

LITHOSTRATIGRAPHY OF THE WOODFORD SHALE, ANADARKO BASIN, WEST-CENTRAL OKLAHOMA

**SHALES
MOVING
FORWARD...**

July 21, 2011



Oklahoma
Geological
Survey

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The University of Oklahoma
MEYERBOURNE COLLEGE OF EARTH & ENERGY

Craig D. Caldwell
Cimarex Energy Co.



A close-up photograph of a fractured rock surface, likely limestone or a similar sedimentary rock. The rock is light-colored with significant brown and reddish staining, particularly along the fractures. A coin is placed on the right side of the rock for scale. The fractures are prominent and run in various directions, creating a complex, blocky pattern.

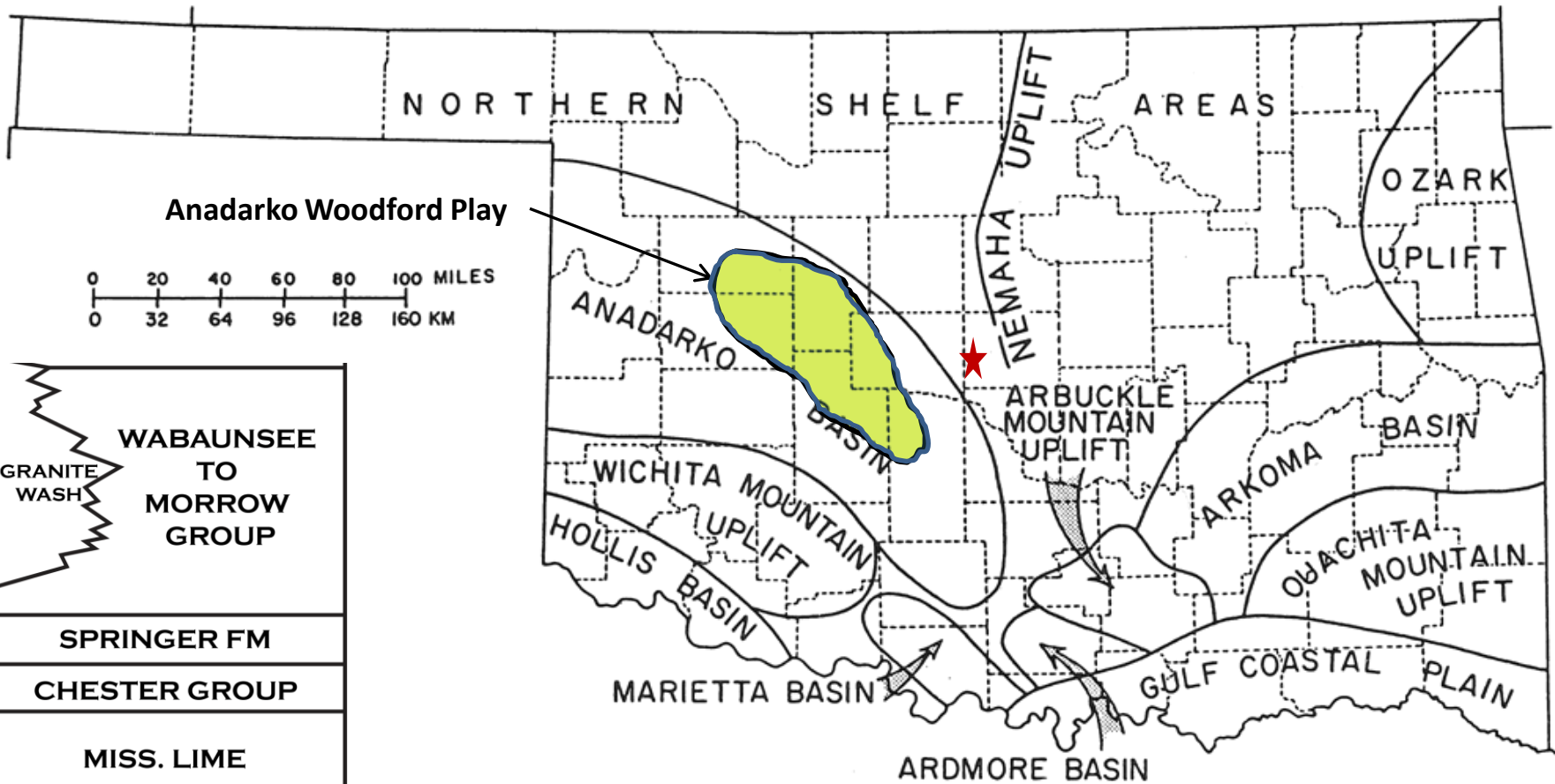
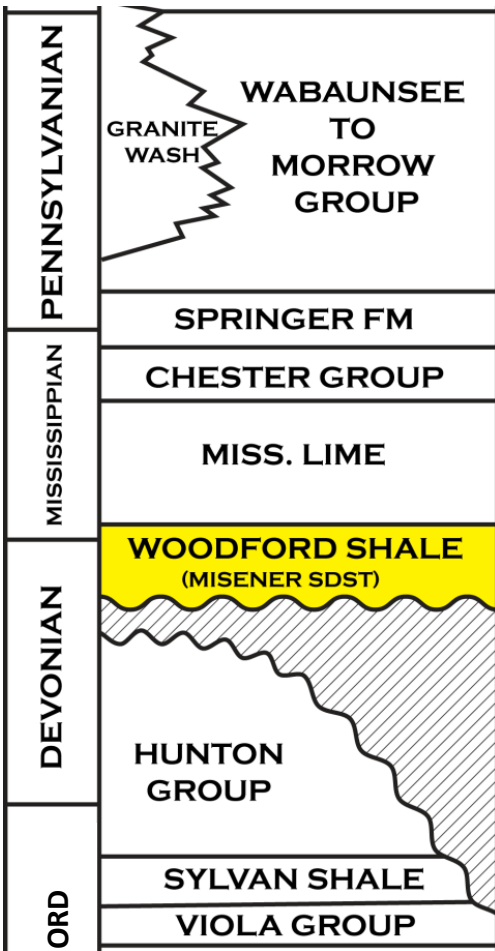
ACKNOWLEDGEMENTS

**Cimarex Energy Co.
Devon Energy Corp.
Weatherford (TOC)
Terra Tek Inc. (XRD &
Photomicrographs)**

The logo for Cimarex Energy, featuring the word "CIMAREX" in a bold, white, sans-serif font. The letters are set against a black rectangular background. A red diagonal line cuts across the bottom right corner of the black rectangle, extending from the bottom edge to the right edge.

CIMAREX

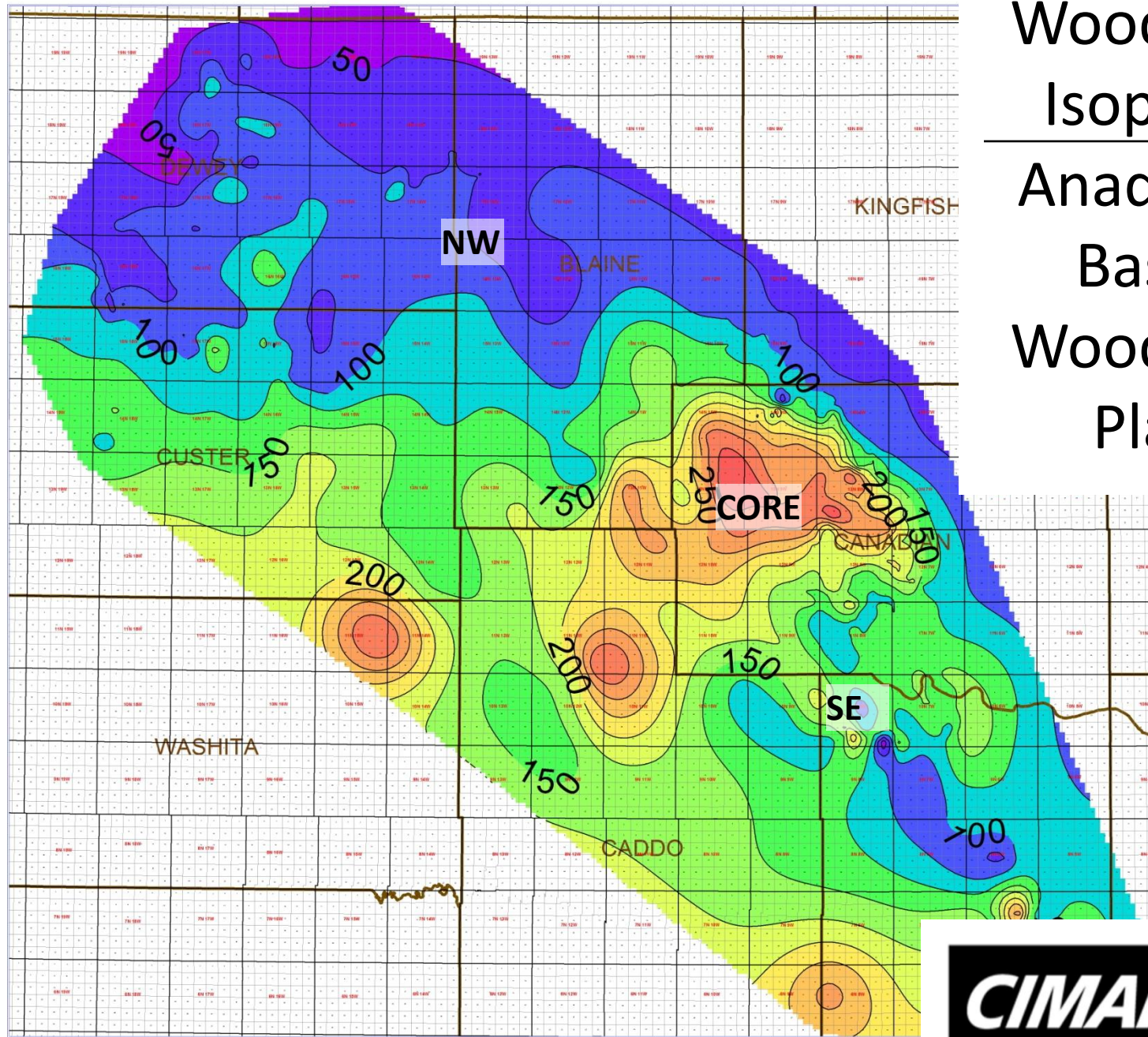
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- **Location Map & Strat Column**
 - **Woodford Isopach**
 - **Woodford Structure**
 - **Internal Woodford Stratigraphy**
 - **Woodford Mineralogy and Rock Types**



