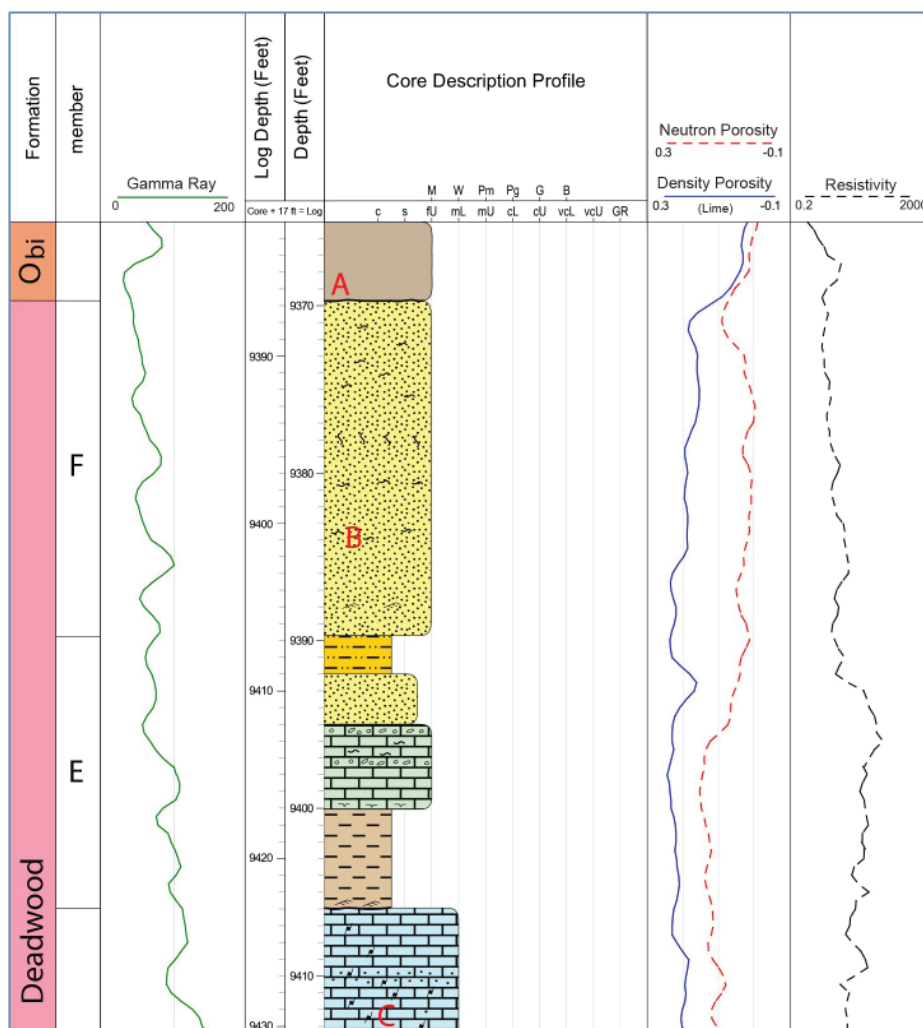


Deadwood Formation (Cambrian/Ordovician) of North Dakota

A Preliminary Core Atlas

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GEOLOGIC INVESTIGATION NO. 257
NORTH DAKOTA GEOLOGICAL SURVEY
Edward C. Murphy, State Geologist
Lynn D. Helms, Director Dept. of Mineral Resources
2021



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INTRODUCTION

The North Dakota Geological Survey (NDGS) is currently conducting studies of the Cambro-Ordovician Deadwood Formation (Deadwood) because of the increased interest in CO₂ storage in underground saline aquifers. This document presents the preliminary results of these studies to release a baseline of information that will be further developed to eventually establish a detailed stratigraphic framework for the Deadwood, and other formations (Inyan Kara and Broom Creek) that are potential candidates for CO₂ sequestration. The Deadwood Formation consists of marginal and shallow marine sedimentary units; dominantly thick, porous, and permeable sandstone and limestone that are present at great depths and thus are ideal for CO₂ storage.

The Deadwood Formation represents two 3rd-order depositional sequences deposited in an overall 2nd-order transgressive-regressive cycle in the Late Cambrian and Early Ordovician Periods (Figs. 1 and 2). In general, the lower sequence (member A) represents the initial sea-level rise during the Cambrian (Fig. 2A) and consists of fluvial-deltaic and eolian deposits that give way to more marginal marine (Fig. 2B) (member B) and nearshore progradational deposits (members C-F) that shallow upwards as represented by 4 parasequences of the highstand normal regression of the upper sequence (Fig. 2C; Sarnoski, 2015).

This document presents detailed lithologic descriptions from two Deadwood Formation rock cores from the state of North Dakota (NDIC #6624 and NDIC #37672; Fig. 3) that will be expanded as further studies are conducted on additional core. Core was viewed and described at the Wilson M. Laird Core and Sample Library in 2014, November 2020, and August–October 2021. Core profiles including: 1) well information; 2) log responses for gamma-ray, resistivity, neutron porosity, and density porosity (Fig. 2); 3) detailed lithology graphic with generalized description; 4) sequence stratigraphic interpretation; and 5) core photographs, are presented. The logs are best viewed using a computer for optimal viewing and printing on 11x17 paper is recommended for readable graphics.

