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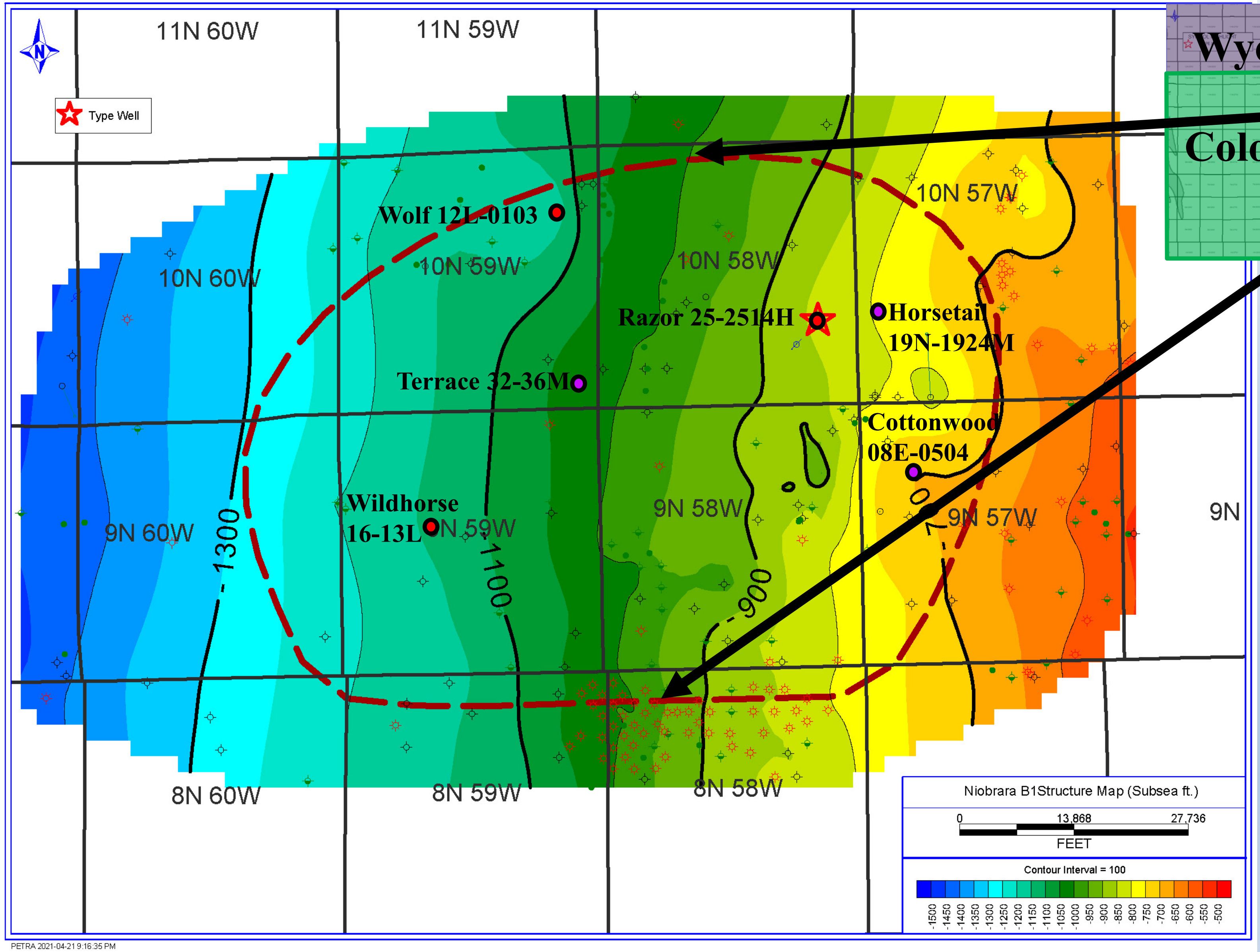
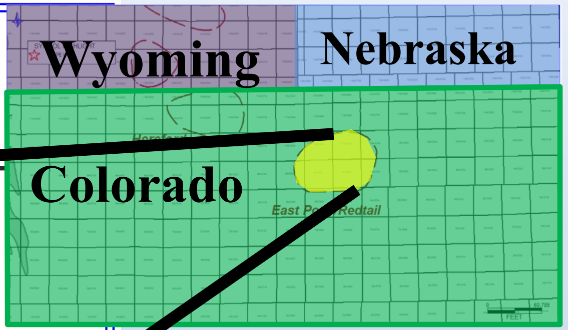
RESERVOIR CHARACTERIZATION OF THE NIOBRARA B INTERVAL AT REDTAIL FIELD: WELD COUNTY, DENVER JULESBURG BASIN, NORTHEAST COLORADO

Outline

- Interval of Study
- Niobrara B Maps
- FE-SEM
- Source Rock Analysis
- Kerogenites
- Future Work

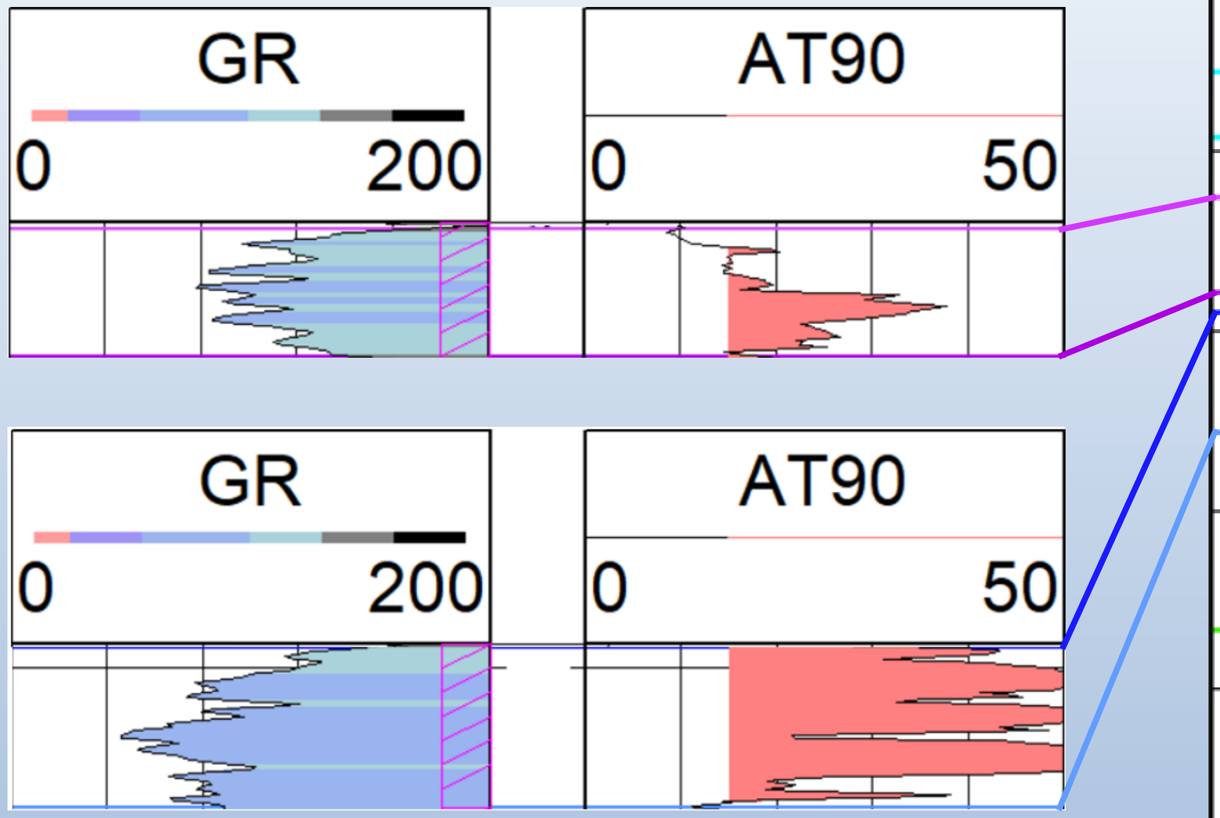
Area of Study





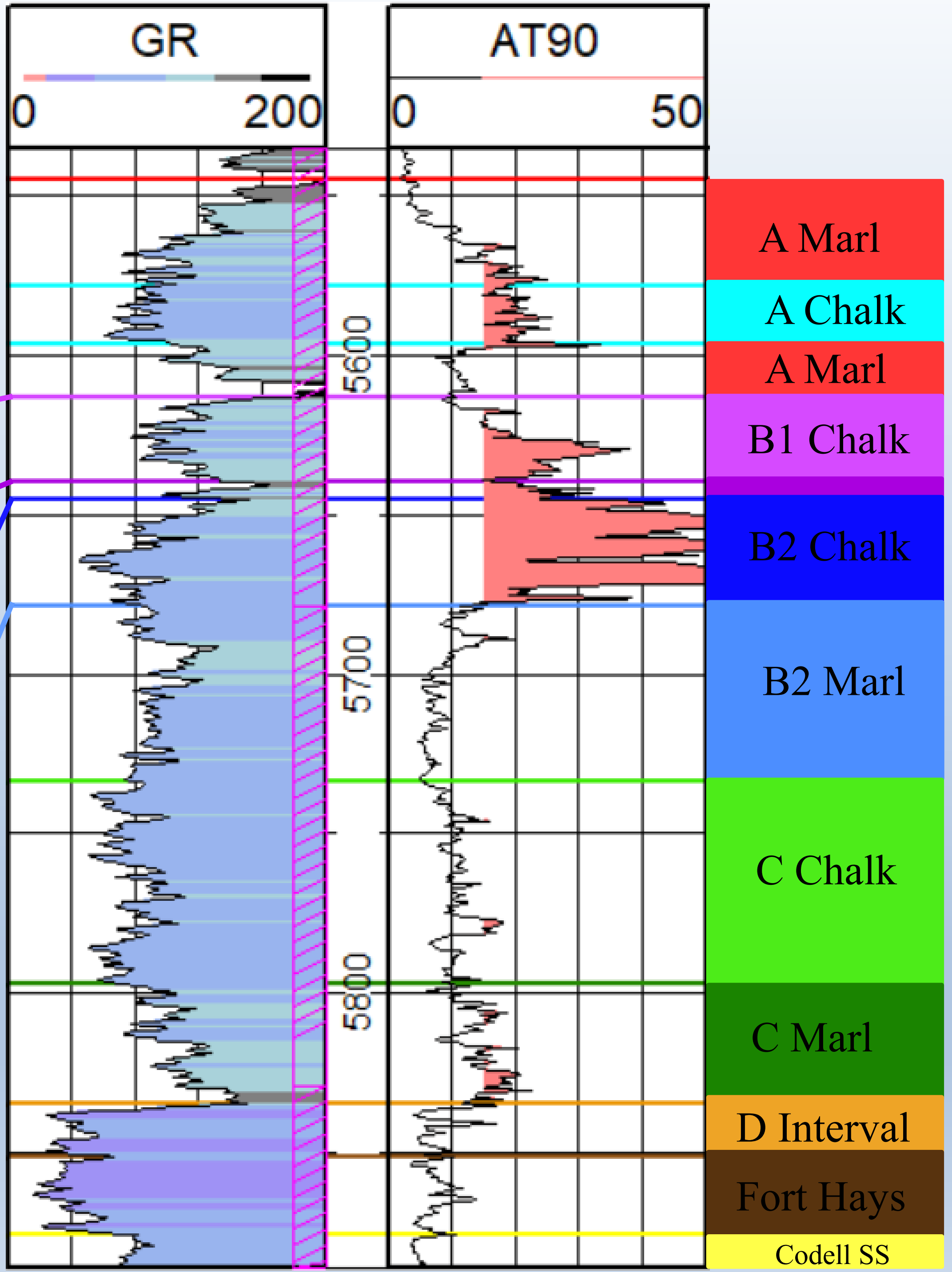
In Redtail Field the B interval of the Niobrara Formation is at a depth of -700-1,250ft subsea

