

Importance of Modern Logs and Accurate Mudlogs: An Example of a New Field Discovery*

Paul W. Smith¹

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Abstract

Numerous new field discoveries may be missed by explorers who fail to use a full suite of modern logs and correctly calibrated mudlogs. A recent new field discovery in the Red Fork Sandstone and the Viola Limestone provides an excellent example of an 'easy-to-miss' field. The initial well was drilled on a 3D seismic structure. The primary objectives were tested as non-commercial. Before plugging, an errant 4-foot section of Red Fork Sandstone was perforated. The well flowed at a rate of 50 BOPD from natural perforations. Subsequently, the second well encountered a section of the Viola Limestone that was very similar to that in the first well (questionable porosity). However, the microlog suggested permeability in the middle Viola section and the mudlog indicated hydrocarbon presence. The mudlog shows and porosity intervals were identical to those not tested in the first well; the first well did not have a microlog. Consequently, the Viola interval was perforated in the second well and began flowing 200 BOPD with no treatment. The Viola flowed more than 15,000 BO in the first 100 days and produced no water. Presently, the field contains three wells producing from the Red Fork Sandstone and one well produces from the Viola Limestone all as a result of close examination of the logs and accurate mudlogs. Existing old style logs in the area would not have predicted the discovery in the Red Fork nor did the old style logs suggest a permeability zone in the Viola.

Importance of Modern Logs and Accurate Mudlogs: An Example of a New Field Discovery

**Paul W. Smith
President
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Norman, Oklahoma**

**AAPG Mid-Continent Section Meeting
October 2015**



A FAMOUS STUDY

STEPHENSON, G. R. (1967)

Cultural Acquisition of Specific Learned
Response Among Rhesus Monkeys



Strategy – Find More Oil/Gas

KNOW YOUR POTENTIAL TARGET RESERVOIRS

Look at cuttings – they are coming out of the ground.

Run a mudlog

There are things that the cuttings may not show

Be sure to calibrate ***and test*** the mudlog unit

Run Logs

Learn all you can about what you encountered

The bulk of the money to drill the well to find potential reservoirs has already been spent.

As a minimum, run **DIL, CNDL, and a real Microlog** (not computer derived).

If possible, run repeat section over potential pay !!!



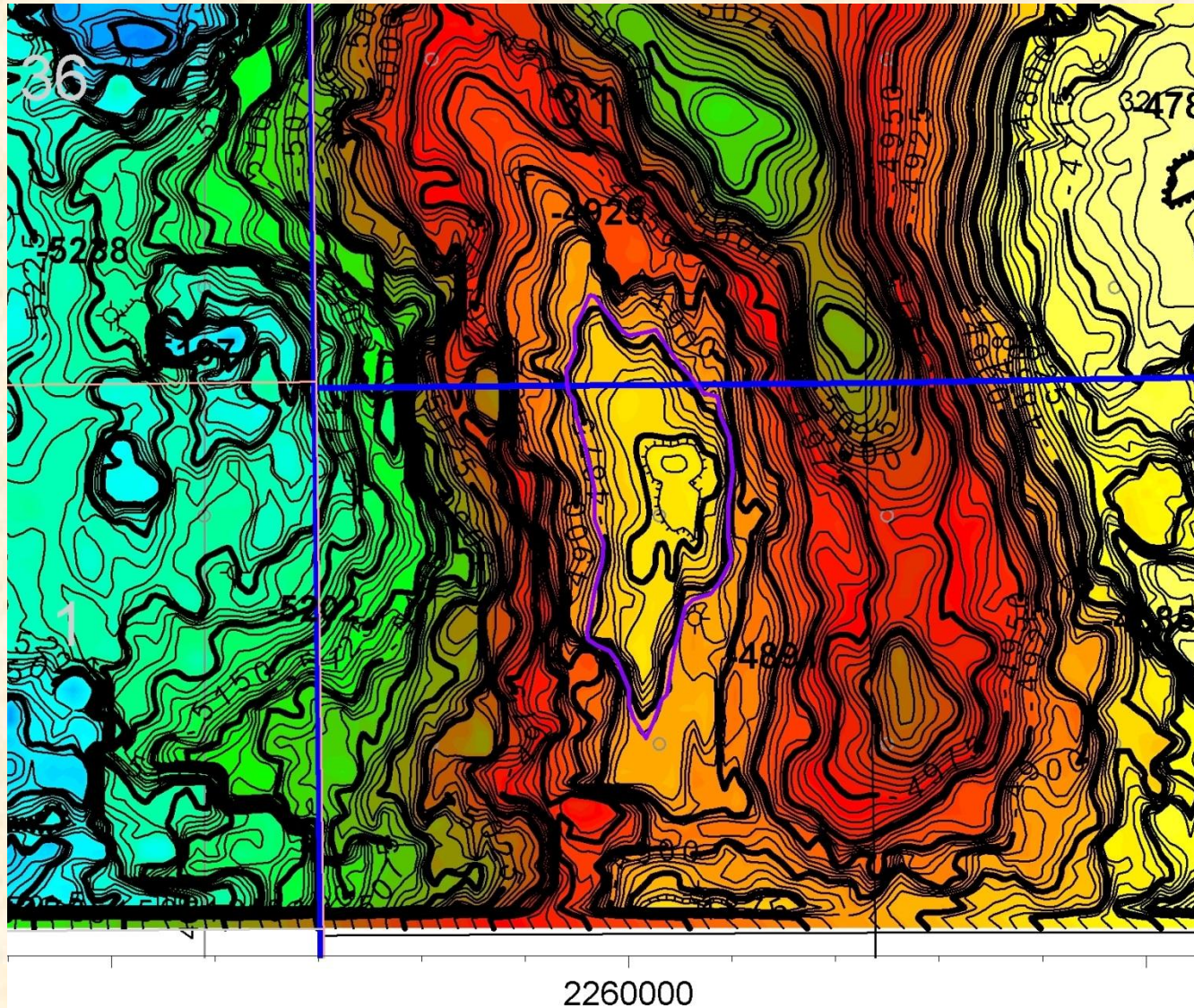
A FAMOUS QUOTE:

