Additional Opportunities in the Fayetteville Shale Play of North-Central Arkansas*

Phillip Shelby¹

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Abstract

The Fayetteville Shale gas field located in north central Arkansas has produced more than 8 TCF of natural gas since the play was initiated by Southwestern Energy in 2004. In excess of 5900 horizontal wells are currently producing from the Fayetteville; however, much of the activity in the past two years has focused on a deeper Mississippian Shale, opening up a new Frontier in the play.
Additional Opportunities in the Fayetteville Shale Play of North-Central Arkansas

AAPG Mid-Continent Section Meeting

October 1-3, 2017
• **Overview**

• Fayetteville Shale Opportunities

• Other Targets within the Play

• Unconventional Potential Outside of the Current Play

• Summary
Domestic Unconventional Plays

Lower 48 states shale plays

Source: Energy Information Administration based on data from various published studies.
Updated: May 6, 2011
• The Fayetteville Shale Play currently consists of portions of 7 counties in North-central Arkansas (Conway, Van Buren, Cleburne, Faulkner, White, Independence, and Jackson)

• Presently the Play contains approximately 6000 Producing Fayetteville Horizontal Wells

• The Fayetteville Play produced in excess of 745 BCF in 2016 down from a peak of 1.025 TCF in 2014

• SW Energy produced a total of 558 BCF in 2016, XTO 95 BCF, and BHP Billiton 89 BCF (per Ark Geologic Survey website)

• The Fayetteville Shale (B43) Field has produced in excess of 7.7 TCF of gas from December, 2004 through December 31, 2016 (per Ark Oil and Gas Commission)
• There have been approx. 20 Horizontal wells completed in the “Moorefield Shale”

• Of these, +/-12 wells are currently producing but these recent “Moorefield” wells are actually producing from the underlying Boone Shale

• More recent Boone Shale wells compare favorably with Fayetteville Shale Horizontals with initial production rates ranging from 1.4-10.3 MMcfg/D

• Most Fayetteville/Boone Shale wells drilled w/in the last 5+ years have laterals avg 4000’-5000’ in length w/ several laterals drilled in excess of 8000’ in length

• At the drilling peak, >60 rigs were active in the Fayetteville

• Currently only 1-2 rigs are drilling in the play (all SWN Energy)
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Graph of Top Fayetteville/Moorefield/Conventional Wells within the Fayetteville Shale Play

**Well IP’s**

- **Fayetteville**
- **Moorefield**
- **Conventional**

**30 Day Avg**

- **Fayetteville**
- **Moorefield**
- **Conventional**

**90 Day Avg**

- **Fayetteville**
- **Moorefield**
- **Conventional**
Graph of Top Fayetteville/Moorefield/Conventional Wells within the Fayetteville Shale Play
• Overview

• *Fayetteville Shale Opportunities*

• Other Targets within the Play

• Unconventional Potential Outside of the Current Play

• Summary
• Historically, the vast majority of Fayetteville horizontal wells produced from the Upper portion of the Lower Fayetteville

• In many areas the Lower Fayetteville Shale contains multiple reservoir-quality lobes within the gross interval which potentially could be tapped with multi-laterals (particularly in the eastern portion of the play)

• Many areas of the Play also exhibit Reservoir-quality lens within the Upper Fayetteville interval

• While the “Central Fairway” portion of the play has been extensively drilled; there are still areas along the play margins with only 1 to 2 wells per section
Top Mississippian Structure
Upper Fayetteville Gross Isopach
Shelby Geological Consultants

Stratigraphic Correlation Lines of Section
• Overview

• Fayetteville Shale Opportunities

• *Other Targets within the Play*

• Unconventional Potential Outside of the Current Play

• Summary
The Fayetteville Shale interval has been the primary target since the Play’s inception; however, SWN Energy has completed several wells within the underlying Boone Shale interval with increased activity in the last 2-4 years.

The last 2 years has seen a significant improvement in initial production rates and EUR’s as the majority of the non-Fayetteville horizontals has targeted the Boone Shale (not Moorefield).

Many Conventional Reservoirs have also been produced with mixed results.

The most prolific conventional producer has been the SWN-Arklan #1-32, Sect. 32-T9N-R11W which has produced a total of 4.6 BCF of gas from the Hale Sand (Morrowan).