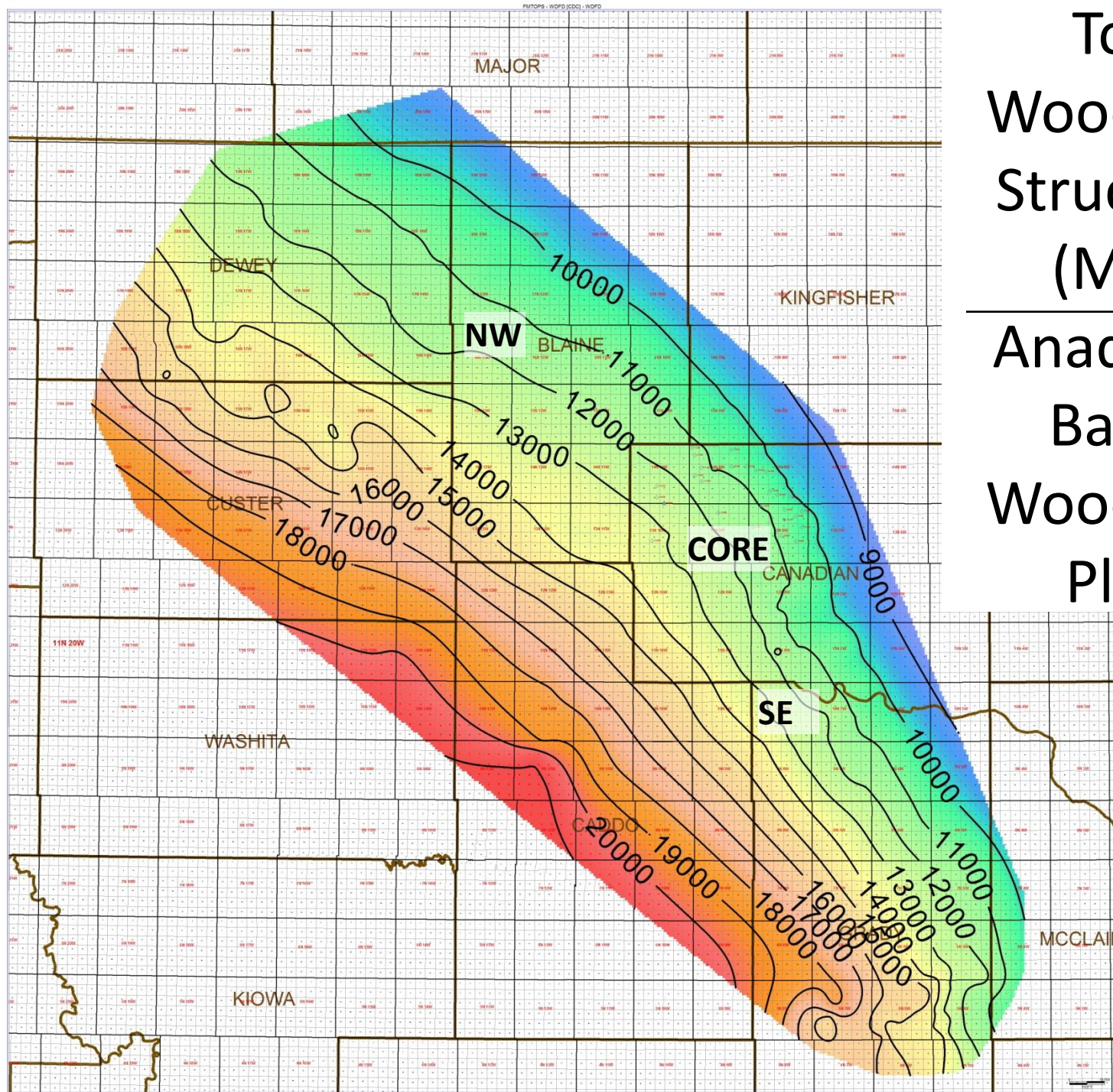
STRAT COLUMN AND MAJOR GEOLOGIC PROVINCES OF OKLAHOMA

*After Johnson et al (2000)

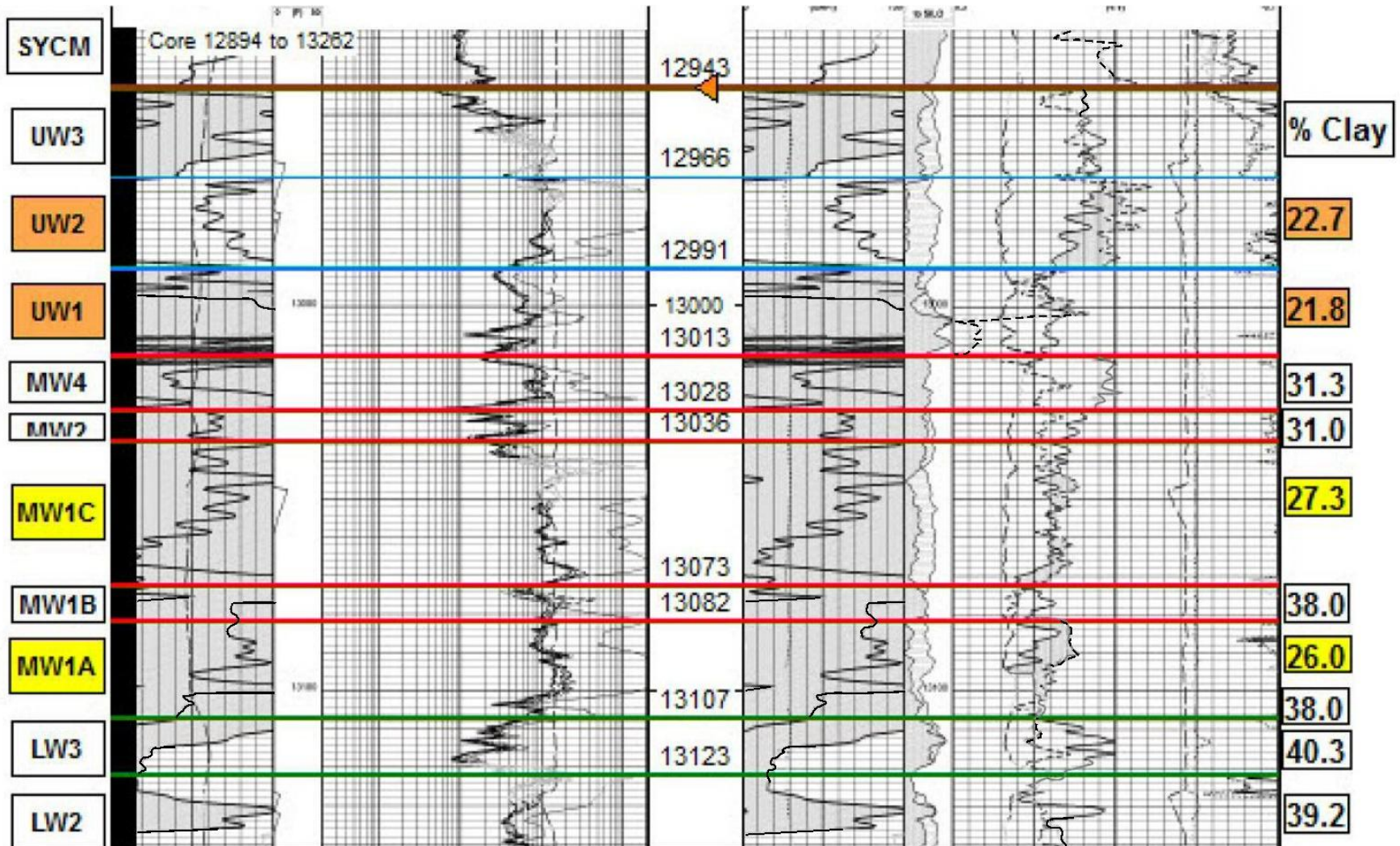
Woodford Isopach Anadarko Basin Woodford Play



