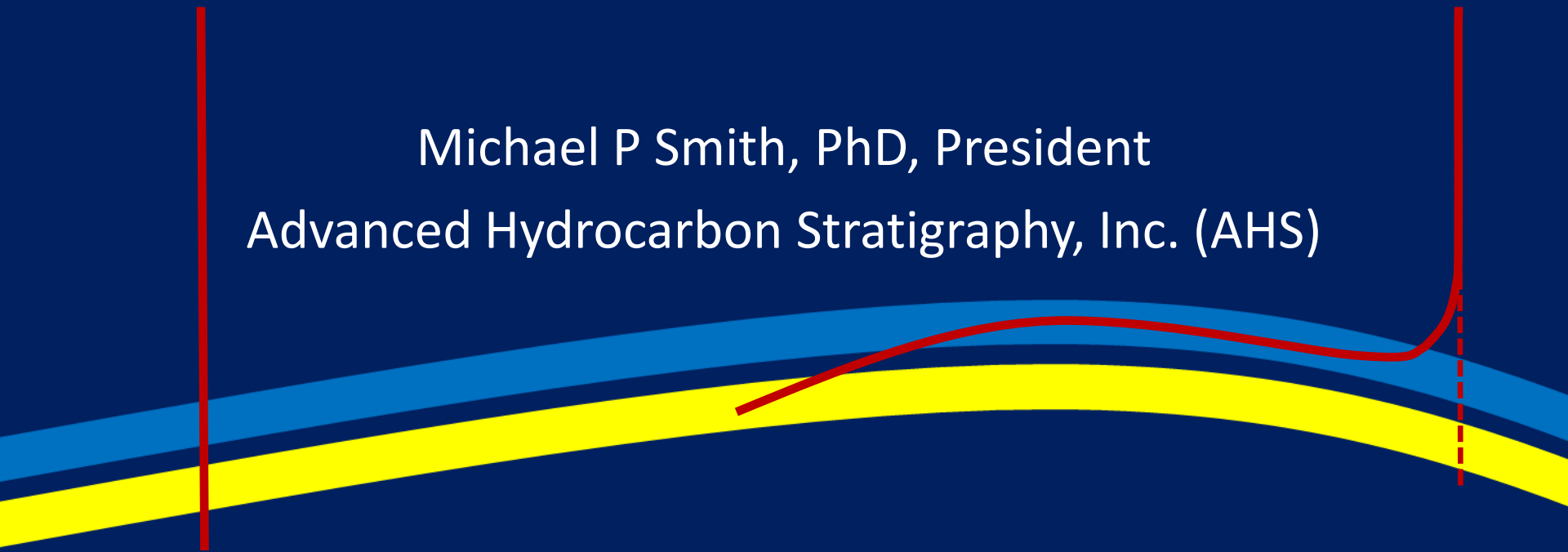


# Advanced Analysis of Hoxbar Well Cuttings for Volatiles Evaluation Using a Cryoscopic Mass Spectrometric System to Show the Effects of Production on Oil and Gas in the Field through Time

Michael P Smith, PhD, President

Advanced Hydrocarbon Stratigraphy, Inc. (AHS)



Or:  
A Unique Look at the Area Drained of  
Oil from Hoxbar Sands Prior to Drilling  
through Natural Fractures.  
As Evidenced by Well Cuttings.

Michael P Smith, PhD, President  
Advanced Hydrocarbon Stratigraphy, Inc. (AHS)



# Presentation Outline

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- 1) Intro to AHS Cuttings and Core Technology
- 2) AHS Water Data Maps Sw and Pay Zones
- 3) AHS Data Maps Depletion Zones in Laterals
- 4) Applying #'s 2 and 3 to a Hoxbar Lateral for 2 Goals:
  - Suggest Optimum Completion Strategy and
  - Estimate Optimum Well Locations

# INTRO: PDC Cuttings, The Sample

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## 1. Operations

- Intelligent, enhanced completion design
- Actual production forecasting before completion
- Land horizontals in best zones

Bottom-line impacts: Detailed knowledge of pay identification, rock type and properties prediction, and report development with expert consultation

## 2. Exploration

- Identify new opportunities and plays
- Basin petroleum system evaluation

Bottom-line impacts: Optimized exploration and successful production



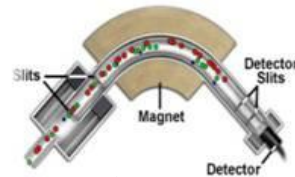
# INTRO: AHS's Unique Technology

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HYDROCARBON  
STRATIGRAPHY

## Well Cuttings

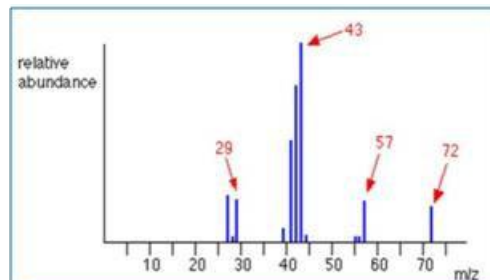


## Single Samples Analyzed Under Low Pressure

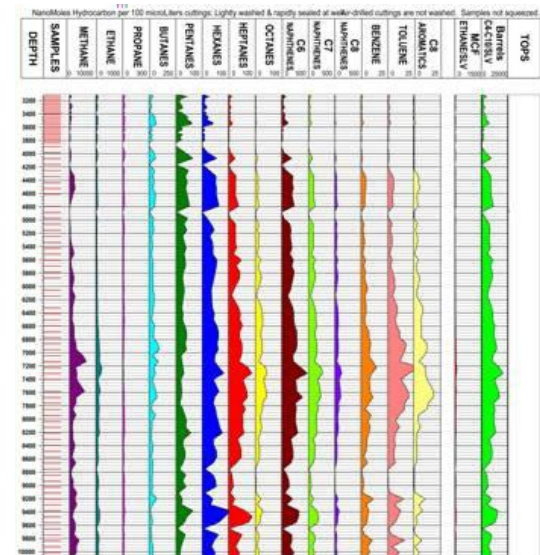


1. Cuttings (or Mud) Samples Sealed or Bagged at Well Site
2. Older well cuttings washed or unwashed
3. Oil based mud and PDC bits have limited impact

## MS Analysis



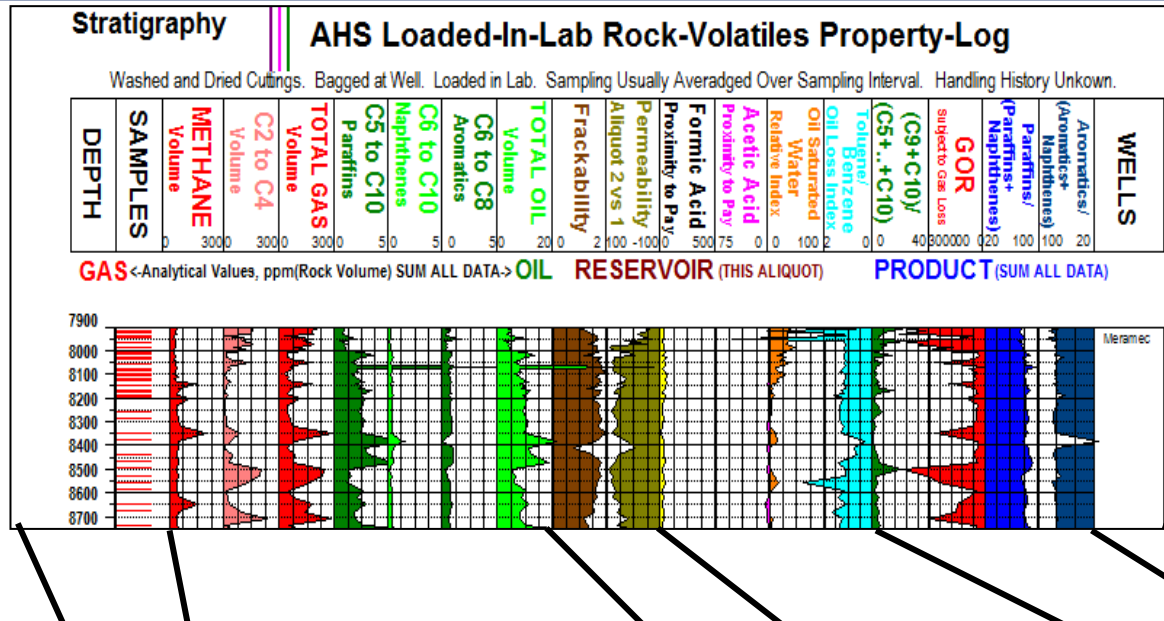
## Quantitative Reservoir Contents



## The 4<sup>th</sup> Log

# INTRO: AHS Data Interpretation

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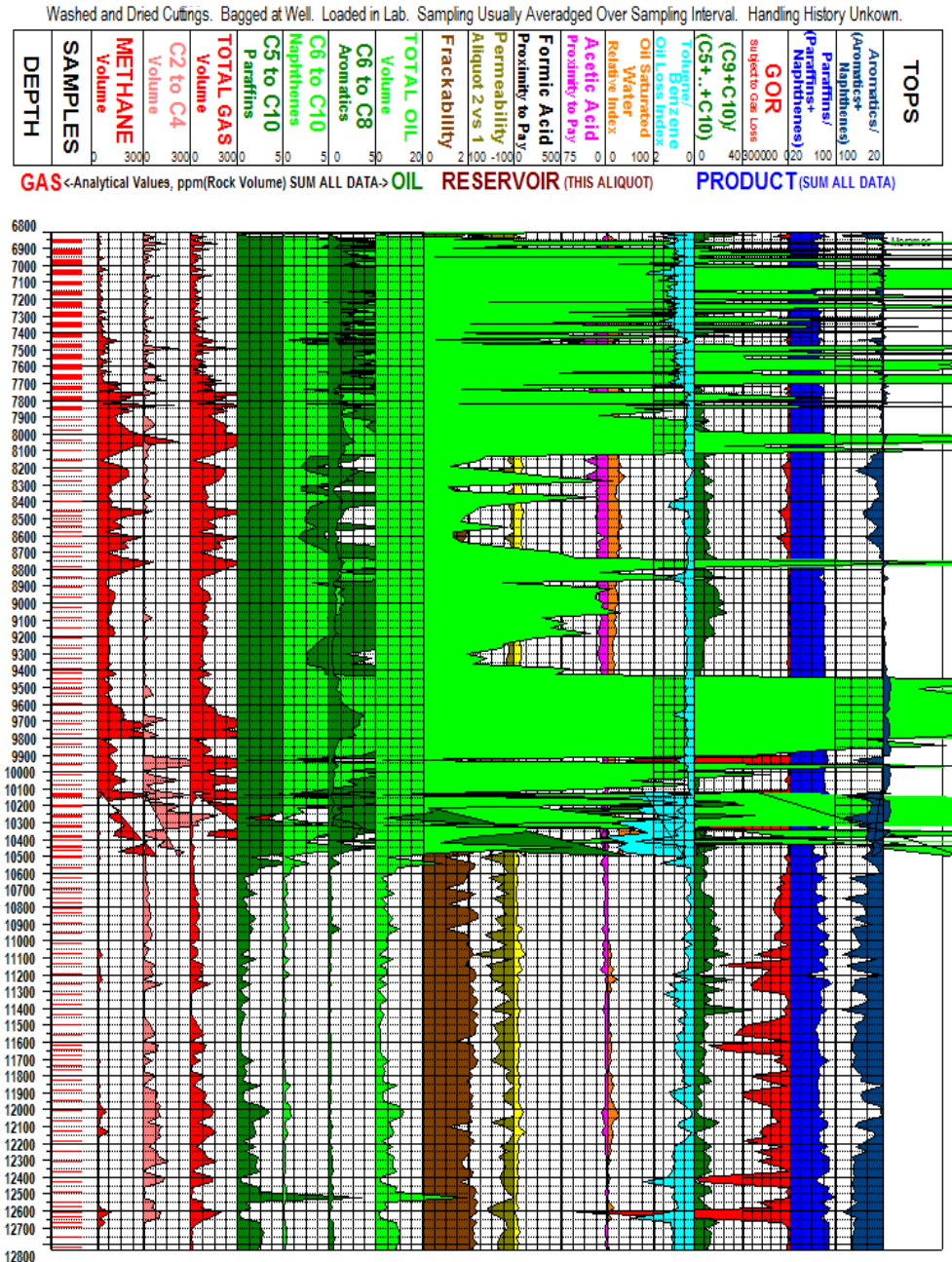


