T. 137 N., R. 91 W., 5th principal meridian,
Clark Butte NW quadrangle, Stark County, N. Dak.

Collar elevation: 2,202 ft. Begun 7/12/66; completed 7/13/66. Logged by H. L. Smith.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	5.0	5.0	-----	Claystone.
5.0	10.0	5.0	-----	Sandstone.
10.0	15.0	5.0	-----	Siltstone.
15.0	20.0	5.0	-----	Top, siltstone; 1.4 ft of lignite; bottom, sandstone.
20.0	25.0	5.0	-----	Sandstone and siltstone.
25.0	110.0	85.0	-----	Siltstone, gray.
110.0	115.3	5.3	-----	Siltstone, gray; fossil shell bed at 114-115 ft.
115.3	130.0	----	14.7	Claystone, very fossiliferous.
130.0	141.0	----	11.0	Claystone.
141.0	161.0	----	20.0	Claystone at 141.0-148.0 ft; sandstone, loss 7½ ft; claystone containing fossil shells at base.

DRILL HOLE 8

SE¼SW¼SW¼ sec. 18, T. 137 N., R. 91 W., 5th principal meridian, Clark Butte NW quadrangle, Stark County, N. Dak.

Collar elevation: 2,347 ft. Begun 9/12/66; completed 9/15/66. Logged by H. L. Smith.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	41.0	41.0	---	Siltstone, clayey, lignite stringers.
41.0	52.0	---	11.0	Siltstone.
52.0	92.0	40.0	---	Claystone.
92.0	102.0	---	10.0	Claystone; lignite at 96.6-96.8 ft.
102.0	108.0	---	6.0	Claystone; loss 1.1 ft.
108.0	114.0	---	6.0	Claystone and siltstone; calcareous concretions at base.
114.0	132.0	---	18.0	Sandstone and siltstone; lignite at 114.8-115.6 ft and 118.2-119.0 ft.
132.0	147.0	---	15.0	Sandstone and siltstone; lignite stringers at 134.3 and 142.8 ft.
147.0	162.0	---	15.0	Sandstone and siltstone; lignite stringer at 150.5 ft; loss, 0.9 ft.
162.0	167.0	---	5.0	Sandstone and siltstone; lignite stringer at 163.1 ft; loss, 0.9 ft.
167.0	182.0	---	15.0	Claystone and sandstone, very fine grained; lignite stringer.
182.0	193.0	---	11.0	Sandstone; lignite at 183.0-185.0 ft; loss, 3.0 ft in sandstone.
193.0	204.5	---	11.5	Sandstone; loss, 4.3 ft at bottom.
204.5	211.0	---	6.5	Claystone, silty.
211.0	214.0	---	3.0	Claystone, and sandstone at 212.8 ft.
214.0	232.0	---	18.0	Sandstone; lignite at 220.0 ft; loss, 5.5 ft in sandstone.
232.0	244.0	---	12.0	Claystone and siltstone; loss, 2.6 ft.
244.0	263.0	---	19.0	Sandstone; loss, 16.0 ft.
263.0	270.0	---	7.0	Sandstone, soft.

DRILL HOLE 9

SW¼SW¼SE¼ sec. 22, T. 138 N., R. 90 W., 5th principal meridian, Clark Butte NE quadrangle, Morton County, N. Dak.

Collar elevation: 2,421 ft. Begun 7/14/66; completed 7/20/66. Logged by H. L. Smith. Sampled by H. L. Smith. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	5.0	5.0	---	Claystone, gray-tan.
5.0	10.0	5.0	---	Claystone, gray, silty.
10.0	15.0	5.0	---	Claystone, gray; 0.5 ft of lignite at 11.0 ft.
15.0	20.0	5.0	---	Claystone, olive-gray, silty.
20.0	25.0	5.0	---	Claystone, gray-tan; greenish color at 24.0 ft.
25.0	35.0	10.0	---	Claystone, greenish, sandy.
35.0	40.0	5.0	---	Claystone, gray, sandy; lignite at 38.2-40.0 ft.
40.0	43.8	---	3.8	Claystone; lignite at 40.0-42.8 ft.
43.8	50.0	6.2	---	Claystone and sandstone at 49.0 ft.
50.0	60.0	10.0	---	Claystone, gray.
60.0	65.0	5.0	---	Claystone, gray; lignite stringers.
65.0	80.0	15.0	---	Claystone, gray.
80.0	85.0	5.0	---	Claystone and lignitic lens.
85.0	100.0	15.0	---	Claystone, light-gray and gray.
100.0	105.0	5.0	---	Claystone and sandstone.
105.0	108.1	3.1	---	Claystone; lignite at 107.8 ft.) Lignite at 107.8-
108.1	110.2	---	2.1	Lignite; loss, 1.3 ft.) 114.2 ft. Chemical
110.2	114.2	---	4.0	Lignite; loss, 1.8 ft.) analysis I-42086.
114.2	123.2	---	9.0	Sandstone; loss, 2.0 ft near bottom.
123.2	125.0	1.8	---	Claystone; fishtailed.
125.0	140.0	15.0	---	Claystone, light-gray.
140.0	145.0	5.0	---	Sandstone.
145.0	150.0	5.0	---	Claystone.
150.0	155.0	5.0	---	Claystone; calcareous zone at 150.0-153.0 ft.
155.0	170.0	15.0	---	Claystone.
170.0	174.6	4.6	---	Claystone; lignite at 174.0-174.6 ft.
174.6	177.6	---	3.0	Lignite, 1.1 ft; clay, 0.8 ft; lignite, 0.8 ft; clay, 0.3 ft.
177.6	180.0	2.4	---	Claystone, gray.
180.0	200.0	20.0	---	Claystone, gray and greenish-gray.
200.0	205.0	5.0	---	Claystone, and sandstone at 203.0 ft.
205.0	210.7	5.7	---	Claystone containing fossil shells.
210.7	219.7	---	9.0	Sandstone; lignite at 218.5-220.3 ft.
219.7	226.2	---	6.5	Sandstone, claystone, and lignite.
226.2	230.0	3.8	---	Claystone.
230.0	235.0	5.0	---	Claystone and sandstone.
235.0	260.7	25.7	---	Claystone, gray.
260.7	277.2	---	16.5	Claystone and sandstone; loss, 2.2 ft in ss; washing at top; 0.6 ft lignite at 272.9-274.6 ft.
277.2	289.7	---	12.5	Lignite and claystone. Lignite sec. at 281.6-285.0 ft; 1.6 ft lignite, 1.4 ft claystone, 0.5 ft lignite, and 1.8 ft claystone.
289.7	309.7	---	20.0	Sandstone and claystone; loss, 18.4 ft.
309.7	328.3	---	18.6	Claystone and siltstone; lignite at 323.6-326.3 ft.
328.3	345.8	---	17.5	Claystone; lignite at 332.2-332.9 ft.
345.8	366.8	---	21.0	Lignite, claystone, and sandstone.
366.8	375.3	---	8.5	Sandstone, soft, and claystone.

