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RESULTS OF CORE DRILLING FOR URANIUM-BEARING LIGNITE IN THE BAR H AREA, SLIM BUTTES, HARDING COUNTY, SOUTH DAKOTA

By Howard D. Zeller

Trace Elements Memorandum Report 342

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Unclassified

RA NO. 105

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Document and Title Description	Present Classification	Revised Classification
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(1) TEI-241 "Uranium-bearing coal and carbonaceous shale in the La Ventana Mesa area, Sandoval County, New Mexico," by J. D. Vine, G.O.Bachman, C. B. Read, and G. W. Moore. Dated January 1953.	OFFICIAL USE ONLY	UNCLASSIFIED
(2) TEI-332 "Results of exploratory core drilling for uranium-bearing coal in the northern part of the Red Desert area, Sweetwater County, Wyoming," by H. Masursky, G.N.Pipiringos, and H. D. Gower. Dated May 1953	OFFICIAL USE ONLY	UNCLASSIFIED
(3) TEM-342 "Results of core drilling for uranium-bearing lignite in the Bar H area, Slim Buttes, Harding County, South Dakota," by H.D.Zeller. June 1953.	OFFICIAL USE ONLY	UNCLASSIFIED
(4) TEM-443 "Trace Elements reconnaissance investigations in New Mexico and adjoining states in 1951," by G.O.Bachman, and C.B.Read. Dated October 1952.	OFFICIAL USE ONLY	UNCLASSIFIED
(5) TEM-601 "Uranium-bearing coal in the Red Desert, Great Divide Basin, Sweetwater County, Wyoming," by H.Masursky and G.N.Pipiringos. Dated March 1953.	OFFICIAL USE ONLY	UNCLASSIFIED

R.O.K. OK Sept 10, 1954 Jesse C Johnson

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Dr. Phillip L. Merritt, Assistant Director
Division of Raw Materials
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Phil:

Transmitted herewith are six copies of TEM-342, "Results of core drilling for uranium-bearing lignites in the Bar H area, Slim Buttes, Harding County, South Dakota," by Howard D. Zeller, June 1953.

Sincerely yours,

Andrew Bronson
for W. H. Bradley
Chief Geologist

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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

RESULTS OF CORE DRILLING FOR URANIUM-BEARING LIGNITES IN THE BAR H AREA, SLIM BUTTES, HARDING COUNTY, SOUTH DAKOTA*

By

Howard D. Zeller

June 1953

Trace Elements Memorandum Report 342

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*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission

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RESULTS OF CORE DRILLING FOR URANIUM-BEARING LIGNITE IN THE BAR H AREA, SLIM BUTTES, HARDING COUNTY, SOUTH DAKOTA

By Howard D. Zeller

ABSTRACT

Core drilling in the Bar H area, Slim Buttes, Harding County, South Dakota, under a contract with the B. H. Mott Drilling Co., Huntington, West Virginia, was resumed June 12, 1952 after a 6-month recess during the winter and was completed July 18, 1952. The drilling was undertaken to obtain information on the distribution and extent of the uranium-bearing lignite beds along the southeast edge of the Bar H area. Eight holes totalling 885 feet were drilled and 52 feet of lignite core submitted for study and analysis. The report includes detailed lithologic descriptions of the lignite cores, Bureau of Mines coal analyses, semi-quantitative spectrographic analyses, and the results of 100 chemical analyses for uranium.

The drilling showed that the thicker, more persistent lignite beds exposed in the northern part of the Bar H area were removed by erosion prior to the deposition of the overlying White River formation in the southeastern part of the area. The beds penetrated by drilling were not of sufficient thickness or uranium content to add to the previously known reserves.

INTRODUCTION

The Bar H area lies at the north end of the Slim Buttes in east-central Harding County, South Dakota. Uranium-bearing lignites in the Ludlow member of the Fort Union formation of Paleocene age crop out within the area along the north and east margins of the Buttes. The area is easily accessible by S. Dak. Highway 8 and is about 20 miles east of Buffalo and a mile west of Reva.

During a program of exploratory core drilling in the Slim Buttes region and other parts of South Dakota, a single hole was drilled in the Bar H area (Zeller, 1952). The drilling, under a contract with the B. H. Mott Drilling Co., Huntington, W. Va. was stopped in November 1951 by winter weather and resumed June 12, 1952. The additional drilling was completed July 18, 1952. The Bar H area, as defined in this report, is considerably larger than that previously called the Bar H area (Zeller, 1952).

Additional drilling in the Bar H area was planned to explore for the uraniferous Bar H bed exposed at the northeast end of the Slim Buttes and to obtain information on the eastward extent of the lignite where the overburden might be less and strip mining might be possible. Holes also were drilled near an outlier of the White River formation in the eastern part of the area to explore for uraniferous lignite. Holes drilled are shown on fig. 2 and listed in Table 1.

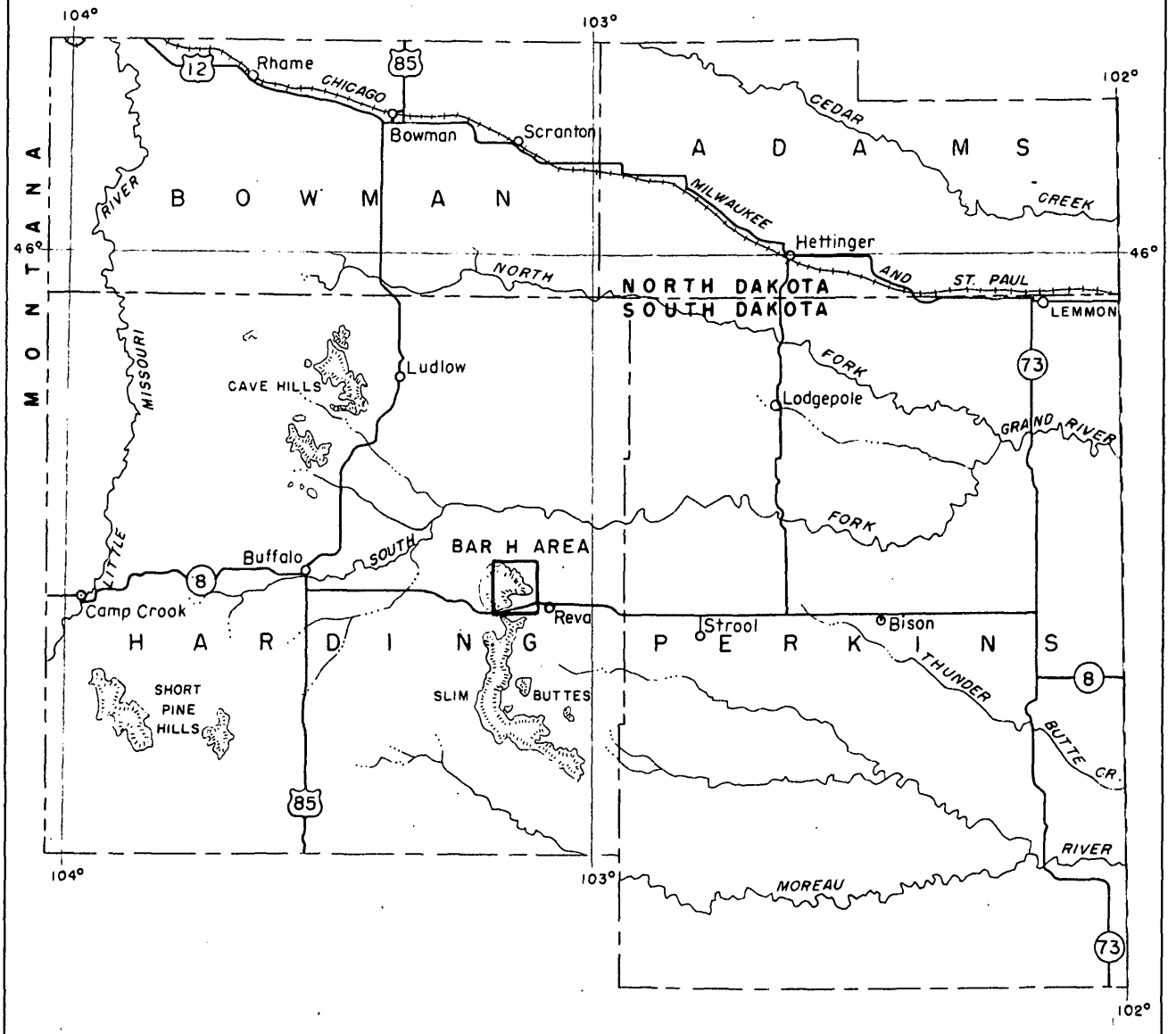


FIGURE 1.--INDEX MAP SHOWING THE BAR H AREA

Table 1.--Data on core holes, Bar H area, Slim Buttes, Harding County, South Dakota

Hole Number Slim Buttes Harding Co., S. Dak. Bar H area	Location (section, township, and range)	Elevation above sea level	Depth to lignite	Thickness of lignite	Total depth
20	C SW 8-18N-8E	3320		None	146'
21	C SW 8-18N-8E	3285	10'	20'4"	100'
22	SE NW 8-18N-8E	3260	28'6"	4'10"	105'
23	SW SE 8-18N-8E	3216	21'10"	8'0"	100'
24	C NE 5-18N-8E	3270	105'8"	9'0"	190'
25	C SL NE NE 3-18N-8E	3177	27'10"	9'4"	100'
26	C NW 35-19N-8E	3100	30'5"	10'0"	75'
27	C WL NW NE 35-19N-8E	3085	10'0"	3'0"	69'
				64'6"	885'

Acknowledgments

Analyses of the lignites were made by the Trace Elements Washington Laboratory. James M. Schopf, Coal Geology Laboratory, Columbus, Ohio, made the detailed descriptions of the lignite cores.

