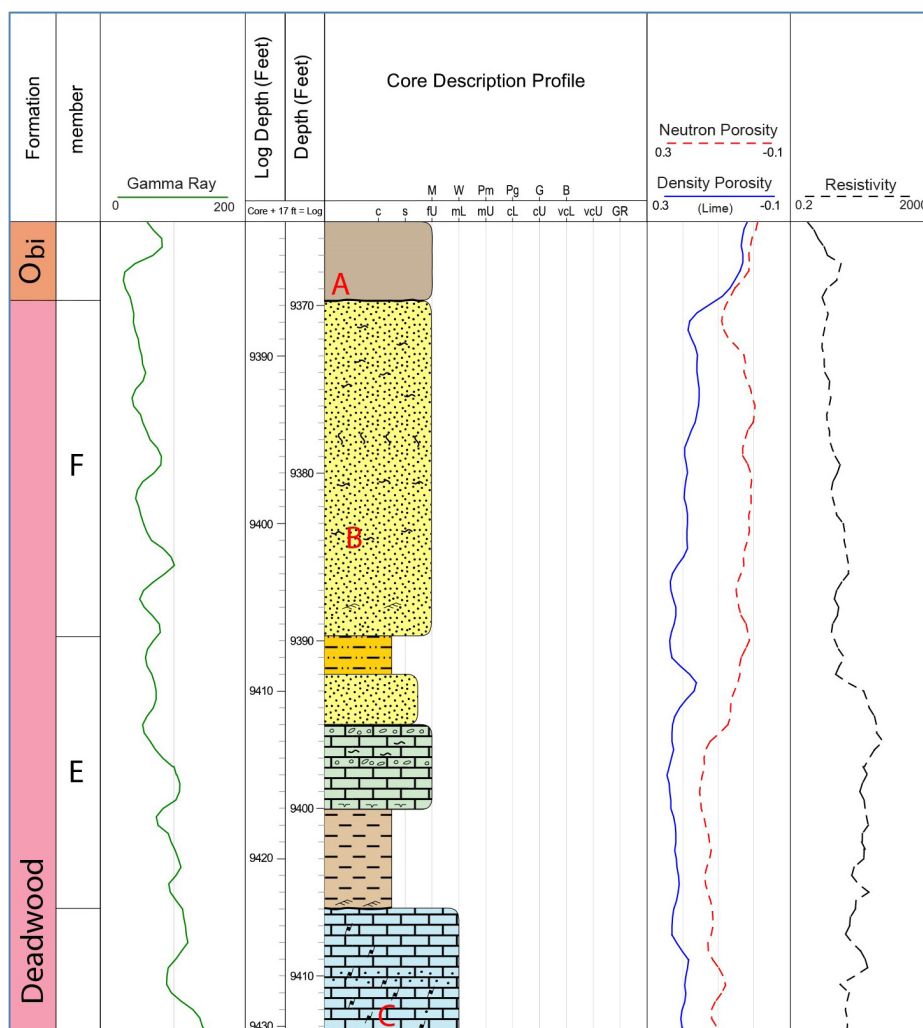


# Deadwood Formation (Cambrian/Ordovician) of North Dakota

## A Core Atlas

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### GEOLOGIC INVESTIGATION NO. 265

NORTH DAKOTA GEOLOGICAL SURVEY

Edward C. Murphy, State Geologist

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2022



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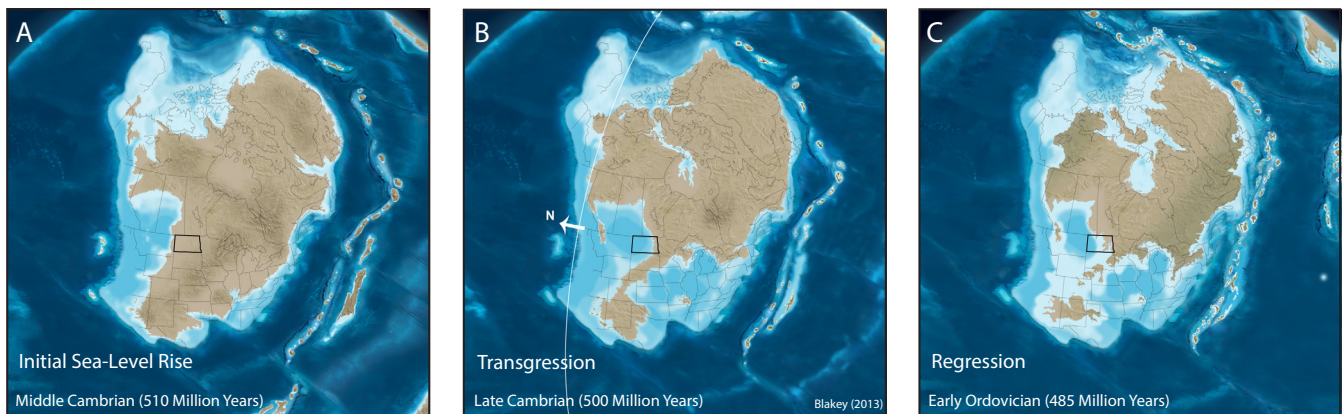
<sup>2</sup>Luff Exploration Company, Denver, Colorado

## INTRODUCTION

The North Dakota Geological Survey (NDGS) is currently conducting studies of the Cambro-Ordovician Deadwood Formation (Deadwood) because of the increased interest in CO<sub>2</sub> storage in underground saline aquifers. This document presents the results of these studies to help establish a detailed stratigraphic framework for the Deadwood. See GI-266 for stratigraphic cross-sections and extent map that may be used in conjunction with this report. 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 CO<sub>2</sub> 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. 1A) and consists of fluvial-deltaic and eolian deposits that give way to more marginal marine (Fig. 1B) (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. 1C; Sarnoski, 2015).

