Stratigraphy and Hydrocarbon Production from Pennsylvanian Age Granite Wash Reservoirs in the Western Anadarko Basin, Oklahoma and Texas

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KEY POINTS

- Play extends over 125 miles from Roberts County, TX to Washita County, OK
- Granite Wash reservoirs derived from erosion of Lower Paleozoic igneous and sedimentary rocks on adjacent Amarillo-Wichita uplift
- Sandstone and conglomerate reservoirs are 8,000 to 14,500 feet deep
- Sedimentary column 2,500 to 5,000 feet thick
- Reservoirs in arkosic sandstones & conglomerates 20 to 200 feet thick
- Reservoirs mainly deposited in southwest to northeast trends
- Stratigraphic traps are dominant trap type
- Play limited on southwest by faults & water bearing massive sandstones; limited on north/northeast by thinning of reservoirs into distal silt facies
- Oil/gas source for Granite Wash believed to be Pennsylvanian age shales
- The western Anadarko Basin horizontal Pennsylvanian Granite Wash play has had 2,092 horizontals wells drilled since 2002, mostly since 2010
- More than 85 million barrels of oil and 1.8 TCF of gas produced from over 1600 horizontal wells primarily over the last three years
- 2013 horizontal Granite Wash well production of 22.5 MMBO and 426 BCFG
- Est. horizontal well daily production in March 2014 of 51,000 BOPD, 1.1 BCFGPD & 110,000+ BWPD
GRANITE WASH PLAY LOCATION MAP

Pennsylvania
Granite Wash Play
Area

12S Miles

GRANITE WASH PLAY PALEOGEOGRAPHY

Middle
Pennsylvanian
Geography

Deep Granite
Wash Producing
Area

Amarillo-Wichita Uplift

Anadarko Sea

Anadarko Rockies

Shallow Marine

Ancient Rockies

Colorado

Texas

New Mexico

Oklahoma

Kansas

Low Relief Land

Carbonates - Shallow Marine

Ouachita Thrust Belt

Modified from Moore 1979
Areas in dark red show locations of Pennsylvanian Granite Wash oil & gas production
Stars show locations of horizontal Granite Wash wells in September 2014
Shaded areas note sub-play types in Granite Wash play (Mitchell, 2011)
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**THE STRATIGRAPHIC COLUMN**

**Translation Chart for Texas Wash**

**Stratigraphic Nomenclature**

**Missourian Stage:**
- Cottage Grove = Lansing
- Hogshooter = Upper Kansas City
- Checkerboard = Lower Kansas City

**Desmoinesian Stage:**
- Marmaton "B" = Carr
- Marmaton "C" = Caldwell/Britt
- Marmaton "D" = Granite Wash "A"
- Marmaton "E" = Granite Wash "B"
- Marmaton "F" = Granite Wash "C"
- Upper Skinner = Granite Wash "D"
- Lower Skinner = Granite Wash "E"

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**GRANITE WASH PLAY MAP:**
**FOUR DISTINCT PLAY AREAS**

Areas in dark red show locations of Pennsylvanian Granite Wash oil & gas production
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Type Log in the Missourian Wash, Deep Anadarko Basin, Texas & Oklahoma; Chesapeake #1-28 Mary K well, Sec. 28, T11N R23W, Beckham Co., Oklahoma

1300+ feet of Missourian Series Granite Wash section

Missourian Wash Has Produced 23.4 MMBO and 103 BCFG from 378 Horizontals Since 2010

Type Log
Desmoinesian Wash, Deep Anadarko Basin, Texas & Oklahoma: Devon #16-4 Truman-Zybach, Sec. 16, Block R&E Survey, Wheeler Co., Texas

1500+ feet of Desmoinesian Series Granite Wash section

Desmoinesian Wash Has Produced 54 MMBO and 1.4 TCFG from 1,205 Horizontals Since 2002
Areas in red show locations of Pennsylvanian Granite Wash Oil & Gas Production
Stars show locations of horizontal Granite Wash wells in September 2014

Stratigraphic Cross Section A-A'
Wheeler Co., Texas to Washita Co., Oklahoma
Datum: 2nd Marmaton Wash Flooding Surface

Marmaton “C” Wash
Important Pay Interval
Texas Shelf Play

Skinner Wash Pay Interval: Grimes-West Cheyenne Fields

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HORIZONTAL GRANITE WASH PLAY
HOGSHOOTER WASH ISOPACH MAP

Hogshooter Wash = U. Kansas City Zone in Texas Usage

Interval Isopach Map
Contour Interval: 40/100 Ft

Key Horizontal Production Data for Interval
Number of Horizontals Drilled thru Mid-2014: 183
Average Max Month Initial Potential (BOEPD): 751
Average 1st Year Decline Rate-Oil: 83%
Average Percent Payout on 1st Year Production: 96%
Marmaton Wash is Upper Desmoinesian in Age

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HORIZONTAL GRANITE WASH PLAY
MARMATON ‘C’ WASH ISOPACH MAP

Marmaton ‘C’ Wash = Caldwell or Britt Zones in Texas Usage

Interval Isopach Map
Contour Interval: 40/100 Ft

HORIZONTAL GRANITE WASH PLAY
MARMATON ‘C’ WASH ISOPACH MAP

Marmaton ‘C’ Wash = Caldwell or Britt Zones in Texas Usage

Key Horizontal Production Data for Interval
Number of Horizontals Drilled thru Mid-2014: 373
Average Max Month Initial Potential (BOEPD): 592
Average 1st Year Decline Rate-Oil: 81%
Average Percent Payout on 1st Year Production: 84%

Interval Isopach Map
Contour Interval: 40/100 Ft
Marmaton ‘D’ Wash = Granite Wash ‘A’ in Texas Usage

Interval Isopach Map
Contour Interval: 40/100 Ft

Key Horizontal Production Data for Interval
Number of Horizontals Drilled thru Mid-2014: 527
Average Max Month Initial Potential (BOEPD): 543
Average 1st Year Decline Rate-Oil: 78%
Average Percent Payout on 1st Year Production: 83%
Drilled Horizontally To Date (Mid-2014)

**Missourian Wash**
- Avg. Initial Potential: 581 BOPD, 1.7 MMCFGD
- GOR = 10,150
- 277 Wells

**U. Desmoinesian Wash**
- Avg. Initial Potential: 251 BOPD, 5.0 MMCFGD
- GOR = 19,717
- 1164 Wells

**Atokan Wash**
- Avg. Initial Potential (Shallow): 136 BOPD & 2.2 MMCFGD
  - GOR = 16,073
  - 126 Wells
- Avg. Initial Potential (Deep): 45 BOPD & 8.4 MMCFGD
  - GOR = 186,000
  - 51 Wells

**Increasing Gas/Oil Ratio & Oil Gravity**

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**PERMITTING DATA PENNSYLVANIAN GRANITE WASH HORIZONTALS**

**HRZ PERMITS BY YEAR THROUGH AUG. 2014**

**PERMITTED HORIZONTAL GRANITE WASH WELLS BY OPERATOR THROUGH AUGUST 2014**

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THANKS!

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