

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Preliminary Report of Coal Exploration Drilling in the Broadus Area,
Powder River County, Montana during 1978

by

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Open-File Report 79-965
1979

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

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Introduction

In 1978 the U.S. Geological Survey conducted the initial phase of a coal exploratory drilling program in the southern part of Powder River County, Montana (fig. 1) that resulted in 4,027 feet (1,228 m) of rotary drilling at nine sites northeast of Moorhead Montana. The purpose of this report is to make available the geophysical and sample logs obtained during the drilling program.

Geophysical logs were obtained from the nine coal exploratory holes completed in the study area. The suite of logs run generally included: natural gamma, gamma-gamma density, resistivity, and caliper. Of the 5,107 feet (1,557 m) of geophysical logs obtained from the study area, 1,172 feet (357 m) of log data was obtained from pre-existing water wells and 3,935 feet (1,200 m) was obtained from the nine U. S. Geological Survey coal exploratory holes.

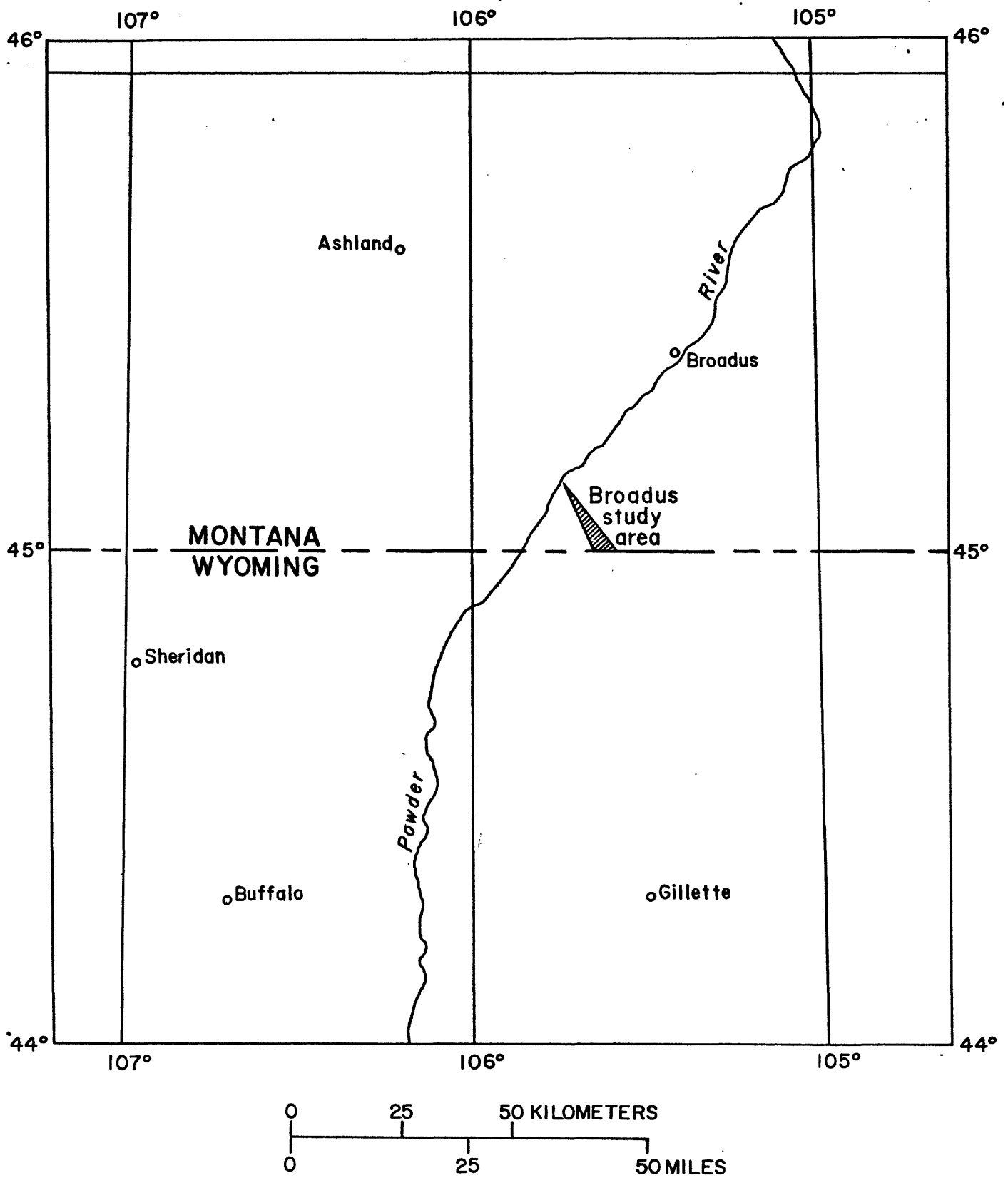


Figure 1.--Index map showing location of Broadus, Montana study area

Acknowledgments

Robert G. Hobbs was project geologist, Richard N. Babcock was field coordinator and George A. Correia and Laura N. Robinson provided assistance in over-seeing drilling operations. Steven J. Grant and Steven B. Roberts were the drillers for the U. S. Geological Survey. Four holes were logged by Goodwell Inc.

Previous Work

Coal deposits in the Broadus area are described by Bryson and Bass (1966). Exploratory drilling and surface mapping has been done in the study area by Matson and Blumer (1973, plate 18).

Geology and Geologic Setting

The Broadus, Montana study area is located on the northern flank of the Powder River Basin, bound on the south by the Wyoming-Montana border. The northeasterly flowing Powder River is a perennial stream that flows along the western border of the study area which is characterized by dissected highlands with a region dip of less than 5° to the southwest.

In the study area, economically important coal beds occur in the Tongue River Member of the Fort Union Formation. The coal-bearing rocks consist chiefly of light-gray to light-yellowish-gray or light-brown shale, sandstone, siltstone, and thin beds of limestone. A thick bed of bluish-green poorly consolidated fine-grained sandstone was frequently encountered during drilling and served as an excellent marker bed.

In most parts of the area, four coal beds were encountered during exploratory drilling. The lowest coal bed in the sequence averaged four feet (1.2 m) thick. It is overlain by 60 feet (18.3 m) of interburden to the base of a six foot (1.8 m) coal bed; 160 feet (48.8 m) of interburden to an 11 foot (3.4 m) coal bed and 30 feet (9.2 m) to the base of a four foot (1.2 m) coal bed.

No coring was done; however, the quality of the coal in the study area has been determined by Matson and Blumer (1973, p. 93) who collected 13 samples from a coal bed they called the T bed. The analysis of the samples as received indicated; 0.57 percent sulfur, 6.2 percent ash, and a heat value of 7120 B.T.U.

In the two southernmost exploratory holes (BCR-78-28 and 78M-BCR5), several locally thick coal beds were encountered stratigraphically higher in the section; this was an exception, however, and will not be discussed as these coal beds are burned out or pinched out in adjacent areas.

Locations of Holes

In general, drill sites were located about two miles (3.2 km) apart. Geophysical logs run on pre-existing water wells supplied sufficient subsurface data to increase the distance between some of the drill sites. In order to penetrate the largest number of coal beds present, drill sites were located on hills or ridges.

Drilling Equipment and Procedure

Drilling equipment used were medium truck-mounted units. When possible, air or mist was used to remove drill cuttings; however, high viscosity mud and additives were used to control problems with lost circulation and caving.

Thick, poorly consolidated sandstones were repeatedly encountered and caused the principle drilling problem because of caving. Numerous additives and high viscosity muds were used to maintain circulation and to build a supporting wall cake. These methods were generally time consuming but successful.

Carbide drag bits were most effective but local limestone stringers made it necessary to change over to a hard rock bit for short periods.

Geophysical Logs and description of cuttings

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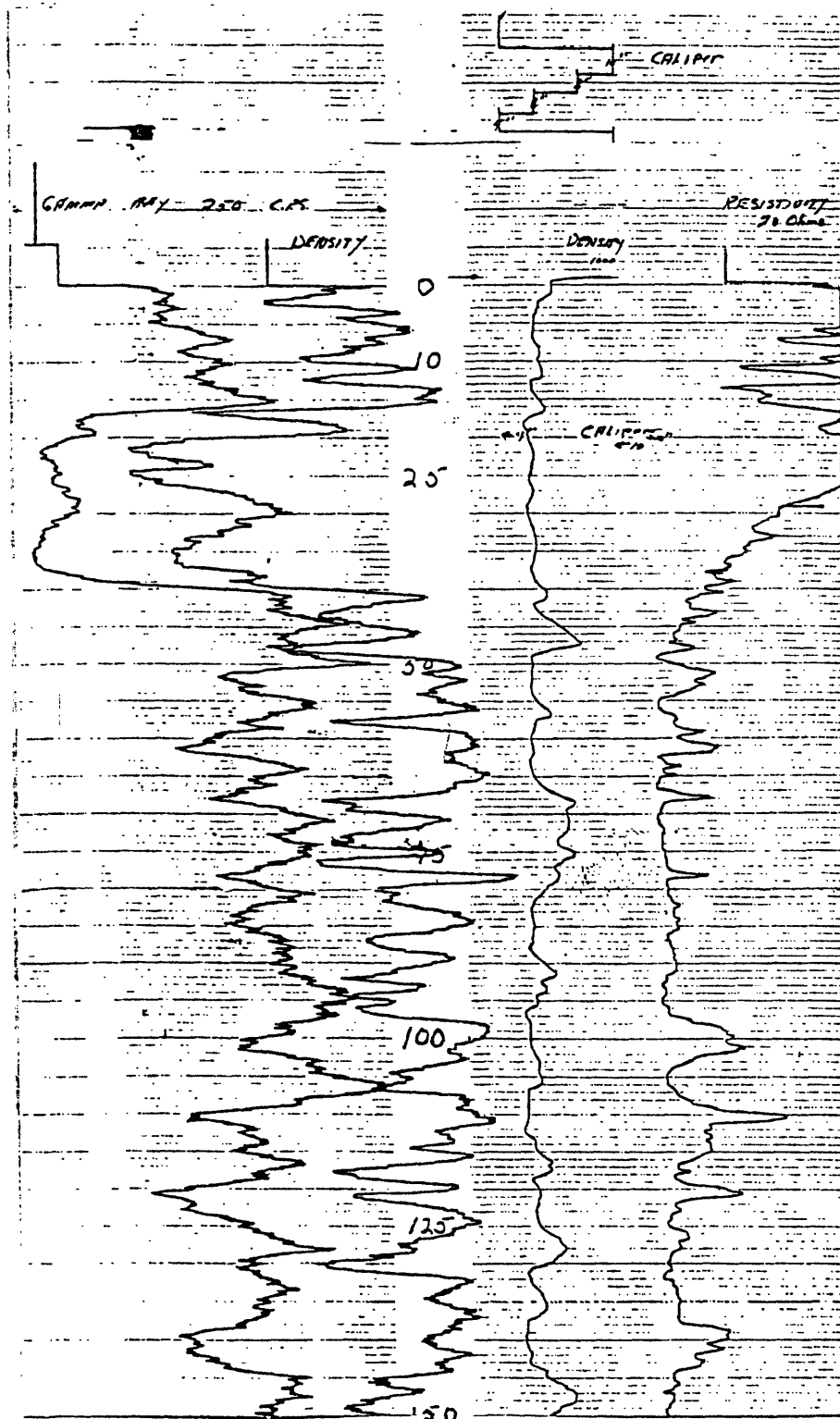
Project Broadus Hole number BCR-78-28 Quadrangle Bay Horse

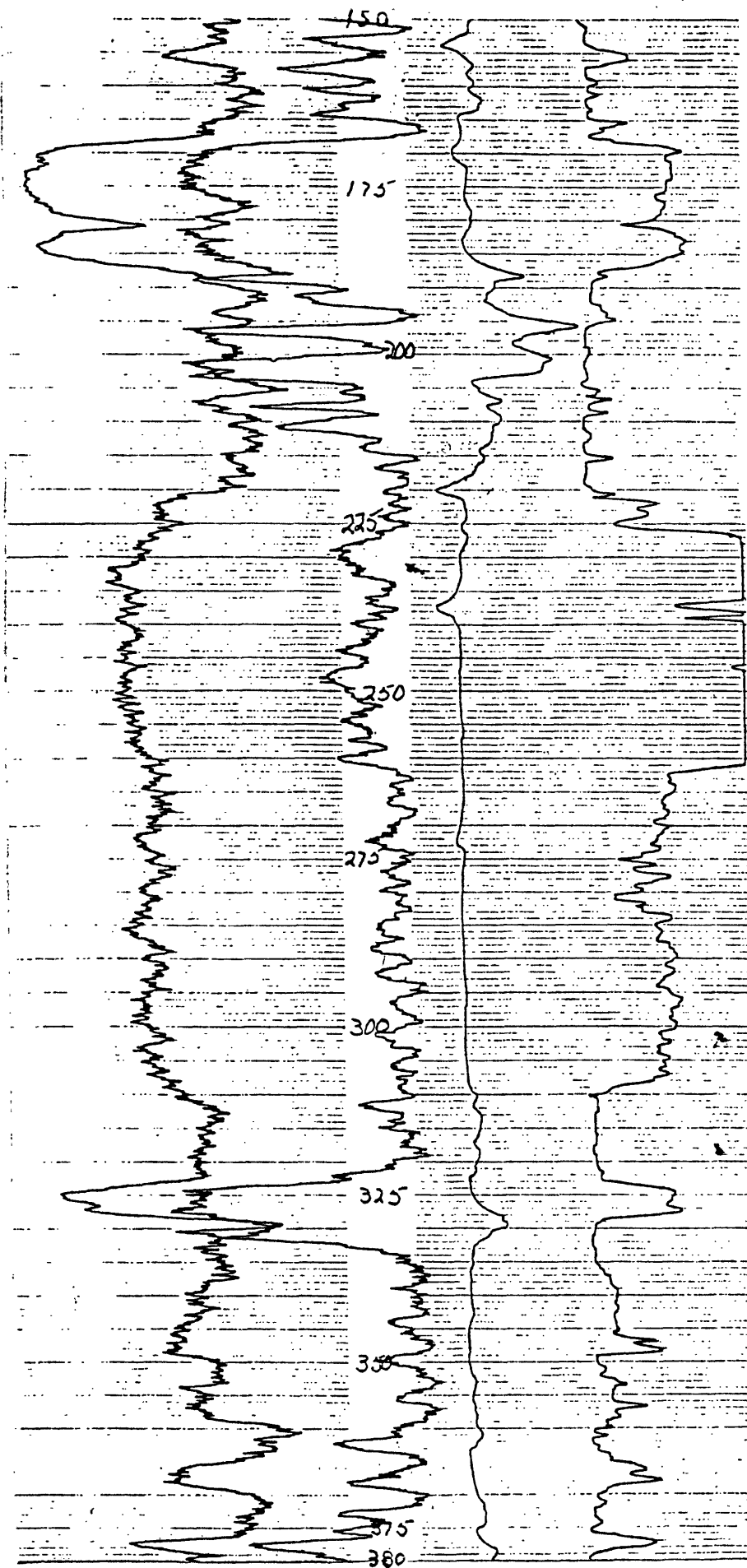
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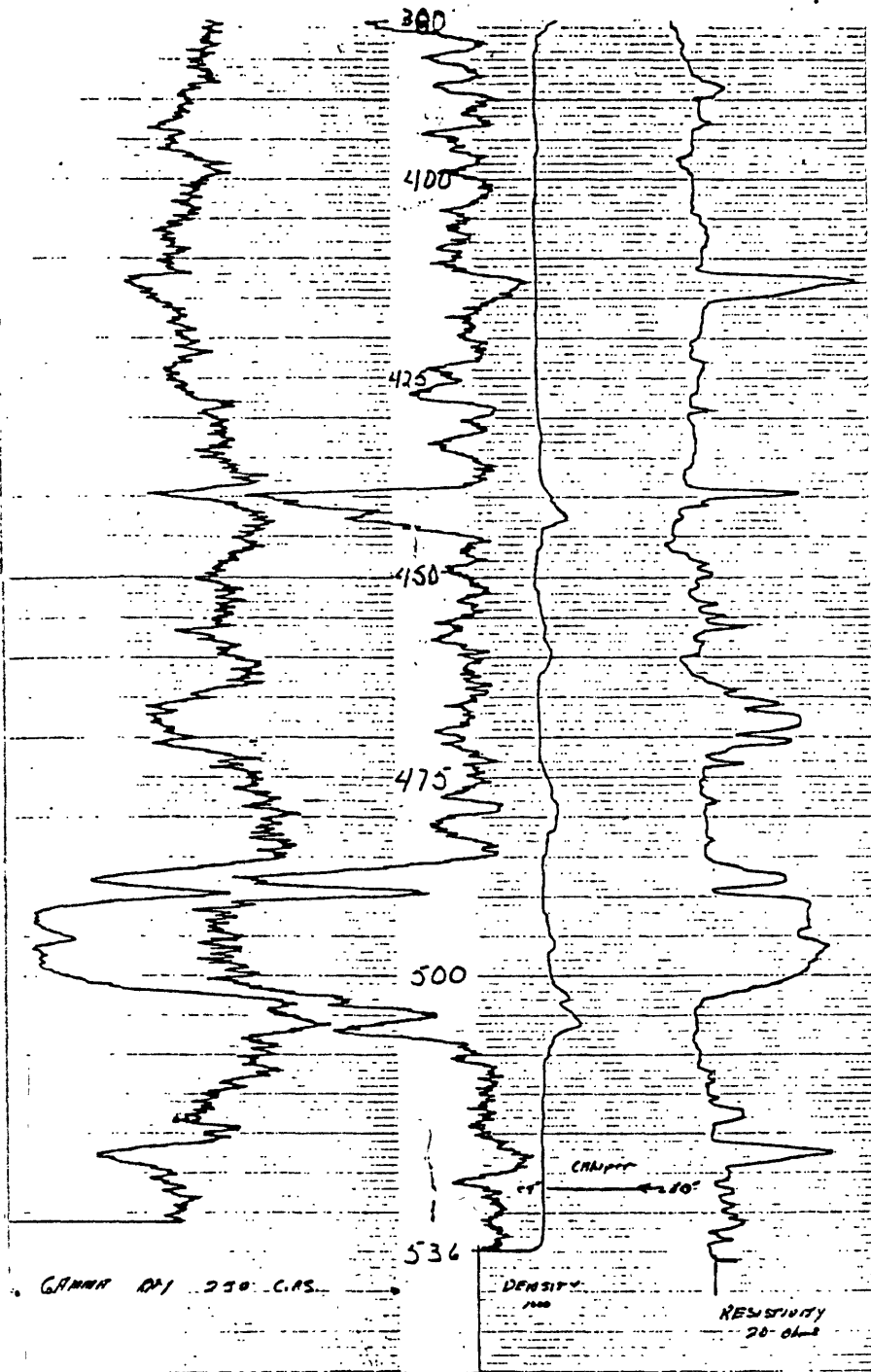
County/State Powder River, Mont. Surface Elevation (ft) 4035'

Interval logged 536' Logged by Goodwell Inc. Rotary footage 536'

Interval cored N/A







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Project Recluse

Hole No. BCR-78-28 Geologist J. Hardie

Type log. Cuttings Elev. 4035 ft. Total depth 536 ft.