**I ALWAYS AVOID PROPHESYING
BEFOREHAND.**

**IT IS A MUCH BETTER POLICY TO
PROPHECY AFTER THE EVENT HAS
TAKEN PLACE**

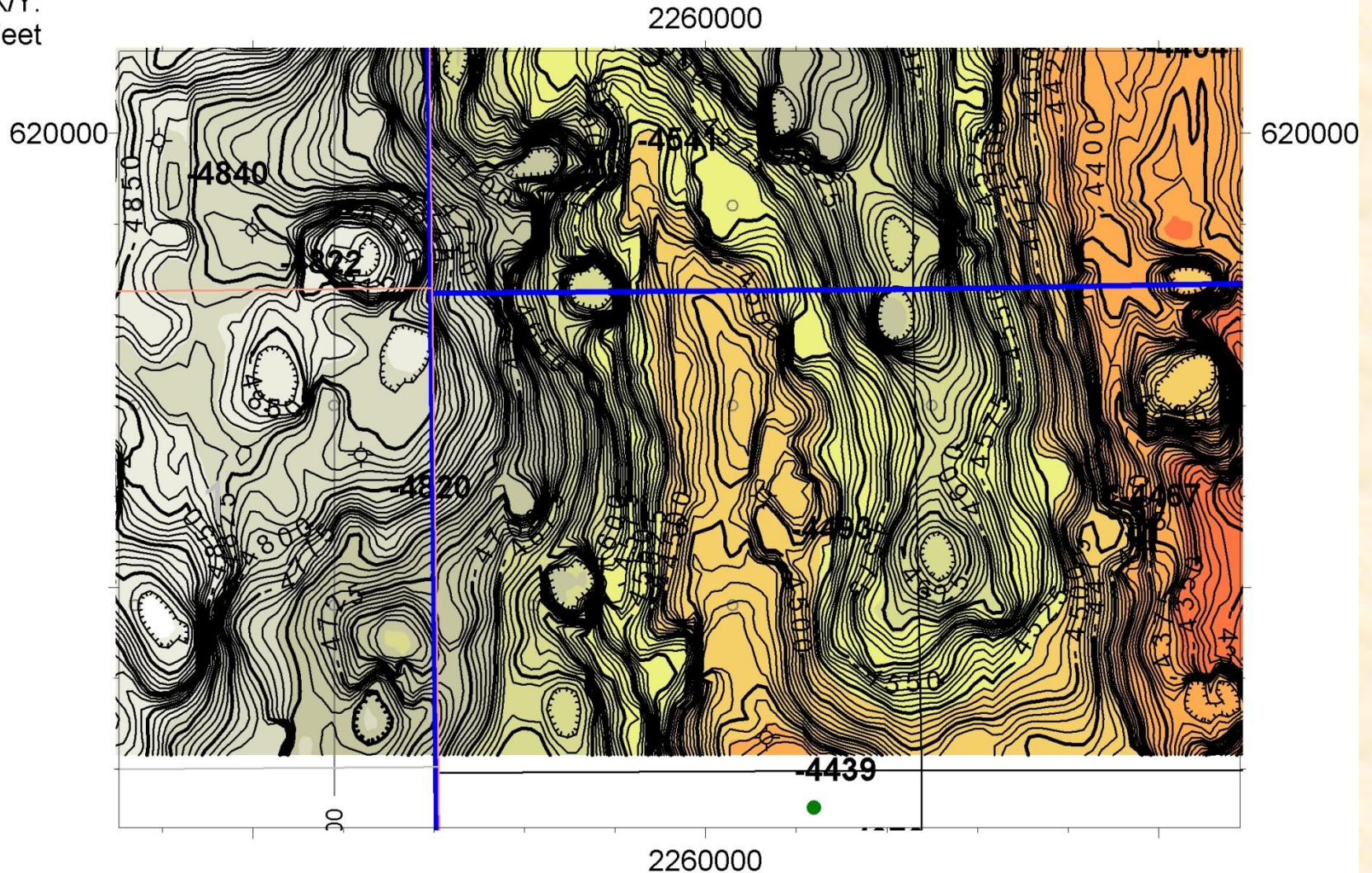


Why - Geological Setting – Bromide Structure

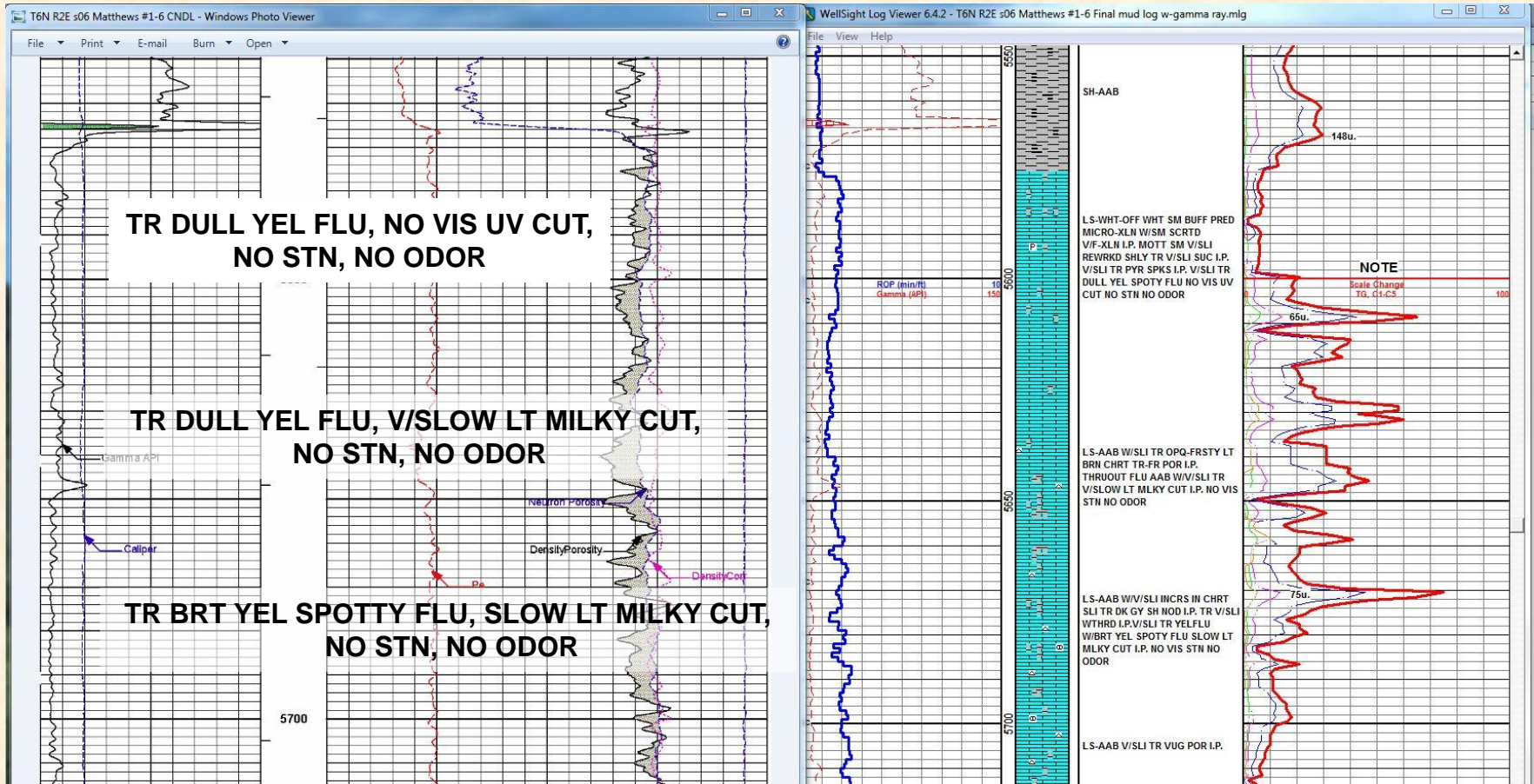


Why - Geological Setting – Viola Structure

X/Y:
Feet



Geological Results – Matthews #1-6

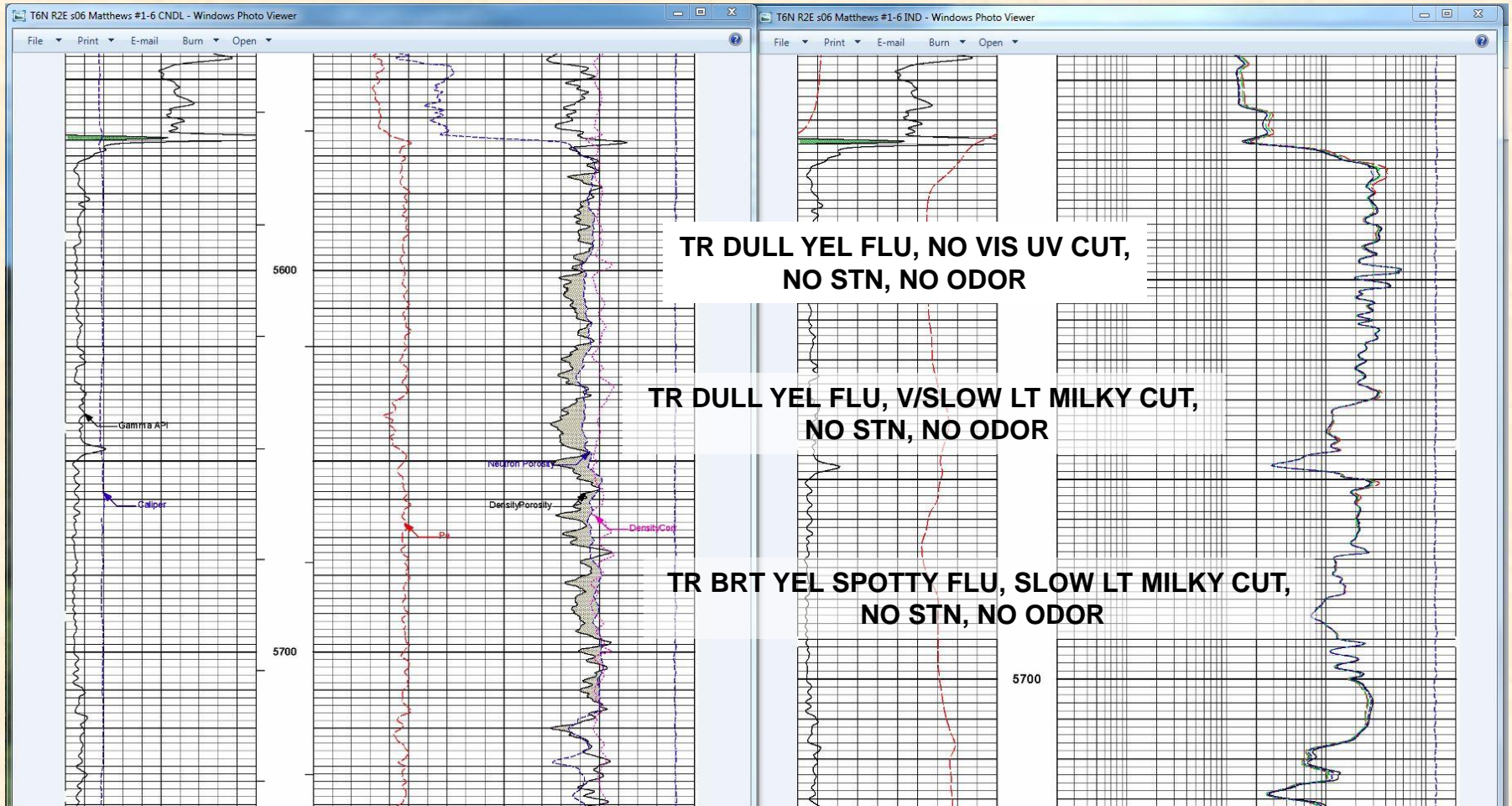


Caliper in gauge, spotty weak shows, low porosity

VIOLA LM:



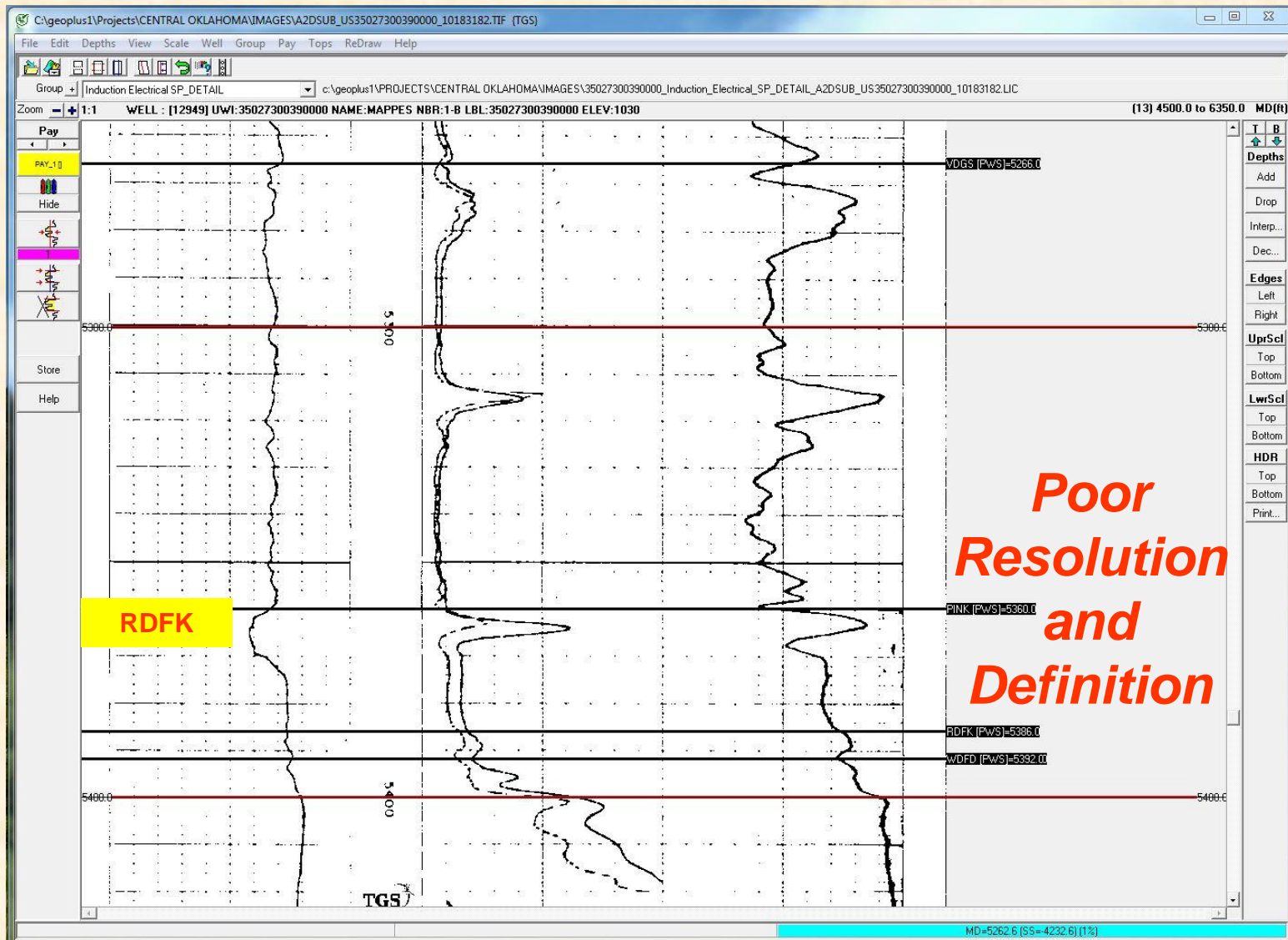
Geological Results – Matthews #1-6



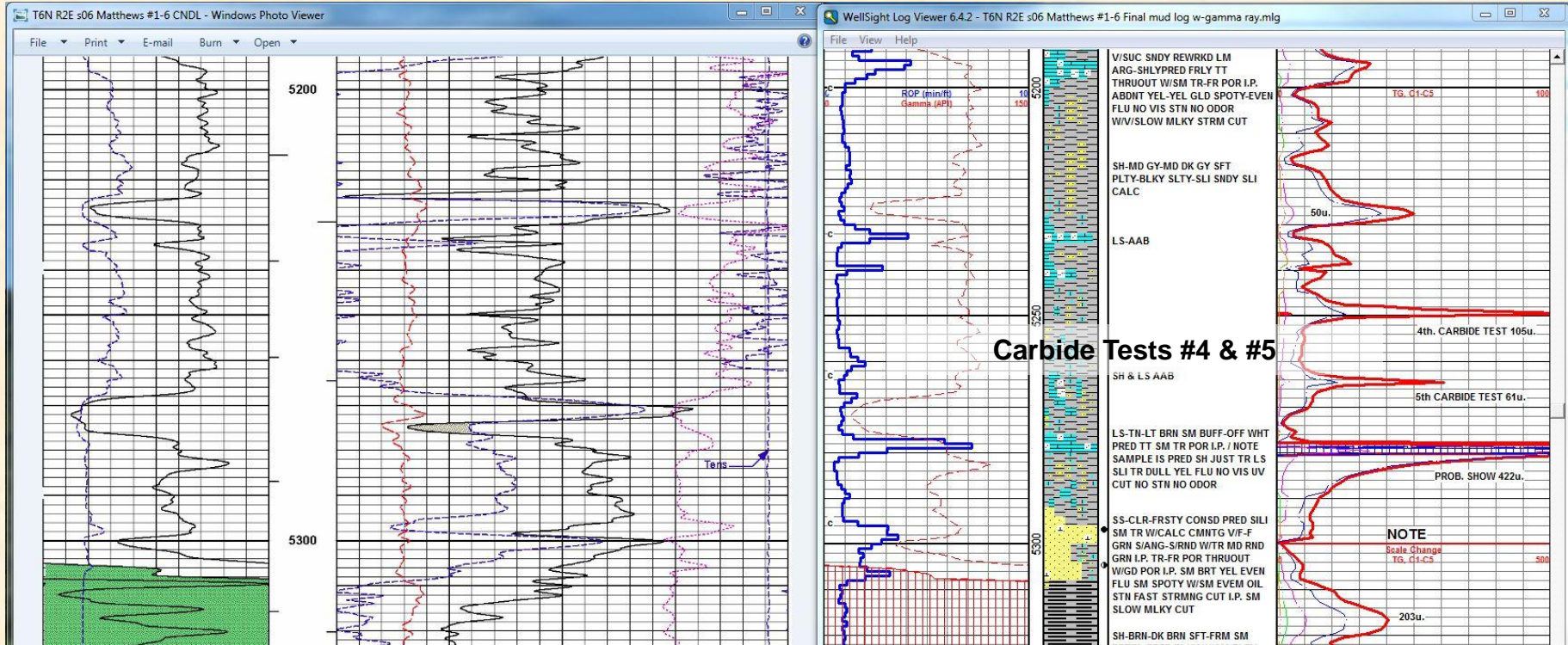
VIOLA LM: Nothing exciting - DID NOT TEST



Red Fork Sandstone - Old Style (nearest log)



Geological Results – Matthews #1-6

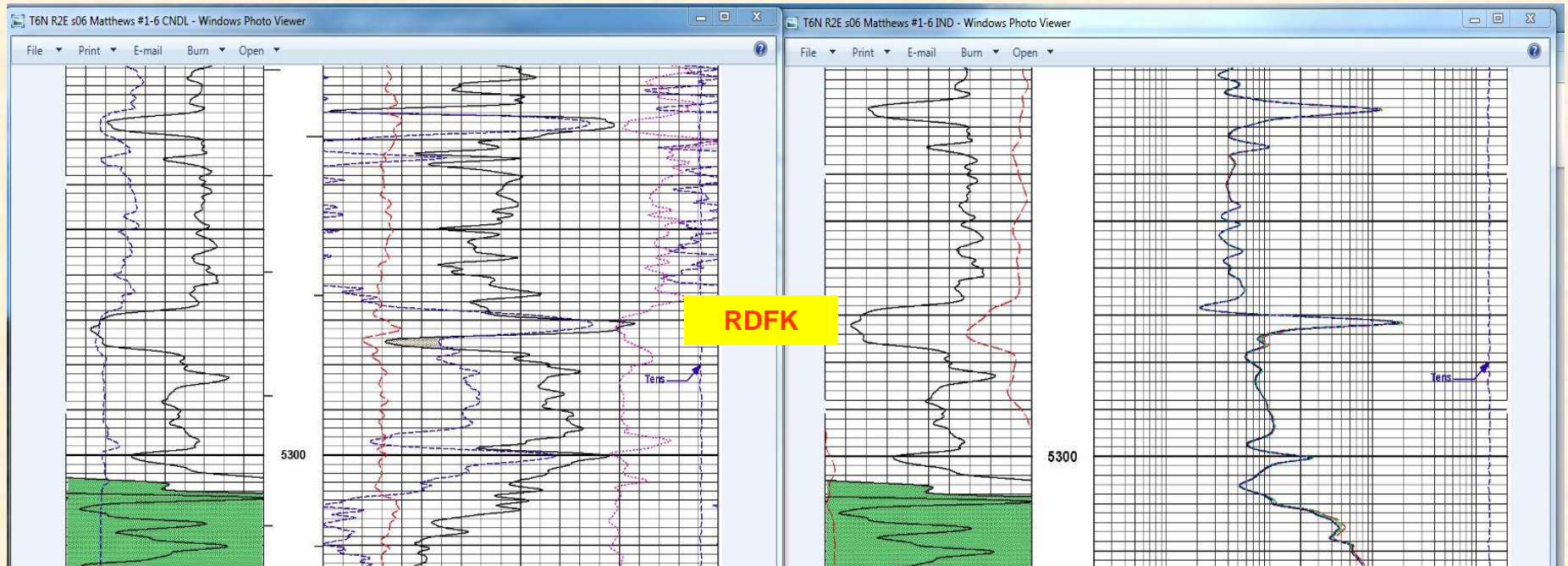


**SS – CLR FROSTY VF-F GRN, W GD POR
SM BRT YEL EVEN FLU, OIL STN, STRMING CUT**

Red Fork Sandstone
(Uphole Potential Target)



Geological Results – Matthews #1-6



SS – CLR FROSTY VF-F GRN, W GD POR
SM BRT YEL EVEN FLU, OIL STN, STRMING CUT
20% Porosity with 8+ Ohms (logs + show)

***Red Fork Sandstone:* To be Tested**



A FAMOUS QUOTE:

**HOWEVER BEAUTIFUL THE STRATEGY,
YOU SHOULD OCCASIONALLY LOOK AT
THE RESULTS.**



Evaluate Results

What we do know

Be Honest...

RISK - There will always be things we do not know going into a project.

\$\$\$ - There will be scientific milestones that have to be objectively examined.