DRILL HOLE 9--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42086

Core from 107.8 to 114.2 ft

Gross weight 2½ lbs.
Net weight 955 grams.

Date of sampling: 7/18/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	34.8	----	----
	Volatile matter[1]	23.5	36.1	51.7
	Fixed carbon	22.0	33.7	48.3
	Ash	19.7	30.2	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	3.8	5.8	8.3
British thermal units		5510	8450	12100

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	3.0
2	Lignite	6.4
3	Underclay[1]	2.0
	Total thickness of bed	6.4
	Thickness in sample	3.3

[1] Excluded from sample.

DRILL HOLE 10

NE¼SW¼NW¼ sec. 10, T. 137 N., R. 89 W., 5th principal meridian, Heart Butte NW quadrangle, Grant County, N. Dak.

Collar elevation: 2,415 ft. Begun 9/5/66; completed 9/10/66. Logged and sampled by H. L. Smith. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	5.0	5.0	---	Soil and sand.
5.0	15.0	10.0	---	Claystone.
15.0	20.0	5.0	---	Clay to 19.0 ft; gray siltstone at 19.0-20.0 ft.
20.0	25.0	5.0	---	Siltstone.
25.0	30.0	5.0	---	Claystone and siltstone; lignite stringer at 25.3 ft.
30.0	40.0	10.0	---	Claystone and siltstone.
40.0	45.0	5.0	---	Siltstone.
45.0	55.0	10.0	---	Sandstone.
55.0	60.0	5.0	---	Sandstone; lignite at 60.0 ft.
60.0	61.5	1.5	---	Lignite.
61.5	64.5	---	3.0	Lignite at 61.5-63.5 ft; loss, 2.0 ft in lignite and clay.
64.5	67.9	3.4	---	Claystone; lignite at 67.9 ft.
67.9	74.9	---	7.0	Claystone; lignite at 68.9-69.4 ft.
74.9	85.0	10.1	---	Claystone.
85.0	90.0	5.0	---	Claystone and siltstone.
90.0	110.0	20.0	---	Siltstone.
110.0	118.0	---	8.0	Claystone, greenish-gray; loss, 4.6 ft.
118.0	125.0	---	7.0	Lignite at 119.3-122.7 ft; loss, 2.2 ft in clay at bottom.
125.0	142.0	---	17.0	Claystone; lignite at 130.0 and 141.3 ft.
142.0	154.5	---	12.5	Siltstone and claystone; loss, 3.0 ft.
154.5	166.5	---	12.0	Claystone; lignite stringer at 156.7 ft.
166.5	183.0	---	16.5	Claystone; silty sandstone from 175.5-177.5 ft.
183.0	193.0	---	10.0	Claystone, silty; very fine grained sandstone at 187.0-188.0 ft and 189.5-192.0 ft.
193.0	210.0	---	17.0	Sandstone at 194.5-197.5 ft and 200.0-201.0 ft; loss, 13 ft.
210.0	221.0	---	11.0	Lignite at 212.2-212.9 ft; sandstone at 214.0-218.0 ft; loss in sandstone.
221.0	233.0	---	12.0	Sandstone and lignite.) Lignite, 230.7-239.4 ft.
233.0	246.6	---	13.6	Lignite and claystone.) Chem. analysis I-44967.
246.6	263.0	---	16.4	Claystone; lignite at 262.4 ft.
263.0	283.0	---	20.0	Claystone; lignite at 282.0 ft.
283.0	292.0	---	9.0	Claystone; lignite at 287.5 ft.
292.0	302.0	---	10.0	Lignite, claystone, and siltstone.
302.0	313.0	---	11.0	Claystone, silty.
313.0	332.0	---	19.0	Claystone and siltstone; fossil shells at 320-323 ft.
332.0	343.0	---	11.0	Claystone and siltstone.
343.0	356.0	---	13.0	Claystone, silty.
356.0	363.0	---	7.0	Claystone and lignite, fossil shells on top lignite at 358.9.) Lignite, 358.9-364.8 ft. Chemical analysis I-44966.
363.0	371.0	---	8.0	Lignite and claystone; lignite stringer.)
371.0	382.0	---	11.0	Claystone; lignite stringer.
382.0	390.0	---	8.0	Claystone; lignite stringers.

DRILL HOLE 10--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-44967

Core from 230.7 to 239.4 ft

Gross weight 2½ lbs.
Net weight 868 grams.

Date of sampling: 9/9/66.
Date of Lab. sampling: 10/4/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	39.8	----	----
	Volatile matter	25.3	42.1	48.7
	Fixed carbon	26.7	44.3	51.3
	Ash	8.2	13.6	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.7	1.2	1.3
British thermal units		6410	10650	12330

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	3.4
2	Lignite	8.7
3	Siltstone[1]	6.4
	Total thickness of bed	8.7
	Thickness in sample	8.7

[1] Excluded from sample.

DRILL HOLE 10--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-44966

Core from 358.9 to 364.8 ft

Gross weight 2½ lbs.
Net weight 1025 grams.

