

## POST APPRAISAL OF THE MISSOURIAN HOGSHOOTER HYDROCARBON SYSTEM: IMPLICATIONS FOR FUTURE EXPLOITATION IN THE ANADARKO BASIN

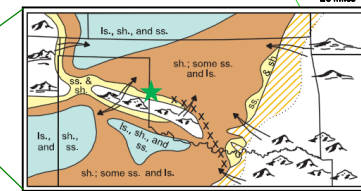
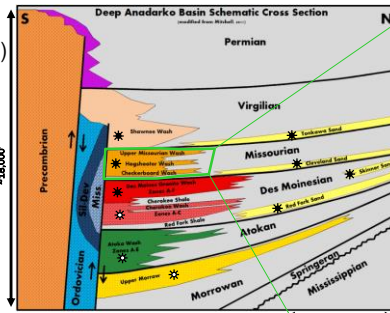
STEVE HOAGLUND (GEOLOGIST - CHESAPEAKE ENERGY)

### BACKGROUND GEOLOGY

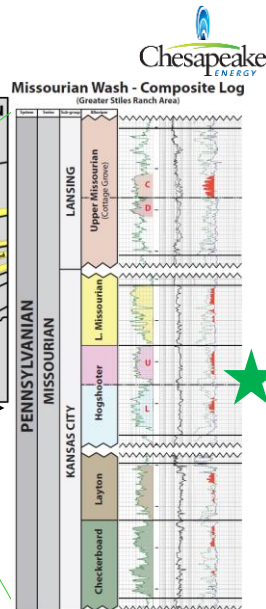
- Wichita Orogeny to the south (10k - 15k uplift)
- Rapid erosion and deposition of uplifted granitic basement rock



Ron Blakey

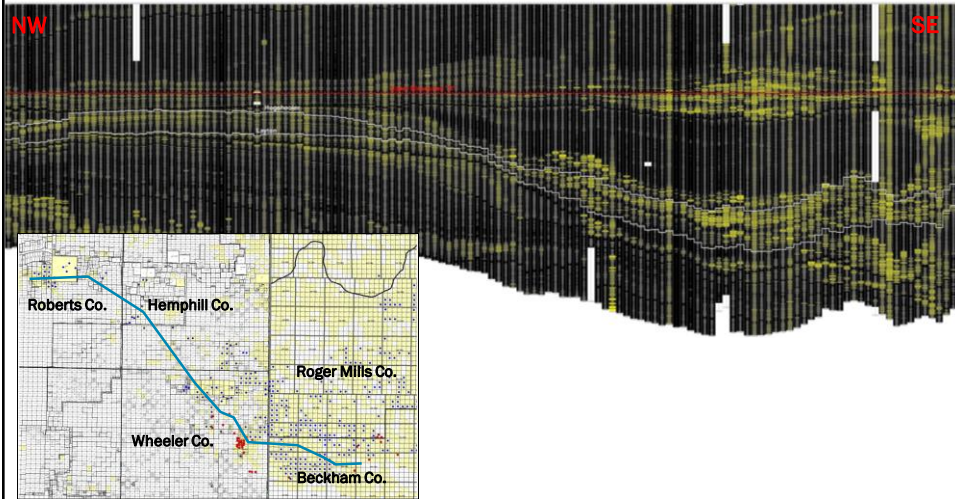


Oklahoma Geological Survey, 2008



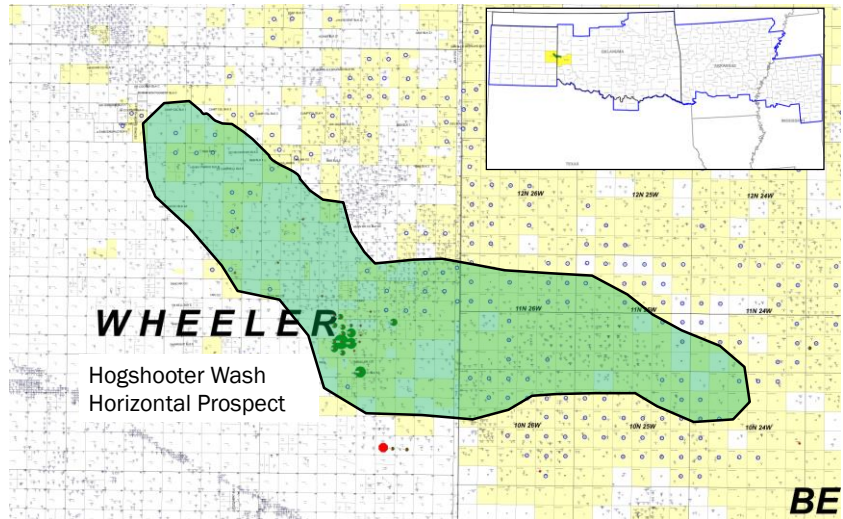
Thick accumulations of Missourian Aged Washes along the paleo-mountain front in Wheeler County, TX and Beckham County, OK