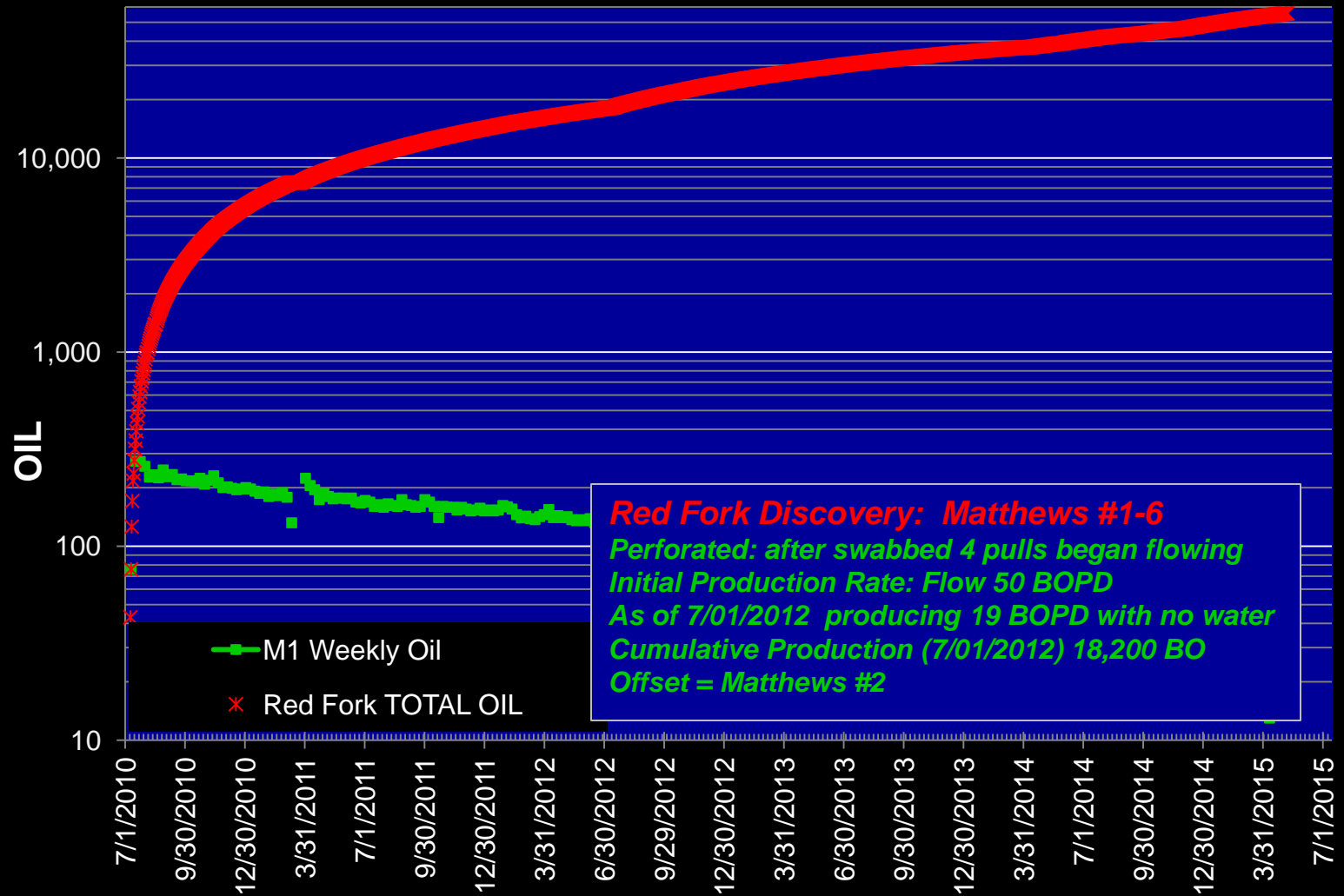
Evaluate – Things may not turn out as expected



Evaluate Results

First Well

Red Fork Sandstone
Matthews Field - T6N R2E s06
Pottawatomie County, Oklahoma



Evaluate Results: Offset Well(s)

Matthews #1-6 swabbed oil from the top of the 2nd Bromide Sandstone.

With actual tops, we re-examined/re-interpreted the seismic.

Determined that we could possibly get 10 feet higher.

Interesting things below the 2nd Bromide prompted an Arbuckle test.

Drilled Matthews #2-6

Ran logs that included Microlog, Sonic log, CNDL, and DIL

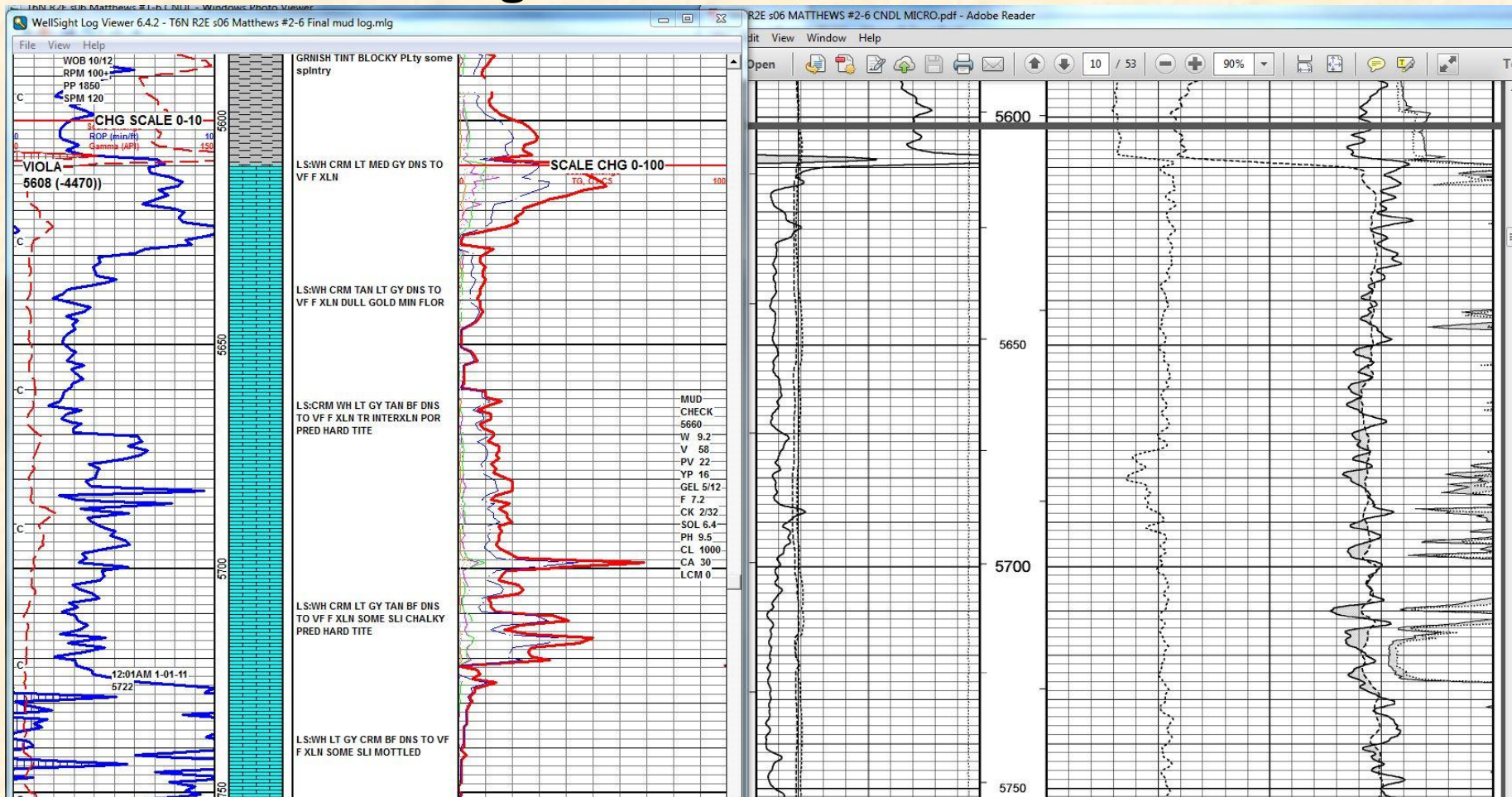
Ran High resolution over areas of interest:

Bromide, Viola, Woodford, and Red Fork

Other zones of interest: Arbuckle – perforated w/ show of gas



Geological Results – Matthews #2-6

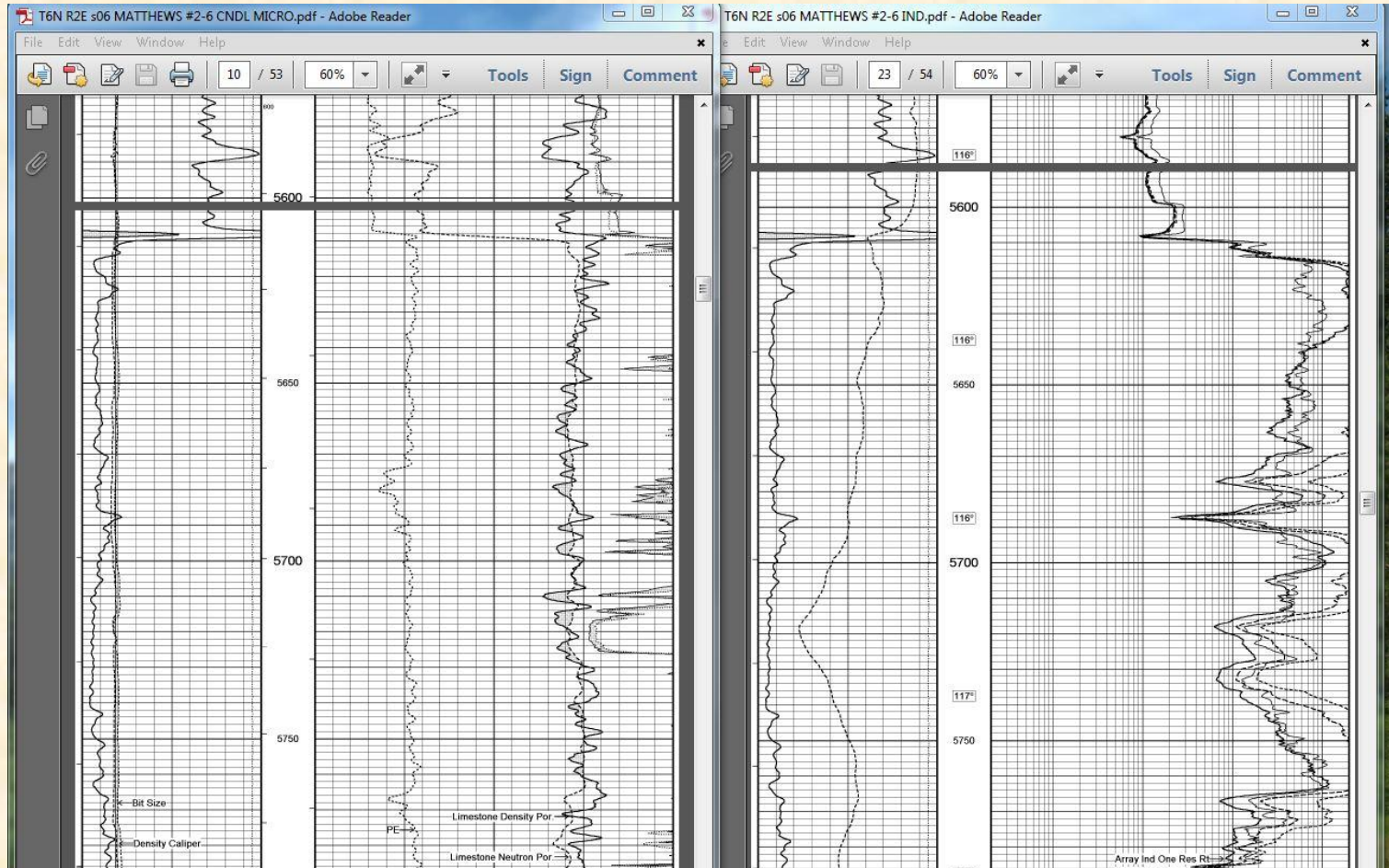


VIOLA LM:

No sample shows reported, gas chromatograph had suggestion of hydrocarbons



Geological Results – Matthews #2-6

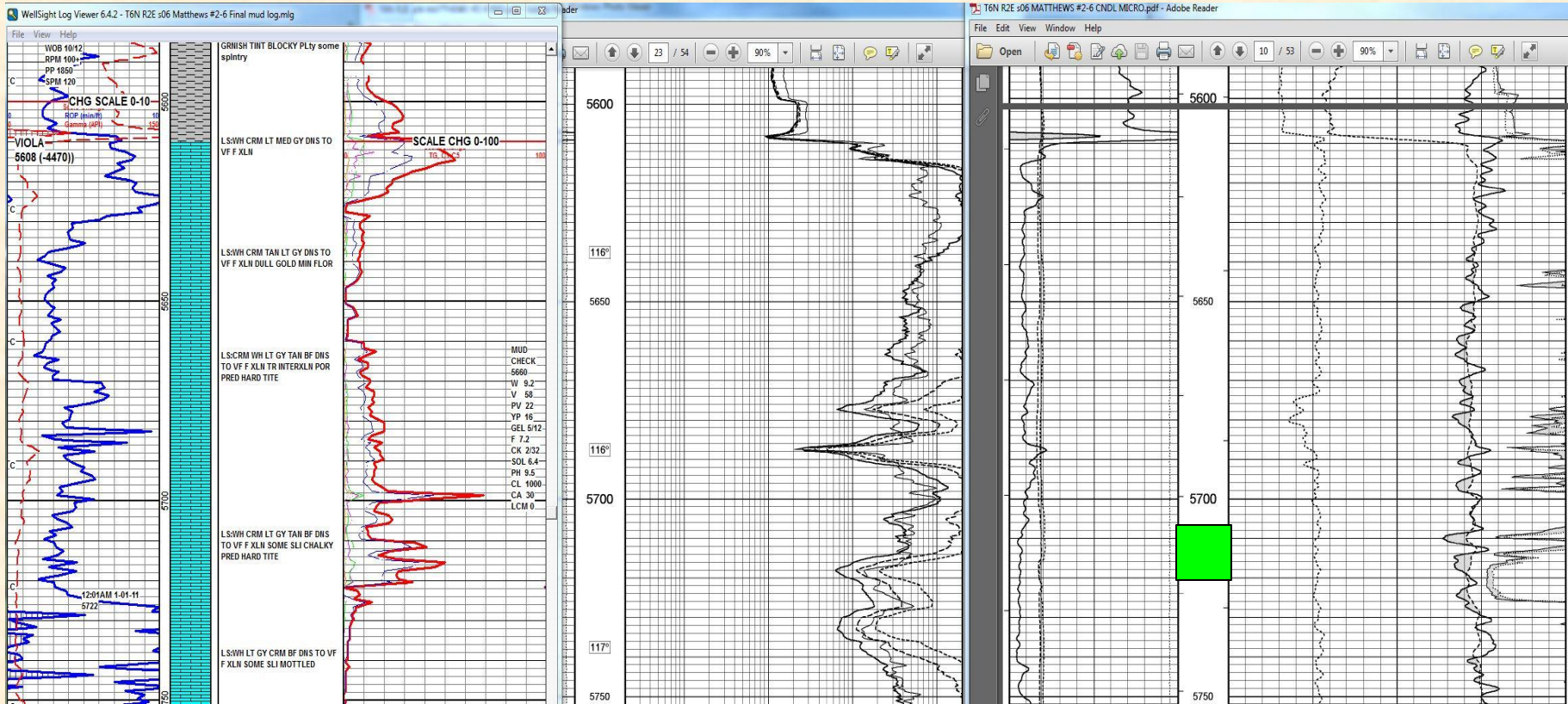


VIOLA LM:

No sample shows reported, gas chromatograph had suggestion of hydrocarbons **Microlog indicated potential zone**



Geological Results – Matthews #2-6



VIOLA LM:

No sample shows reported, gas chromatograph had suggestion of hydrocarbons **Microlog indicated potential zone.**
Decided to Perforate Viola (5708 – 5720).



Evaluate Results

Viola Limestone (5708 – 5720')

During fifth swab run well began to flow
(recovered 3700' fluid during first 4 runs)

Flow well 3 hrs before beginning production tests.
Instant SITP 500 psi. SITP 775 psi in 20 min.