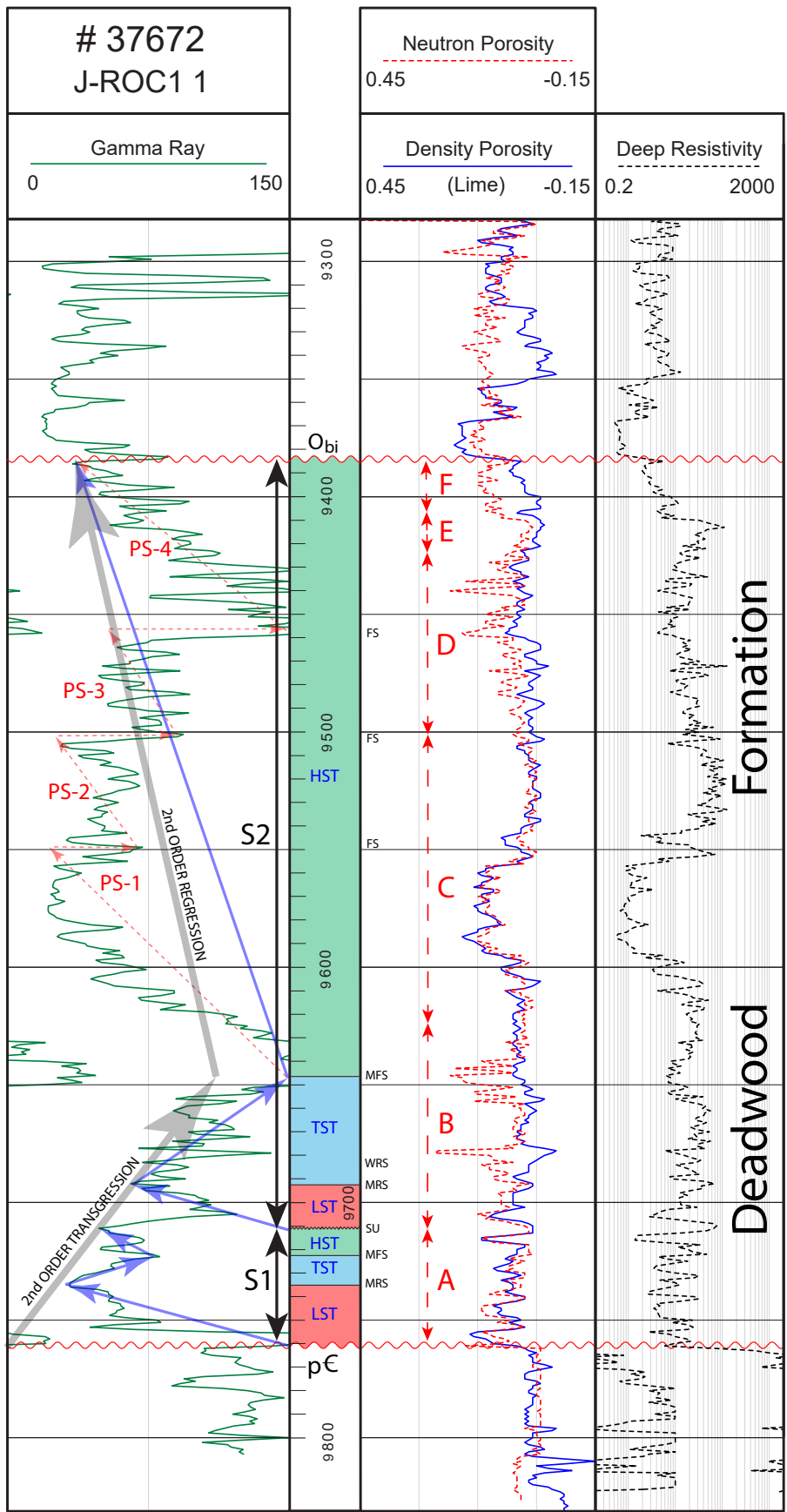
This document presents detailed lithologic descriptions from three Deadwood Formation rock cores and one set of chips from the state of North Dakota (NDIC #6624, NDIC #37672, NDIC #6264, NDIC #38594, and NDIC#155; Fig. 3). Core was viewed and described at the Wilson M. Laird Core and Sample Library in 2014, November 2020, August—October 2021, and March—June 2022. 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
	Carbonaceous		Unconformity
	Chondrites		Wavy bedding
	Crinoid		Wavy lamination
	Cross bedding		

Obi	Ordovician Black Island Formation
p-C	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

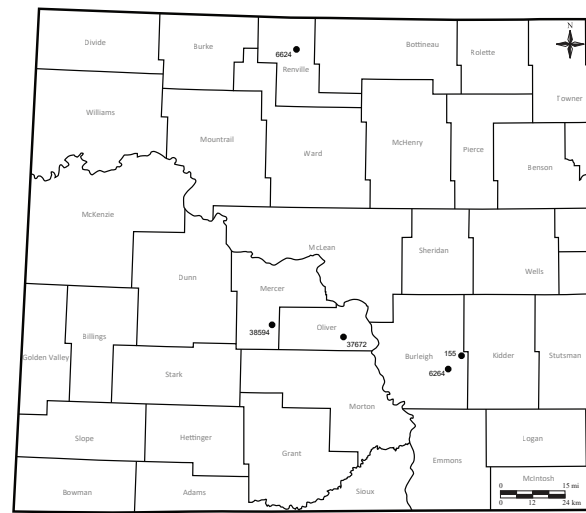


Figure 3.

### Explanation

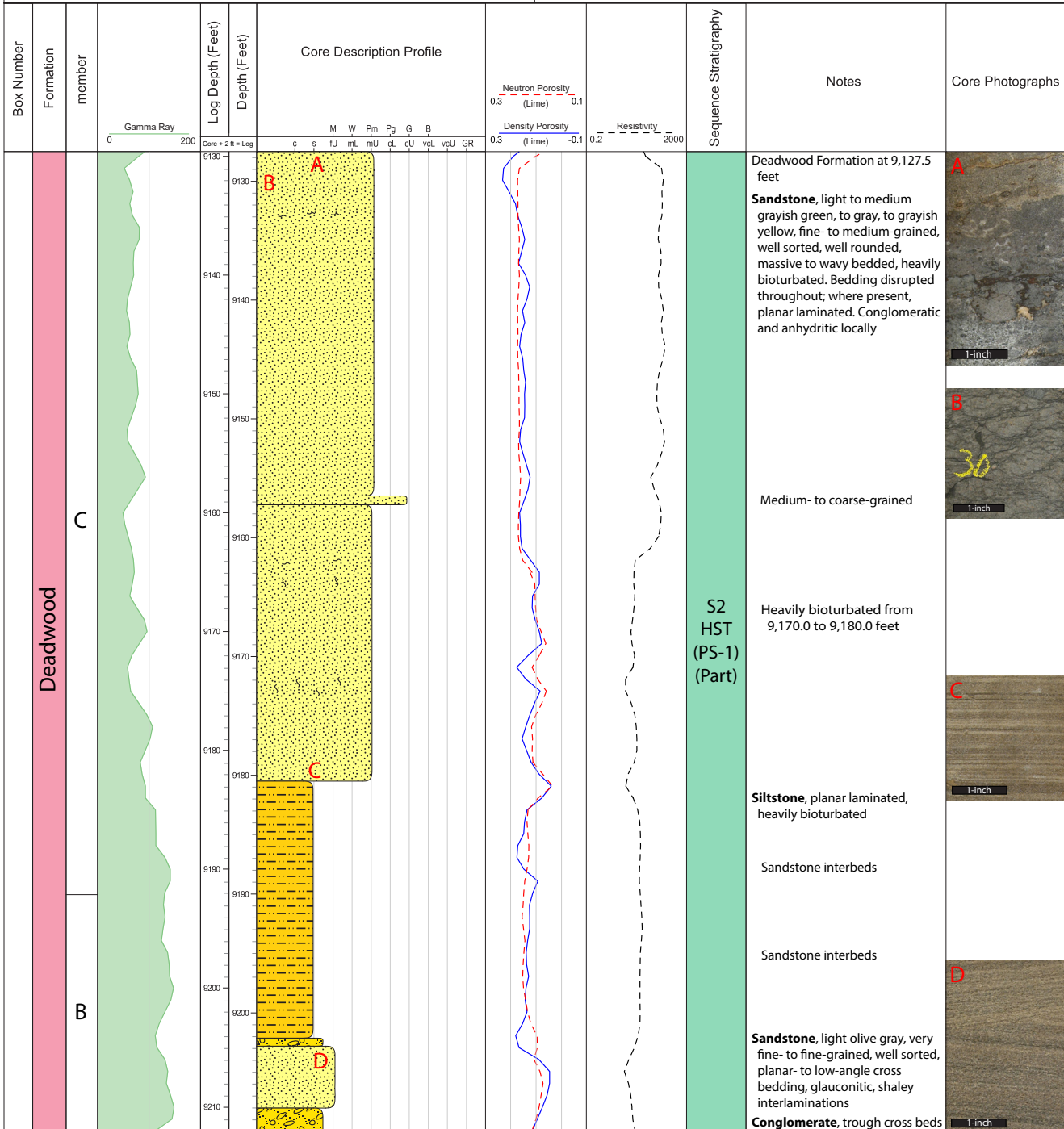
Well Location with NDIC number



Figure 3. Index map showing well locations.