# STRATIGRAPHY



Regionally extensive flooding surfaces can be correlated throughout the basin

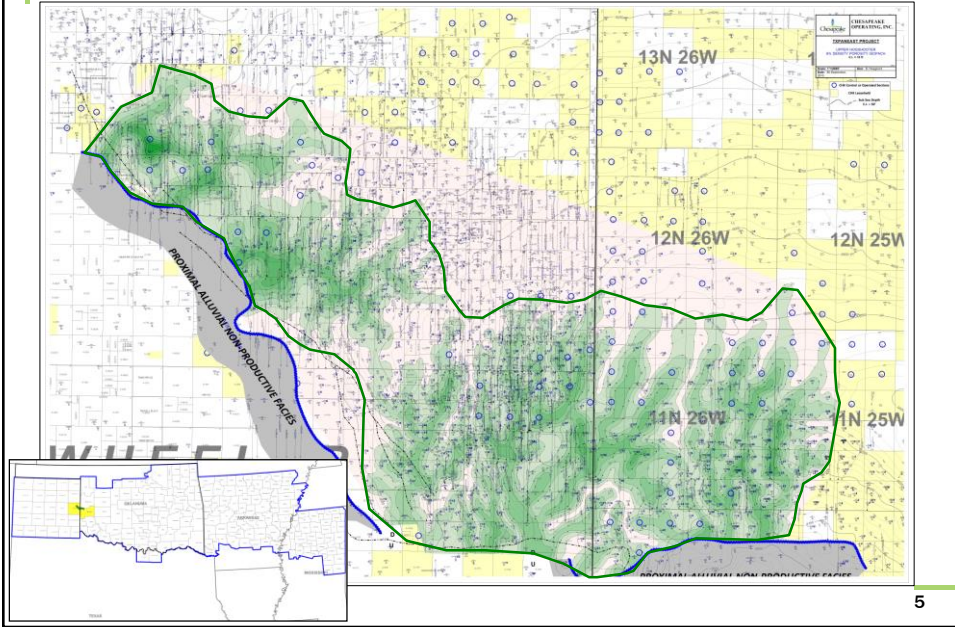
# PRODUCTION HISTORY



Vertical production is not always indicative of horizontal potential

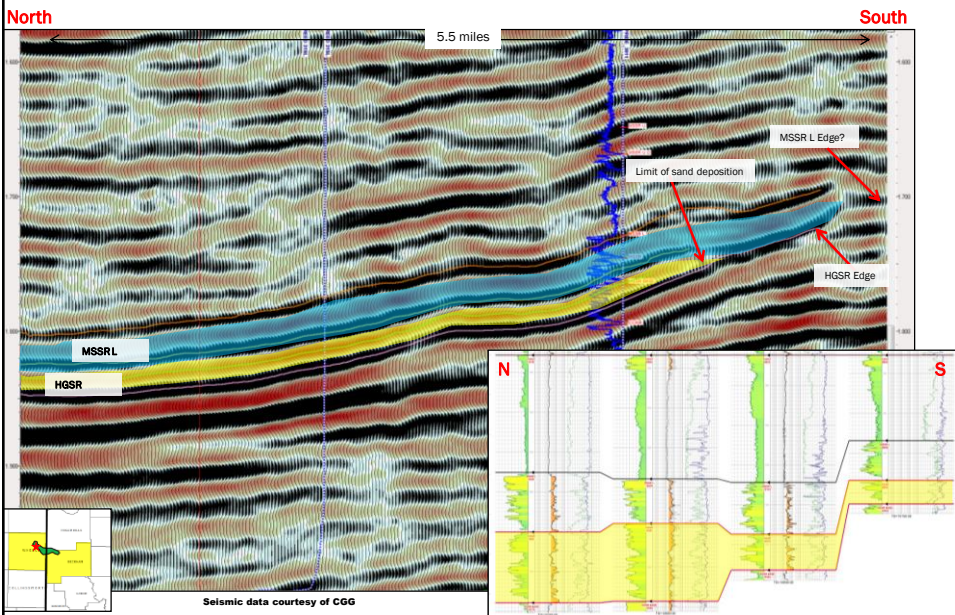
# UPPER HOGSHOOTER WASH: PLAY EXTENTS

6% Density Porosity Isopach with Subsea Structure Overlay



5

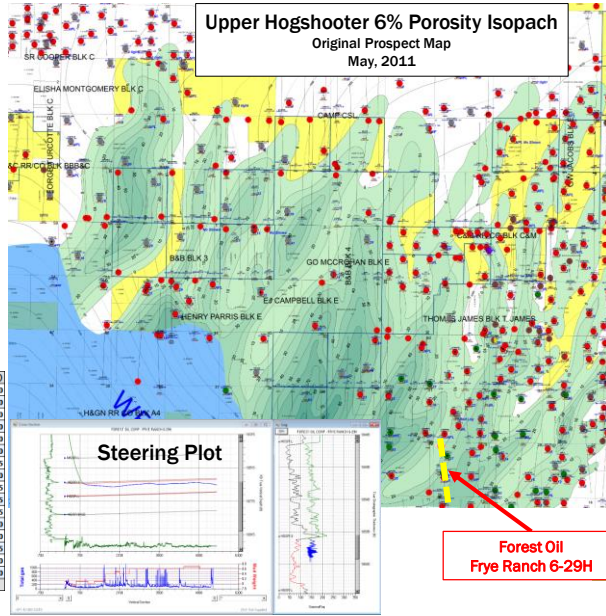
# UPPER HOGSHOOTER WASH: STRATIGRAPHIC TRAP



# EXPLORATION STRATEGY



- Forest Frye Ranch 6-29H
  - › Non-Op Well proposal (2011)
  - › Located in a mapped thick
  - › Steered 100% in zone
  - › Cum 64 MBO in first month of production
  - › **EUR 1.4 BCF + 320 MBO**



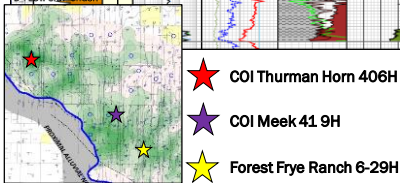
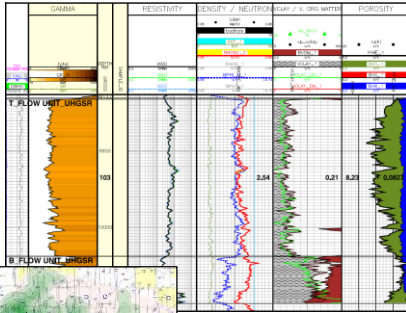
