• Granite Wash:
• Where Engineering and Geology Collide.
• An Unstoppable Force Meets An Immovable Object

Bill Grieser Carla Eichler
Nov 13th 2014

• Outline

• Granite Wash Deposition
• Subsurface visualization
• Granite Wash Stack Play Completions Overview
• Completion averages 2005-2014
• Fracture geometry
• Questions
Geologic History

- GRANITE WASH PLAY DEPOSITIONAL MODEL
- Deepwater Submarine Fan Lobes (Proximal to Medial to Distal)

Mitchell, 2011.

© 2014 HALLIBURTON. ALL RIGHTS RESERVED.


Area of Interest

- Roger Mills
- County

- Wheeler
- County

Preferred Units:
2,439,687.798.52 square feet
Additional US Units:
241,989,001.98 square yards
0.11 square miles
55,777.77 acres

Additional Metric Units:
225,225,225.22 square metres
120,120,120.12 square kilometers
22,522,522.52 hectares

Perimeter:
201,502,502.50 Common feets

© 2014 HALLIBURTON. ALL RIGHTS RESERVED.
• Stratigraphic Correlation

Figure 1. Areal map of western Oklahoma and adjacent areas of Texas showing lines of cross sections (dashed lines) made for current study. County lines shown by slightly bolder lines. Reference wells for shelf area, basin area, and mountain-front area are located by solid triangles.

• Hendrickson et al., 2001

© 2014 HALLIBURTON. ALL RIGHTS RESERVED.

Stratigraphy and Structure

© 2014 HALLIBURTON. ALL RIGHTS RESERVED.
Well Placement

- Lateral Well in Lateral Well in
- Lower Skinner Upper Skinner
- Wash Wash

References

Granite Wash Names

Granite Wash by definition is material eroded from granites and redeposited
forming a rock with the same major mineral constituents as the original rock. That in
simpler terms, means that Granite Wash got its name from the weathering process
that granite underwent over time.

Cleveland Wash
Hogshooter
Marmaton A-F
Alvin GW
ClearFork
Caldwell
Des Moines Wash
Colony Wash
Strawn Wash
Cherokee Wash
Granite Wash A-H
RedFork A-D
Atoka A-E

Granite Wash Area

Active Counties
• Wheeler
• Hemphill
• Roberts
• Grady
• Beckham
• Roger Mills
• Custer
• Washita
• Custer

• Area: 4800 sq miles
• Depth TVD: 3000-17000
• GOR scf/bbl: 30,000-42,000
• Yield bbl/MMCF: 23
• API: 34
• Cost Horz: $4.7 MM
• Dual Lateral: $8-10 MM
**Stacked Play**

- **Grane WASH**
  - Granite Wash A
  - Granite Wash B
  - Granite Wash C
  - Granite Wash D
  - Granite Wash E
  - Granite Wash F
  - Granite Wash G

- **Cherokee Wash**
  - Cherokee Wash

- **Undifferentiated Mantle Wash**
  - Undifferentiated Mantle Wash

- **Ilan Wash**
  - Ilan Wash

- **Halleck Wash**
  - Halleck Wash

**Drainage Moderate Perm Drainage Low Perm**

- Area = 4000 x 1200 = 110 acre
- Lateral Length = 4000 ft.
- 2x = 1200 ft.

**Well EUR**
- Depends on (kh)
- Not (h)

**Horizontal drainage** = (lateral length)² (2x)
Spacing ($S_p$) = (SL) – (NC)(CL)
• Overall Stage Length (SL)
• Number of Clusters (NC)
• Cluster Length (CL)
• Stimulation Span (SS) = stage bottom perf – stage top perf

• Average Lateral Length VS YEAR

© 2014 HALLIBURTON. ALL RIGHTS RESERVED. 16
**Lbs prop/stage VS Year**

- Average Lbs Per Stage

**Marking:**

- 260190
- 260000
- 240000
- 220000
- 236569
- 250061
- 204060
- 200000
- 180000
- 160000
- 158212
- 152623
- 140000
- 136945
- 132328
- 120000
- 100000
- 80000
- 60000
- 40000
- 20000
- 0

- Color by Year (DATE)
  - 2005
  - 2006
  - 2007
  - 2008
  - 2009
  - 2010
  - 2011
  - 2012
  - 2013
  - 2014

**GW Completions**

- Lateral stim length (SL) = 4000-4300 ft.
- Number of stages 8-21
- Stim Span Ft/stage (SS) 200-525 ft.

- Lateral stim length (SL) = 9600-9800 ft.
- Number of stages 25-30
- Stim Span Ft/stage (SS) 325 – 388 ft.

**Perforations:**

- 3 clusters 3 ft. 6spf 54 holes 127 ft spacing
- 4 clusters 3 ft. 4spf 48 holes 107 ft. spacing
- 1.5 to 1.7 BPM/perf
• Granite Wash Horizontal Frac Planes From MSM

132 planes (7 families 77°, 111°, 82°, 110°, 118°, 254°)
9.99e7 ft² Fracture Face Area

• Question(s)

• SPE 104546
  • Granite Wash Field Study-Buffalo Wallow Field, Texas Panhandle

• SPE 106531
  • Enhancing and Sustaining Well Production - Granite Wash, TX Panhandle

• SPE 88530
  • Holistic Field Evaluations Improve Prospect Opportunities

• SPE 39814
  • Granite Wash Completion Optimization with the Aid of Artificial Neural Networks

• SPE 67198
  • Zone Selection and Production Prediction Using Advanced Logging Technology

• SPE 125732
  • What Can Injection Falloff Tell About Job Placement and Production in Tight Gas Sand