R. W. Edmonds and J. Foran, Division of Raw Materials, U. S. Atomic Energy Commission, spent a day with the writer in the field. This work is part of a program of exploration for radioactive raw materials undertaken by the U. S. Geological Survey on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

GEOLOGY

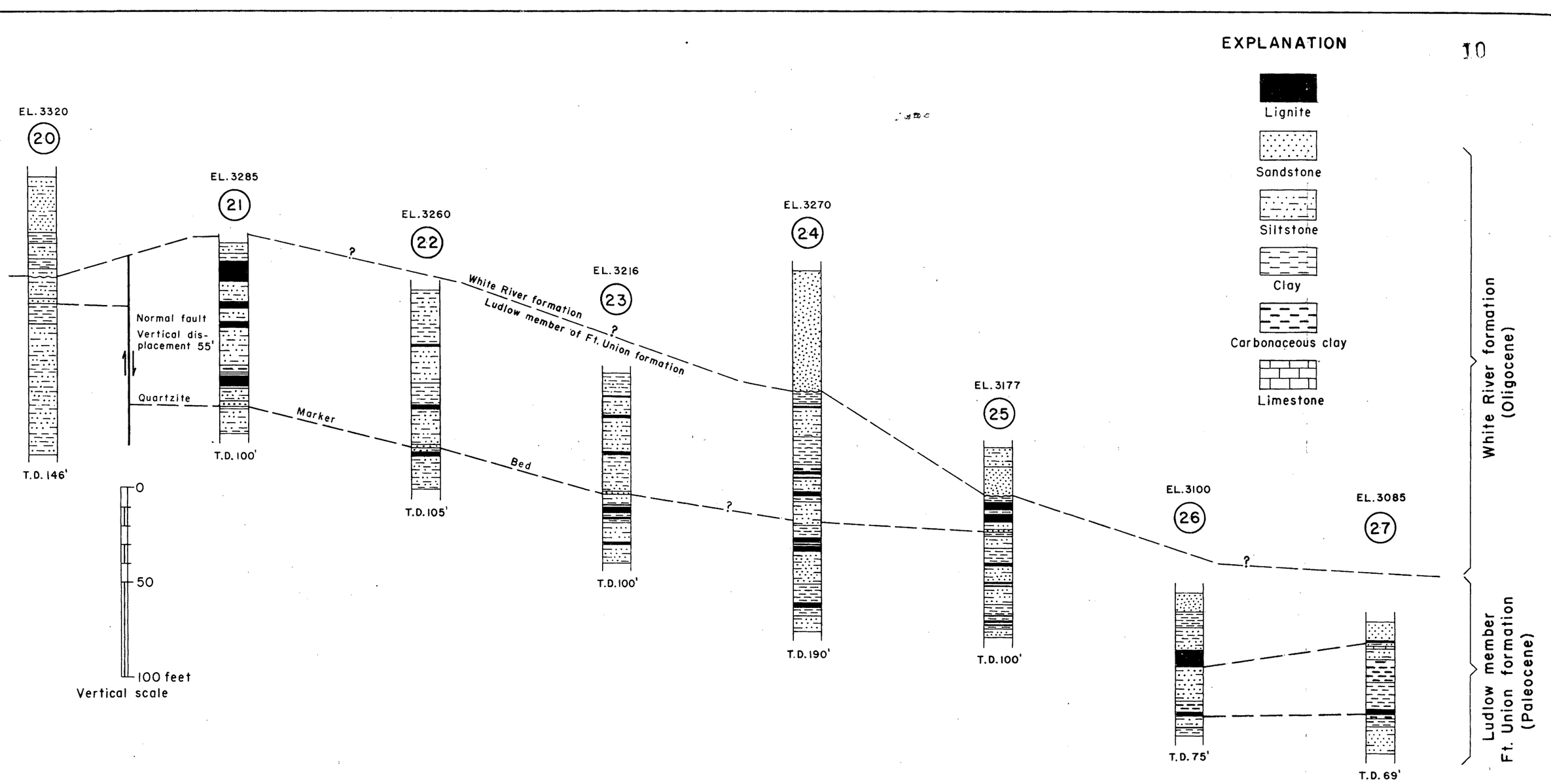
The bedrock in the Bar H area consists of three formations. The oldest is the lignite-bearing Ludlow member of the Fort Union formation of Paleocene age, which crops out along the base of the buttes. The Ludlow member consists predominantly of soft light-buff and tannish-gray sandstone, gray shale, and lignite, and is unconformably overlain by 340 feet or more of chalky-gray tuffaceous sandstone and bentonitic clay of the White River formation of Oligocene age. The Arikaree formation of Miocene age consists of tuffaceous sandstone and, with the White River formation, stands in imposing cliffs 200 feet high along the margins of Slim Buttes that rise 300 to 400 feet above the surrounding country. The

geologic map (fig. 2) compiled from aerial photographs shows the locations of the drill holes and the areal distribution of the rock units described above.

The Bar H lignite bed is believed to be the stratigraphically highest persistent lignite bed over most of the area although in some places a thin "rider" bed lies 60 feet or more above the Bar H bed. The Bar H bed has an average thickness of about 12 feet and is exposed at many places along the north base of Slim Buttes. Erosion prior to the deposition of the White River formation removed the Bar H bed in the areas drilled south of the surface outcrop of the bed. Consequently, only beds stratigraphically below the Bar H lignite bed were drilled, with the possible exception of the upper bed in hole 21 which may correlate with the Bar H bed.

Structure

High-angle normal faults cut the lignite beds in several places along the east margin of the buttes and trend N. 60-80° W. The more prominent ones are shown on the geologic map (fig. 2). Between holes 20 and 21 in Reva Gap, there is a fault with a displacement of about 55 feet. (See figs. 2 and 3). The faults do not appear to cut the White River formation in the Bar H area and are thought to be pre-White River in age. Strata of the Ludlow member dip steeply adjacent to faults because of drag along the fault, chiefly on the downthrown side. Large-scale slumping in recent time,



STRATIGRAPHIC CHART SHOWING CORRELATION OF RADIOACTIVE LIGNITE BEDS
IN CORE HOLES, BAR H AREA, SLIM BUTTES, HARDING COUNTY, SOUTH DAKOTA
1952

FIGURE 3

especially along the north face of Slim Buttes, complicates the mapping of individual lignite beds. The rocks in the greater part of the area are essentially horizontal but the regional dip appears to be northeast.

Quality of lignite

U. S. Bureau of Mines analyses show that the lignite in cores from the Bar H area contain an average of 24 percent fixed carbon, 12 percent ash, 1.3 percent sulfur, and have an average heating value of 5,390 Btu's. These figures are based on the "as received" condition. Analyses of individual beds are tabulated in Appendix B.

Distribution and concentration of uranium

The lignite cores recovered from holes 21, 22, 26, and 27 contain only a small amount of uranium, although the upper foot of the highest lignite cored in hole 22 contains nearly 0.01 percent uranium in the ash and about 11 percent ash. Lignite seams ranging from 6 to 18 inches in thickness in holes 23, 24, and 25 contain from 0.005 to 0.01 percent uranium. The two upper seams in hole 25, aggregating 2 feet 8 inches in thickness, contain from 0.03 to 0.066 percent uranium in the ash and an average of less than 20 percent ash. (See fig. 4). In most of the more highly uraniferous beds, the uranium content is greatest at the top of the bed, and lignite in the upper part of the stratigraphic section contains more uranium than the underlying beds of lignite.

The upper lignite in hole 21 is 10 feet thick and core could not be recovered; however, it is estimated that the uranium content of the upper 3 feet of the bed is about 0.01 percent. This estimate is based on comparison of the gamma ray log of hole 21 with those from other holes in the Slim Buttes area (Zeller, 1952) from which the uranium content of the lignite core has been determined by chemical analysis.

Semi-quantitative spectrographic analyses of lignite ash were made of parts of the lignite core. These analyses are listed in Appendix A.

RESERVES

The additional drilling in the Bar H area disclosed that the Bar H bed in the southern part of the area had been removed by erosion prior to the deposition of the overlying White River formation. Thus no reserves in the Bar H bed were added to those reported in TEI-238 (Zeller, 1952). No uraniferous lignite beds were found by drilling near the outlier of the White River formation in the eastern part of the area.

Inferred underground reserves of uraniferous lignite in the Bar H bed, based on outcrops in the northern part of the area, are estimated to be 5,100,000 tons of lignite having an average grade of 0.01 percent uranium and uranium content of 510 tons. These reserves underlie an area of about 600 acres in secs. 20, 21, 28, 29, and 33, T. 19 N., R. 8 E., Harding County, and are constituted by the upper 5 feet of the Bar H bed,

which is about 12 feet thick. On the assumption that 40 percent of the lignite is recoverable by underground mining methods, about 200 tons of uranium is potentially recoverable.

The Bar H "rider" bed was cored in hole 19 of the previous drilling (Zeller, 1952). The "rider" bed consists of three seams of lignite aggregating 6 feet 10 inches in thickness in a total stratigraphic interval of 13 feet 8 inches. No reserves were estimated for these seams although a sample of an interval about 11 inches thick from the middle seam contained 0.037 percent uranium.

Deep holes drilled from the top of Slim Buttes in sections 19, 20, 28, 29, 30, 31, 32, and 33, T. 19 N., R. 8 E. will be necessary before any more definite reserves can be estimated for the Bar H bed.

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APPENDIX A

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSES AND CHEMICAL ANALYSES ON ASH FROM DAKOTA LIGNITE CORES, TRACE ELEMENTS WASHINGTON LABORATORY

Spectrographic analyses by: C. Annell, K. Valentine, C. L. Waring, and H. Worthing.

Chemical analyses by: M. Delevaux, E. Farley, C. R. Hoy, H. Levine, S. Lundine, and I. May.

Slim Buttes, Bar H area, Harding County, South Dakota
Core Hole No. 21

Semi-quantitative spectrographic analyses of lignite ash

A = over 10%; B = 1-10%; C = 0.1-1.0%; D = 0.01-0.1%;
E = 0.001-0.01%; F = 0.0001-0.001%.

TE sample number	Laboratory number	Thickness of sample (inches)	Percent ash in sample	Si	Fe	Mg	Ca	Na	Ba	Sr	Mn	B	Cu	Mo	V	Cr	Ni	Pb	Co	Sc	Zr	Ga	Y	Sn	Yb	Be	Ag	Th	Li	Ge	La	K	Zn	P	Nd	Gd	Dy	Uranium in ash (percent) 1/
1	82968	5	21.8	A	A	B	B	B	D	D	C	C	C	D	D	D	E	D	D	E	E		E	F	F	F	D										0.001
2	82969	6-1/4	8.8	A	B	C	B	A	B	C	D	C	D	E	D	D	E	E	D	E	E	E	E	F	F	F	D	D	D	E								0.001
3	82970	7-1/8	10.7	B	A	B	B	B	C	D	C	D	C	D	E	E	E	E	D	E	D	E	E	F	F	F	D											0.002
4	82971	10-5/8	13.4	B	A	B	B	B	C	D	C	D	C	D	E	D	D	E	E	D	E	E	E	F	F														0.001
															7' gray clay and siltstone																							
5	82972	1-1/8	20.4	A	A	C	B	B	B	C	D	C	C	C	D	D	D	E	D	D	E	D	D	E	E	E	F	F	C	D	B							0.001
															7-3/8" gray clay																							
6	82973	8-1/8	19.3	A	A	B	B	B	B	C	D	C	D	C	D.	D	D	E	D	D	E	E	E	E	E	F	F				B	E						0.001
7	82974	9-1/8	17.7	A	A	C	B	B	B	C	D	C	C	C	C	D	E	D	E	D	D	E	E	E	E	F	F	D			B							0.001
8	82975	9	22.2	A	A	C	B	B	B	C	D	C	D	C	D	E	D	E	D	E	D	E	E	E	E	F	F	D			B							0.001
															24' 4-3/4" gray clay																							
9	82976	2-1/2	18.2	A	A	C	B	B	B	C	D	C	D	C	D	E	D	D	E	D	E	E	E	E	E	F	F	D	D		B	D						0.003
															2-1/2" gray clay																							
10	82977	2	21.2	A	A	C	B	B	B	C	D	C	D	C	D	E	D	D	E	D	D	E	E	D	E	E	F	F	C	D	D		s					0.004
															9-1/4" gray clay																							
11	82978	9-1/2	27.1	A	A	B	B	B	B	C	D	C	D	C	D	D	E	E	D	D	E	D	E	E	E	E	F					E							0.003
12	82979	9-1/8	14.6	B	A	C	B	B	B	C	D	C	D	C	D	C	D	E	E	D	D	E	D	E	E	F	F	D											0.003
13	82980	7-3/4	10.2	A	B	C	B	B	B	C	C	C	D	C	D	E	E	E	E	D	D	E	D	E	C		E	F	F	D	D	C		C	D	D	E		0.007
14	82981	7-5/8	29.7	B	B	A	C	B	B	C	D	C	D	C	D		E	E		D	E	E		E	E		E	F		D		D	B					0.001
15	82982	10-1/8	11.1	A	B	C	B	B	B	C	C	C	D	C	D	E	E	E	E	D	D		D	E	E		E	F	F	D		D	B	C				0.006
16	82983	6-7/8	9.5	A	B	C	B	B	B	C	C	C	D	C	D	E	E	E	E	E	D	E	D	E	E		E	F	F	D		D	B	D				0.004
17	82984	8-1/4	17.8	A	A	C	B	B	B	C	C	C	D	C	D	E	E	D	D	E	E	D	E	E	E		E	F	F	D		E	B					0.006

1/ Uranium content based on results of chemical analyses.