Category	depth	C1-C10, Total Gas/Oil	Frac & Perm	Pay Zones, Prospectivity	HC Analysis	Well Tops
Interpretation		HC Detection, ID: faults, fractures, rock types, etc. Reservoir Quality, Oil Migration Off ramps, Pullovers, Accommodations, Penitentiaries	AHS only	Sw, Proximity to Pay, Oil Migration Super Highways	Pay Zone Mapping, product quality	From Client

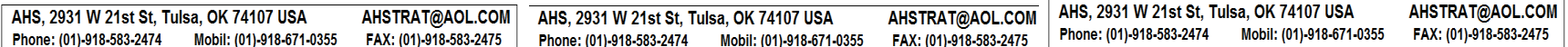
# INTRO: STACK Faulted Lateral

A  
H  
S

- Pay zone mapped on toe side of fault



# ADVANCED HYDROCARBON STRATIGRAPHY



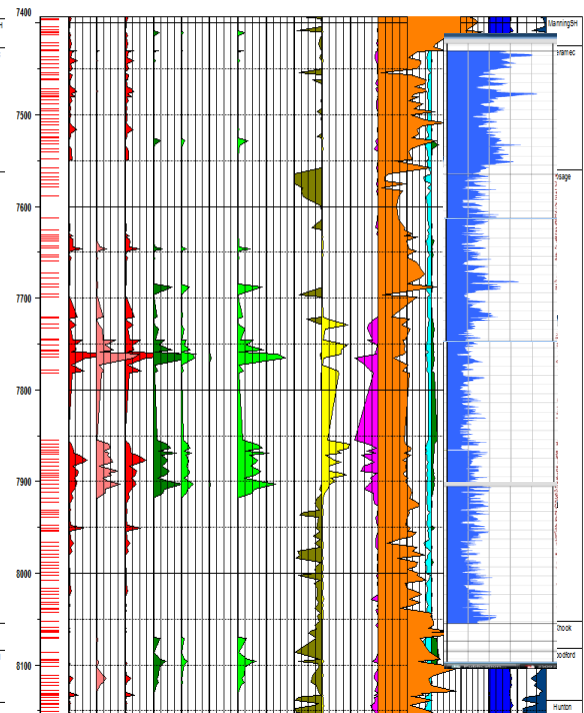
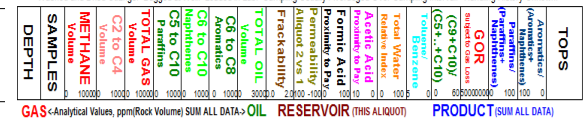


# ADVANCED HYDROCARBON STRATIGRAPHY

Lab Loaded OBM core chips Sum All Data

### AHS Lab-Loaded Rock-Volatiles High Response Property-Log

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab. Sampling Usually Averaged Over Sampling Interval. Handling History Unknown.

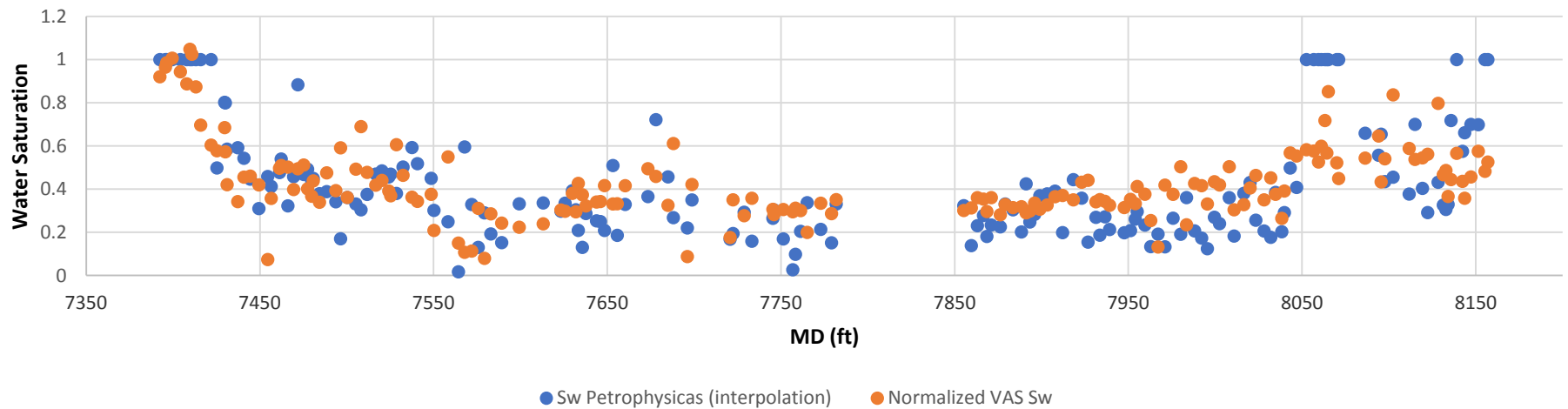


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# AHS Water Data: Sw and PayZones

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Sw Point by Point Comparison of VAS to Petrophysics

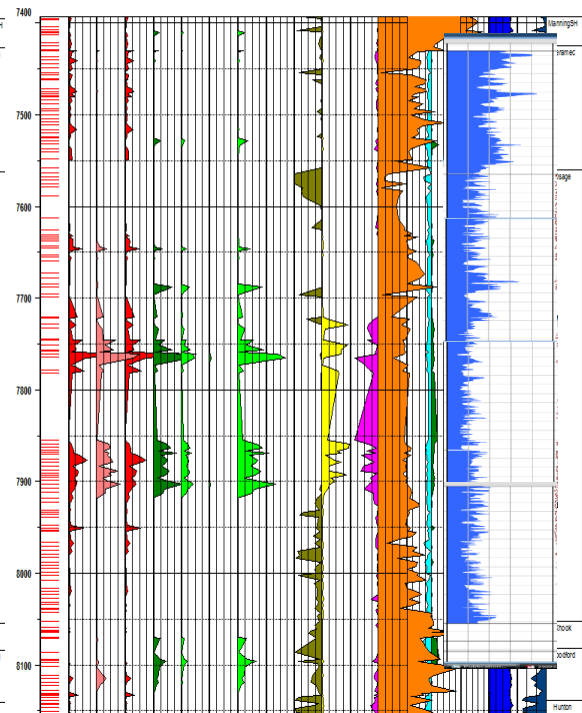
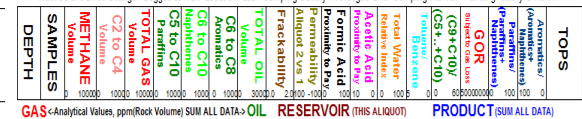


# ADVANCED HYDROCARBON STRATIGRAPHY

Lab Loaded OBM core chips Sum All Data

### AHS Lab-Loaded Rock-Volatiles High Response Property-Log

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab. Sampling Usually Averaged Over Sampling Interval. Handling History Unknown.



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# AHS Water Data: Sw and PayZones

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Figure 7

AHS xA1water vs xA2water.

Well 1

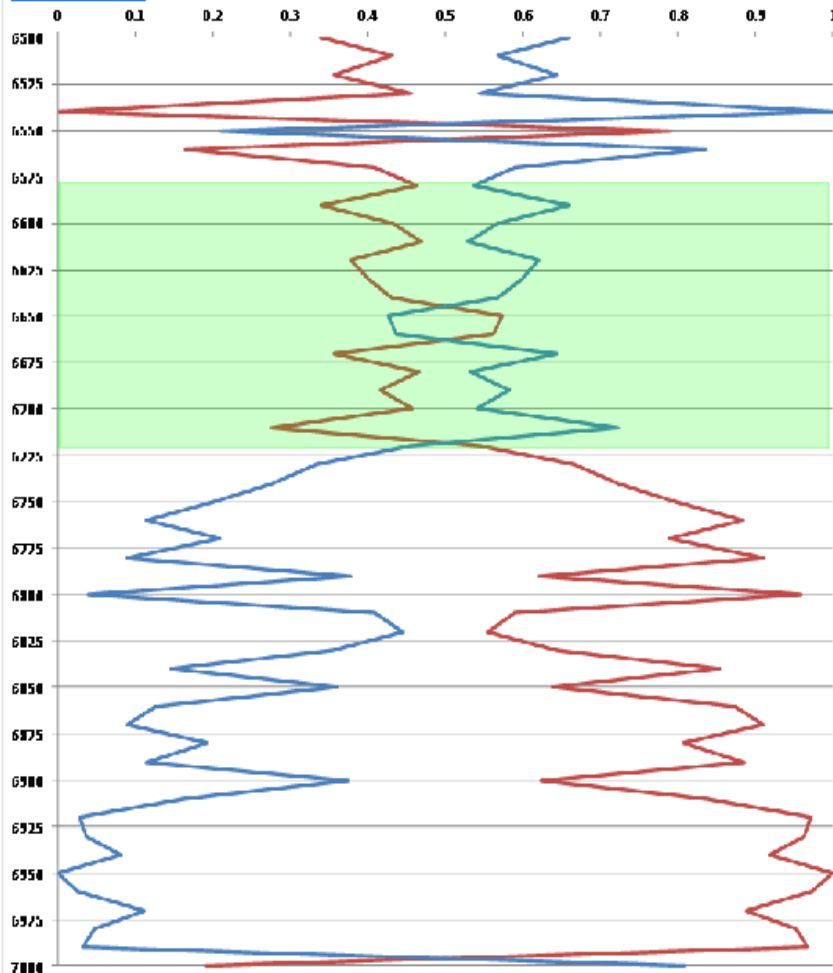
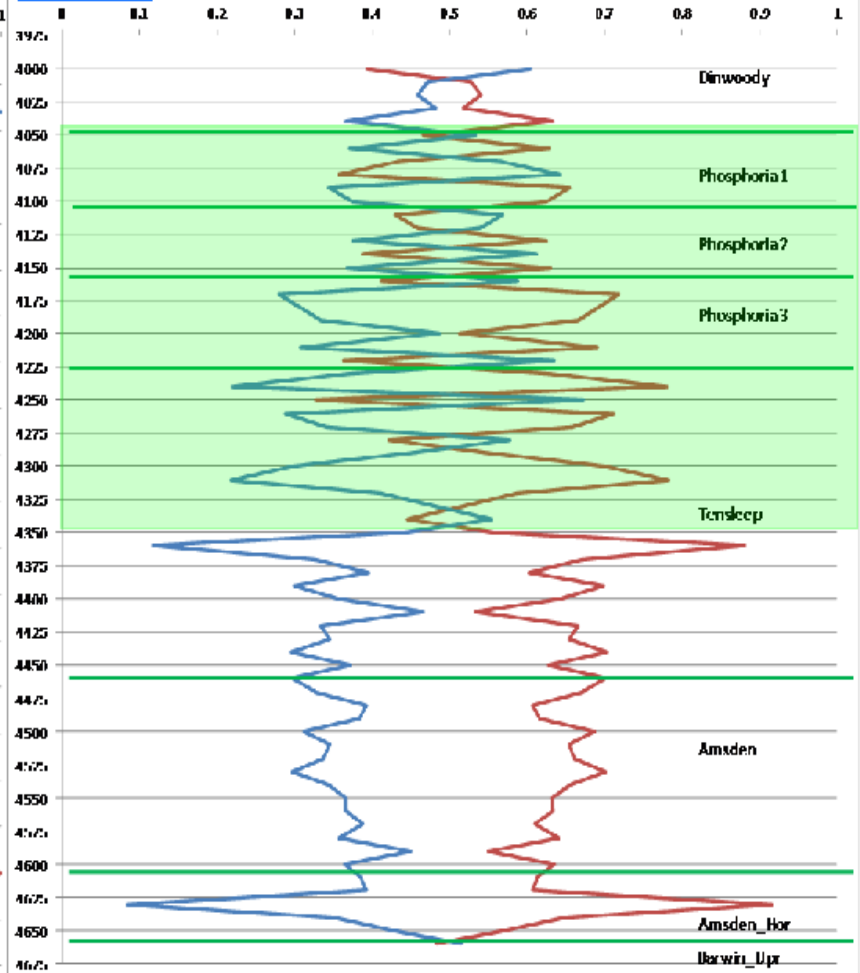


Figure 8

AHS xA1water vs xA2water.