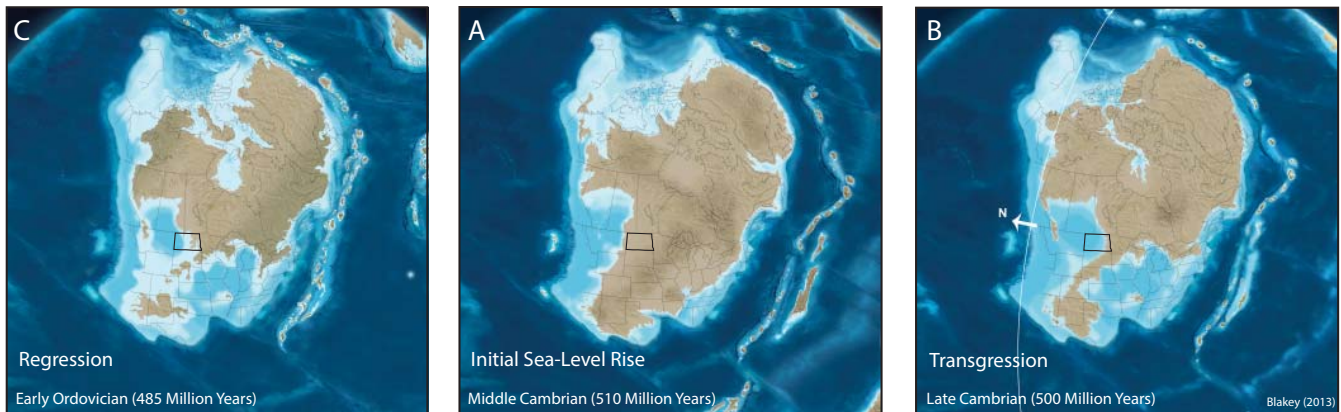


Figure 1. Cambro-Ordovician paleogeographic maps of North America showing transgression and regression of seaway during Deadwood deposition in North Dakota.

REFERENCES

- Blakey, R., 2013, North America paleogeography: <http://cpgeosystems.com/nam.html>.
- Sarnoski, A. H., 2015, The stratigraphy and depositional history of the Deadwood Formation, with a focus on Paleozoic subsidence of the Williston Basin: University of North Dakota Theses and Dissertations, <https://commons.und.edu/theses/1957>.

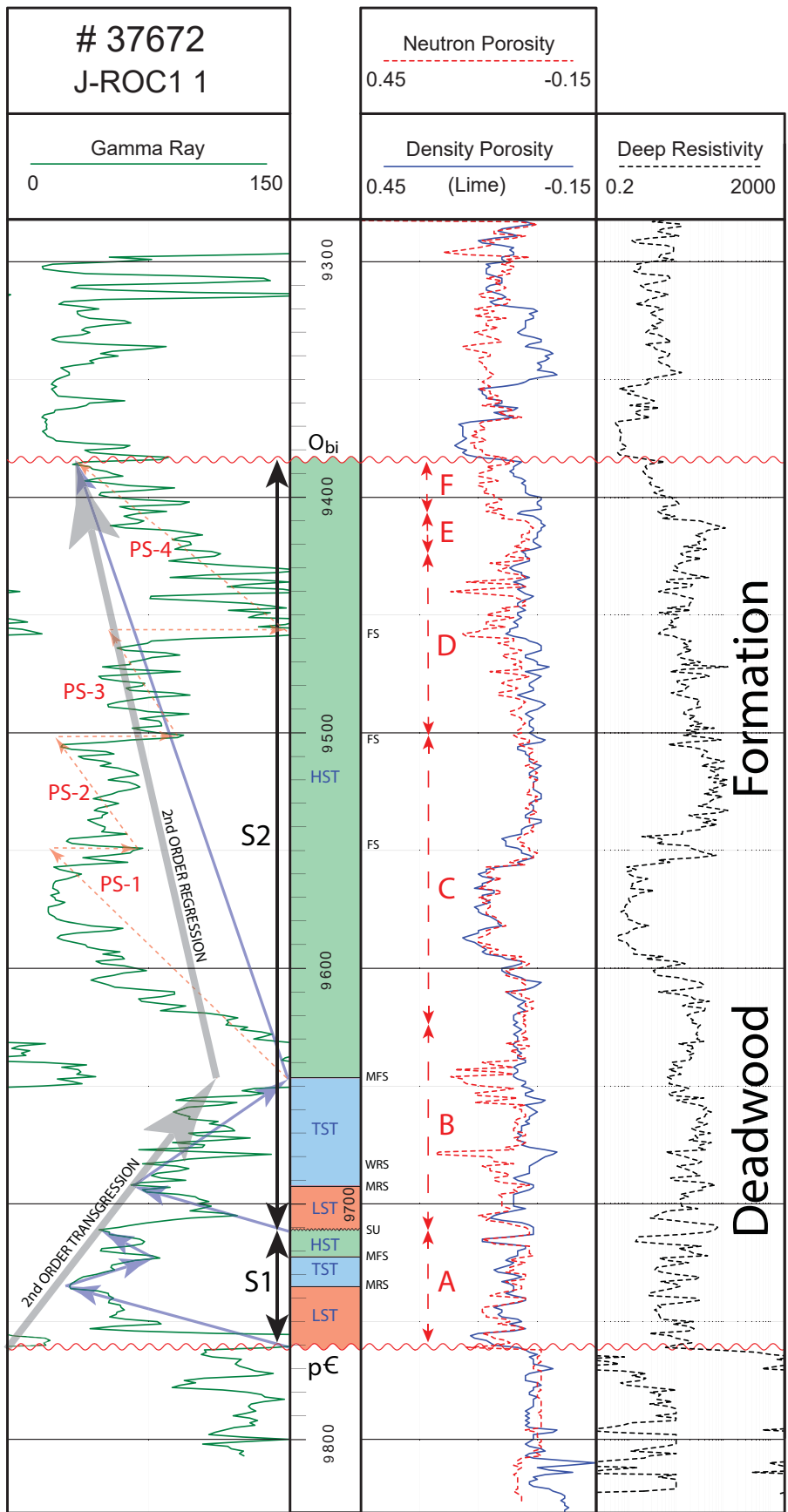
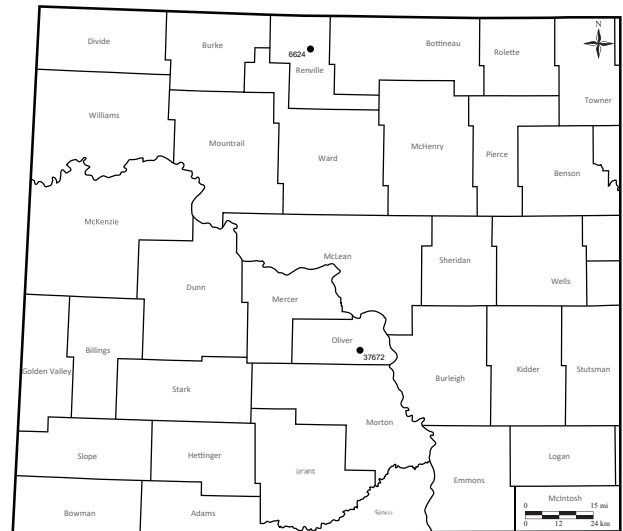