Unfortunately, all of the conventional wells producing to date appear to be single-well reservoirs.
Boone Shale Type Log

- Upper Fayetteville
- Middle Fayetteville
- Lower Fayetteville
- Hindsville/Batesville
- Moorefield Shale
- Boone Shale
- Boone Limestone/Chert
- Chattanooga Shale
- Penters Chert

Rel Depth(ft)

-500  -400  -300  -200  -100  0  100  200  300  400  500  600  700  800  900  1000  1100  1200  1300  1400  1500  1600  1700  1800  1900  2000  2100  2200  2300  2400  2500  2600  2700  2800  2900  3000  3100  3200  3300  3400  3500  3600  3700  3800  3900  4000  4100  4200  4300  4400  4500  4600  4700  4800  4900  5000  5100  5200  5300  5400  5500  5600  5700  5800  5900  6000  6100  6200  6300  6400  6500  6600  6700  6800  6900  7000  7100  7200  7300  7400  7500  7600  7700  7800  7900  8000  8100  8200  8300  8400  8500  8600  8700  8800  8900  9000  9100  9200  9300  9400  9500  9600  9700  9800  9900  10000

Johnson Co., AR - Fay Shale Project

HS=1526

PETRA 3/13/2017 12:40:12 PM (FS Bn Sh Corr Sect 26-9N-8W thru 12-10N-5W.CSP)
Boone Shale Gross Isopach
Shelby Geological Consultants

• Overview
• Fayetteville Shale Opportunities
• Other Targets within the Play
• Unconventional Potential Outside of the Current Play
• Summary
• Unconventional potential does exist in the Western “Conventional Fairway” portion of the Arkansas Arkoma

• SWN Energy obtained SWC’s from several wells and one Conventional Core in their legacy HPB areas in Franklin and Johnson Counties

• This rock data compared favorably with cores taken within the Fayetteville Shale Play area in terms of TOC, Mineralogy, and Porosity/Permeability

• However, due to thickness of individual stratigraphic units (or lack thereof), the Unconventional Targets should be considered in terms of a Gross Unconventional Package

• This package consists of the Pitkin Limestone, Fayetteville Shale (Upper and Lower), Boone Shale, and the Chattanooga (Woodford) Shale
• This “Unconventional Package” is not prospective everywhere but does possess potential in multiple areas within the Conventional Fairway

• Several vertical Fayetteville Shale wells were completed early (2001-03) and while all were uneconomic they do compare favorably with early vertical wells completed in the Fayetteville Play

• SWN Energy completed 1 vertical Chattanooga Shale well in 2006, the Eschbach #1-12 in Sect. 12-T9N-R26W (IP 316 Mcf/D; Cum Prod 99 MMcfg) from +/-54’ of shale (perfs 5964’-6000’)

• Recent Horizontal Woodford (Chattanooga) wells in SE Oklahoma exhibit average EUR’s from 3-10 Bcfg
Johnson County Fayetteville Shale Type Log

Lawco-Hurley #1-4, Sect. 4-T9N-R23W

402HALE
CUMGAS : 202,812
West to East Correlation - Section from Hughes Co., OK to Franklin Co., AR

Avatar-Davis #1-4W
Sec 4-T7N-R11E
Hughes Co, OK

Arco-Lake Eufala #1-2
Sec 2-T6N-R16E
Pittsburg Co, OK

XTO-Fulgham #1-28
Sec 28-T7N-R32W
Sebastian Co, AR

Shields-Hill #1-4
Sec 4-T7N-R28W
Pittsburg Co, OK, AR

SWN-Eschbach #1-12
Sec 12-T9N-R26W
Franklin Co, AR

Woodford/Chattanooga Shale
Type Log for NE Hughes & NW Pittsburg Cos., OK

Woodford/Chattanooga Shale
Type Log for E. Pittsburg Cos., OK

Woodford/Chattanooga Shale
Type Log for Sebastian Co., AR

Woodford/Chattanooga Shale
Type Log for Franklin Co., AR

1st Prod 3/2006, Vertical Well
IP 316 Mcf/D, Cum Prod 99 MMCF
Perf 5964'-6000'

West
A

East
A'

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

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Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log

Gamma Ray – Comp Neutron/Density Log
Overview

Fayetteville Shale Opportunities

Other Targets within the Play

Unconventional Potential Outside of the Current Play

Summary
The Fayetteville Shale Field (B43) is now the largest producing gas field in Arkansas (>7.7 TCF)

The Fayetteville Play produced in excess of 745 BCF in 2016

According to SWN’s most recent investor presentation, they believe they have an additional 675 drillable locations at $3.00/MCF gas and 1575 locations at $3.50/MCF gas prices

Additional potential exists in the Play with Reservoir-quality rock present in the Upper Fayetteville, multiple lobes in the Lower Fayetteville, and untapped areas with Boone Shale potential

Prolific Conventional production exists in the Play but has been limited to “single well” pools
• Unconventional potential exists in the Western “Conventional Fairway” portion of the Arkansas Arkoma but is limited to selected areas

• Due to lack of thickness of individual stratigraphic units, the Unconventional Targets should be considered in terms of a Gross Unconventional Package

• Fayetteville Shale potential in the Conventional Fairway Area appears greatest in Johnson and Pope Counties

• The Chattanooga/Woodford Shale appears most prospective in Sebastian and southwestern Franklin Counties