2010 Bakken Three Forks Core Workshop

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Richard D. LeFever
Stephan H. Nordeng
Isopach map of the Bakken Upper Shale Member (C.I. = 2 ft.)
Isopach map of the Bakken Middle Member (C.I. = 5 ft.)
Isopach map of the Three Forks Formation (C.I. = 20 ft.)
Reference log showing middle Bakken facies
## Workshop Cores

<table>
<thead>
<tr>
<th></th>
<th>Well</th>
<th>Cored Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NENW Sec. 35, T156N, R93W&lt;br&gt;Shell Oil Company - #21-35 L. Texel</td>
<td>10167-10246</td>
</tr>
<tr>
<td>2</td>
<td>NWNW Sec. 28, T155N, R92W&lt;br&gt;Brigham Oil &amp; Gas, L.P. - #28-1H Anderson</td>
<td>10061-10124</td>
</tr>
<tr>
<td>3</td>
<td>NESE Sec 28, T154N, R92W&lt;br&gt;Fidelity Exploration &amp; Production Co. –&lt;br&gt;#43-28H Deadwood Canyon Ranch</td>
<td>10077-10147</td>
</tr>
<tr>
<td>4</td>
<td>NWNW Sec. 11, T153N, R91W&lt;br&gt;Whiting Oil and Gas Corporation - #11-11H Braaflat</td>
<td>9872-9933</td>
</tr>
<tr>
<td>5</td>
<td>Lot 3, Sec. 5, T152N, R90W&lt;br&gt;EOG Resources, Inc. - #1-05H N&amp;D</td>
<td>9421 - 9471</td>
</tr>
<tr>
<td>6</td>
<td>SESE Sec. 12, T151N, R90W&lt;br&gt;EOG Resources, Inc. - #1-12H Fertile</td>
<td>9365 - 9405</td>
</tr>
</tbody>
</table>
33-061-00187-0000
#5088
NENW Sec. 35, T156N, R93W
Shell Oil Company
#21-35 L. Texel
KB = 2409 ft.

Gamma Ray
Sonic
Resistivity

Unit 2
Unit 3
Unit 4
Unit 5
Unit 6
Bakken Formation
Three Forks Formation
Core + 2 = Log
NENW Sec. 35, T.156N., R. 93W.
Shell Oil Co.
#21-35 Shell-Texel

Cored Interval: 10167-10213.5 ft
33-061-00765-0000
#17351
NWNW Sec. 28, T155N, R92W
Brigham Oil & Gas, L.P.
#28-1H Anderson
KB = 2320 ft.

Gamma Ray
Neutron Porosity
Density Porosity
Deep Resistivity
Permeability
Grain Density
Porosity

Bakken Formation
Three Forks Formation

Core + 10 = Log
NWNW Sec. 28, T.155N., R92W.
Brigham Oil & Gas, L.P.
#28 1-H Anderson

Cored Interval: 10061 - 11095.5 ft
33-061-00581-0000
#16841
NESE Sec 28, T154N, R92W
Fidelity Exploration & Production Co.
#43-28H Deadwood Canyon Ranch
KB = 2129 ft.

Gamma Ray
Neutron Porosity
Density Porosity
Deep Resistivity
Porosity

Grain Density
Permeability

0.3 0.1
0.2 2000
0.0001 10
2.4 3

Core + 9 = Log

Bakken Formation
Three Forks Formation

Unit 2
Unit 3
Unit 4
Unit 5
Unit 6

"basal Bakken"

upper
middle
lower
Cored Interval: 10077 - 10110 ft

Fidelity Exploration & Production Company

#43-28H Deadwood Canyon Ranch
NESE Sec 28., T.154N., R.92W.
Fidelity Exploration & Production Company
#43-28H Deadwood Canyon Ranch

Cored Interval: 10110 - 10147 ft
33-061-00641-0000
#17023
NWNW Sec. 11, T153N, R91W
Whiting Oil and Gas Corporation
#11-11H Braaflat
KB = 2299 ft

Core + 4 = Log
NWNW Sec. 11, T.153N., R91W.
Whiting Oil and Gas Corporation
#11-11H Braaflat

Cored Interval: 9872 - 9907 ft
Lot 3 Sec. 5, T.152N., R. 90W.
EOG Resources, Inc.
#1-05H N&D

Cored Interval: 9421.5-9446
Lot 3 Sec. 5, T.152N., R. 90W.
EOG Resources, Inc.
#1-05H N&D

Cored Interval: 9446-9471
33061005570000
#16743
SESE Sec. 12, T151N, R90W
EOG Resources, Inc.
#1-12H Fertile
KB=2130 ft.