Figure 2. Geophysical logs for the J-ROC1 1 well showing sequence stratigraphic relations and members of the Deadwood Formation.

Legend

	Sandstone		Erosion surface
	Siltstone		Herring-bone cross bedding
	Shale		Karst
	Conglomerate		Lag
	Limestone		Mud crack
	Dolostone		Planolites
	Schist		Ripple cross-lamination
	Anhydrite nodule		Rip-up clast
	Burrow		Thalassinoides
	Chondrites		Unconformity
	Crinoid		Wavy bedding
	Cross bedding		Wavy lamination

Obi	Ordovician Black Island Formation
p-Є	Precambrian
FS	Flooding surface
HST	Highstand systems tract
LST	Lowstand systems tract
MFS	Maximum flooding surface
MRS	Maximum regressive surface
PS	Parasequence
TST	Transgressive systems tract
S	Sequence
SU	Subaerial unconformity
WRS	Wave ravinement surface



Explanation

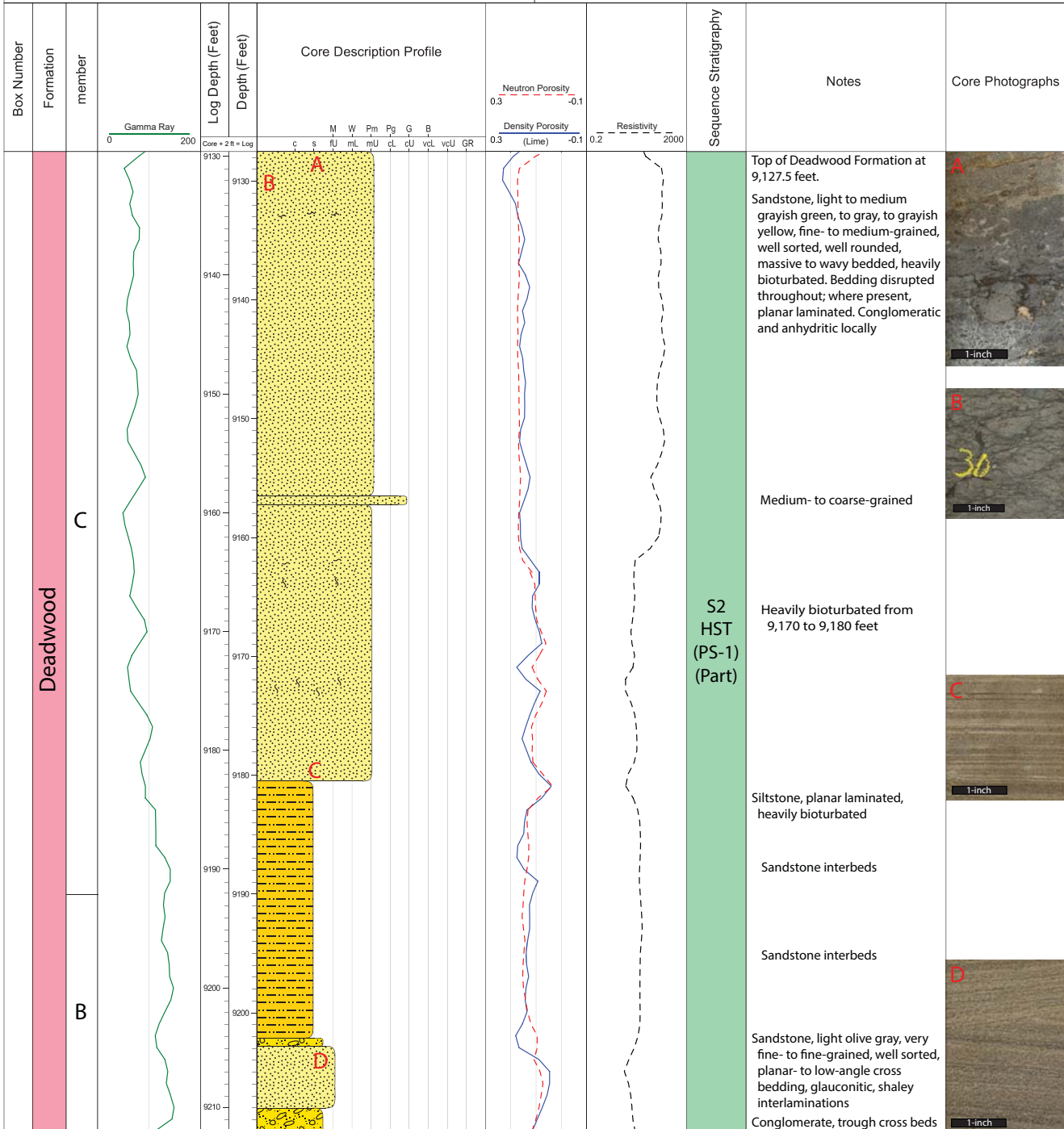
Well Location with NDIC number



Figure 3. Index map showing well locations.

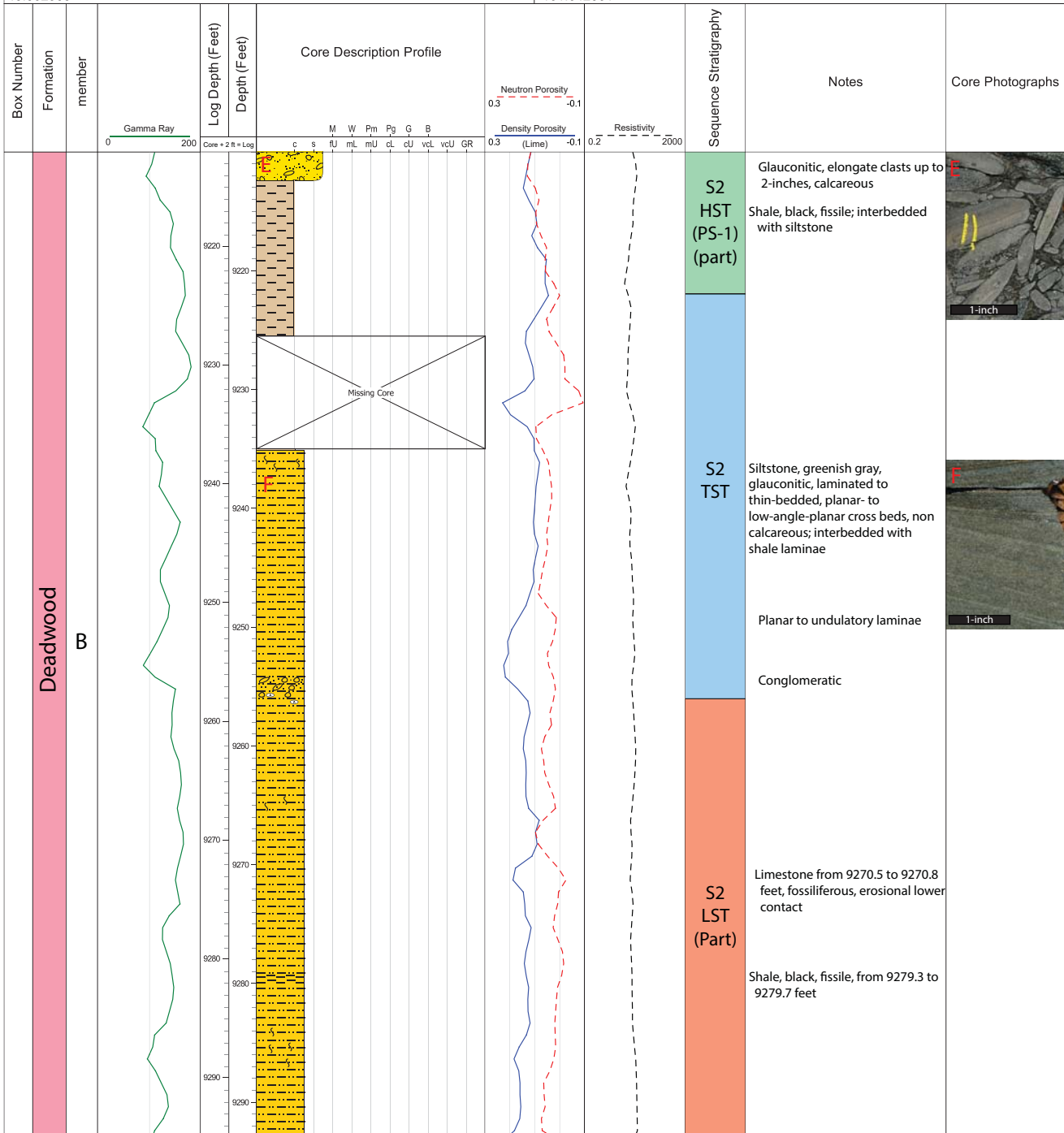


Operator Shell Oil Company		Page 1 of 3
Top 9127.5 ft	Bottom 9210 ft	
Well Name & No. Osterberg 22N-1		Location SENW Sec. 1, T161N, R85W
Logged by Jeff Bader and Anthony Samoski		Date 11/14 and 11/20
Basin Williston		UWI No. 33-075-00763-00-00
NDIC No. 6624		Field Wildcat
KB 1715 ft		TD 9509
Latitude 48.802903		Longitude -101.642301