Date of sampling: 9/9/66.
Date of Lab. sampling: 10/4/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	40.5	----	----
	Volatile matter	24.9	41.9	48.4
	Fixed carbon	26.6	44.7	51.6
	Ash	8.0	13.4	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.7	1.2	1.4
British thermal units		6390	10730	12390

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	3.0
2	Lignite	5.9
3	Claystone[1]	4.6
	Total thickness of bed	5.9
	Thickness in sample	5.9

[1] Excluded from sample.

DRILL HOLE 11

SE¼SE¼ sec. 28, T. 138 N., R. 88 W., 5th principal meridian,
Heart Butte quadrangle, Morton County, N. Dak.

Collar elevation: 2,375 ft. Begun 8/3/66; completed 8/11/66. Logged and sampled by H. L. Smith. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	21.0	21.0	---	Claystone, silty; lignite at 21.0 ft.
21.0	26.1	---	5.1	Siltstone and sandstone; lignite at 21.0-22.9 ft.
26.1	27.0	0.9	---	Sandstone and siltstone; hole making water.
27.0	55.0	28.0	---	Claystone, gray.
55.0	57.4	2.4	---	Claystone, gray; lignite at 57.4 ft.
57.4	69.5	---	12.1	Lignite and clay; lignite at 57.4-67.15 ft. Chemical analysis I-43794.
69.5	81.5	12.0	---	Claystone, greenish; set surface casing.
81.5	85.0	3.5	---	Claystone, greenish, at 81.5-83.0 ft; claystone, gray, at 83.0-85.0 ft.
85.0	90.1	5.1	---	Claystone; calcareous concretions at 87-89 ft.
90.1	97.4	---	7.3	Lignite at 90.1-90.6 ft; loss, 2.2 ft in soft sandstone at bottom.
97.4	115.0	17.6	---	Claystone, light-gray.
115.0	120.0	5.0	---	Clay, gray, soft.
120.0	127.5	---	7.5	Clay and siltstone; loss, 5.8 ft.
127.5	128.3	---	0.8	Claystone.
128.3	134.7	---	6.4	Claystone, light-gray; loss, 2.5 ft.
134.7	142.4	---	7.7	Claystone, and lignite at 136.75-141.25 ft.
142.4	162.4	---	20.0	Claystone and sandstone.
162.4	172.4	---	10.0	Claystone and sandstone.
172.4	183.0	---	10.6	Sandstone, claystone, and lignite; lignite with clay partings at 177.6-182.6 ft.
183.0	203.0	---	20.0	Claystone and sandstone; lignite at 197.1-198.0 ft.
203.0	211.3	---	8.3	Sandstone, claystone, and siltstone; lignite at 210.3 ft.
211.3	227.3	---	16.0	Claystone and sandstone; lignite at 210.3-212.4 ft.
227.3	237.3	---	10.0	Sandstone, medium-gray.
237.3	243.1	---	5.8	Sandstone, fine-grained.
243.1	253.0	---	9.9	Sandstone, fine-grained.
253.0	261.5	---	8.5	Sandstone; lignite stringers.
261.5	268.3	---	6.8	Sandstone, medium-gray.
268.3	280.3	---	12.0	Sandstone, medium-gray.
280.3	283.3	---	3.0	Sandstone, medium-gray.
283.3	303.0	---	19.7	Claystone and sandstone.
303.0	323.0	---	20.0	Sandstone, soft, fine-grained.
323.0	343.0	---	20.0	Sandstone, soft, fine-grained.
343.0	361.8	---	18.8	Sandstone; lignite stringers.
361.8	381.8	---	20.0	Siltstone and sandstone.

DRILL HOLE 11--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-43794

Core from 57.4 to 67.15 ft

Gross weight 2½ lbs.
Net weight 922 grams.

Date of sampling: 8/3/66.
Date of Lab. sampling: 9/14/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	44.1	----	----
	Volatile matter[1]	24.0	42.9	47.9
	Fixed carbon	26.0	46.6	52.1
	Ash	5.9	10.5	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.2	2.2	2.4
British thermal units		6050	10810	12070

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	4.5
2	Lignite	0.4
3	Lignite, pyritic[1]	0.15
4	Lignite	0.15
5	Lignite, pyritic[1]	0.3
6	Lignite	8.75
7	Underclay[1]	2.3
	Total thickness of bed	9.75
	Thickness in sample	9.3

[1] Excluded from sample.

DRILL HOLE 12

SE¼NE¼NE¼SE¼ sec. 20, T. 138 N., R. 88 W., 5th principal meridian, Glen Ullin quadrangle, Morton County, N. Dak.

Collar elevation: 2,400 ft. Begun 7/21/66; completed 7/21/66. Logged and sampled by H. L. Smith. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	6.0	6.0	---	Siltstone.
6.0	11.5	5.5	---	Shale, carbonaceous.
11.5	16.0	4.5	---	Claystone; lignite and carbonaceous shale seams in basal 0.5 ft.
16.0	21.0	5.0	---	Sandstone.
21.0	28.5	7.5	---	Claystone.
28.5	32.0	3.5	---	Sandstone.
32.0	35.1	3.1	---	Claystone and siltstone.
35.1	36.1	1.0	---	Sandstone.
36.1	39.0	2.9	---	Siltstone, clayey.
39.0	40.5	1.5	---	Sandstone.
40.5	62.5	22.0	---	Claystone and silty claystone; lignite seam at 55.0 ft.
62.5	64.2	1.7	---	Shale, carbonaceous.
64.2	70.5	6.3	---	Claystone.
70.5	88.0	17.5	---	Sandstone.
88.0	90.0	2.0	---	Lignite.
90.0	101.5	---	11.5	Lignite and sandstone; loss, 4.8 ft in sandstone.
101.5	120.9	---	19.4	Sandstone; lignite in lower 0.9 ft.
120.9	132.9	---	12.0	Claystone and lignite; lignite at 120.0-129.9 ft. Chemical analysis I-42082.