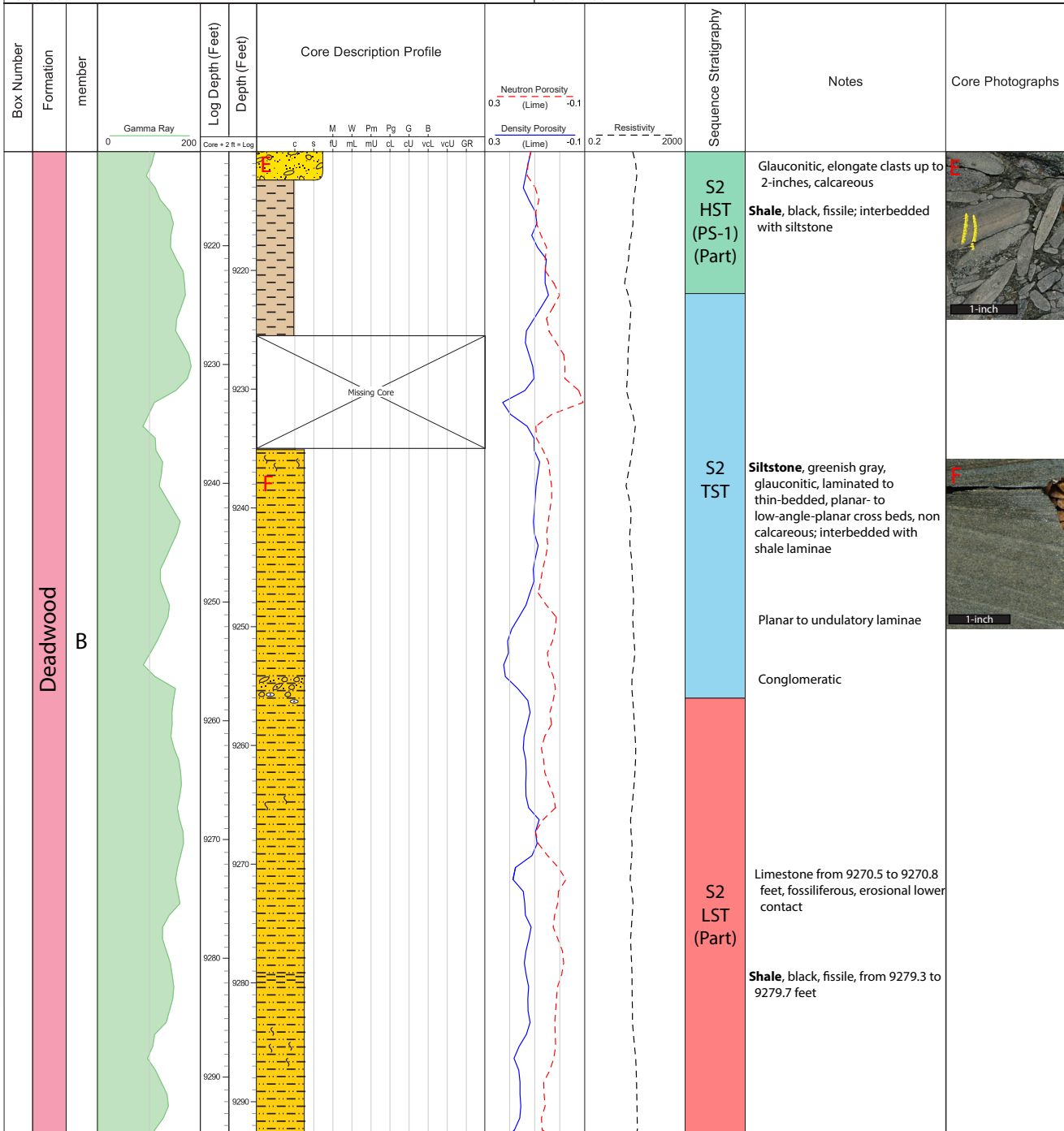


Operator <b>Shell Oil Company</b>		Page 1 of 3
Top 9127.5 ft	Bottom 9210 ft	
Well Name & No. <b>Osterberg 22N-1</b>		Location <b>SENW Sec. 1, T161N, R85W</b>
Logged by <b>Jeff Bader and Anthony Samoski</b>		Date <b>11/14 and 11/20</b>
Basin <b>Williston</b>		UWI No. <b>33-075-00763-00-00</b>
NDIC No.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



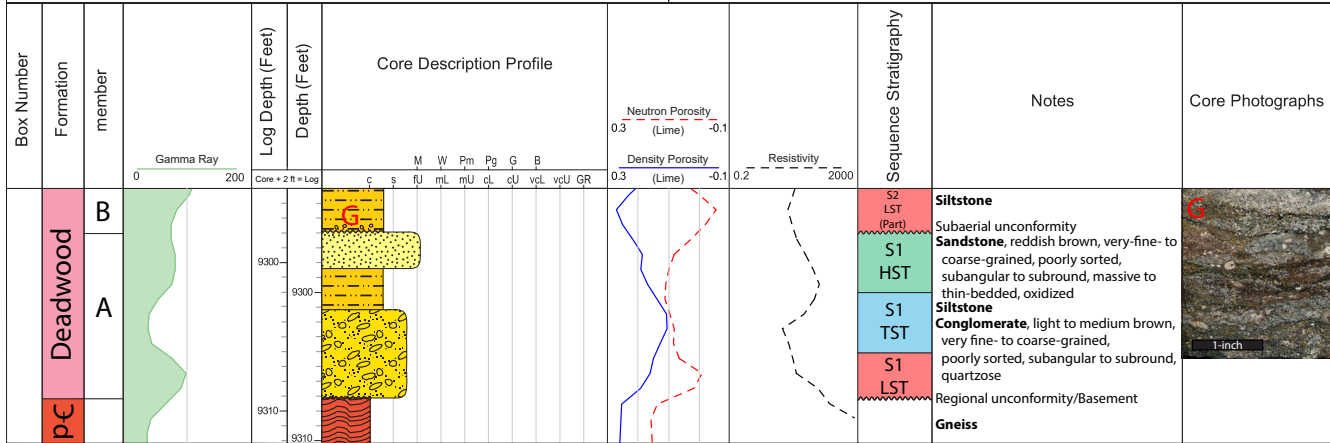


Operator <b>Shell Oil Company</b>		Page 2 of 3
Top 9210 ft	Bottom 9293 ft	
Well Name & No. Osterberg 22N-1	Location SENW Sec. 1, T161N, R85W	
Logged by Jeff Bader and Anthony Sarnoski	Date 11/14 and 11/20	
Basin Williston	UWI No. 33-075-00763-00-00	
NDIC No. 6624	Field Wildcat	
KB 1715 ft	TD 9509	
Latitude 48.802903	Longitude -101.642301	





Operator <b>Shell Oil Company</b>		Page 3 of 3
Top 9293 ft	Bottom 9310.2 ft	
Well Name & No. <b>Osterberg 22N-1</b>	Location <b>SENW Sec. 1, T161N, R85W</b>	
Logged by <b>Jeff Bader and Anthony Sarnoski</b>	Date <b>11/14 and 11/20</b>	
Basin <b>Williston</b>	UWI No. <b>33-075-00763-00-00</b>	
NDIC No. <b>6624</b>	Field <b>Wildcat</b>	
KB <b>1715 ft</b>	TD <b>9509</b>	
Latitude <b>48.802903</b>	Longitude <b>-101.642301</b>	