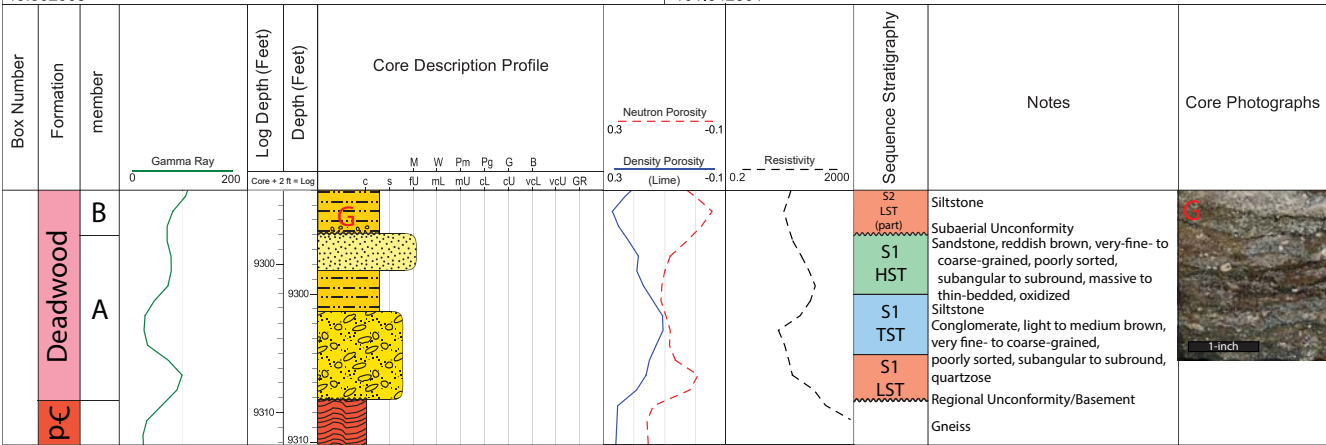
Operator Shell Oil Company		Page 2 of 3	
Top 9210 ft		Bottom 9293 ft	
Well Name & No. Osterberg 22N-1		Location SENW Sec. 1, T161N, R85W	
Logged by Jeff Bader and Anthony Sarnoski		Date 11/14 and 11/20	
Basin Williston		UWI No. 33-075-00763-00-00	
NDIC No. 6624		Field Wildcat	
KB 1745 ft		TD 9509	
Latitude 48.802903		Longitude -101.642301	





Operator: **Shell Oil Company** Page 3 of 3

Top 9293 ft	Bottom 9310.2 ft
Well Name & No. Osterberg 22N-1	Location SENW Sec. 1, T161N, R85W
Logged by Jeff Bader and Anthony Sarnoski	Date 11/14 and 11/20
Basin Williston	UWI No. 33-075-00763-00-00
NDIC No. 6624	Field Wildcat
KB 1715 ft	TD 9509
Latitude 48.802903	Longitude -101.642301