DRILL HOLE 12--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42082

Core from 120.0 to 129.9 ft

Gross weight 2½ lbs.
Net weight 911 grams.

Date of sampling: 7/21/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal: As received	Coal: Moisture free	Coal: Moisture and ash free
Proximate analysis	Moisture	42.7	----	----
	Volatile matter[1]	24.6	42.9	48.2
	Fixed carbon	26.4	46.2	51.8
	Ash	6.3	10.9	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.8	1.5	1.6
British thermal units		6140	10710	12030

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone and impure lignite[1]	4.6
2	Lignite[2]	9.9
3	Underclay[1]	1.7
	Total thickness of bed	9.9
	Thickness of sample	9.0

[1] Excluded from sample.

[2] 0.9 ft of impure lignite and carbonaceous shale partings excluded from sample.

DRILL HOLE 13

NE¼SE¼SE¼NE¼ sec. 20, T. 138 N., R. 87 W., 5th principal meridian, Dengate quadrangle, Morton County, N. Dak.

Collar elevation: 2,225 ft. Begun 7/28/66; completed 8/2/66. Logged and sampled by H. L. Smith and C. S. V. Barclay. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	20.0	20.0	---	Claystone and minor amount of sandstone.
20.0	29.8	---	9.8	Mostly sandstone; lignite at 27.5 ft; loss, 6.9 ft in ss; loss in circulation at 28.0 ft. Set casing.
29.8	39.8	---	10.0	Claystone and siltstone; lignite at 30.6 ft and 39.8 ft; loss, 1.1 ft in claystone.
39.8	47.8	---	8.0	Claystone, siltstone, sandstone, and lignite; lignite at 39.8-41.5 ft; loss, 0.4 ft in claystone.
47.8	48.5	----------		Depth correction, 0.7 ft.
48.5	65.7	---	17.2	Siltstone, claystone, and sandstone; loss, 2.2 ft in claystone near bottom.
65.7	82.7	---	17.0	Siltstone, sandstone, and claystone; loss, 8.2 ft in sandstone near bottom.
82.7	90.3	---	7.6	Claystone, siltstone, and lignite.) Lignite, 87.5-
90.3	103.9	---	13.6	Lignite, claystone, and siltstone; loss, 2.3 ft in claystone (left in hole).) 92.8 ft.) Chem. analysis) I-42084.
103.9	120.4	---	16.5	Claystone, siltstone, and sandstone; lignite at 120.4 ft; loss, 1.8 ft in sandstone at bottom.
120.4	136.6	---	16.2	Claystone, siltstone, and sandstone; lignite at 120.4-121.4 ft and at 136.6 ft; loss, 0.7 ft in ss.
136.6	154.1	---	17.5	Claystone and sandstone; lignite stringer; loss, 7.9 ft in sandstone.
154.1	172.6	---	18.5	Claystone, siltstone, and at base sandstone; 0.6 ft lignite at 162.5 ft; claystone with fossil shells at 156.0 ft; loss, 2.6 ft in sandstone at bottom.
172.6	192.6	---	20.0	Claystone, sandstone, and siltstone; loss, 6.7 ft in sandstone.
192.6	212.6	---	20.0	Sandstone and siltstone; loss, 3.7 ft in ss at bottom.
212.6	221.6	---	9.0	Siltstone, sandstone, claystone, and lignite; lignite at 214.0-216.5 ft. Chemical analysis I-42087.
221.6	233.6	---	12.0	Siltstone, claystone, and sandstone; loss, 1.7 ft in sandstone at bottom.
233.6	253.6	---	20.0	Siltstone and sandstone and minor lignitic claystone at bottom; loss, 1.3 ft; lignite at 252.9-256.0 ft. Chemical analysis I-42085.
253.6	273.6	---	20.0	Lignite with underclay; loss, 17.6 ft.
273.6	278.6	---	5.0	Sandstone and siltstone; loss, 0.7 ft in ss at bottom.
278.6	293.0	---	14.4	Sandstone and siltstone; loss, 3.3 ft in sandstone.
293.0	305.0	---	12.0	Siltstone and sandstone.

DRILL HOLE 13--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42084

Core from 87.5 to 92.8 ft

Gross weight 2½ lbs.
Net weight 951 grams.

Date of sampling: 7/29/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	38.1	----	----
	Volatile matter[1]	25.2	40.7	50.6
	Fixed carbon	24.6	39.8	49.4
	Ash	12.1	19.5	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.5	.8	1.0
British thermal units		6070	9790	12170

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Clay[1]	4.0
2	Lignite	5.3
3	Clay, carbonaceous[1]	1.6
	Total thickness of bed	5.3
	Thickness in sample	5.3

[1] Excluded from sample.

DRILL HOLE 13--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42087

Core from 214.0 to 216.5 ft

Gross weight 2½ lbs.
Net weight 930 grams.

Date of sampling: 7/30/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal: As received	Coal: Moisture free	Coal: Moisture and ash free
Proximate analysis	Moisture	37.2	----	----
	Volatile matter[1]	26.6	42.4	49.6
	Fixed carbon	27.0	43.0	50.4
	Ash	9.2	14.6	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.9	1.4	1.7
British thermal units		6640	10570	12380

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	3.15
2	Lignite	2.5
3	Underclay[1]	1.5
	Total thickness of bed	2.5
	Thickness in sample	2.5

[1] Excluded from sample.

DRILL HOLE 13--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42085

Core from 252.9 to 256.0 ft

Gross weight 2½ lbs.
Net weight 984 grams.

Date of sampling: 8/2/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	36.3	----	----
	Volatile matter[1]	23.8	37.4	47.5
	Fixed carbon	26.3	41.3	52.5
	Ash	13.6	21.3	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.2	.4	.5
British thermal units		5900	9250	11760

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Siltstone[1]	2.5
2	Lignite	3.1
3	Underclay[1]	2.0
	Total thickness of bed	3.1
	Thickness in sample	3.1

[1] Excluded from sample.