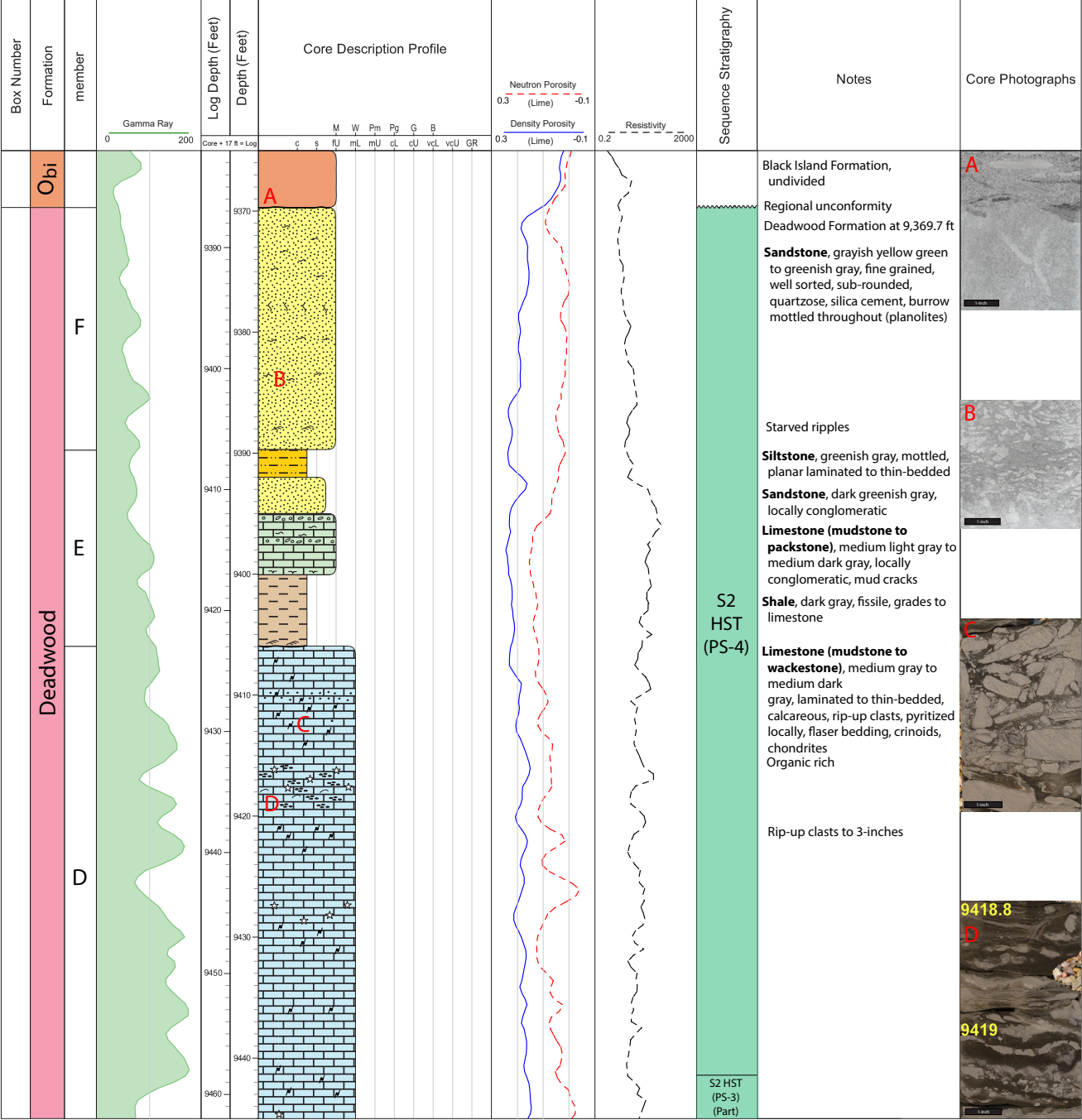




Operator  
Minnkota Power Cooperative Inc.

Page 1 of 5

Top 9365 ft	Bottom 9445 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

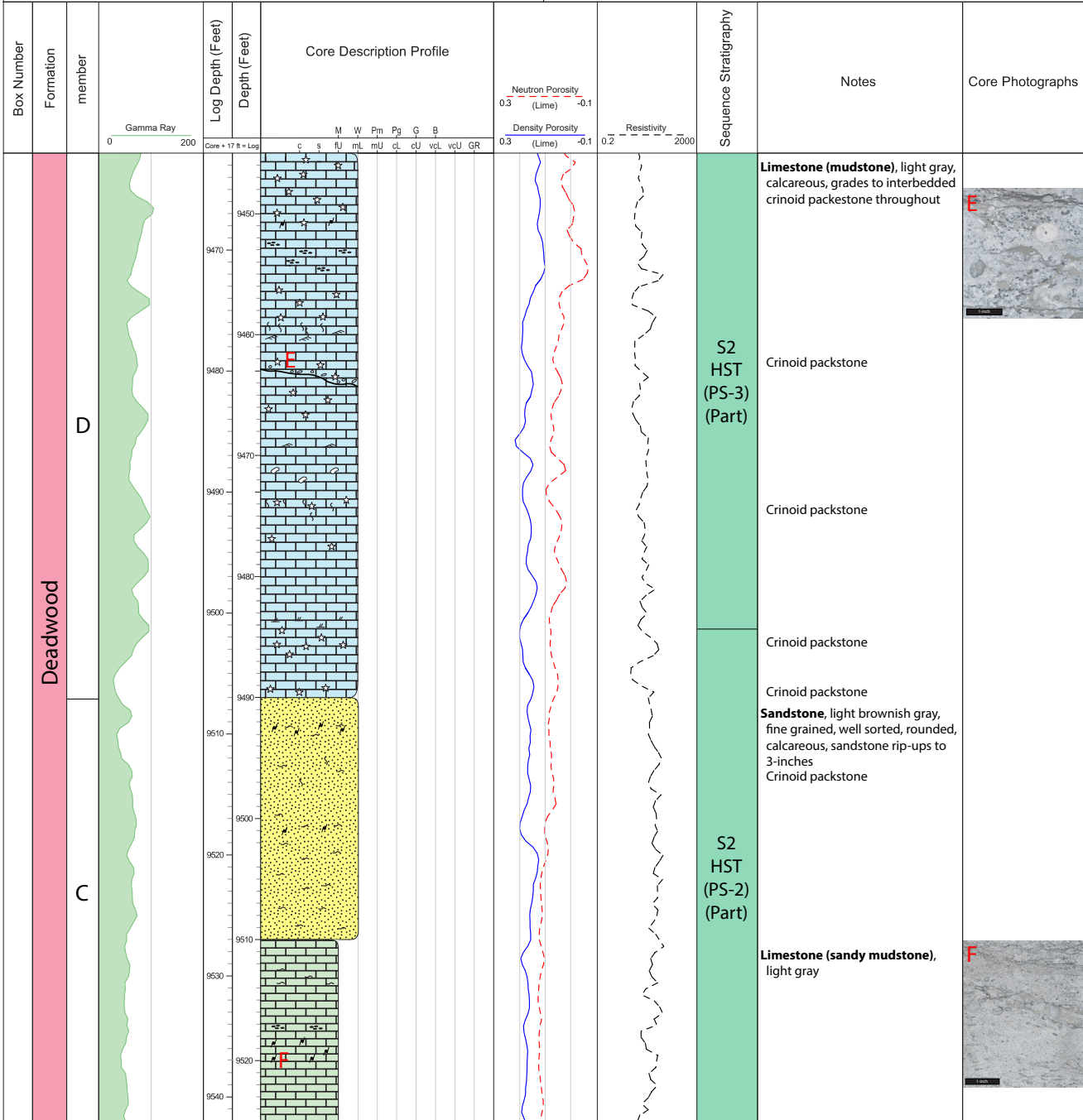




Operator  
Minnkota Power Cooperative Inc.