Slim Buttes, Bar H area, Harding County, South Dakota
Core Hole No. 22

Semi-quantitative spectrographic analyses of lignite ash

A = over 10%; B = 1-10%; C = 0.1-1.0%; D = 0.01-0.1%;
E = 0.001-0.01%; F = 0.0001-0.001%.

TE sample number	Laboratory number	Thickness of sample (inches)	Percent ash in sample	Al	Si	Fe	Mg	Ca	Na	Ba	Sr	Mn	Ti	B	Cu	Mo	V	Cr	Ni	Pb	Co	Sc	Zr	Ga	Y	Yb	Be	Ag	Li	Ge	Uranium in ash (percent) 1/
1	85589	5-1/2	10.3	A	A	B	B	B	B	C	C	C	C	C	D	D	E	E	E	E	E	E	D	E	E	F	F			0.009
2	85590	4-1/4	9.4	A	A	B	B	B	B	C	C	C	C	C	D	D	E	D	E	D	E	E	D	D	E	F			E	0.010
3	85591	9	19.9	A	A	B	B	B	B	C	D	D	C	C	D	D	D	D	D	D	D	E	D	E	E	F	F		E	0.005
				30' 7-1/8" gray siltstone																											
4	85592	4-1/8	13.7	A	A	B	B	B	A	C	D	D	D	C	D	D	E	E	E		E	E	D	E	E	F	F			0.007
5	85593	5-3/4	7.0	A	B	B	B	B	B	C	C	D	D	C	D	D	E	E	E		E	E	D	E	E	F	F	F	D	0.007
6	85594	6	12.6	A	B	B	B	B	B	D	C	D	D	C	D	D	E	E	D		D	E	D	E	E	F	F	F	D	0.007
7	85595	5-3/4	29.1	A	A	B	B	B	B	D	D	D	C	C	E	D	E	D	D	D	D	E	D	E	E	F	F	F		0.006
				22' 8-1/2" gray siltstone and clay																											
8	85596	5-3/4	17.5	A	A	B	B	B	B	C	D	D	C	C	D	D	E	E	E	E	E	E	E	E	E	F	F		D	0.004
9	85597	6	8.8	A	A	B	B	B	B	C	C	D	D	C	D	E	E	D	E	E	E	E	E	D	E	F	E	F	D E	0.011
10	85598	5-1/4	29.5	A	A	B	B	B	B	C	D	D	C	C	D	D	E	D	E	E	E	E	E	E	E	F	F		E	0.003

1/ Uranium content based on results of chemical analyses.

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Slim Buttes, Bar H area, Harding County, South Dakota
Core Hole No. 23

Semi-quantitative spectrographic analyses of lignite ash

A = over 10%; B = 1-10%; C = 0.1-1.0%; D = 0.01-0.1%;
E = 0.001-0.01%; F = 0.0001-0.001%

TE sample number	Laboratory number	Thickness of sample (inches)	Percent ash in sample	Al	Si	Fe	Mg	Ca	Na	Ba	Sr	Mn	Ti	B	Cu	Mo	V	Cr	Ni	Pb	Co	Sc	Zr	Ga	Y	Sn	Yb	Be	Ag	As	Li	Ge	La	Zn	Uranium in ash (percent) 1/
1	85554	4-3/8	37.4	B	A	A	B	B	C	C	C	D	C	D	D	D	D	D	D	D	D	E	D	E	D		E	F	F	D		E	E	D	0.027
2	85555	2-1/8	44.6	B	A	B	C	B	C	C	C	D	C	D	D	D	E	D	D	D	D	E	D	E	E		F	F	F			E	E		0.013
3	85556	2	32.3	B	A	A	B	B	B	C	C	D	D	D	E	D	E	E	D	E	D	F	D	E	E		F	F							0.009
4	85557	2	43.0	A	A	B	B	B	C	C	C	D	C	D	E	D	E	D	D	E	D	E	D	E	E		F	F							0.006
5	85558	2	45.7	A	A	B	B	B	C	C	C	D	C	D	E	D	E	D	D	E	D	E	D	E	E		F	F							0.007
6	85559	1-3/4	47.4	A	A	B	B	B	C	C	C	D	C	D	E	D	E	D	D	E	D	E	D	E	E		F	F				E			0.013
7	85560	1-1/4	52.4	A	A	B	B	B	C	C	C	D	C	D	E	D	E	D	D	E	D	E	D	E	E		F	F				E	E		0.015
				16' gray clay and siltstone																															
8	85561	6	20.9	B	A	A	B	B	B	C	C	D	C	C	E	E	E	D	E	E	E	F	D	E	E		F	F				E			0.005
9	85562	3-3/4	13.3	B	B	A	B	B	B	C	C	D	D	C	E	D	E	E	D	E	E	E	E	E	E		F	F							0.008
				2' 9" gray clay																															
10	85563	7-1/8	6.2	B	B	B	A	A	B	C	C	C	C	C	D	D	D	D	E	D	D	E	D	D	E	E	F	F	F		D	E			0.008
11	85564	3-7/8	42.3	B	A	B	B	B	C	C	D	D	C	C	D	E	E	D	E	D		E	D	E	E	E	F	F							0.001
				1" core loss																															
12	85565	5-1/2	19.0	A	A	B	B	B	B	C	C	D	C	C	D	E	E	D	E	D	E	E	D	D	E	E	F	F	F		D	D			0.004
				24' 6-1/2" gray clay																															
13	85566	3	12.3	A	A	B	B	B	B	C	C	D	C	C	D	D	E	D	E	E	D	E	D	D	E		F	F	F			D			0.004
				10" gray clay																															
14	85567	7-1/2	24.6	A	A	B	B	B	B	C	C	D	D	C	D	E	E	E	E	D	E	E	E	E			F	F	F						0.002
15	85568	4-1/4	16.9	A	A	B	B	B	B	C	C	D	D	C	D	E	E	E	E	E	F	E	E	E	E	F	F	F							0.002
16	85569	8-1/2	9.1	A	A	B	B	B	B	C	C	D	D	C	D	E	E	E	E	E	E	D	E	E			F	F			D				0.006
18	85571	10-1/2	17.5	A	A	B	B	B	B	C	D	D	D	C	D	E	E	D	D	E	D	F	E	E		E	F	F	F			E			0.004
				3' 10-1/4" gray clay																															
19	85572	6	38.0	B	A	A	C	C	B	C	D	D	D	C	E	E	E	D	D	E	D	F	E	E	E		F	F							0.003
20	85573	2-1/4	26.6	A	A	B	B	B	B	C	D	D	C	C	D	D	D	D	D	D	E	D	D	E			F	F				E			0.006
				12' 7" gray clay and siltstone																															
21	85574	6-1/2	17.6	A	A	B	B	B	B	C	C	D	C	C		E	E	D	E	D	E	E	D	D	E		F	E				D			0.002

1/ Uranium content based on results of chemical analyses.

Slim Buttes, Bar H area, Harding County, South Dakota
Core Hole No. 24

Semi-quantitative spectrographic analyses of lignite ash

A = over 10%; B = 1-10%; C = 0.1-1.0%; D = 0.01-0.1%;
E = 0.001-0.01%; F = 0.0001-0.001%

TE sample number	Laboratory number	Thickness of sample (inches)	Percent ash in sample	Al	Si	Fe	Mg	Ca	Na	Ba	Sr	Mn	Ti	B	Cu	Mo	V	Cr	Ni	Pb	Co	Sc	Zr	Ga	Y	Sn	Yb	Be	Ag	Li	Ge	Zn	Uranium in ash (percent) 1/
1	85740	2-1/4	26.8	A	A	B	B	B	B	C	C	C	C	C	D	D	E	E	D	D	E	E	E	E		E	E	F		E	D	0.034
2	85741	3	59.6	A	A	B	B	C	C	D	D	D	C	D	E	D	E	D	D	E	D	E	E	E	E		F	F			E	0.016
				1' 4-3/4" gray clay																													
3	85742	2	48.1	A	A	B	C	C	B	D	D	D	C	C	D	D	E	D	D	D	D	E	E	E	E		F	F					0.007
				8' 4" gray clay																													
4	85743	5	8.25	A	B	B	B	A	A	C	C	C	C	C	D	D	D	D	E	E	D	E	E	D	E		F	F			E		0.020
5	85744	6-3/4	11.0	A	B	B	B	A	A	C	C	C	C	C	D	D	E	E	E		E	E	E	E	E	E	F	F	F	D			0.013
6	85745	7-1/2	21.8	A	A	B	B	B	B	C	D	C	C	C	D	E	E	E	E	D		E	E	E	E	E	F	F		D			0.005
7	85746	4-3/4	19.2	A	A	B	B	B	B	C	C	C	C	C	D	D	E	D	E	D		E	E	E	E		F	F		D			0.005
				22' 6-1/2" gray clay																													
8	85747	6-1/2	19.9	A	B	B	B	B	B	C	D	C	D	C	D	D	E	E	D	E	E	E	E	E	E		F	F	F				0.002
9	85748	5-3/4	15.3	A	A	B	B	B	B	C	C	C	C	C	D	D	E	E	E	E	E	E	E	E	E	E	F	F		D			0.001
10	85749	9-1/4	47.1	A	A	B	B	C	B	D	D	D	C	C	E	D	E	D	D	E	E	E	E	E	E		F	F					0.001
				1' 2" gray clay																													
11	85750	7-1/2	45.7	A	A	B	B	C	C	D	D	D	C	C	D	E	E	D	D	E	D	E	E	E	E		F	F				E	0.001
				4-1/4" gray clay																													
12	85751	7-3/4	37.6	A	A	B	B	B	B	D	D	D	C	C	E	E	E	E	D	E	E	E	E	E			F	F					0.001
13	85752	8-1/2	23.6	A	A	B	B	B	B	D	D	D	C	C	E	E	E	E	D	E	F	E	E	E			F	F		D			<0.001
14	85753	7-1/4	14.4	A	A	B	B	B	B	C	D	C	C	C	D	E	E	E	E	E	E	E	E	E	E	E	F	F	F	D	E		0.002
				28' 5-3/4" gray clay																													
15	85754	9-1/2	18.7	A	A	B	B	B	B	D	D	C	D	C	D	E	E	E	E	E	E	F	E	E	E		F	F	F			E	0.001
16	85755	7-3/4	22.6	A	A	B	B	B	B	D	D	D	C	C	D	E	E	D	D	E	E	E	E	E	E		F	F				E	0.001
				1-1/4" dark gray clay																													
17	85756	3	33.3	A	A	B	B	B	B	D	D	C	D	C	D	D	E	D	E	E	E	E	E	E	E		F	F			D		0.001
				1-3/4" dark gray clay																													
18	85757	2-1/4	21.8	A	A	B	B	B	B	D	D	C	D	C	D	D	E	D	E	E	E	E	E	E	E		F	F			D		0.005

1/ Uranium content based on results of chemical analyses.