3 hr test avg 10 BO/HR @ 475 FTP on 12/64" choke

5 hr test avg 13 BO/HR @ 475 psi FTP on 12/64" choke

4.5 hr test avg 11 BO/HR @ 495 psi FTP on 11/64" choke

3.5 hr test avg 9.4 BO/HR @ 525 psi FTP on 10/64" choke

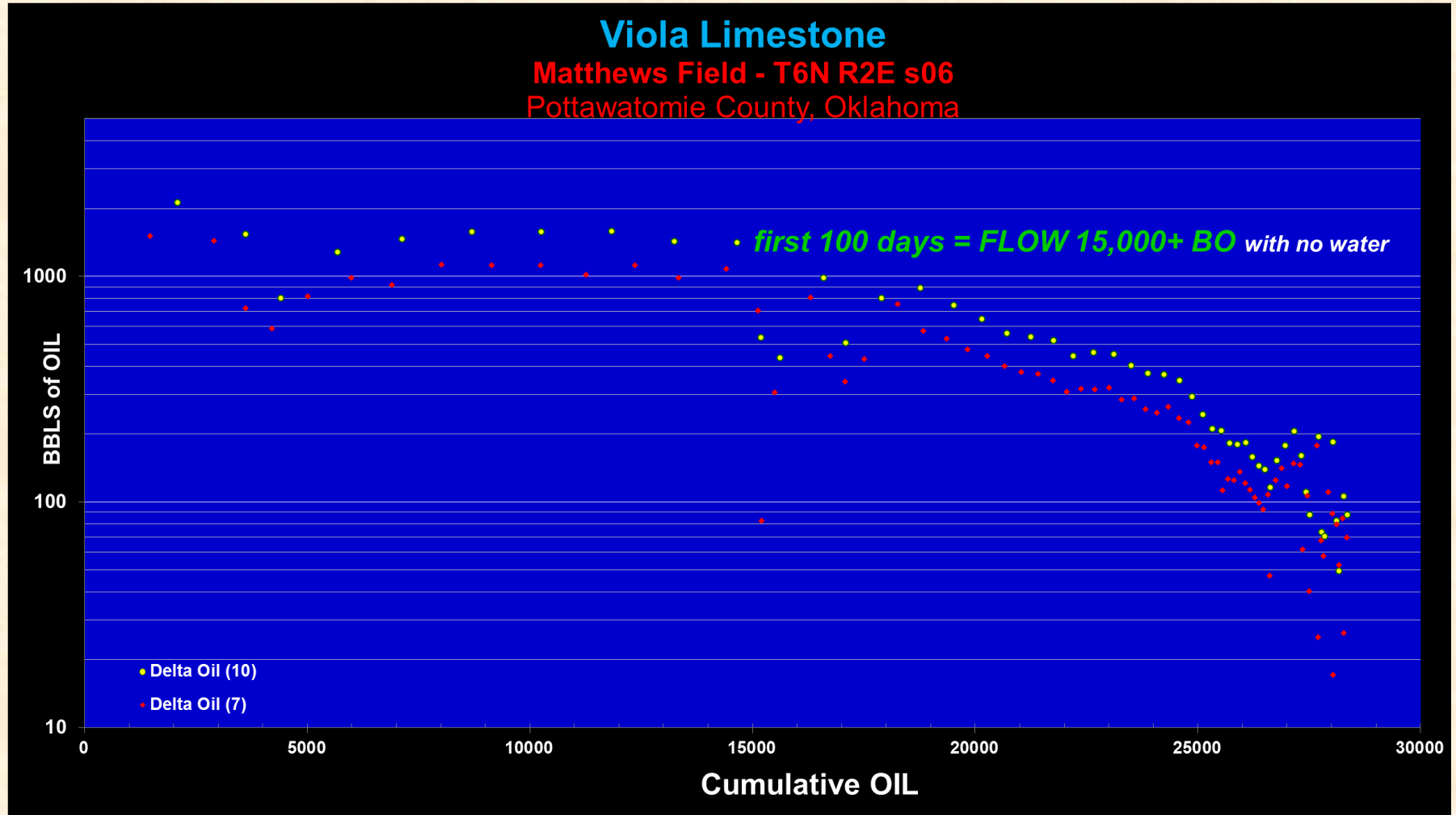
5.5 hr test avg 11 BO/HR @ 580 down to 500 psi FTP on
10/64" choke

300+ BO in tank after first 24 hours.

**24 hr test avg 9.5 BO/HR @ 525 psi FTP on 9/64" choke
= 228 BOPD**



Evaluate Results



A FAMOUS QUOTE:

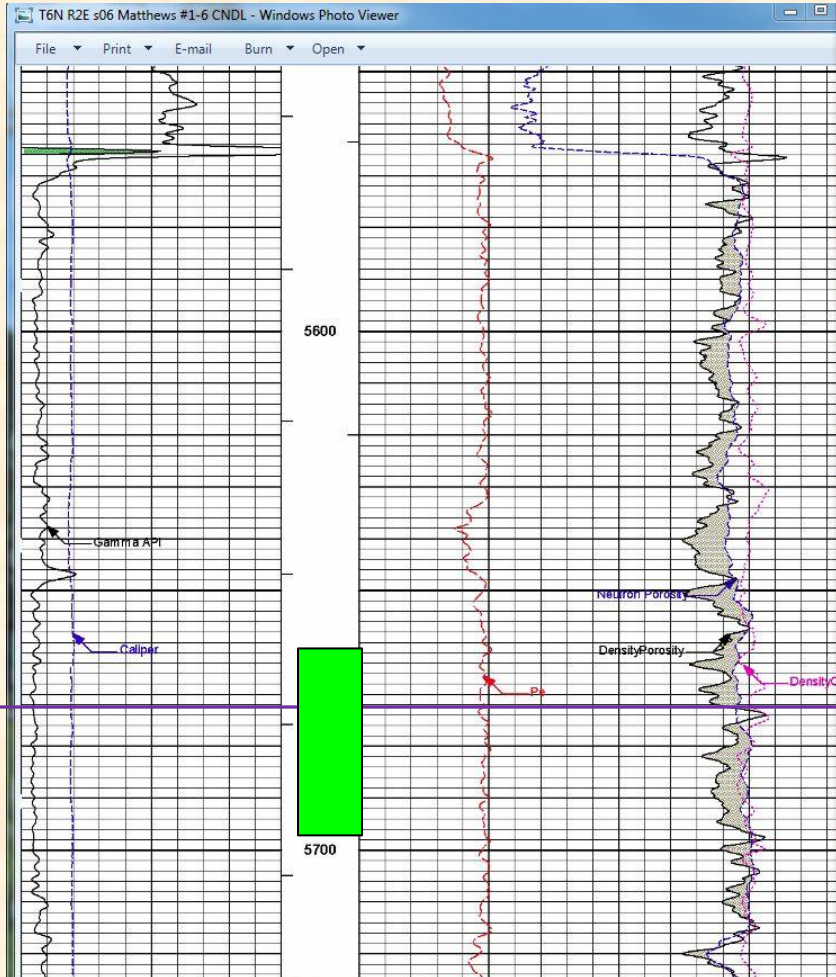
**PERSONALLY, I AM ALWAYS READY TO
LEARN,**