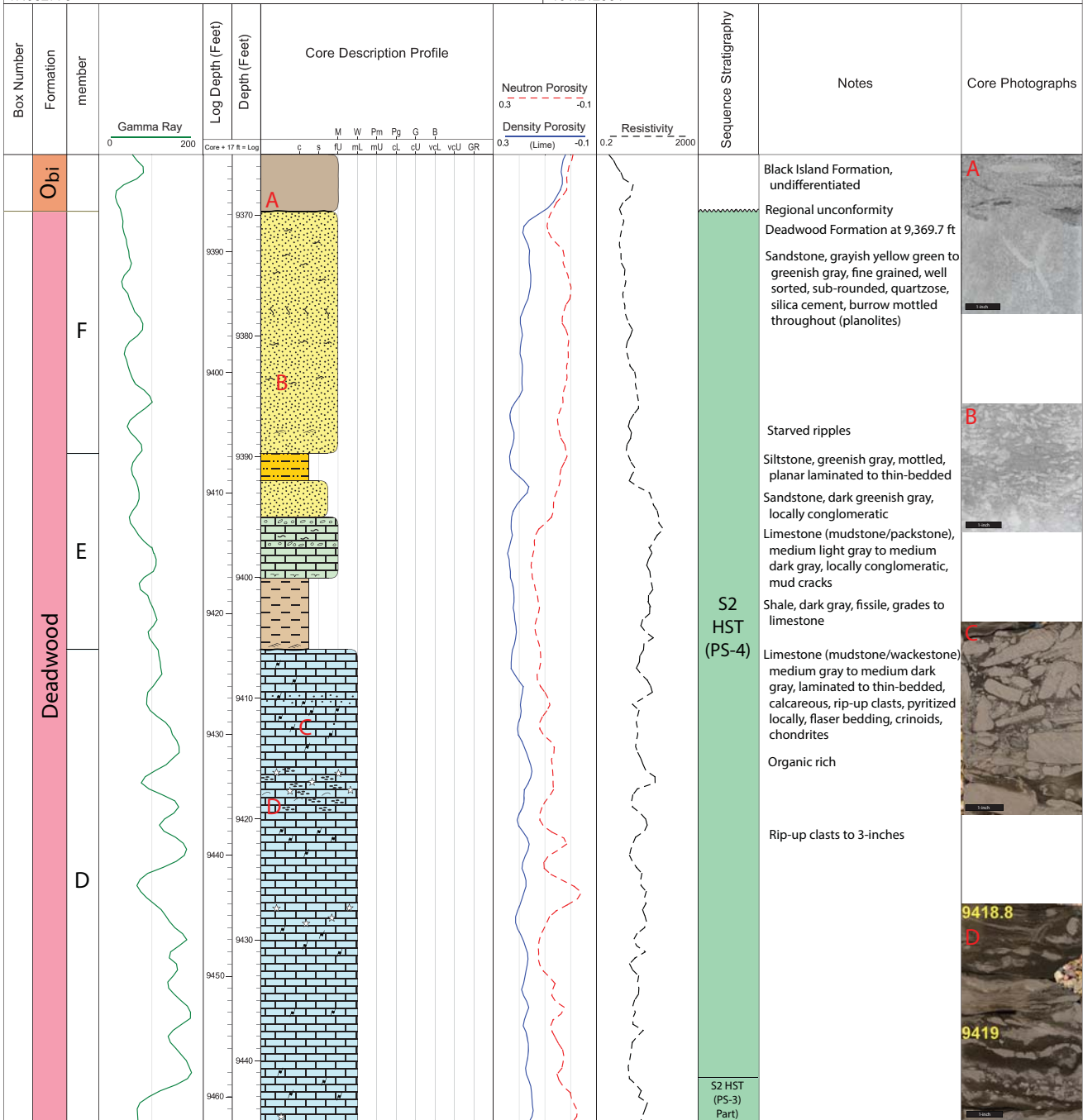




Operator
Minnkota Power Cooperative Inc.

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Top 9365 ft	Bottom 9445 ft
Well Name & No. J-ROC11	Location SWNW Sec. 4, T141N, R83W
Logged by Jeff Bader and John Lake	Date 8/21-10/21
Basin Williston	UWI No. 33-065-00020-00-00
NDIC No. 37672	Field Wildcat
KB 2029 ft	TD 9817
Latitude 47.062776	Longitude -101.212964