Razor 25-2514H
UWI: 05123364180000



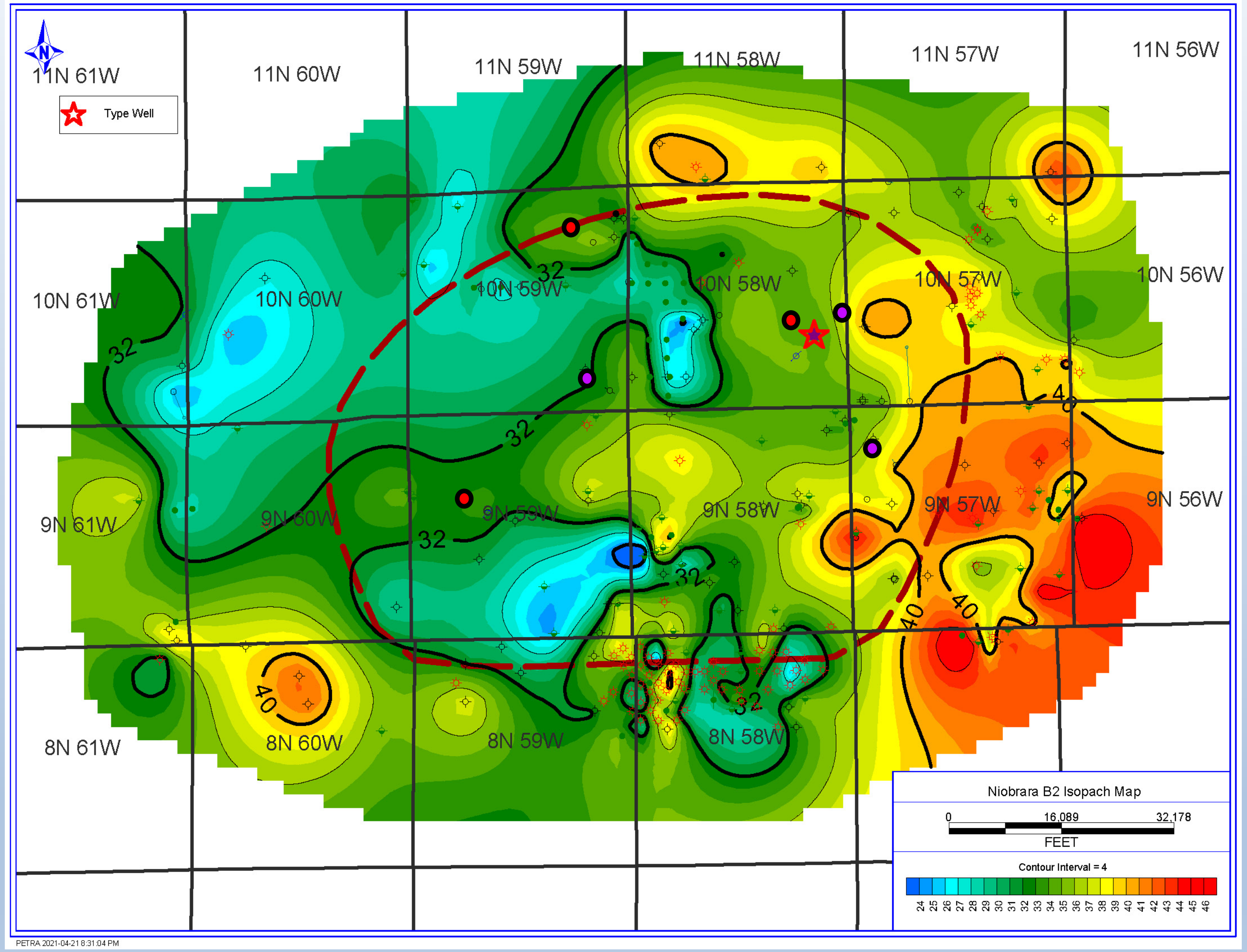
B1 Chalk: 5,613-5,639 ft TVD

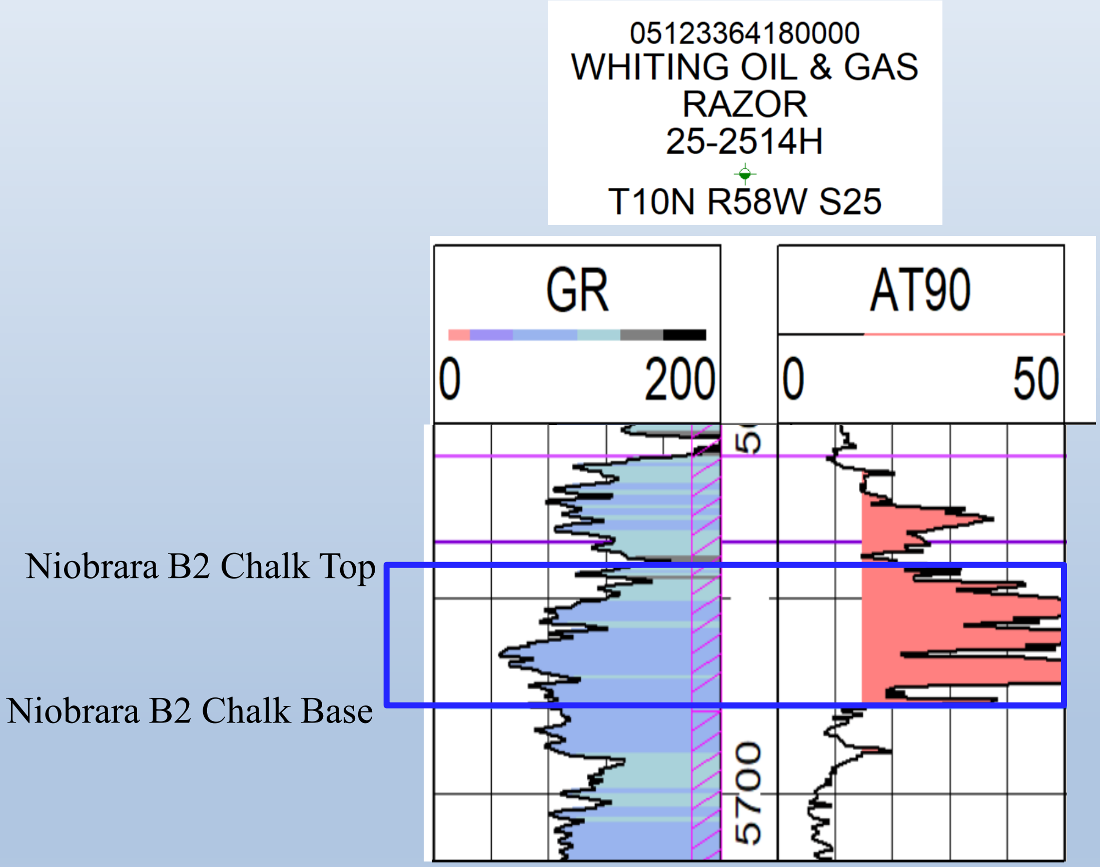
B2 Chalk: 5,645-5,678 ft TVD



Niobrara B2 Chalk Isopach Map

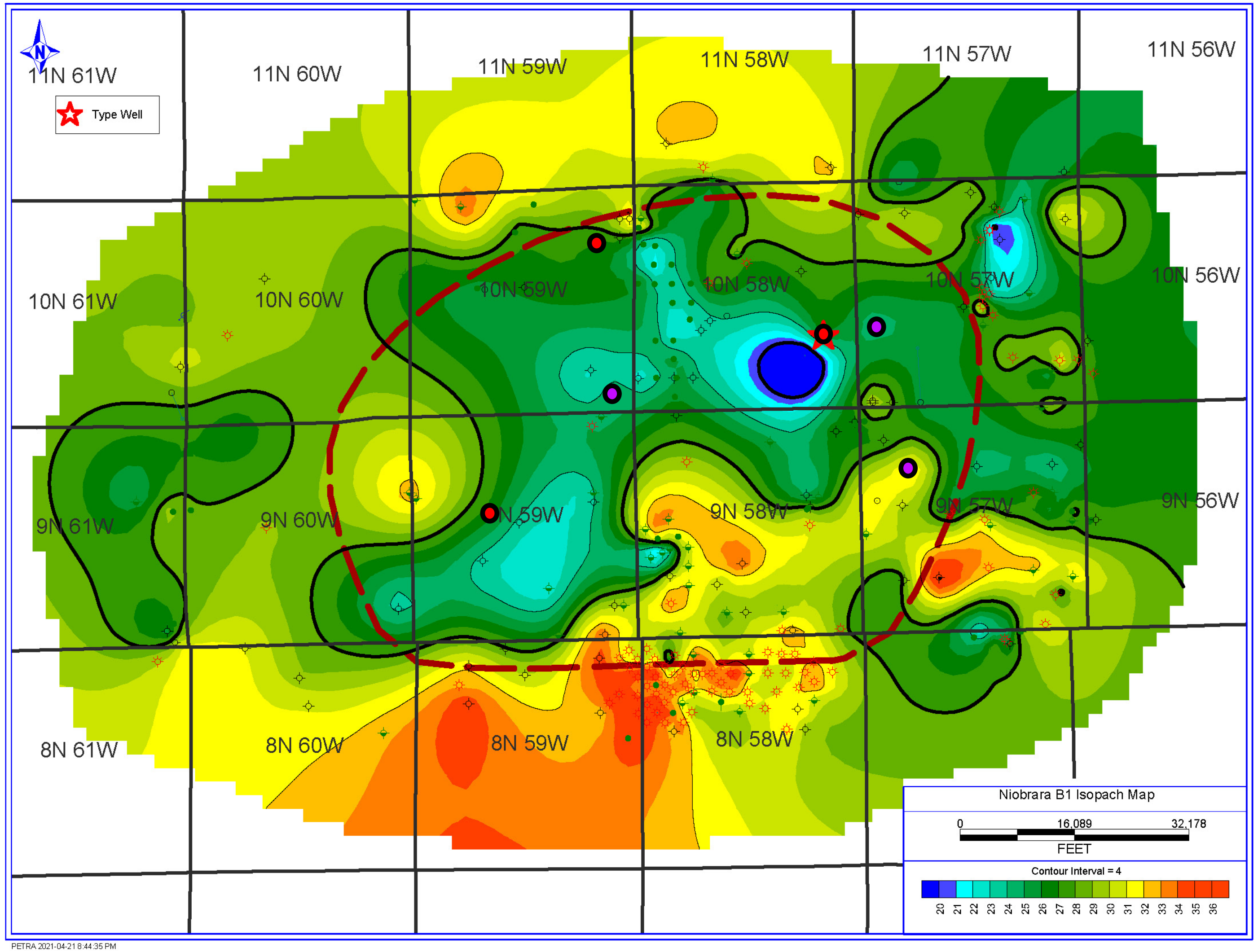
COLORADO SCHOOL OF MINES MUDTOC

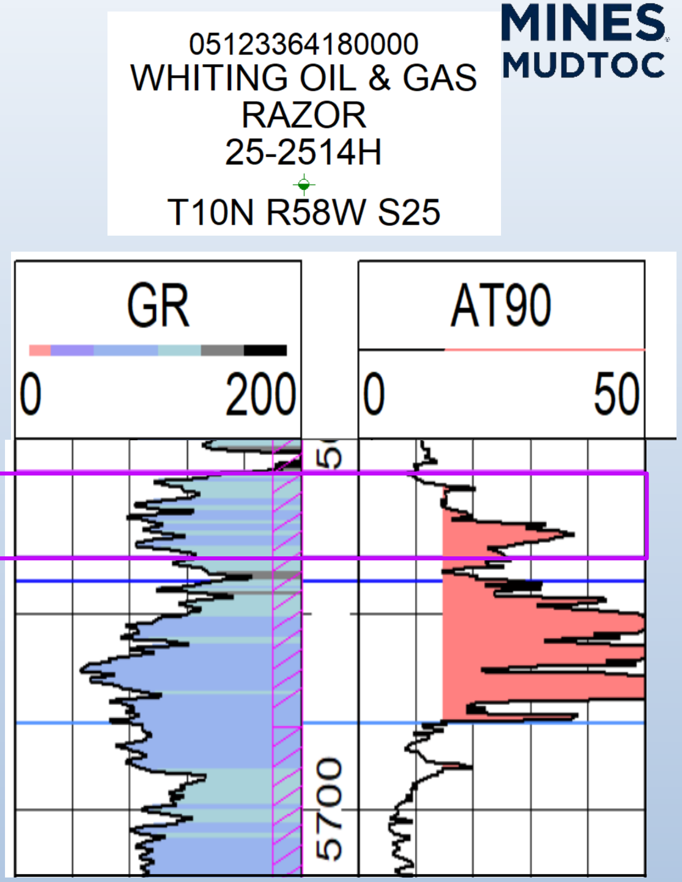




Niobrara B2 has a variable thickness in the field ranging from 24-43 ft.
B1 thin is compensated by thicker B2.