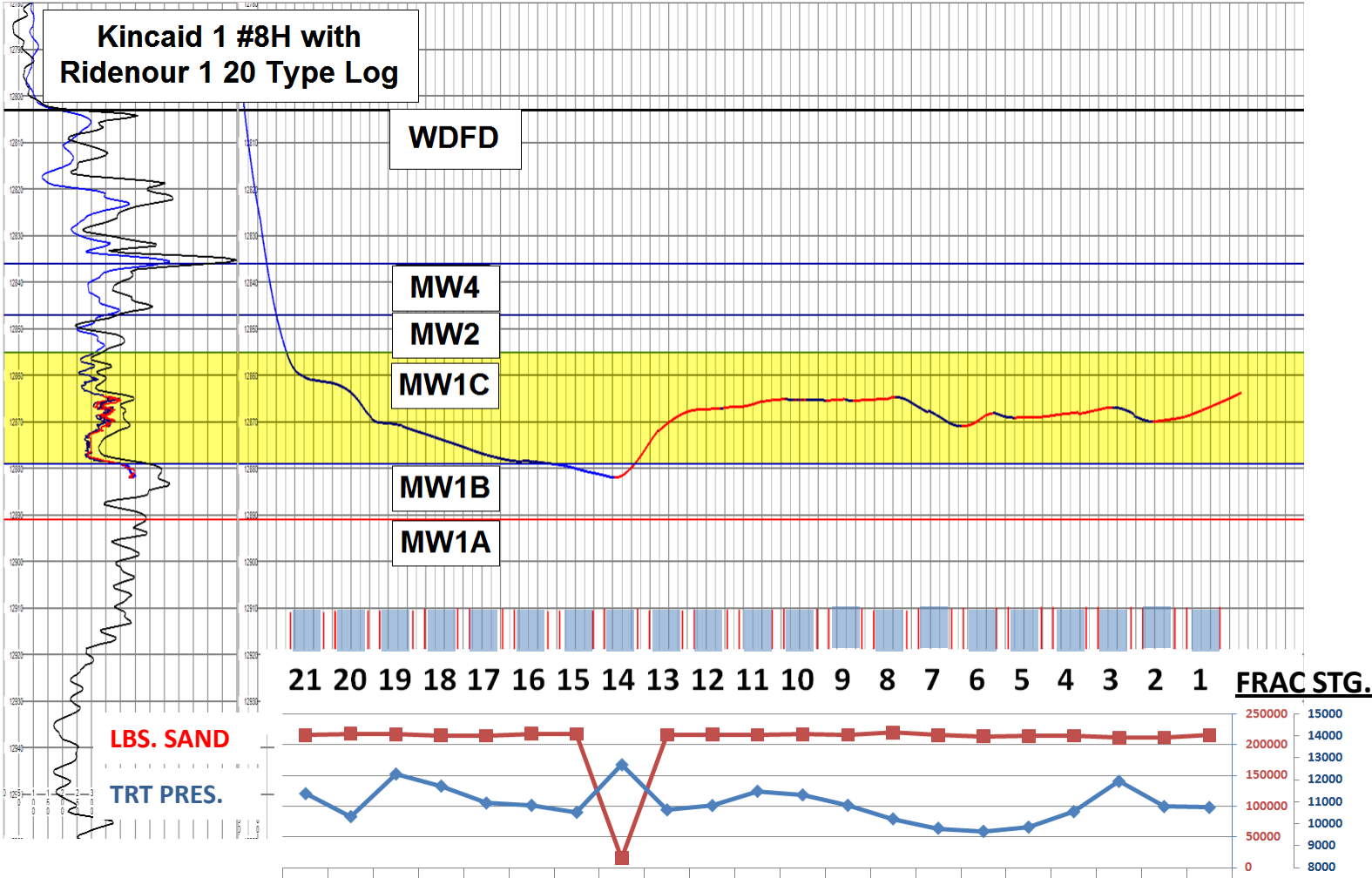
Top Woodford Structure (MD) Anadarko Basin Woodford Play



Type Log from Core Area Showing Lithostratigraphy and % Clay for Middle & Upper Woodford



Well Path Showing Woodford Lithostratigraphy and Lateral Placement



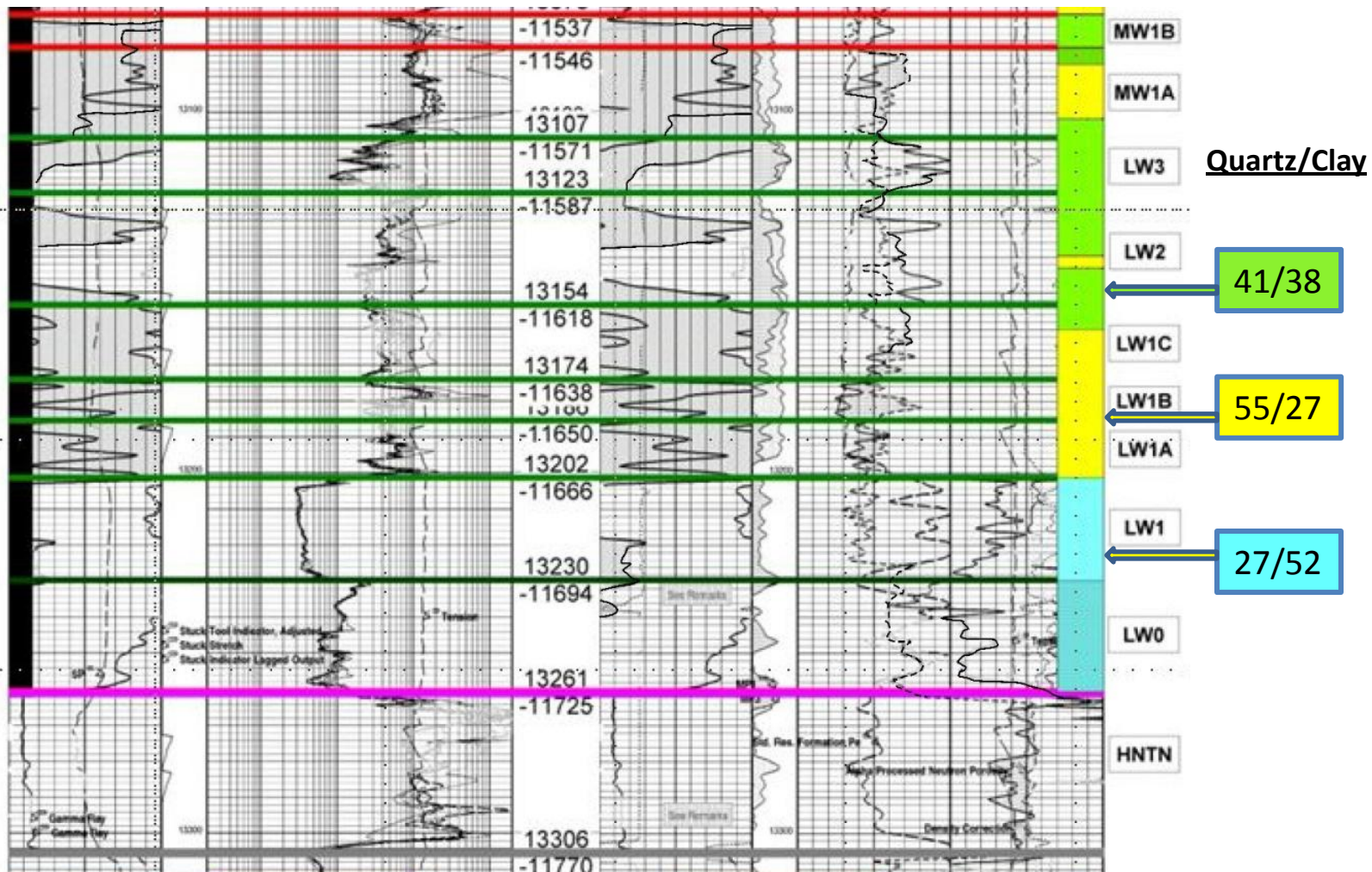
Woodford Lithofacies

Anadarko Basin Woodford Play

LITHOFACIES	% QUARTZ	% CLAY	% DOLOMITE	% PYRITE	% TOC	% GAS-FILLED POROSITY	PRv
Silicic Mudstone	75.2	14.5	2.8	1.3	4.95	5.9	0.155
Argillaceous, silicic mudstone	54.8	27.4	3.6	3.1	6.43	6.8	0.164
Argillaceous mudstone	40.6	38	5.0	3.6	5.97	5.6	0.192
Organic-poor, argillaceous mudstone	41.4	41	5.8	2.7	1.98	3	0.212
Organic-poor, argillaceous mudstone	27.3	52.4	4.3	2.8	0.6	1.8	0.25
Dolomitic, argillaceous mudstone	32.4	33.4	14.8	6.1	6.34	5.2	
Pyritic, organic-rich mudstone	33	30.7	1.7	20.0	10.1	4.9	