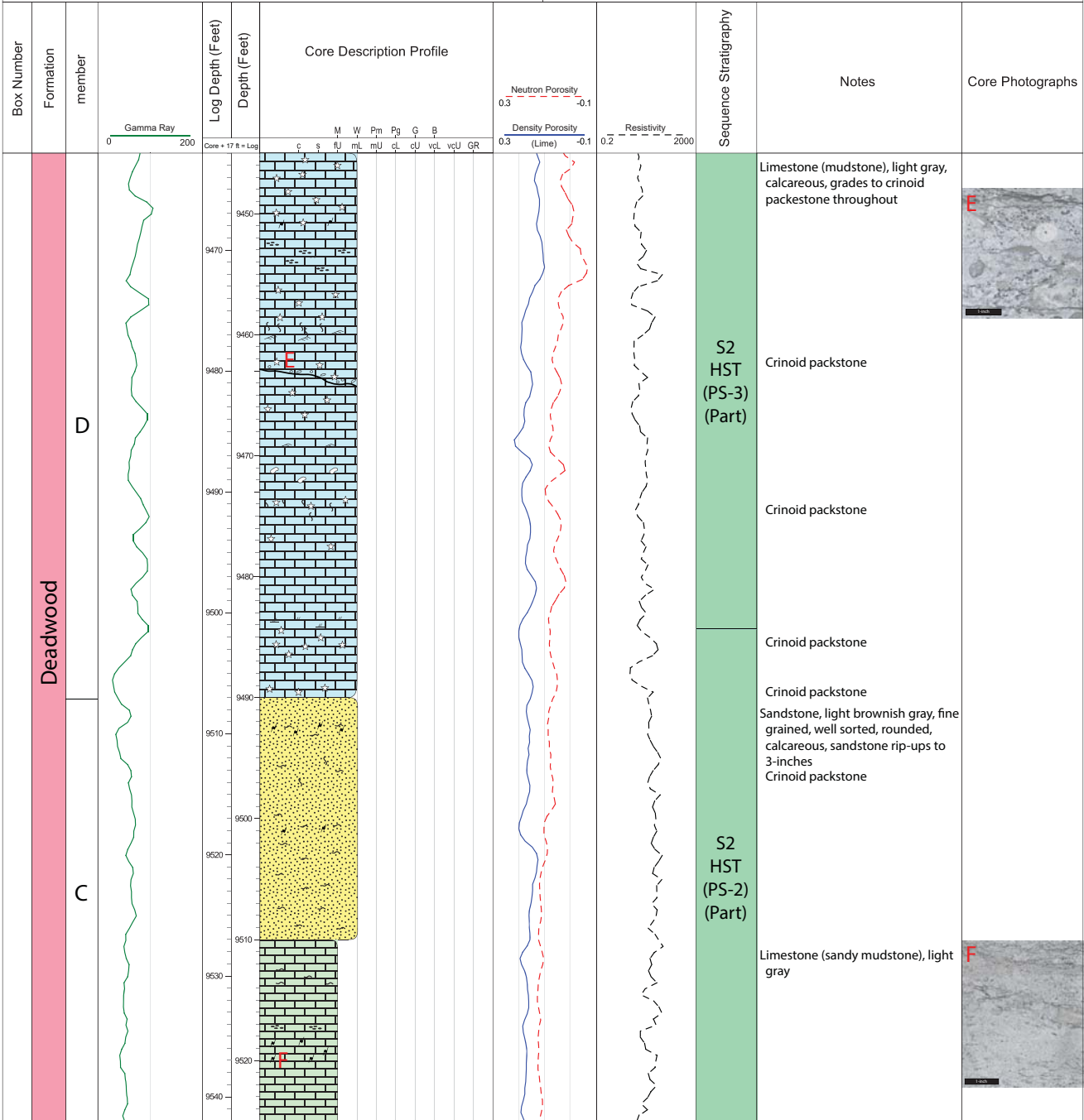




Operator
Minnkota Power Cooperative Inc.

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Top 9445 ft	Bottom 9525 ft
Well Name & No. J-ROC1 1	Location SWNW Sec. 4, T141N, R83W
Logged by Jeff Bader and John Lake	Date 8/21-10/21
Basin Williston	UWI No. 33-065-00020-00-00
NDIC No. 37672	Field Wildcat
KB 2029 ft	TD 9817
Latitude 47.062776	Longitude -101.212964





Operator

Minnkota Power Cooperative Inc.