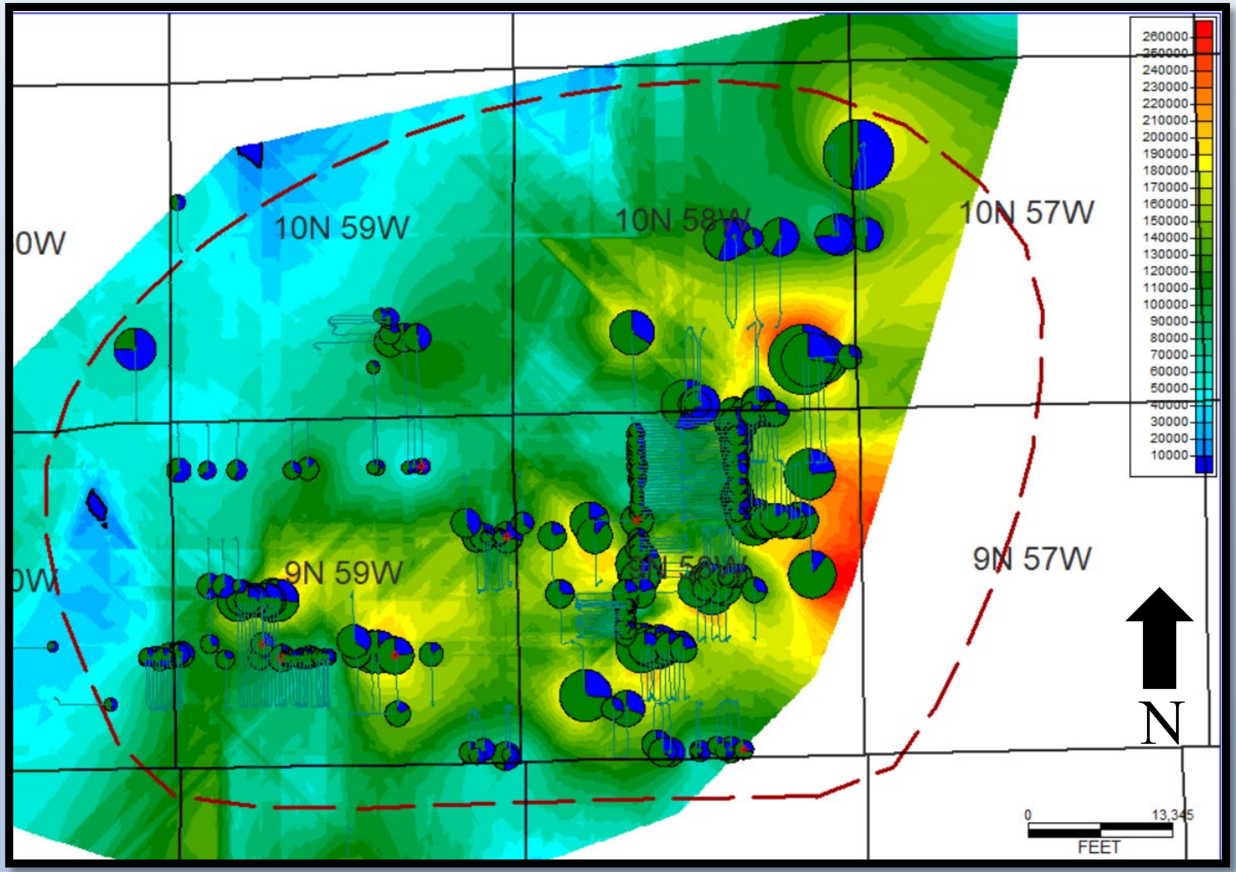
Niobrara B1 Chalk Isopach Map

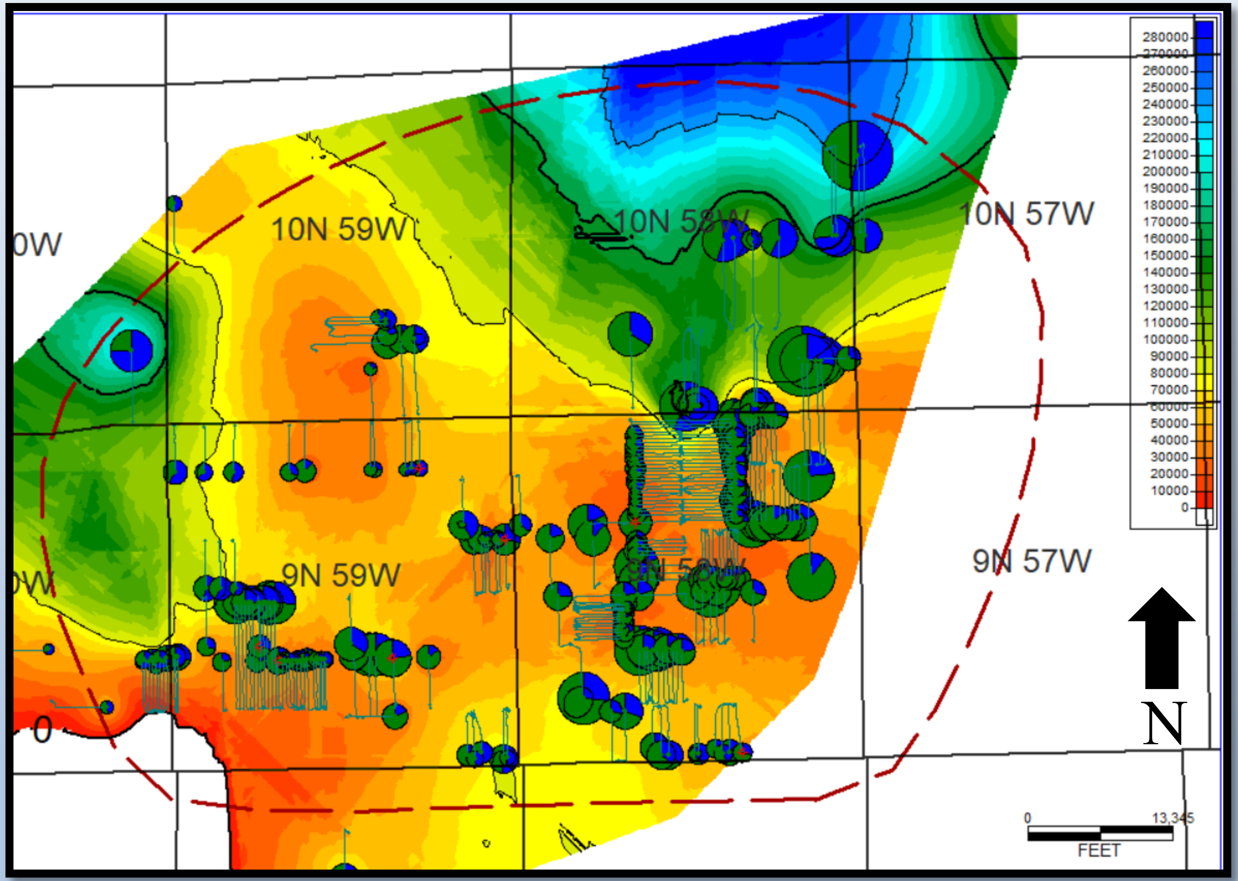




B1 Chalk has a variable thickness in the field ranging from 20-35 ft.
The dark blue spot is the location of the Razor 26J-2633L well. The thickness of the other interval seem appropriate and my current theory is that there is a fault that thinned the Nio B1.