## 1st 15 days production

Date	Gas Prod (Mcf)	Oil Prod (bbl)	Prod (Hcf)	Water Prod (bbl)	Casing (psig)
9/30/2011	795	171	1,809	4,684	1,450
10/1/2011	2,439	987	8,381	4,202	1,500
10/2/2011	3,023	1,454	11,749	3,199	1,500
10/3/2011	3,377	2,014	15,462	2,829	1,500
10/4/2011	3,649	2,056	15,985	2,411	1,450
10/5/2011	3,750	2,141	16,597	1,797	1,400
10/6/2011	4,056	2,267	17,657	1,532	1,375
10/7/2011	3,701	2,304	17,527	1,428	1,300
10/8/2011	4,384	2,446	19,060	1,317	1,225
10/9/2011	4,058	2,627	19,217	1,279	1,125
10/10/2011	4,744	3,027	22,607	1,118	1,025
10/11/2011	4,695	2,515	19,783	1,176	950
10/12/2011	4,608	2,726	20,961	1,151	850
10/13/2011	4,095	2,758	21,442	1,156	775
10/14/2011	4,856	2,722	21,190	1,173	700
10/15/2011	4,924	2,786	21,637	1,167	700
<b>TOTAL CUM</b>	<b>655,165</b>	<b>226,599</b>	<b>2,014,757</b>	<b>77,575</b>	