Location 1600 F.N.L. 2400 F.W.L. Sec. 28 T. 9S R. 50E

Nearest town Bay Horse County Powder River State Mont. Quad. Bay Horse

Drilled by: _____

Driller(s): _____

Drill: Gardner Denver Date start Oct. 8, 1978 Complete Oct. 8, 1978

Non-core intervals and size hole: N/A

Cored intervals and size: Straight rotary

Remarks: _____

LOG				CORE			
From	To	Length	Description	No.	From To	Foot Rec'd	2 Rec'd
0	16		Detritus, brown, sandy				
16	40		Coal, dull-black, soft, highly oxidized				
40	51		Shale, gray with streaks of carbonaceous material				
51	54		Sandstone, light-gray, very fine grained				
54	57		Shale, gray				
57	62		Sandstone, light-gray, very fine grained				
62	66		Shale, gray, silty				
66	82		Sandstone, light-gray with minor shale partings				
82	92		Shale, light-gray, silty				
92	98		Shale, light-gray				
98	102		Sandstone, light-gray, very fine grained				
102	109		Shale, dark-brown, carbonaceous with coal-streaks				

LOG				CORE			
From	To	Length	Description	No.	From To	Foot Rec'd	7 Rec'd
109	112		Sandstone, light-gray, very fine grained				
112	119		Shale, gray, silty				
119	126		Sandstone, light-gray, very fine grained				
126	138		Shale, gray				
138	144		Sandstone, light-gray, very fine grained				
144	154		Shale, brown, carbonaceous				
154	157		Sandstone, light-gray, very fine grained				
157	168		Shale, gray with minor sandstone partings				
168	180		Coal, dull-black, soft				
180	181.5		Sandstone, light-gray, very fine grained				
181.5	187		Coal, dull-black, soft				
187	189		Sandstone, light-gray, very fine grained				
189	193		Shale, grayish-brown, carbonaceous				
193	221		Shale, light-gray with sandstone				
			partings				
221	286		Sandstone, grayish-brown, fine-grained,				
			well-sorted				
286	288		Limestone, gray, hard				
288	311		Sandstone, grayish-brown, fine-grained,				
			well-sorted				
311	323		Shale, blueish-green, soft				
323	329		Coal, dull-black, soft				
329	359		Shale, blueish-green, soft				
359	365		Shale, gray, hard				
365	369		Sandstone, light-gray, very fine grained				
369	377		Shale, gray, hard				
377	379		Sandstone, light-gray, very fine grained				
379	403		Shale, blueish-green, soft				
403	412		Shale, dark-gray, carbonaceous				
412	415		Limestone, gray, hard				
415	439		Shale, brownish-gray, silty				

Log Continuation:

Hole No.: BCR-78-28

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Project: Recluse

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U.S. Geological Survey

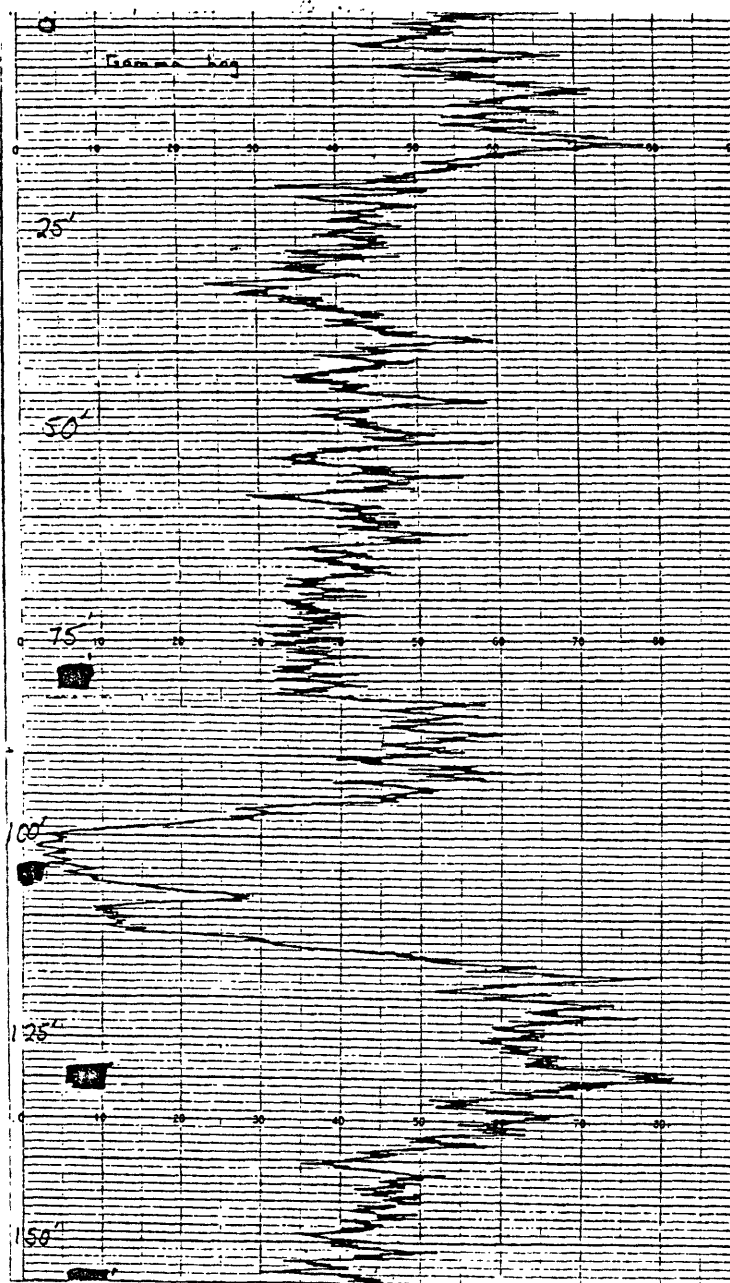
Project Broadus Hole number 78M-BCR5 Quadrangle Bay Horse

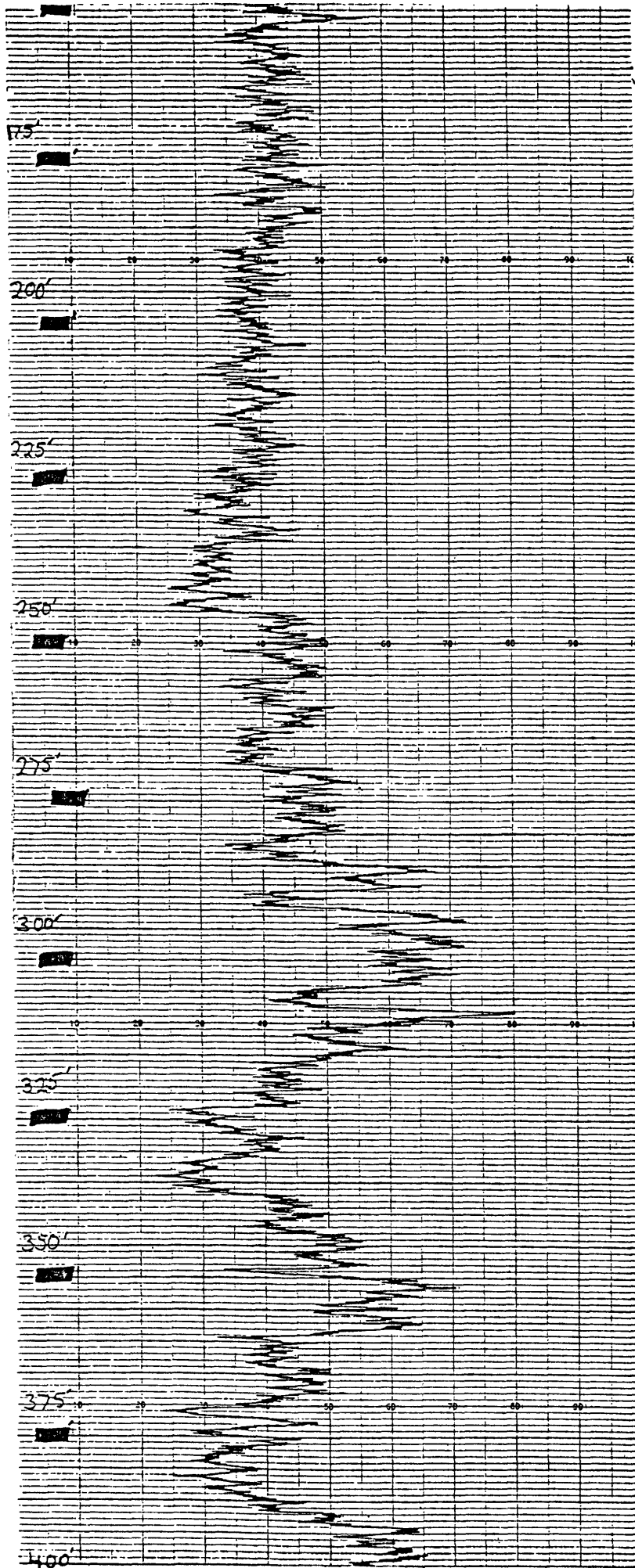
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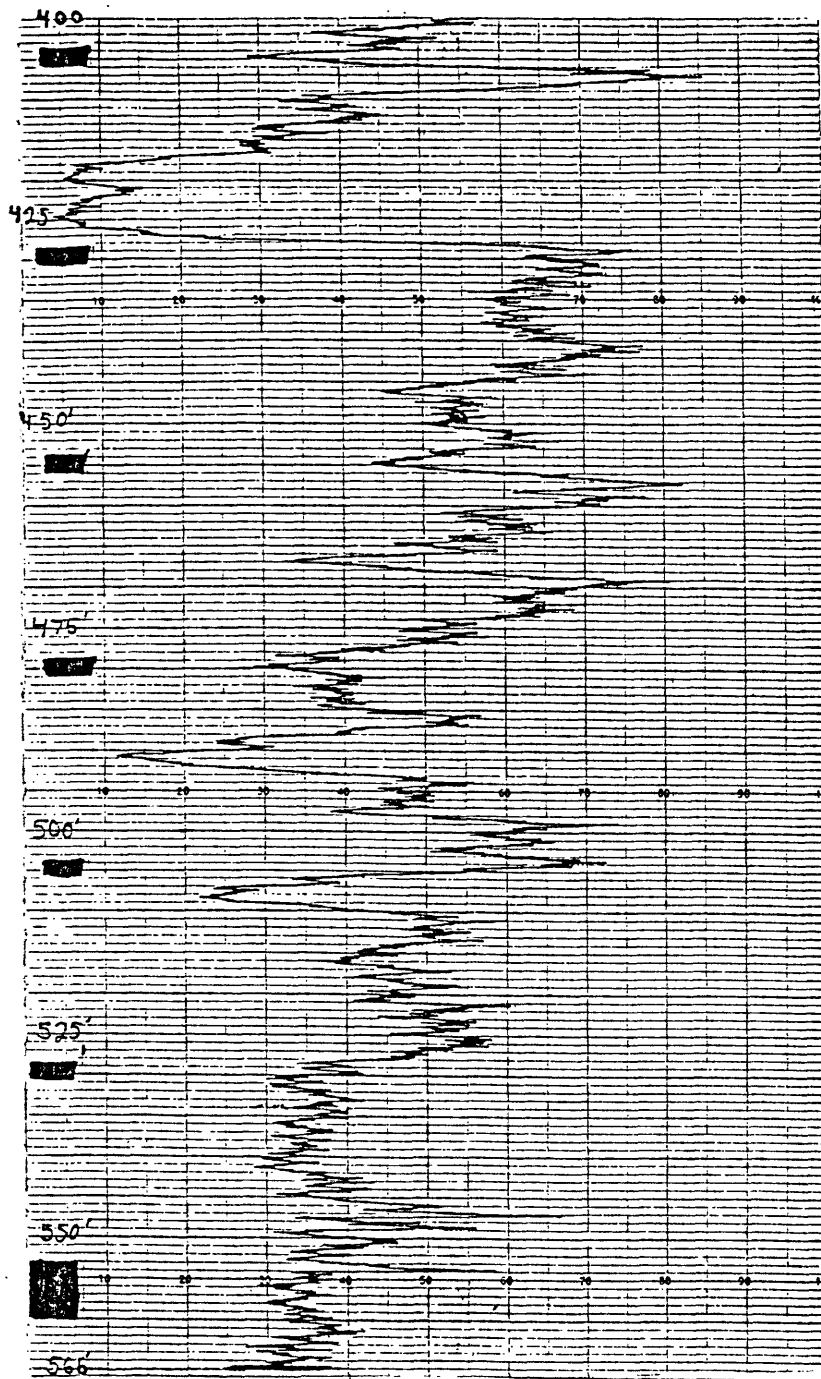
County/State Powder River, Mont. Surface Elevation (ft) 4010'

Interval logged 566' Logged by J. Hardie Rotary footage 566'

Interval cored N/A







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Project Broadus

Hole No. 78M - BCR5 Geologist J. Hardie

Type log. Cuttings Elev. 4010 ft. Total depth 566 ft.

Location 300 FEL 2150 FSL Sec. 21 T. 9S R. 50E

Nearest town Bay Horse County Powder River State Mont. Quad. Bay Horse

Drilled by: U.S.G.S. O.E.R.

Driller(s): Steve Grant

Drill: Porta drill Date start Sept. 2, 1978 Complete Sept. 3, 1978

Non-core intervals and size hole: N/A

Cored intervals and size: Straight rotary

Remarks: _____

LOG				CORE			
From	To	Length	Description	No.	From To	Foot Rec'd	1 Rec'd
0	13		Detritus, brown, sandy				
13	16		Shale, brown, soft				
16	26		Sandstone, light-brown, fine-grained, well-sorted				
26	28		Coal, shiny black, hard				
28	33		Shale, black, carbonaceous				
33	63		Sandstone, light-brown, very fine grained, moderate- to well-sorted with minor shale partings				
63	83		Sandstone, light-brown, fine-grained, well-sorted				
83	98		Shale, dark-gray, hard				
98	106.5		Coal, black, hard				
106.5	108		Sandstone, light-gray, very fine grained				
108	112		Coal, dull-black, soft				

Log Continuation:

Hole No.: 78M - BCR5

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Project: Broadus

LOG				CORE			
From	To	Length	Description	No.	From To	Foot Rec'd	Z Rec'd
112	138		Shale, light-gray, silty				
138	290		Sandstone, light-gray, very fine grained,				
			well-sorted				
290	294		Shale, gray, hard				
294	298		Sandstone, light-gray, very fine grained				
298	309		Shale, gray, hard				
309	313		Sandstone, light-gray, very fine grained				
313	315		Shale, blueish-green, soft				
315	318		Shale, blueish-green, silty				
318	320		Shale, blueish-green, soft				
320	355		Sandstone, light-gray, very fine grained,				
			argillaceous				
355	363		Shale, blueish-green, soft				
363	369		Shale, blueish-green, sandy				
369	372		Shale, brown, carbonaceous				
372	375		Shale, gray with coal streaks				
375	377		Limestone, blueish-green, hard				
377	379		Shale, gray, sandy				
379	392		Sandstone, blueish-green, fine-grained,				
392	397		Shale, brownish-gray, hard				
397	402		Shale, dark-brown to black, carbonaceous				
402	404		Sandstone, light-brown, very fine grained				
404	405.5		Coal, dull-black, soft				
405.5	409		Shale, brown, hard				
409	417		Sandstone, grayish-brown, very fine grained				
			with coal streaks				
417	421		Coal, dull-black, shaly				
421	422		Sandstone, light-gray				
422	428		Coal, black, hard				
428	440		Shale, brown, carbonaceous				
440	445		Shale, gray, hard				

Log Continuation:

Hole No.: 78M - BCR5

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Project: Broadus

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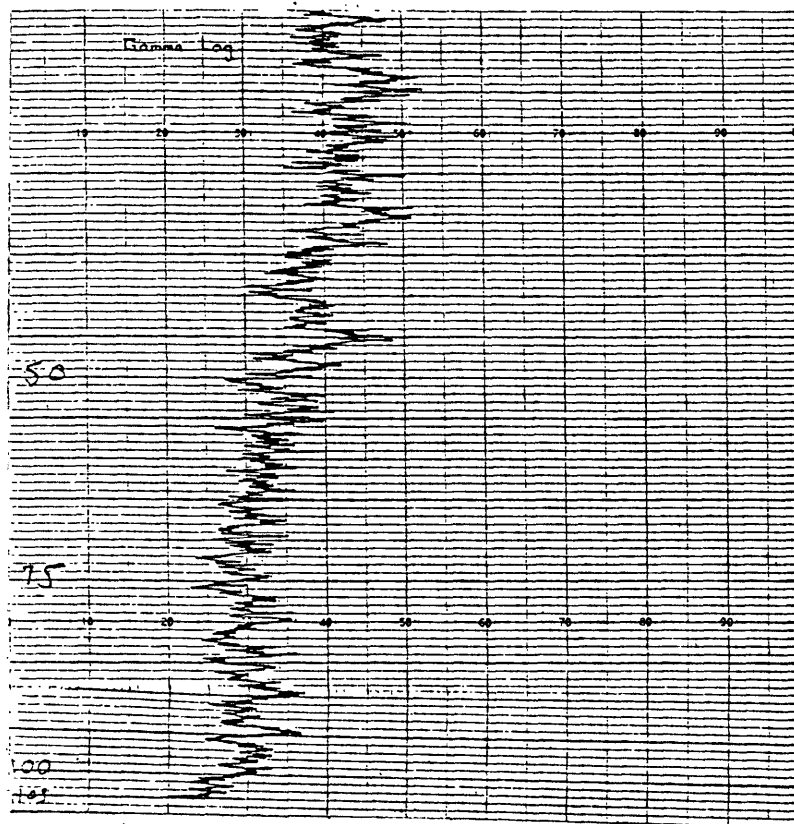
Project Broadus Hole number W78M-BCR1 Quadrangle Bay Horse