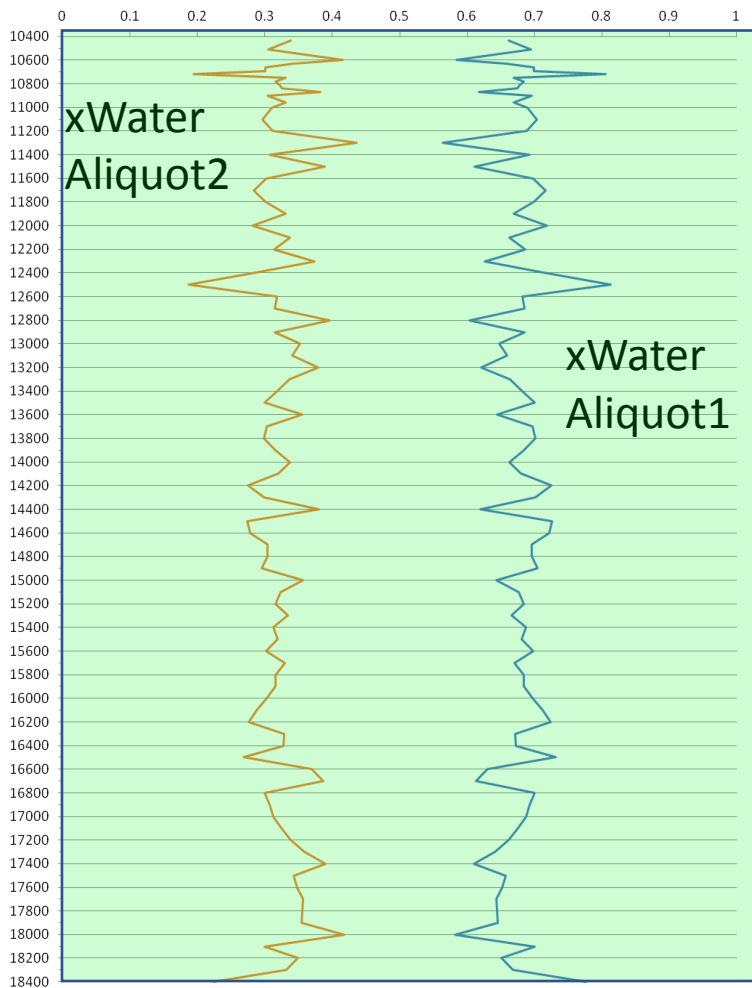
Well 2



# AHS Water Data: Sw and PayZones

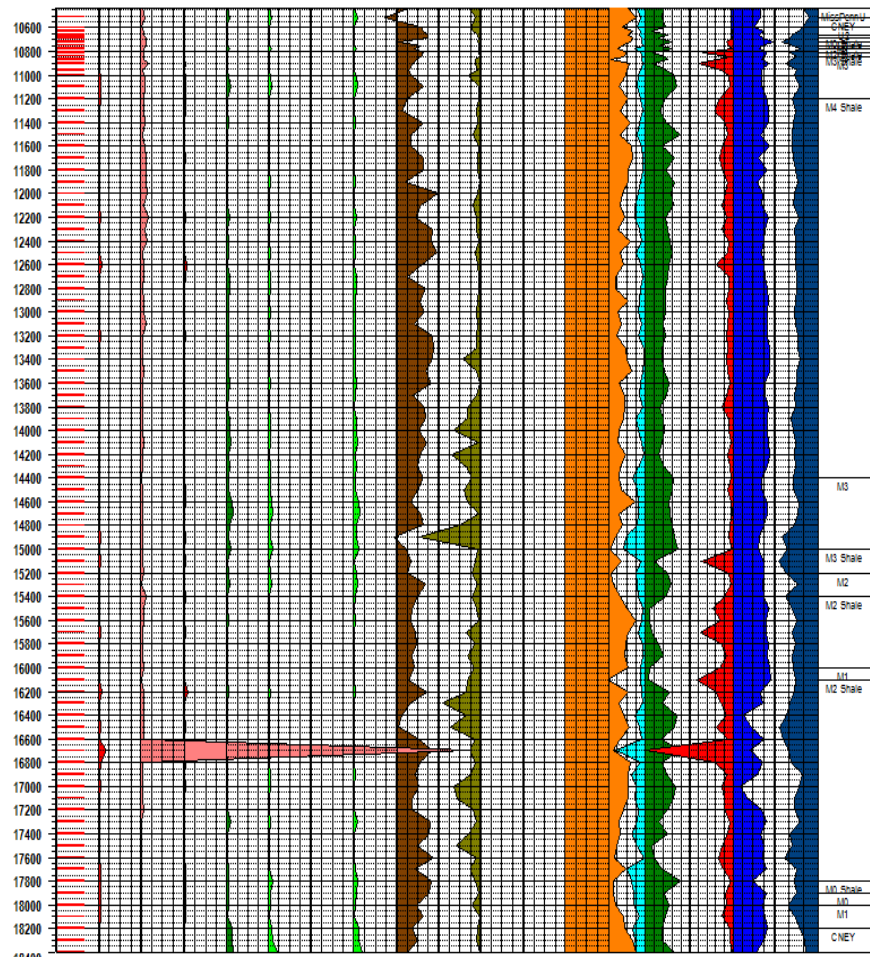
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xA2 vs xA1 Water: Roan



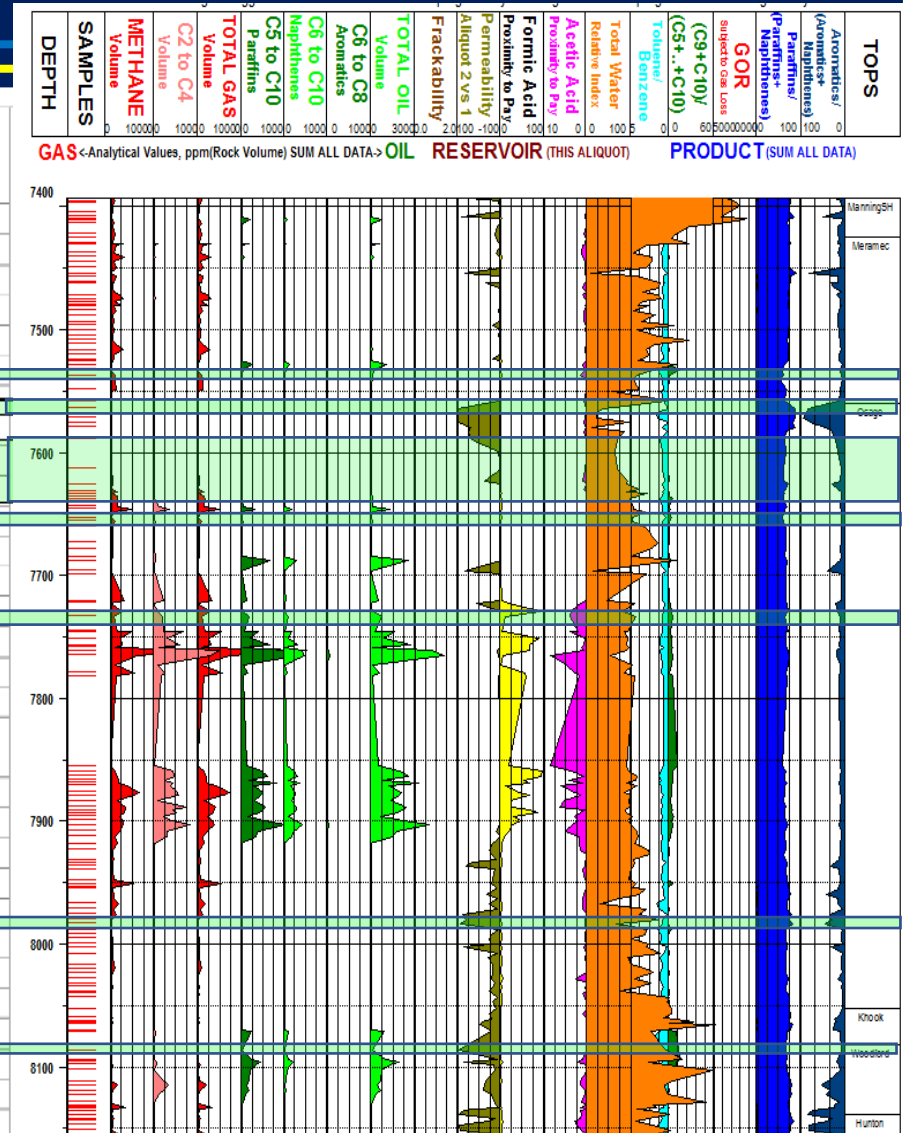
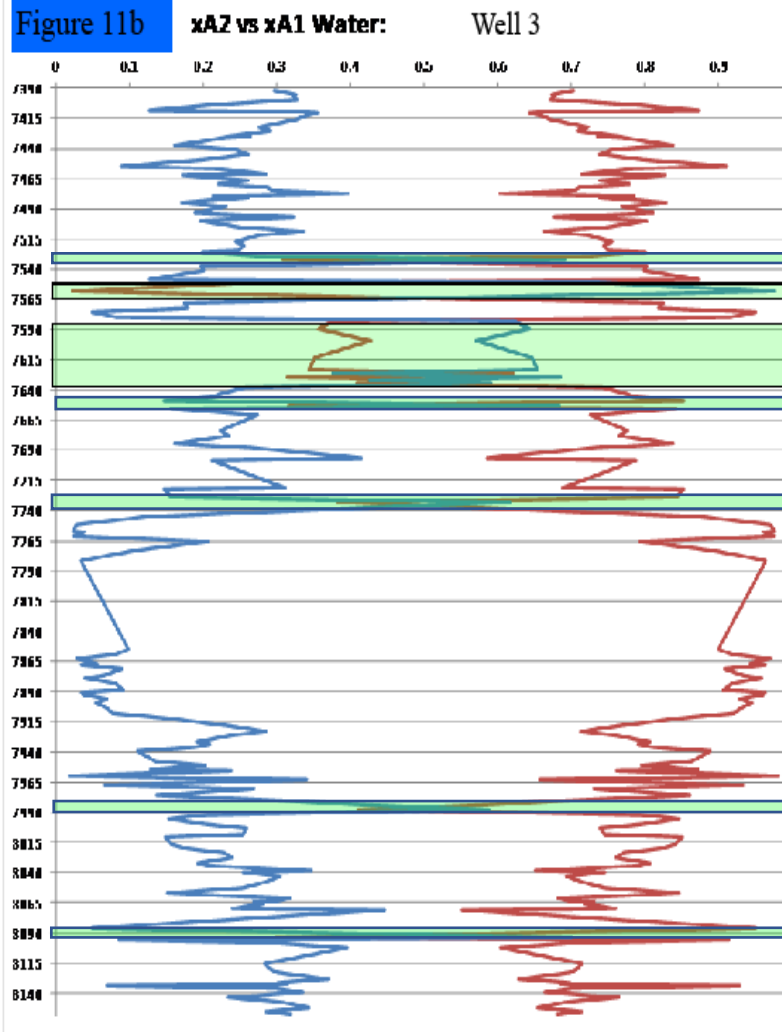
DEPTH	SAMPLES	METHANE Volume	C2 to C4 Volume	TOTAL GAS Volume	C5 to C10 Naphthenes	C6 to C8 Aromatics	TOTAL OIL Volume	Mechanical Strength	Aliquot 2 vs 1	Permeability	Formic Acid Proximity to Pay	Acetic Acid Proximity to Pay	Total Water Absolute	Oil Index	GOR	Subject to Gas Loss (C9+C10)	Subject to Gas Loss (C5+.C10)	Paraffins (Naphthenes)	Aromatics (Aromatics)	TOPS
0	100000	1500	100000	5000	5000	5000	2500	1.0	1.5	0	750	750	0	125	0	100	100000	0	75	0