**ALTHOUGH I HAVE NOT ALWAYS
ENJOYED THE LESSONS.**



Evaluate Results

Matthews #1

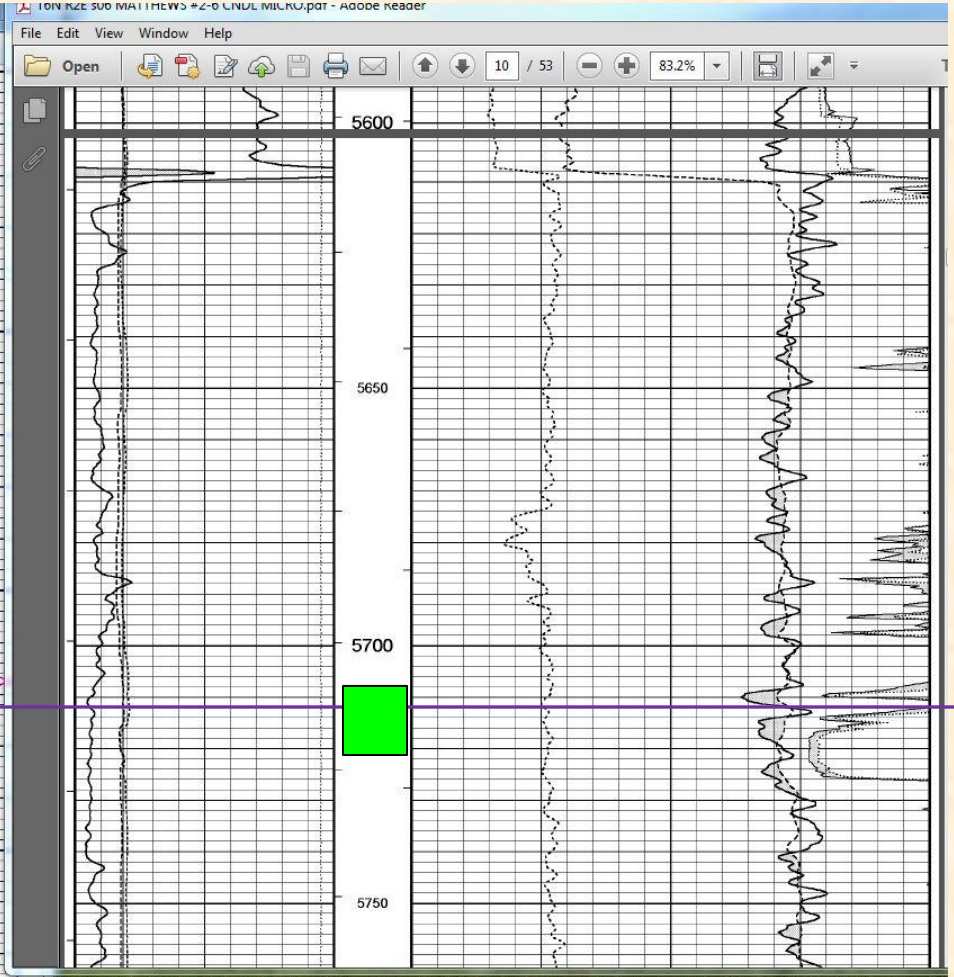


Missed \$\$\$

Red Microlog, good mudlog



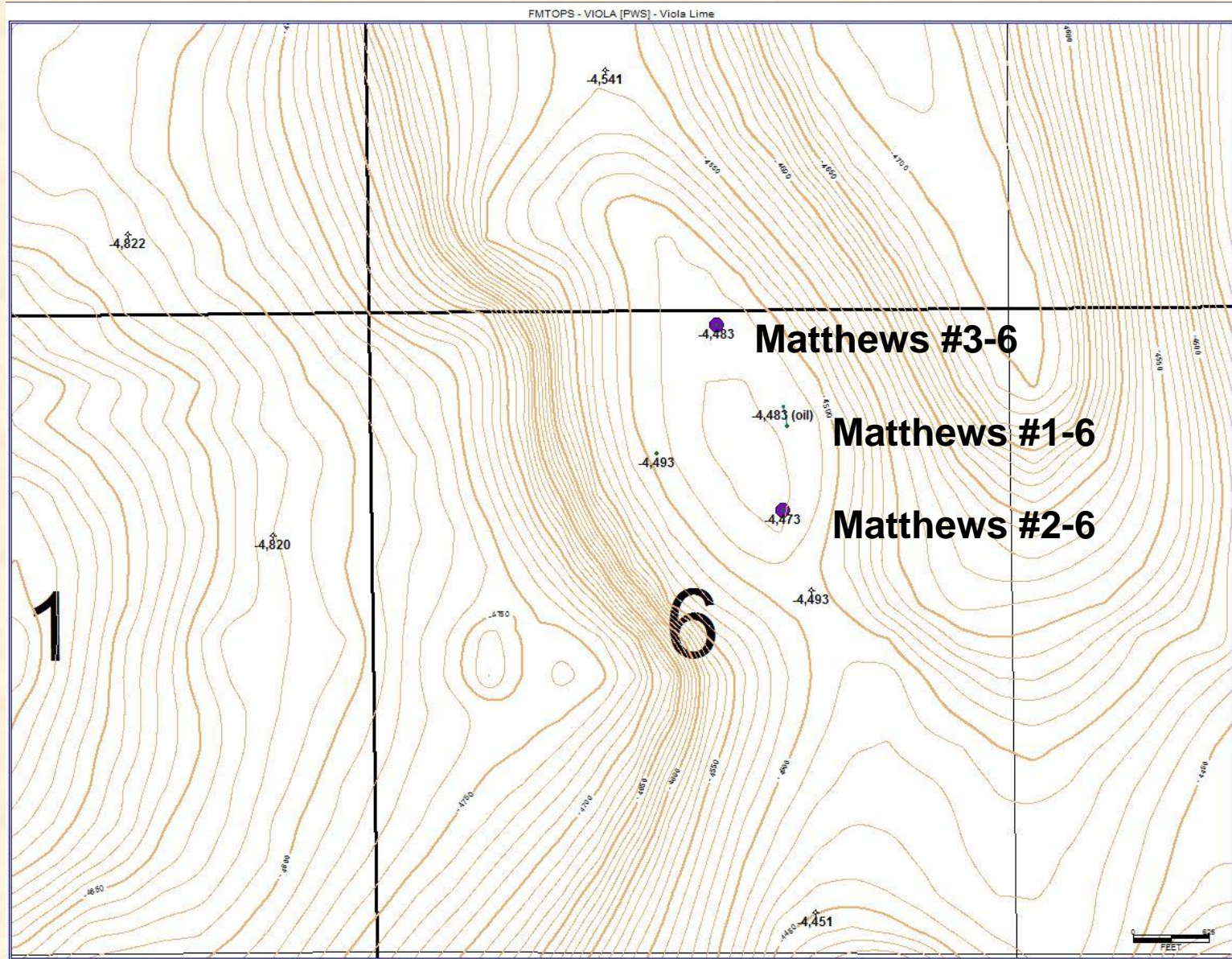
Matthews #2



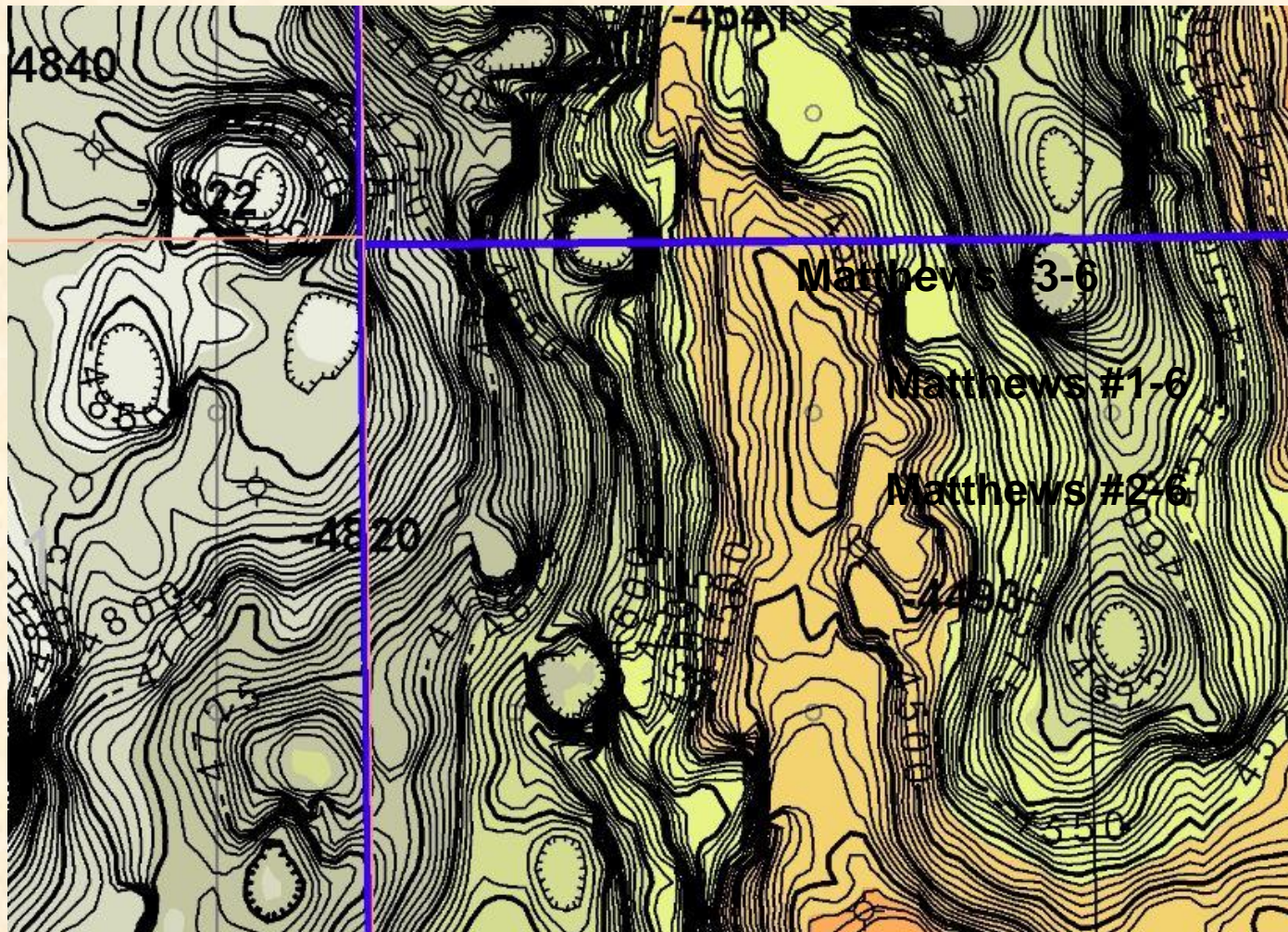
\$1,500,000 in 100 days

Good Microlog, good mudlog

Evaluate Results - VIOLA



Evaluate Results - VIOLA



OTHER FAMOUS STUDIES

How to learn and motivate success “***carrot or stick***”

B. F. Skinner experimented with dogs, levers, and rewards (***carrot***)

Basset Hounds do not make good test subjects.

Seligman & Maier experimented with dogs, levers, and shock (***stick***)

Group 1 put into harnesses for a period of time – no shock

Group 2 either dog could press a lever to stop the electrical shock

Group 3 only one dog (A) could press the lever to stop the shock while the other dog's (B) lever did nothing

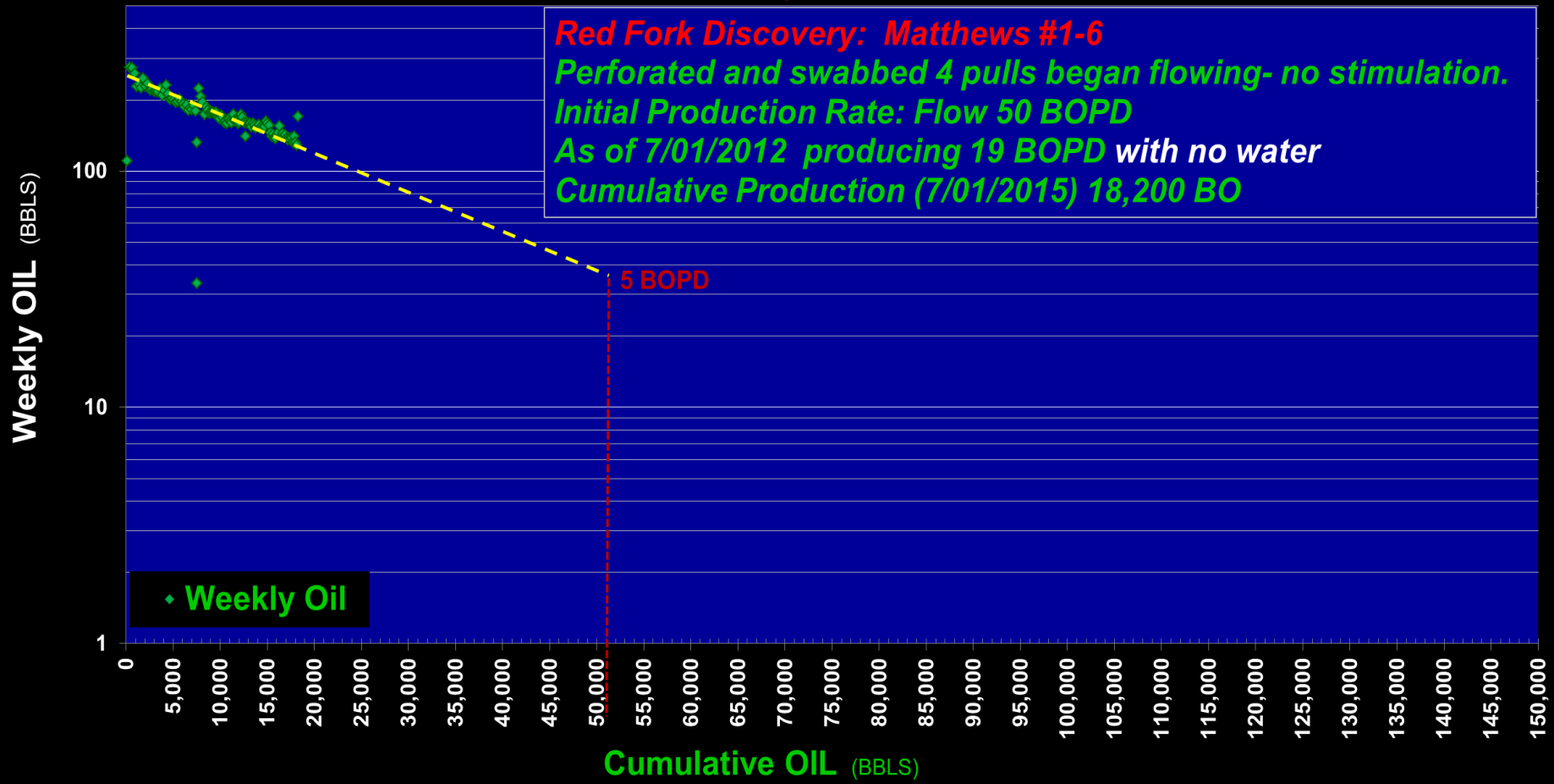
Only 3A dogs learned to act. Group 3B dogs exhibited the “learned helplessness response” and had symptoms similar to chronic clinical depression.

Subsequent experiments using dogs, monkeys, and rats point to the same conclusion. Subjects that have a mechanism of control (lever) over their destiny do learn to act to create positive results. Subjects that have no mechanism of control do not learn to create positive results.

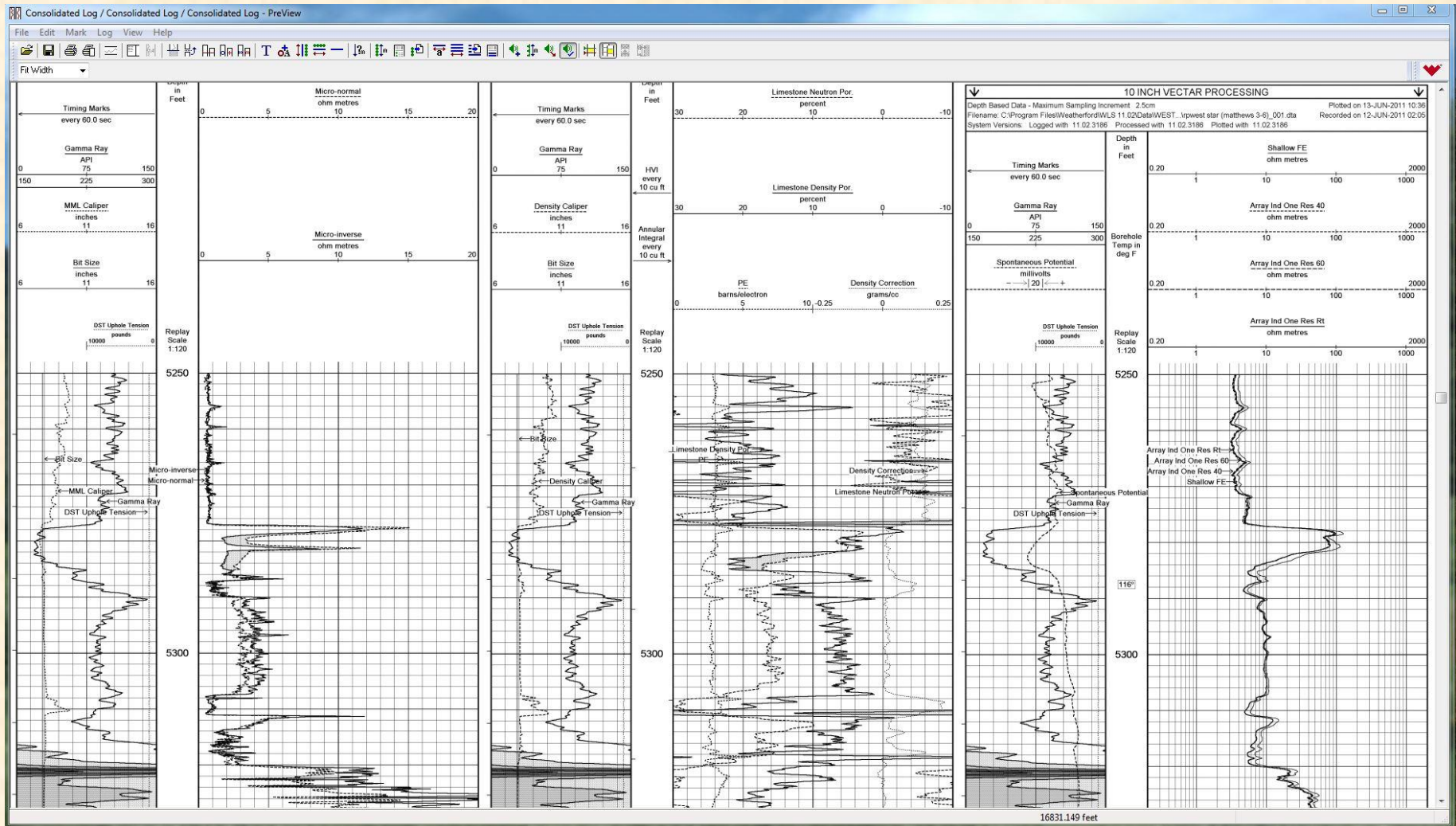


Evaluate Results – Red Fork

Red Fork Sandstone
Matthews Field - T6N R2E s06
Pottawatomie County, Oklahoma



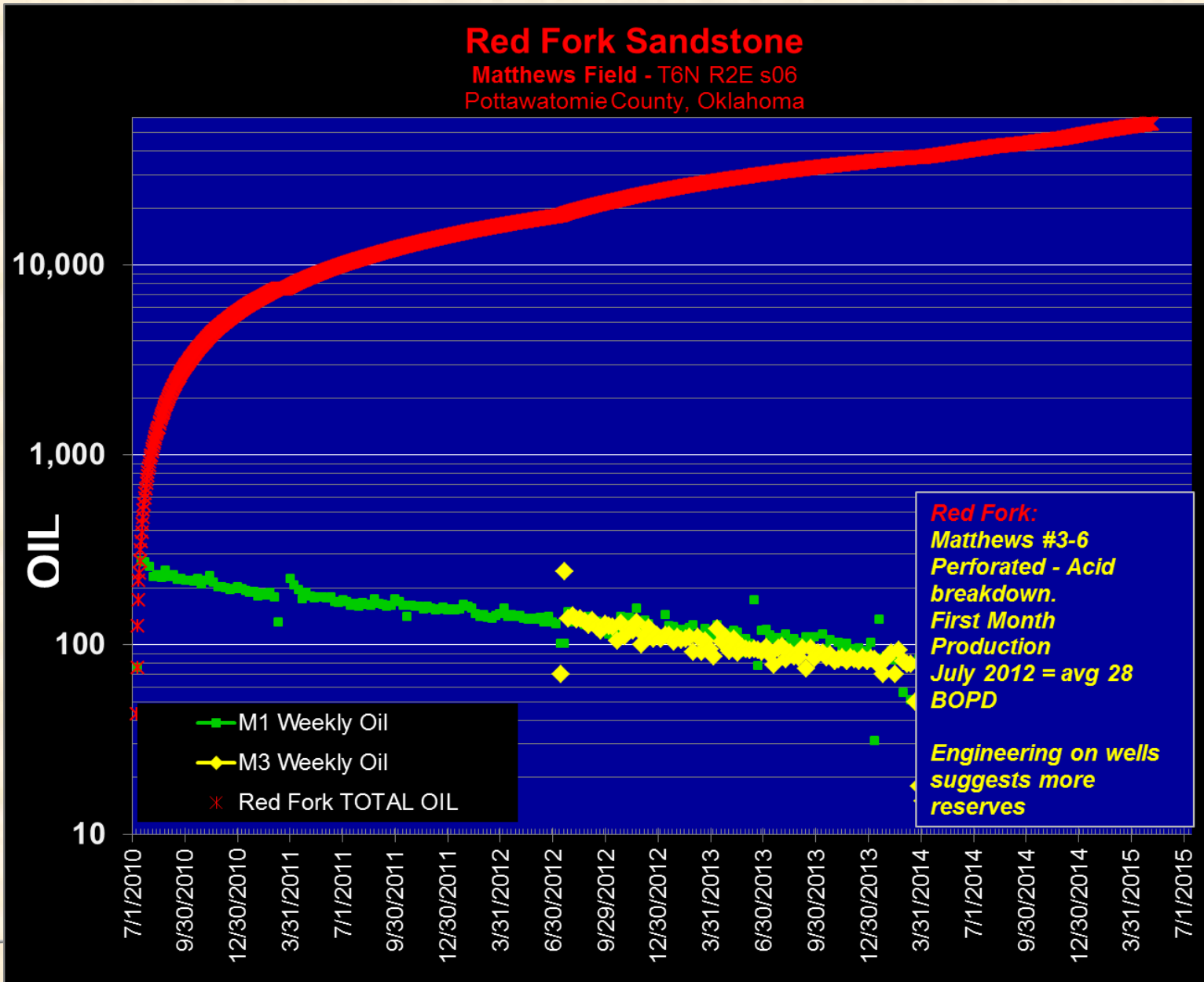
Geological Results – Matthews #3-6



sample shows reported, gas chromatograph had suggestion of hydrocarbons. **High Resolution Logs show potential zone**