Slim Buttes, Bar H area, Harding County, South Dakota
Core Hole No. 25

Semi-quantitative spectrographic analyses of lignite ash

A = over 10%; B = 1-10%; C = 0.1-1.0%; D = 0.01-0.1%;
E = 0.001-0.01%; F = 0.0001-0.001%

TE sample number	Laboratory number	Thickness of sample (inches)	Percent ash in sample	Al	Si	Fe	Mg	Ca	Na	Ba	Sr	Mn	Ti	B	Cu	Mo	V	Cr	Ni	Pb	Co	Sc	Zr	Ga	Y	Yb	Be	Ag	As	Ge	La	Nd	Ce	P	Uranium in ash (percent) 1/
1	87658	7-1/4	26.7	B	A	B	B	B	C	C	C	D	C	C	E	C	E	E	E		F	D	E	E	F	F		D	E				C	0.031
2	87659	10-1/4	8.1	A	B	B	B	B	B	C	C	D	D	C	D	C	E	E	D	E	E	E	D	E	E	F	F	F	D	E				0.066
				8" gray clay																														
3	87660	8-3/4	18.8	A	A	C	B	B	B	C	C	D	D	C	D	D	E	E	E		E	E	E	E	E	F	F			E				0.040
4	87661	4-3/4	8.4	A	B	C	B	B	B	C	C	C	D	C	D	D	E	D	D	E	D	E	D	E	D	F	F	F		E	D	D	D	C	0.056
				3' 2-1/2" gray clay																														
5	87662	7-3/8	15.2	B	B	A	B	B	C	D	D	D	D	C	D	E	E	E	D		E	F	E	E		F	F		D					0.011
6	87663	8-5/8	8.7	A	A	C	B	B	B	C	C	C	C	C	D	E	E	E	E	E			E	E	E		F	F							0.013
				1" core loss																														
7	87664	7-1/2	7.4	A	A	C	A	B	B	C	C	C	C	C	D	E	E	E	E	E	E	F	E	E	E		F	F							0.016
8	87665	9-3/4	5.2	A	B	C	A	B	B	C	C	C	D	C	D	E	E	E	E	E	E	F	E	E	E		F	F							0.024
9	87666	8-3/4	14.3	B	B	A	B	B	C	C	D	D	D	C	D	E	E	E	E				E	E		F	F								0.007
10	87667	8	10.6	A	A	C	B	B	B	C	C	D	D	C	D	E	E	E	E	E	E	E	D	E	E	F				E					0.012
				22' 1-1/4" gray clay																														
11	87668	8-3/4	19.7	A	A	A	B	B	B	D	C	D	C	C	D	E	E	E	D		E	E	D	E	E	F	E			E					0.002
				9' 4-1/2" gray clay and siltstone																														
12	87669	6-1/2	14.4	A	A	C	B	B	B	D	C	D	D	C	D	E	E	E	E		E	E	E	E	F	F									0.002
				20' 1-1/4" brown-gray clay, siltstone, and lignite stringers																														
13	87670	4-1/2	34.1	B	A	C	B	B	B	D	C	D	C	C	E	E	E	E	E		E	E		E	E	F	E			E					<0.001

1/ Uranium content based on results of chemical analyses.

Slim Buttes, Bar H area, Harding County, South Dakota
Core Hole No. 26

Semi-quantitative spectrographic analyses of lignite ash

A = over 10%; B = 1-10%; C = 0.1-1.0%; D = 0.01-0.1%;
E = 0.001-0.01%; F = 0.0001-0.001%

TE sample number	Laboratory number	Thickness of sample (inches)	Percent ash in sample	Al	Si	Fe	Mg	Ca	Na	Ba	Sr	Mn	Ti	B	Cu	Mo	Cr	Ni	Pb	Co	Sc	Zr	Ga	Y	Sn	Yb	Ag	Li	Ge	La	V	Uranium in ash (percent) 1/
1	87671	8-3/8	18.3	A	B	A	B	B	C	D	D	D	D	C	E	D	E	E	E		E	E	E	E		F						0.005
2	87672	8	9.8	A	B	B	A	B	B	C	C	C	D	C	D	D	E	E	E		F	E	E	E		F				D		0.007
3	87673	9	13.1	B	B	A	B	B	B	C	C	C	D	C	D	E	E	E	E			E	E	E		F						0.001
4	87674	4-1/2	16.2	B	C	A	B	B	B	C	D	D	D	C	D	E	E					E	E	E		F						<0.001
5	87675	6-3/4	15.2	A	A	B	B	B	B	C	D	D	C	C	D	D	D	E	E	E	E	E	E	E		F		D			E	0.001
6	87676	3-3/4	14.5	B	A	B	B	B	B	C	D	C	D	C	D	E	E	E	E		F	E	E			F					E	0.002
				1" core loss																											
7	87677	6-3/4	17.3	A	A	B	B	B	B	C	C	C	C	C	E	D	E	E	D	E	E	E	E	E		F		D				0.002
8	87678	6-3/4	7.7	A	B	B	A	A	B	C	C	C	C	C	D	D	E	E	E	F	E	E	E		F	F	D				0.001
9	87679	6-1/2	7.4	A	B	B	A	A	B	C	C	C	D	C	D	E	E	E		E		E	E	E		F		D				0.001
10	87680	6	6.6	B	C	A	B	B	B	C	C	C	D	C	D	E	E	E	E	E		E	E	E		F						0.001
11	87681	7-1/2	8.9	A	C	B	A	A	B	C	C	D	E	C	D	E	E	E		D	F	E	E	E		F		D				<0.001
12	87682	8-1/2	4.5	B	B	A	B	B	B	C	C	D	D	C	D	E	E	E	E	E	E	E	E	E	E	F		D				0.001
13	87683	6-1/2	8.9	A	B	B	B	B	B	C	D	D	D	C	D	E	E	E	E		F	E	E	E		F			E			0.002
14	87684	6-1/2	15.0	B	B	A	B	B	B	C	D	D	D	C	D	E	E	D	E	E	E	E	E	E		F						0.002
				23' 9-1/2" gray clay and siltstone																											
15	87685	8-1/4	20.6	B	B	A	B	B	B	C	D	D	E	C	D	E	E	D	E	E		E	E	E		F						<0.001
16	87686	8-3/4	10.8	A	B	B	B	B	B	C	C	D	D	C	D		E	E	E		F	E	E	E		F		D				0.001
17	87687	3-3/4	9.8	B	B	A	B	B	B	C	C	D	D	C	D	E	E	E	E	E	E	E	E	E		F			E			0.003

1/ Uranium content based on results of chemical analyses.

Slim Buttes, Bar H area, Harding County, South Dakota
Core Hole No. 27

Semi-quantitative spectrographic analyses of lignite ash

A = over 10%; B = 1-10%; C = 0.1-1.0%; D = 0.01-0.1%; E = 0.001-0.01%; F = 0.0001-0.001%

TE sample number	Laboratory number	Thickness of sample (inches)	Percent ash in sample	Al	Si	Fe	Mg	Ca	Na	Ba	Sr	Mn	Ti	B	Cu	Mo	Cr	Ni	Pb	Co	Sc	Zr	Ga	Y	Yb	Ge	V	Be	Uranium in ash (percent) 1/
1	87654	2-3/4	35.1	B	A	A	B	B	B	C	D	D	D	D	D	D	D	E	E	E	F	E	E	E	F	E	E	F	0.002
				35' 4-1/2" gray clay and siltstone																									
2	87655	13-1/2	13.2	B	A	B	B	B	B	C	C	D	D	C	D	E	E	E	E	E	F	E	E	E	F		E	F	<0.001
3	87656	9	14.5	B	B	A	B	A	B	C	C	D	D	C	D	E	D	E	E	E		E	E	E	F		E	F	0.001
4	87657	8	42.3	B	A	A	B	C	B	C	D	D	D	D	D	E	D	E	E		F	E	E	E	F		E	F	<0.001

1/ Uranium content based on results of chemical analyses.

RESTRICTED

RESTRICTED

APPENDIX B

PROXIMATE AND ULTIMATE ANALYSES OF DAKOTA LIGNITE CORES

ANALYSES BY U. S. BUREAU OF MINES,
PITTSBURGH, PENNSYLVANIA

ANALYSES OF DAKOTA LIGNITE CORES 1/

Hole No.	Thickness	Lab. No.	Specific gravity	Condition 2/	PROXIMATE: Moisture	PROXIMATE: Volatile matter	PROXIMATE: Fixed carbon	PROXIMATE: Ash	ULTIMATE: Hydrogen	ULTIMATE: Carbon	ULTIMATE: Nitrogen	ULTIMATE: Oxygen	Forms of sulfur: Sulfate	Forms of sulfur: Pyritic	Forms of sulfur: Organic	British thermal units
				SLIM BUTTES, BAR H AREA, HARDING CO., SOUTH DAKOTA												
21	2' 5"	D-89670	1.59	1	44.3	22.5	25.7	7.5	7.2	34.9	.4	48.8	.07	.45	.68	5,850
				2		40.4	46.1	13.5	4.0	62.6	.7	17.1	.13	.80	1.22	10,510
				3		46.7	53.3		4.7	72.4	.8	19.6	.15	.93	1.41	12,150
	2' 2-1/4"	D-89671	1.65	1	43.7	20.9	24.4	11.0	7.0	32.6	.4	48.2	.03	.33	.42	5,490
				2		37.2	43.3	19.5	3.8	57.9	.7	16.7	.05	.59	.75	9,750
				3		46.2	53.8		4.7	71.8	.9	20.9	.06	.73	.93	12,110
	4' 11-1/4"	D-89672	1.70	1	43.3	20.5	25.3	10.9	6.8	32.7	.4	46.7	.02	2.10	.37	5,500
				2		36.2	44.5	19.3	3.6	57.7	.7	14.3	.04	3.71	.66	9,700
				3		44.8	55.2		4.4	71.4	.9	17.8	.05	4.59	.81	12,020
22	1' 6-3/4"	D-89995	1.65	1	46.4	20.4	24.1	9.1	7.3	31.4	.3	50.9	.19	.48	.32	5,300
				2		38.0	45.0	17.0	3.9	58.5	.6	18.2	.36	.89	.60	9,880
				3		45.8	54.2		4.7	70.5	.7	21.9	.44	1.07	.72	11,900
	1' 9-5/8"	D-89996	1.65	1	46.9	19.8	22.8	10.5	7.4	29.8	.5	51.1	.04	.24	.47	5,070
				2		37.3	42.9	19.8	4.0	56.2	.9	17.7	.07	.46	.88	9,560
				3		46.5	53.5		5.0	70.0	1.1	22.1	.08	.58	1.09	11,920
	1' 5"	D-89997	1.62	1	42.3	22.2	23.6	11.9	7.1	33.1	.4	46.1	.03	1.02	.37	5,670
				2		38.6	40.7	20.7	4.2	57.3	.7	14.6	.05	1.77	.64	9,820
				3		48.6	51.4		5.3	72.3	.9	18.4	.06	2.24	.81	12,390