Gamma Ray

Neutron Porosity

Density Porosity

Deep Resistivity

Permeability

Porosity

Grain Density

Core + 10 = Log
SESE Sec. 12, T.151N., R. 90W.
EOG Resources, Inc.
#1-12H Fertile

Cored Interval: 9365-9375
SESE Sec. 12, T.151N., R. 90W.
EOG Resources, Inc.
#1-12H Fertile

Cored Interval: 9385-9395
### Workshop Cores

<table>
<thead>
<tr>
<th></th>
<th>Well</th>
<th>Cored Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NWNW Sec. 10, T154N, R102W&lt;br&gt;Brigham Oil &amp; Gas, L.P. - #10-15-1-H Olson</td>
<td>10609 – 10730.5</td>
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<tr>
<td>2</td>
<td>NESW Sec. 14, T149N, R100W&lt;br&gt;Whiting Oil &amp; Gas Corporation - #23-14 Curl</td>
<td>11033 – 11096</td>
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<tr>
<td>3</td>
<td>NWNE Sec. 12, T146N, R99W&lt;br&gt;American Hunter Exploration Ltd. – #12-31 H3 AHEL et al Grassey Butte</td>
<td>11284 – 11330</td>
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<tr>
<td>4</td>
<td>SWSW Sec. 5, T143N, R99W&lt;br&gt;Texaco, Inc. - #5-1 Texaco Thompson Unit</td>
<td>11031 – 11089</td>
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<td>5</td>
<td>SWNE Sec. 34, T141N, R100W&lt;br&gt;Florida Exploration Company - #34-1 Federal</td>
<td>10497 – 10540</td>
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<tr>
<td>6</td>
<td>NWNW Sec. 9, T142N, R97W&lt;br&gt;Ansbro Petroleum Company, LLC - #1-9 Griggs</td>
<td>10630 – 10689</td>
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<tr>
<td>7</td>
<td>SESE Sec. 14, T141N, R96W&lt;br&gt;Anschutz Exploration Corp. - #24-14H Sadowsky</td>
<td>10450 – 10538</td>
</tr>
</tbody>
</table>
33-105-01693-0000

#17513

NWNW Sec. 10, T154N, R102W
Brigham Oil & Gas, L.P.
#10-15-1-H Olson
KB=2183 ft.

Gamma Ray
Density Porosity
Neutron Density
Pe
Grain Density
Deep Resistivity
Permeability
Porosity

Core + 7.4 = Log
NWNW Sec. 10, T.154N., R.102W.
Brigham Oil & Gas, L.P.
#10-15-1-H Olson

Cored Interval: 10609 - 10643 ft
NWNW Sec. 10, T.154N., R.102W.
Brigham Oil & Gas, L.P.
#10-15-1-H Olson

Cored Interval: 10676 - 10709 ft
### Log Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Values</th>
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<tbody>
<tr>
<td>Gamma Ray</td>
<td></td>
<td></td>
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<tr>
<td>Neutron Porosity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep Resistivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permeability (md)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain Density</td>
<td></td>
<td></td>
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</tbody>
</table>

### Formation Layers

- **Bakken Formation**
  - Unit 1
  - Unit 2
  - Unit 3
  - Unit 4
  - Unit 5
  - Unit 6

- **Three Forks Formation**
  - Upper
  - Lower

### Core Analysis

- Core - 6.5 = Log
NESW Sec. 14, T.149N., R.100W.
Whiting Oil and Gas Corporation
#23-14 Curl

Cored Interval: 11033 - 10066.5 ft
NESW Sec. 14, T.149N., R.100W.
Whiting Oil and Gas Corporation
#23-14 Curl

Cored Interval: 11066.5 - 11096 ft
NWNE Sec. 12, T.146N, R.99W
American Hunter Exploration Ltd.
#12-31 H3 AHEL et al Grassey Butte

Cored Interval: 11284 - 11306 ft.
NWNE Sec. 12, T.146N, R.99W
American Hunter Exploration Ltd.
#12-31 H3 AHEL et al Grassey Butte

Cored Interval: 11306-11330 ft.
33-007-01185-0000
#12748
SWSW Sec. 5, T143N, R99W
Texaco, Inc.
#5-1 Texaco Thompson Unit
KB=2669 ft.