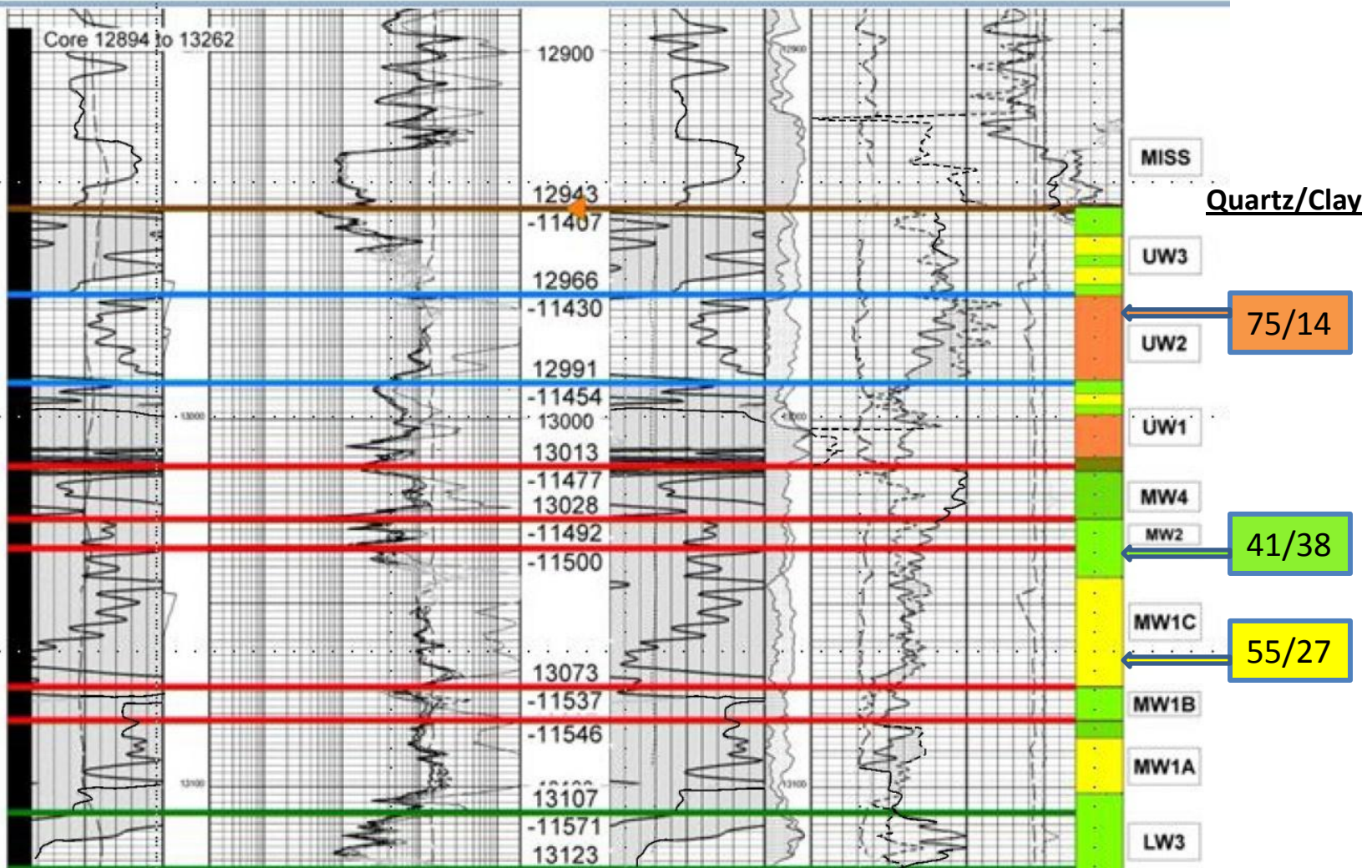
Lower & Middle Woodford Lithostratigraphy, Anadarko Woodford Play – Core Area



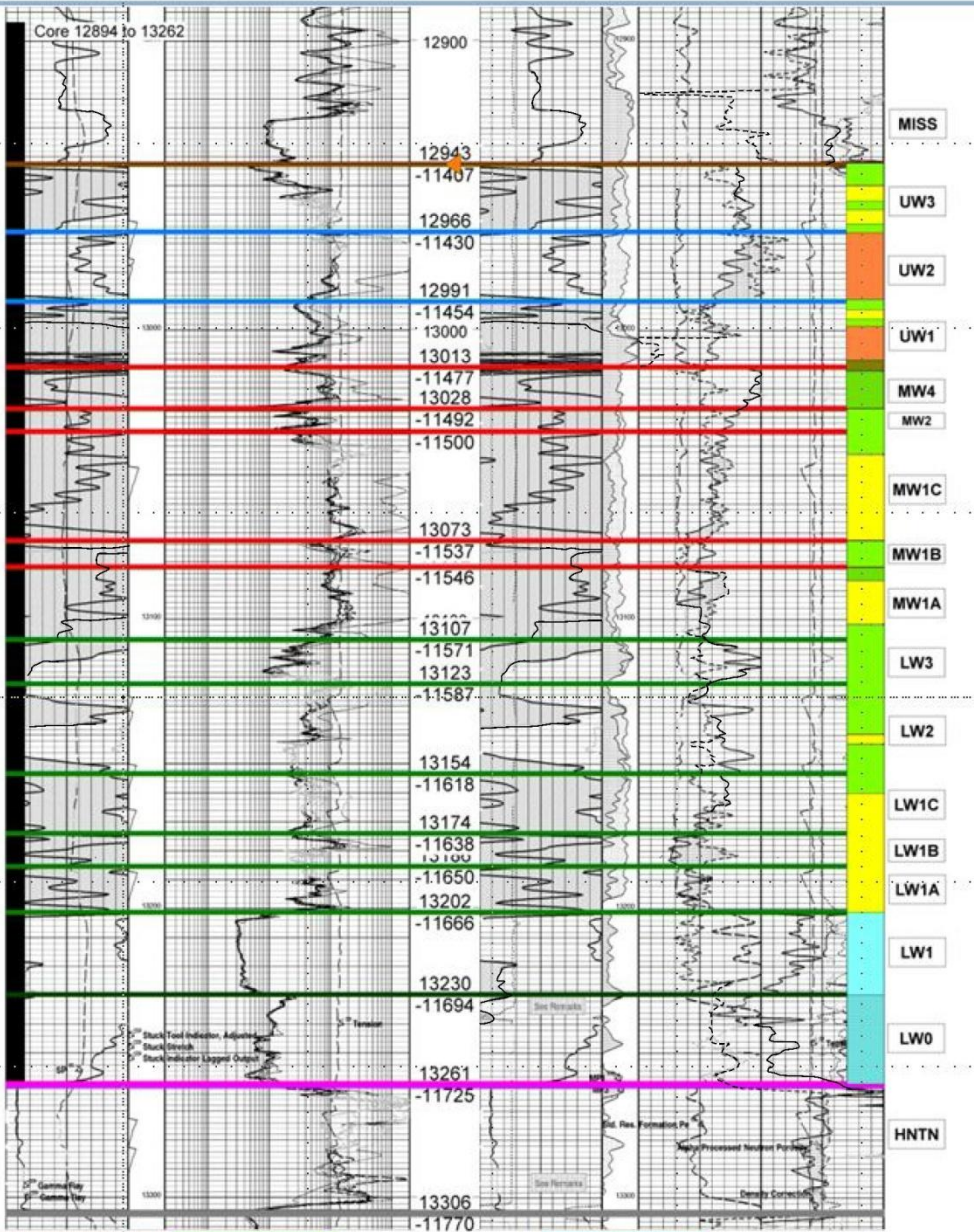
Silicic mudstone	Silty, argill mudstone	Organic-poor, argill mudstone	Silty, pry, orgn-rich mudstone
Silty, argill, silicic mudstone	Silty, argill, pyr/dolo mudstone	Organic-poor, silty, argill mudstone	