Location SE - SW Sec. 20 T. 9S R. 50E

County/State Powder River, Mont. Surface Elevation (ft) 3825'

Interval logged 104' Logged by R. Babcock Rotary footage N/A

Interval cored N/A Existing water well



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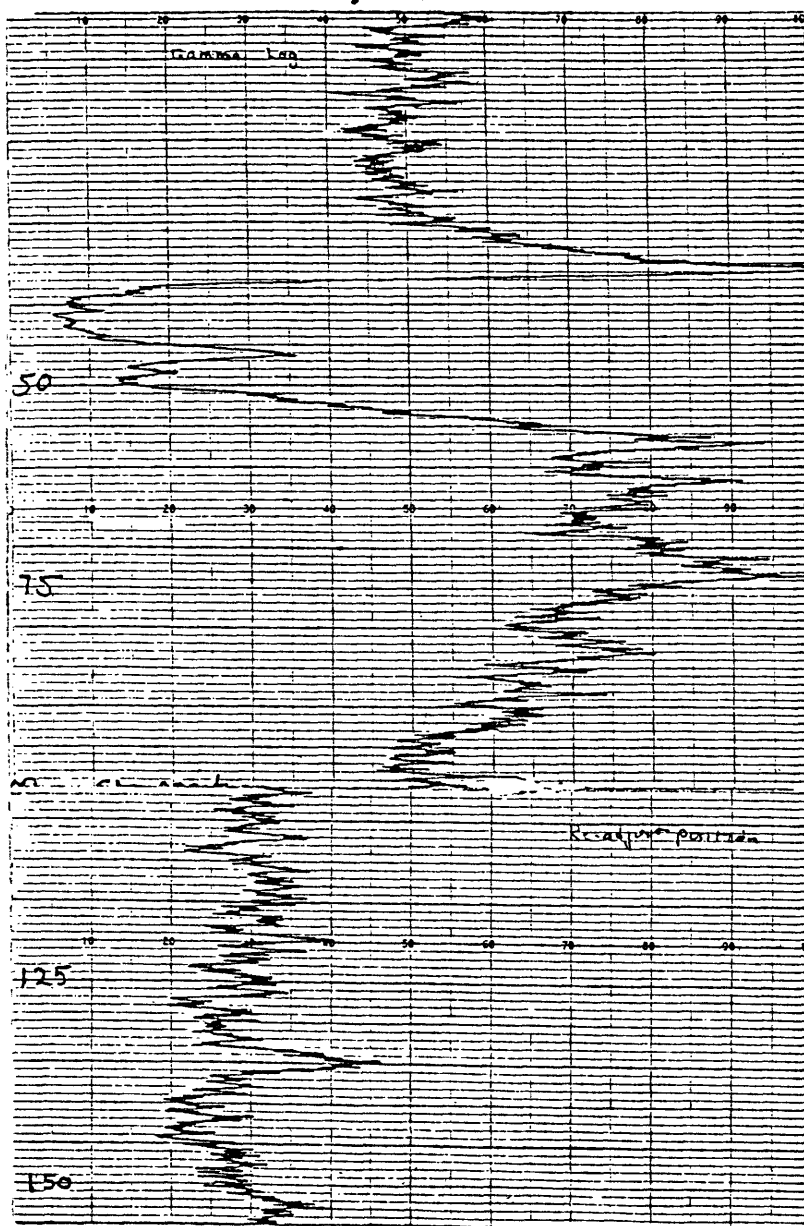
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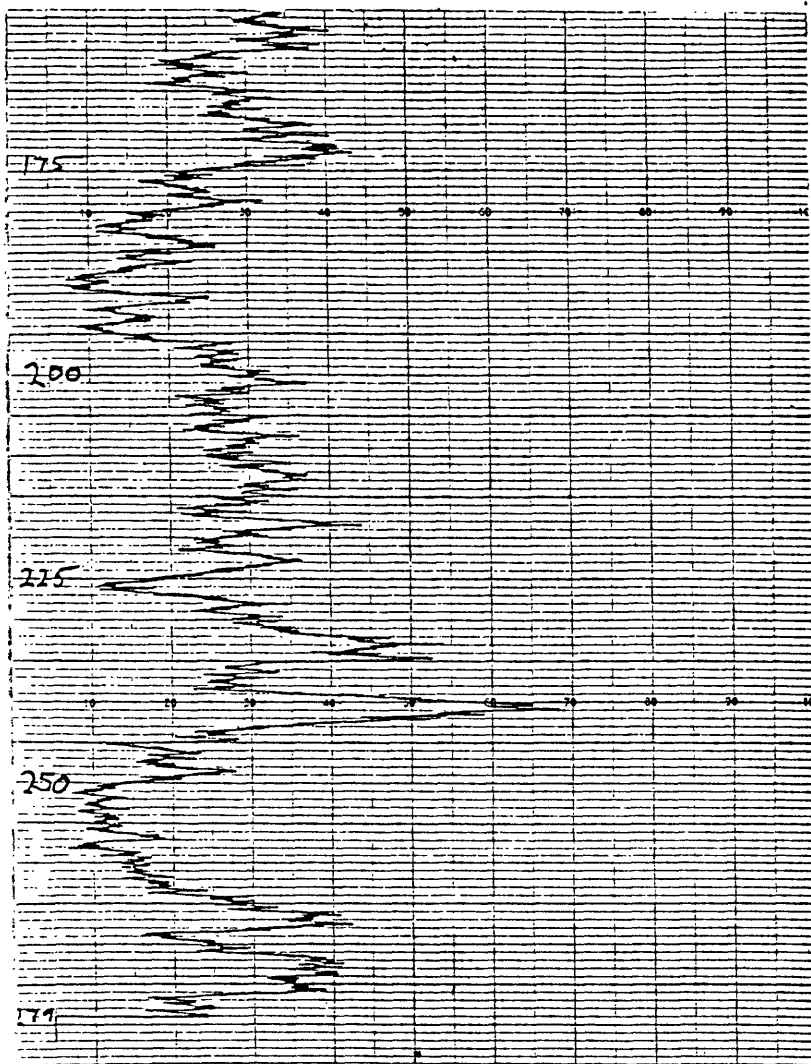
Location NE - NE Sec. 20 T. 9S R. 50E

County/State Powder River, Mont. Surface Elevation (ft) 3950⁺

Interval logged 279' Logged by R. Babcock Rotary footage N/A

Interval cored N/A Existing water well





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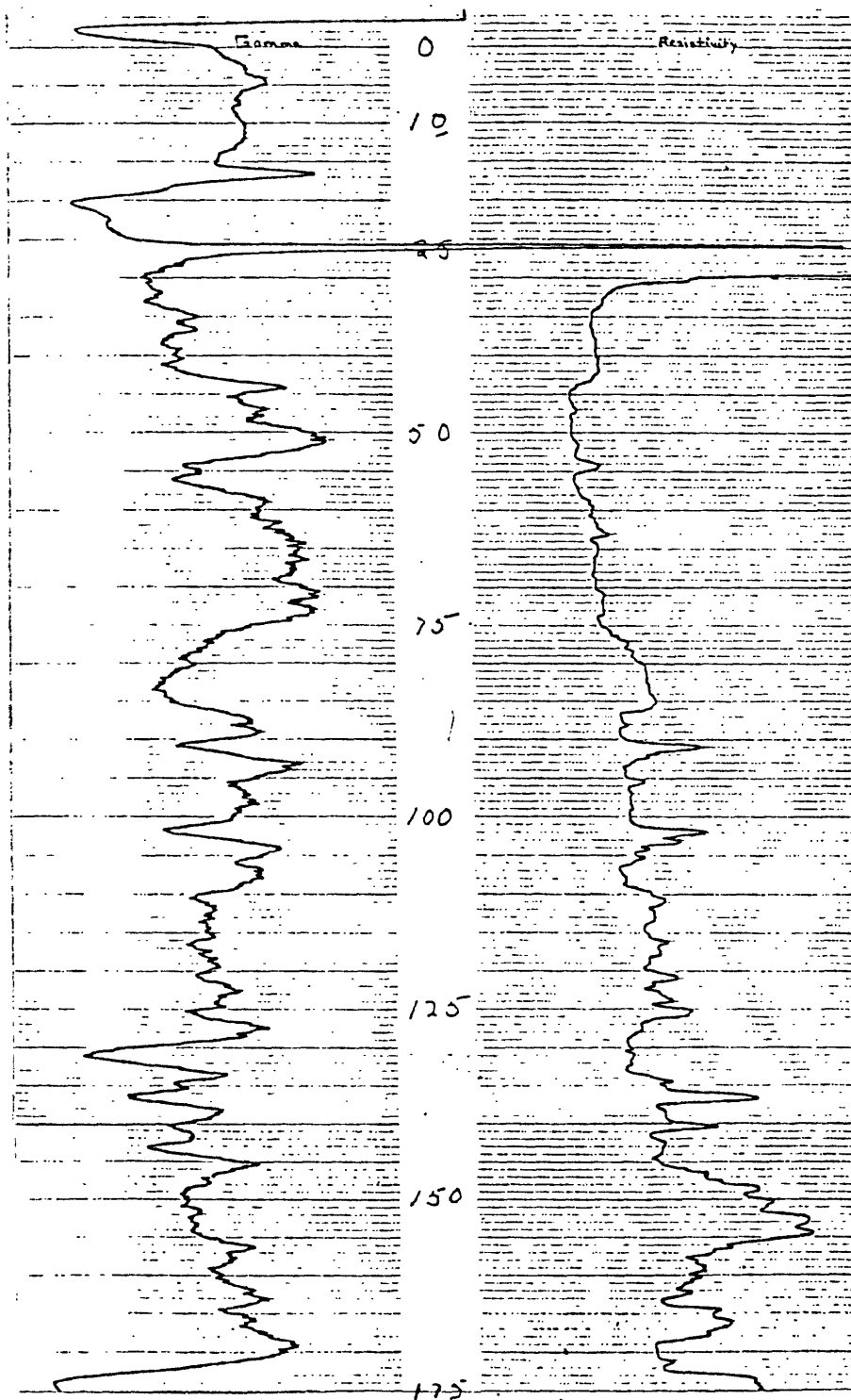
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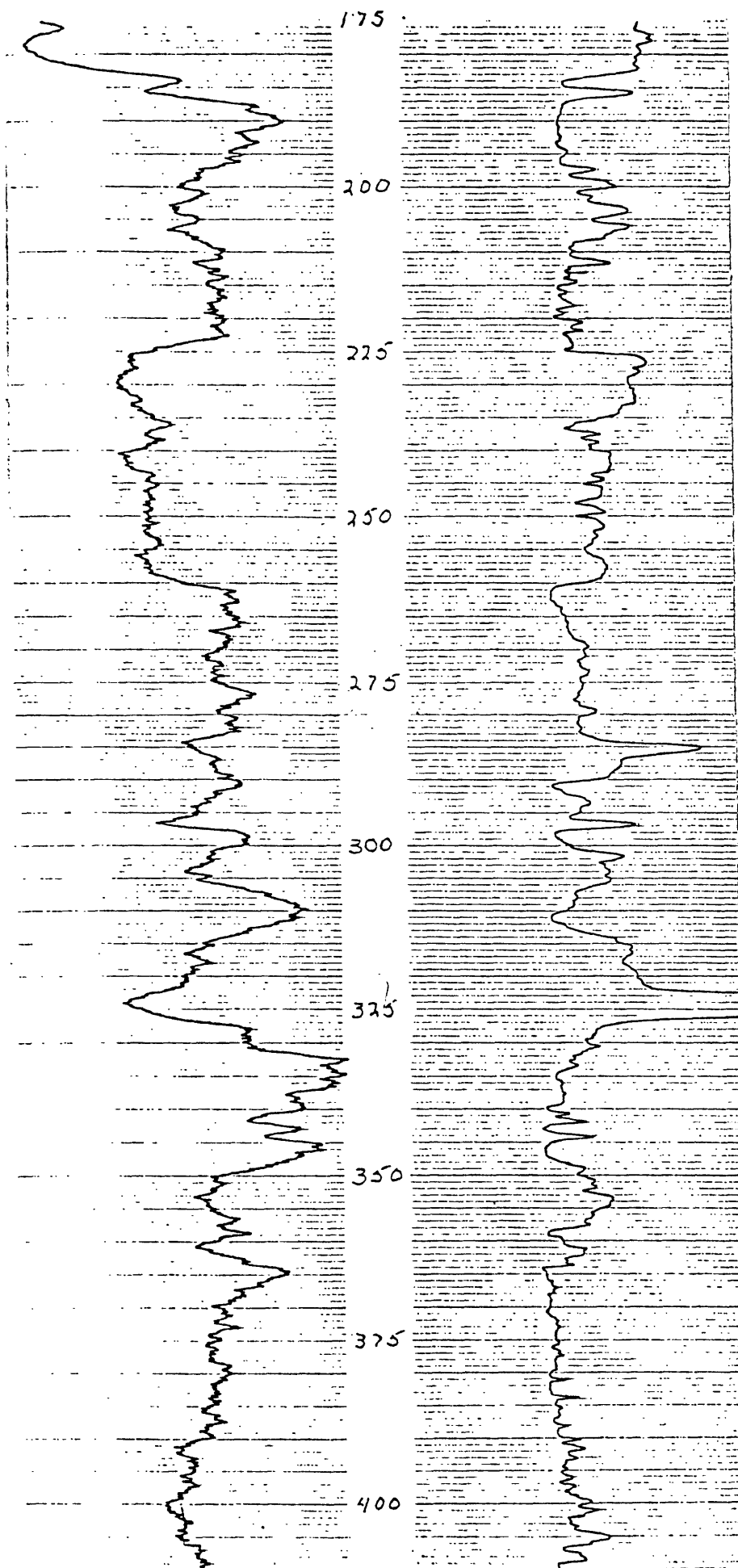
Location SE - SE Sec. 9 T. 9S R. 50E

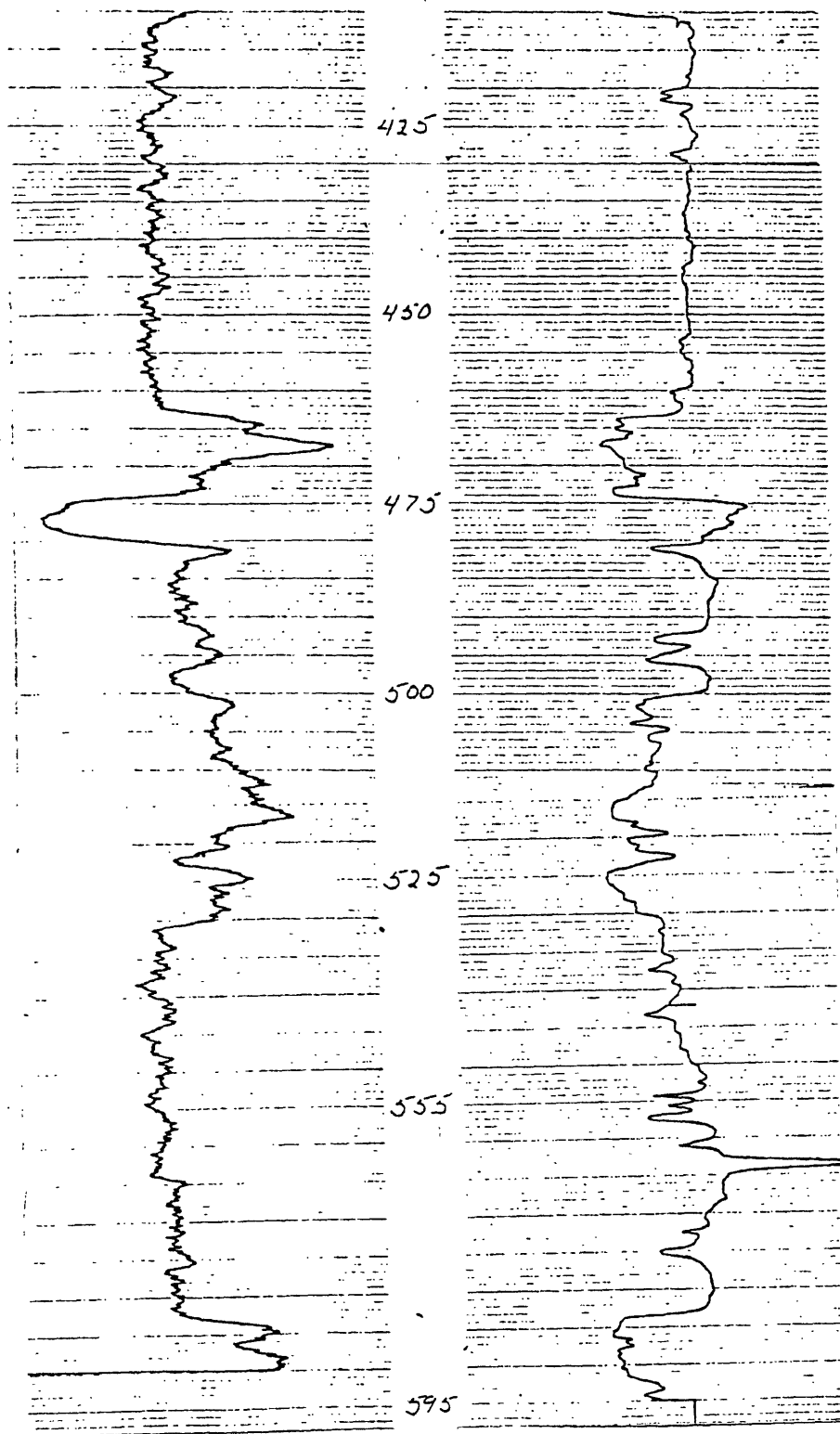
County/State Powder River, Mont. Surface Elevation (ft) 3760'