Niobrara B Cumulative Production Data



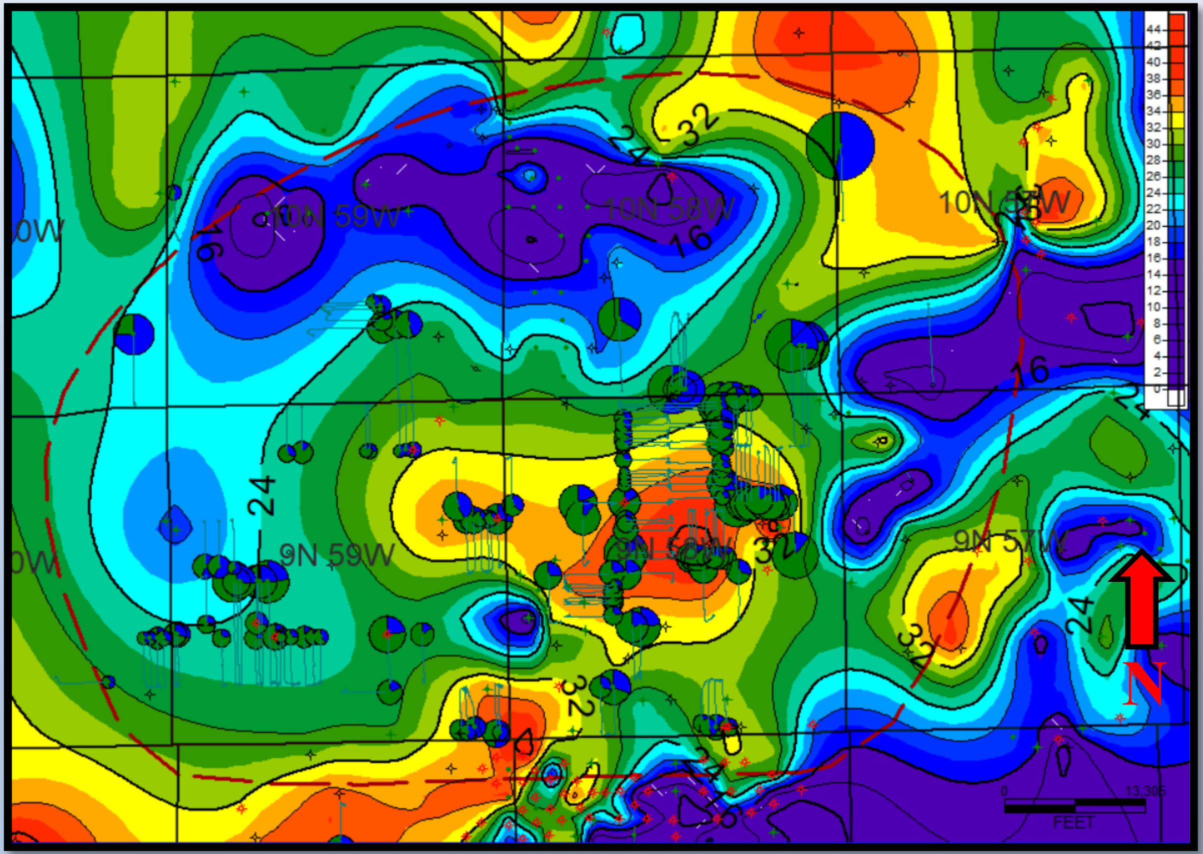


Cumulative oil ranges from
10,000-260,000 BO

Cumulative water rages from
0-280,000 BW

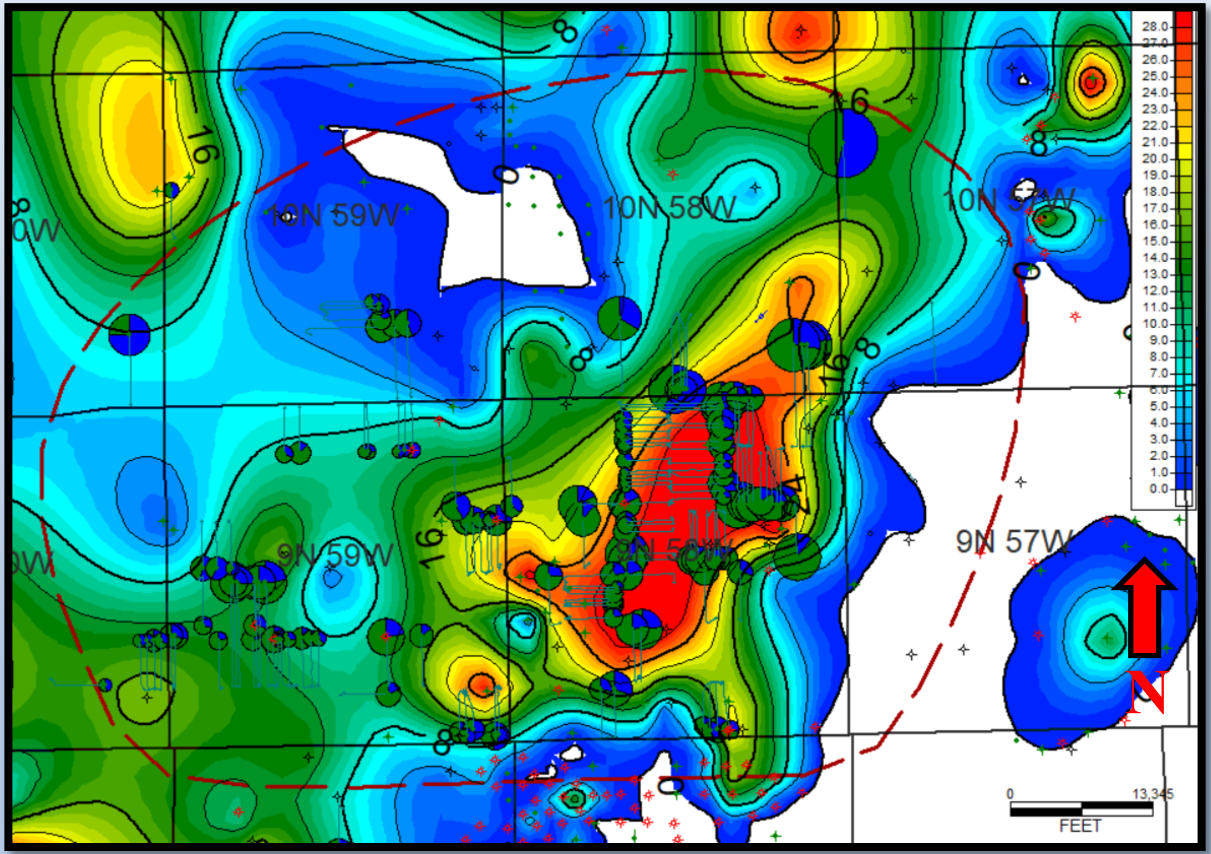
B2 Chalk Resistivity Isopach Maps

Niobrara B2 chalk 15 ohm



Ranges from 0-44 feet thick

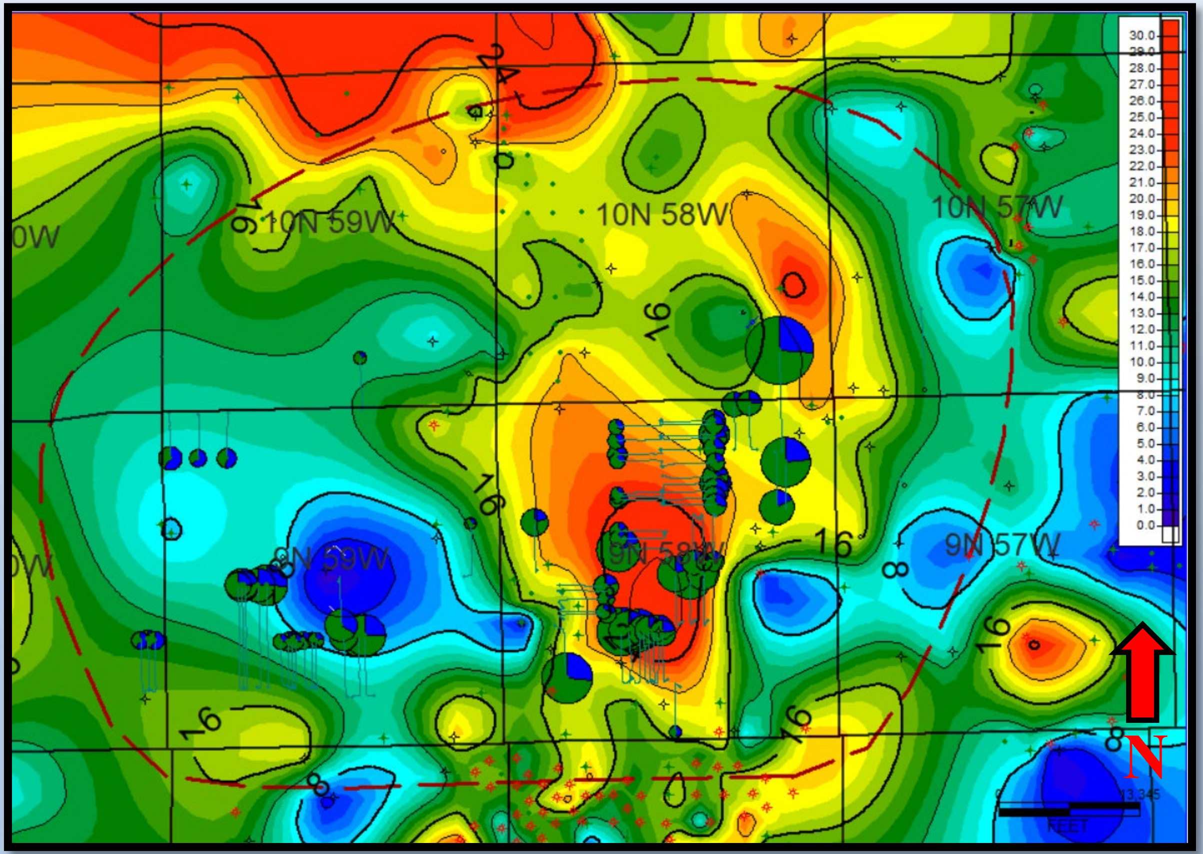
Niobrara B2 chalk 30 ohm resistivity



Ranges from 0-28 feet thick

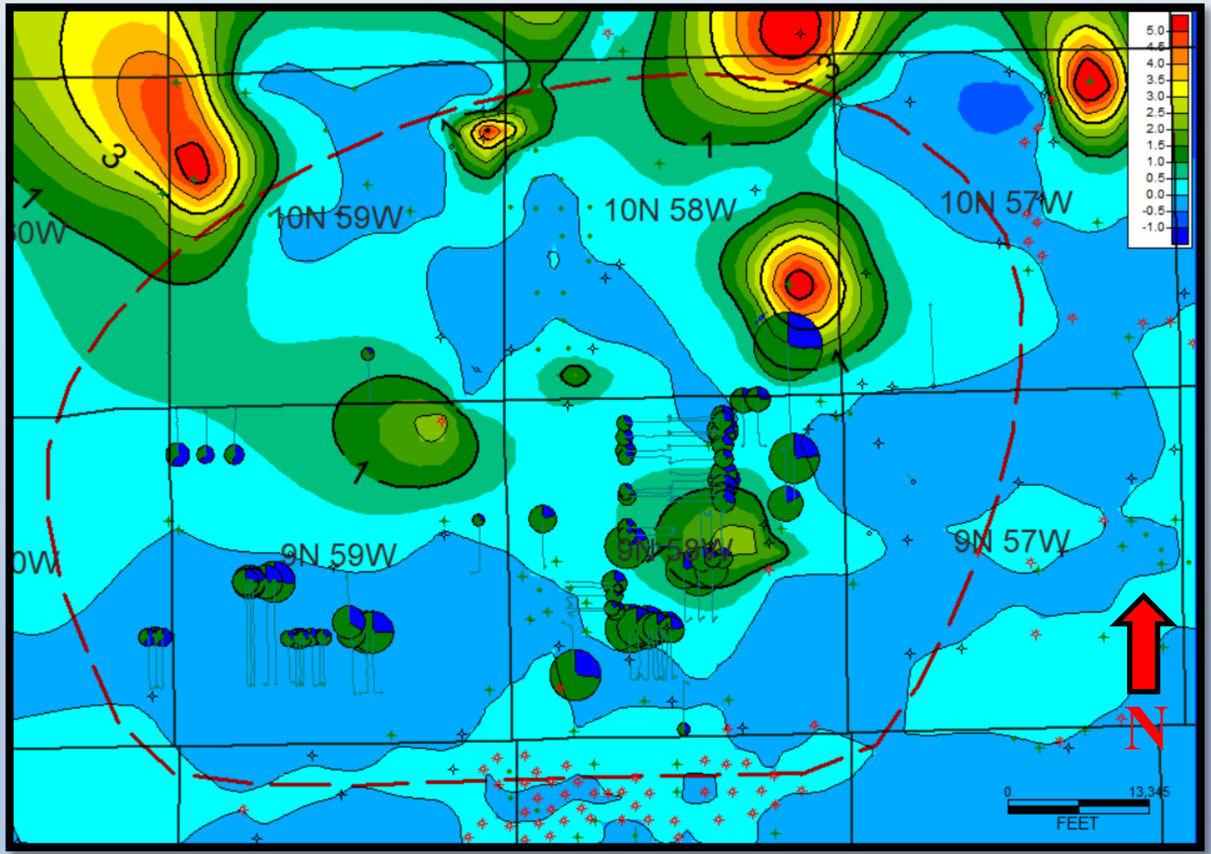
B1 Chalk Resistivity Isopach Maps

Niobrara B1 chalk 15 ohm resistivity



Ranges from 0-30 feet thick

Niobrara B1 chalk 30 ohm resistivity