DRILL HOLE 14

SE¼NE¼ sec. 32, T. 139 N., R. 88 W., 5th principal meridian,
Glen Ullin quadrangle, Morton County, N. Dak.

Collar elevation: 2,135 ft. Begun 7/22/66; completed 7/26/66. Logged and sampled by H. L. Smith and C. S. V. Barclay. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	1.5	1.5	---	Siltstone, clayey.
1.5	9.5	8.0	---	Carbonaceous claystone, shale, and impure lignite.
9.5	11.5	2.0	---	Lignite and claystone.
11.5	20.0	8.5	---	Claystone and silty claystone and carbonaceous shale at top.
20.0	22.0	---	2.0	Claystone, siltstone, and sandstone; loss, 1.5 ft in sandstone.
22.0	23.6	---	1.6	Claystone; loss, 1.6 ft.
23.6	41.6	---	18.0	Claystone; loss, 11.5 ft.
41.6	52.4	---	10.8	Claystone; lignite at 45.5-51.1 ft.
52.4	71.1	---	18.7	Claystone, siltstone, and sandstone; loss, 4.1 ft in lower part.
71.1	83.1	---	12.0	Sandstone, claystone, and siltstone; loss, 6.6 ft in sandstone at top.
83.1	96.1	---	13.0	Siltstone, clayey, and minor amount of sandstone; loss, 4.5 ft.
96.1	100.1	---	4.0	Sandstone; loss, 4.0 ft; loss of circulation.
100.1	101.0	---	0.9	Limestone; reamed hole; set casing.
101.0	101.4	---	0.4	Depth correction 0.4 ft after setting casing.
101.4	105.1	---	3.7	Limestone, 1.0 ft; claystone, 0.2 ft; loss, 1.2 ft at bottom.
105.1	121.7	---	16.6	Siltstone and sandstone, pyritic at bottom; loss, 14.6 ft in sandstone at top.
121.7	138.4	---	16.7	Sandstone, siltstone, and claystone; loss, 11.9 ft in sandstone in upper part.
138.4	155.4	---	17.0	Sandstone and siltstone; loss, 5.2 ft in sandstone at top.
155.4	172.2	---	16.8	Sandstone, siltstone, claystone, and lignite; loss, 0.6 ft; lignite at 162.6-166.4 ft. Chemical analysis I-42083.
172.2	189.2	---	17.0	Siltstone and sandstone; loss, 8.9 ft.
186.2	----------			Depth correction, 3.0 ft, may apply to interval 121.7-138.4 ft.
186.2	195.0	---	8.8	Siltstone; loss, 1.8 ft.
195.0	201.0	---	6.0	Sandstone; loss, 4.3 ft at bottom.
201.0	212.3	---	11.3	Sandstone; loss, 11.1 ft.

DRILL HOLE 14--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42083

Core from 162.6 to 166.4 ft

Gross weight 2½ lbs.
Net weight 930 grams.

Date of sampling: 7/25/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	39.1	----	----
	Volatile matter[1]	25.9	42.6	48.8
	Fixed carbon	27.2	44.6	51.2
	Ash	7.8	12.8	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.7	1.1	1.3
British thermal units		6490	10650	12210

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Clay[1]	5.3
2	Lignite	3.8
3	Underclay[1]	2.3
	Total thickness of bed	3.8
	Thickness in sample	3.8

[1] Excluded from sample.

DRILL HOLE 15

SW¼SE¼NW¼ sec. 10, T. 139 N., R. 88 W., 5th principal meridian,
Glen Ullin quadrangle, Morton County, N. Dak.

Collar elevation: 2,165 ft. Begun 7/27/66; completed, 7/27/66. Logged by H. L. Smith. Sampled by H. L. Smith and C. S. V. Barclay. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	1.0	1.0	---	Siltstone, clayey.
1.0	4.0	3.0	---	Siltstone, clayey.
4.0	6.8	2.8	---	Claystone, silty; lignite at 6.8-7.0 ft.
6.8	10.5	3.7	---	Claystone, silty, and lignite.
10.5	15.0	4.5	---	Sandstone; lignite at 10.7-12.5 ft.
15.0	20.0	5.0	---	Sandstone and silty claystone.
20.0	25.0	5.0	---	Sandstone, clayey.
25.0	26.4	1.4	---	Claystone.
26.4	28.0	1.6	---	Lignite with carbonaceous shale partings.
28.0	30.0	2.0	---	Sandstone, silty.
30.0	32.6	2.6	---	Claystone.
32.6	33.6	1.0	---	Lignite.
33.6	33.7	0.1	---	Claystone.
33.7	35.0	1.3	---	Lignite.
35.0	35.2	0.2	---	Claystone.
35.2	37.0	1.8	---	Lignite.
37.0	40.0	3.0	---	Claystone, silty.
40.0	45.0	5.0	---	Claystone.
45.0	50.2	5.2	---	Claystone.
50.2	54.2	---	4.0	Sandstone, lignite, claystone, and clayey siltstone.
54.2	67.9	---	13.7	Clayey siltstone and sandstone; lignite at 65.2-67.3 ft; loss, 2.0 ft in ss above lignite. Chemical analysis I-42088.
67.9	80.9	---	13.0	Sandstone and siltstone; loss, 5.5 ft in sandstone.
80.9	87.6	---	6.7	Sandstone, siltstone, and lignite; loss, 2.4 ft in sandstone near top.) Lignite at 85.0-89.6 ft.
87.6	101.6	---	14.0	Lignite, claystone, and sandstone; loss, 5.8 ft in ss at bottom.) Chemical analysis I-42091.

DRILL HOLE 15--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42088

Core from 65.2 to 67.3 ft

Gross weight 2½ lbs.
Net weight 920 grams.

Date of sampling: 7/27/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal: As received	Coal: Moisture free	Coal: Moisture and ash free
Proximate analysis	Moisture	37.6	----	----
	Volatile matter[1]	26.1	41.8	50.2
	Fixed carbon	25.8	41.4	49.8
	Ash	10.5	16.8	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.6	1.0	1.2
British thermal units		6400	10250	12310

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Sandstone[1]	7.0
2	Lignite	2.1
3	Clay[1]	0.9
	Total thickness of bed	2.1
	Thickness in sample	2.1

[1] Excluded from sample.