GAS <Analytical Values, ppm(Rock Volume) SUM ALL DATA> OIL RESERVOIR (THIS ALIQUOT) PRODUCT (SUM ALL DATA)



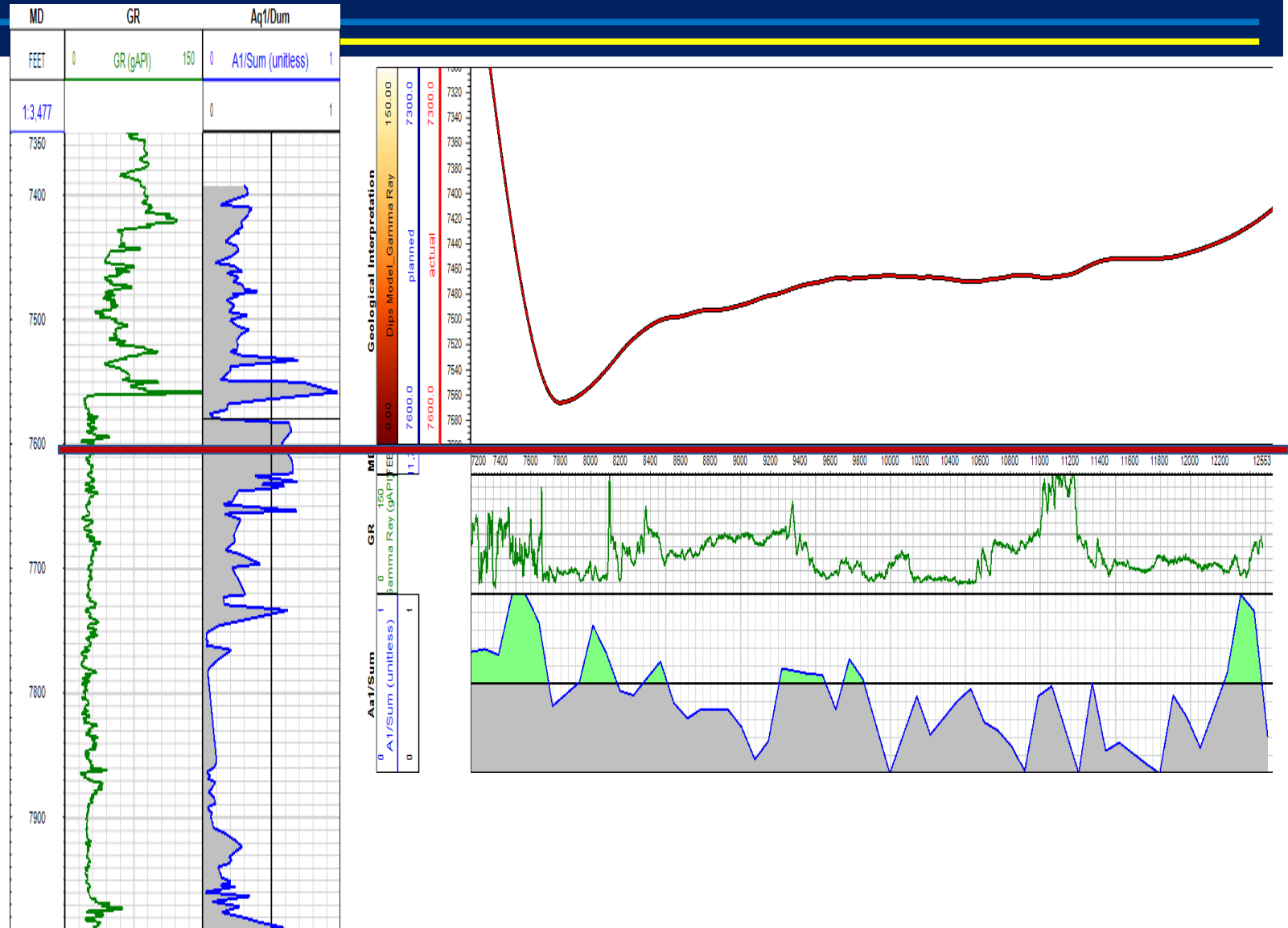
# AHS Water Data: Sw and PayZones

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STRATIGRAPHY



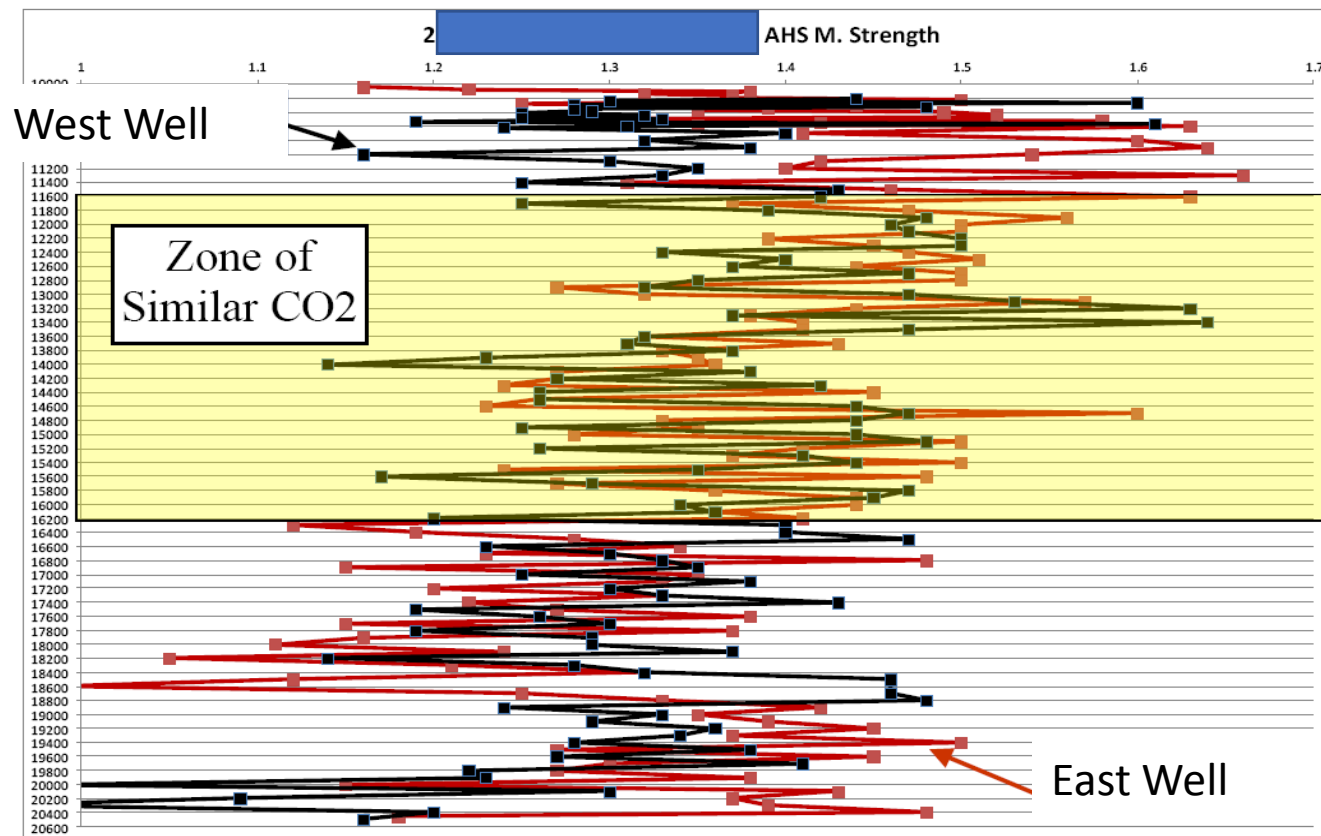
# AHS Water Data: Sw and PayZones

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# AHS Data: Already Produced Zones

/ANCED  
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# AHS Data: Already Produced Zones

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## West Well

Lab Loaded OBM Cuttings Aliquot 1

### VAS Preliminary Property-Log

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab.

TOPS																						
Aromatics/ Naphthenes	Paraffins/ Naphthenes	GOR	GOR skeletal C10	(C9+C10)/ (C5+ +C10)	TOC % Benzene	Oil Loss Index	Total Water	Absorbance	Acetic Acid Proximity to Pay	Formic Acid Proximity to Pay	Permeability Darcy	Aliquot 2 vs 1	Mechanical Strength	TOTAL OIL Volume	C6 to C8 Aromatics	C6 to C10 Naphthenes	C5 to C10 Paraffins	TOTAL GAS Volume	C2 to C4 Volume	METHANE Volume	SAMPLES	DEPTH
75	75	1000000	0	100	0	125	0	0	750	50	100	1000000	1.0	2500	5000	5000	5000	5000	1500	1000000	1000000	0
GAS <Analytical Values, ppm(10000 Volume) SUM ALL DATA> RESERVOIR (THIS ALL LIQUID) PRODUCT (SUM ALL DATA)																						

GAS <Analytical Values, ppm(Rock Volume) SUM ALL DATA> OIL RESERVOIR (THIS ALIQUOT) PRODUCT (SUM ALL DATA)

Advanced  
Hydrocarbon  
Stratigraphy

## East Well

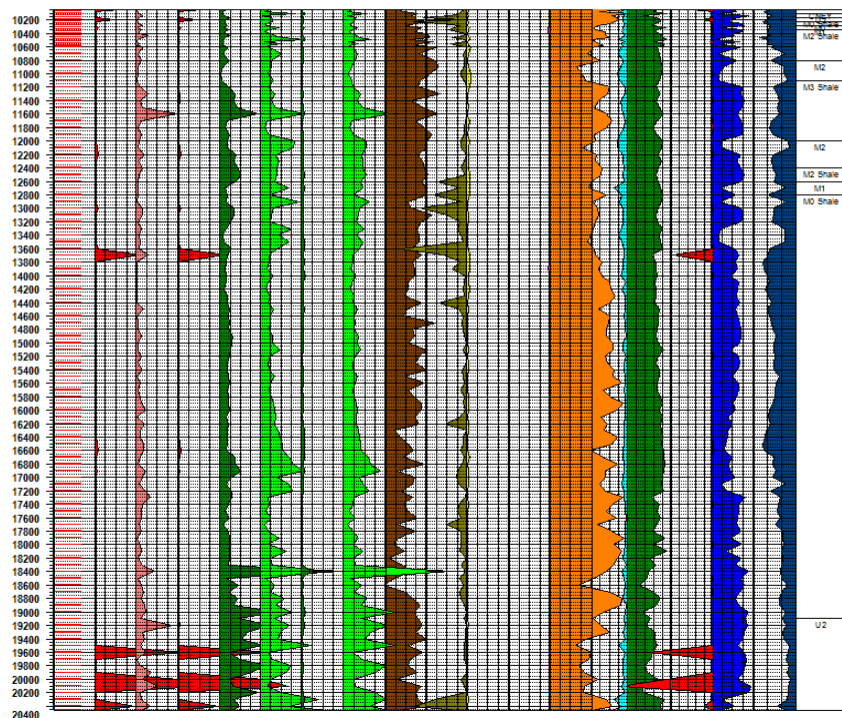
Lab Loaded OBM Cuttings Aliquot 1

### VAS Preliminary Property-Log

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab.