# EARLY SUCCESS: THURMAN HORN 406H



## Pilot Hole Logs

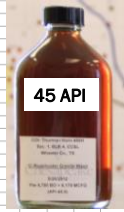


## Average Petrophysical Properties

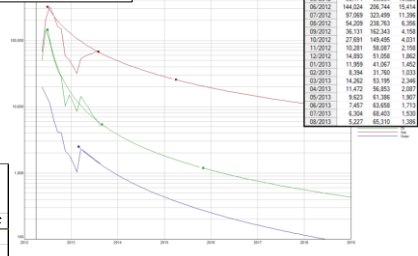
Well (Interval)	Average Thickness (ft)	Average Effective Porosity (%)	Average SW (%)	Average Effective In-situ Oil Permeability (mD)	Average OOIP (MBOE/SEC)
Thurman Horn 406H (Upper Hogshooter)	103	8.3	30	0.003725	17.6

## 1st 10 days of production

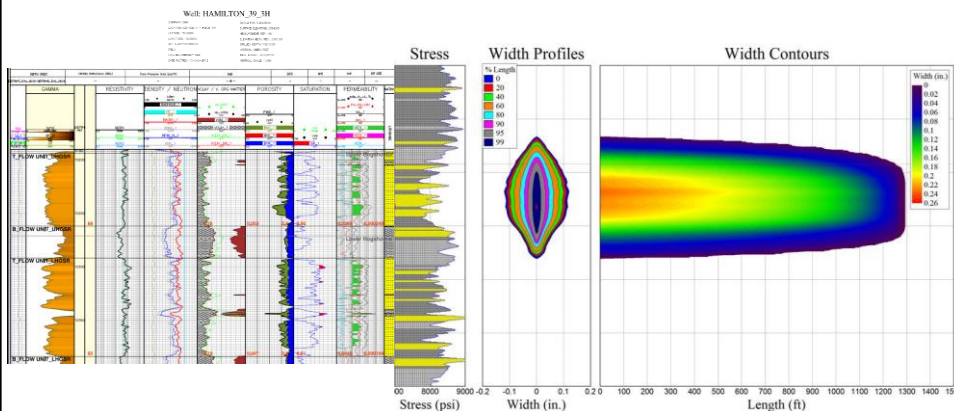
Total Net Gas Produced: 43,745		Production										Total Water Produced: 22,330						
Date	#	Type	Net Gas	Water	FIP	FOP	LP	STP	BCP	Choke	GSR	OSR	WSR	FL	Sal	CO2%	H2S	
5/29/2012	1	Initial	5829	5573	990	922	204			35/64	24	5921	209	41				
Comment: Sand light @ 4 hrs.																		
5/29/2012	1	Stable	5229	5199	1071	962	162			35/64	24	6131	293	48				
Comment: Light sand @ 2 hrs.																		
5/27/2012	1	Initial	7163	5516	1528	977	166			37/64	24	6528	216	52				
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5/28/2012	1	Stable	5116	3759	2632	938	199			40/64	24	6133	282	113				
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5/25/2012	1	Initial	5194	6496	2935	1919	202			40/64	24	6319	272	114				
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5/23/2012	1	Initial	2349	3969	1628	1412	219			35/64	24	4206	132	72				
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5/22/2012	1	Initial	2105	1763	1142	1600	165			32/64	24	2413	96	52				
Comment: Light sand @ 1 hr.																		
5/21/2012	1	Initial	1758	1423	1185	1700	164			30/64	24	1930	57	51				
Comment: Med sand @ 1 hr.																		
5/20/2012	1	Initial	805	520	597	1700	200			28/64	13	1564	52	45				
Comment: First to sales @ 4 pm to CWP/Enbridge, ch. 24/64, top 1400, stat 161, sh 0, with 0, spot 2179, Med sand @ 1 hr.																		