DRILL HOLE 15--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-42091

Core from 85.0 to 89.6 ft

Gross weight 2½ lbs.
Net weight 990 grams.

Date of sampling: 7/27/66.
Date of Lab. sampling: 8/15/66.

	Air-dry loss	Coal: As received	Coal: Moisture free	Coal: Moisture and ash free
Proximate analysis	Moisture	38.9	----	----
	Volatile matter[1]	24.1	39.4	48.4
	Fixed carbon	25.6	42.0	51.6
	Ash	11.4	18.6	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.5	.9	1.1
British thermal units		6020	9850	12110

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Clay[1]	2.1
2	Lignite	4.6
3	Clay[1]	1.8
	Total thickness of bed	4.6
	Thickness in sample	4.6

[1] Excluded from sample.

DRILL HOLE 16

SE¼SW¼SW¼ sec. 18, T. 139 N., R. 87 W., 5th principal meridian, Dengate quadrangle, Morton County, N. Dak.

Collar elevation: 2,225 ft. Begun 8/29/66; completed 9/2/66. Logged and sampled by H. L. Smith and C. S. V. Barclay. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	1.5	1.5	---	Soil.
1.5	3.5	2.0	---	Sandstone.
3.5	22.0	18.5	---	Claystone; lignite and carbonaceous shale at 6.2-6.8 ft, 13.0-13.2 ft, and 17.1-18.3 ft.
22.0	23.0	---	1.0	Claystone, silty; loss, 0.4 ft.
23.0	35.5	---	12.5	Siltstone and minor amount sandstone and claystone; loss, 3.4 ft near bottom in siltstone.
35.5	39.3	---	3.8	Siltstone; sandstone at bottom.
39.3	49.3	---	10.0	Claystone, siltstone, and ss; lignite at 43.0-43.2 ft.
49.3	67.3	---	18.0	Claystone, siltstone, and ss; lignite at 58.4-60.4 ft; loss, 3.6 ft in claystone at bottom.
67.3	77.3	---	10.0	Sandstone; siltstone and claystone at top.
77.3	88.6	---	11.3	Siltstone and claystone, and lignite at 83.1-84.0, 87.5-88.6.) Lignite at 87.5-
88.6	92.5	---	3.9	Lignite; loss, 0.6 ft.) 95.9 ft. Chem-
92.5	95.3	---	2.8	Lignite.) ical analysis
95.3	101.5	---	6.2	Lignite, siltstone, claystone.) I-43796.
101.5	105.3	3.8	---	Siltstone.
105.3	120.3	---	15.0	Claystone; some very thin lignite seams.
120.3	122.0	---	1.7	Limestone concretion.
122.0	133.0	---	11.0	Sandstone and siltstone; loss, 0.3 ft; limestone concretion in upper 0.8 ft.
133.0	142.0	---	9.0	Sandstone and minor amount of siltstone; loss, 1.0 ft in sandstone at base.
142.0	157.0	---	15.0	Siltstone and claystone and thin sandstone near base; lignite at 149.5-152.3 ft; loss, 1.0 ft.
157.0	172.0	---	15.0	Claystone and carb. shale; lignite at 162.7-163.0 and 166.1-168.5 ft; loss, 2.0 ft in claystone at bottom.
172.0	192.0	---	20.0	Sandstone and siltstone and minor amount claystone.
192.0	202.0	---	10.0	Sandstone, siltstone, and claystone; loss, 0.3 ft.
202.0	216.0	---	14.0	Sandstone and claystone and minor amount siltstone; lignite at 213.2 ft; loss, 4.7 ft.
216.0	234.0	---	18.0	Siltstone and sandstone; loss, 8.7 ft in siltstone in upper part.
234.0	244.0	---	10.0	Mostly siltstone and sandstone; lignite at 239.2-240.5 ft; loss, 1.7 ft.
244.0	260.0	---	16.0	Siltstone, claystone, and sandstone; loss, 8.8 ft in sandstone near base.
260.0	280.0	---	20.0	Claystone and sandstone and minor amount siltstone; lignite and carb. shale at 267.4-267.6, 272.2-272.7, and 275.3-276.3 ft; loss, 3.0 ft at bottom.
280.0	287.0	---	7.0	Claystone and lignite.) Lignite at 284.9-
287.0	291.0	---	4.0	Claystone and lignite; loss, 1.3 ft in claystone at base.) 288.9 ft. Chemical analysis I-43792.
291.0	310.0	---	19.0	Claystone and siltstone; loss, 8.5 ft in siltstone at bottom.
310.0	311.5	---	1.5	Siltstone and claystone; loss, 0.8 ft.
311.5	323.0	---	11.5	Siltstone and claystone; loss, 9.5 ft.
323.0	330.0	---	7.0	Siltstone and sandstone; loss, 1.2 ft.
330.0	340.0	---	10.0	Sandstone; loss, 7.5 ft in lower part.

DRILL HOLE 16--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-43796

Core from 87.5 to 95.9 ft

Gross weight 2½ lbs.
Net weight 916 grams.

Date of sampling: 8/31/66.
Date of Lab. sampling: 9/14/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	41.0	----	----
	Volatile matter[1]	23.7	40.3	47.7
	Fixed carbon	26.1	44.2	52.3
	Ash	9.2	15.5	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.2	2.1	2.5
British thermal units		6140	10410	12330

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	2.0
2	Lignite	1.1
3	Pyritic lens[1]	0.2
4	Lignite	0.2
5	Pyritic lens[1]	0.25
6	Lignite	0.85
7	Impure lignite and pyrite[1]	0.2
8	Lignite	1.0
9	Clay[1]	0.1
10	Lignite	0.1
11	Clay[1]	0.5
12	Lignite	3.3
13	Clay[1]	0.15
14	Lignite	0.45
15	Underclay[1]	1.6
	Total thickness of bed	8.4
	Thickness in sample	6.4

[1] Excluded from sample.