Middle and Upper Woodford Lithostratigraphy, Anadarko Woodford Play – Core Area



Woodford Lithostratigraphy Anadarko Basin Woodford Play Core Area



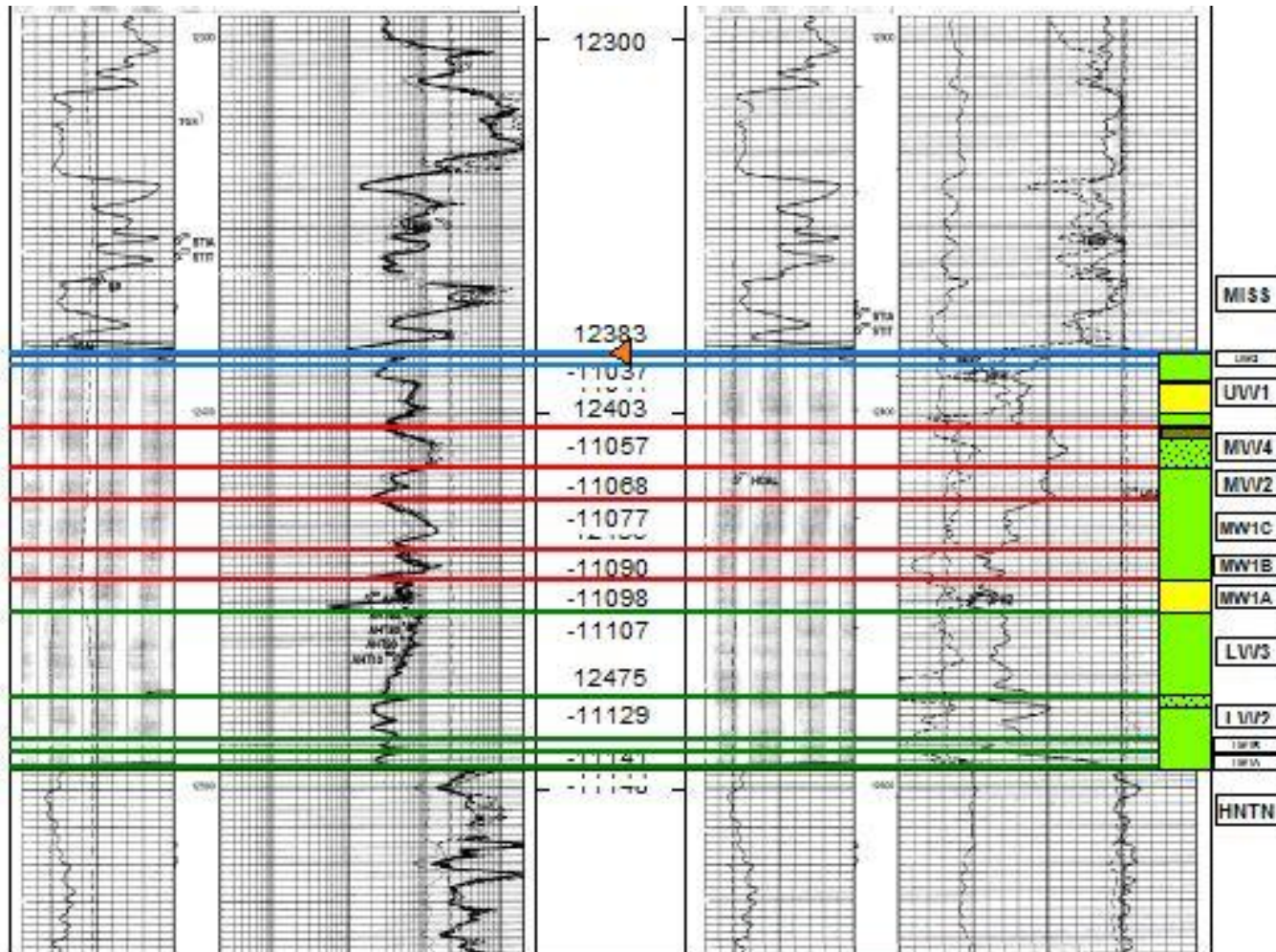
Silicic mudstone	Silty, argill mudstone	Organic-poor, argill mudstone	Silty, pry, orgn-rich mudstone
Silty, argill, silicic mudstone	Silty, argill, pyritic mudstone	Organic-poor, silty, argill mudstone	

318'



Woodford Lithostratigraphy Anadarko Basin

Woodford Play - SE Area



Silicic mudstone

Argillaceous mudstone

TD=13220

Organic-poor, argill. mudstone

Silty, pry, orgn-rich mudstone

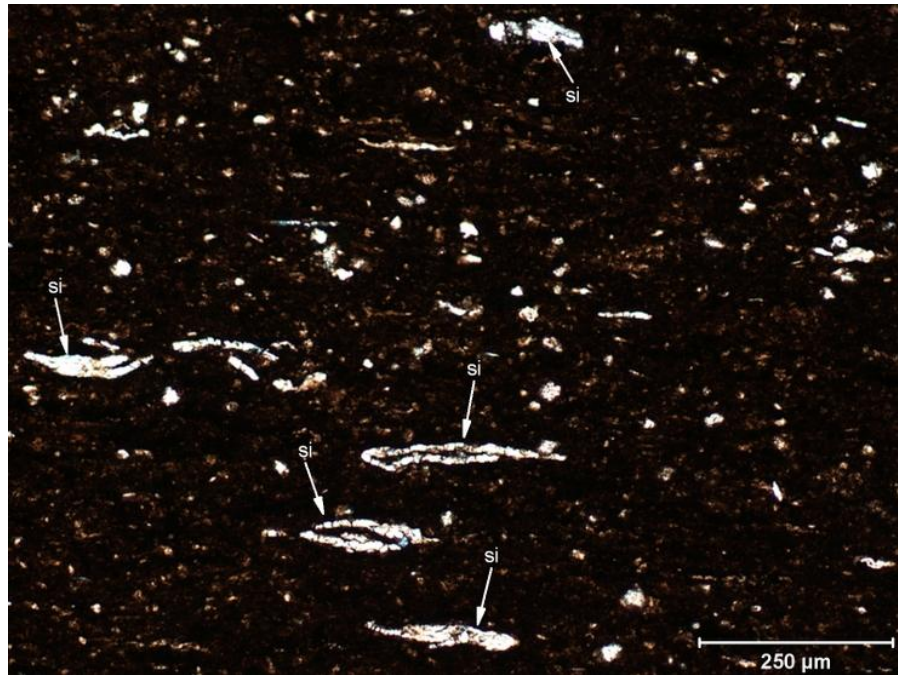
Argillaceous, silicic mudstone

Argillaceous pyritic mudstone

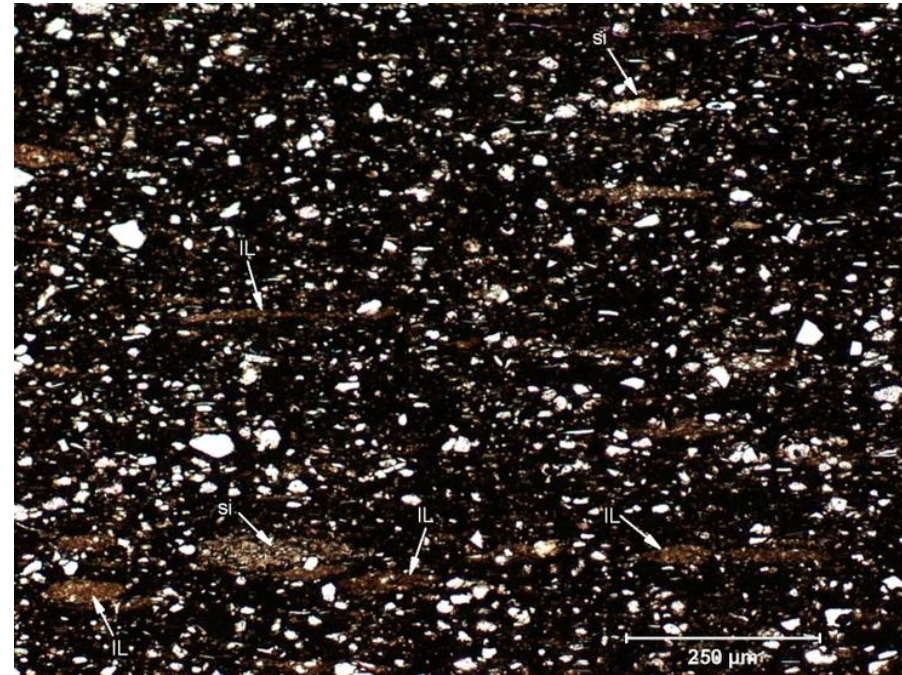
Organic-poor, silty argill. mudstone



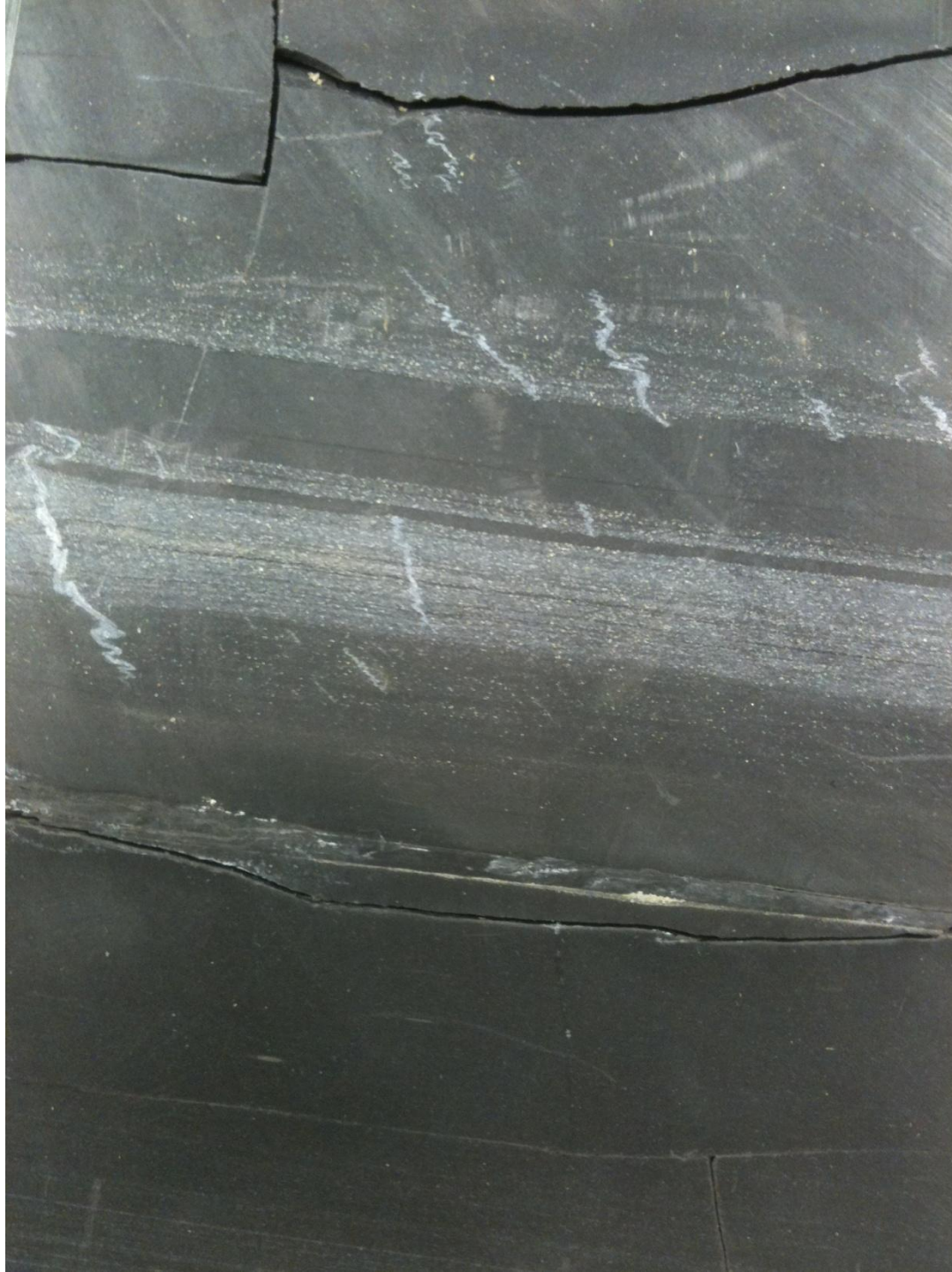
Thin Section Photomicrographs of Woodford Rock Types