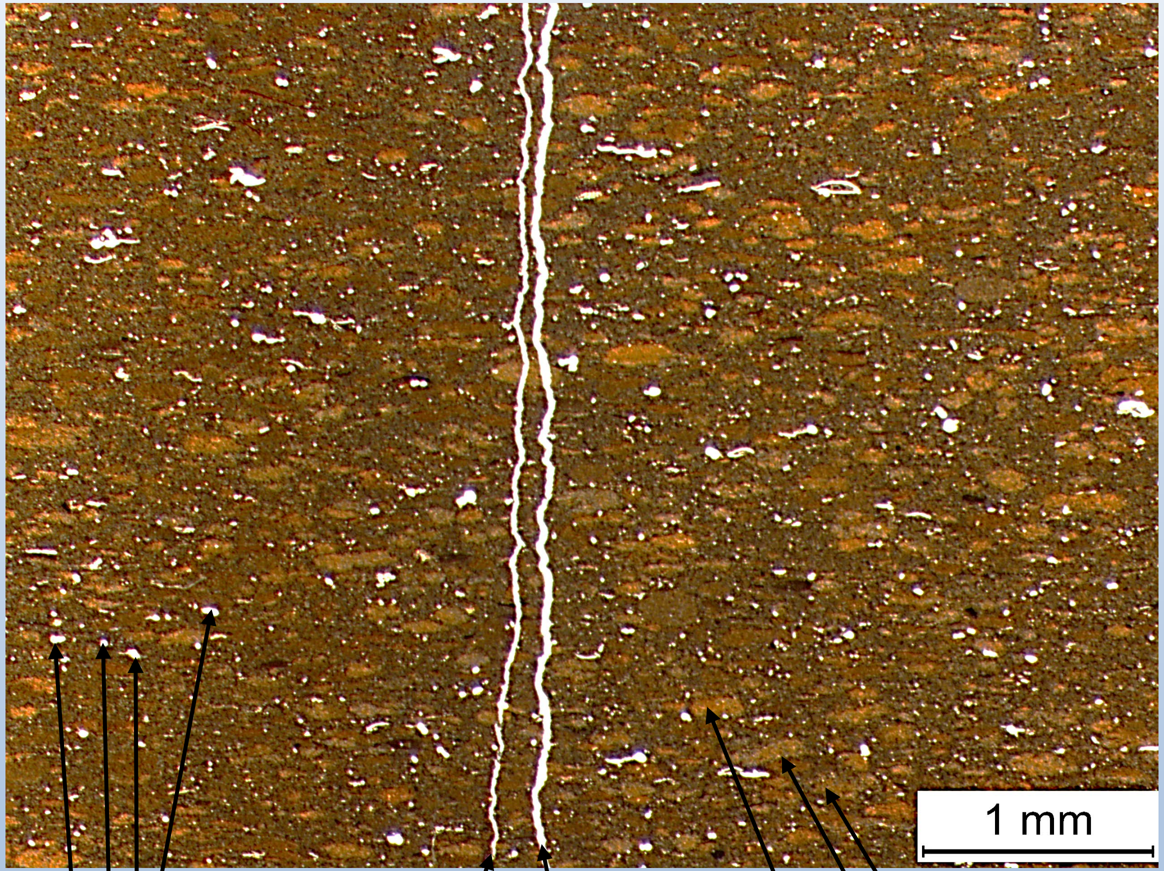
Ranges from 0-5 feet thick

THIN SECTIONS
RAZOR 25-2514H

COLORADO SCHOOL OF MINES MUDTOC

Niobrara B1 Chalk

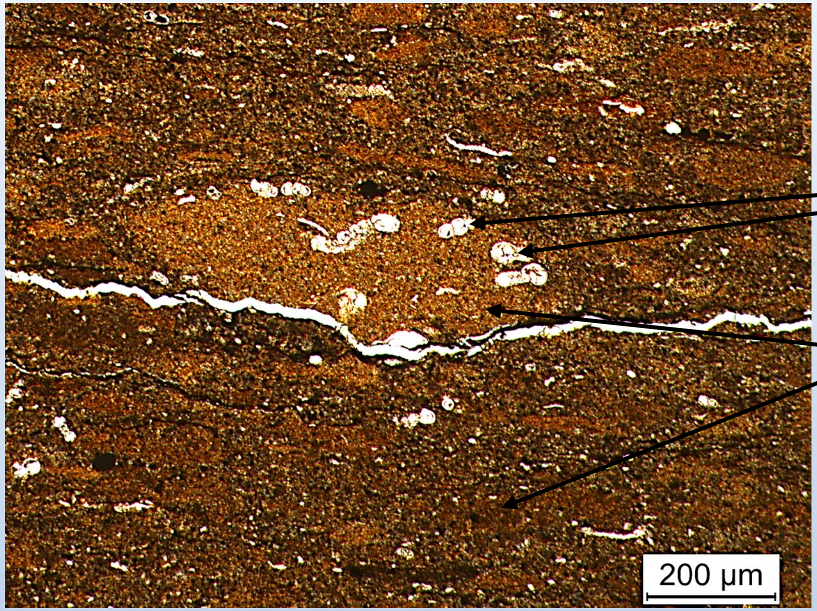
Pellet Packstone



Forams

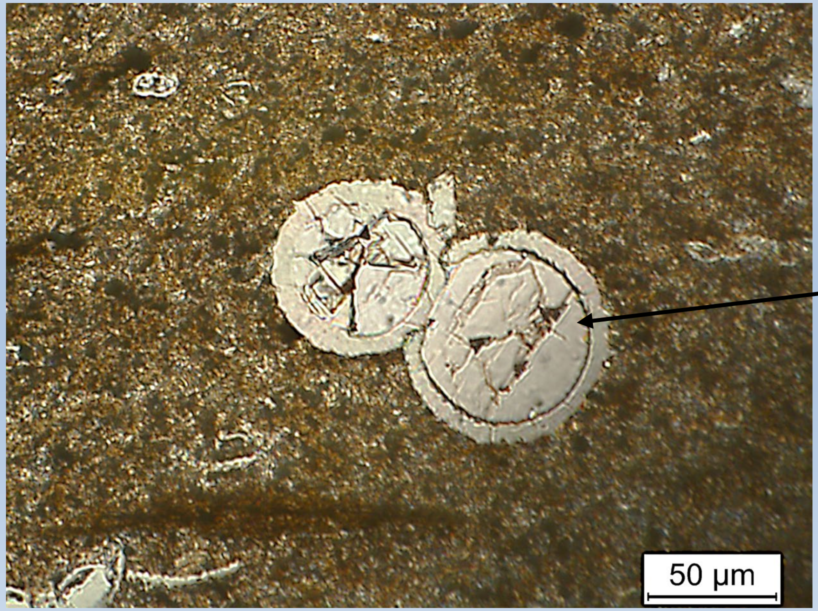
Calcite Filled
Vertical Fractures

Fecal Pellets



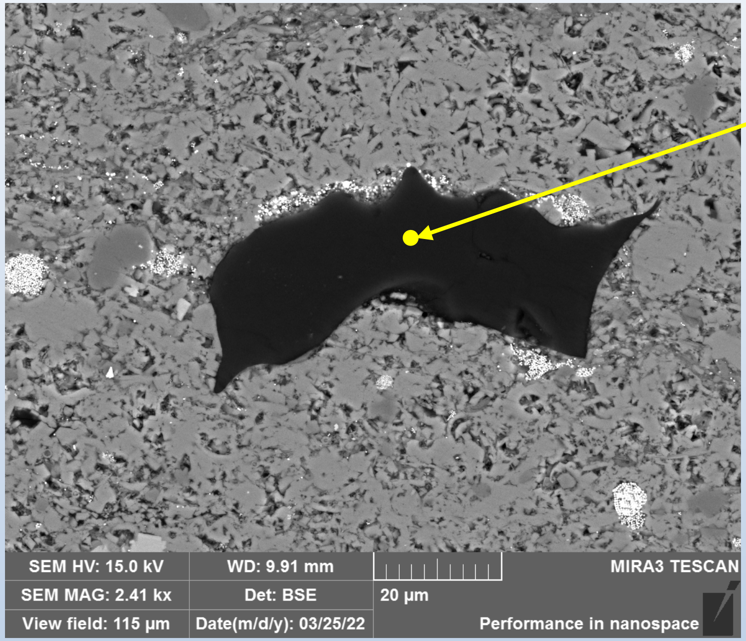
Forams

Fecal Pellets

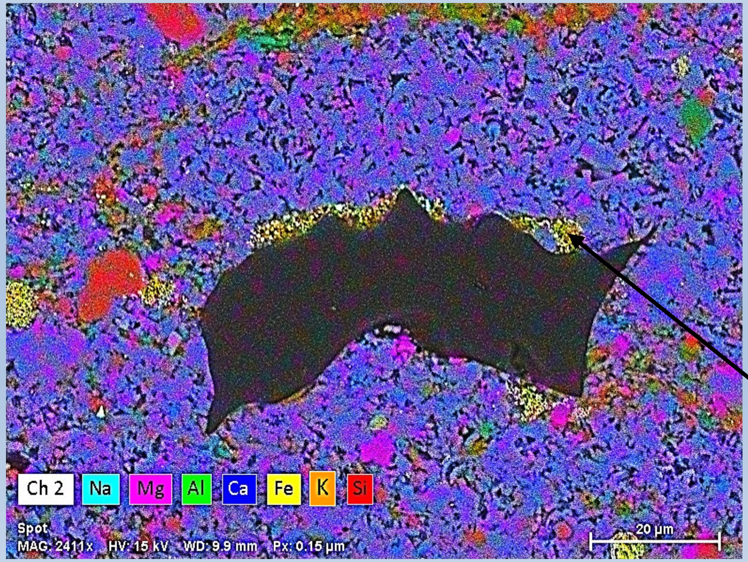


Foram with Calcite
Cement Filled
Chambers

Organic Matter and Pore Space



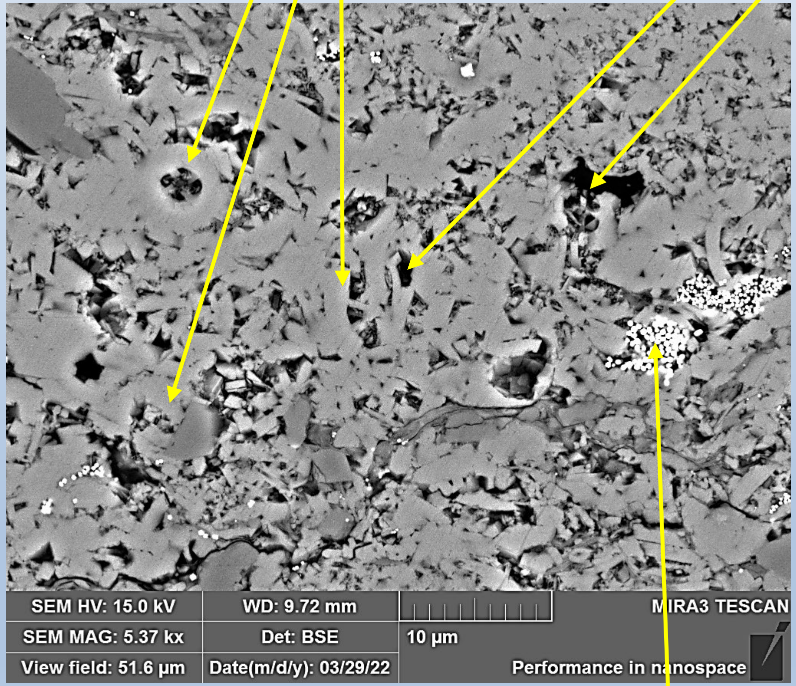
Organic Matter
EDS Wt%
O: 1.5
S: 0.9
Ca: 0.3