Page 2 of 5

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	DWI No. 33-065-00020-00-00
NDC No. 37672	Field Wildcat
KB 2029 ft	TD 9817
Latitude 47.062776	Longitude -101.212964



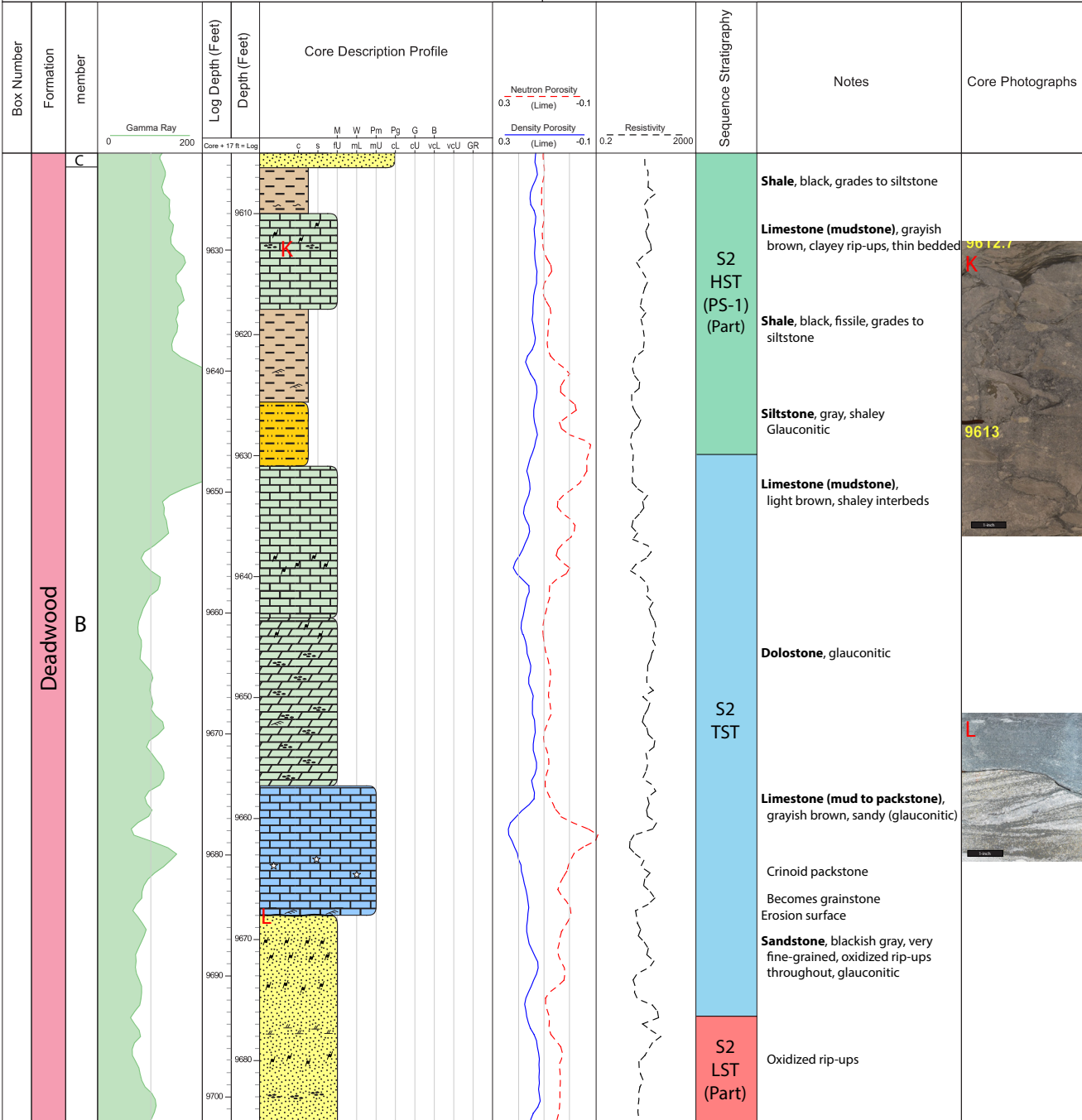




Operator  
Minnkota Power Cooperative Inc.

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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	DWI No. 33-065-00020-00-00
NZIC No. 37672	Field Wildcat
KB 2029 ft	TD 9817
Latitude 47.062776	Longitude -101.212964

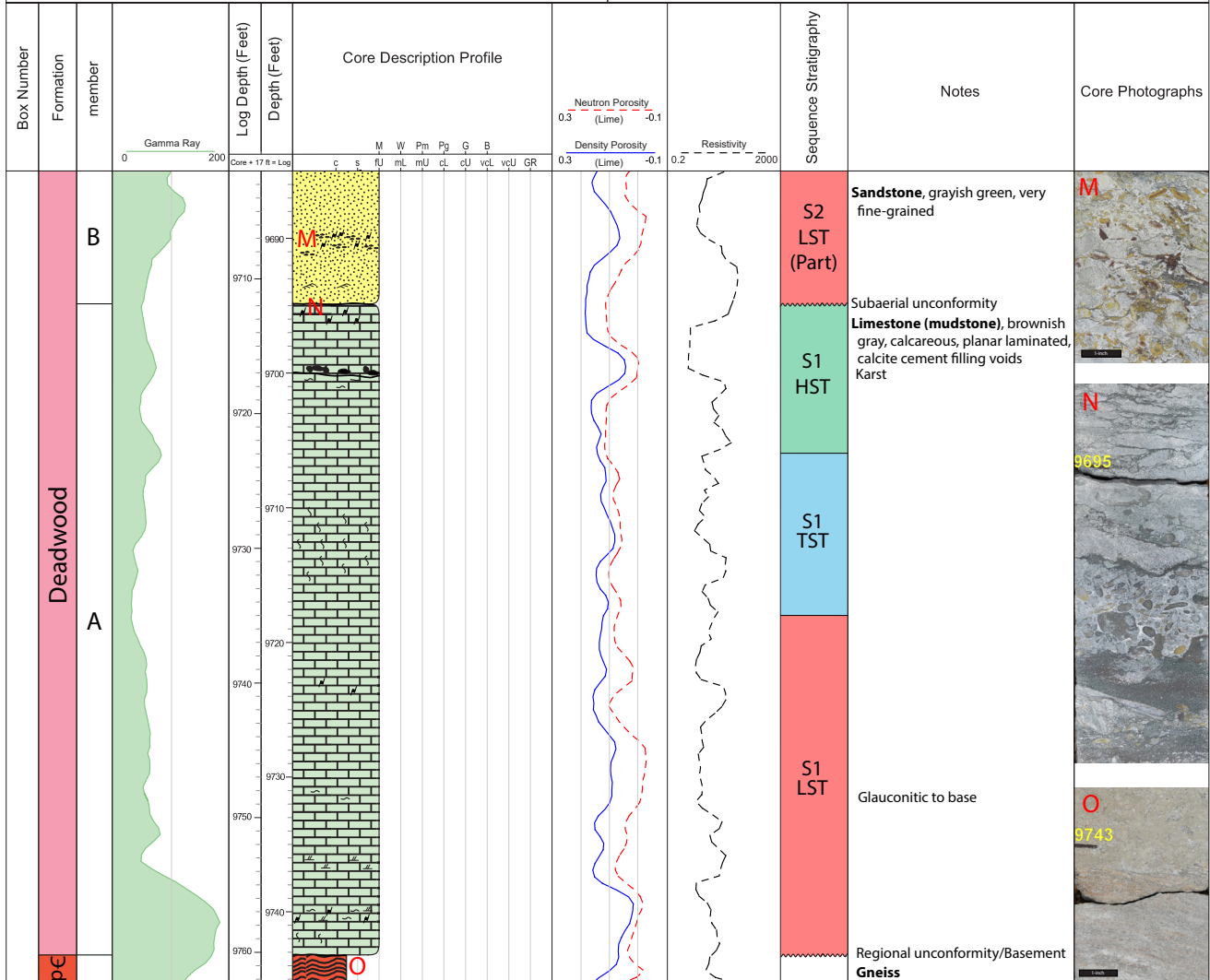




Operator  
Minnkota Power Cooperative Inc.