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Top
9525 ft

Bottom
9605 ft

Well Name & No.
J-ROC1 1

Location
SWNW Sec. 4, T141N, R83W

Logged by
Jeff Bader and John Lake

Date
8/21-10/21

Basin
Williston

UWI No.
33-065-00020-00-00

NDIC No.
37672

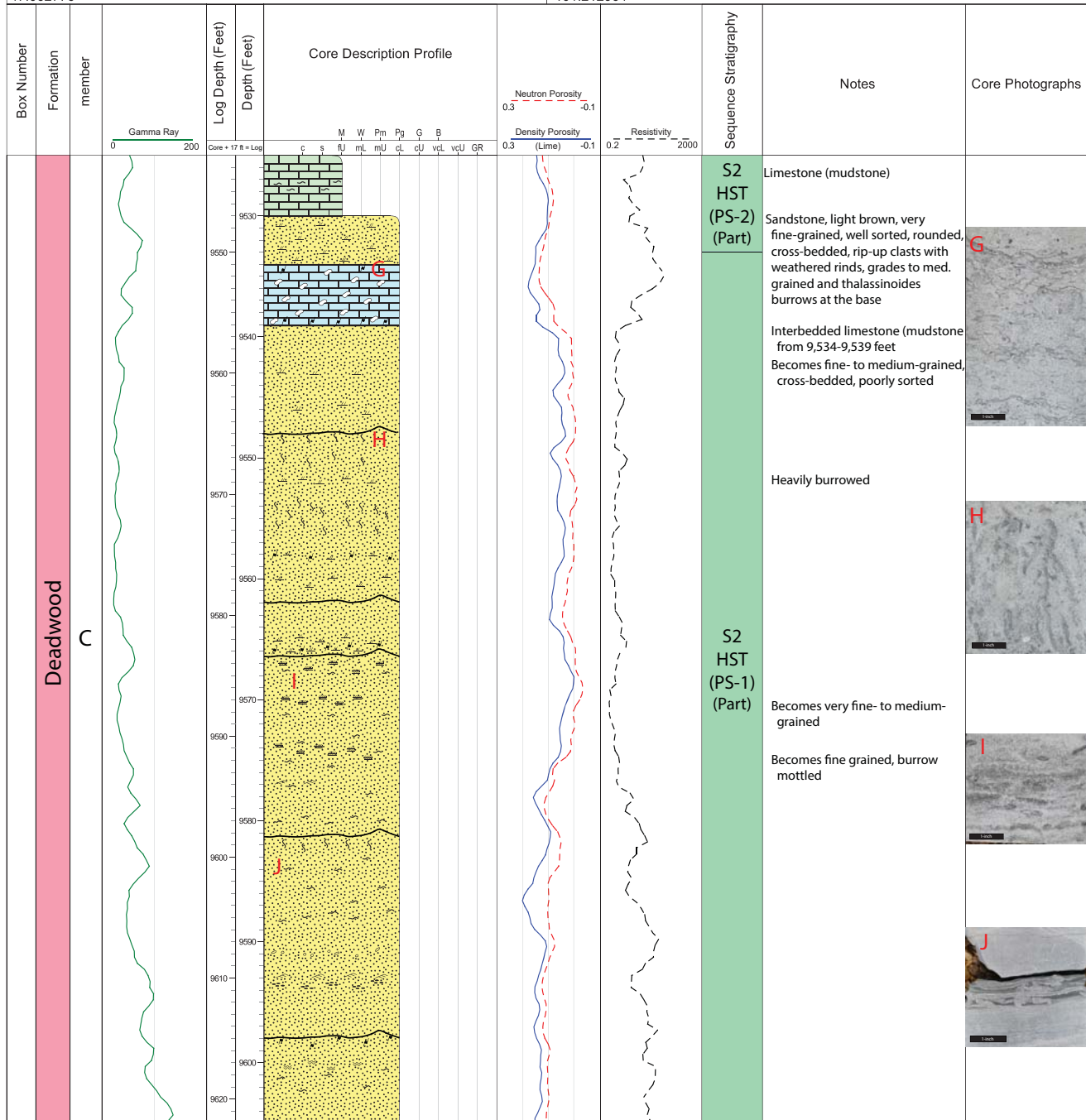
Field
Wildcat

KB
2029 ft

TD
9817

Latitude
47.062776

Longitude
-101.212964

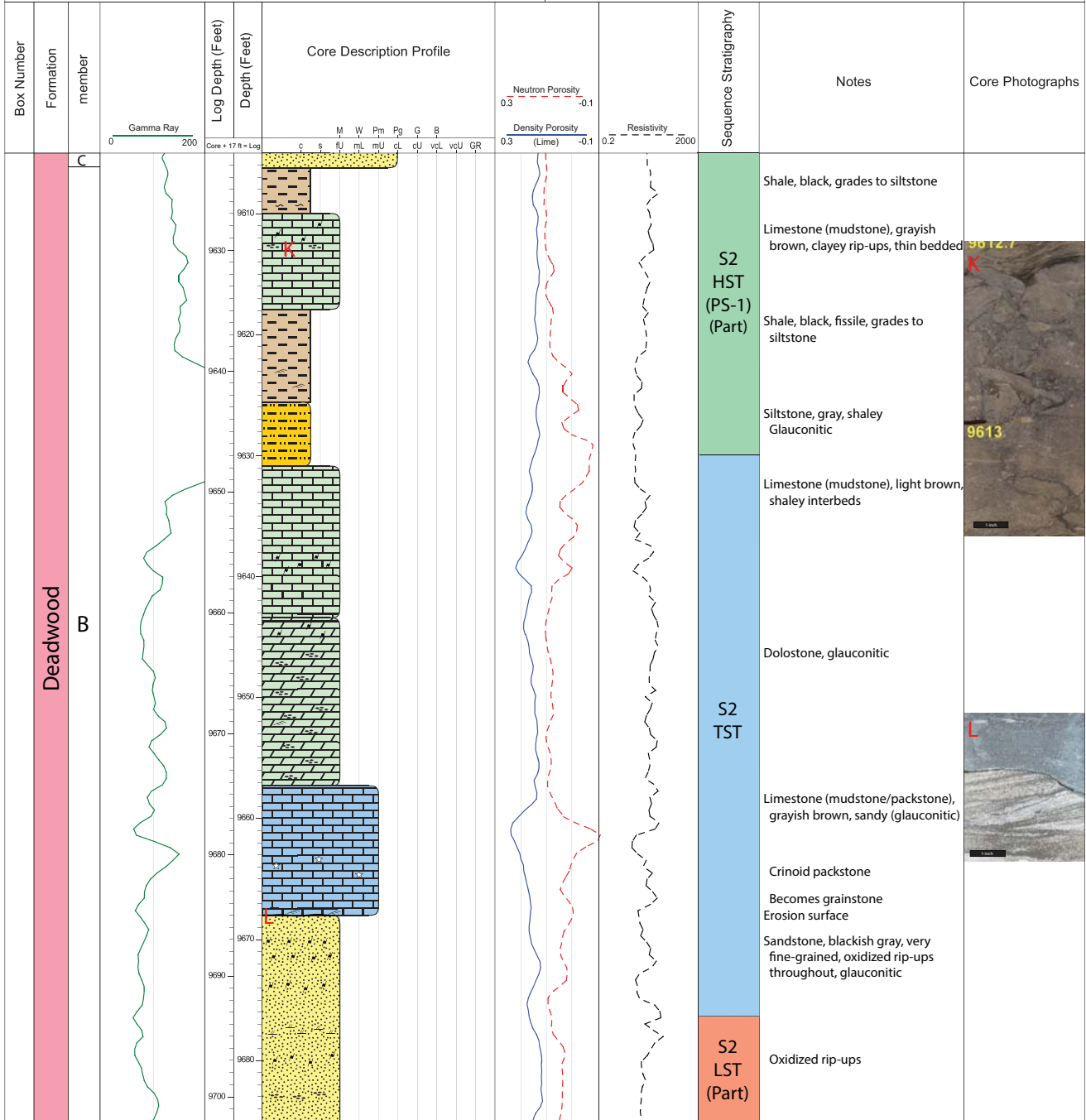




Operator
Minnkota Power Cooperative Inc.

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Top 9605 ft	Bottom 9685 ft
Well Name & No. J-ROC1 1	Location SWNW Sec. 4, T141N, R83W
Logged by Jeff Bader and John Lake	Date 8/21-10/21
Basin Williston	UWI No. 33-065-00020-00-00
NDIC No. 37672	Field Wildcat
KB 2029 ft	TD 9817
Latitude 47.062776	Longitude -101.212964





Operator

Minnkota Power Cooperative Inc.

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Top
9685 ft

Bottom
9745.2 ft

Well Name & No.
J-ROC1 1

Location
SWNW Sec. 4, T141N, R83W

Logged by
Jeff Bader and John Lake

Date
8/21-10/21

Basin
Williston

UWI No.
33-065-00020-00-00

NDIC No.
37672

Field
Wildcat

KB
2029 ft

TD
9817

Latitude
47.062776

Longitude
-101.212964