**CUM: 546 MBO, 2.4 BCF**  
**EUR: 603 MBO, 4.3 BCF**

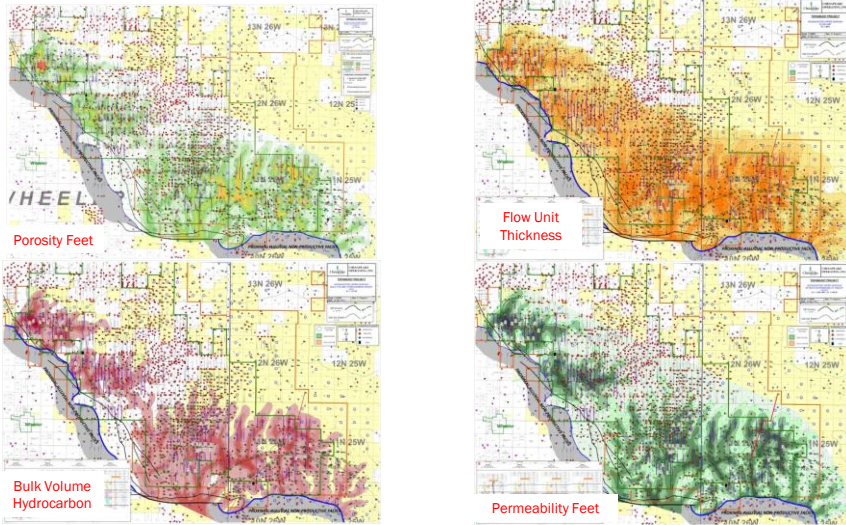


# HOGSHOOTER FRAC MODEL



Frac modeling suggests two discrete reservoirs when both Upper and Lower Hogshooter are present

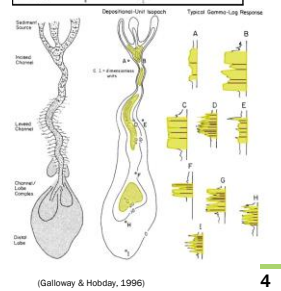
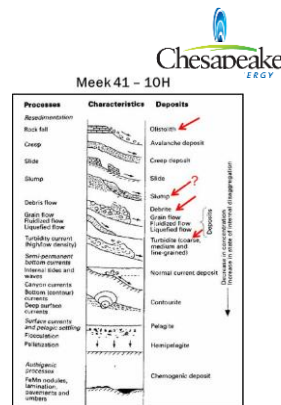
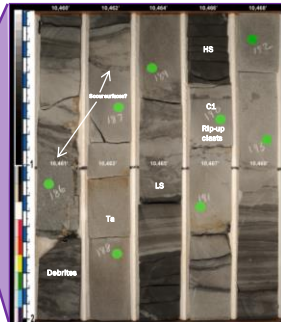
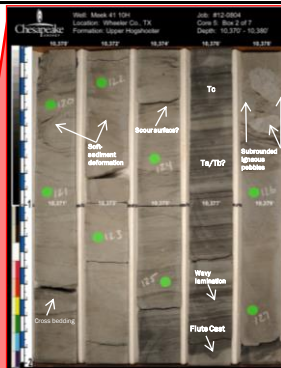
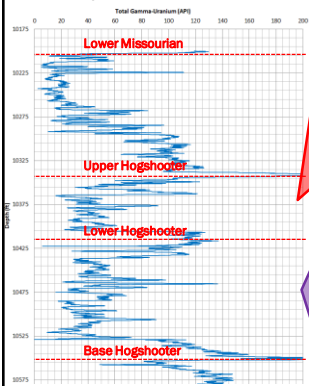
# PETROPHYSICAL MAPPING



Mapping of petrophysical parameters results in similar trends

## MEEK 41 10H: SANDS

- Sands show depositional characteristics of a deepwater channel/lobe complex



A. Seyedolali and S. Hoaglund (2012) Chesapeake Energy

(Galloway & Hobday, 1996)