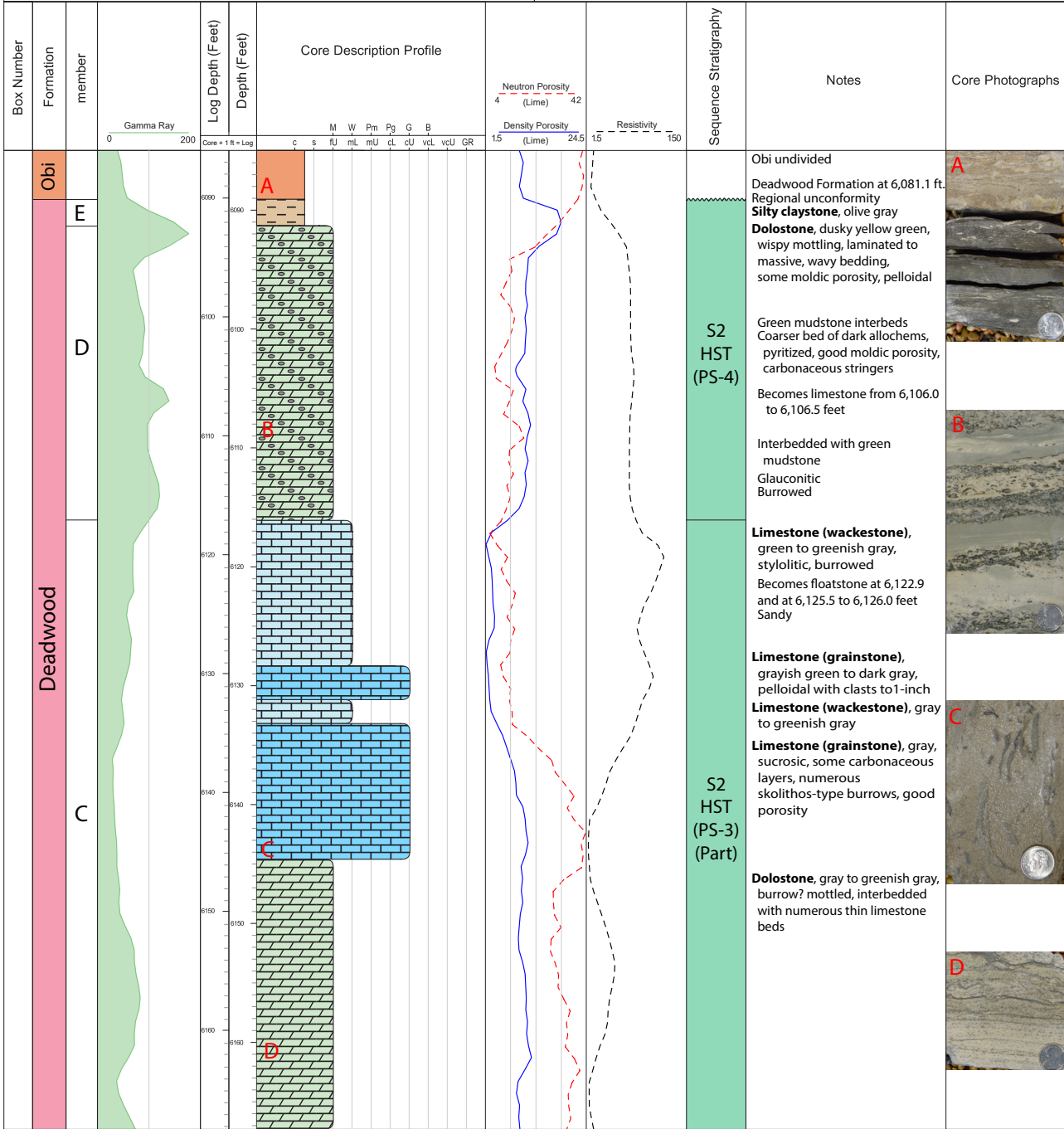
Page 5 of 5

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



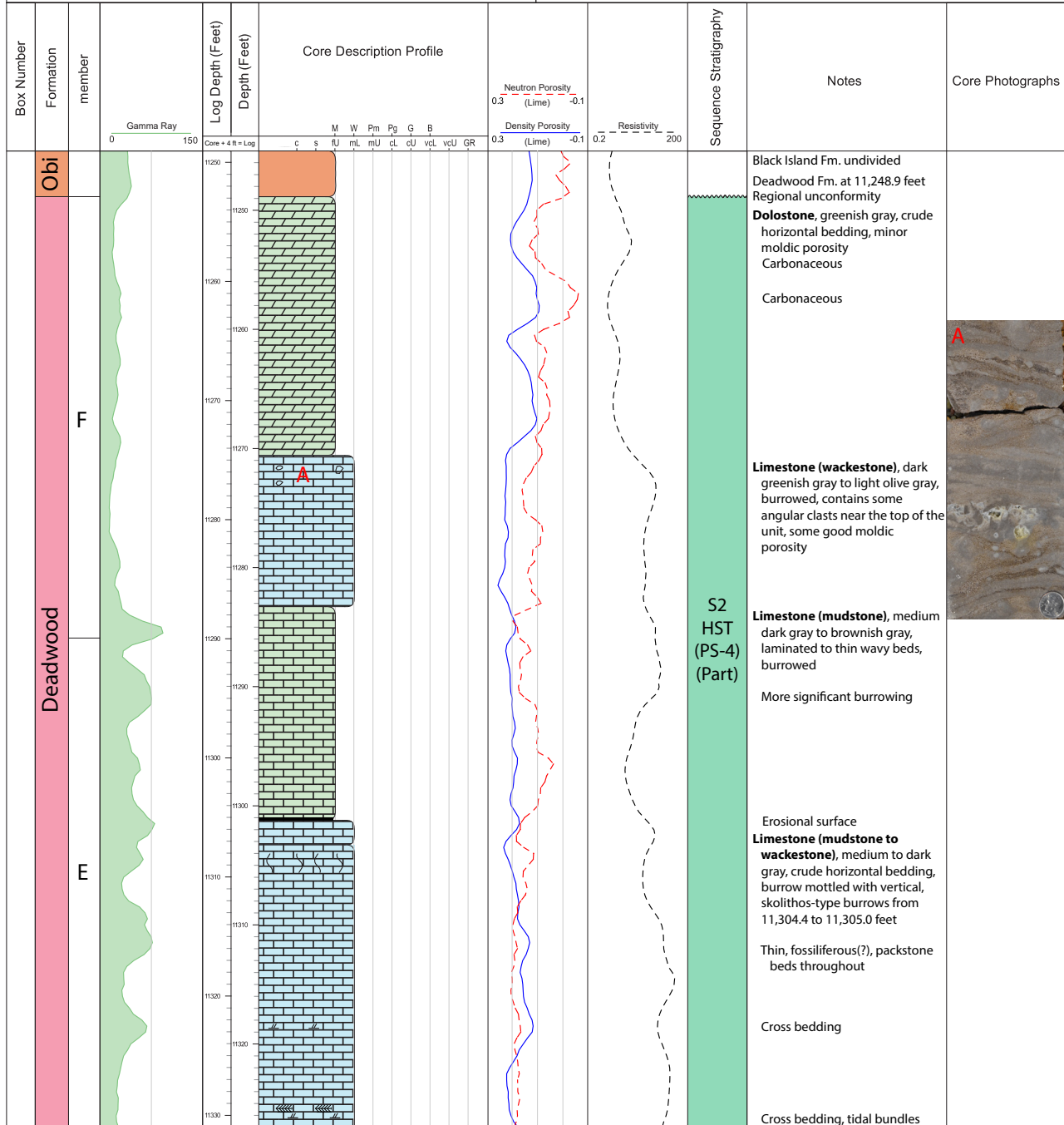


Operator <b>Tom F. Marsh</b>		Page 1 of 1
Top 6085 ft	Bottom 6167 ft	
Well Name & No. <b>Funston #1</b>	Location <b>NENE Sec. 9, T139N, R76W</b>	
Logged by <b>Jeff Bader</b>	Date <b>Mon Mar 7 2022</b>	
Basin <b>Williston</b>	UWI No. <b>33-015-00032-00-00</b>	
NDIC No. <b>6264</b>	Field <b>Wildcat</b>	
KB <b>1938 ft</b>	TD <b>6300</b>	
Latitude <b>46.878560</b>	Longitude <b>-100.269600</b>	