Interval logged 595' Logged by Goodwell Inc. Rotary footage 595'

Interval cored N/A







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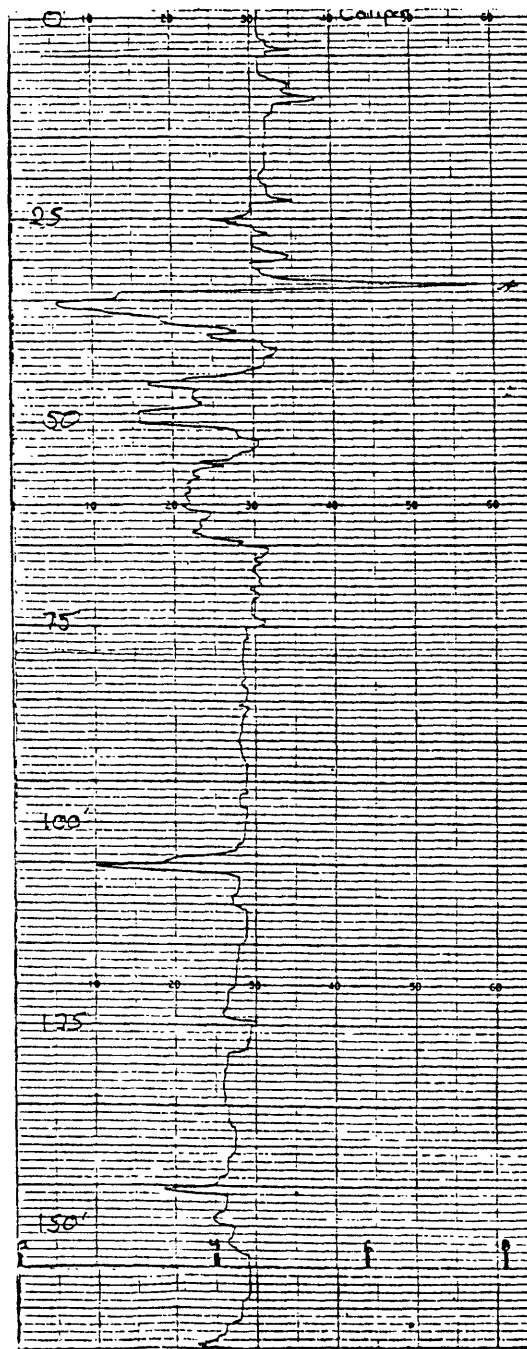
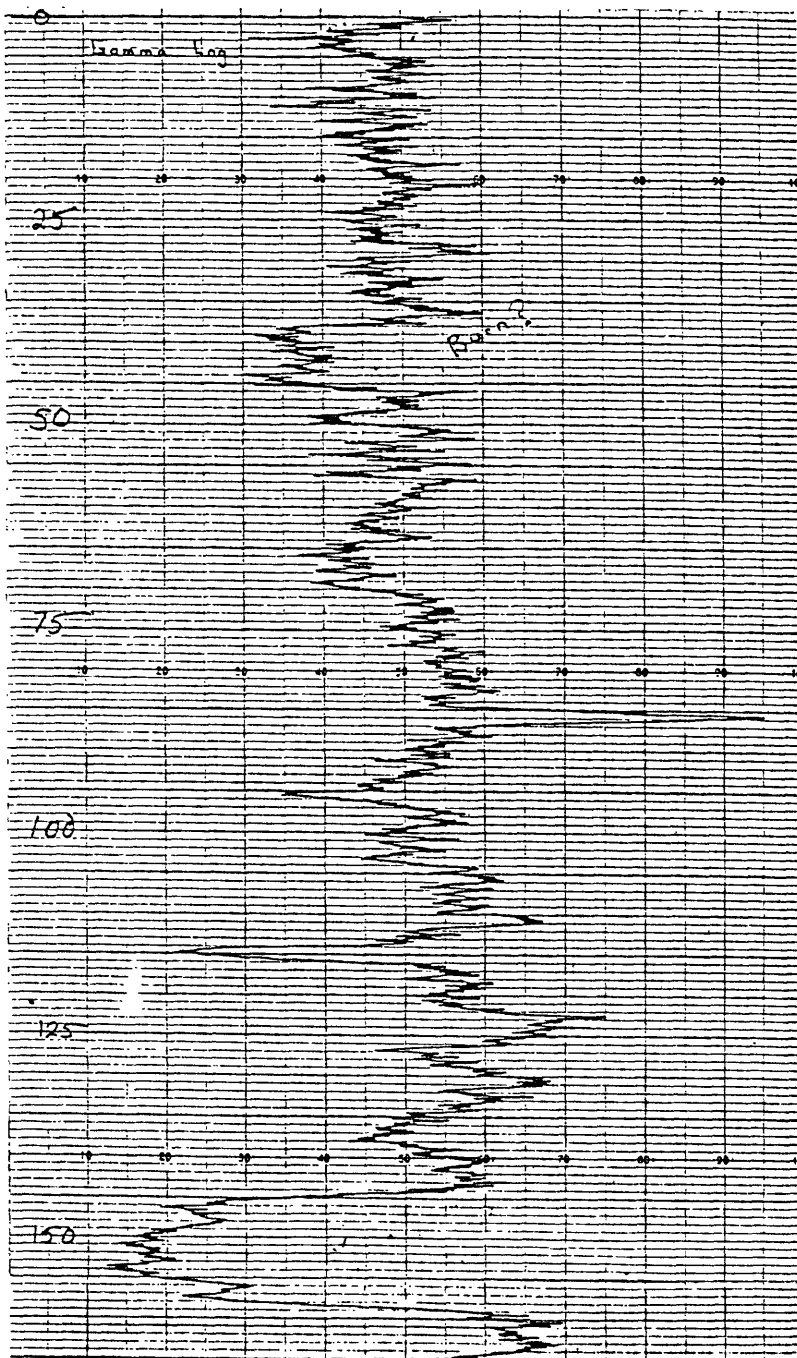
Project Broadus Hole number 78M-BCR6 Quadrangle Bay Horse

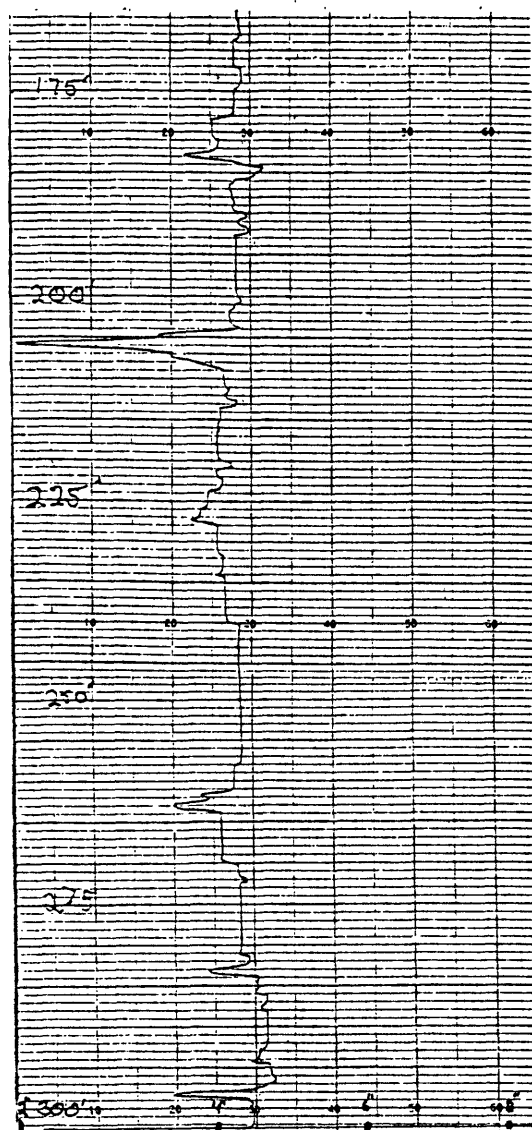
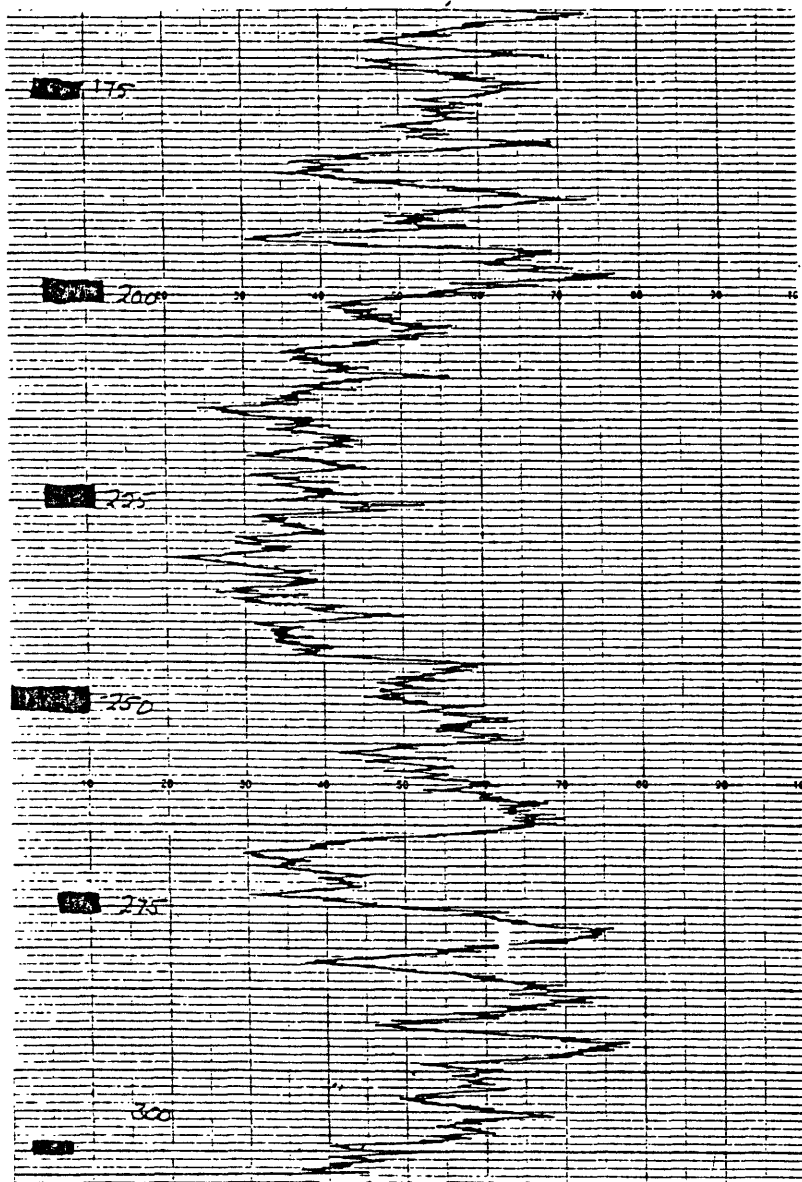
Location SW - SE Sec. 32 T. 8S R. 50E

County/State Powder River, Mont. Surface Elevation (ft) 3640'

Interval logged 303' Logged by R. Babcock Rotary footage 303'

Interval cored N/A





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Hole No. 78M - BCR6 Geologist J. Hardie

Type log. Cuttings Elev. 3640 ft. Total depth 303 ft.

Location 1100 F.N.L. 2750 F.W.L. Sec. 32 T. 8S R. 50E

Nearest town Bay Horse County Powder River State Mont. Quad. Bay Horse

Drilled by: U.S.G.S. O.E.R.

Driller(s): Steve Grant

Drill: Porta Drill Date start Sept. 5, 1978 Complete Sept. 6, 1978

Non-core intervals and size hole: N/A

Cored intervals and size: Straight rotary

Remarks: _____

LOG				CORE			
From	To	Length	Description	No.	From To	Foot Rec'd	% Rec'd
0	5		Detritus, grayish-brown, sandy				
5	38		Shale, brown, slightly sandy				
38	46		Clinker, reddish-orange, hard				
46	64		Shale, gray, slightly-sandy				
64	70		Clinker, various colors, hard				
70	85		Shale, gray, hard				
85	87		Shale, gray with coal streaks				
87	94		Shale, dark gray, carbonaceous				
94	97		Sandstone, light-gray, very fine grained				
97	104		Shale, gray, slightly carbonaceous, hard				
104	114		Shale, gray, hard with coal streaks				
114	116		Coal, dull-black, hard				
116	144		Shale, gray, hard				
144	158		Coal, dull-black, hard				
158	183		Shale, gray, hard				

Log Continuation:

Hole No.: 78M-BCR6

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Project: Broadus

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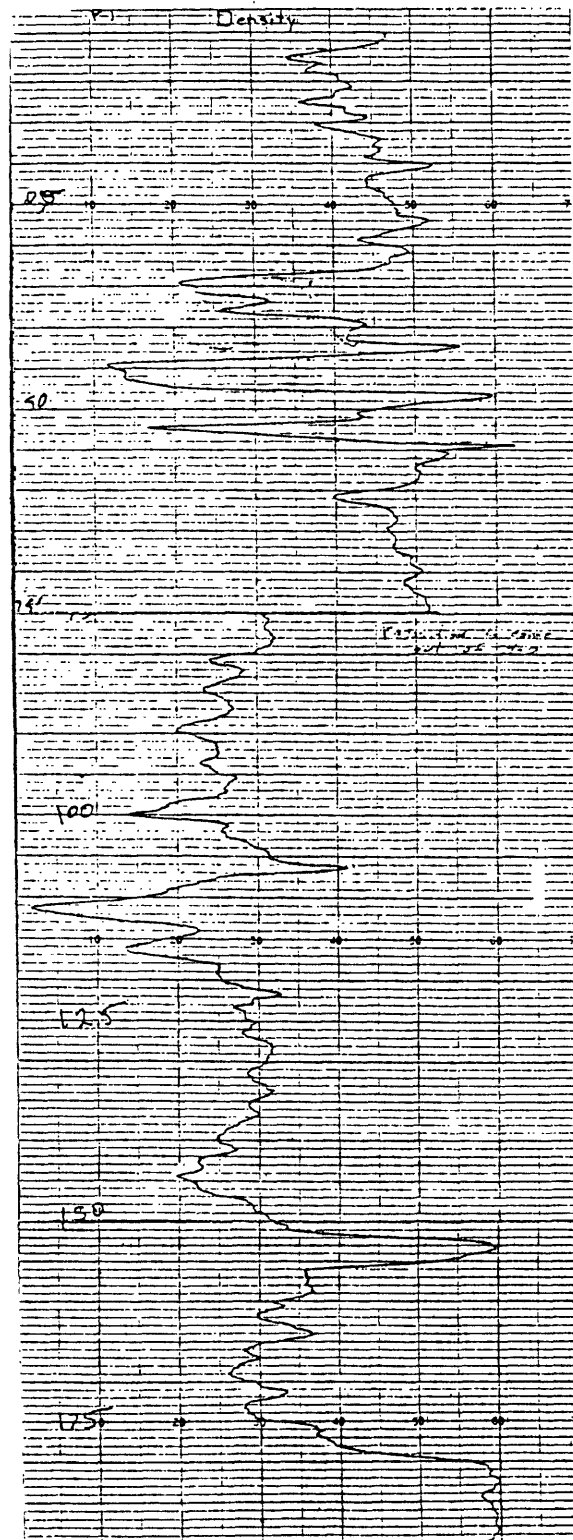
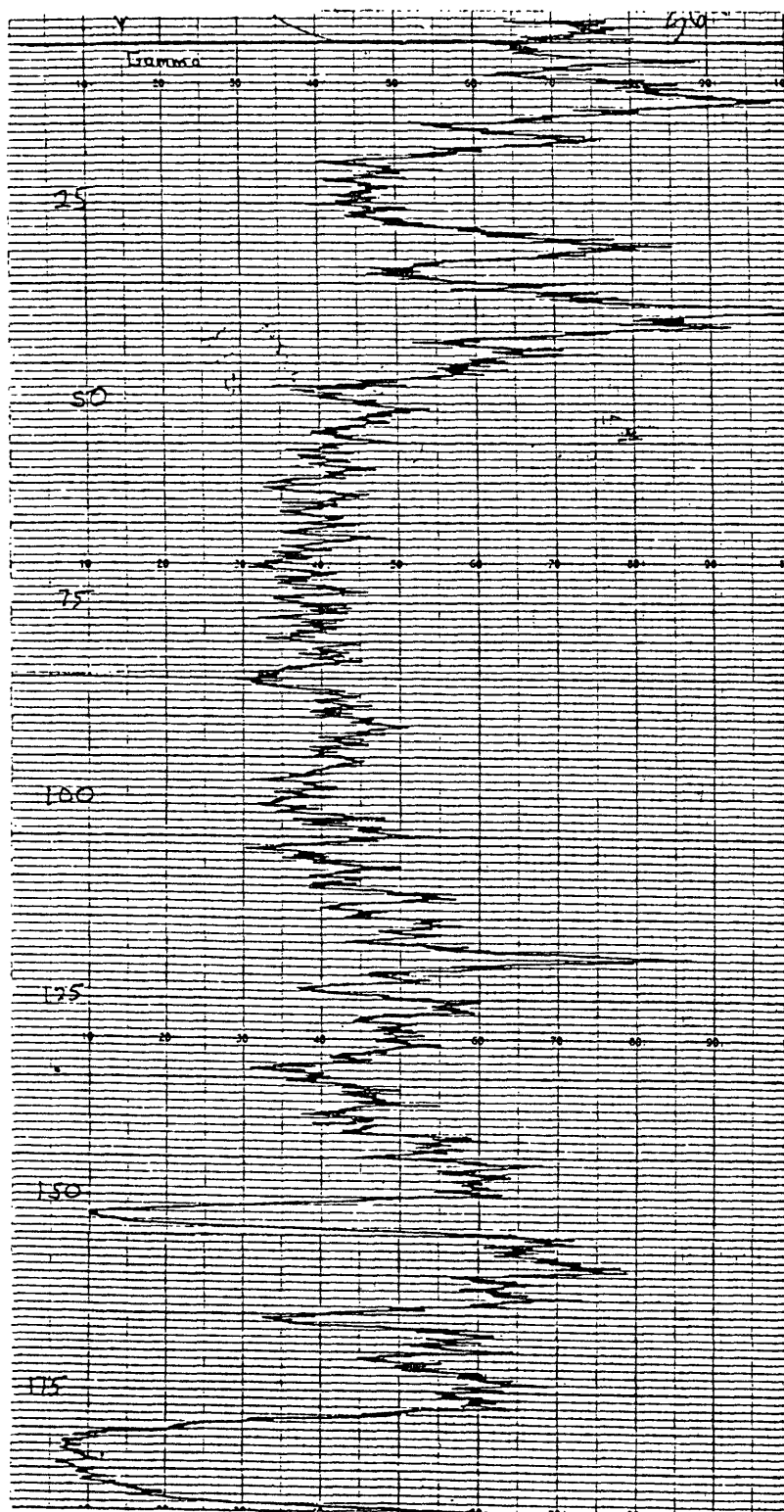
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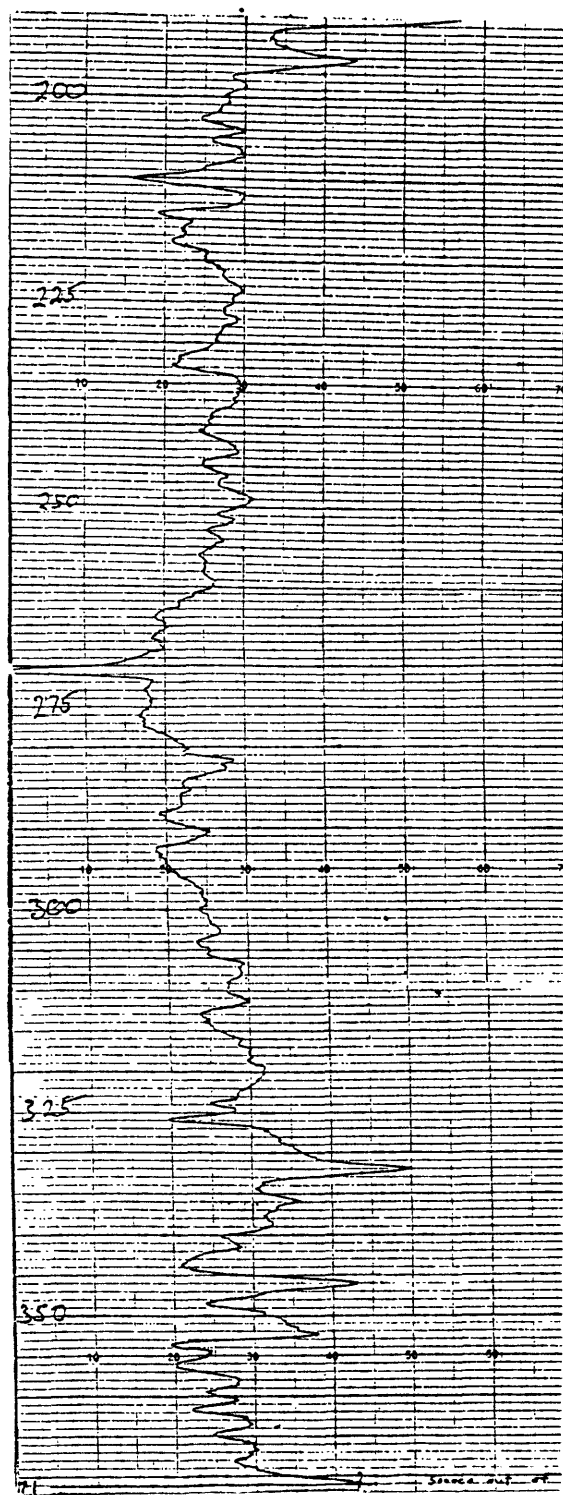
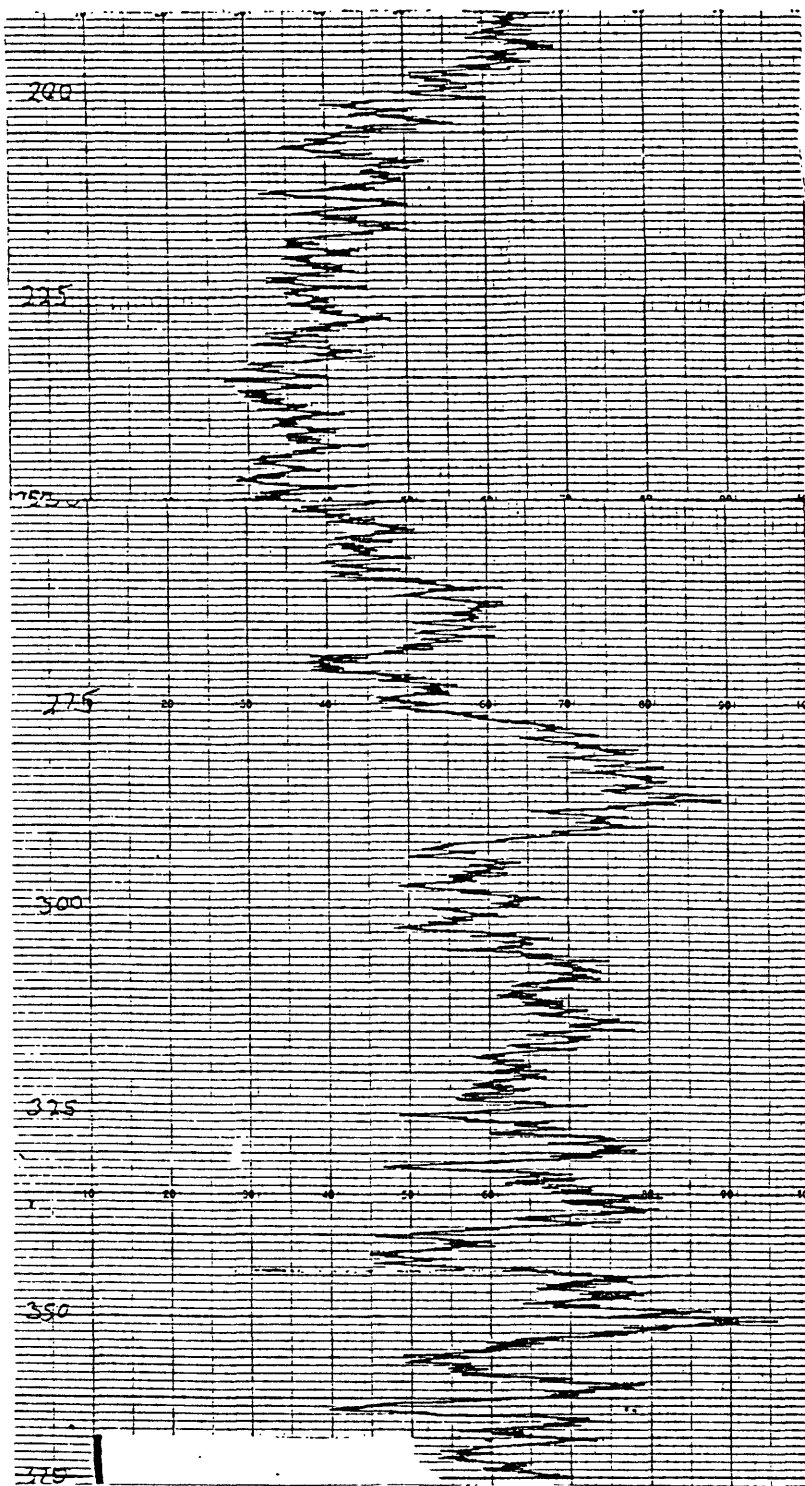
Location SW - NE Sec. 30 T. 8S R. 50E

County/State Powder River, Mont. Surface Elevation (ft) 3640'

Interval logged 370' Logged by J. Hardie Rotary footage 370'

Interval cored N/A





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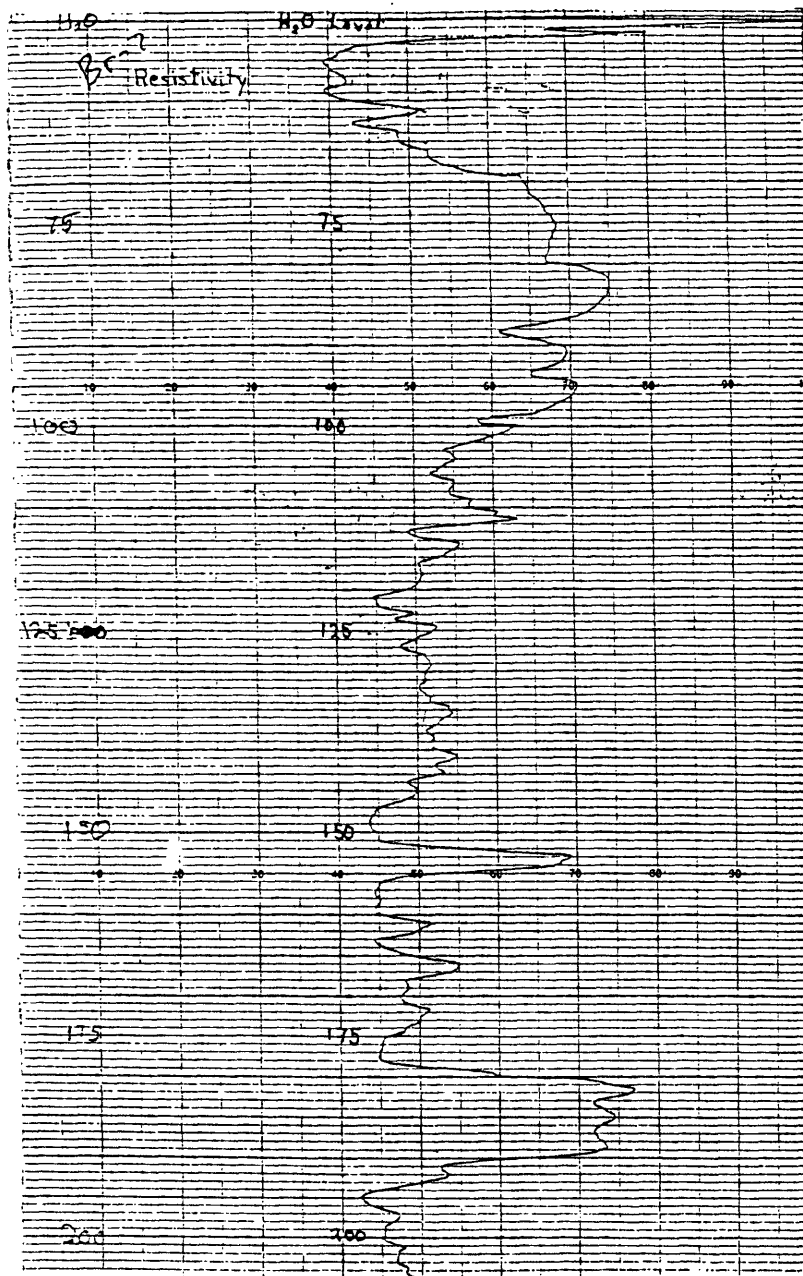
Project Broadus Hole number 78M-BCR7 Quadrangle Three Bar Ranch

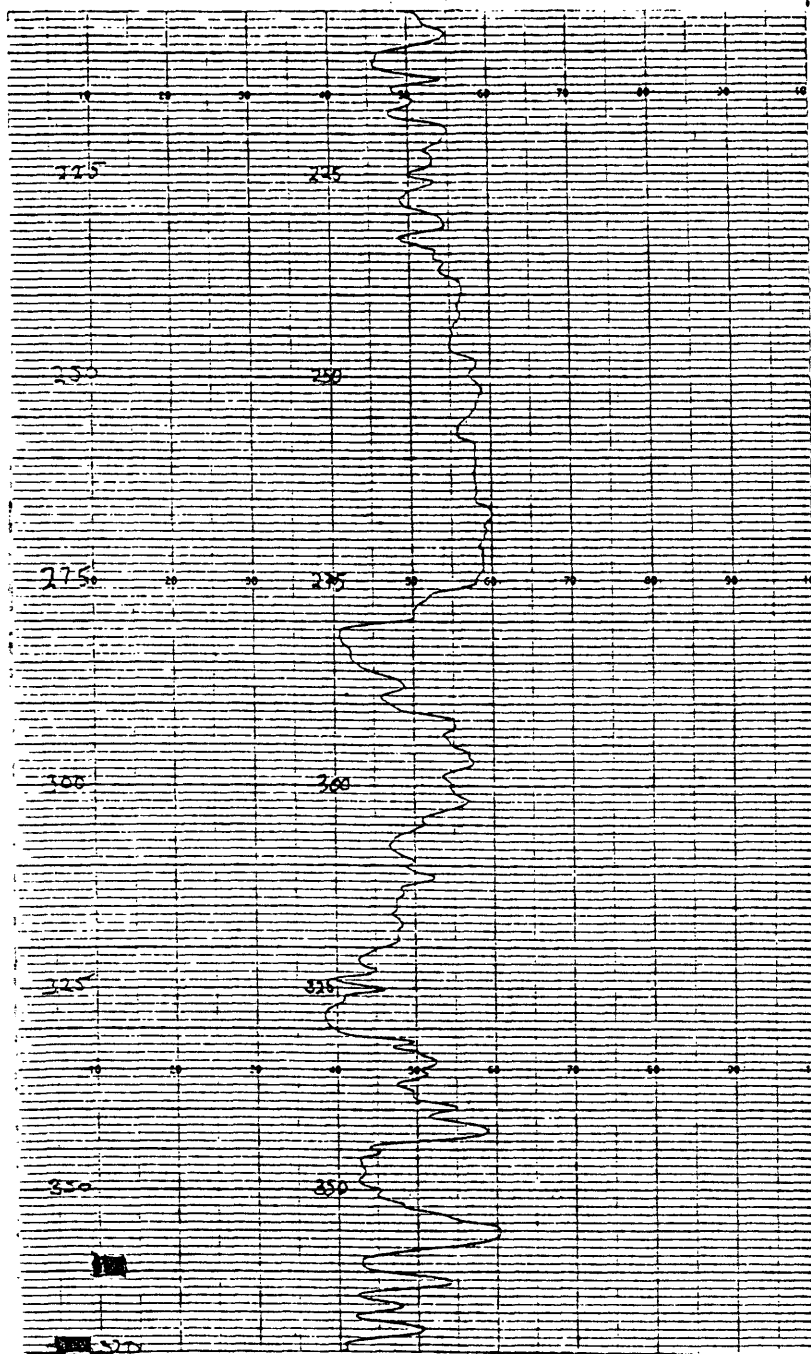
Location SW - NE Sec. 30 T. 8S R. 50E

County/State Powder River, Mont. Surface Elevation (ft) 3640'

Interval logged 370' Logged by J. Hardie Rotary footage 370'

Interval cored N/A





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Branch of Coal Resources

Project Broadus

Hole No. 78M - BCR 7 Geologist J. Hardie

Type log. Cuttings Elev. 3640 ft. Total depth 370 ft.

Location 2400 FSL 1600 FWL Sec. 30 T. 8S R. 50E

Nearest town Bay Horse County Powder River State Mont. Quad. Three Bar Ranch

Drilled by: U.S.G.S. O.E.R.