UW1 sample showing silicified Tasmanites; sample is 64% quartz and 21% clay. Silicic mudstone lithofacies.



MW1B sample showing detrital silt; sample is 34% quartz and 38% clay. Argillaceous mudstone lithofacies.



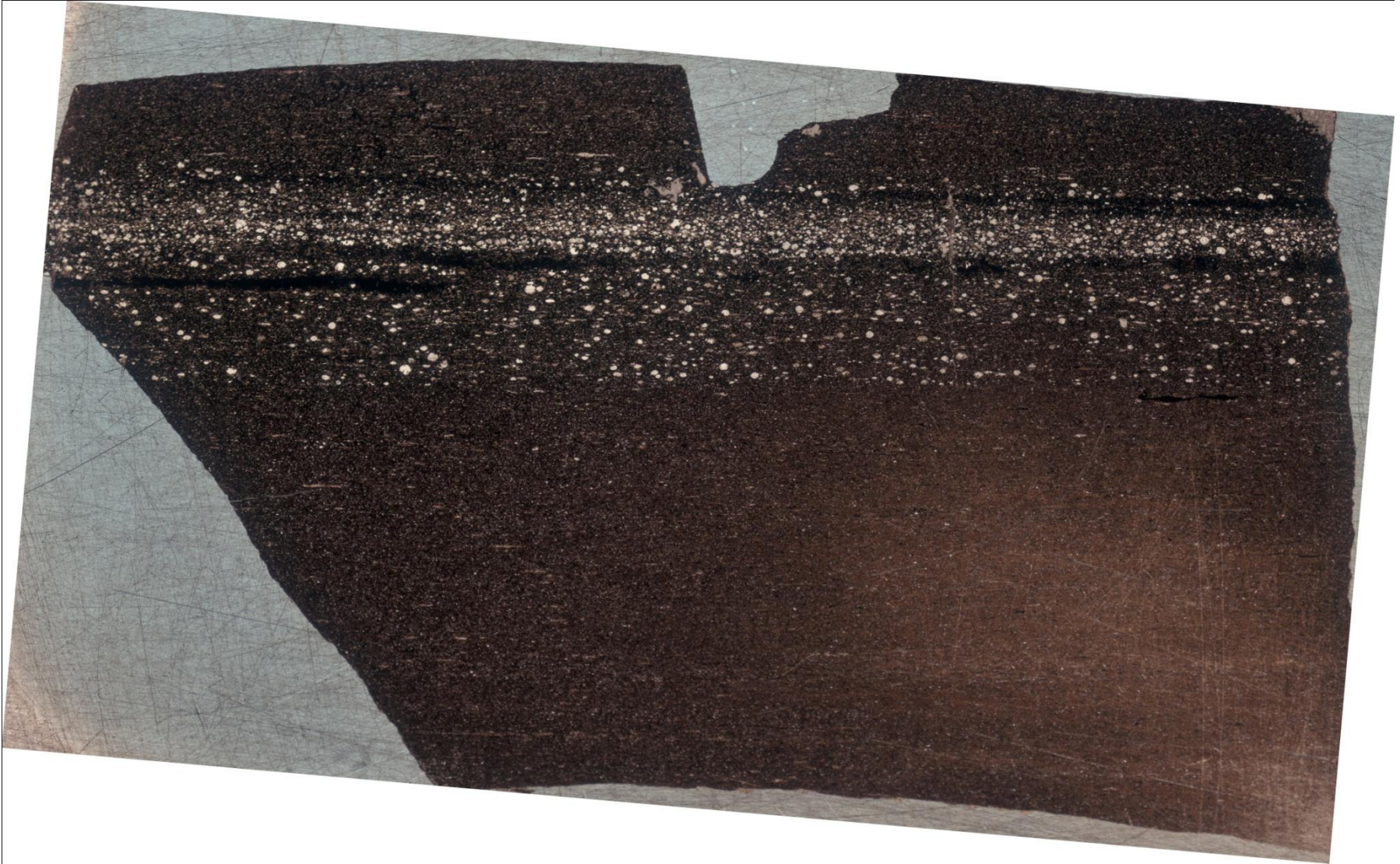
**Bed-limited
dolomite-cemented
fractures in thin
silicic layers**