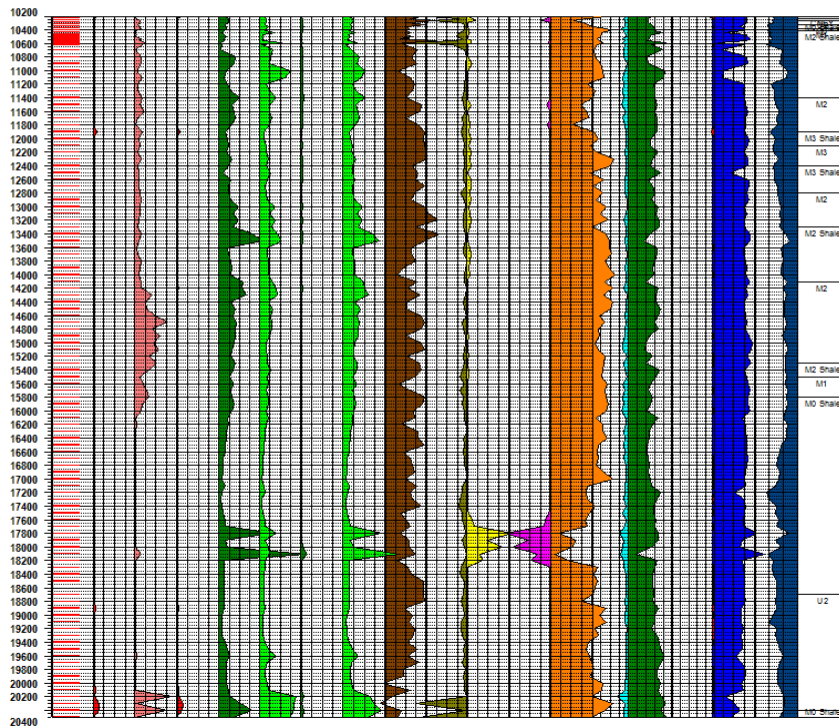
TOPS																					
Aromatic/ Naphthenes	0	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Paraffins/ Naphthenes	0	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
GOR	0	1000000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(C9+C10)/ (C5+...+C10)	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
TOLOGUE Benzene Oil Loss Index	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Water	0	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Absorbance	0	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid Proximity to Pay	0	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Formic Acid Proximity to Pay	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Permeability Aliquot 2 vs 1	0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Mechanical Strength	0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
TOTAL OIL	0	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Volume	0	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
C8 to C8	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Aromatics	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
C6 to C10	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Naphthenes	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
C5 to C10	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Paraffins	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
TOTAL GAS	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Volume	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
C2 to C4	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Volume	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
METHANE	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Volume	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
SAMPLES	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
DEPTH	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
GAS < Analytical Values, ppm(Rock Volume) SUM ALL DATA >																					
RESERVOIR (THIS ALIQUOT)																					

GAS <Analytical Values, ppm(Rock Volume) SUM ALL DATA> OIL RESERVOIR (THIS ALIQUOT) PRODUCT (SUM ALL DATA)



AHS, 2931 W 21st St, Tulsa, OK 74107 USA  
Phone: (01)-918-583-2474 Mobil: (01)-918-671-0355

AHSTRAT@AOL.COM  
FAX: (01)-918-583-2475

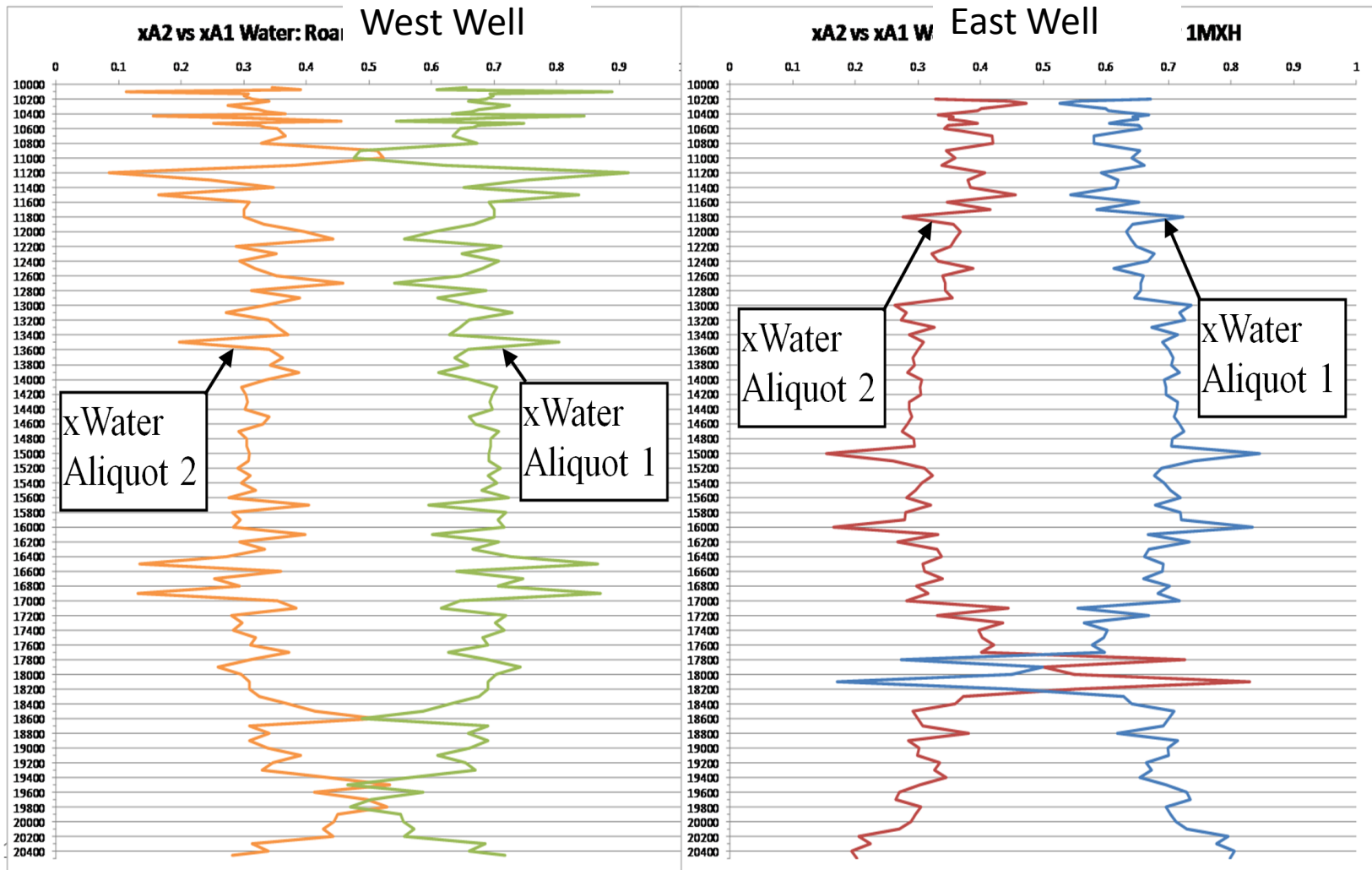


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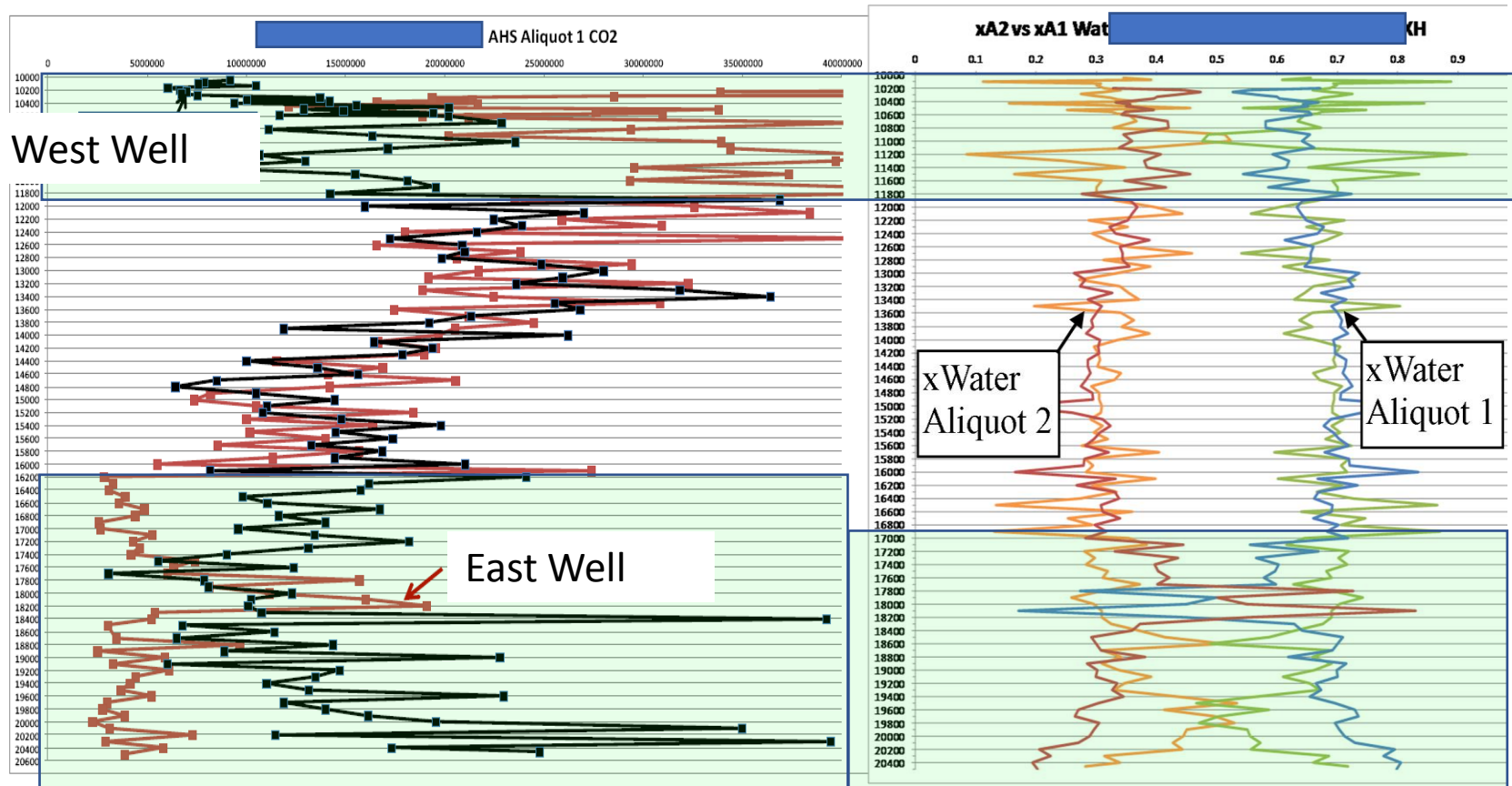
# AHS Data: Already Produced Zones

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# AHS Data: Already Produced Zones

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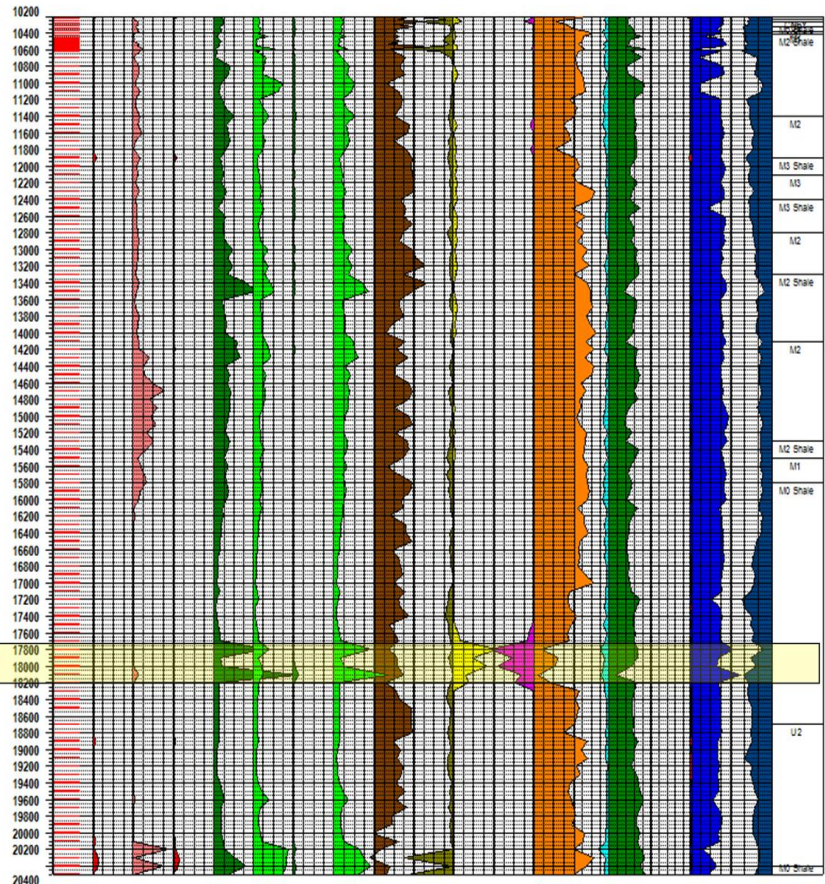
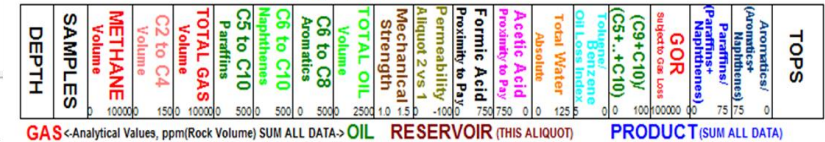




# ADVANCED HYDROCARBON STRATIGRAPHY

### Lab Loaded OBM Cuttings Aliquot 1

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab.





