The Barnett Shale Oil Model of North Texas*

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Abstract

Initiation of the Barnett Shale gas play in 1981 ushered in a new era of understanding of source-rock resource plays. Over the years, as industry's knowledge base increased, many attempts were made to extend the shale play into the oil window. In the late 1980's, Mitchell made several unsuccessful attempts in Jack County, followed by Oryx's 1991 failed attempt in their horizontal Grant #1 in Montague County.

In 2000, Dallas production Inc. drilled and completed their Swint #1 in the Barnett Shale as an oil well in Montague County, and industry began to seriously consider the oil potential. However, the production data from the Swint#1 and unsuccessful attempts by industry to follow up on this producer only resulted in a short period of enthusiasm.

It was not until W. B. Osborne's successful recompletions and wells at St. Jo Ridge field in Southeast Montague County that industry really began to take notice. Mitchell Energy had internally proposed a Barnett Shale oil model in the late 1990's but, due to low oil prices and preoccupation with the gas play, never tested the idea. There were many lines of evidence that suggested the existence of a commercial oil play and the geologic conditions by which it might be successful.

In 2008, EOG drew industry attention with their entry into a Barnett Shale oil play. Since that entry, EOG has adopted the name 'combo play' for good reason. Their early analysis had indicated commerciality would be dependent upon oil production, associated gas and the significant volumes of Natural Gas Liquids (NGL's). It was because of the liquids’ contribution that EOG almost immediately began construction of a 40 mmcfg/d natural gas processing plant.

With oil prices in excess of $60/BBL, the play has potential for being much more widespread than Mitchell's original model suggested. EOG's establishment of this combo play has created a new technological boom in the Barnett; however, like the gas play, it is not without risk.
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North Texas Structural Provinces

with Estimated Extent of Oil & Gas Prone Areas in the Barnett

Gas Prone
Oil Prone
Transition
Viola Erosional Limit
Barnett Core in Faulted Area
Barnett Core Showing Minor Faults and Regional Fracture
Barnett Core with Regional Fracture
Early Barnett Oil Tests

1) Oryx - Grant #1H
   (42-337-32883) SPUD 7/17/1991

2) MEC – JJ Wood #1
   (42-337-30265) TEST 10/1989

3) Anadarko – Gaskins #A-1
   (42-337-32938) SPUD 2/8/1993

4) Anadarko – Henderson #B1
   (42-337-32937) SPUD 2/27/1993

5) MEC – USA 237-21 #1
   (42-497-34327) TEST 10/1999

6) MEC – Cherryhomes-Worthington #3
   (42-237-37089) SPUD 1/20/1986

7) MEC – Lindsey Ranch #11
   (42-237-34662) TEST 10/1982

8) Explo - Mircham #3
   (42-049-35282) SPUD 6/7/1990

9) Quicksilver – J Christianson #3
   (42-193-30258) TEST 9/2001
North Texas Structural Models

Reef

Anticline

Faults

Karst
Mississippian Reef Examples

1) Park Springs (Miss)
   42,600 BO
   5.0 BCFG

2) J.W. Loving 12
   80,000 BO
   0.068 BCFG

3) M.F. Stewart A-1 & A-2

4) Richey (Miss)
   721,000 BO
   1.2 BCFG

5) Missy (Miss)
   2,707 BO
   1.13 BCFG
Reef Example
Anticlinal Structures

1) St. Jo Ridge (Barnett Shale)

2) Dallas Production Inc. Swint #1
Anticline with Fault Example
Montague County Structure Example

Est. St. Jo Ridge Structure

St. Jo Ridge Production

St. Jo Ridge
(Barnett Shale) Producers

Cumulative Production: 800,000 BO & 4.1 BCFG from 46 wells

5 wells account for 366,600 BO & 1.2 BCFG or 45% of the oil production.

Dallas Production Inc., Swint #1
Cumulative Production: 25,915 BO & 141 MMCFG
Detail Map of St. Jo Ridge Structure with Key Wells

Map Source: DrillingInfo, Inc.
Prepared by: Emily Mitchell
Production Rates & Declines for Selected St. Jo Ridge (Barnett Shale) Oil Producers

**Peak, Baker #1**
- Lease Number: 39248 - District: R - Montague County, Texas
- CUM: 10,809 BO
- CUM: 59 MMCFG

**Osborn, Crump-Lucas Unit 2 #1**
- Lease Number: 36241 - District: R - Montague County, Texas
- CUM: 113,212 BO
- CUM: 355 MMCFG

**Encana, Orrell #1H**
- Lease Number: 30596 - District: S - Montague County, Texas
- CUM: 82,943 BO
- CUM: 296 MMCFG

**Osborn, Crump-Lucas Unit 1 #1**
- Lease Number: 36167 - District: S - Montague County, Texas
- CUM: 79,228 BO
- CUM: 177 MMCFG
Karst Example

Boonville (Basal Atoka) Area - Karst Chimney Production

5 wells
Cumulative Production of 265,000 BO & 3.2 BCFG

3-D seismic data sets that encountered numerous karst features
3D Seismic Coverage Featuring Extensive Karst Formation in the Ellenburger Structure on top of the Ellenburger
Karst Chimney Example
EOG Resources
Barnett Shale Oil Play

Scaling Ranch A #2H
150 Bopd + 200 Mcfd

Paul Swint B #5H
50 Bopd + 750 Mcfd

Weise #2H
320 Bopd + 550 Mcfd

Ron Cheek #2H
275 Bopd + 400 Mcfd

Tunnicliff #2H
235 Bopd + 600 Mcfd

ARCHE
CLAY
MONTAGUE
Oil Play Concerns

- Stimulation
- Drilling Cost
- Product Pricing
- Estimated Recovery efficiencies short term/long term
- Resource play or typical fracture play?
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