**Silicic mudstone
lithofacies**



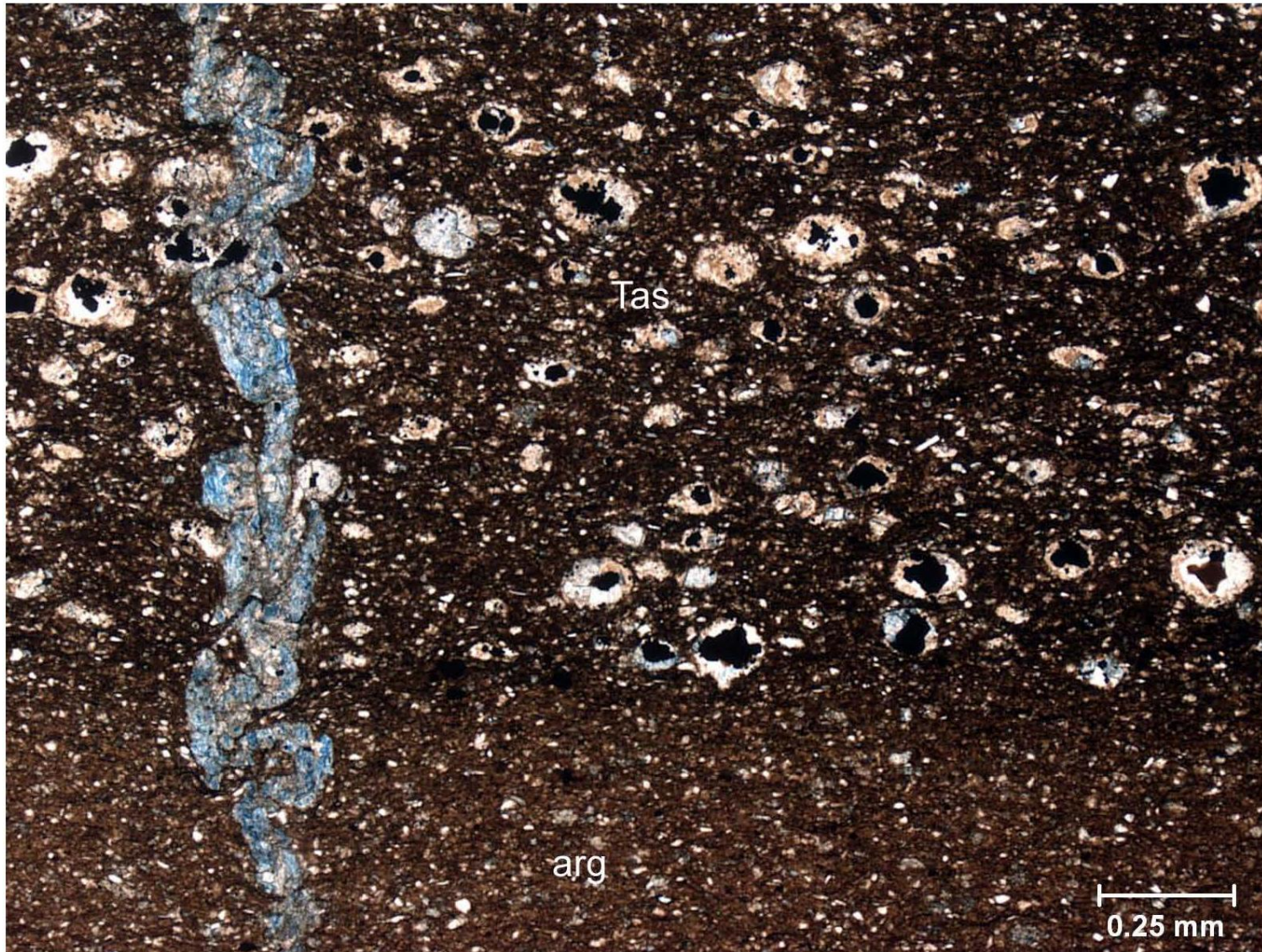


**Thin section scan showing silicic laminae
Argillaceous silicic mudstone lithofacies**

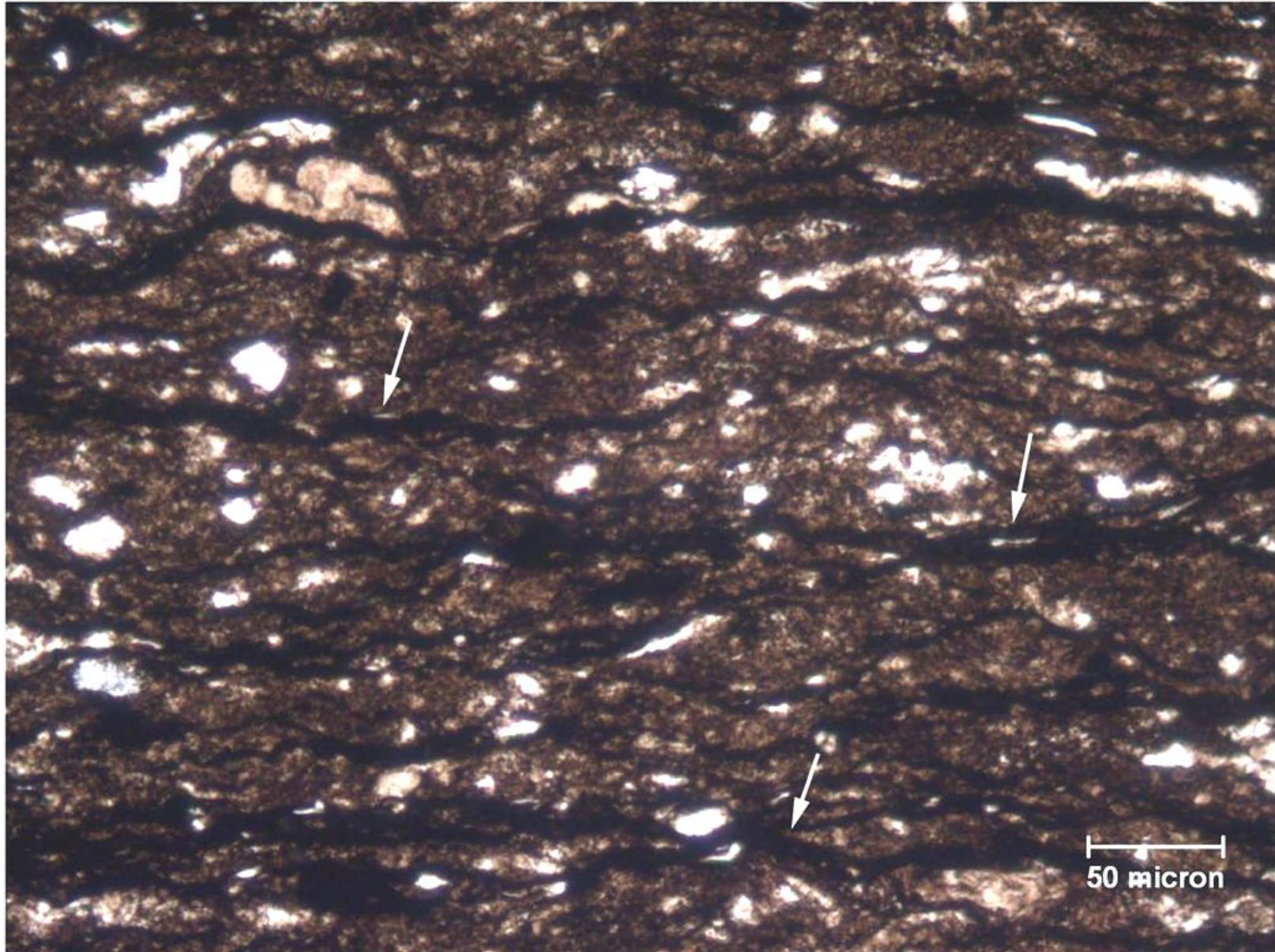


Silicic laminae with dolomite-cemented fracture

Silicic mudstone lithofacies

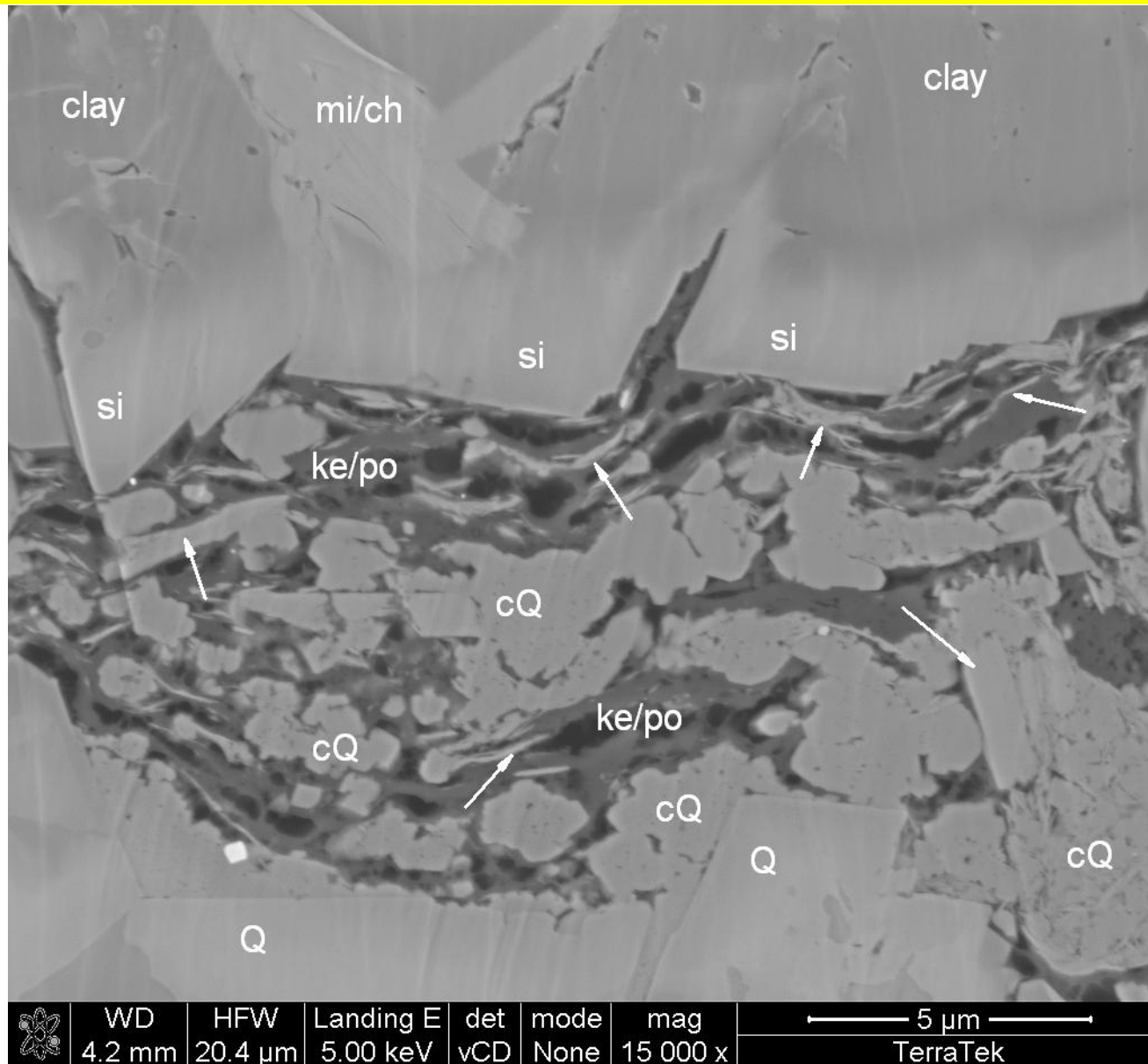


Organic laminations Silicic mudstone lithofacies




Porosity in organic laminae

Argillaceous silicic mudstone



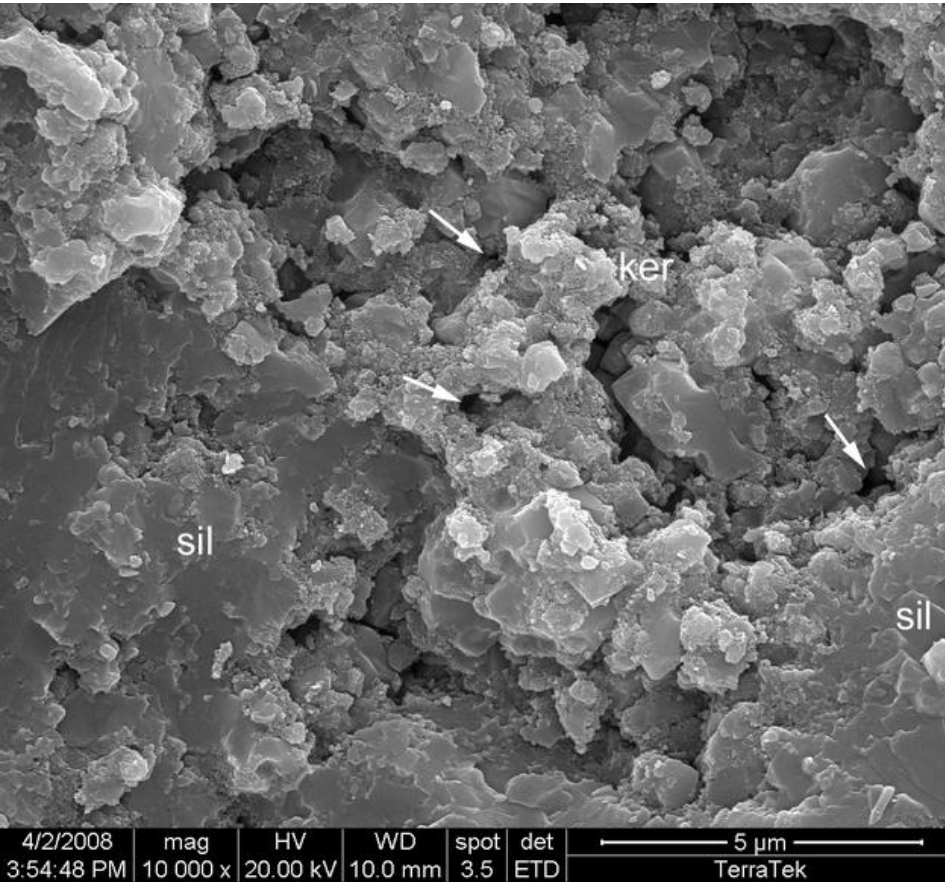
13115

**Bioturbated bed
Argillaceous
mudstone lithofacies**

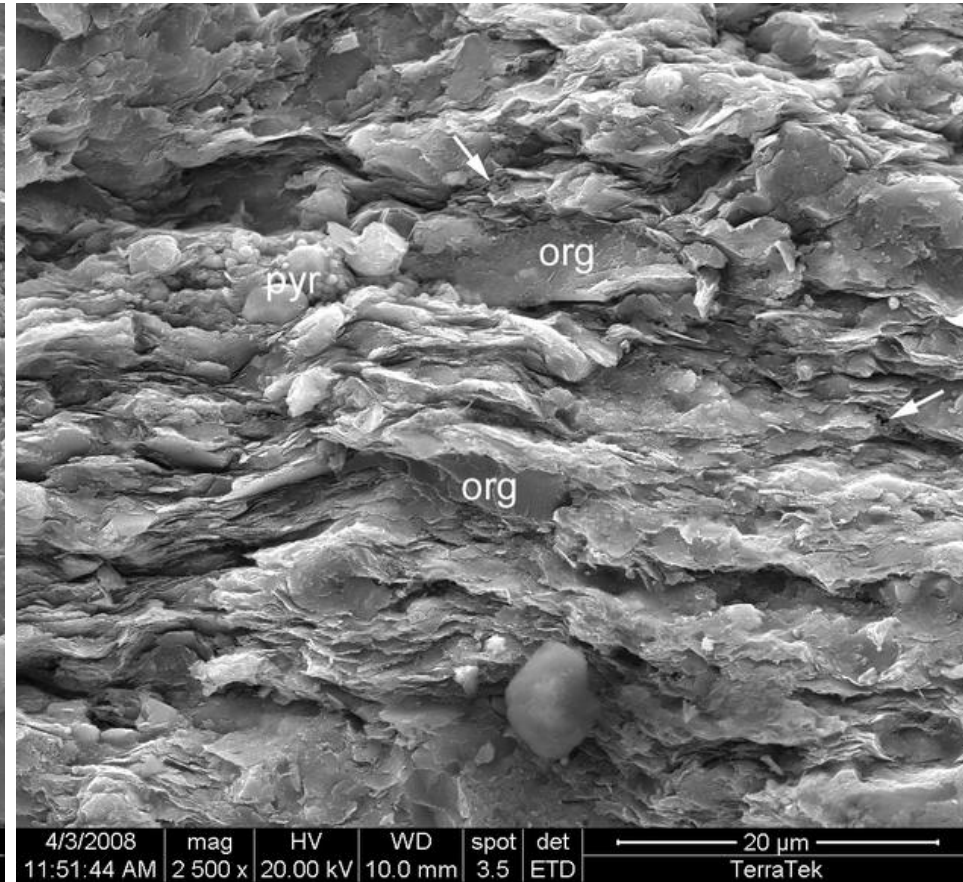
A photograph showing a dark, almost black, sedimentary rock surface. The surface exhibits fine-scale, wavy, and irregular