Driller(s): Steve Grant

Drill: Porta drill Date start Sept. 14, 1978 Complete Sept. 15, 1978

Non-core intervals and size hole: None

Cored intervals and size: Straight rotary

Remarks: _____

LOG				CORE			
From	To	Length	Description	No.	From To	Foot Rec'd	1 Rec'd
0	10		Detritus, brown, sandy				
10	15		Shale, black, carbonaceous				
15	19		Shale, gray with coal streaks				
19	28		Shale, gray with thin coal stringers				
28	32		Shale, reddish-brown, greasy				
32	36		Shale, reddish-brown, with coal streaks				
36	42		Shale, reddish-brown, greasy				
42	47		Shale, reddish-brown with coal streaks				
47	106		Sandstone, light-gray, very fine grained				
			with small gypsum crystals disseminated				
			throughout				
106	107		Limestone, gray, hard				
107	113		Sandstone, light-gray, very fine grained				
			with small gypsum crystals disseminated				
			throughout				

Log Continuation:

Hole No.: 78M - BCR7

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Project: Broadus

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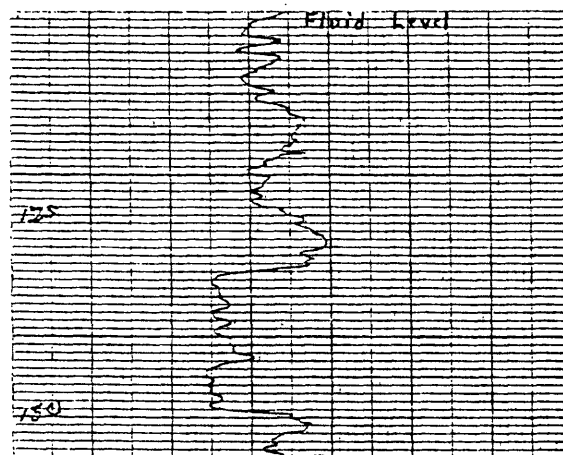
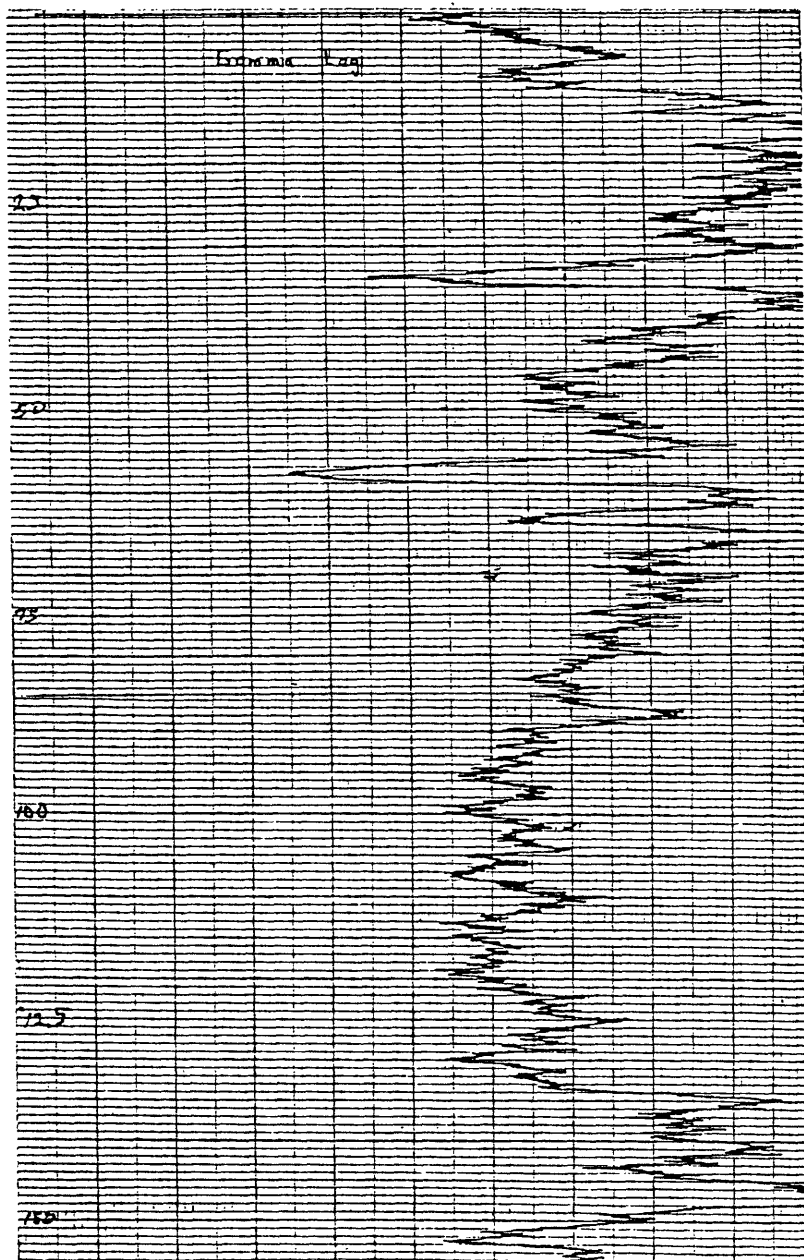
Project Broadus Hole number 78M-BCR8 Quadrangle Three Bar Ranch

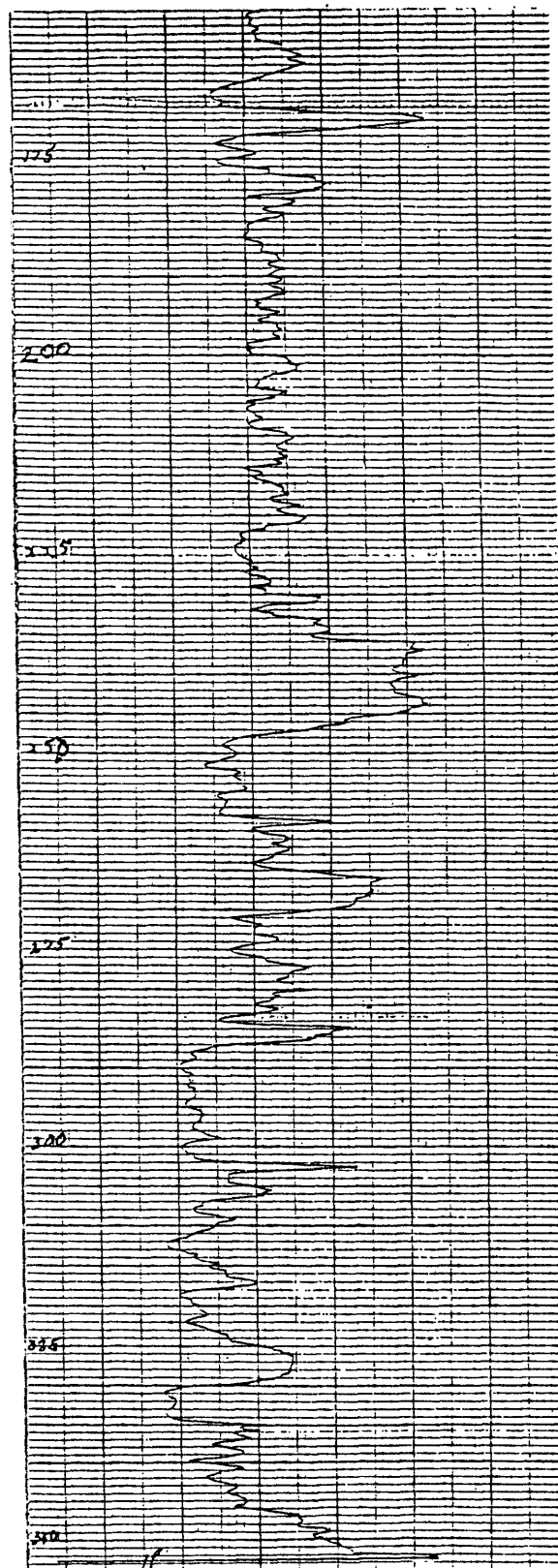
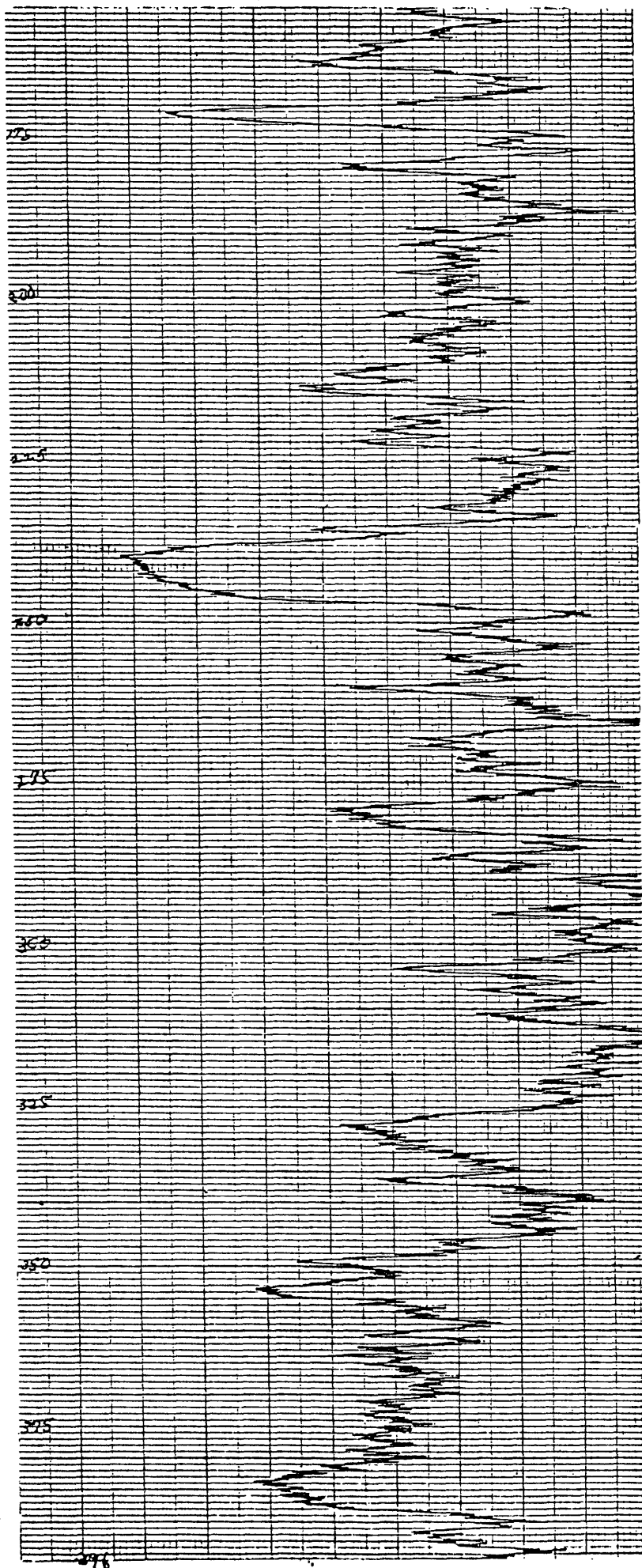
Location SW - NE Sec. 25 T. 8S R. 49E

County/State Powder River, Mont. Surface Elevation (ft) 3590'

Interval logged 396' Logged by R. Babcock Rotary footage 396'

Interval cored N/A





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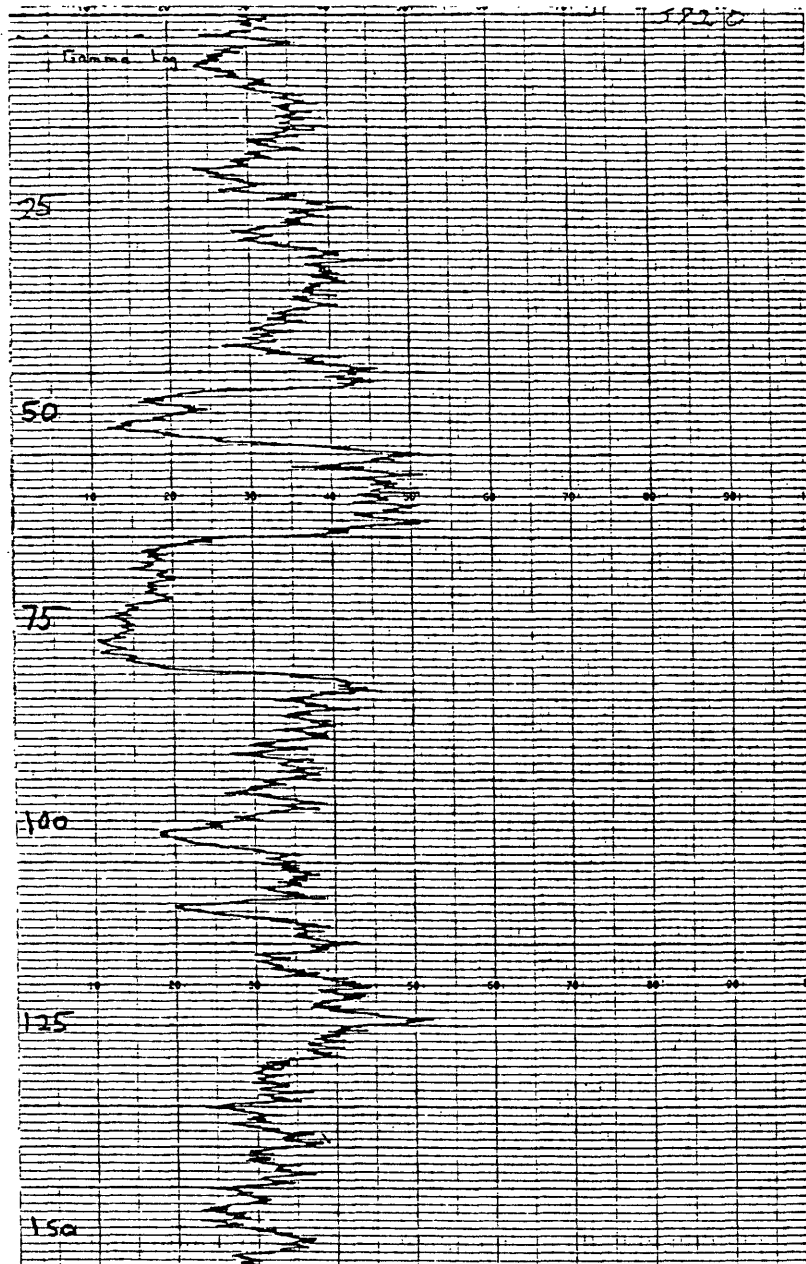
Project Broadus Hole number W78M-BCR3 Quadrangle Huckins School

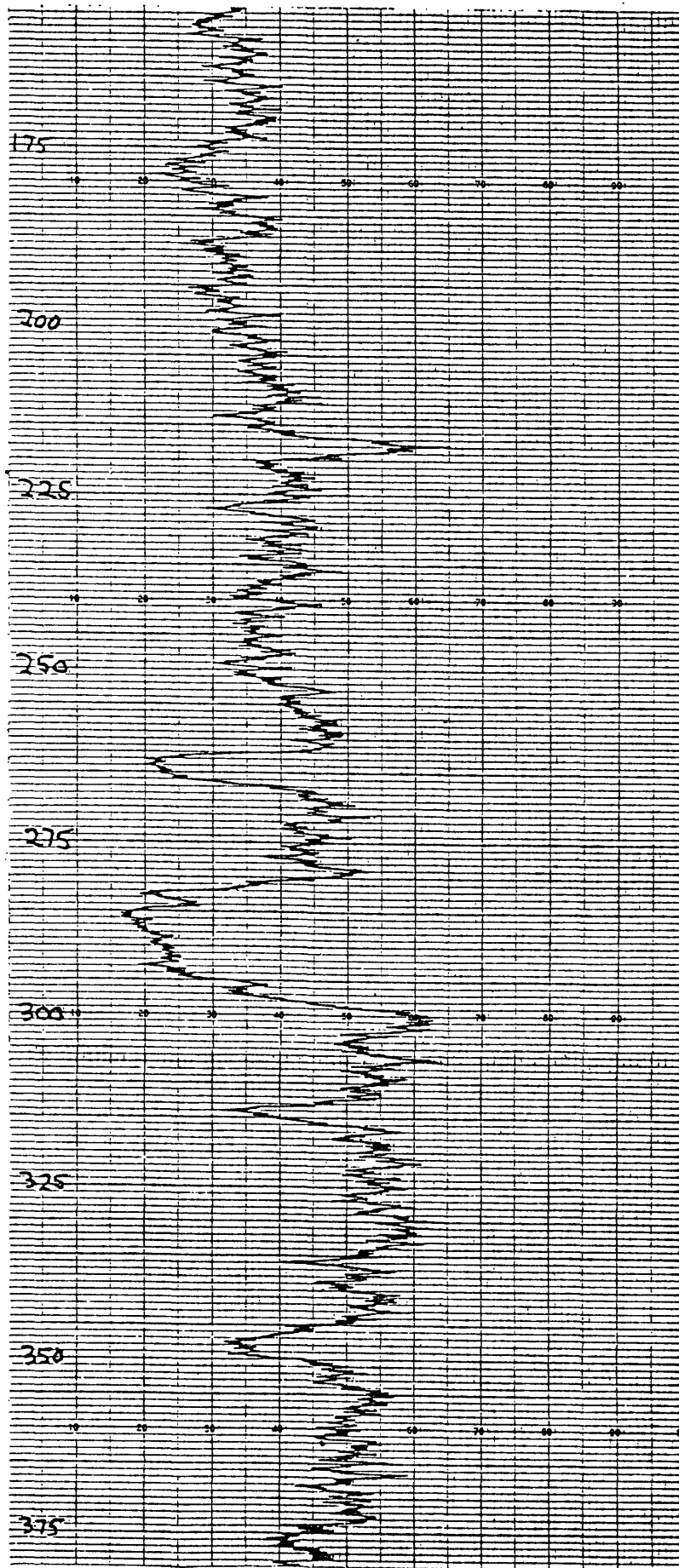
Location NE - NE Sec. 19 T. 8S R. 50E

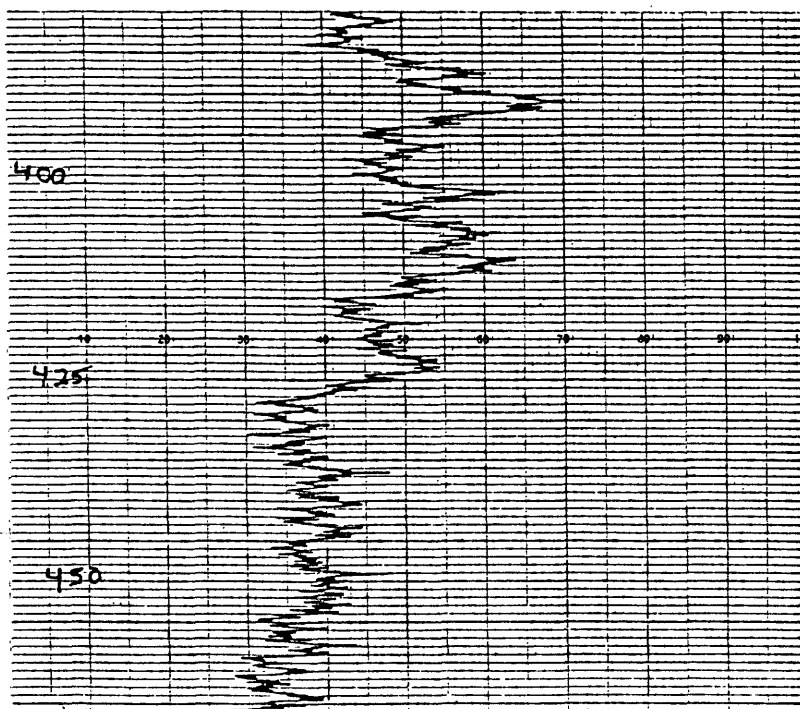
County/State Powder River, Mont. Surface Elevation (ft) 3720'