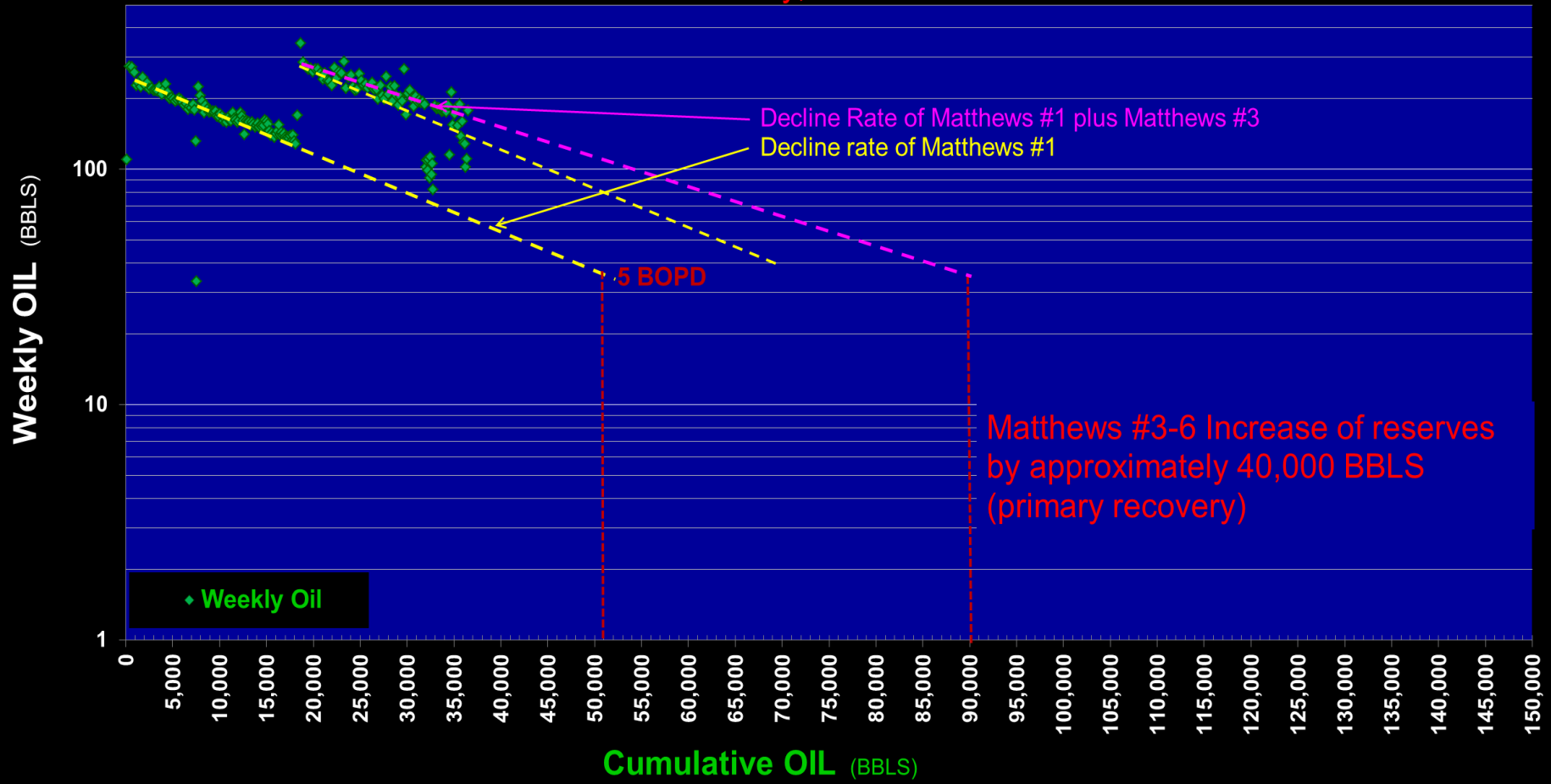


Evaluate Results – Red Fork



Evaluate Results – Red Fork

Red Fork Sandstone
Matthews Field - T6N R2E s06
Pottawatomie County, Oklahoma

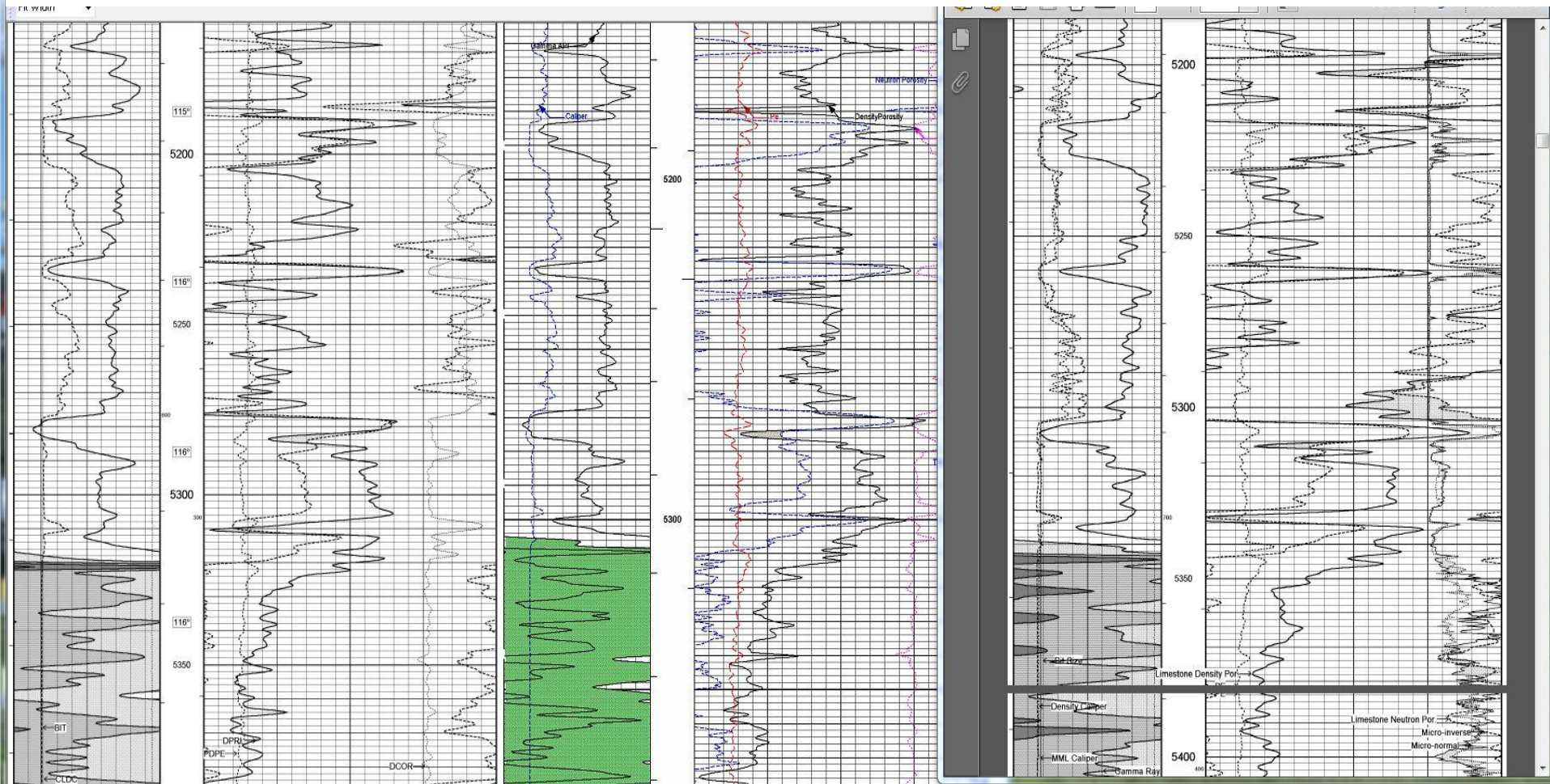


Geological Results – Red Fork – Continuity of Sand

Matthews #3-6

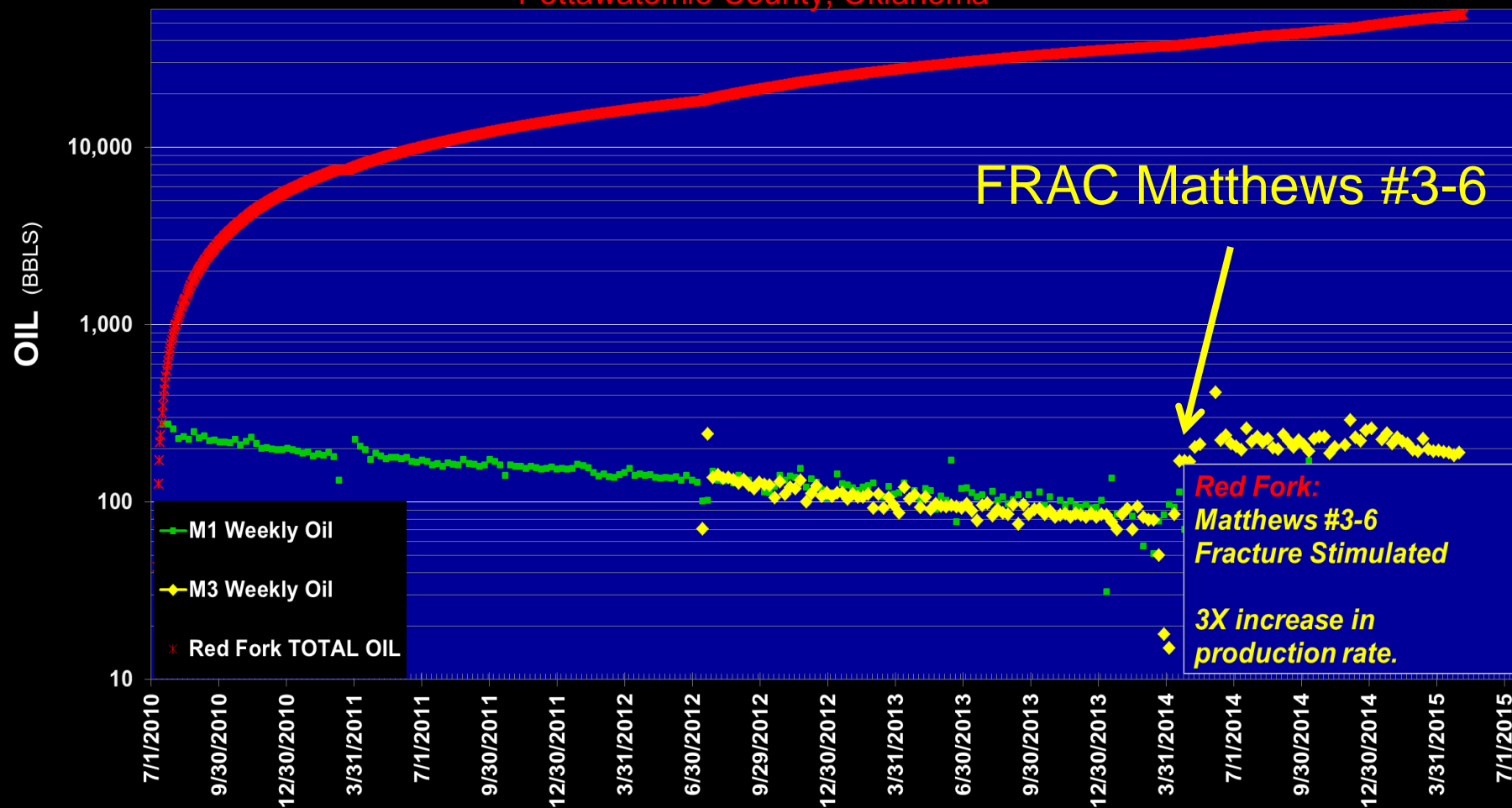
Matthews #1-6

Matthews #2-6



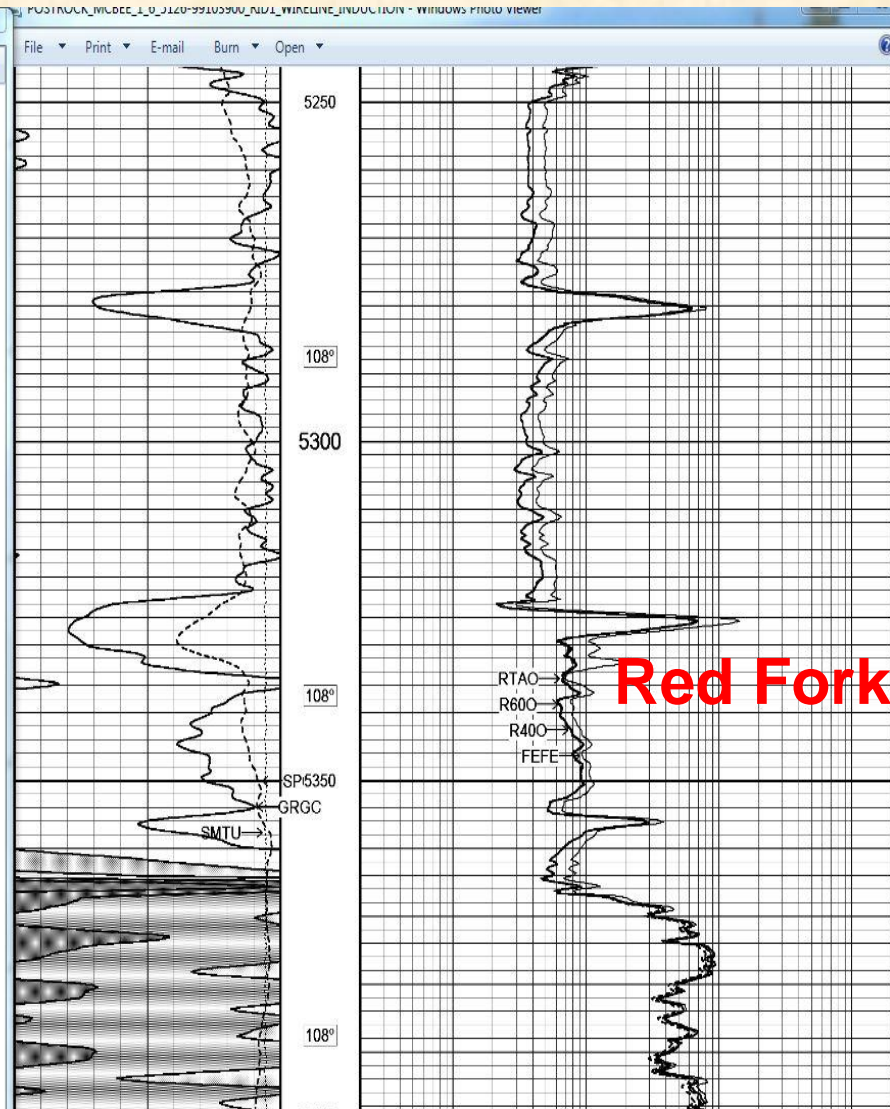
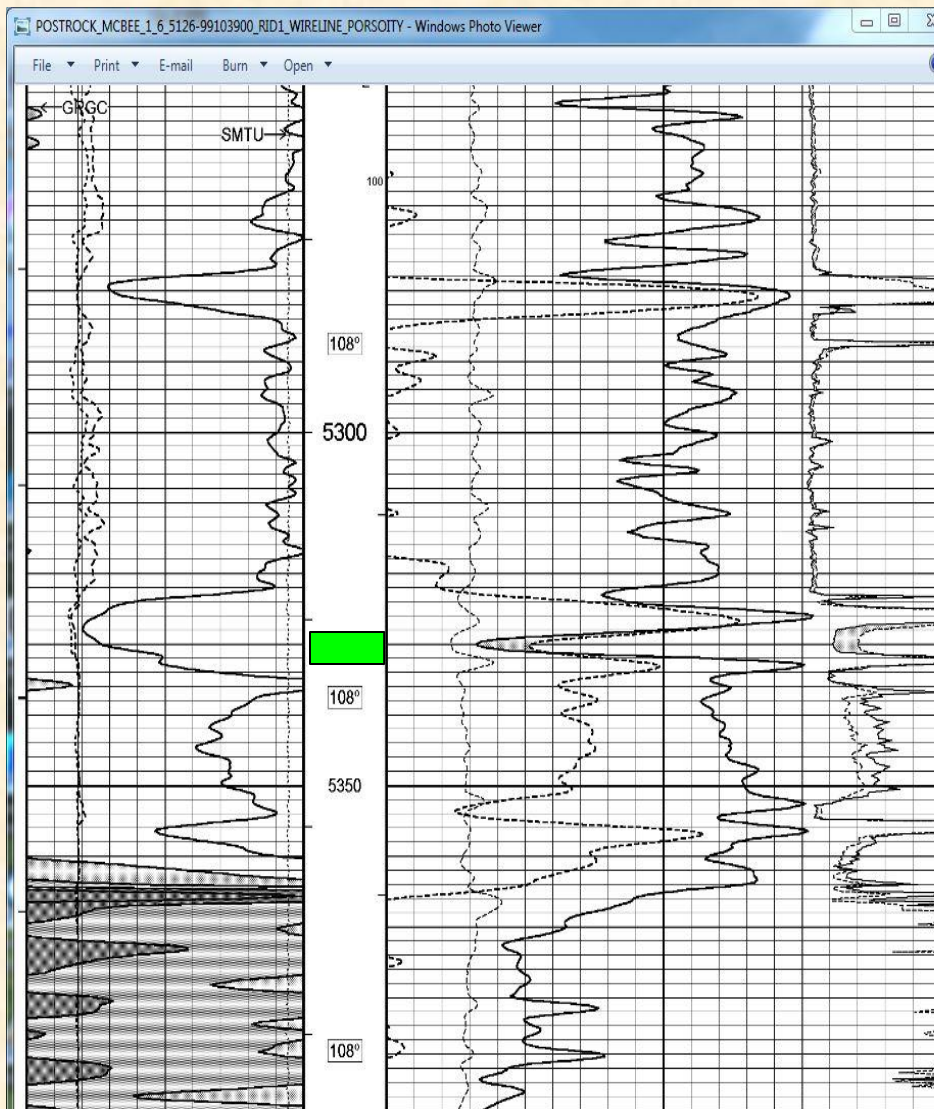
Evaluate Results – Red Fork