Density Porosity
0.3 -0.1

Neutron Porosity
0.3 -0.1

Deep Resistivity
0.2 2000

Porosity
0 15

Permeability
0.0001 10

Grain Density
2 3

Granular Density
11050
11100
11150
11200
11250
11300
11350

“basal Bakken”

Three Forks Formation

Core + 8 = Log
SWSW Sec. 5, T.143N., R.99W.
Texaco, Inc.
#5-1 Texaco Thompson Unit

Cored Interval: 11051.75 - 11070.5
SWNE Sec. 34, T.141N., R100W.
Florida Exploration Company
#34-1 Federal

Cored Interval: 10528 - 10540 ft
### Gamma Ray
- 0.3 - 0.1

### Neutron Porosity
- 0.3 - -0.1

### Density Porosity
- 0.2 - 2000

### PE
- 2 - 6

### Deep Resistivity
- 0 - 15

### Porosity
- 0.0001 - 10

### Permeability
- 2 - 3

### Grain Density
- 10650 - 10900

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**Unit 4**

**Unit 5**

**Unit 6**

**Three Forks Formation**

**Bakken Formation**

*upper*

*middle*

*lower*

*"basal Bakken"*

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Core + 5.9 = Log

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33-025-00612-0000

#16466

NWNW Sec. 9, T142N, R97W

Ansbro Petroleum Company, LLC

#1-9 Griggs

KB=2485 ft.
NWNW Sec. 9, T.142N., R.97W.
Ansbro Petroleum Company, LLC
#1-9 Griggs

Cored Interval: 10662 - 10689
33-025-00868-0000
#17808
SESW Sec. 14, T141N, R96W
Anschutz Exploration Corp.
#24-14H Sadowsky
KB = 2569 ft.

Gamma Ray
Neutron Porosity
Density Porosity
Permeability
Porosity
Deep Resistivity
Density
Grain Density

10450
10500
10550
10600
10650
10700
10750

upper
middle
“basal Bakken”

Core + 5.9 = Log
SESW Sec. 14, T.141N., R.96W.
Anschutz Exploration Corporation
#24-14H Sadowsky

Cored Interval: 10484 - 10516.5 ft
<table>
<thead>
<tr>
<th>No.</th>
<th>Well</th>
<th>Cored Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SESE Sec. 14, T161N, R98W Samson Resources Company - #14-23-161-98H Nordstog</td>
<td>8698 – 8737</td>
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<tr>
<td>2</td>
<td>SWSW Sec. 17, T158N, R96W Pogo Producing Company LLC - #2-17H Pegasus</td>
<td>10198 – 10249</td>
</tr>
<tr>
<td>3</td>
<td>SESE Sec. 36, T153N, R95W Burlington Resources Oil &amp; Gas Company LP - #44-36 Washburn</td>
<td>10548 – 10665</td>
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<tr>
<td>4</td>
<td>SWNE Sec. 24, T149N, R93W Socony-Vacuum Oil Company, Inc. - #F32-24-P Angus Kennedy</td>
<td>10601 – 10661</td>
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<td>5</td>
<td>SENW Sec. 22, T149N, R91W Mobil Producing Company – #F-22-22-1 Pegasus Div Solomon Bird Bear</td>
<td>9999 - 10275</td>
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<tr>
<td>6</td>
<td>SWSE Sec. 9, T145N, R90W XTO Energy, Inc. - #34X-9 Miller</td>
<td>9507 – 9591</td>
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<tr>
<td>7</td>
<td>SESE Sec 6, T158N, R90W EOG Resources, Inc. - #1-06H Sidonia</td>
<td>8790 – 8887.25</td>
</tr>
<tr>
<td>8</td>
<td>SWNE Sec. 2, T153N, R85W Stanolind Oil &amp; Gas Company - #1 Walter &amp; Ingeberg Waswick</td>
<td>7572 - 7612</td>
</tr>
</tbody>
</table>
33-023-00489-0000
#16089
SESE Sec. 14, T161N, R98W
Samson Resources Company
#14-23-161-98H Nordstog
KB=2092 ft.

Gamma Ray
Density Porosity
Neutron Porosity
PE
Deep Resistivity
Porosity
Grain Density
Permeability

Gamma Ray
Density Porosity
Neutron Porosity
PE
Deep Resistivity
Porosity
Grain Density
Permeability

Bakken Formation
Three Forks Formation

upper
middle
lower
Unit 6
Unit 5
Unit 4
Core - 6 = Log
33-105-01598-0000
#16405
SWSW Sec. 17, T158N, R96W
Pogo Producing Company LLC
#2-17H Pegasus
KB=2437 ft.