Operator Summit Carbon Solutions, LLC		Page 1 of 6
Top 11245 ft	Bottom 11327 ft	
Well Name & No. Milton Flemmer 1	Location NWNE Sec. 35, T141N, R88W	
Logged by Jeff Bader	Date Mon May 2 2022	
Basin Williston	UWI No. 33-057-00041-00-00	
NDIC No. 38594	Field Wildcat	
KB 2315 ft	TD 12009 ft	
Latitude 46.994918	Longitude -101.792969	

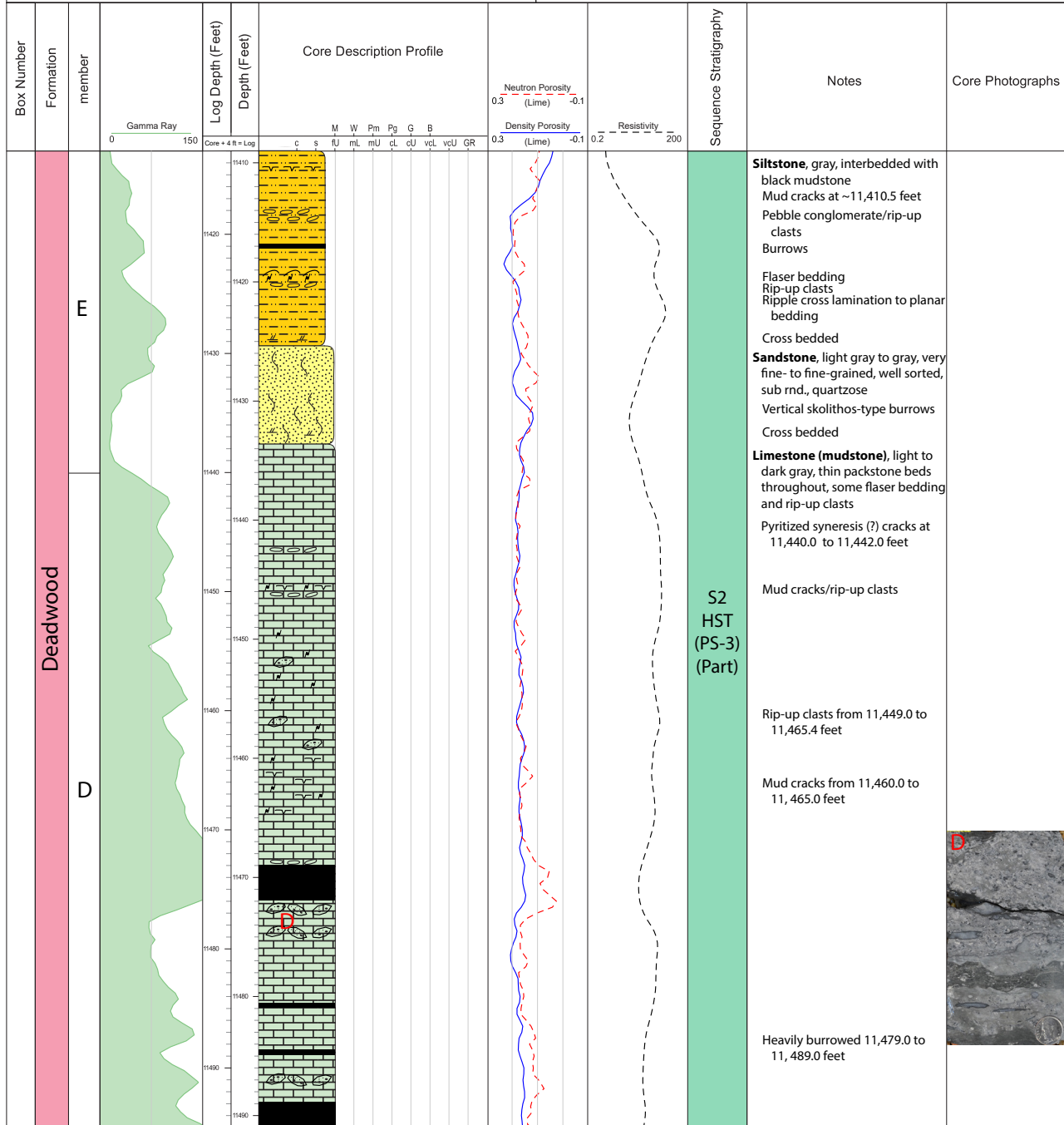






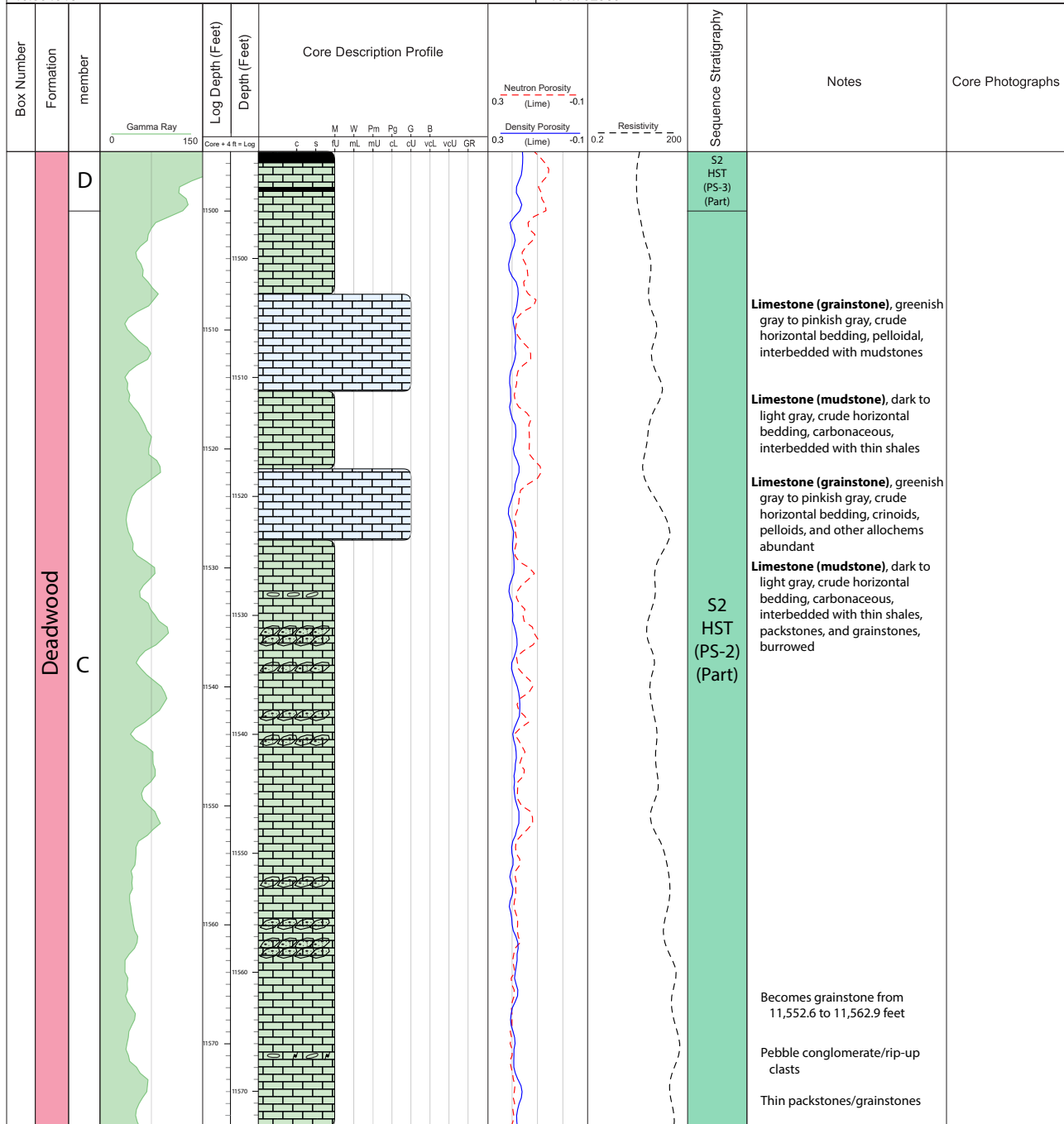


Operator Summit Carbon Solutions, LLC		Page 3 of 6
Top 11409 ft	Bottom 11491 ft	
Well Name & No. Milton Flemmer 1	Location NWNE Sec. 35, T141N, R88W	
Logged by Jeff Bader	Date Mon May 2 2022	
Basin Williston	UWI No. 33-057-00041-00-00	
NDIC No. 38594	Field Wildcat	
KB 2315 ft	TD 12009 ft	
Latitude 46.994918	Longitude -101.792969	





Operator <b>Summit Carbon Solutions, LLC</b>		Page 4 of 6
Top 11491 ft	Bottom 11573 ft	
Well Name & No. Milton Flemmer 1	Location NWNE Sec. 35, T141N, R88W	
Logged by Jeff Bader	Date Mon May 2 2022	