1/ Analyses supplied by U. S. Bureau of Mines, Central Experiment Station, Pittsburgh, Pa., Roy F. Abernethy, chemist in charge

2/ Condition: 1. As received 2. Moisture free 3. Moisture ash free

ANALYSES OF DAKOTA LIGNITE CORES 1/

Hole No.	Thickness	Lab. No.	Specific gravity	Condition 2/	PROXIMATE: Moisture	Volatile matter	Fixed carbon	Ash	ULTIMATE: Hydrogen	Carbon	Nitrogen	Oxygen	Forms of sulfur: Sulfate	Pyritic	Organic	British thermal units
SLIM BUTTES, BAR H AREA, HARDING CO., SOUTH DAKOTA																
23	8"	D-90065	2.06	1	51.9	15.5	11.4	21.2	6.7	16.5	.3	54.9				2,440
				2		32.2	23.7	44.1	1.9	34.3	.6	18.2				5,060
				3		57.7	42.3		3.4	61.3	1.1	32.5				9,060
	1' 4-1/2"	D-90066	1.69	1	42.3	20.2	22.3	15.2	6.7	29.7	.4	47.7	.04	.07	.24	4,970
				2		35.0	38.6	26.4	3.5	51.4	.6	17.5	.07	.12	.41	8,630
				3		47.5	52.5		4.7	69.9	.8	23.8	.10	.17	.56	11,730
	2' 6-1/4"	D-90067	1.66	1	43.5	20.7	25.5	10.3	6.8	32.9	.5	48.9	.03	.25	.34	5,460
				2		36.7	45.1	18.2	3.6	58.1	.9	18.1	.06	.45	.60	9,660
				3		44.8	55.2		4.3	71.0	1.1	22.2	.07	.55	.73	11,800
24	2' 0"	D-90297	1.66	1	44.2	20.4	25.8	9.6	6.9	33.0	.3	49.9	.01	.05	.20	5,370
				2		36.6	46.3	17.1	3.6	59.1	.5	19.2	.02	.09	.35	9,620
				3		44.1	55.9		4.4	71.3	.6	23.1	.02	.11	.43	11,610
	1' 9-1/2"	D-90298	1.81	1	37.1	19.5	21.2	22.2								4,740
				2		30.9	33.8	35.3								7,540
				3		47.8	52.2									11,650
	2' 7"	D-90299	1.75	1	41.6	18.9	21.1	18.4								4,600
				2		32.3	36.2	31.5								7,880
				3		47.3	52.7									11,510
	1' 10-1/2"	D-90300	1.70	1	41.7	20.4	22.2	15.7								5,040
				2		34.9	38.1	27.0								8,640
				3		47.8	52.2									11,840

ANALYSES OF DAKOTA LIGNITE CORES 1/

Hole No.	Thickness	Lab. No.	Specific gravity	Condition 2/	PROXIMATE: Moisture	PROXIMATE: Volatile matter	PROXIMATE: Fixed carbon	ULTIMATE: Ash	ULTIMATE: Hydrogen	ULTIMATE: Carbon	ULTIMATE: Nitrogen	ULTIMATE: Oxygen	Forms of sulfur: Sulfate	Forms of sulfur: Pyritic	Forms of sulfur: Organic	British thermal units
SLIM BUTTES, BAR H AREA, HARDING CO., SOUTH DAKOTA																
25	2' 7"	D-90758	1.60	1	40.2	22.9	26.8	10.1	6.8	34.9	.4	46.8				5,890
				2		38.2	44.9	16.9	4.0	58.4	.6	18.5				9,850
				3		46.0	54.0		4.8	70.3	.8	22.2				11,850
	4' 2"	D-90759	-	1	44.5	21.9	26.3	7.3								
				2		39.5	47.3	13.2								5,700
				3		45.5	54.5									10,280
																11,840
26	7' 11-3/8"	D-90760	1.61	1	40.3	23.6	27.5	8.6	6.8	36.7	.2	46.5	.06	.77	.39	6,120
				2		39.6	46.0	14.4	3.9	61.4	.3	18.0	.10	1.28	.65	10,250
				3		46.2	53.8		4.5	71.8	.3	21.0	.11	1.50	.76	11,980
	1' 9-3/4"	D-90761	-	1	41.6	21.5	26.3	10.6								
				2		36.8	45.1	18.1								5,760
				3		45.0	55.0									9,880
																12,050
27	2' 2-3/4"	D-90762	1.79	1	39.3	20.3	23.5	16.9	6.4	29.8	.4	43.3	.08	2.90	.23	5,090
				2		33.5	38.7	27.8	3.3	49.1	.6	13.9	.13	4.78	.38	8,390
				3		46.5	53.5		4.5	68.1	.9	19.2	.18	6.63	.53	11,620

APPENDIX C

LITHOLOGIC DESCRIPTIONS OF DAKOTA LIGNITE CORES BY JAMES M. SCHOPF, COAL GEOLOGY LABORATORY, COLUMBUS, OHIO

Lignite core description by James M. Schopf, U. S. Geological Survey Coal Geology Laboratory, Columbus, Ohio

SLIM BUTTES, HARDING CO., SOUTH DAKOTA
Bar H area

Hole 21

Location: C-SW-8-18N-8E — Elevation: 3,285 feet

Date cored: 6/20-21/52 — Date described: 6/30/52

0'

Surface deposits; no core.

10'

Badly weathered lignite; recorded at drill site but not submitted to laboratory.

20'

Core not shipped to laboratory.

30'10" (Top of core sent to Columbus Laboratory)

Shale, gray with thin lighter gray streaks.

31' 3-3/4"

Thin pyritic layer.

31' 4"

Coal, sparsely medium-banded, matrix earthy; lower 2-1/2" broken in drilling. TE sample No. 1*

31' 9"

Coal; upper 4" almost entirely woody; earthy below. TE sample No. 2.

32' 3-1/4"

Coal, dominantly woody, medium- to thick-banded, 1/8" fusain bleb at 32' 8-3/4". TE sample No. 3.

32'10-3/8"

Coal, sparsely to moderately woody, medium- and thick-banded, 1/2" pyritic bleb at 32' 11-3/4"; core partly broken in drilling. TE sample No. 4.

33' 9"

3" loss in coring, accumulated below 31' 4".

(Bureau of Mines Sample D-89670)

34'

Clay, gray, soft and plastic.

35' 2"

70" core not shipped to laboratory; includes siltstone and clay, described at drill site.

41'

Coal, earthy, probably impure. TE sample No. 5.

41' 1-1/8"

Clay, top dark gray, lower portion light gray.

* Numbers in parentheses following T.E. samples refer to percent uranium in the sample. Where no number appears the uranium content is less than 0.001 percent.

Hole 21 (cont.)

41' 8-1/2"
Coal, moderately woody, thin- and medium-banded; 1/4" pyrite lens below 42' 3/4". TE sample No. 6.
42' 4-5/8"
Coal, moderately woody, medium- to thick-banded; 2-1/2" woody layer below 42' 10"; thin fusain bleb at top of section. TE sample No. 7. (Bureau of Mines Sample D-89671)
43' 1-3/4"
Coal, 2-1/2" woody piece at top, lower part dominantly attrital; middle part badly broken. TE sample No. 8.
43'10-3/4"
1-1/4" loss in coring, accumulated below 41' 8-1/2".
44'
Clay, dark gray; somewhat lignitic, soft and plastic with woody lenses at the top; 1/4" pyrite bleb below 44' 4".
44'10"
23' 2" of core not shipped to laboratory; includes gray siltstone, described at drill site.
68'
Clay, medium gray, soft and plastic.
68' 4-3/4"
Coal, dominantly woody; irregular contact with clay below. TE sample No. 9 (0.001 U).
68' 7-1/4"
Clay, dark gray, soft and plastic; irregular contact with coal below; contains some coal fragments from above and below.
68' 9-3/4"
Coal, dominantly woody; earthy in lower portion. TE sample No. 10 (0.001 U).
68'11-3/4"
1/4" loss in drilling accumulated below 68'.
69'
Clay, dark gray, soft and plastic.
69' 9"
Coal, dominantly attrital; 1/8" pyrite lenses at 61'10-1/4" and 62' 1/8"; core broken in drilling. TE sample No. 11 (0.001 U).
70' 6-1/2"
Coal, moderately thick- to medium- and sparsely thin-banded. TE sample No. 12. (Bureau of Mines Sample D-89672)
71' 3-5/8"
Coal, moderately thin- to thick-banded. TE sample No. 13. (0.001 U).
71'11-3/8"
Coal, dominantly attrital with a few woody fragments; core badly broken. TE sample No. 14.
72' 7"
Coal, upper half dominantly attrital; lower half medium- to thick-banded; 1/2" attrital zone at base contains small buff colored clayey pellets. TE sample No. 15 (0.001 U).

Hole 21 (cont.)

73' 5-1/8"		
	Coal, completely crushed in coring; fragments dominantly attrital with woody fragments in upper 2". TE sample No. 16.	Bureau of Mines Sample D-89672
74'		
	(Drill pull at this depth) Coal, dominantly woody, wood fragments irregular, central portion; broken in coring; 1/8" clay parting below 74' 6-5/8". TE sample No. 17 (0.001 U).	
74' 8-1/4"		
	Clay, dark gray, coaly to 74' 9-1/4"; medium gray, soft and plastic to 75' 2-3/4"; dark gray, soft and plastic to 75' 4-1/4"; light gray, soft and plastic below.	
75' 9-1/4"		
	(Bottom of core submitted to Columbus Laboratory).	

General Notes: Core was received in good condition, moist as unpacked although portions were broken in coring and some coal losses are recorded. Bureau of Mines samples may contain slight excess of moisture over bed conditions.

One half of the core is retained as reserve; core sampled for both Bureau of Mines and Trace Elements determinations represent riffle "splits" of crushed core from each described interval, 1/2 "split" for each being combined as backeted to serve regular coal analytic purposes.

TE samples 5, 9 and 10 represent 1/2 of the core in each instance, as coal included in these did not warrant regular coal analytic attention.