Red Fork Sandstone
Matthews Field - T6N R2E s06
Pottawatomie County, Oklahoma



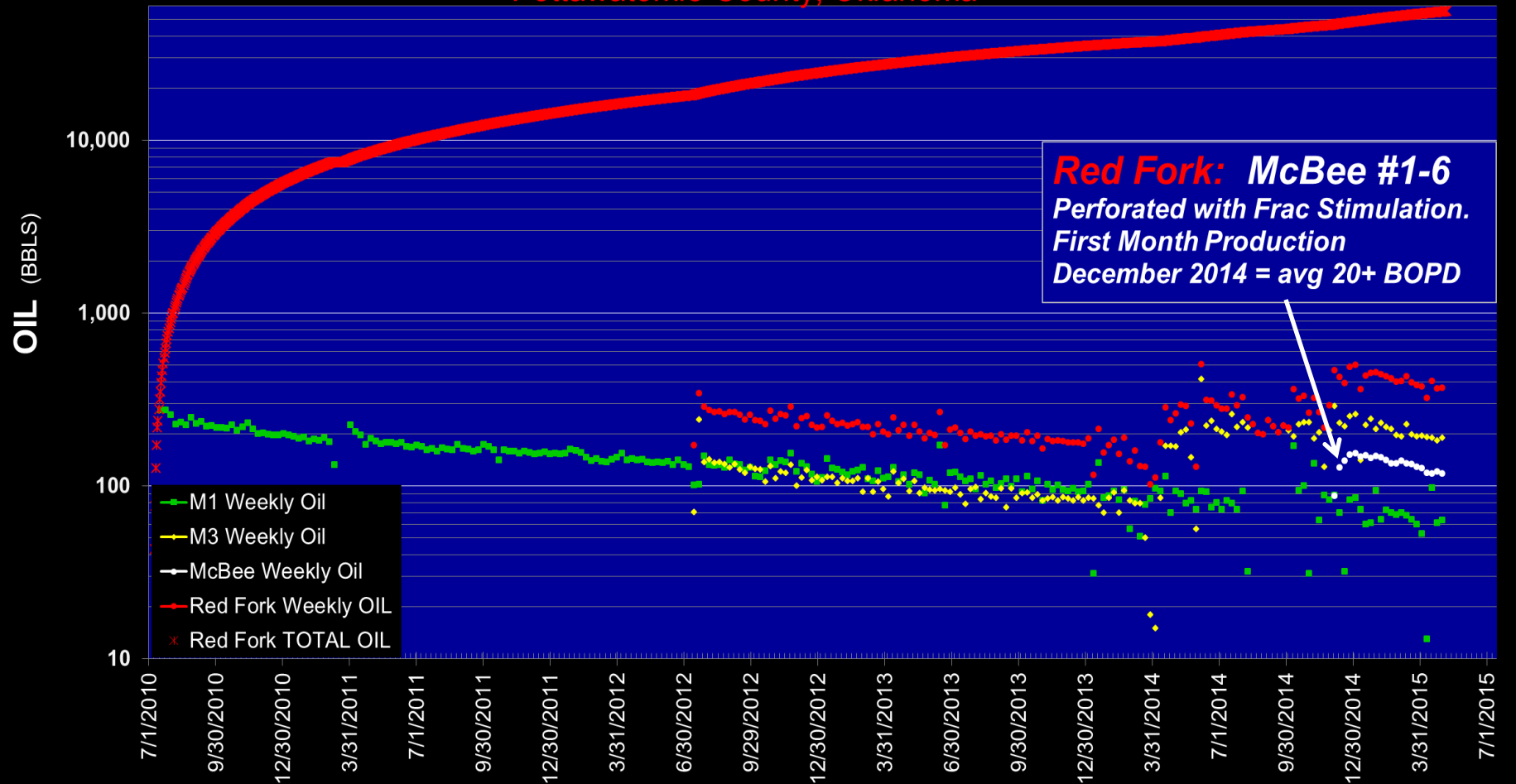
 **Effect of Fracture Stimulation on Production Rate**

Geological Results – Red Fork – McBee #1-6



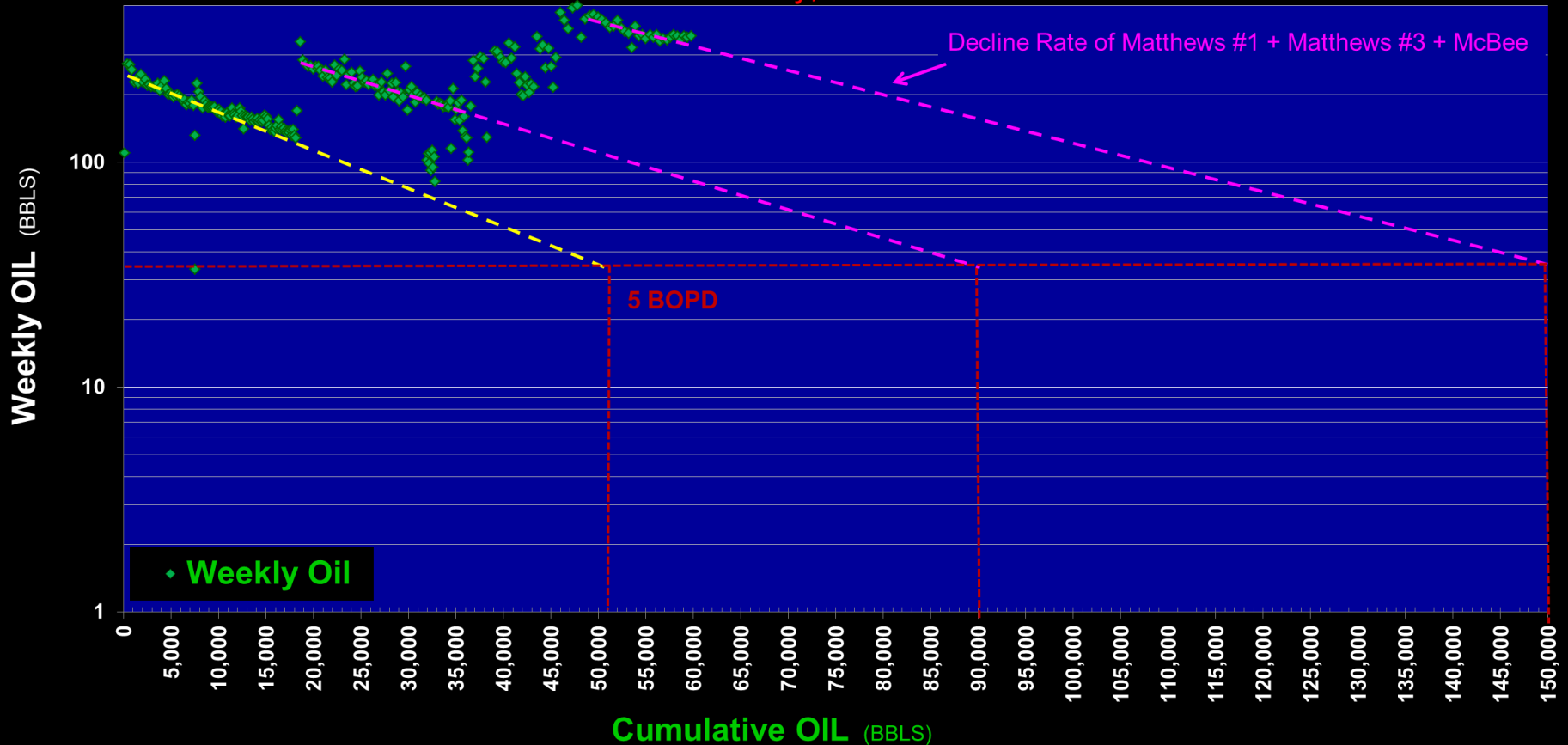
Evaluate Results – Red Fork

Red Fork Sandstone
Matthews Field - T6N R2E s06
Pottawatomie County, Oklahoma



Evaluate Results – Red Fork

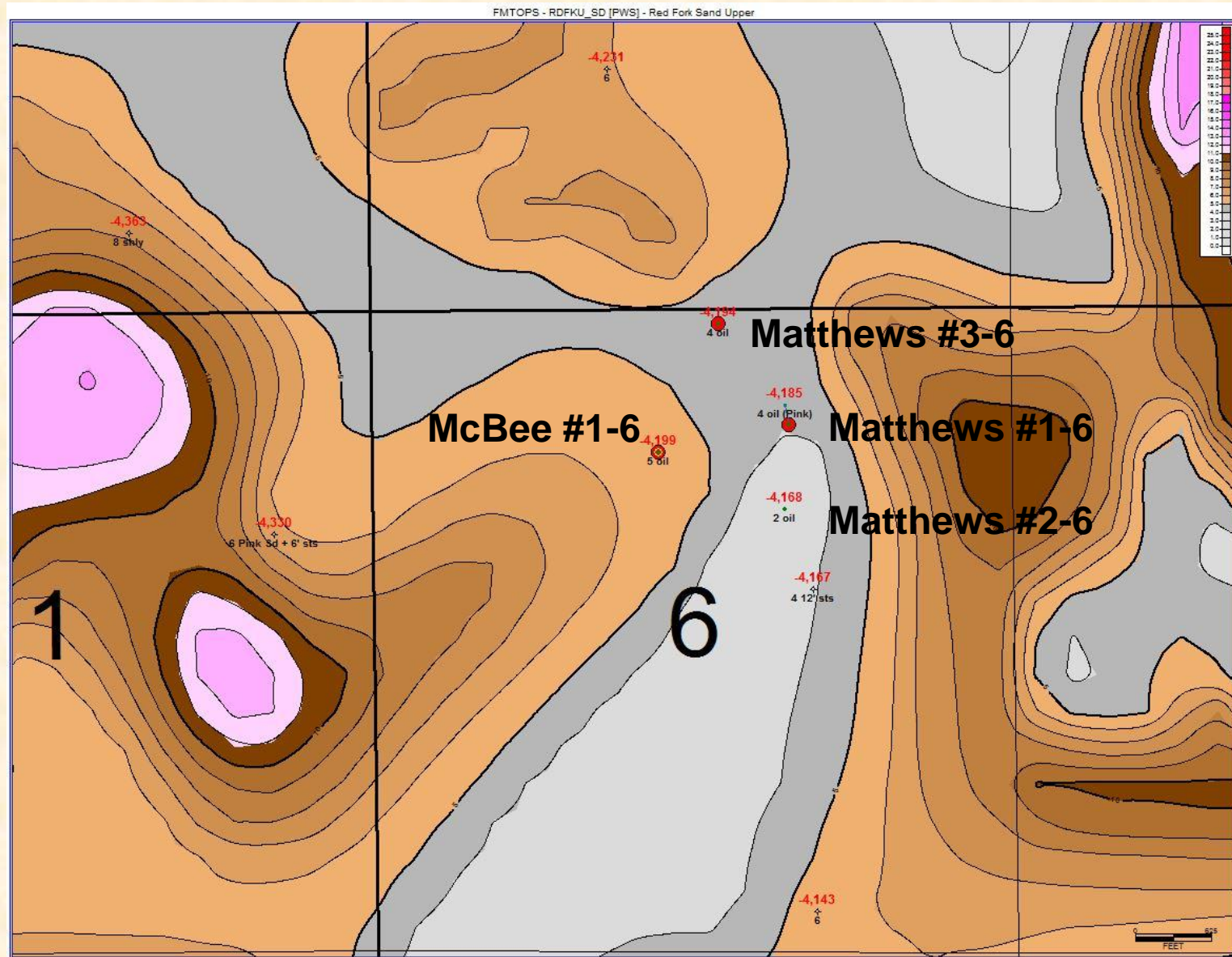
Red Fork Sandstone
Matthews Field - T6N R2E s06
Pottawatomie County, Oklahoma



Using old style logs, the field would not have been detected.



Evaluate Results – Red Fork



Evaluate Results

What we do know

Be Honest about everything...

RISK -

\$\$\$ -

Evaluate –

Flexible – *Do not* repeat the same thing with the expectation of different results.