Pyrite Framboid

Coccolith Fragments

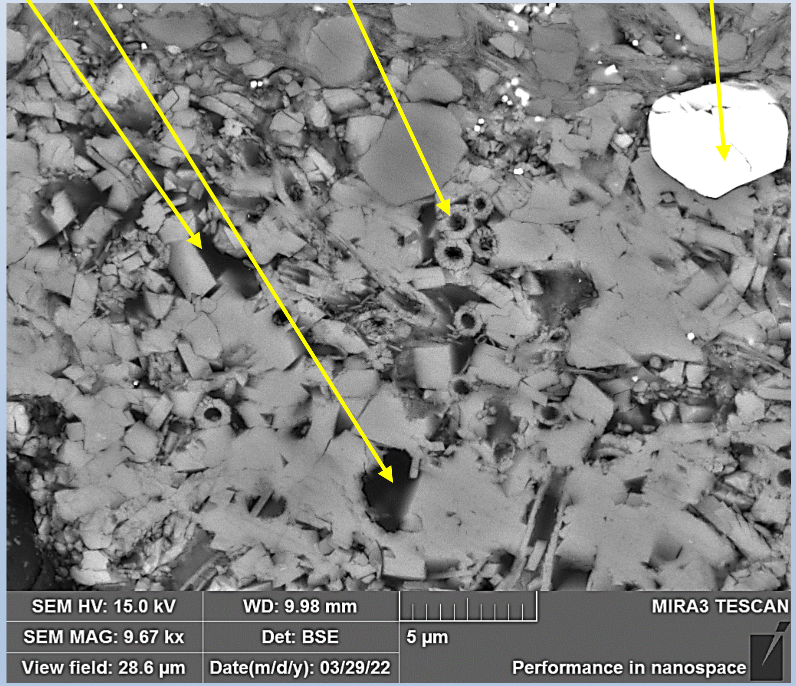
Organic Matter



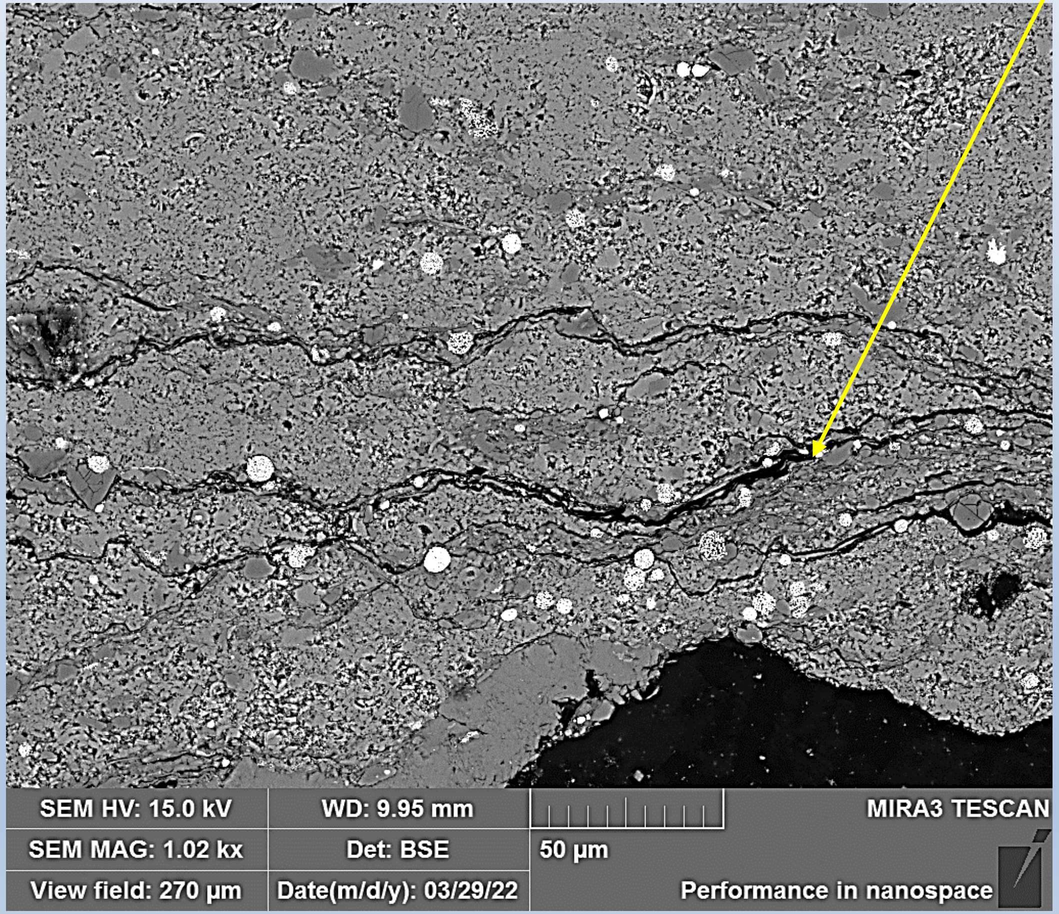
Pyrite Framboid

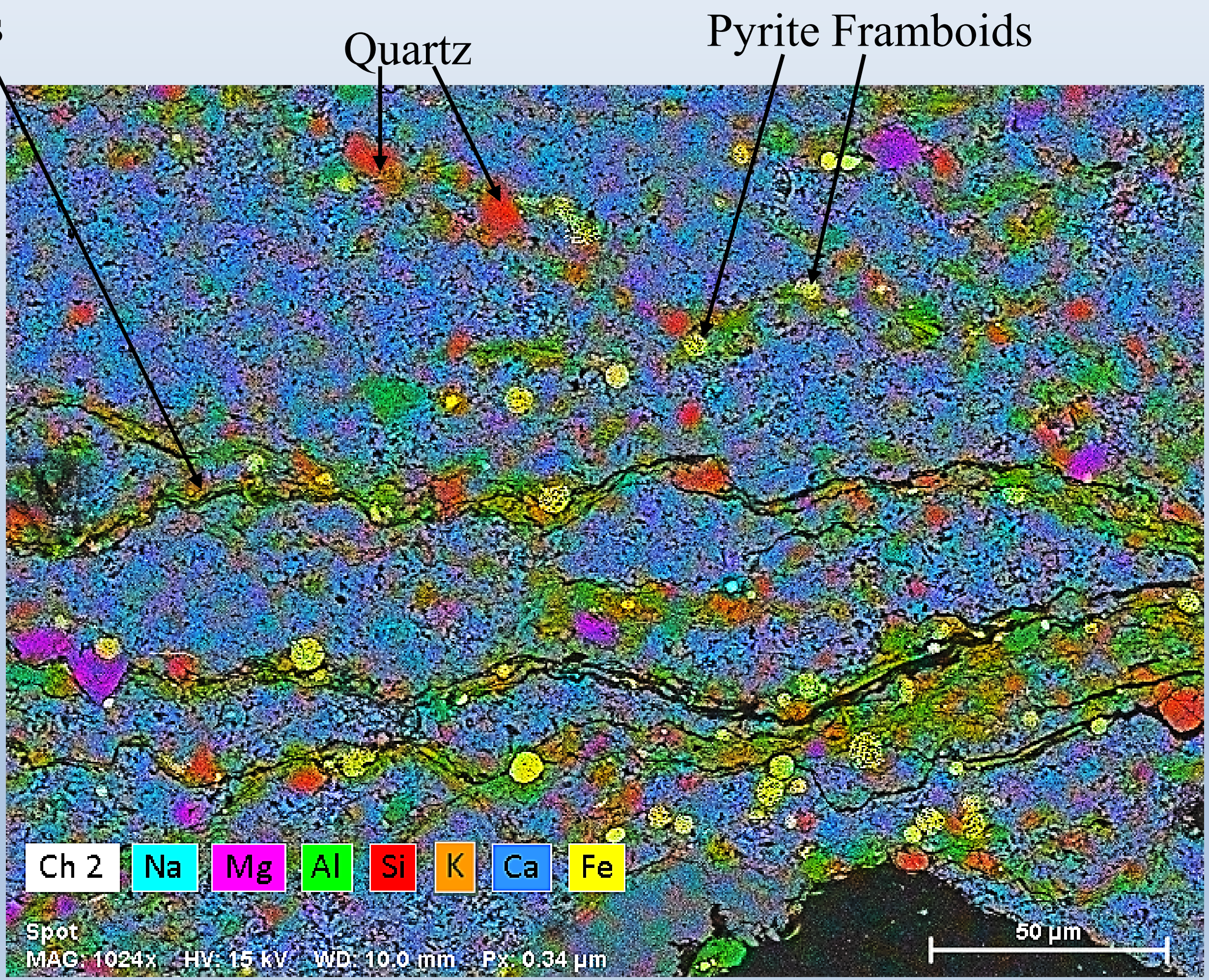
Coccolith Spines

Pyrite



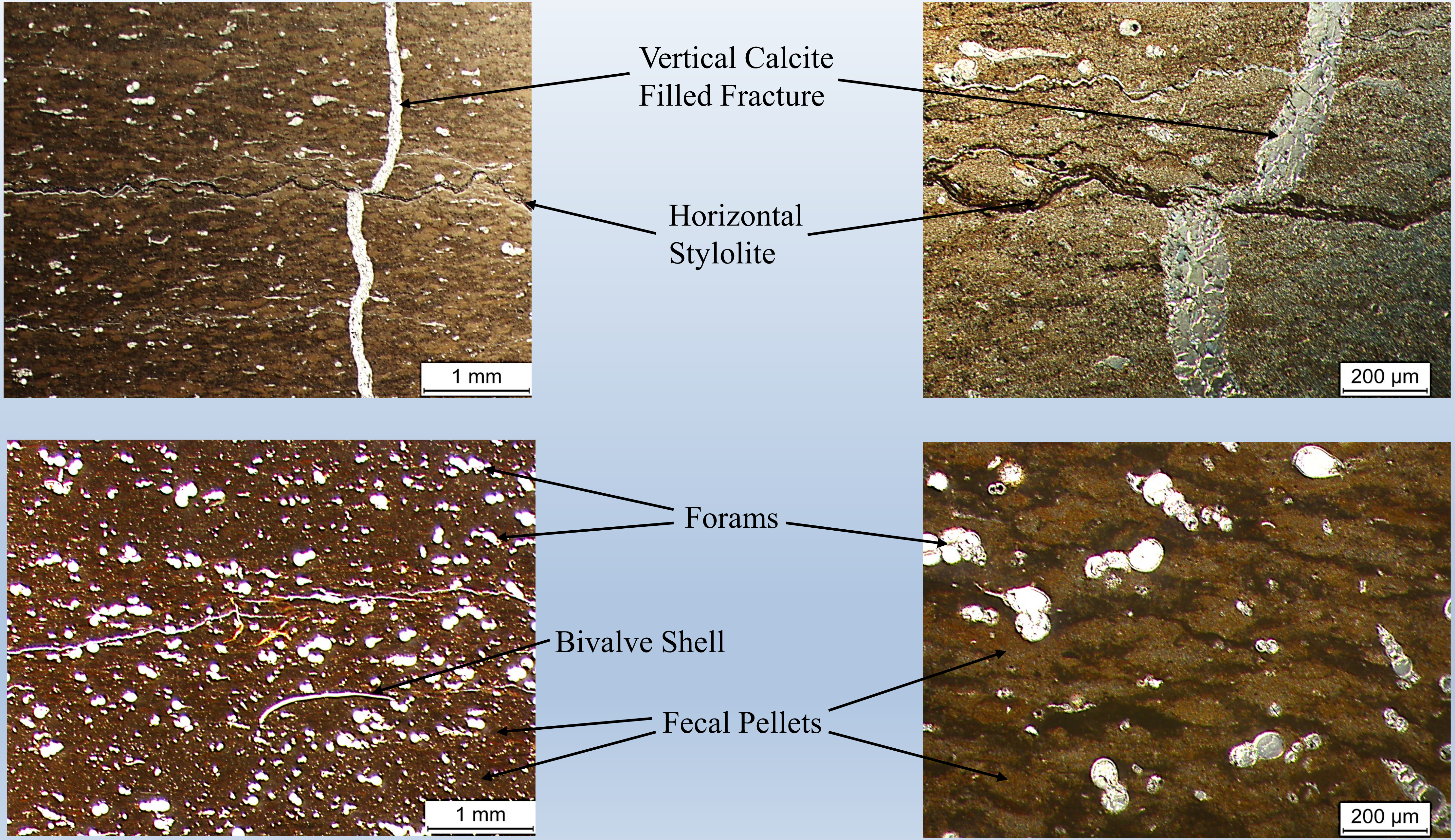
B1 Stylolites





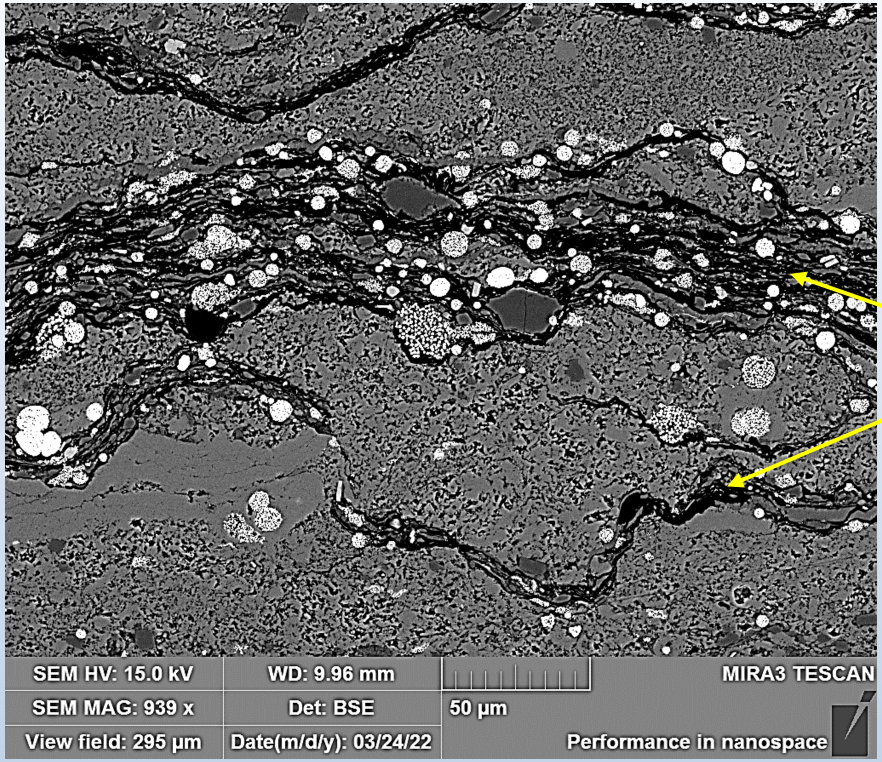
Niobrara B2 Chalk

COLORADO SCHOOL OF MINES
MUDTOC

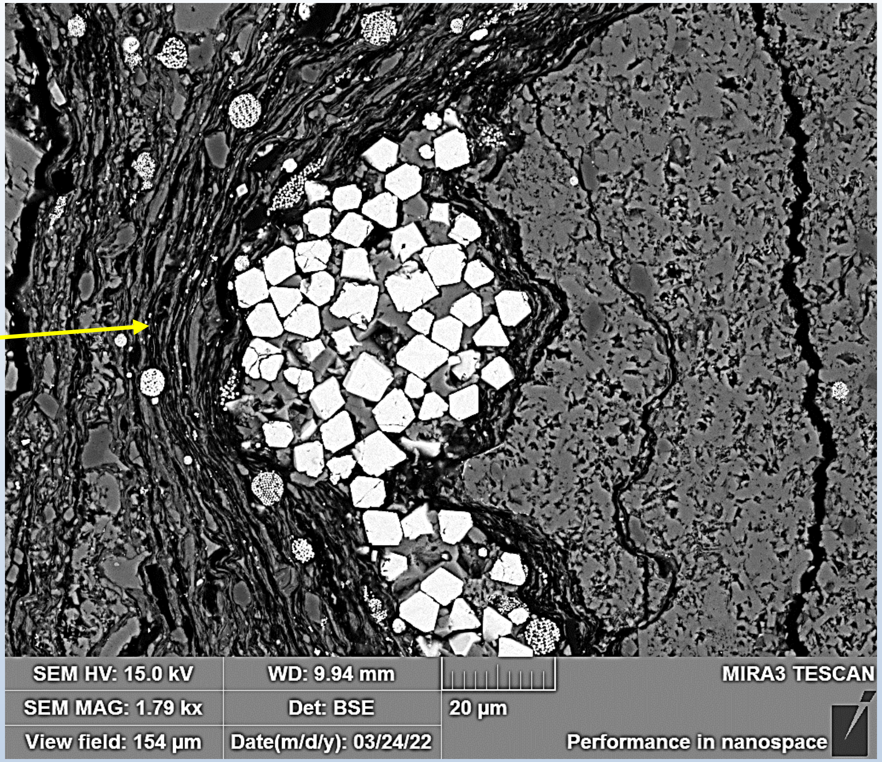


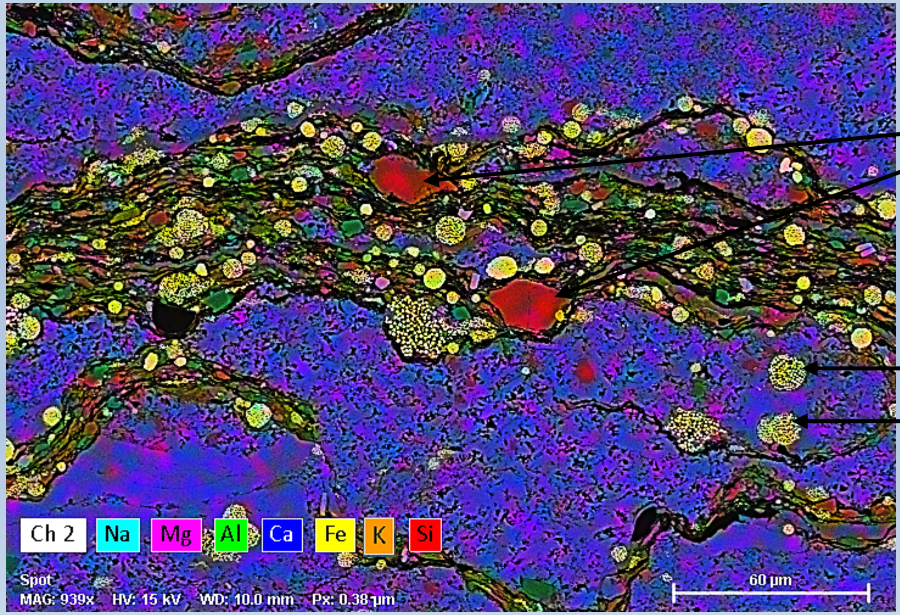
B2 Stylolites

COLORADO SCHOOL OF MINES
MINES
MUDTOC



Stylolites



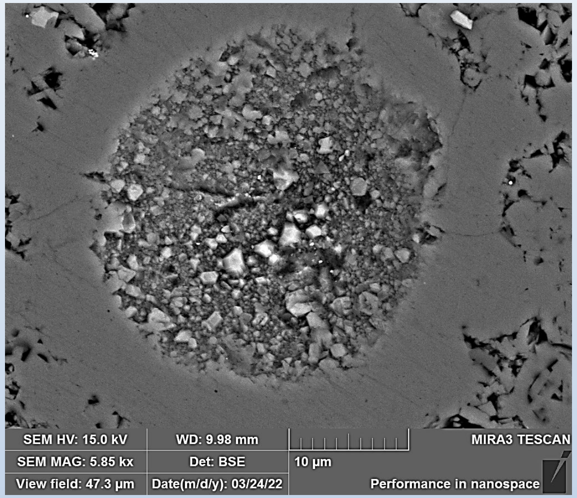


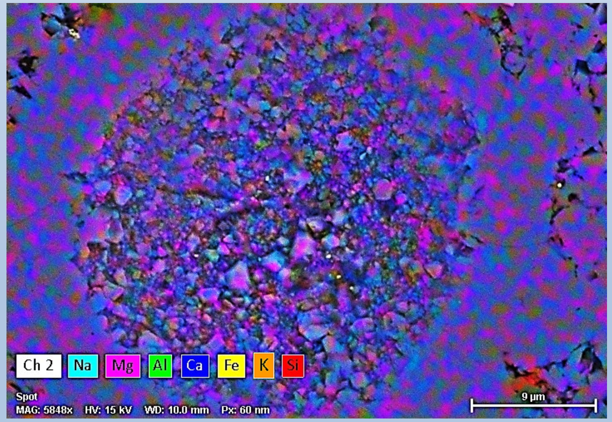
Quartz Grains

Pyrite

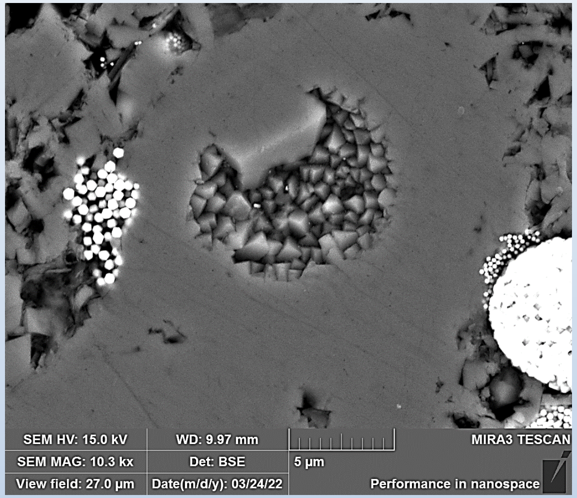
Pyrite Framboids

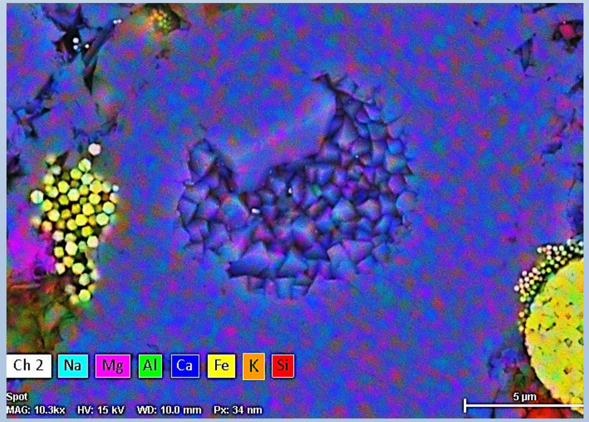