patterns characteristic of bioturbation. There are some lighter-colored, possibly silicified, features scattered across the surface, including a prominent, elongated, light-colored feature on the left side. The overall texture is rough and uneven.

**Bioturbated,
argillaceous bed
Argillaceous silicic
mudstone lithofacies**

SEM Photomicrographs of Woodford Microfabrics

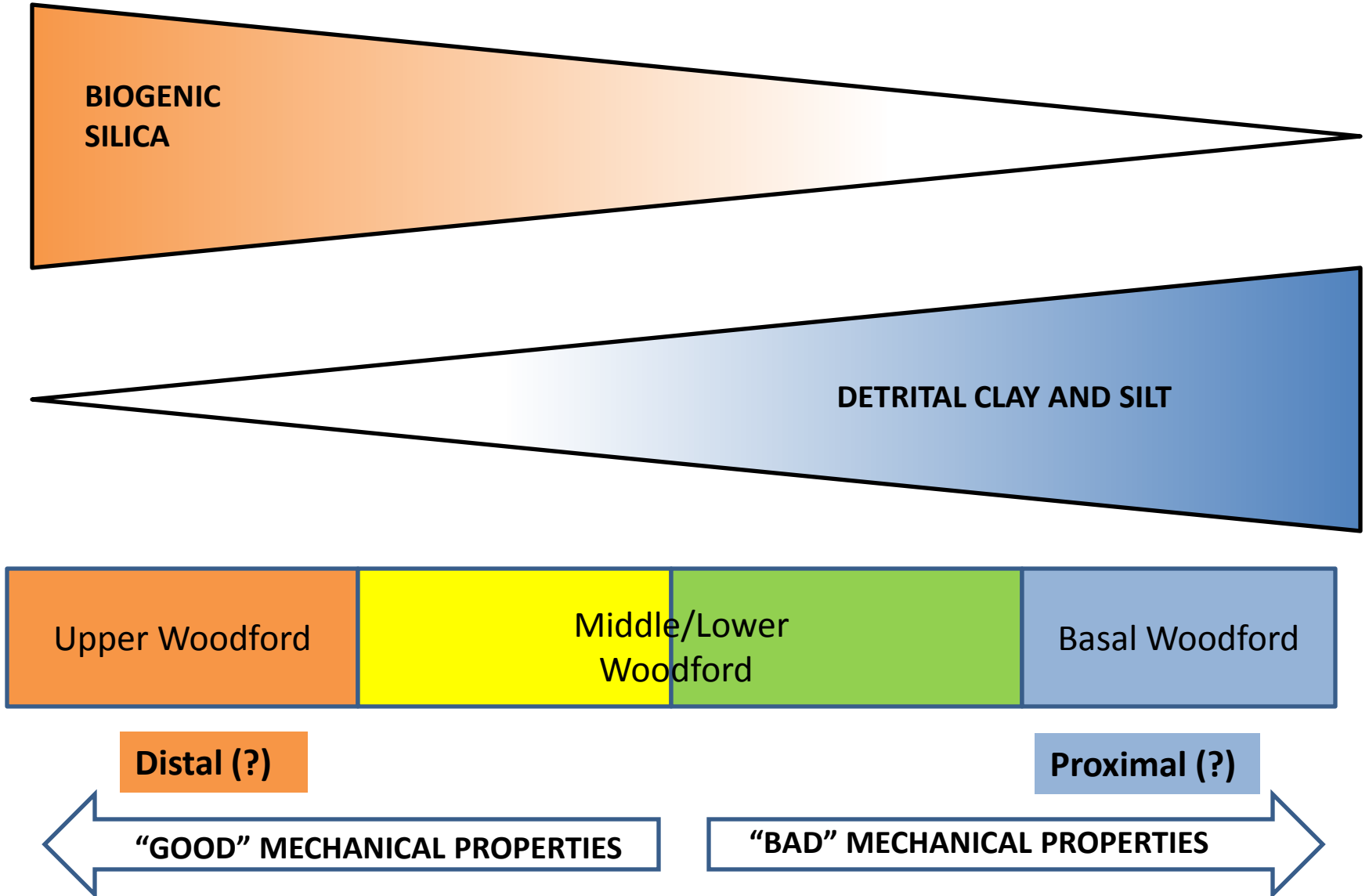


UW2 sample showing microcrystalline silica with intercrystalline porosity; sample is 76% quartz and 18% clay. Silicic mudstone lithofacies.



MW4 sample showing parallel alignment of illite clay; sample is 26% quartz and 44% clay. Argillaceous mudstone lithofacies.

Woodford Lithofacies



CONCLUSIONS