Conduct “mini” experiments along the way (tweak things)

(expect that sometimes they go wrong)

What is the best option on logs/information?

Typically one needs to determine Porosity, Permeability, Resistivity, and using a good gas chromatograph that is tested while drilling increases the chances of not overlooking a reservoir.

Using modern logs and accurate mudlogs, did we find appreciable amounts of OIL/GAS that otherwise might have been missed?

Yes, approximately 185,000 BO on primary recovery



A FAMOUS QUOTE:

FOR MYSELF, I AM AN OPTIMIST,

**IT DOES NOT SEEM TO BE MUCH USE
BEING ANYTHING ELSE.**



Summary

Examine the cuttings – but they are not always conclusive.

A well run and calibrated/tested mudlog is a valuable tool – but the conditions may not be optimal for the tool to be conclusive.



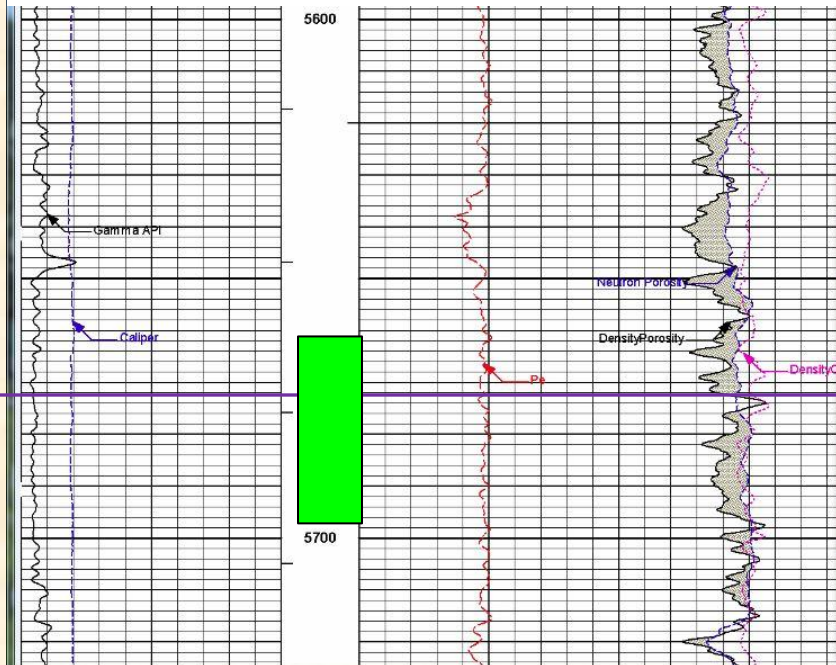
Summary

Matthews #1

65 unit mudlog shows
Slight milky cut

No suggestion of permeability

Not Tested

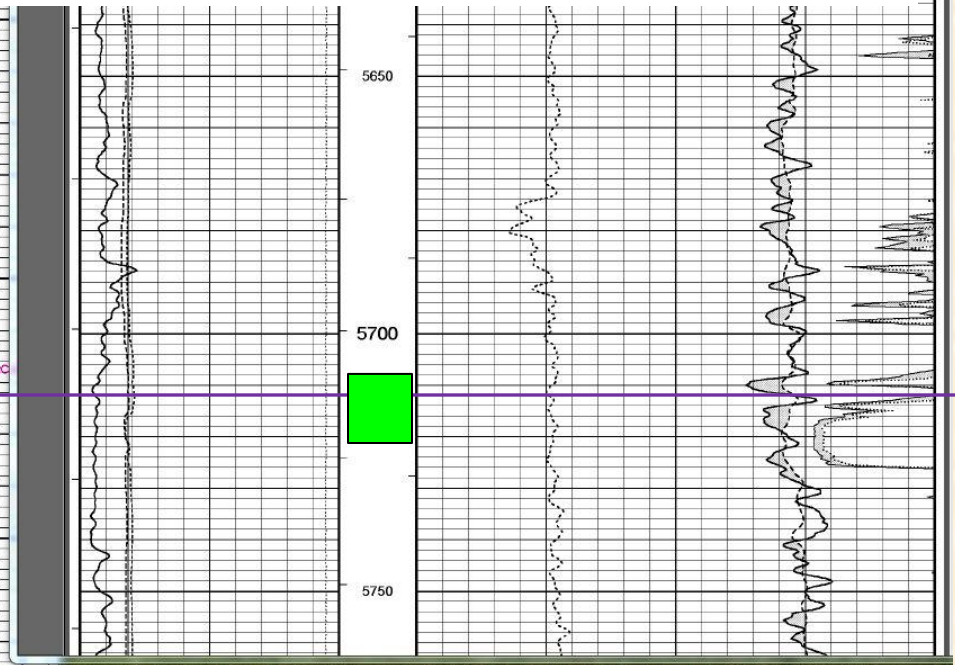


Matthews #2

50 unit mudlog shows
No cut mentioned

Permeability indicated

Producing



Missed \$\$\$

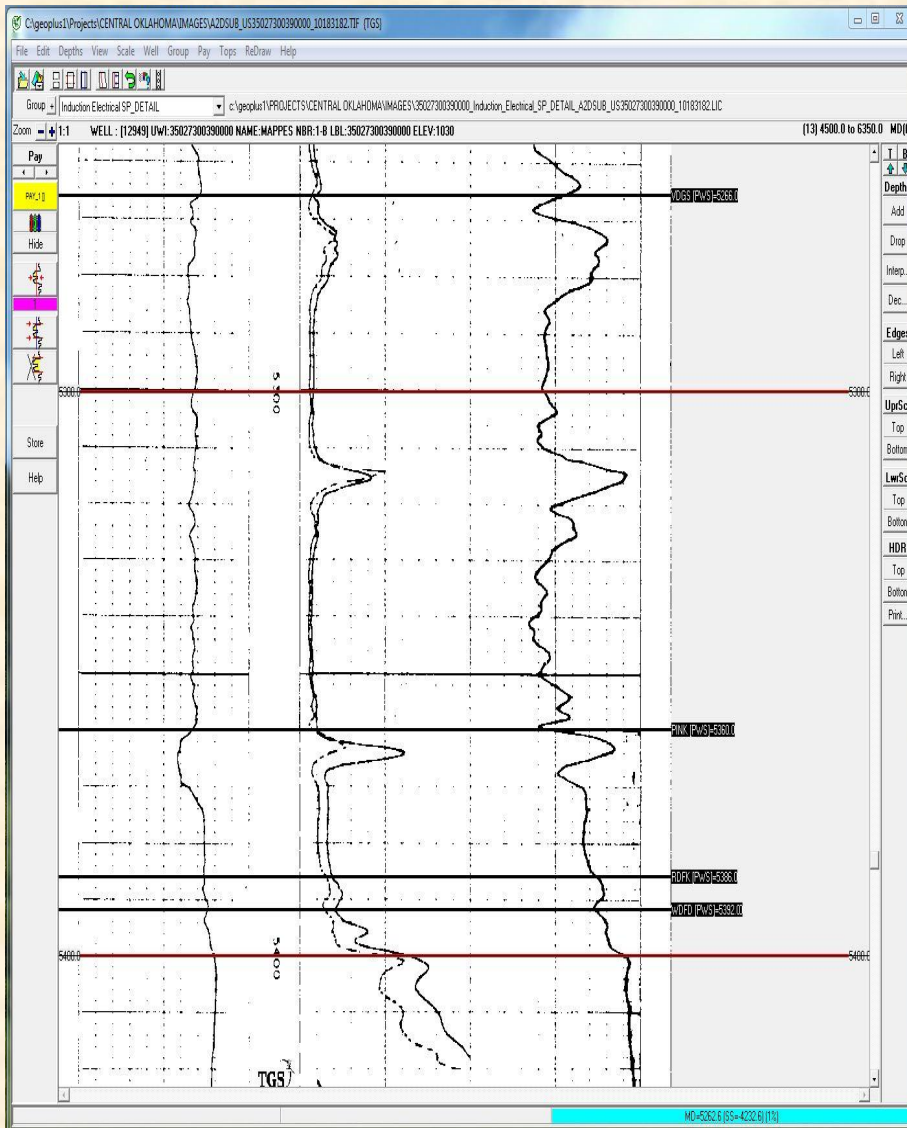
Red Microlog, good mudlog



\$1,500,000 in 100 days

Good Microlog, good mudlog

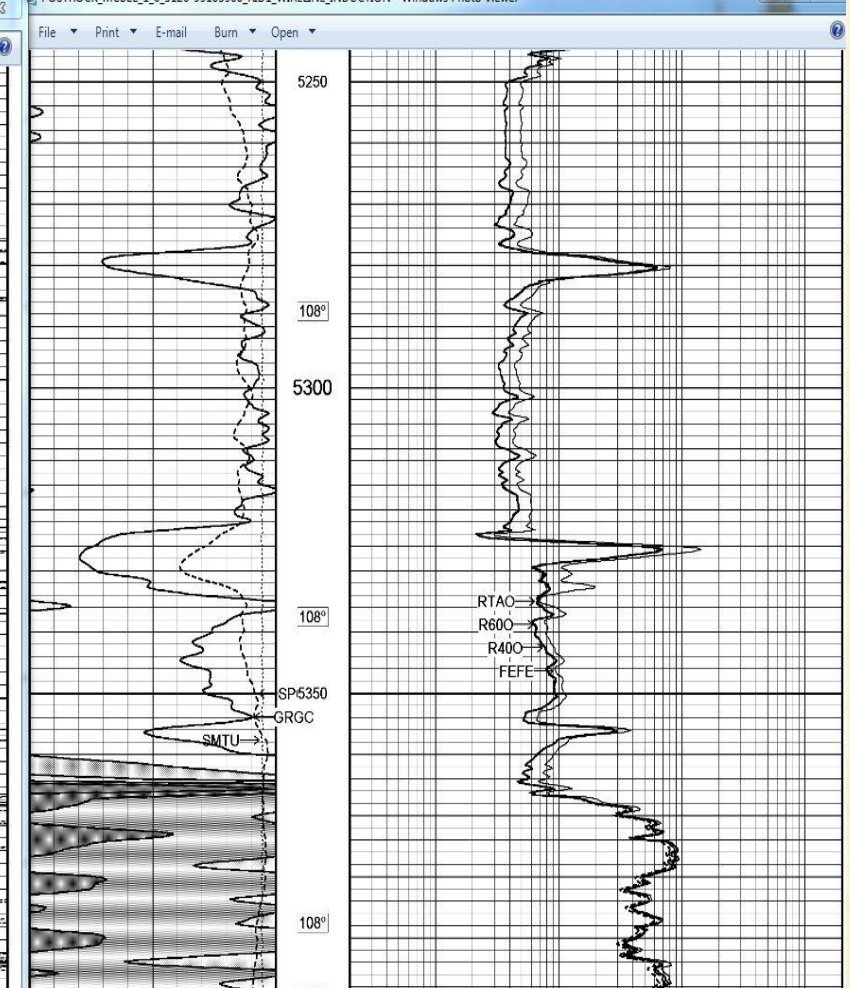
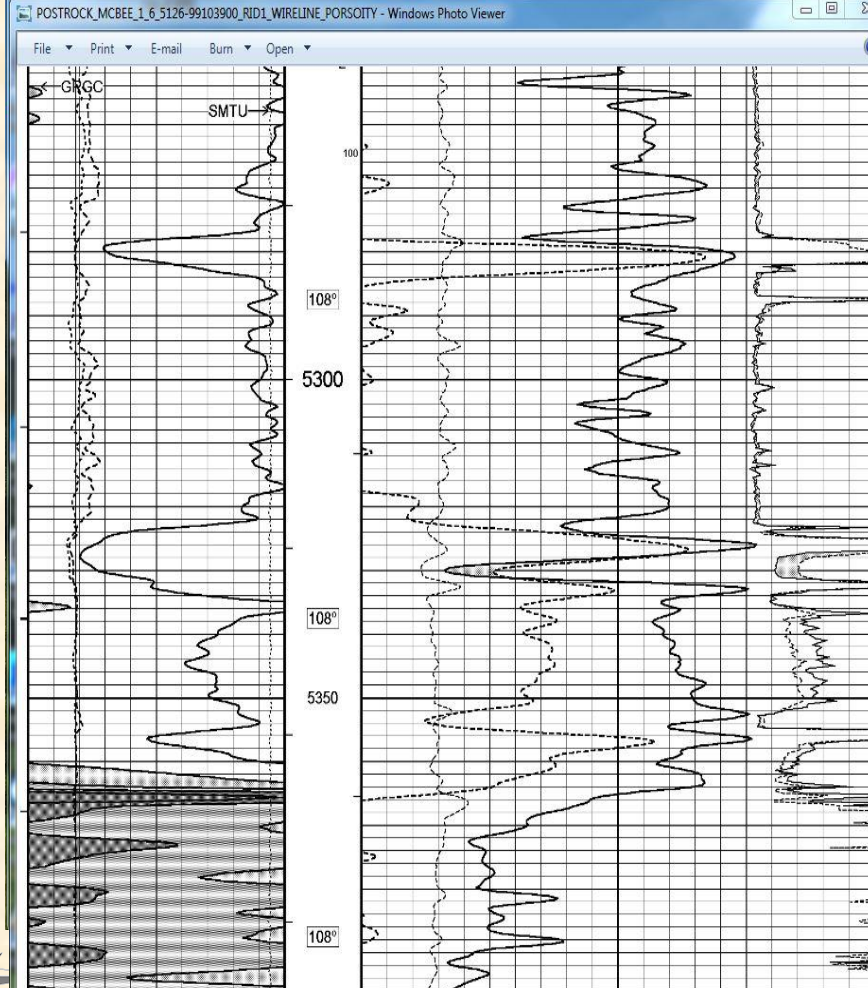
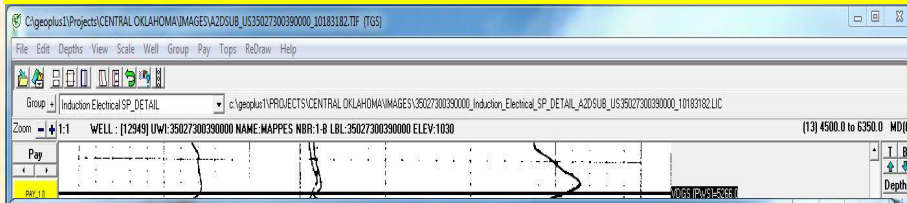
Summary



Red Fork



Vintage logs are useful – New logs provide definition



Summary *CONTINUED*

This field would not have been tested with old style logs – modern logs provide more resolution and definition.

Run enough logs to thoroughly evaluate the reservoirs – keep in mind there may be mineral, rock, drilling fluid, and/or hole conditions that cause less than optimal results.

Each tool “or methodology” on its own has merit. Using several tools can increase the value of each of the individual tools.

You may be the last monkey in the cage. Climb the ladder and get the bananas before you starve to death.

Remember the Group 3B dogs...

Prevent bad behavior and helplessness -

Empower your team with good logs and mudlogs.

GET BETTER RESULTS



THANK YOU
FOR YOUR TIME
AND ATTENTION

QUESTIONS???



ALL OF THE FAMOUS QUOTES

WINSTON CHURCHILL