DRILL HOLE 16--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-43792

Core from 284.9 to 288.9 ft

Gross weight 2½ lbs.
Net weight 943 grams.

Date of sampling: 9/2/66.
Date of Lab. sampling: 9/14/66.

	Air-dry loss	Coal: As received	Coal: Moisture free	Coal: Moisture and ash free
Proximate analysis	Moisture	36.4	----	----
	Volatile matter[1]	25.7	40.5	50.0
	Fixed carbon	25.8	40.5	50.0
	Ash	12.1	19.0	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.0	1.6	2.0
British thermal units		6380	10030	12390

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	2.0
2	Lignite	4.0
3	Underclay[1]	1.5
	Total thickness of bed	4.0
	Thickness in sample	4.0

[1] Excluded from sample.

DRILL HOLE 17

NW¼SW¼SW¼ sec. 12, T. 139 N., R. 87 W., 5th principal meridian, North Almont quadrangle, Morton County, N. Dak.

Collar elevation: 2,188 ft. Begun 8/11/66; completed 8/19/66. Logged and sampled by H. L. Smith. Analysis: proximate.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	35.0	35.0	---	Sandstone, light-gray, fine-grained; lignite stringer at 33.4-33.7 ft.
35.0	40.0	5.0	---	Siltstone, medium-gray; making water.
40.0	60.0	20.0	---	Sandstone and claystone.
60.0	73.8	---	13.8	Claystone and siltstone; loss, 4.1 ft at bottom.
73.8	79.7	---	5.9	Siltstone; lignite at 76.5 ft.)
79.7	81.7	---	2.0	Lignite.) Lignite at
81.7	84.4	---	2.7	Lignite and claystone; base of lignite at 83.4 ft.) 76.5-93.8 ft.) Chemical analysis
84.4	92.4	---	8.0	Lignite and claystone; lignite at 87.3-91.1 ft.) I-43795.)
92.4	102.9	---	10.5	Lignite, claystone, and ss.)
102.9	122.9	---	20.0	Claystone; lignite at 117.5-119.6 ft.
122.9	132.9	---	10.0	Claystone, medium-gray; lignite at 131.6-133.4 ft.
132.9	150.9	---	18.0	Lignite, claystone, and siltstone; lignite at 148.7-150.0 ft.
150.9	165.9	---	15.0	Claystone; lignite stringers.
165.9	170.1	---	4.2	Claystone; lignite stringers.
170.1	180.6	---	10.5	Claystone.
180.6	193.0	---	12.4	Siltstone, gray.
193.0	213.0	---	20.0	Sandstone, dark-gray; loss, 4.8 ft in basal part.
213.0	233.0	---	20.0	Sandstone and siltstone.
233.0	234.2	---	1.2	Claystone.
234.2	246.0	---	11.8	Siltstone, gray.
246.0	263.0	---	17.0	Siltstone and sandstone.
263.0	277.5	---	14.5	Sandstone, dark-gray; loss, 5.5 ft.
277.5	280.6	---	3.1	Sandstone, dark-gray.
280.6	295.4	---	14.8	Sandstone, dark-gray.
295.4	305.4	---	10.0	Sandstone and claystone.
305.4	309.4	---	4.0	Claystone; lignite at 308.6 ft.
309.4	314.7	---	5.3	Claystone; lignite at 310.7 ft.
314.7	330.0	---	15.3	Clay and claystone; lignite at 314.7-317.6 ft and 325.0-327.8 ft.
330.0	350.0	---	20.0	Siltstone and sandstone.
350.0	370.0	---	20.0	Sandstone, greenish-gray.
370.0	380.0	---	10.0	Sandstone, greenish-gray.
380.0	385.0	---	5.0	Sandstone, greenish-gray; lignite at 383.9-385.0 ft.
385.0	393.0	---	8.0	Sandstone, greenish-gray.
393.0	403.0	---	10.0	Sandstone, greenish-gray, and siltstone.

DRILL HOLE 17--continued

COAL ANALYSIS REPORT

U.S. Bureau of Mines Lab. No. I-43795

Core from 76.5 to 93.8 ft

Gross weight 2½ lbs.
Net weight 935 grams.

Date of sampling: 8/13/66.
Date of Lab. sampling: 9/14/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	40.4	----	----
	Volatile matter[1]	24.9	41.8	49.3
	Fixed carbon	25.6	43.0	50.7
	Ash	9.1	15.2	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.1	1.9	2.3
British thermal units		6120	10260	12100

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	2.7
2	Lignite	6.9
3	Underclay[1]	3.9
4	Lignite	3.9
5	Underclay[1]	0.5
6	Lignite	2.1
7	Underclay[1]	1.8
	Total thickness of bed	17.3
	Thickness in sample	12.9

[1] Excluded from sample.

DRILL HOLE 18

SE¼SE¼NW¼ sec. 30, T. 139 N., R. 86 W., 5th principal meridian, North Almont quadrangle, Morton County, N. Dak.

Collar elevation: 2,108 ft. Begun 8/18/66; completed 8/20/66. Logged by H. L. Smith.

Feet				Lithologic description
From	To	Drilled	Cored	
0.0	10.0	10.0	---	Claystone; lignite at 9.6-10.0 ft.
10.0	20.0	10.0	---	Siltstone, dark-gray.
20.0	23.9	---	3.9	Siltstone; lignite at 20.6-21.6 ft; underclay.
23.9	28.0	---	4.1	Siltstone, dark-gray.
28.0	31.0	---	3.0	Siltstone, dark-gray.
31.0	33.0	---	2.0	Claystone and siltstone; loss, 2.0 ft.
33.0	42.0	---	9.0	Underclay and siltstone; lignite at 33.0-33.1 ft.
42.0	52.0	---	10.0	Siltstone and claystone; lignite at 45.6-46.7 ft.
52.0	62.0	---	10.0	Claystone and siltstone.
62.0	76.6	---	14.6	Claystone and siltstone; lignite at 68.8-69.7 ft.
76.6	84.6	---	8.0	Claystone and siltstone.
84.6	92.0	---	7.4	Claystone; lignite at 86.3-86.5 ft.
92.0	97.6	---	5.6	Claystone; lignite at 93.4-93.5 ft and 95.7-97.0 ft.