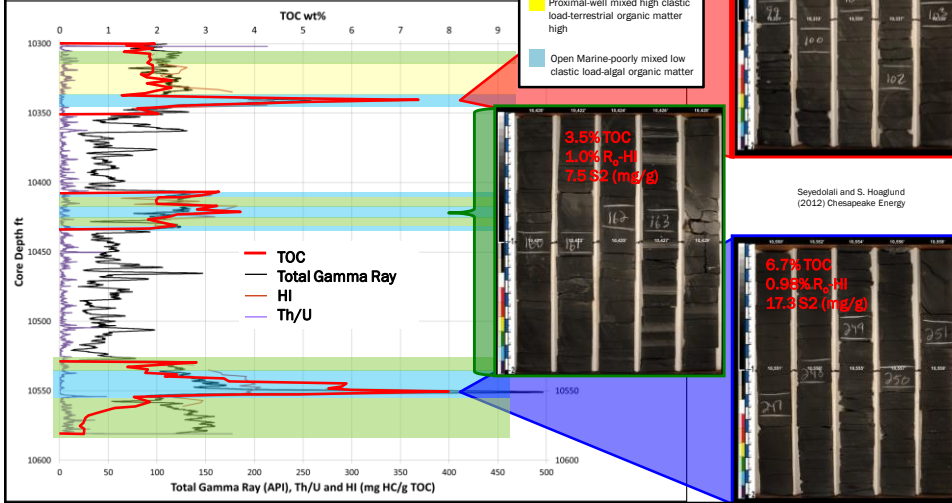
# MEEK 41 10H: SOURCE ROCK



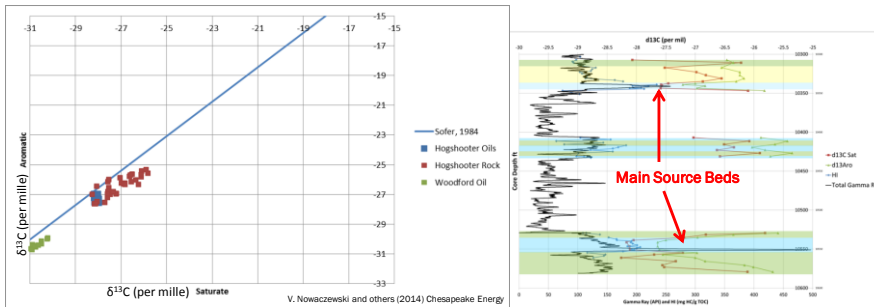
- Organic-rich shales bracketing the reservoir have excellent source-rock potential

## Facies Key

- Proximal-well mixed low clastic load-terrestrial organic matter high + high bacterial reworking
- Proximal-well mixed high clastic load-terrestrial organic matter high
- Open Marine-poorly mixed low clastic load-algal organic matter



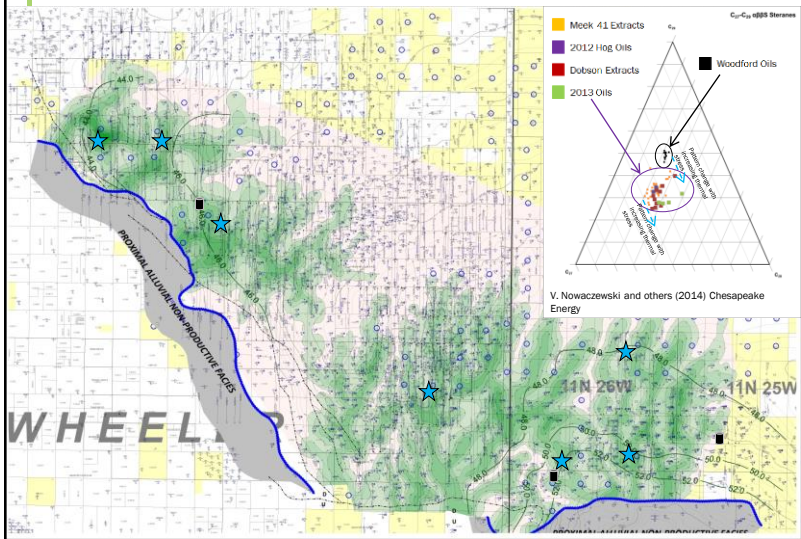
# GEOCHEMICAL STUDY: TYPING THE OILS



- Hogshooter Bitumen and oil is isotopically distinct from that of the Woodford shale oil.
- The fact that the Hogshooter oils are on the light side of the Hogshooter shale bitumen range further suggests that the open marine organic facies is largest contributor to the Hogshooter reservoir oil pool.

Biomarker and bulk isotope analyses indicate that Hogshooter oils are sourced by Hogshooter Shales

# GEOCHEMICAL STUDY



Chesapeake ENERGY

★ Geochemical Analysis Complete

🗑 Whole Core

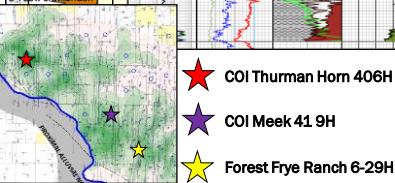
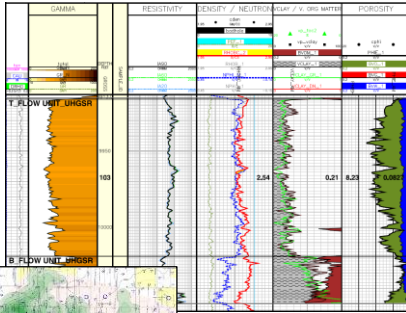
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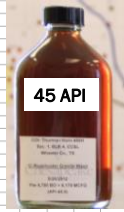