# AHS Data: Already Produced Zones

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STRATIGRAPHY

Advanced  
Hydrocarbon  
Stratigraphy

East Well

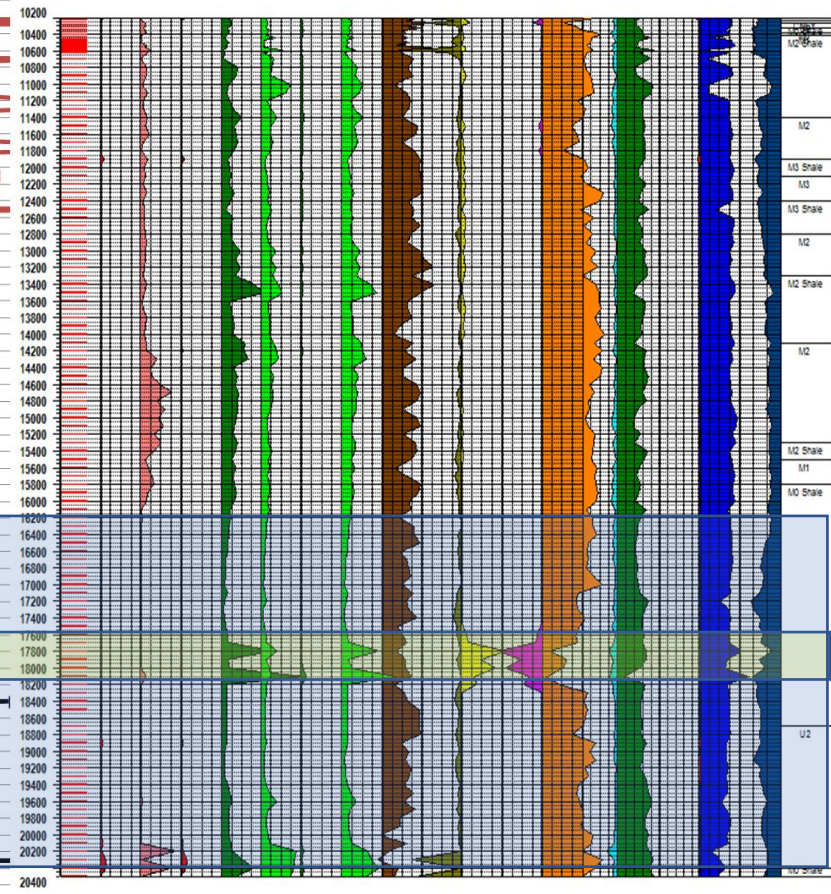
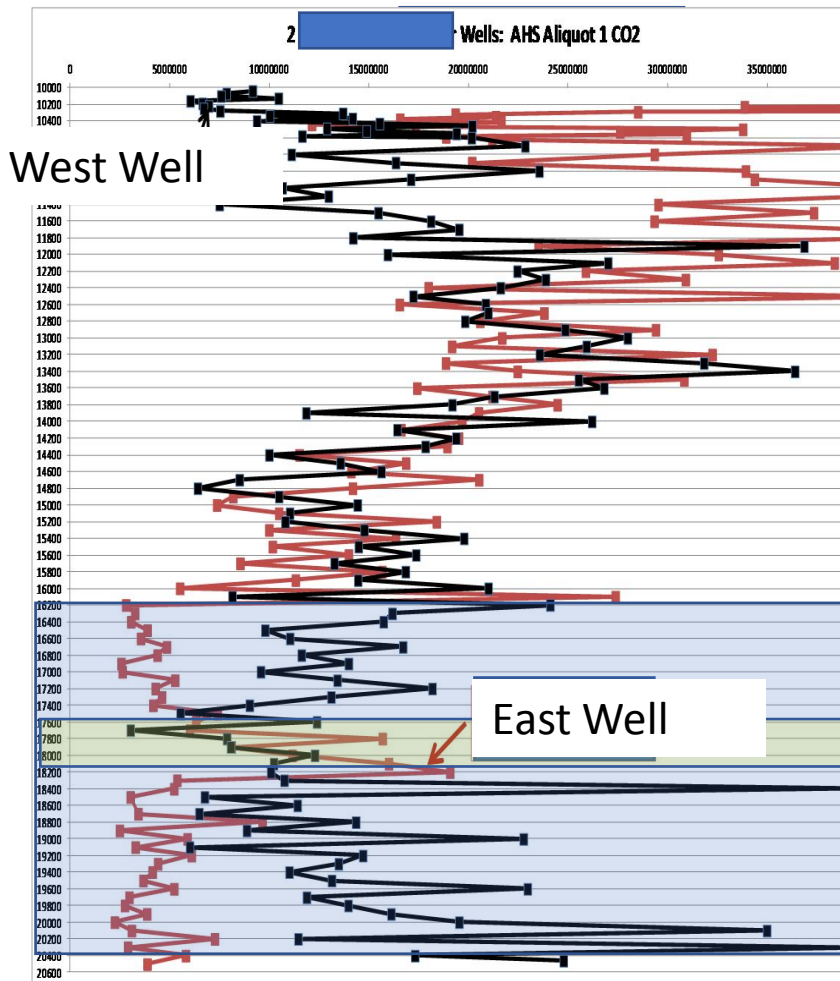
Lab Loaded OBM Cuttings Aliquot 1

VAS Preliminary Property-Log

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab.

DEPTH	SAMPLES	METHANE Volume	C2 to C4 Volume	TOTAL GAS Volume	C5 to C10 Paraffins	Naphthenes	Aromatics	C6 to C8 Aromatics	C6 to C10 Naphthenes	TOTAL OIL Volume	Mechanical Strength	Permeability Al. Aliquot 2 vs 1	Formic Acid Proximity to Pay	Acetic Acid Proximity to Pay	Total Water	Oil Loss Index	Benzene Oil Loss Index	(C9+C10) (C5+..+C10)	GOR Subject to our loss	Paraffins (Naphthenes)	Aromatics/ Resin/ Asphaltenes	TOPS
0	1000000	150	100000	500	500	500	500	500	500	2500	1.0	1.5	100	750	750	0	0	0	1000000	0	75	0

GAS <Analytical Values, ppm(Rock Volume) SUM ALL DATA> OIL RESERVOIR (THIS ALIQUOT) PRODUCT (SUM ALL DATA)



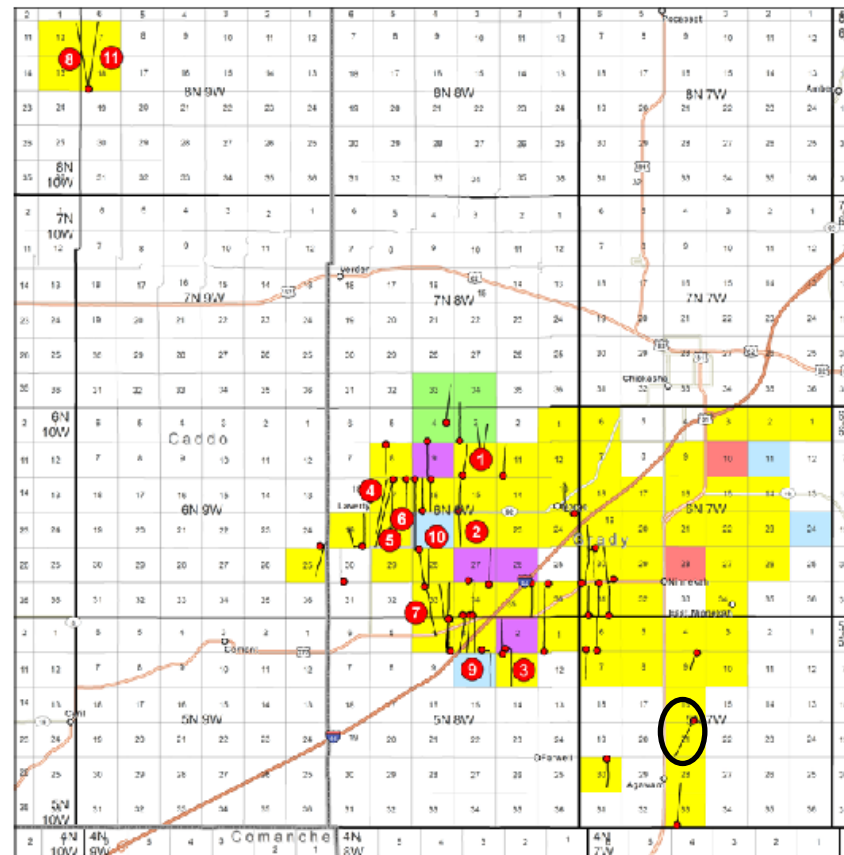
# Hoxbar Atkinson 1-21H Evaluation

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STRATIGRAPHY



Unit Petroleum  
 Camino  
 Echo E&P LLC  
 Kaiser- Francis  
 Limerock Resources