Interval logged 472' Logged by J. Hardie Rotary footage N/A

Interval cored N/A Existing water well







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U.S. Geological Survey

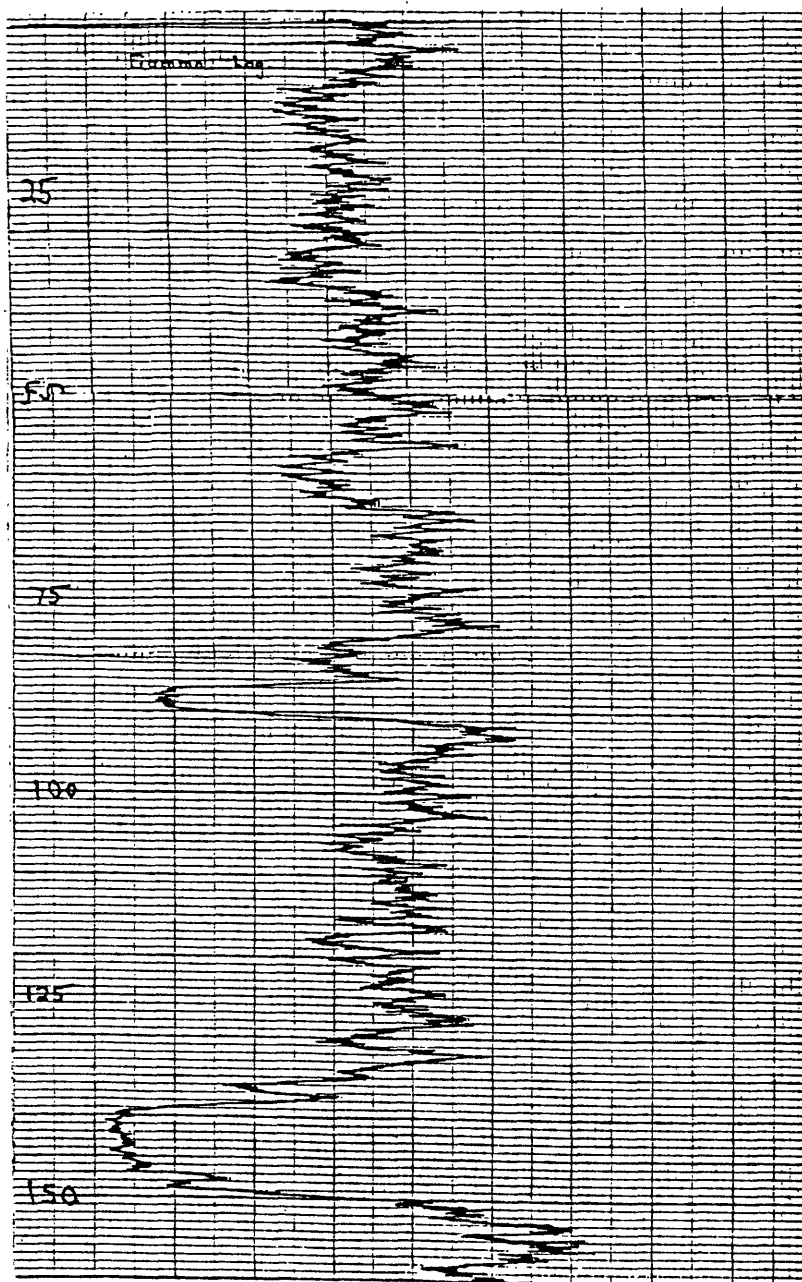
Project Broadus Hole number W78M-BCR4 Quadrangle Huckins School

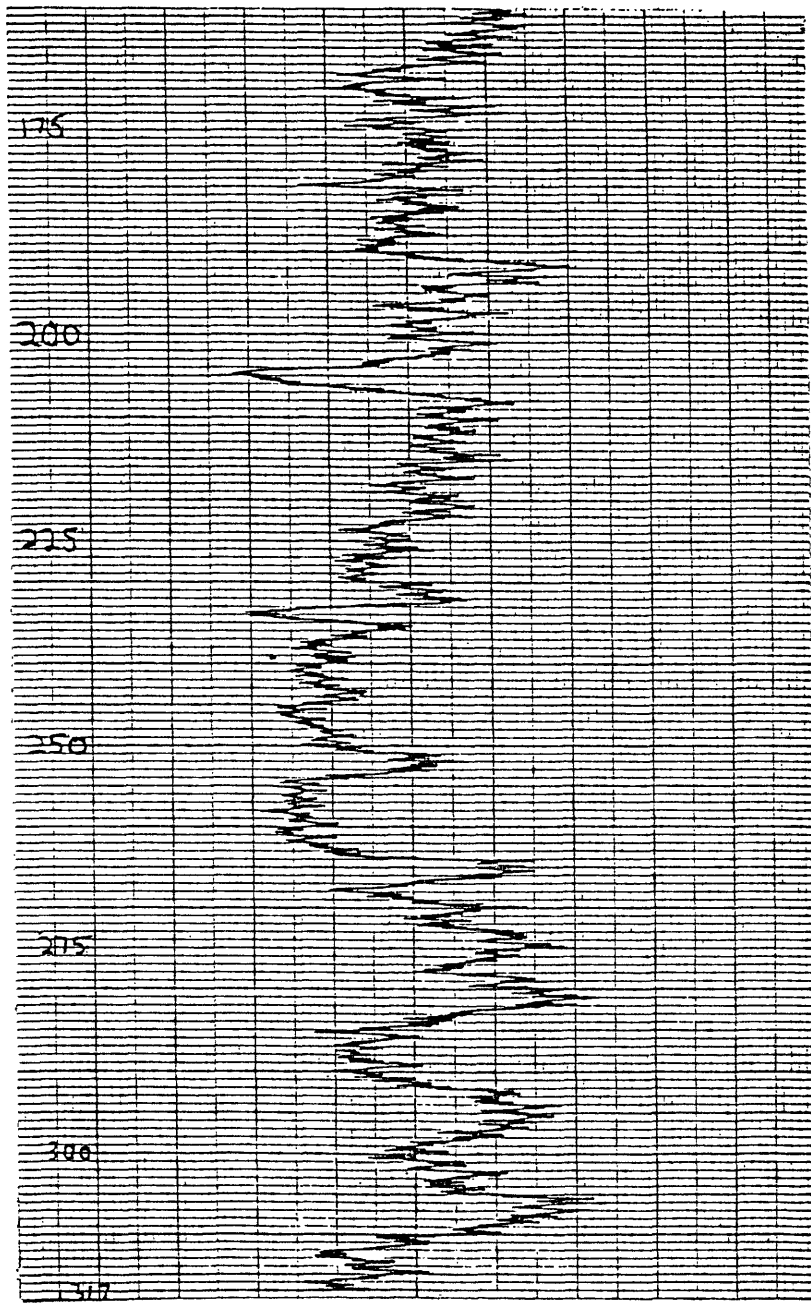
Location NE - NW Sec. 24 T. 8S R. 49E

County/State Powder River, Mont. Surface Elevation (ft) 3480'

Interval logged 317' Logged by J. Hardie Rotary footage N/A

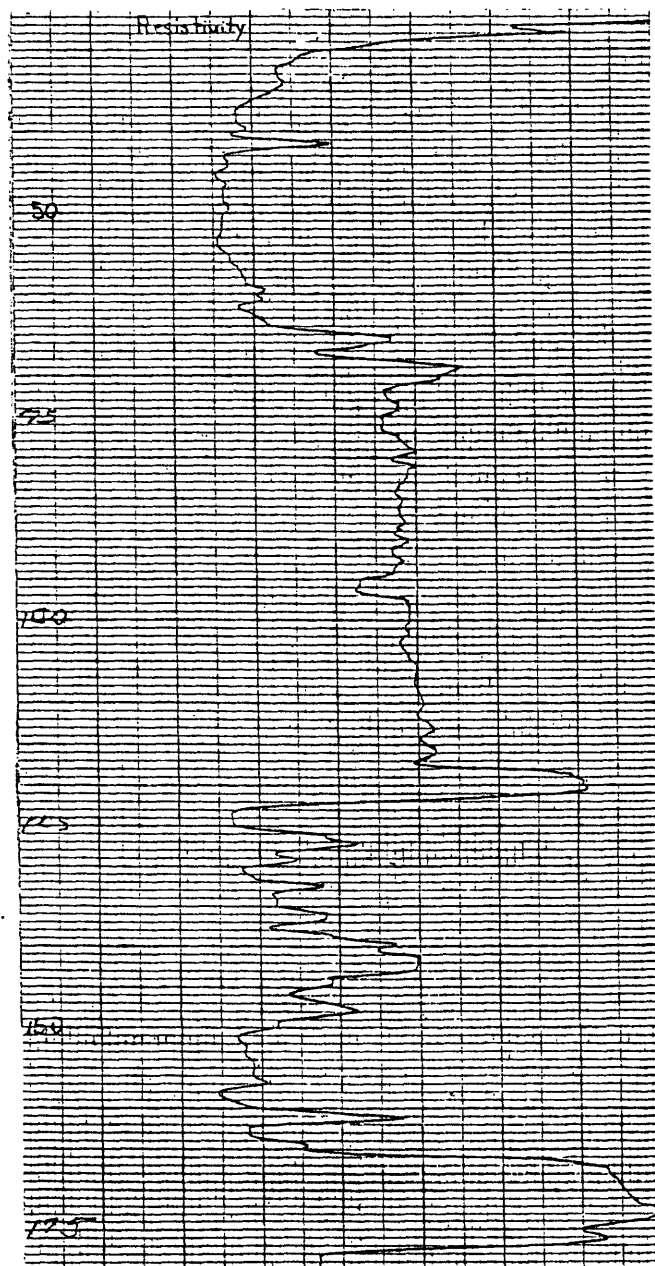
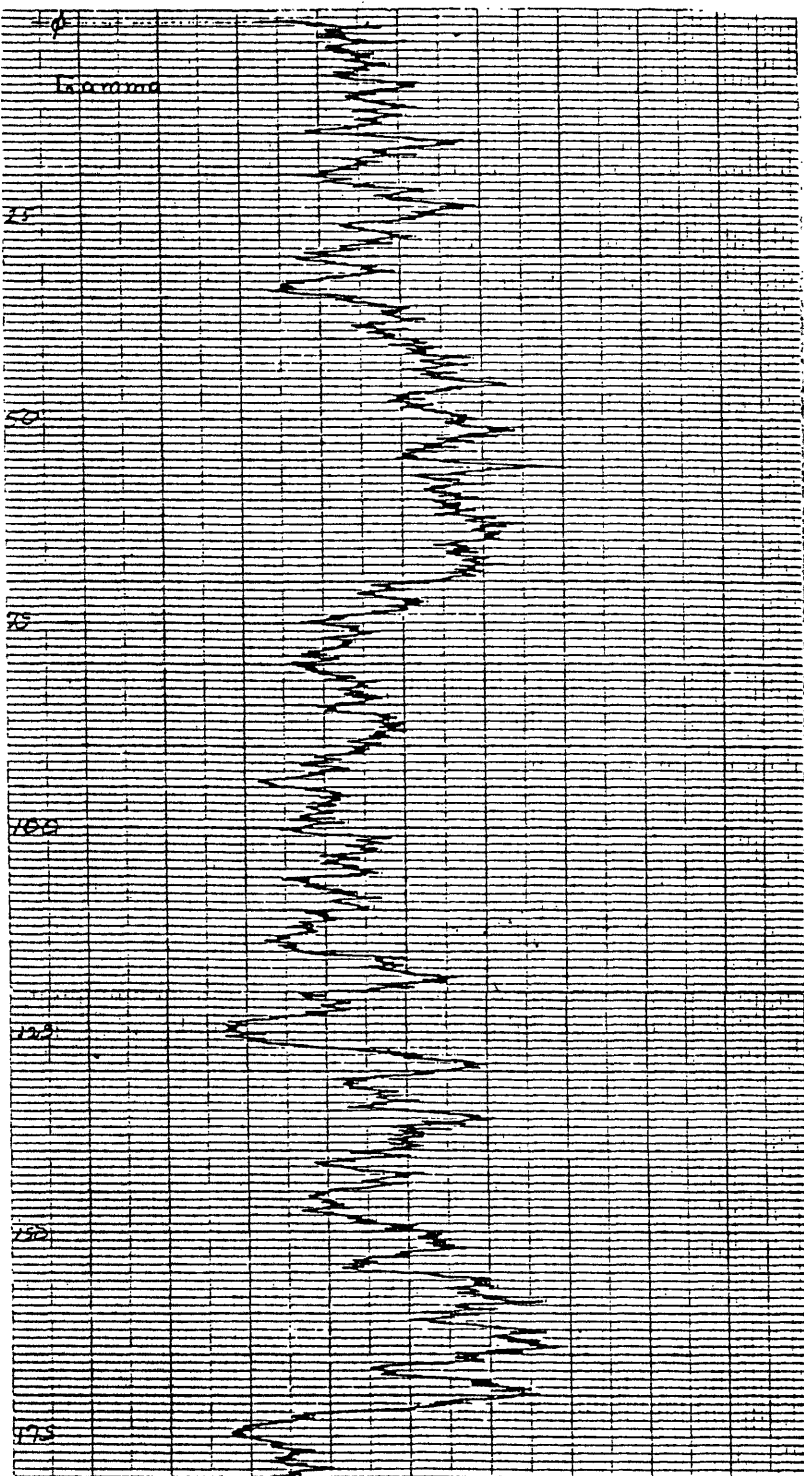
Interval cored N/A Existing water well

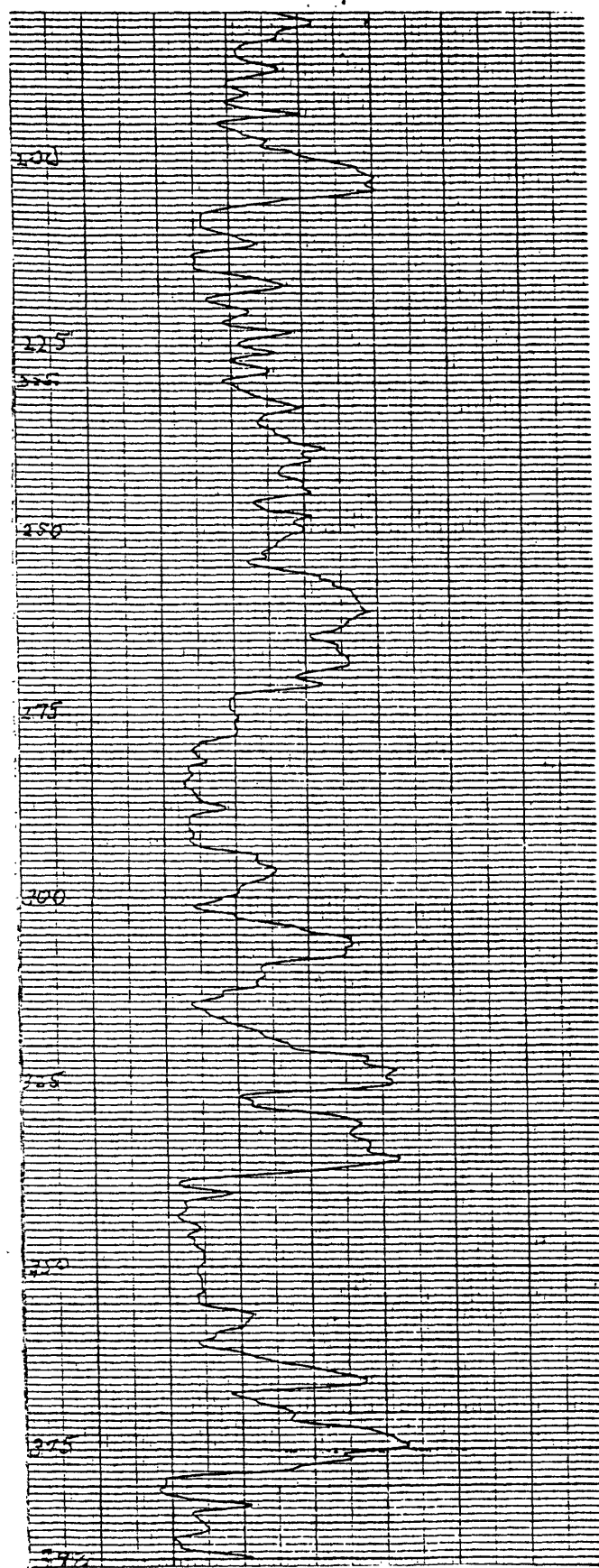
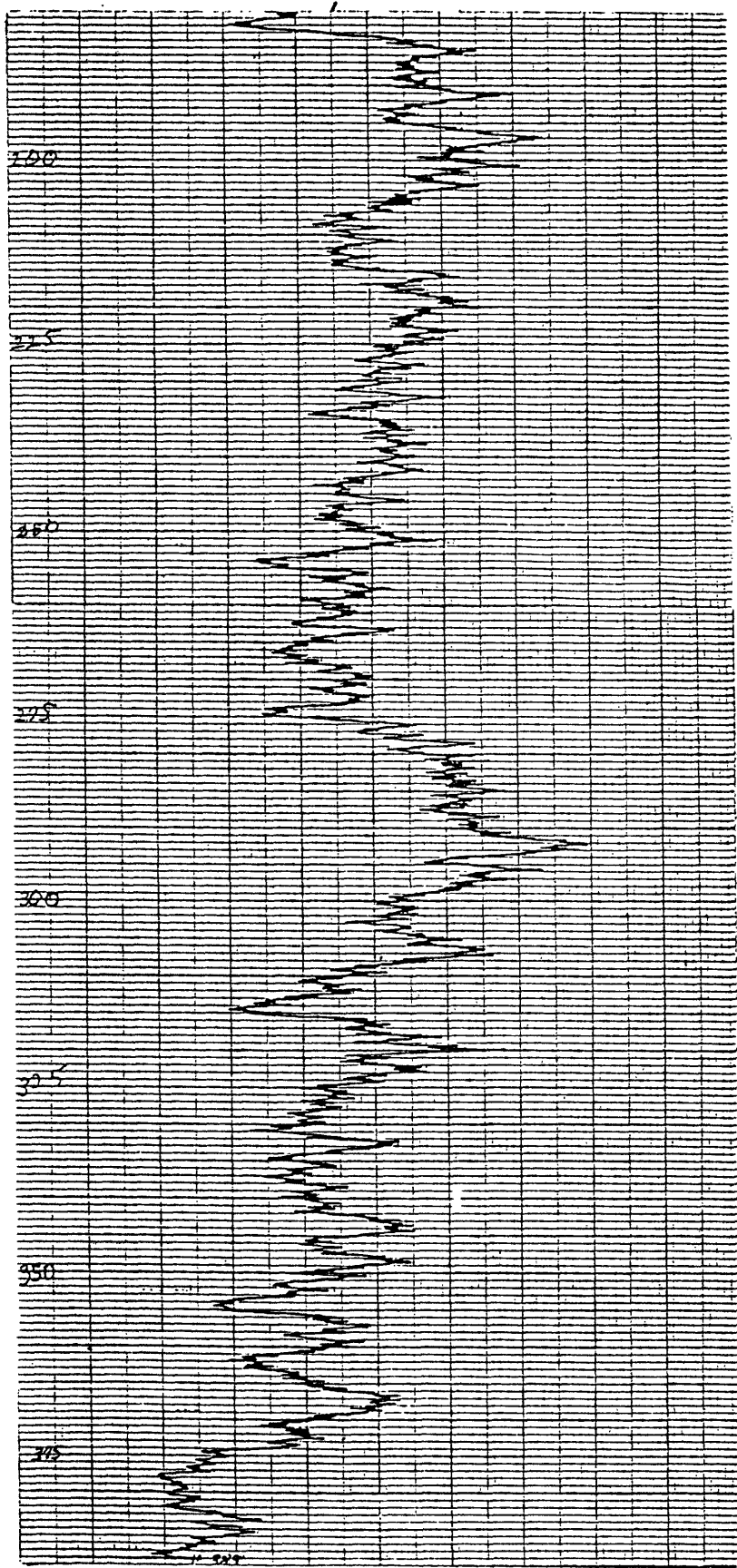