Basin Williston	UWI No. 33-057-00041-00-00	
NDIC No. 38594	Field Wildcat	
KB 2315 ft	TD 12009 ft	
Latitude 46.994918	Longitude -101.792969	

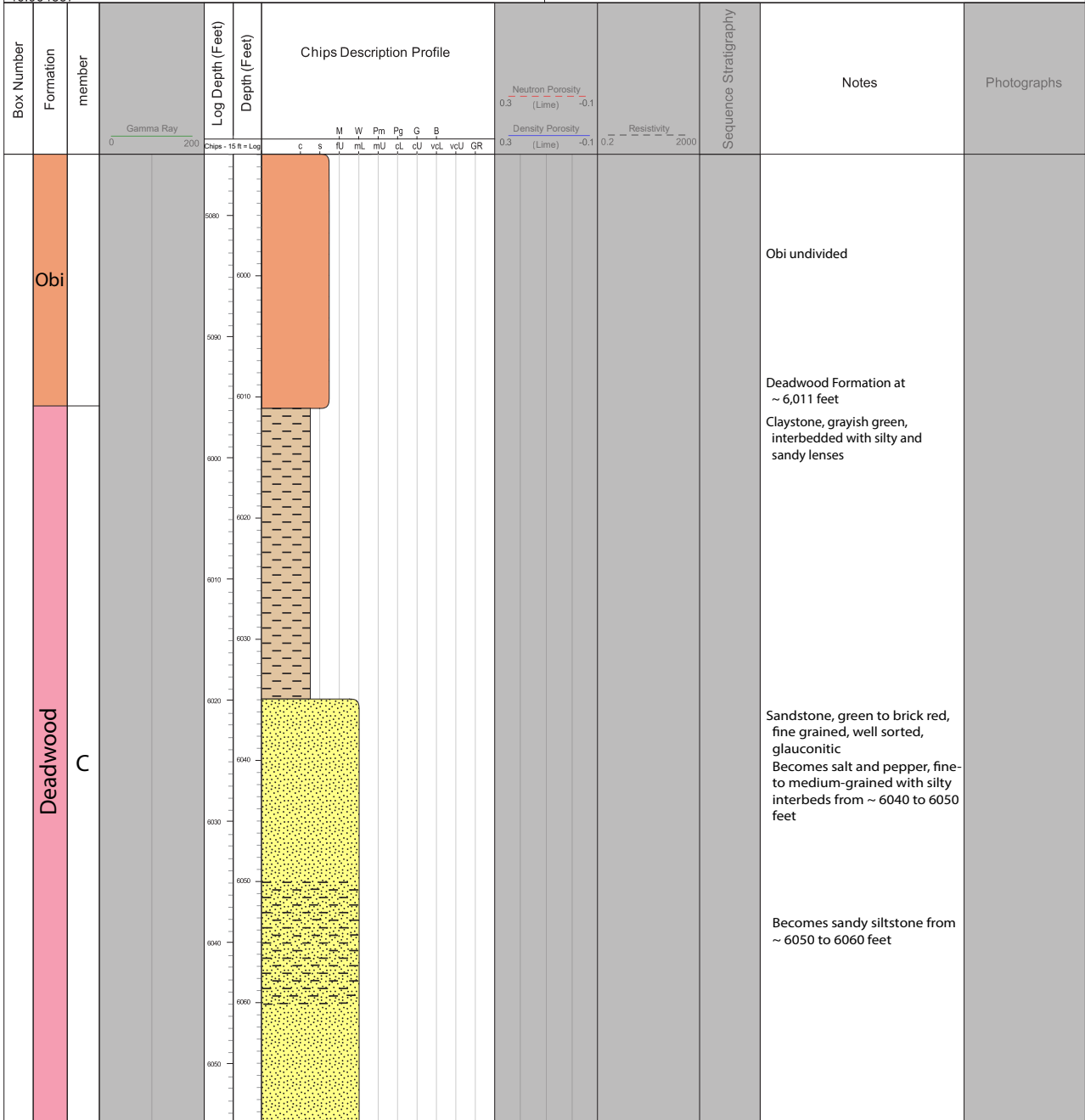








Operator <b>Continental Oil Company</b>		Page 1 of 2
Top 5990 ft	Bottom 6070 ft	
Well Name & No. Dronen #1	Location NENE Sec. 9, T140N, R75W	
Logged by Jeff Bader	Date Tue Mar 15 2022	
Basin Williston	UWI No. 33-015-00004-00-00	
NDIC No. 155	Field Wildcat	
KB 1912 ft	TD 6155	
Latitude 46.964837	Longitude -100.141447	





Operator <b>Continental Oil Company</b>		Page 2 of 2
Top 6070 ft	Bottom 6142 ft	
Well Name & No. <b>Dronen #1</b>	Location <b>NENE Sec. 9, T140N, R75W</b>	
Logged by <b>Jeff Bader</b>	Date <b>Tue Mar 15 2022</b>	
Basin <b>Williston</b>	UWI No. <b>33-015-00004-00-00</b>	
NDIC No. <b>155</b>	Field <b>Wildcat</b>	
KB <b>1912 ft</b>	TD <b>6155</b>	
Latitude <b>46.964837</b>	Longitude <b>-100.141447</b>	