Core + 10 = Log

Gamma Ray
Neutron Porosity
Density Porosity
Deep Resistivity
Porosity
Grain Density
Permeability

Unit 2
Unit 3
Unit 4
Unit 5
Unit 6

Bakken Formation
Three Forks Formation
SWSW Sec. 17, T.158N., R96W.
Pogo Producing Company, LLC
#2-17H Pegasus

Cored Interval: 10234 - 10249 ft.
Gamma Ray 0.3 -0.1
Neutron Porosity 0.3 -0.1
Density Porosity 2 6
PE 0.2 2000
Deep Resistivity 0 15
Porosity 0.0001 10
Permeability 2 3
Grain Density 10450 10500 10550 10600 10650 10700 10750

33-053-02894-0000
#17309
SESE Sec. 36, T153N, R95W
Burlington Resources Oil & Gas Company LP
#44-36 Washburn
KB=2356 ft.

Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
Unit 6
Three Forks Formation
Bakken Formation
Birdbear Formation
upper
middle
lower

Core = Log
SESE Sec. 36, T.153N., R.95W.
Burlington Resources Oil & Gas Company LP
#44-36 Washburn

Cored Interval: 10548 - 10578 ft.
Burlington Resources Oil & Gas Company LP

Cored Interval: 10578 - 10608 ft.

SESE Sec. 36, T.153N., R.95W.

#44-36 Washburn
SESE Sec. 36, T.153N., R.95W.
Burlington Resources Oil & Gas Company LP
#44-36 Washburn

Cored Interval: 10608 - 10638 ft.
SESE Sec. 36, T.153N., R.95W.
Burlington Resources Oil & Gas Company LP
#44-36 Washburn

Cored Interval: 10638 - 10665 ft.
SWNE Sec. 24, T.149N., R.93W.
Socony-Vacuum Oil Company, Inc.
#F32-24P Angus Kennedy

Cored Interval: 10626 - 10661 ft
Mobil Producing Company

#F-22-22-1 Pegasus Div Solomon Bird Bear

KB=2102 ft.

Bakken Formation

- Unit 1
- Unit 2
- Unit 3
- Unit 4
- Unit 5
- Unit 6

Three Forks Formation

- Unit 2
- Unit 3
- Unit 4
- Unit 5
- Unit 6

Birdbear Formation

Core = Log

Gamma Ray

Deep Resistivity
SENW Sec. 22, T.149N., R.91W.
Mobil Producing Company

#F22-22-1 Pegasus Div Solomon Bird Bear

Cored Interval: 9999 - 10080 ft

LSh

DTF

LSh

Mmbk

USh

Mmbk
SWSE Sec. 9, T.145N., R.90W.
XTO Energy Inc.
#34X-9 Miller

Cored Interval: 9540 - 9575 ft.

Cored Interval: 9999 - 10080 ft.
Cored interval: 9575 - 9591 ft.

SWSE Sec. 9, T.145N., R.90W.

XTO Energy Inc.

#34X-9 Miller
33-061-00884-0000
#17676
SESE Sec 6, T158N, R90W
EOG Resources, Inc.
#1-06H Sidonia
KB = 2313 ft.

Unit 2
Unit 3
Unit 4
Unit 5
Unit 6

Bakken Formation
Three Forks Formation
SESE Sec. 6, T.158N., R.90W.
EOG Resources, Inc.
#1-06H Sidonia

Cored Interval: 8823 - 8859 ft.
SESE Sec. 6, T.158N., R.90W.
EOG Resources, Inc.
#1-06H Sidonia

Cored Interval: 8859 - 8887.25 ft.
33-101-00006-0000
#105
SWNE Sec. 2, T153N, R85W
Stanolind Oil & Gas Company
#1 Walter & Ingeberg Waswick
KB=2175 ft.

Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
Unit 6

Bakken Formation
upper middle lower

Three Forks Formation

Birdbear Formation

Gamma Ray

Neutron

Deep Resistivity

Core - 12(?) = Log
SWNE Sec. 2, T.153N., R85W.  
Stanolind Oil & Gas Company  
#1 Walter & Ingeberg Waswick  

Cored Interval: 7572 - 7612 ft