Foram Variations



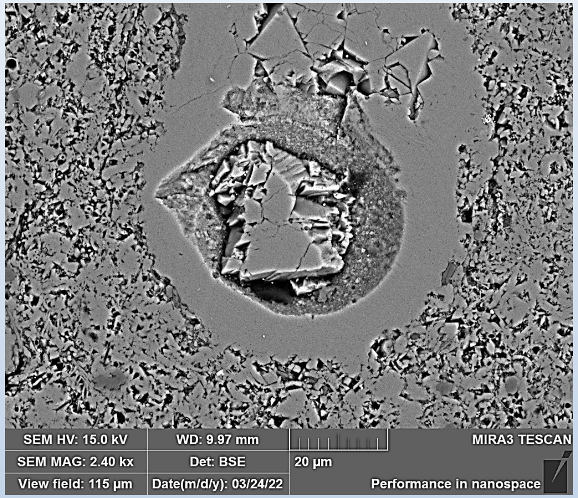


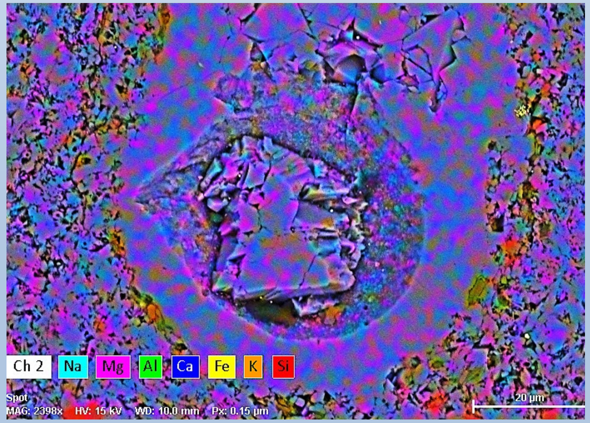
Empty



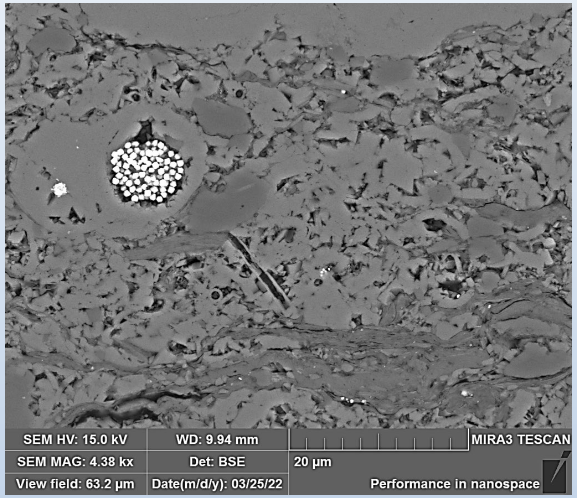


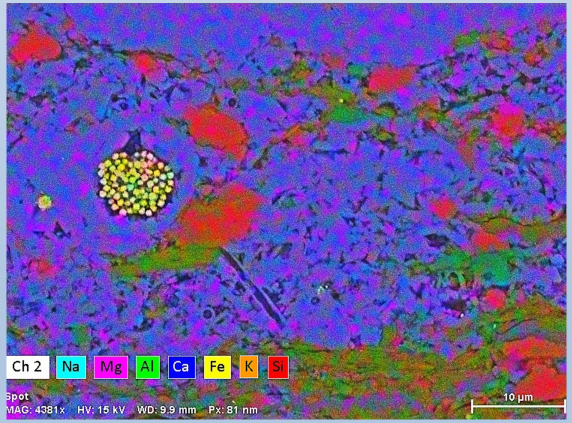
Partially Filled with Calcite Cement





Almost Completely Filled with Calcite Cement



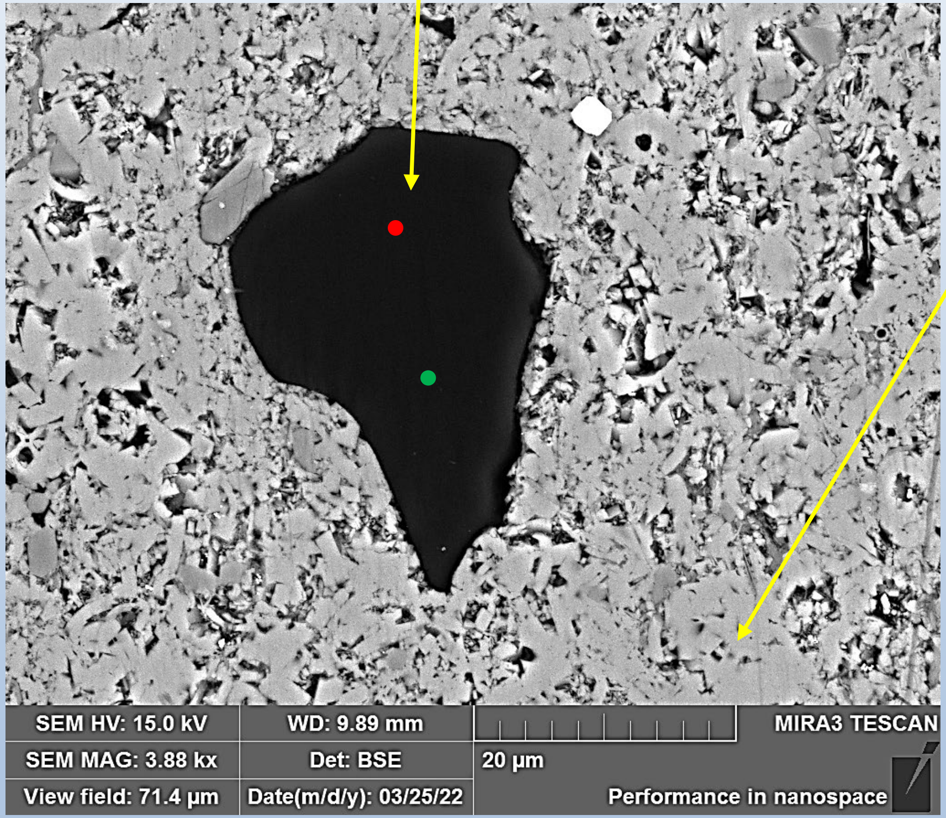


Filled with Pyrite Framboid

Organic Matter and Pore Space

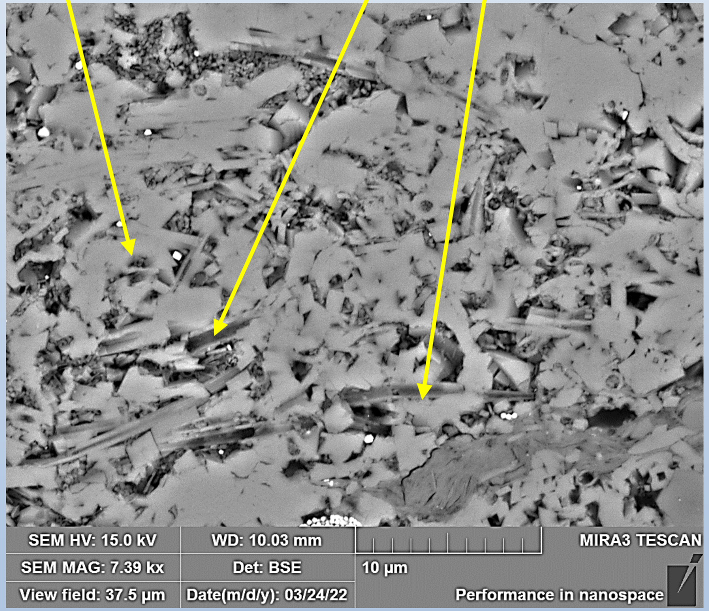
COLORADO SCHOOL OF MINES
MUDTOC

Organic Matter

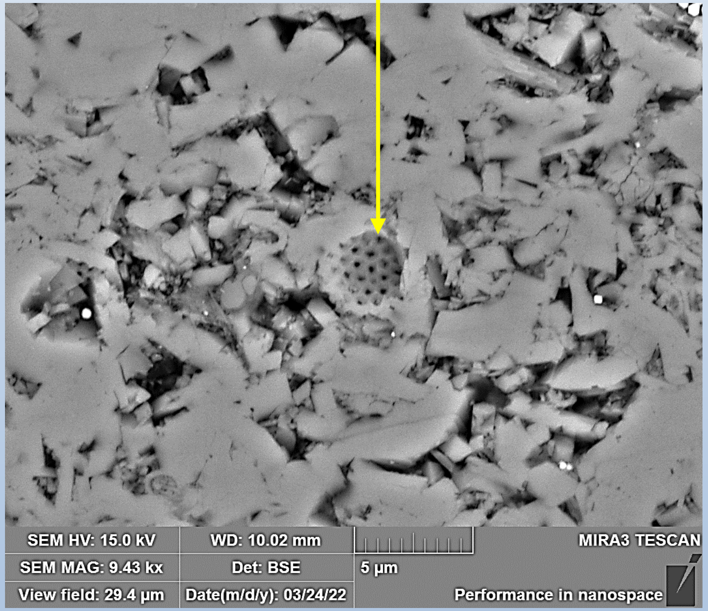


Coccolith Fragments

Coccolith Spines

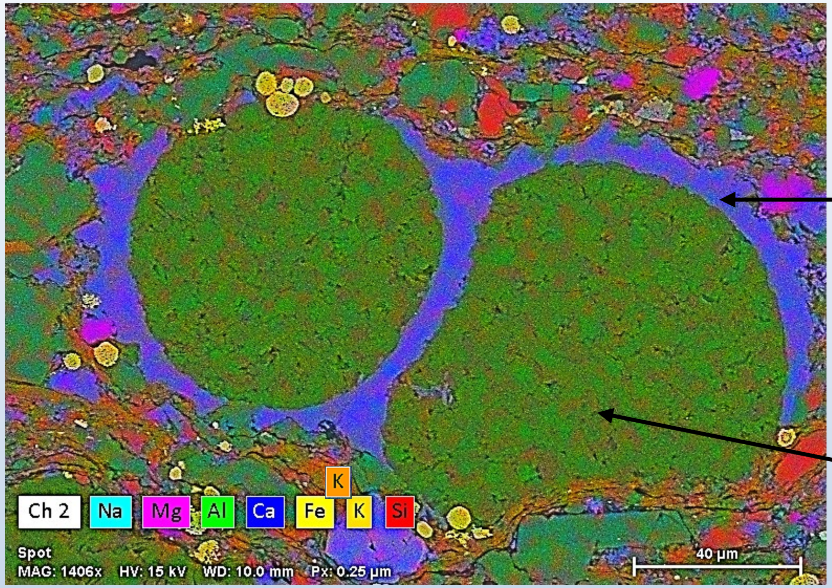


Coccolith Fragment



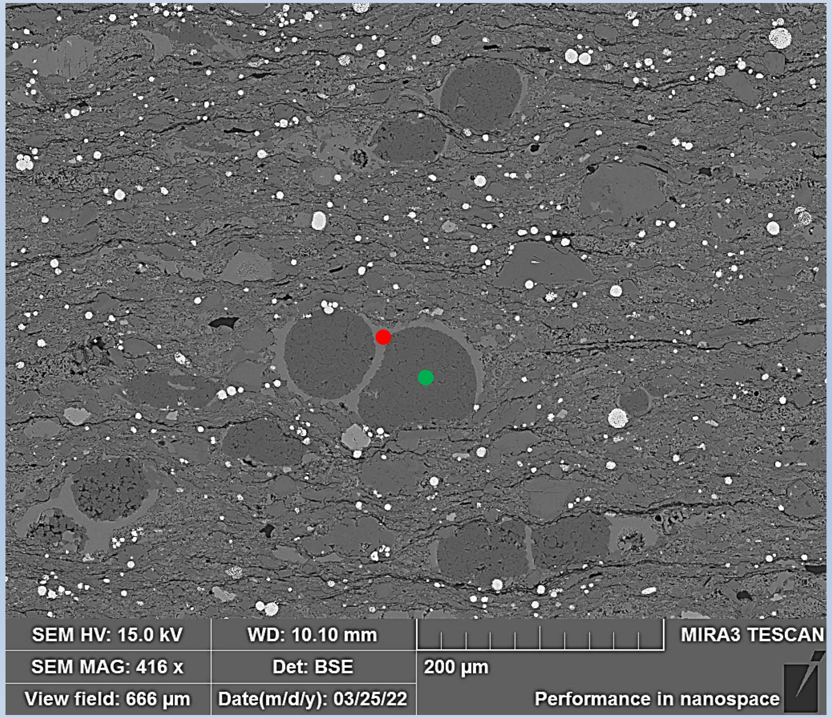
	Spectrum	O	Mg	S	Ca
Spot 1	Spot 919	2.1	0.2	1.0	1.0
Spot 2	Spot 920	2.0	0.2	1.1	0.8