Denotes Unit Non-Op working interest  
 Marchand Horizontal



**11** Unit Petroleum  
 5D "A" 18/7 1HXL  
 IP30: 497 Boe/d 98% Oil

**10** Kaiser Francis  
 Amanda 21-6-8 1H  
 IP30: 540 Boe/d 71% Oil

**9** Kaiser Francis  
 Torralba 10-5-8 1H  
 IP30: 578 Boe/d 70% Oil

**8** Unit Petroleum  
 5D 13/12 1HXL  
 IP30: 520 Boe/d 88% Oil

**7** Unit Petroleum  
 Livingston Land 1HXL  
 IP30: 565 Boe/d 72% Oil

**6** Unit Petroleum  
 Schenk Trust 3-17HXL  
 IP30: 1,470 Boe/d 75% Oil

**5** Unit Petroleum  
 Schenk Trust 2-17HXL  
 IP30: 1,463 Boe/d 79% Oil

**1** Unit Petroleum  
 Schmidt 1-10H  
 IP30: 687 Boe/d 80% Oil

**2** Unit Petroleum  
 Nina 1-22H  
 IP30: 1,124 Boe/d 76% Oil

**3** Unit Petroleum  
 McConnell 1-11H  
 IP30: 1,271 Boe/d 63% Oil

**4** Unit Petroleum  
 Schenk Trust 1-17HXL  
 IP30: 2,349 Boe/d 79% Oil

# ADVANCED HYDROCARBON STRATIGRAPHY

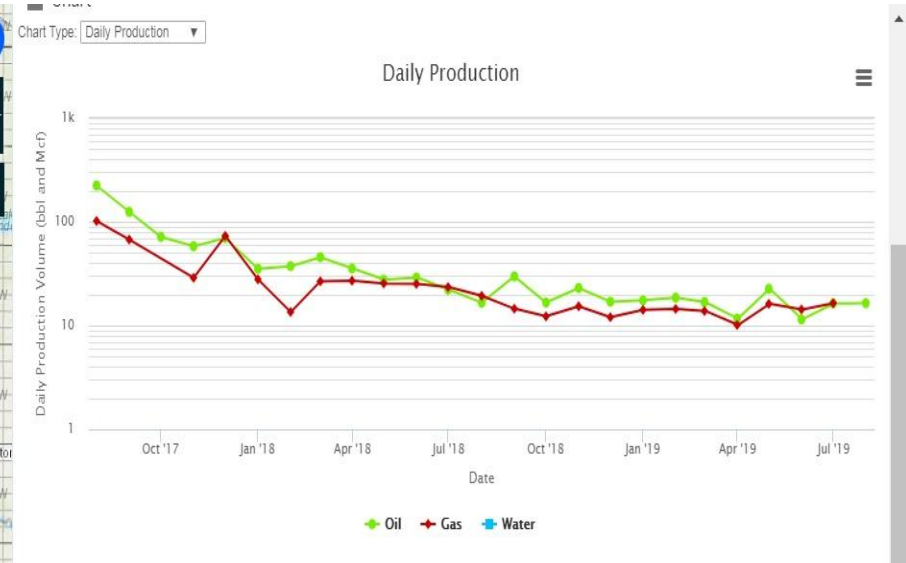
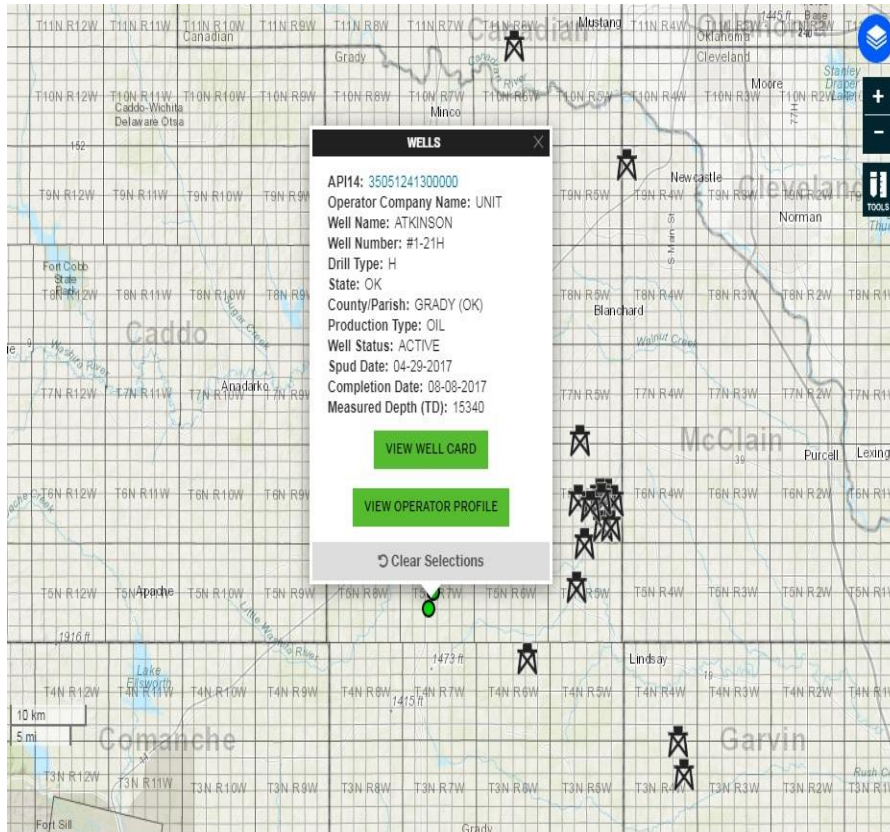
**Sections 16 & 21, T 5 N, R 7 W.I.M.,  
Grady County, Oklahoma.**





# Hoxbar Atkinson 1-21H Evaluation

ADVANCED  
HYDROCARBON  
STRATIGRAPHY



### Production

Date	Monthly Oil (bbl)	Monthly Gas (Mcf)	Monthly Water (bbl)	Avg Daily Oil (bbl)	Avg Daily Gas (Mcf)	Avg Daily Water (bbl)	Wells	Days
08-2017	6,921	3,151	0	223	102	0	1	
09-2017	3,740	2,022	0	125	67.4	0	1	
10-2017	2,218	0	0	71.55	0	0	1	
11-2017	1,744	866	0	58.13	28.87	0	1	
12-2017	2,156	2,265	0	69.55	73.06	0	1	
01-2018	1,090	864	0	35.16	27.87	0	1	
02-2018	1,045	378	0	37.32	13.5	0	1	

TABLE	LEASES	PRODUCTION	WELLS	PERMITS	RIGS	LANDTRAC LEASE	LANDTRAC UNIT	APPLICATIONS & ORDERS	COMPANY ACREAGE	DEALS FOR SALE	TRANSACTIONS	SHAPEFILES
Active Filters: API10 = 3505124130												
API14	Well Name	Well Number	Lease Name	Operator Alias (Legacy)	Operator Company Name	Operator (Reported)	Operator Ticker	Field	County/Parish	DI Basin	DI Play	DI Subplay
35051241300000	ATKINSON	#1-21H	ATKINSON UNIT PETR	UNIT	UNIT PETROLEUM C...	UNIT	HARNESS NW	GRADY (OK)	ANADARKO	SCOOP	HOXBAR	HOXBAR

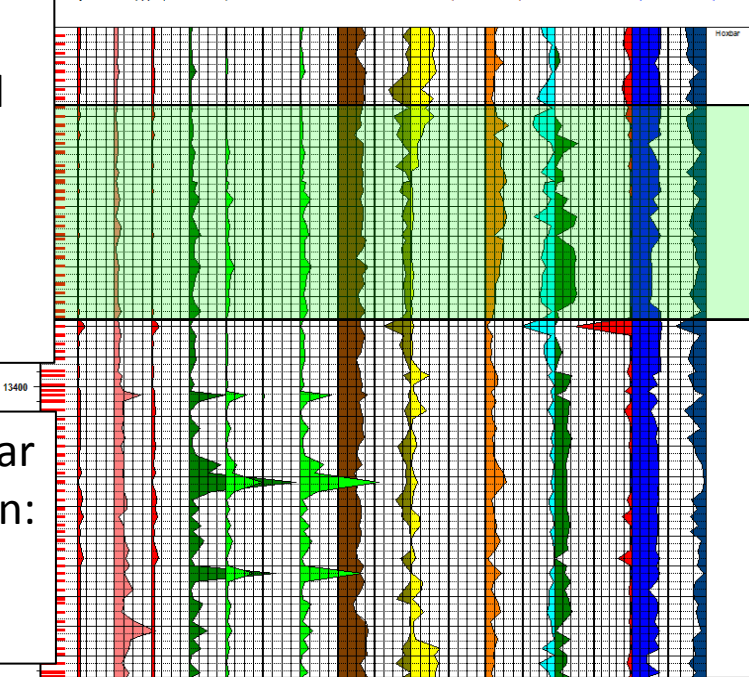


# ADVANCED HYDROCARBON STRATIGRAPHY

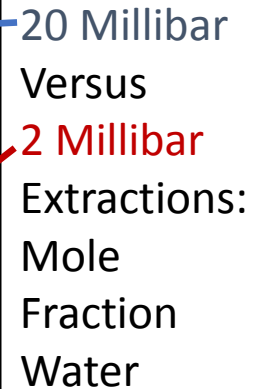
## 20 Millibar Extraction

## 2 Millibar Extraction

# ADVANCED HYDROCARBON STRATIGRAPHY



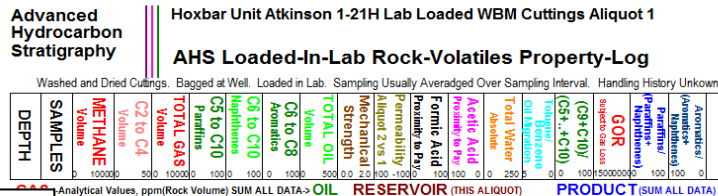
20 Millibar  
Extraction:  
Cuttings  
Volatiles



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# Hoxbar Atkinson 1-21H Evaluation

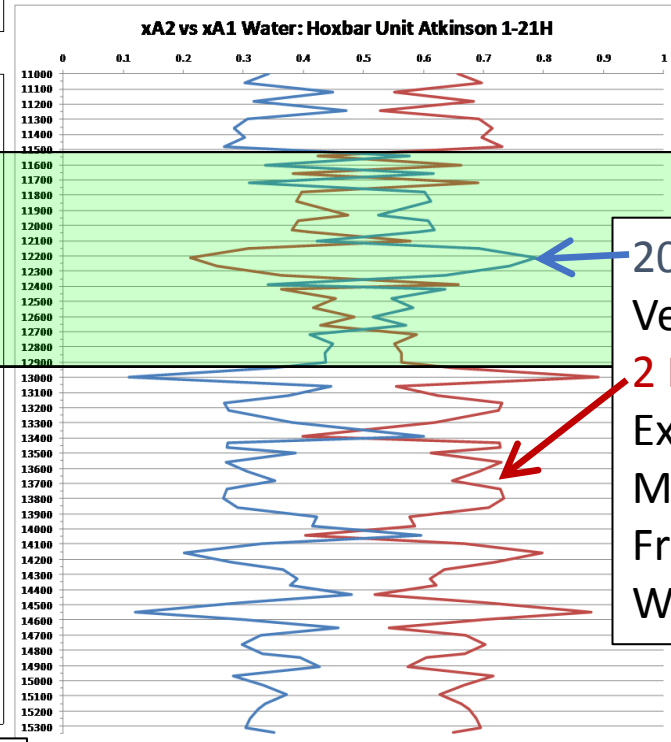
ADVANCED  
HYDROCARBON  
STRATIGRAPHY



Pay Zone  
Indicated  
by A1 vs  
A2 Mole  
Fractions  
of Water

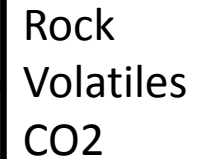
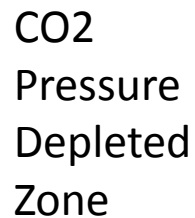
20 Millibar  
Extraction:  
Cuttings  
Volatiles