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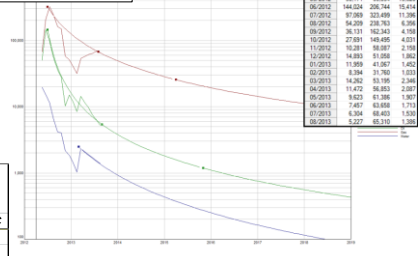
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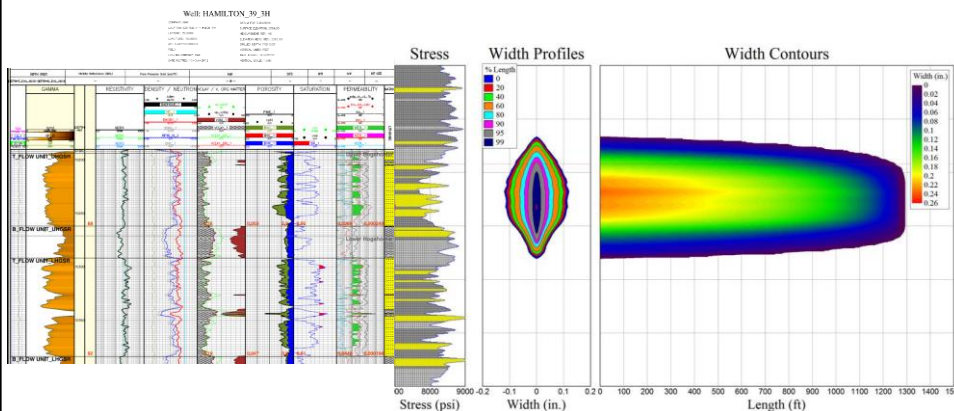
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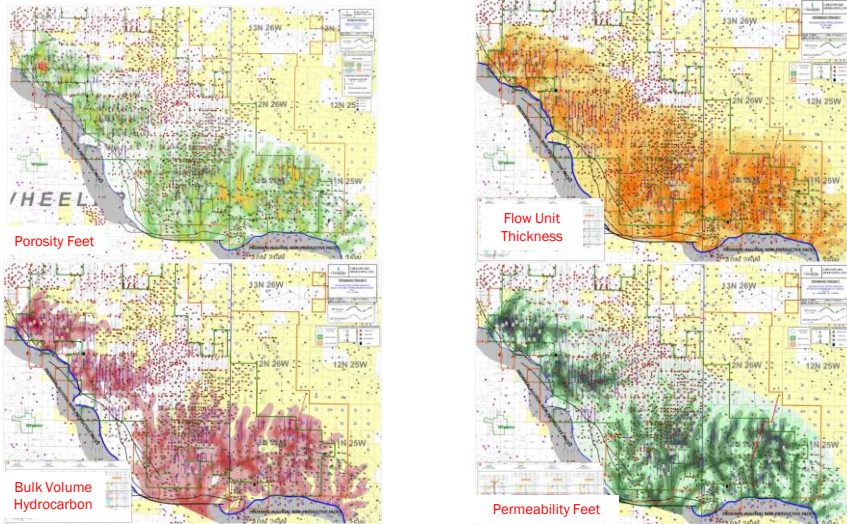


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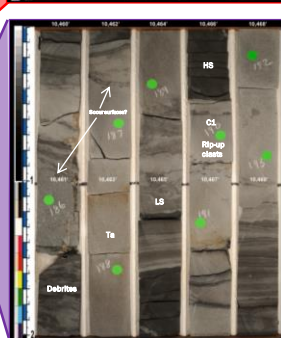
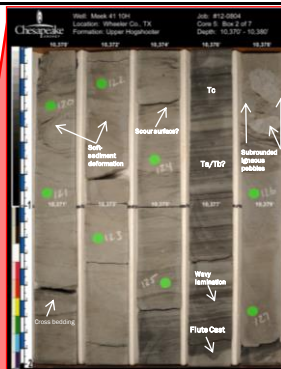
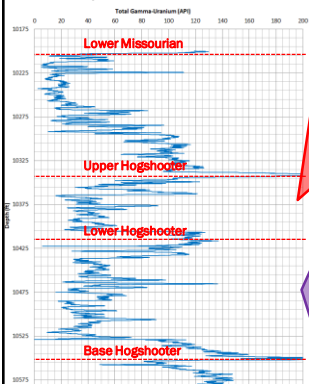
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Chesapeake Energy

### Meek 41 - 10H

Processes	Characteristics	Deposits
Abandonment		Channel deposit
Rock fall		
Crimp		Channel deposit
Slide		Crustal deposit
Slump		Slide
Debris flow		Slump
Grain flow		Grain flow
Fluid flow		Grain flow
Liquid flow		Liquid flow
Turbidity current (right-hand intensity)		Turbidity current, mudstone and fine-grained
some antecedent bottom currents		Normal current deposit
Normal side-slope waves		
Currents parallel to bottom		Conformable
Deep seafloor currents		
Soft-sediment deformation		Parahgite
Fluctuation		Homoplagite
Fluctuation		Chemogenic deposit