DRILL HOLE 19

SW¼NW¼SW¼ sec. 8, T. 138 N., R. 85 W., 5th principal meridian, New Salem quadrangle, Morton County, N. Dak.

Collar elevation: 2,115 ft. Begun 8/23/66; completed 8/29/66. Logged and sampled by H. L. Smith. Analysis: proximate.

Feet				Lithologic description	
From	To	Drilled	Cored		
0.0	10.0	10.0	---	Sandstone.	
10.0	25.0	15.0	---	Sandstone and weathered lignite; lignite at 12.8-19.7 ft. Chemical analysis I-43793.	
25.0	30.3	5.3	---	Sandstone, very fine grained, weathered.	
30.3	32.1	---	1.8	Siltstone, greenish-gray.	
32.1	42.1	10.0	---	Siltstone.	
42.1	55.4	---	13.3	Claystone and siltstone, greenish-gray; loss, 1.5 ft.	
55.4	63.0	---	7.6	Claystone and siltstone.	
63.0	78.3	---	15.3	Siltstone, claystone, and lignite; lignite at 64.3-68.25 ft (Chemical analysis I-43790) and 69.3-70.1 ft.	
78.3	91.0	---	12.7	Siltstone and claystone; lignite stringers at 78.3-78.5, 86.1-86.5, and 87.0-87.4 ft.	
91.0	111.0	---	20.0	Siltstone, claystone, and sandstone.	
111.0	123.0	---	12.0	Claystone, greenish-gray, and sandstone.	
123.0	139.0	---	16.0	Lignite and claystone; lignite at 125.6-130.3 ft. Chemical analysis I-43791.	
139.0	153.0	---	14.0	Claystone, greenish-gray; loss, 13.5 ft.	
153.0	163.0	---	10.0	Siltstone, sandstone, and claystone; loss, 4.3 ft.	
163.0	172.0	---	9.0	Sandstone, claystone, and siltstone.	
172.0	184.0	---	12.0	Claystone, siltstone, and lignite; lignite at 172.7-173.1, 176.0-176.8, and 177.3-179.1 ft.	
184.0	194.9	---	10.9	Claystone, siltstone containing fossil shells, and lignite stringer.	
194.9	202.6	---	7.7	Claystone and siltstone.	
202.6	207.0	---	4.4	Claystone.	
207.0	216.0	---	9.0	Claystone, siltstone, and lignite.	Lignite section:
216.0	221.7	---	5.7	Clay and lignite.	Lignite, 215.3-216.8 ft Clay, 216.8-217.0 ft
221.7	224.7	---	3.0	Lignite.	Lignite, 217.0-230.5 ft
224.7	231.7	---	7.0	Lignite and clay.	
231.7	238.0	---	6.3	Claystone and siltstone.	
238.0	243.0	---	5.0	Claystone and siltstone.	
243.0	263.0	---	20.0	Claystone and siltstone.	
263.0	276.6	---	13.6	Siltstone and sandstone.	
276.6	280.6	---	4.0	Lignite and clay.	Lignite at 276.6-280.2 and 280.4-282.2 ft; clay at 280.2-280.4 ft.
280.6	300.6	---	20.0	Lignite and siltstone.	

DRILL HOLE 19--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-43793

Sampled by drill cutting (air): 12.8-19.7 ft

Gross weight 2½ lbs.
Net weight 941 grams.

Date of sampling: 8/23/66.
Date of Lab. sampling: 9/14/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	43.8	----	----
	Volatile matter[1]	27.0	48.0	54.8
	Fixed carbon	22.2	39.6	45.2
	Ash	7.0	12.4	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	.5	.8	.9
British thermal units		4970	8860	10110

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Sandstone[1]	12.0
2	Lignite	6.9
3	Underclay[1]	5.5
	Total thickness of bed	6.9
	Thickness in sample	6.9

[1] Excluded from sample.

DRILL HOLE 19--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-43790

Core from 64.3 to 68.25 ft

Gross weight 2½ lbs.
Net weight 901 grams.

Date of sampling: 8/24/66.
Date of Lab. sampling: 9/14/66.

	Air-dry loss	Coal: As received	Coal: Moisture free	Coal: Moisture and ash free
Proximate analysis	Moisture	37.9	----	----
	Volatile matter[1]	27.1	43.6	48.1
	Fixed carbon	29.2	47.0	51.9
	Ash	5.8	9.4	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.0	1.6	1.7
British thermal units		6940	11170	12330

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	1.3
2	Lignite	3.95
3	Claystone[1]	1.0
	Total thickness of bed	3.95
	Thickness in sample	3.95

[1] Excluded from sample.

DRILL HOLE 19--continued

COAL ANALYSIS REPORT

U.S. Bureau Mines Lab. No. I-43791

Core from 125.6 to 130.3 ft

Gross weight 2½ lbs.
Net weight 1016 grams.

Date of sampling: 8/24/66.
Date of Lab. sampling: 9/14/66.

	Air-dry loss	Coal		
		As received	Moisture free	Moisture and ash free
Proximate analysis	Moisture	32.9	----	----
	Volatile matter[1]	28.1	41.9	57.9
	Fixed carbon	20.5	30.5	42.1
	Ash	18.5	27.6	----
		100.0	100.0	100.0
Ultimate analysis	Sulfur	1.5	2.3	3.2
British thermal units		5910	8810	12170

[1] Determined by modified method.

SAMPLING REPORT

Sample from moist, fresh coal

No.	Section of bed	Feet
1	Claystone[1]	2.5
2	Lignite	3.6
3	Clay[1]	0.1
4	Lignite	1.0
5	Claystone[1]	1.0
	Total thickness of bed	4.7
	Thickness in sample	4.6

[1] Excluded from sample.

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