Oil Filled Fractures



20 Millibar  
Versus  
2 Millibar  
Extractions:  
Mole  
Fraction  
Water

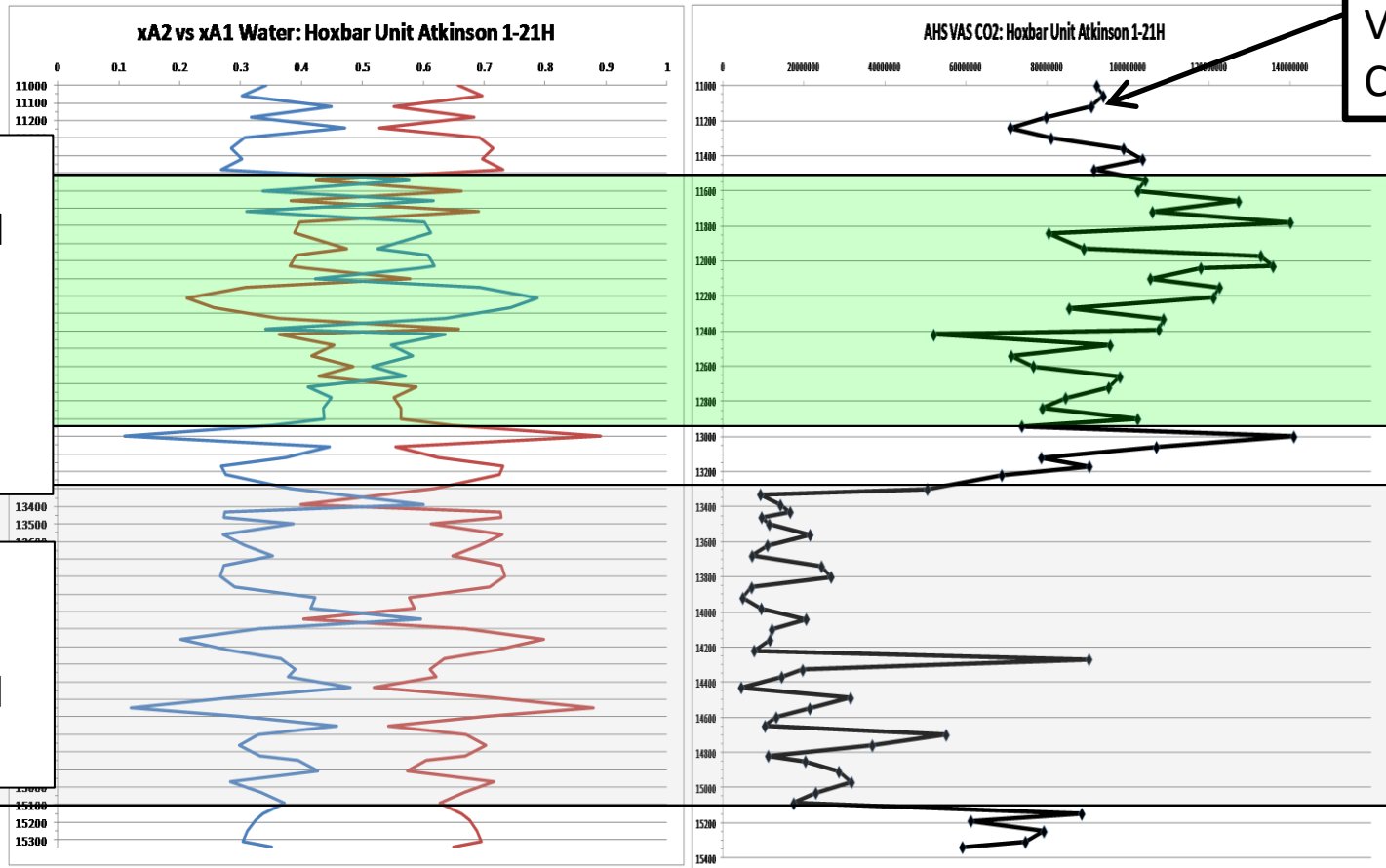
# ADVANCED HYDROCARBON STRATIGRAPHY



**FAX: (01)-918-583-2475**

# Hoxbar Atkinson 1-21H Evaluation

ADVANCED  
HYDROCARBON  
STRATIGRAPHY



# ADVANCED HYDROCARBON STRATIGRAPHY

## 20 Millibar Extraction

## 2 Millibar Extraction



# Hoxbar Atkinson 1-21H Evaluation

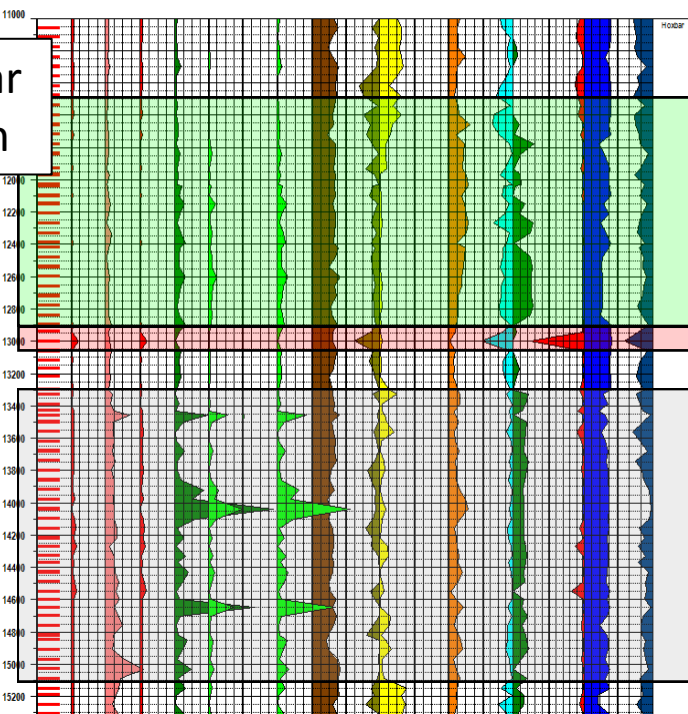
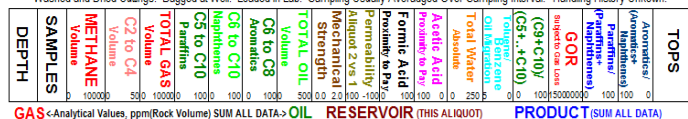
ADVANCED  
HYDROCARBON  
STRATIGRAPHY

Advanced  
Hydrocarbon  
Stratigraphy

Hoxbar Unit Atkinson 1-21H Lab Loaded WBM Cuttings Aliquot 1

AHS Loaded-In-Lab Rock-Volatiles Property-Log

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab. Sampling Usually Averaged Over Sampling Interval. Handling History Unknown.



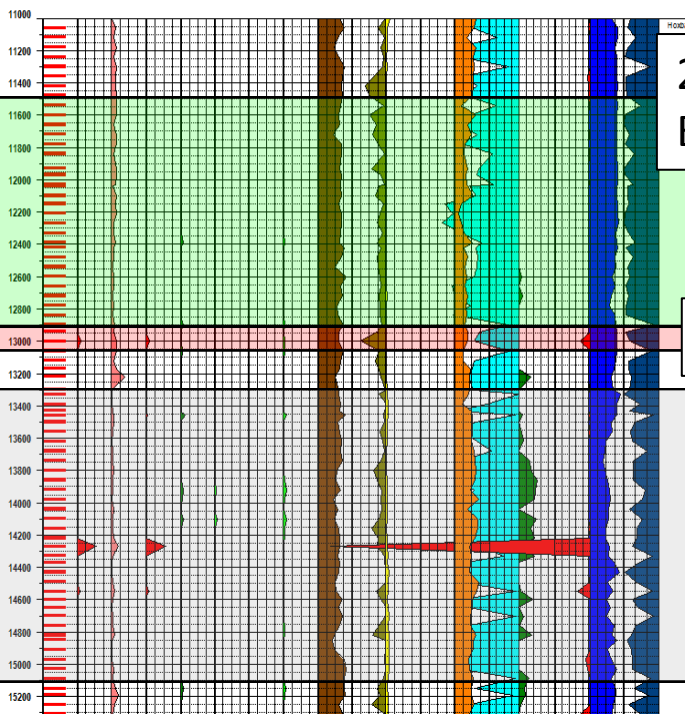
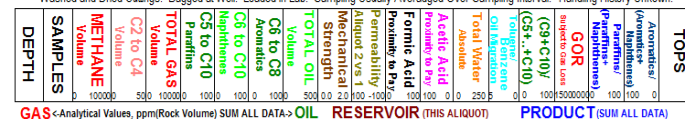
20 Millibar  
Extraction

Advanced  
Hydrocarbon  
Stratigraphy

Hoxbar Unit Atkinson 1-21H Lab Loaded WBM Cuttings Aliquot 2

AHS Loaded-In-Lab Rock-Volatiles Property-Log

Washed and Dried Cuttings. Bagged at Well. Loaded in Lab. Sampling Usually Averaged Over Sampling Interval. Handling History Unknown.



2 Millibar  
Extraction

Gas Zone

# Hoxbar Atkinson 1-21H Evaluation

ADVANCED  
HYDROCARBON  
STRATIGRAPHY

## Properties Log

## Hydrocarbon Log

## Mole Fraction Water

## CO2 Log

Heel

2 vs xA1 Water: Hoxbar Unit Atkinson 1-21H



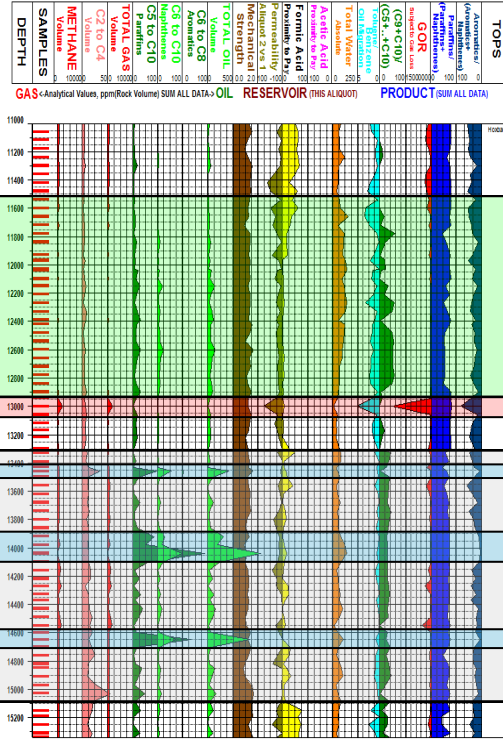
Up Dip

Advanced  
Hydrocarbon  
Stratigraphy

Hoxbar Unit Atkinson 1-21H Lab Loaded WBM Cuttings Aliquot 1

AHS Loaded-In-Lab Rock-Volatiles Property-Log

Washed and Dried Cuttings: Bagged at Well. Loaded in Lab. Sampling Usually Averaged Over Sampling Interval. Handling History Unknown.

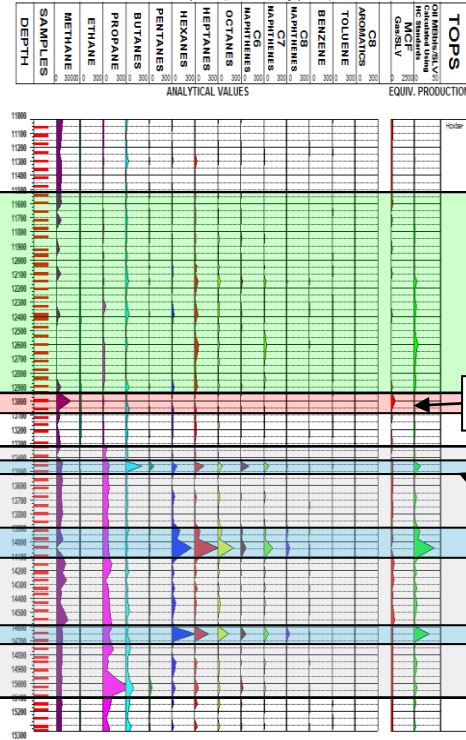


Advanced  
Hydrocarbon  
Stratigraphy

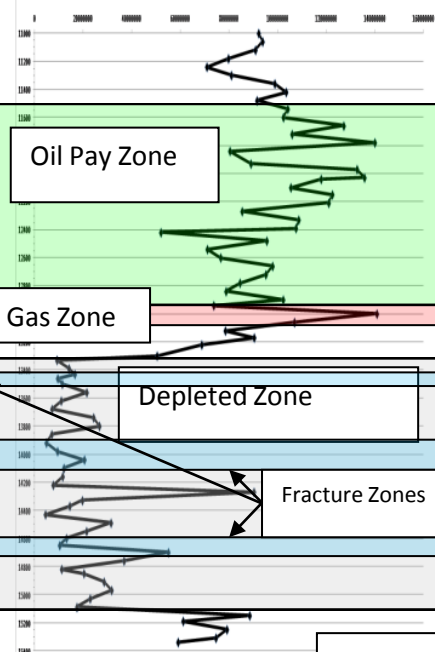
Hoxbar Unit Atkinson 1-21H Lab Loaded WBM Cuttings Aliquot 1

Fixed HC Scales, SLV=Standard Lateral Volume=4500' long, Radius=100'

NanoMoles Hydrocarbon per 400 microMeters Legacy Core Chips



AHS VAS CO2: Hoxbar Unit Atkinson 1-21H



Oil Pay Zone

Gas Zone

Depleted Zone

Fracture Zones

Toe

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1) AHS Cuttings Volatiles Analysis Maps  
Pay Zones  
Already Drained Zones

2) This Allows Avoiding Already Drained Zones  
Optimized Completions  
Optimized Well Locations