Eleven small specimens taken from the core reserve have been stored under water for preparation of thin sections of attrital and woody coal.

Bureau of Mines Sample D-89670: 31' 4" to 34', interval 32", rejected 0", loss 3", C.I.S. 2' 5".

Bureau of Mines Sample D-89671: 41' 8-1/2" to 44' 0", interval 27-1/2", rejected 0", loss 1-1/4", C.I.S. 2' 2-1/4".

Bureau of Mines Sample D-89672: 69' 9" to 74' 8-1/4", interval 59-1/4", rejected 0", loss 0", C.I.S. 4' 11-1/4".

Lignite core description by James M. Schopf, U. S.
Geological Survey Coal Geology Laboratory, Columbus, Ohio

SLIM BUTTES, HARDING CO., SOUTH DAKOTA
Bar H area

Hole 22

Location: SE-NW-8-18N-8E — Elevation: 3,260 feet

Date cored: 6/30-7/1/52 — Date described: 7/7-8/52

28' 6"	(Top of core submitted to Columbus Laboratory)----------	
	Coal, abundantly woody, thick- to very thick-banded; upper and lower 1/3 badly broken in coring; middle 1/3 solid wood fragment; 3/8" pyritic nodule in lower 1/2. TE sample No. 1 (0.001 U).	Bureau of Mines Sample D-89995
28'11-1/2"	Coal, dominantly woody, very thick-banded. TE sample No. 2 (0.001 U).	
29' 3-3/4"	Coal, upper 1" dominantly woody; remainder sparsely woody, thin-banded and badly broken in coring. TE sample No. 3 (0.001 U).	
30' 3/4"	----------	
	Clay, silty, medium gray, soft and plastic.	
30'11"	Coal, dominantly woody, thin- and thick-banded.	
30'11-1/2"	Clay, same as above; complete recovery of core from 28' 6" to 31'.	
31'	29' 5" core not shipped to laboratory; includes gray siltstone described at drill site.	
60' 5"	Clay, silty, medium gray, soft and plastic; lower 1" contains carbonaceous streaks about 1/10" thick.	
60' 7-7/8"	----------	
	Coal, moderately woody, thin- and thick-banded. TE sample No. 4 (0.001 U).	
61'	Coal, abundantly woody, thin- to thick-banded; lower half slightly broken in coring. TE sample No. 5.	Bureau of Mines Sample D-89996
61' 5-3/4"	Coal, dominantly attrital, thin-banded; lower half slightly broken in coring. TE sample No. 6 (0.001 U).	
61'11-3/4"	Coal, abundantly woody, thin- to thick-banded. TE sample No. 7 (0.002 U).	
62' 5-1/2"	----------	
	Clay, medium gray, soft and plastic; carbonaceous zone with coaly fragments between 62' 6-1/4" and 62' 6-3/4"; complete recovery of core from 69' 5" to 63'.	

Hole 22 (cont.)

63'	22' 2" core not shipped to laboratory; includes gray siltstone described at drill site.	
85' 2"	Coal, abundantly woody, thin- to thick-banded; top 1/3 pulverized in coring. TE sample No. 8 (0.001 U).	Bureau of Mines Sample D-89997
85' 7-3/4"	Coal, dominantly woody, thin- to very thick-banded; middle portion consists of 2-1/2" biscuits. TE sample No. 9 (0.001 U).	
86' 1-3/4"	Coal, dominantly attrital, thin- to thick-banded; 1" from base pyritic lenticles. TE sample No. 10 (0.001 U).	
86' 7"	1-1/2" loss in coring accumulated below 85' 2".	
86' 8-1/2"	Clay, medium gray, soft and plastic; top 1/2" carbonaceous streaks.	
87' 4"	(Bottom of core submitted to Columbus Laboratory).	

General Notes: Core was received in good condition, moist as unpacked although considerable portions were pulverized and broken in coring. Bureau of Mines samples probably contain slight excess of moisture over bed conditions.

One half of the core was retained as reserve; core sampled for both Bureau of Mines and Trace Elements determinations represent riffle "splits" of crushed core from each described interval, 1/2 "split" for each interval being combined as bracketed to serve regular coal analytic purposes.

Eight small specimens taken from the core reserve have been stored under water for preparation of thin sections of attrital and woody coal.

Inclination of lineated constituents in lower portion of core examined suggests either slumping of unconsolidated material or structural adjustment. Inclination or apparent dip ranges from 4° to 12°. Average apparent dip is 7°.

Bureau of Mines Sample D-89995: 28' 6" to 30' 3/4"; interval 18-3/4"; rejected 0"; loss 0"; C.I.S. 1' 6-3/4".

Bureau of Mines Sample D-89996: 60' 7-7/8" to 62' 5-1/2"; interval 21-5/8"; rejected 0"; loss 0"; C.I.S. 1' 9-5/8".

Bureau of Mines Sample D-89997: 85' 2" to 86' 8-1/2"; interval 18-1/2"; rejected 0"; loss 1-1/2"; C.I.S. 1' 5".

Lignite core description by James M. Schopf, U. S.
Geological Survey Coal Geology Laboratory, Columbus, Ohio

SLIM BUTTES, HARDING CO., SOUTH DAKOTA
Bar H area

Hole 23

Location: SW-SE-8-18N-8E — Elevation: 3,216 feet

Date cored: 7/2-3/52 — Date described: 7/10-11-14/52

20' 6" (Top of core sent to Columbus Laboratory)
Clay, silty, medium gray.

21' 9-3/4"
Coal and clay; in coring silty clay apparently pushed down into coal or coal squeezed up around the clay; silty clay is brown stained; coal is weathered, pulverized in coring. TE sample No. 1 (0.010 U).

22' 2-1/8"
Coal, weathered, pulverized in coring; silty clay pushed into coal as above. TE sample No. 2 (0.006 U).

22' 4-1/4"
Coal, weathered, pulverulent, friable; faint, oblique banding. TE sample No. 3 (0.003 U).

22' 6-1/4"
Coal, weathered, pulverulent, friable, but in normal position; faint horizontal banding. TE sample No. 4 (0.003 U).

22' 8-1/4"
Coal, weathered, pulverulent, friable but in normal position; sparsely medium-banded. TE sample No. 5 (0.003 U).

22'10-1/4"
Coal, weathered, friable but in normal position; sparsely. thin-banded. TE sample No. 6 (0.006 U).

23' 0"
Coal, weathered, friable but in normal position; sparsely, thin-banded; clayey in lower 1/2". TE sample No. 7 (0.008 U).

Bureau of Mines Sample D-90065

23' 1-1/4"
Clay, dark brown; 1/2" layer of weathered coaly material with thin woody streaks below 23' 1-1/4".

23' 6" 15' 4" core not shipped to laboratory; includes gray siltstone and clay described at drill site.

38'10"
Clay, medium; 3/4" pyritic nodule at 39' 1".

39' 1-1/4"
Coal, dominantly woody, upper half broken in coring; 1" pyritic nodule at 39' 2-3/4". TE sample No. 8 (0.001 U).

39' 7-1/4"
Coal, dominantly very thick-banded. TE sample No. 9 (0.001 U).

39'11"
Clay, medium gray, plastic.

Hole 23 (cont.)

41' 3-3/4"
Clay, medium gray.

42' 2"
Clay, medium gray, plastic.

42' 8"
Coal, dominantly very thick-banded; upper 1/3 of core broken in coring. TE sample No. 10.

43' 3-1/8"
Coal, sparsely, thin- to medium-banded; broken in coring; 1-3/4" large pyritic nodule at top. TE sample No. 11. (Bureau of Mines Sample D-90066)

43' 7"
1" loss in coring accumulated below 42' 8".

43' 8"
(Pull at this depth)
Coal, dominantly, thin- to thick-banded. TE sample No. 12 (0.001 U).

44' 1-1/2"
1/2" loss in coring accumulated below 43' 8".

44' 2"
Clay, dark gray, plastic, weathered; 1/4" weathered woody band 1/2" from top.

44' 8"
23' 6" core not shipped to laboratory.

68' 2"
Clay, carbonaceous; 1/4" pyritic nodule at 68' 7-1/2".

68' 8"
Coal, moderately, medium-banded; 1/2" pyritic nodule at 68' 8". TE sample No. 13.

68'11"
Clay, medium to dark gray, with thin woody streaks from 68'11" to 68'11-1/2".

69' 9"
Coal, sparsely, thin- to thick-banded. TE sample No. 14.

70' 4-1/2"
Coal, moderately, thin- to thick-banded; lower half broken in coring. TE sample No. 15. (Bureau of Mines Sample D-90067)

70' 8-3/4"
Coal, abundantly, thin- to very thick-banded. TE sample No. 16 (0.001 U).

71' 5-1/4"
Coal, sparsely, thin- to medium-banded. TE sample No. 18. (0.001 U).

72' 3-3/4"
3-1/4" loss in drilling accumulated below 69'9".

72' 7"
Clay, medium gray; fine specks of pyrite at 72'11".

73' 2-1/2"
2'-11-1/2" core not shipped to laboratory; includes gray clay described at drill site.

76' 2"
Coal, moderately, thin- to thick-banded; upper 1/3 contains about 10% pyritic streaks up to 1/4" thick. TE sample No. 19 (0.001 U).

Hole 23 (cont.)

76' 8" (Pull at this depth)
Coal, thin-banded but dominantly woody; 1/2" pyritic nodule at 76' 9-1/8". TE sample No. 20 (0.002 U).

76'10-1/4"
3/4" loss in coring accumulated below 76' 2".

76'11"
Clay, medium to dark gray; thin woody streaks from 76'11" to 76'11-1/2".

77' 2"
11' 10" core not shipped to laboratory; includes gray clay and siltstone described at drill site.

89' 0"
Clay, carbonaceous.

89' 6"
Coal, sparsely, thin- to thick-banded. TE sample No. 21.

90' 1/2"
1/2" loss in coring accumulated below 89' 6".

90' 1"
Clay, medium gray; carbonaceous streaks from 90' 1" to 90' 1-1/2".

90' 2"
(Bottom of core submitted to Columbus Laboratory).

General Notes: Core was received in good condition, moist as unpacked, although considerable portions were pulverized and broken in coring. Bureau of Mines samples may contain slight excess of moisture over bed conditions.

One half of the core was retained as reserve; core sampled for both Bureau of Mines and Trace Elements determinations represent riffle "splits" of crushed core from each described interval, 1/2 "split" for each interval being combined as bracketed to serve regular coal analytic purposes.

Eighteen small specimens taken from the core reserve have been stored under water for preparation of thin sections of attrital and woody coal.

Bureau of Mines Sample D-90065: Interval 22' 4-1/4" to 23' 1/4", interval 8"; rejected 0"; loss 0"; C.I.S. 8".

Bureau of Mines Sample D-90066: Interval 42' 8" to 44' 2", interval 18"; rejected 0"; loss 1-1/2"; C.I.S. 1' 4-1/2".

Bureau of Mines Sample D-90067: Interval 69' 9" to 72' 7", interval 34"; rejected 0"; loss 3-3/4"; C.I.S. 2' 6-1/4".