↑ increases in turbidity  
↓ decreases in turbidity

Depositional systems: Tidal Channel, Estuarine, Lobe, Channel/Lobe, Deep

Typical Gamma-Ray Response

(Galloway & Hobday, 1996)

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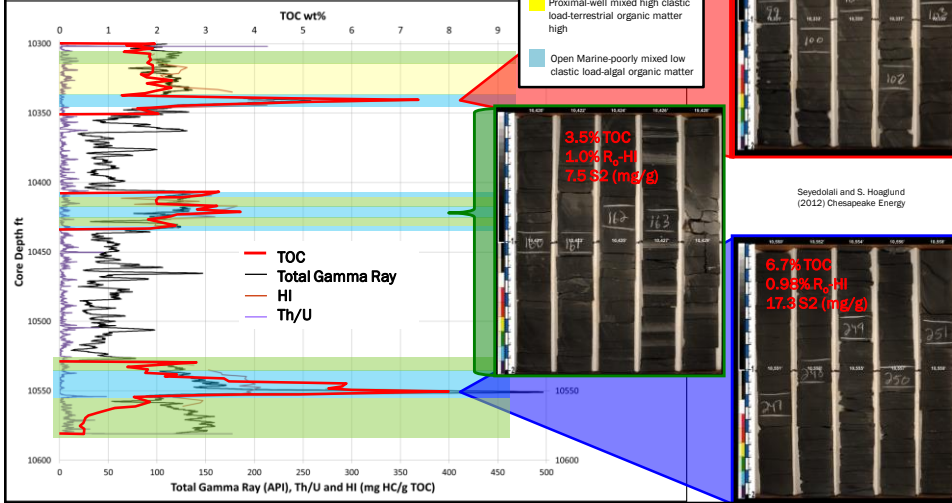
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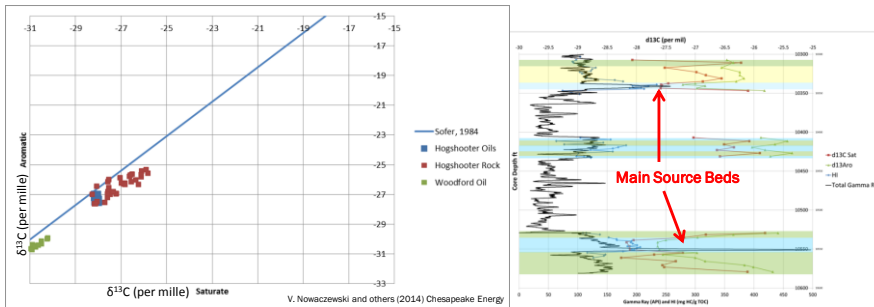
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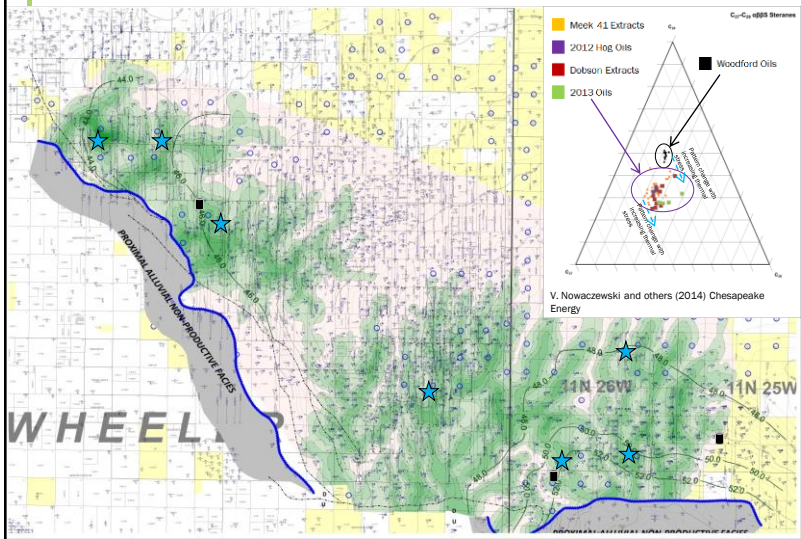
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