Branch of Coal Resources
U.S. Geological Survey

Project Broadus Hole number 78M-BCR9 Quadrangle Huckins School
Location NE - SE Sec. 14 T. 8S R. 49E
County/State Powder River, Mont. Surface Elevation (ft) 3520'
Interval logged 389' Logged by R. Babcock Rotary footage 389'
Interval cored N/A





Branch of Coal Resources
U.S. Geological Survey

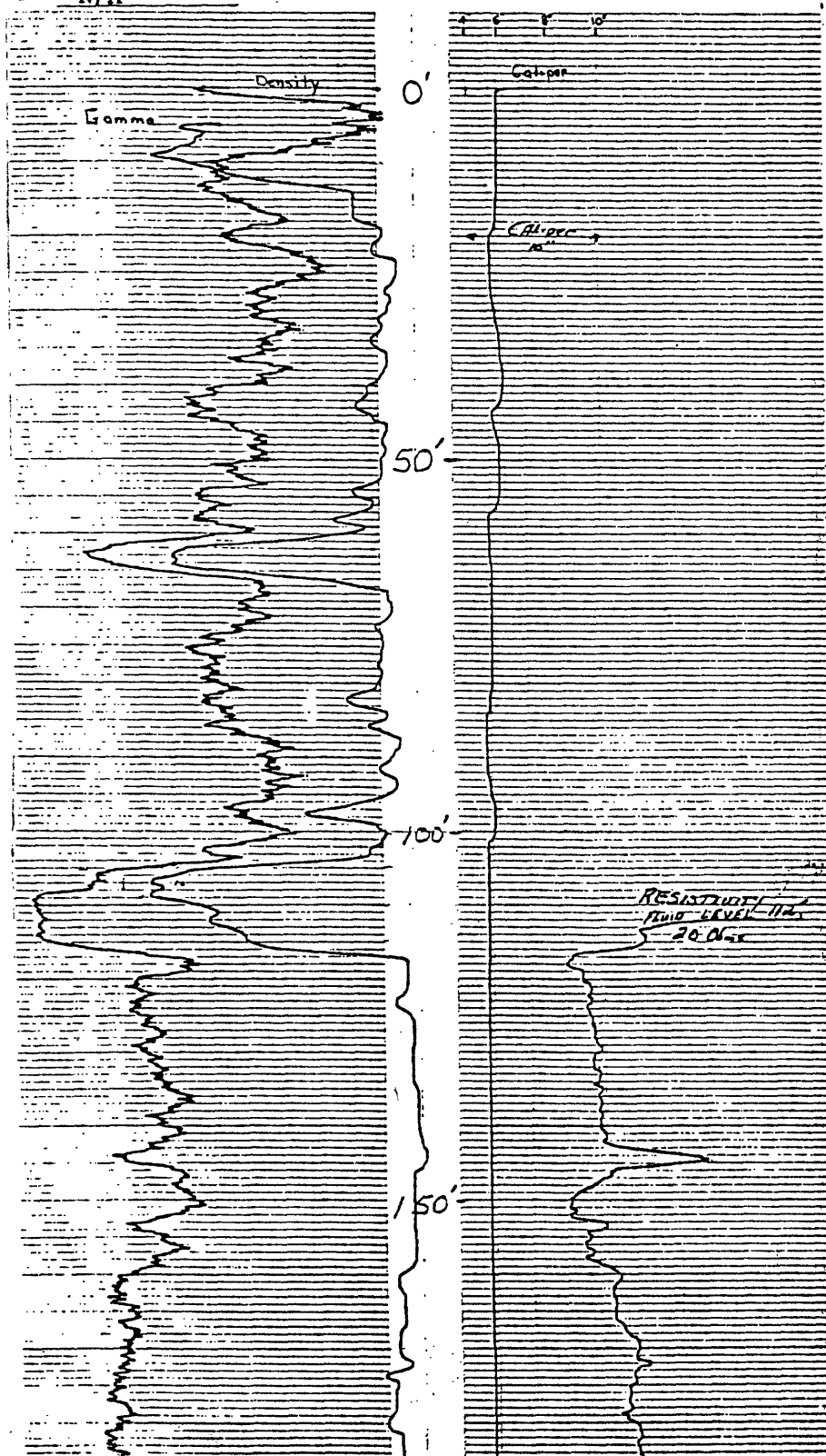
Project Broadus Hole number 78M-BCR10 Quadrangle Huckins School

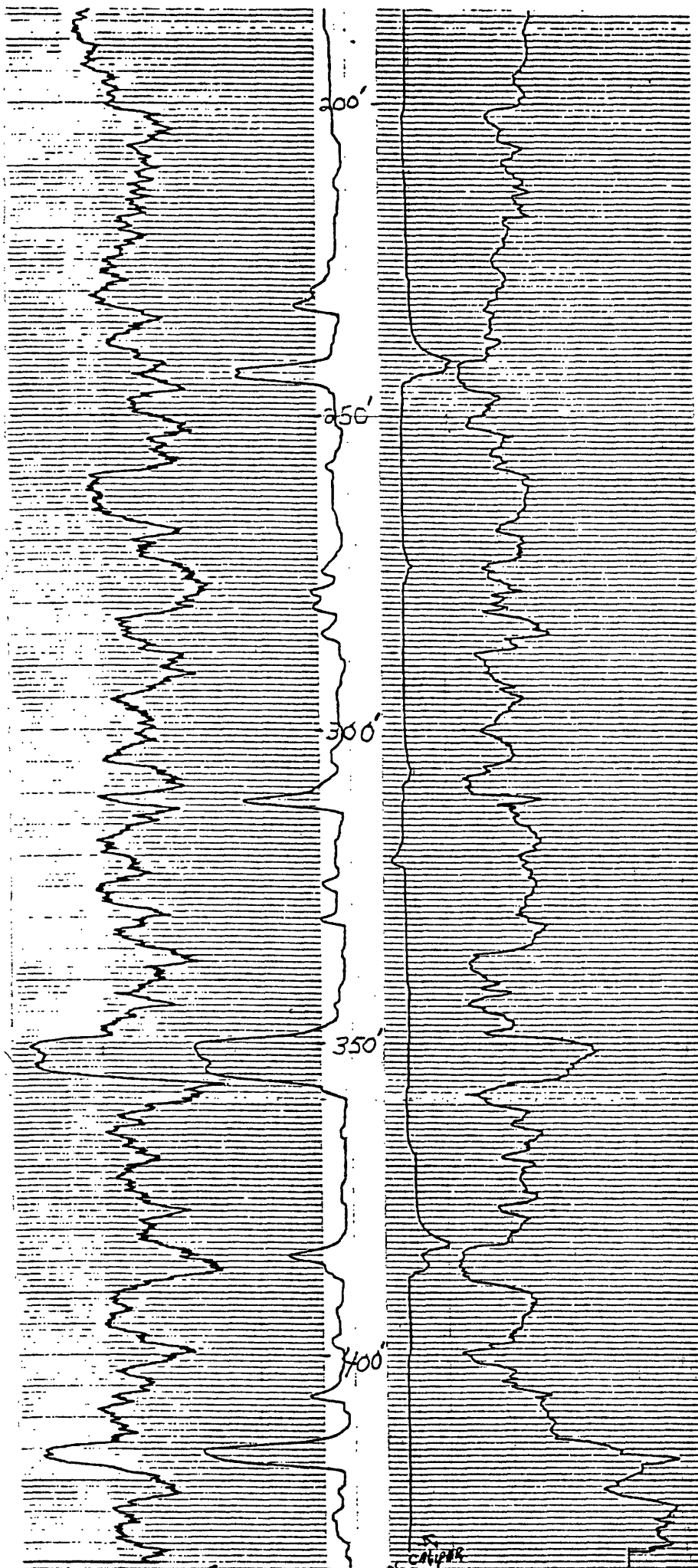
Location SE - SW Sec. 11 T. 8S R. 49E

County/State Powder River, Mont. Surface Elevation (ft) 3490'

Interval logged 438' Logged by Goodwell Inc. Rotary footage 455'

Interval cored N/A





Branch of Coal Resources
U.S. Geological Survey

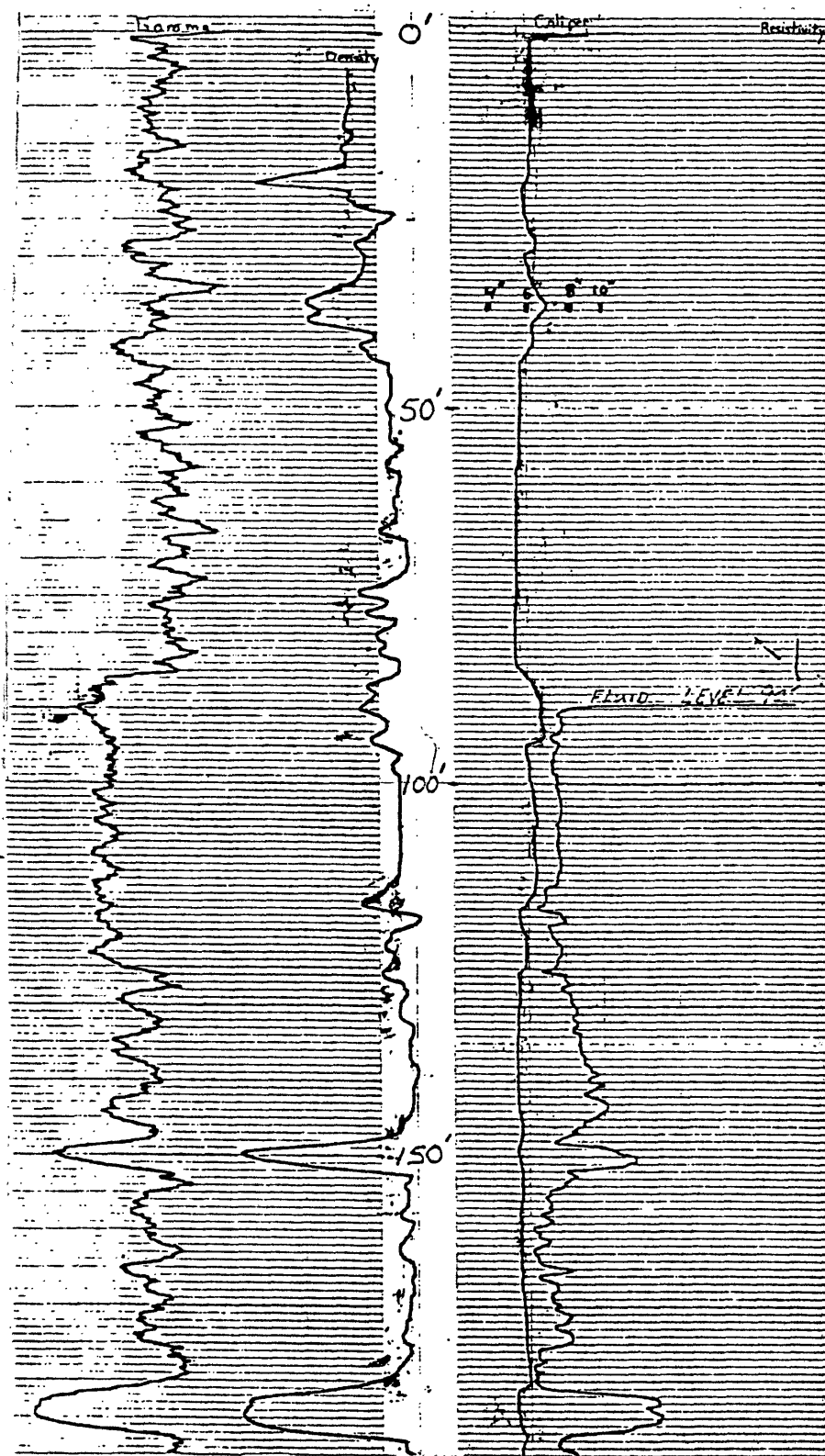
Project Broadus Hole number 78M-BCR11 Quadrangle Huckins School

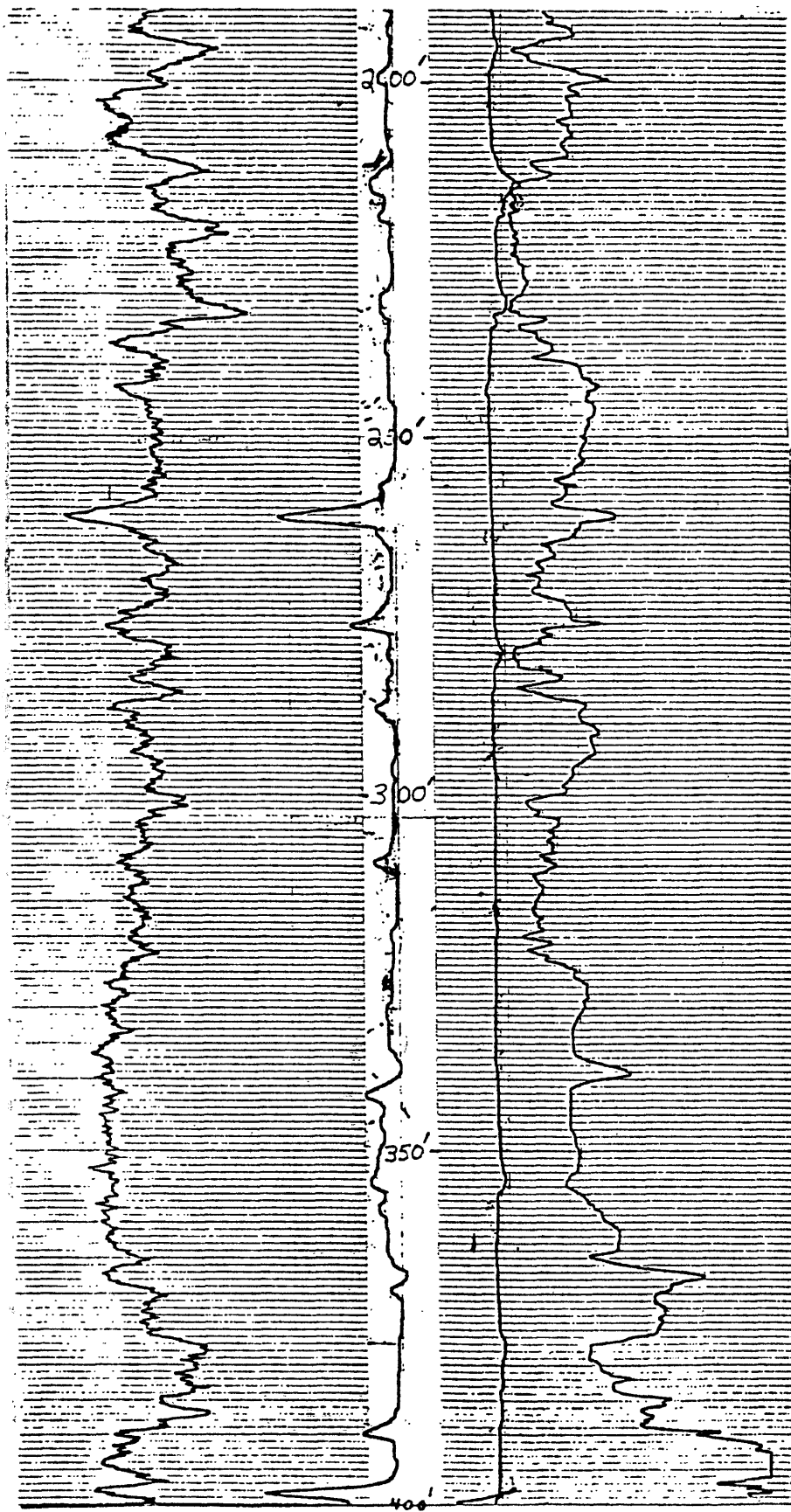
Location NE - SE Sec. 34 T. 7S R. 49E

County/State Powder River, Mont. Surface Elevation (ft) 3340'

Interval logged 405' Logged by Goodwell Inc. Rotary footage 415'

Interval cored N/A





References Cited

Bryson, R.P., and Bass, N.W., 1966, Geologic Map and Coal Sections of the Moorhead Coal Field, Montana: U. S. Geologic Survey Open-file report, 2 maps, 15 tables

Matson, R.E., and Blumer, J.W., 1973, Quality and Reserves of Strippable Coal, Selected Deposits, Southeastern Montana. Montana Bureau Mines and Geology Bulletin 91, p. 92-94.