Lignite core description by James M. Schopf, U. S. Geological Survey Coal Geology Laboratory, Columbus, Ohio

SLIM BUTTES, HARDING COUNTY, SOUTH DAKOTA
Bar H area

Hole 24

Location: C-NE-5-18N-8E Elevation: 3,270 feet

Date cored: 7/8/52 Date described: 7/15-16/52

105' 6" (Top of core sent to Columbus Laboratory)
Clay, silty, dark gray.

105' 8"
Coal, dominantly thin- to medium-banded; 105' 8" to 105' 9" broken in coring. TE sample No. 1 (0.009 U).

105'10-1/4"
Impure coal, fibrous bands shot with clayey mineral matter. TE sample No. 2 (0.010 U).

106' 1-1/4"
Clay, medium to dark gray; 1/16" streak of attrital coal at 106' 8-3/4".

106'10-1/4"
Clay, medium to dark gray; thin woody streaks at 106'11-1/2", 107', 107' 1-1/2", and 107' 2-1/2".

107' 3-3/8"
Clay, medium to dark gray; two thin woody streaks at 107' 5-1/2".

107' 6"
Clay, gray with carbonaceous streaks. TE sample No. 3 (0.003 U).

107' 8"
Clay, gray; three thin woody streaks 107' 8" to 107' 8-3/4".

107'10"
8' 2" core not shipped to laboratory; no field data given.

116' 0"
Coal, dominantly thin- to thick-banded. TE sample No. 4 (0.002 U).

116' 5"
Coal, moderately thin- to thick-banded. TE sample No. 5 (0.001 U).

116'11-3/4"
Coal, moderately thin- to thick-banded; 1-1/4" pyritic lenses at 116'11-3/4" to 117' 1". TE sample No. 6 (0.001 U)

117' 7-1/4"
Coal, dominantly thick- to very thick-banded. TE sample No. 7 (0.001 U).

Bureau of Mines Sample D-90297

118' 0"
Clay, carbonaceous; thin to medium coaly straks from 118' 3-3/4" to 118' 6-3/4" and 118' 2" to 118' 2-1/2".

118' 6-1/4"
21' 5-3/4" core not shipped to laboratory; no field data given.

Hole 24 (cont.)

140' 0"
Clay, medium to dark gray; carbonaceous at 140' 3/4"; thin woody streaks at 140' 4" to 140' 4-1/2" and 140' 5-1/2" to 140' 6-1/2".

140' 6-1/2"
Coal, moderately thin- to very thick-banded. TE sample No. 8.

141' 1"
Coal, moderately thin- to thick-banded. TE sample No. 9.

141' 6-3/4"
Coal, moderately thin- to thick-banded; carbonaceous clay 141' 8" to 141' 9-3/4" and 141'11" to 141'11-1/2" included in Bureau of Mines sample; 1/4" pyritic nodule at 142' 2-1/2". TE sample No. 10.

Bureau of Mines Sample D-90298

142' 4"
Clay, medium gray; thin carbonaceous streaks 142' 4" to 142' 5-1/4".

142' 9-1/2"
1" loss in coring accumulated below 142' 4".

142'10-1/2"
Clay, medium gray; thin carbonaceous streaks 143' 2-1/2" to 143' 3-1/2".

143' 6"
Coal, solid wood. TE sample No. 11.

144' 1-1/2"
Clay, dark gray; thin woody streaks 144' 3-3/4" and 144' 4-3/4"; interval excluded from Bureau of Mines sample.

144' 5-3/4"
Coal, moderately thin- to medium-banded; 144' 8" to 144' 11-1/2" broken in coring. TE sample No. 12.

Bureau of Mines Sample D-90299

145' 1-1/2"
Coal, dominantly thin- to very thick-banded; carbonaceous clay 145' 1-3/4" to 145' 2-3/4" included in Bureau of Mines sample. TE sample No. 13.

145'10"
Coal, moderately thin to thick-banded. TE sample No. 14.

146' 5-1/4"
Clay, light gray, thin woody streak at 145' 9".

146' 9-1/2"
27' 7-1/2" core not shipped to laboratory, no field data given.

174' 5"
Clay, gray; thin carbonaceous streaks 174' 5" to 174' 6".

174'11"
Coal, dominantly thin- to thick-banded; thin clayey streaks 175' 3/4" to 175' 1-1/4" included in Bureau of Mines sample. TE sample No. 15.

175' 8-1/2"
Coal, dominantly thin- to thick-banded; carbonaceous clay at 176' 0" to 176' 3/4" included in Bureau of Mines sample; coal broken in coring 176' 3/4" to 176' 1-3/4". TE sample No. 16.

Bureau of Mines Sample D-90300

Hole 24 (cont.)

176' 4-1/4"	)
Clay, dark gray, 3/4" pyritic nodule at 176' 4-3/4" excluded from Bureau of Mines sample.	) Bureau of
176' 5-1/2"	) Mines
Coal, dominantly thin- to thick-banded. TE sample No. 17	) Sample
176' 8-1/2"	) D-90300
Clay, dark gray, thin carbonaceous streaks; excluded from Bureau of Mines sample.	)
176'10-1/4"	)
Coal, solid wood. TE sample No. 18 (0.001 U).	)
177' 1/2"	)
Clay, dark gray; thin carbonaceous streaks 177' 1/2" to 177' 2".	
177' 7"	
(Bottom of core submitted to Columbus Laboratory.	

General Notes: Core was received in good condition, moist as unpacked, with very little breakage in coring. Bureau of Mines samples may contain slight excess of moisture over bed conditions.

One half of the core was retained as reserve; core sampled for both Bureau of Mines and Trace Elements determinations represent riffle "splits" of crushed core from each described interval, 1/2 "split" for each interval being combined as bracketed to serve regular coal analytic purposes.

Eighteen small specimens taken from the core reserve have been stored under water for preparation of thin sections of attrital and woody coal.

Bureau of Mines Sample D-90297: 116' 0" to 118' 0"; interval 24"; rejected 0"; loss 0"; C.I.S. 2' 0".

Bureau of Mines Sample D-90298: 140' 6-1/2" to 142' 4"; interval 21-1/2"; rejected 0"; loss 0"; C.I.S. 1' 9-1/2".

Bureau of Mines Sample D-90299: 143' 6" to 146' 5-1/4"; interval 35-1/4"; rejected 4-1/4"; loss 0"; C.I.S. 2' 7".

Bureau of Mines Sample D-90300: 174'11" to 177' 1/2"; interval 35-1/4"; rejected 3"; loss 0"; C.I.S. 1'10-1/2".

Lignite core description by James M. Schopf, U. S.
Geological Survey Coal Geology Laboratory, Columbus, Ohio

SLIM BUTTES, HARDING CO., SOUTH DAKOTA
Bar H area

Hole 25

Location: C-SL-NE-NE-3-18N-8E Elevation: 3,177 feet

Date cored: 7/11-14/52 Date described: 7/18,21/52

27' 6"	(Top of core sent to Columbus Laboratory) Clay, dark gray; white clayey flecks 27' 8-1/4" to 27' 8-1/2" and 27' 9" to 27' 9-1/4".	
27' 9-1/2"	Coal, sparsely to moderately thin- to thick-banded; sparse white clayey flecks 28' 3" to 38' 4-1/4"; broken in coring from 28' 1/4" to 28' 3". TE sample No. 1 (0.008 U).	
28' 4-3/4"	Coal, abundantly thin- to thick-banded; solid wood 28' 7-1/8" to 28' 10-3/4"; 1/8" pyrite nodule at 29' 1". TE sample No. 2 (0.005 U).	Bureau of Mines Sample D-90758
29' 3"	Clay, medium gray; thin carbonaceous streaks 29' 3" to 29' 3-3/4"; excluded from Bureau of Mines sample.	
29' 11"	Coal, moderately to dominantly thin- to thick-banded; broken in coring from 29' 11" to 30' 0" and 30' 3-1/4" to 30' 6". TE sample No. 3 (0.008 U).	
30' 7-3/4"	Coal, moderately to abundantly thin- to thick-banded; pyrite flecks at 30' 8-1/2". TE sample No. 4 (0.005 U).	
31' 1/2"	2-1/2" loss in coring accumulated below 29' 11".	
31' 3"	Clay, carbonaceous, thin woody streaks 31' 6-1/4" and 31' 6-1/2"; 1/4" pyrite nodule at 31' 7-1/2".	
31' 8-1/2"	2' 2-1/2" core not shipped to laboratory; includes clay and siltstone described at drill site.	
33' 11"	Clay, gray; thin carbonaceous streaks 34' 1/4" and 34' 1-1/2".	
34' 3"	Coal, moderately thin- to thick-banded; 1/16" to 1/4" fusain streaks 34' 9" to 34' 10-3/8"; broken in coring from 34' 3-1/4" to 34' 4-1/2". TE sample No. 5 (0.002 U).	Bureau of Mines Sample D-90759
34' 10-3/8"	Coal, moderately thin- to thick-banded. TE sample No. 6 (0.001 U).	
35' 7"	1" loss in coring accumulated below 34' 3".	

Hole 25 (cont.)

35' 8" (Pull at this depth)
Coal, sparsely to moderately thin- to medium-banded; 1/16" to 1/4" fusain streaks 35' 8-1/2", 35' 10-1/2" to 36' 1/2"; solid wood 36' 1-3/4" to 36' 3-1/2". TE sample No. 7 (0.001 U).

36' 3-1/2"
Coal, abundantly thin- to thick-banded; 1/16" fusain streaks 36' 9-3/4" to 37' 0"; broken in coring from 36' 8" to 36' 9-3/4". TE sample No. 8 (0.001 U). Bureau of Mines Sample D-90759

37' 1-1/4"
Coal, moderately to dominantly thin- to thick-banded; broken in coring from 37' 1-1/4" to 37' 1-3/4" and 37' 5-3/4" 37' 10". TE sample No. 9 (0.001 U).

37' 10"
Coal, moderately thin- to thick-banded; 1/16" to 1/4" fusain streaks 38' 0" to 38' 2" and 38' 3-3/4" to 38' 5-1/2) 1/16" pyrite nodule 38' 5-3/4". TE sample No. 10 (0.001 U.)

38' 6"
Clay, silty, medium gray; thin woody streaks 38' 8".

38' 9"
21' 4" core not shipped to laboratory; no field data given.

60' 1"
Clay, dark gray; tiny mica flakes 60' 1" to 60' 2"; thin woody streaks at 50' 3-1/4", 60' 7-1/4" and 60' 6-3/4".

60' 7-1/4"
Coal, sparsely to moderately thin- to thick-banded; broken in coring from 60' 7-1/4" to 61' 1/2". TE sample No. 11.

61' 4"
Clay, silty, medium gray; thin woody streaks 61' 4" to 61' 4-1/2", 61' 5-1/4", 61' 5-1/2".

61' 7"
8' 8" core not shipped to laboratory; includes silty clay described at drill site.

70' 3"
Clay, silty, medium gray.

70' 8-1/2"
Coal, moderately to abundantly thin- to thick-banded; two 1/4" pyrite nodules 70' 8-1/2" to 70' 9"; thin fusain streaks 71' 1-1/2" to 72' 2-1/4". TE sample No. 12.

71' 3"
2" loss in coring accumulated below 70' 8-1/2".

71' 5"
Clay, gray, carbonaceous 71' 5" to 71' 5-3/4", 71' 6" to 71' 6-1/4", 71' 8-1/4" to 71' 9-1/4", dark brown 71' 11" to 72' 2"; thin woody streaks 71' 9-1/4" to 71' 9-1/2"; 72' 0" to 72' 1/2".

72' 2"
Impure coal, sparsely thin-banded with intercalated carbonaceous clay; broken in coring from 72' 2" to 72' 4-1/2".

Hole 25 (cont.)

72' 4-1/2"
1/2" loss in coring accumulated below 72' 2".

72' 5"
Clay, medium brown gray.

72'10"
18' 2" core not shipped to laboratory; includes siltstone and clay described at drill site.

91' 0"
Clay, medium brown to gray; thin woody streaks 91' 3" to 91' 4-1/4".

91' 4-1/4"
Coal, sparsely to moderately thin- and thick banded; broken in coring from 91' 7" to 91' 7-1/2". TE sample No. 13.

91' 8-3/4"
Impure coal, sparsely thin-banded with intercalated carbonaceous clay; white clayey streaks 91' 9-1/2" to 91' 10".

91' 11"
Clay, medium gray; carbonaceous with white clayey streaks 91' 11-1/2" to 92' 0"; 1/2" oblique coaly layer containing thin woody streaks 92' 1" to 92' 4".

92' 5"
(Bottom of core submitted to Columbus laboratory).

General Notes: Core was received in good condition, moist as unpacked, with some breakage in coring. Bureau of Mines samples may contain slight excess of moisture over bed conditions.

One half of the core was retained as reserve; core sampled for both Bureau of Mines and Trace Elements determinations represent riffle "splits" of crushed core from each described interval, 1/2 "split" for each interval being combined as bracketed to serve regular coal analytic purposes.

Twenty-two specimens taken from the core reserve have been stored under water for preparation of thin sections of attrital and woody coal.

Bureau of Mines Sample D-90758: 27' 9-1/2" to 31' 3"; interval 41-1/2"; rejected 8"; loss 2-1/2"; C.I.S. 2' 7".

Bureau of Mines Sample D-90759: 34' 3" to 38' 6"; interval 51"; rejected 0"; loss 1"; C.I.S. 4' 2".

Lignite core description by James M. Schopf, U. S. Geological Survey Coal Geology Laboratory, Columbus, Ohio

SLIM BUTTES, HARDING CO., SOUTH DAKOTA
Bar H area

Hole 26

Location: C-NW-35-19N-8E — Elevation: 3,100 feet

Date cored: 7/17/52 — Date described: 7/22-23/52

29' 9" (Top of core sent to Columbus Laboratory). Clay, medium gray, contains thin woody streaks 30' 3" to 30' 4-5/8".

30' 4-5/8"
Coal, sparsely thin and moderately medium-banded; solid wood 30' 4-5/8" to 30' 5-1/2"; 1" pyrite nodule 30' 9" to 30' 10"; broken in coring from 30' 6-1/2" to 31' 1". TE sample No. 1 (0.001 U).

31' 1"
Coal, sparsely thin- and medium-banded; broken in coring from 31' 1-1/4" to 31' 9". TE sample No. 2 (0.001 U).

31' 9"
Coal, sparsely thin- and medium-banded; 1/16" to 1/4" fusain streaks 32' 1-1/2" to 32' 3-1/2". TE sample No. 3.

32' 6"
Coal, sparsely thin- and medium-banded; 1" pyrite nodule 32' 7-1/2" to 32' 8-1/2". TE sample No. 4.

32' 10-1/2"
Coal, sparsely thin- and medium-banded; solid wood 33' 2-1/2" to 33' 5-1/4"; broken in coring 33' 1-1/2" to 33' 2-1/2". TE sample No. 5. — Bureau of Mines Sample D-90760

33' 5-1/4"
Coal, sparsely thin- and medium-banded; broken in coring 33' 5-1/4" to 33' 9". TE sample No. 6.

33' 9"
1" loss in coring accumulated below 30' 4-5/8".

33'10"
Coal, sparsely thin-, medium-, and thick-banded; 3/8" pyrite nodule 33' 10" to 33' 10-3/8"; broken in coring 33'10" to 34' 4-3/4". TE sample No. 7.

34' 4-3/4"
Coal, moderately thin- and medium-banded, sparsely thick-banded. TE sample No. 8.

34'11-1/2"
Coal, dominantly medium-banded, sparsely thin-banded; 1/16" to 1/4" fusain streaks 35' 4" to 35' 6". TE sample No. 9.

35' 6"
Coal, sparsely thin- and medium-banded; 1/16" to 1/4" fusain streaks 35' 7-1/4" to 35' 8-1/2". TE sample No. 10.

Hole 26 (cont.)

36' 0"

Coal, moderately medium-banded and sparsely thin- and thick-banded; solid wood 36' 1-1/2" to 36' 2-1/2"; 1/4" fusain streaks 36' 8-1/2" to 36' 9-1/2". TE sample No. 11.

36' 7-1/2"

Coal, sparsely medium-banded; solid wood 36' 10-1/2" to 37' 4". TE sample No. 12. — Bureau of Mines Sample D-90760

37' 4"

Coal, moderately medium-banded, sparsely thin- and thick-banded; 3/4" pyrite nodule 37' 4-1/4" to 37' 5"; 1/16" to 1/4" fusain streaks 37' 6-1/2" to 37' 8-1/2". TE sample No. 13.

37'10-1/2"

Coal, sparsely thin-, medium-, and thick-banded; 1" pyrite nodule 38' 3-1/2" to 38' 4-1/2". TE sample No. 14.

38' 5"

Clay, carbonaceous; thin pyritic streaks 38' 5-1/4".

38' 6-1/2"

Clay, medium gray; small pyrite nodules and flecks 38' 7" to 38' 7-1/2", 38' 9-1/2" to 38'10", 38'11-1/4" to 39'.

39' 1"

Clay, medium gray; 1/8" pyrite nodule 39' 5-1/2".

39' 6-1/2"

21' 7-1/2" core not shipped to laboratory; no field data given.

61' 2"

Clay, silty, medium dark gray; 1/16" gray sandy streaks throughout unit.

61' 8"

Clay, silty, medium to dark gray, carbonaceous 62' 2" to 62' 2-1/2".

62' 2-1/2"

Coal, moderately thin-banded, sparsely medium-banded; broken in coring from 62' 3" to 62' 4-1/2" and 62' 8-1/2" to 62'10-3/4". TE sample No. 15.

62'10-3/4"

Coal, sparsely thin-, medium-, and thick-banded; solid wood 63' 3/4" to 63' 1-3/4"; 1/16" to 1/2" fusain streaks 62'11-1/4" to 63' 3/4". TE sample No. 16. — Bureau of Mines Sample D-90761

63' 7-1/2"

Coal, abundantly medium-banded, sparsely thin- and thick-banded. TE sample No. 17.

63'11-1/4"

2-3/4" loss in coring accumulated below 62' 2-1/2".

64' 2"

Clay, gray, brown; thin to medium woody streaks 64' 3" to 64' 6".

Hole 26 (cont.)

64' 7-1/4"
Clay, silty, light to medium gray.
65' 0"
(Bottom of core submitted to Columbus Laboratory).

General Notes: Core was received in good condition, moist as unpacked, with a good deal of breakage in coring. Bureau of Mines samples may contain slight excess of moisture over bed conditions.

One half of the core was retained as reserve; core sampled for both Bureau of Mines and Trace Elements determinations represent riffle "splits" of crushed core from each described interval, 1/2 "split" for each interval being combined as bracketed to serve regular coal analytic purposes.

Twenty-nine specimens taken from the core reserve have been stored under water for preparation of thin sections of attrital and woody coal.

Bureau of Mines Sample D-90760: 30' 4-5/8" to 38' 5"; interval 96-3/8"; rejected 0"; loss 1"; C.I.S. 7'11-3/8".

Bureau of Mines Sample D-90761: 62' 2-1/2" to 64' 2"; interval 24-1/2"; rejected 0"; loss 2-3/4"; C.I.S. 1' 9-3/4".

Lignite core description by James M. Schopf, U. S.
Geological Survey Coal Geology Laboratory, Columbus, Ohio

SLIM BUTTES, HARDING CO., SOUTH DAKOTA
Bar H area

Hole 27

Location: C-WL-NW-NE-35-19N-8E Elevation: 3,085 feet

Date cored: 7/17/52 Date described: 7/23-24/52

10' (Top of core sent to Columbus Laboratory).
Coal, pulverized in coring. TE sample No. 1 (0.001 U).

10' 2-3/4"
Coal, pulverized and mixed with chocolate-brown clay in coring; thin jarosite streaks 10' 3-3/4" to 10' 4-1/2".

10' 5"
Clay, chocolate brown; thin jarosite streaks 10' 5-1/2", 10' 7-1/4".

10' 8"
Sand, fine grained, yellow-brown stained.

10'10-1/4"
Clay, chocolate brown with intercalated yellow sandy streaks.

11' 6"
33' 9" core not submitted to laboratory; includes siltstone and gray clay described at drill site.

45' 3"
Clay, silty, dark gray.

45' 7-1/4"
Coal, sparsely thin-, medium-, and thick-banded; 1/4" pyrite nodule at 46' 1/4". TE sample No. 2.

46' 5"
Coal, sparsely thin-, medium-, and thick-banded; 1/2" pyrite nodule 46'11-3/4" to 47' 1/4". TE sample No. 3.

47' 2"
Coal, moderately thin-banded, sparsely medium-banded; irregular 1-3/4" pyrite nodule 47' 2" to 47' 3-3/4". TE sample No. 4.

47'10"
2" loss in coring accumulated below 45' 7".

(Bureau of Mines Sample D-90762)

48' 0"
Clay, dark gray; carbonaceous streaks 48' 0" to 48' 1/2".

48' 7"
Clay, dark gray; thin woody streaks 49' 1".

49' 2"
Clay, dark gray.

49' 4-1/2"
Clay, dark gray.

50' 1-1/2"
Coal, sparsely thin- and medium-banded; broken in coring 50' 1-1/2" to 50' 4".

Hole 27 (cont.)

50' 4"
Clay, gray.
50' 6-1/2"
(Bottom of core submitted to Columbus Laboratory).

General Notes: Core was received in good condition, moist as unpacked, with considerable breakage in coring. Bureau of Mines sample may contain slight excess of moisture over bed conditions.

One half of the core was retained as reserve; core sampled for both Bureau of Mines and Trace Elements determinations represent riffle "splits" of crushed core from each described interval, 1/2 "split" for each interval being combined as bracketed to serve regular coal analytic purposes

Bureau of Mines Sample D-90762: 45' 7-1/4" to 48' 0"; interval 28-3/4"; rejected 0"; loss 2"; C.I.S. 2' 2-3/4".