Clay Composition

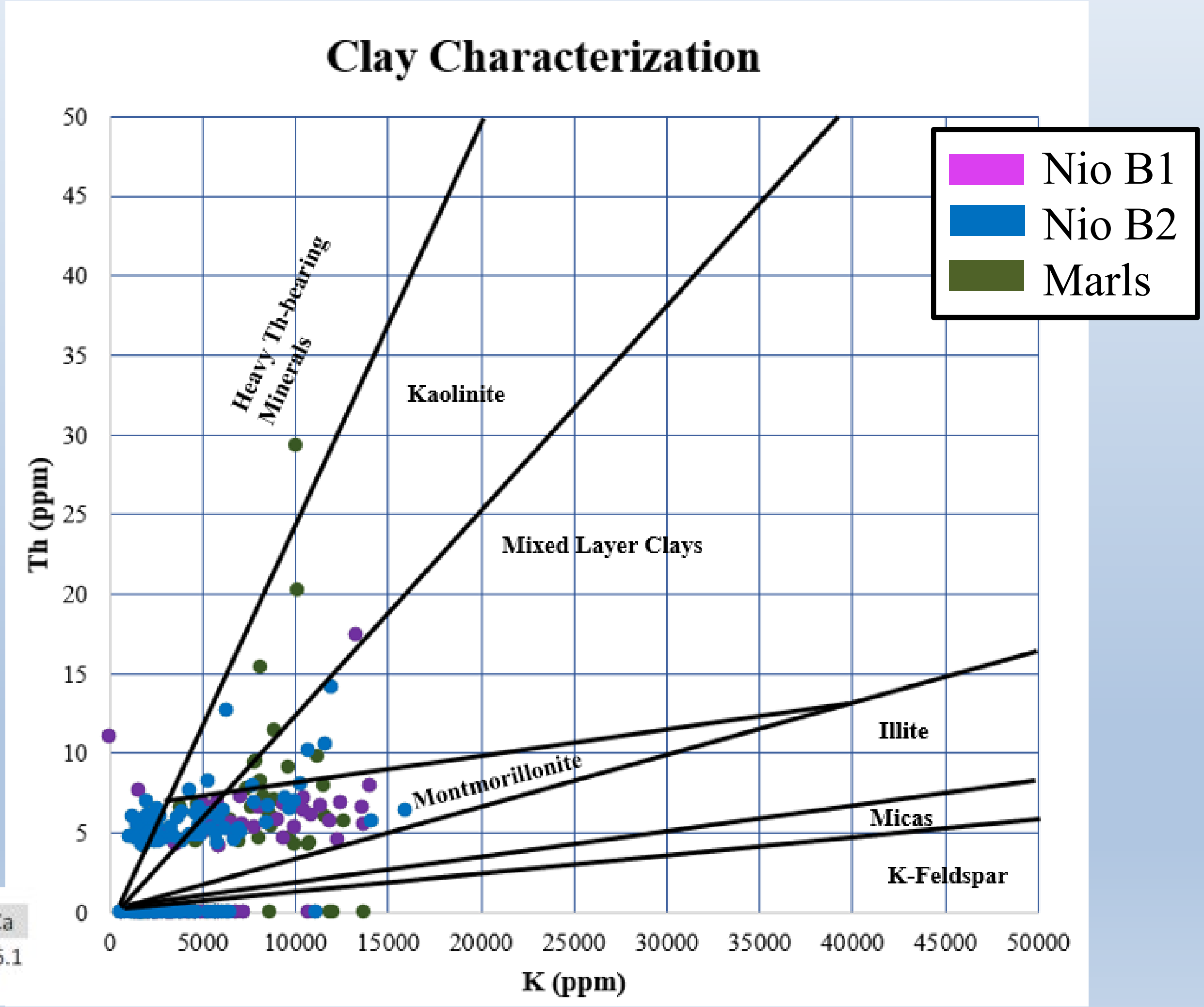


Foram Calcite Shell

Montmorillonite
$Al_2H_2O_{12}Si_4$



Spectrum	O	Al	Si	Ca
Spot 1	50.9			46.1
Spot 2	48.7	18.2	19.9	

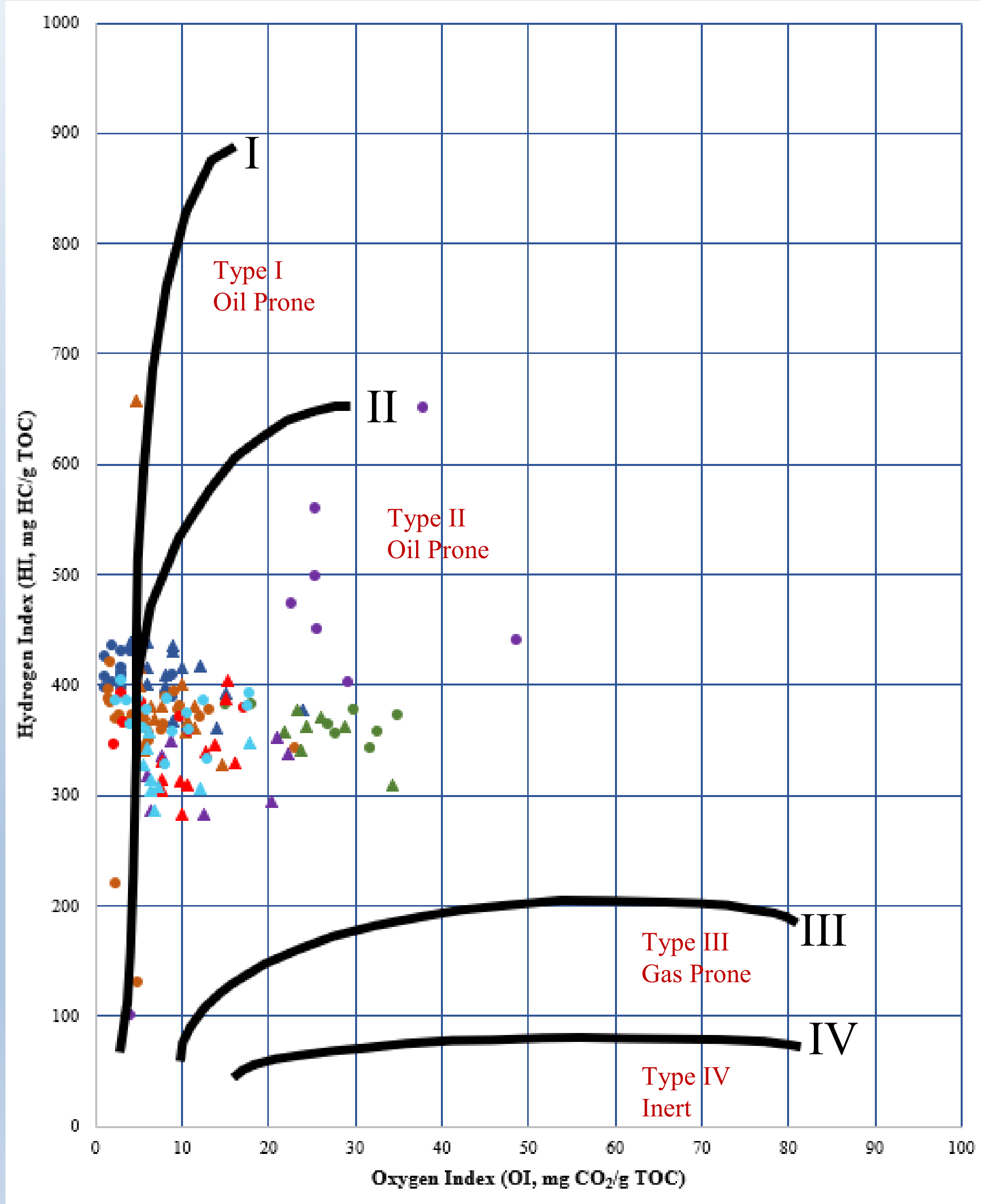


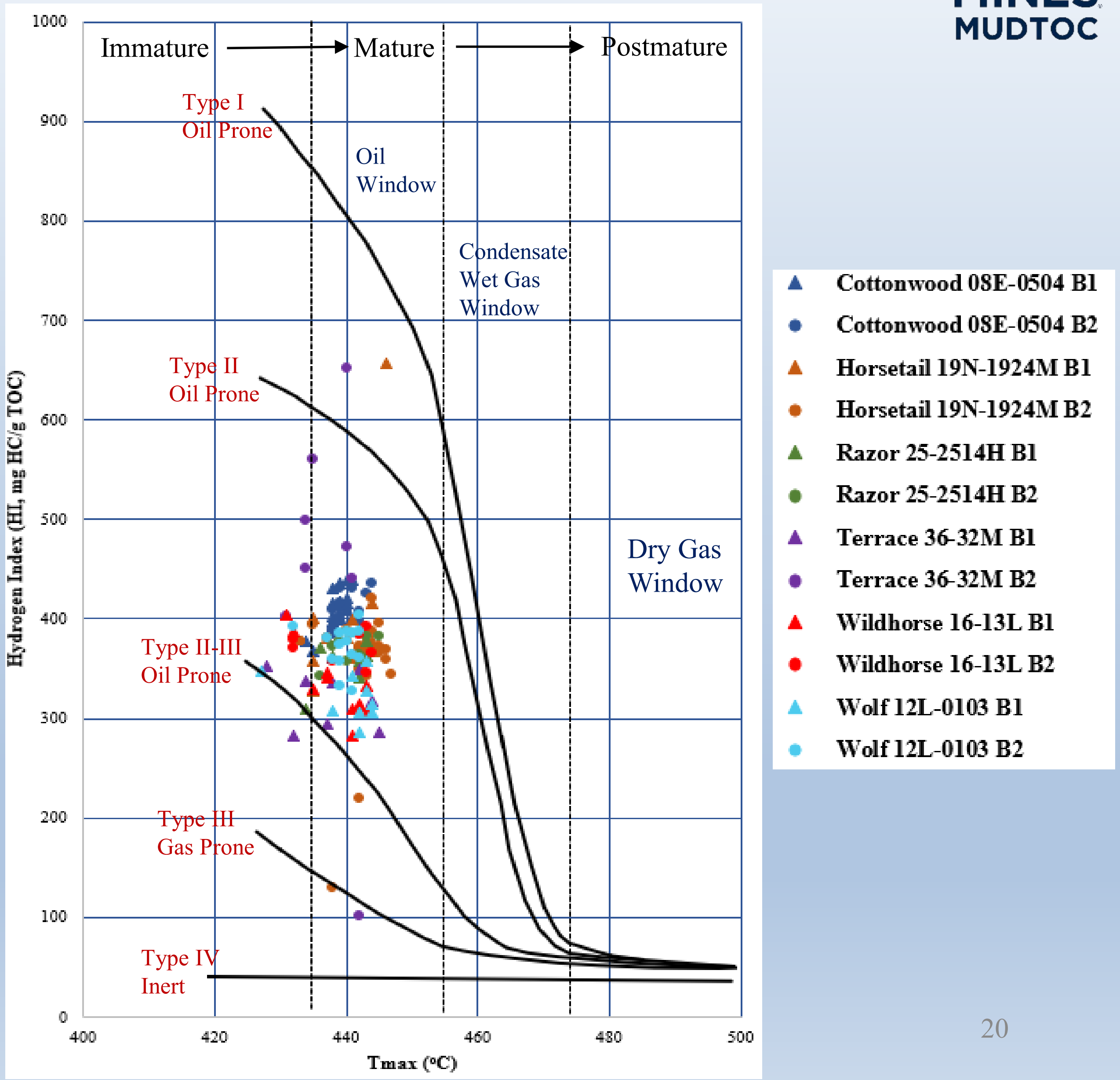
(Template from Schlumberger, 1985)

PYROLYSIS DATA
RAZOR 25-2514H

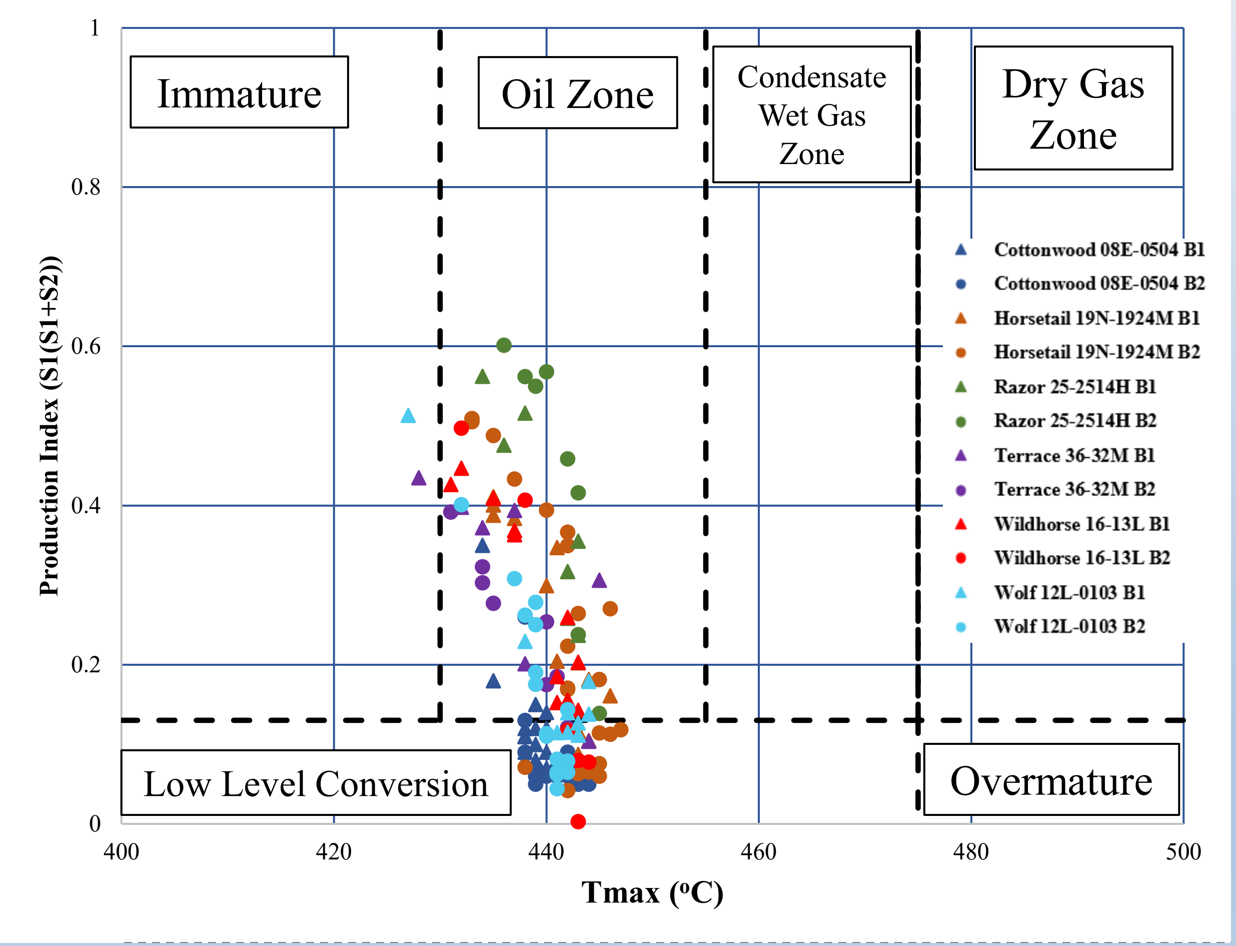
COLORADO SCHOOL OF MINES MUDTOC

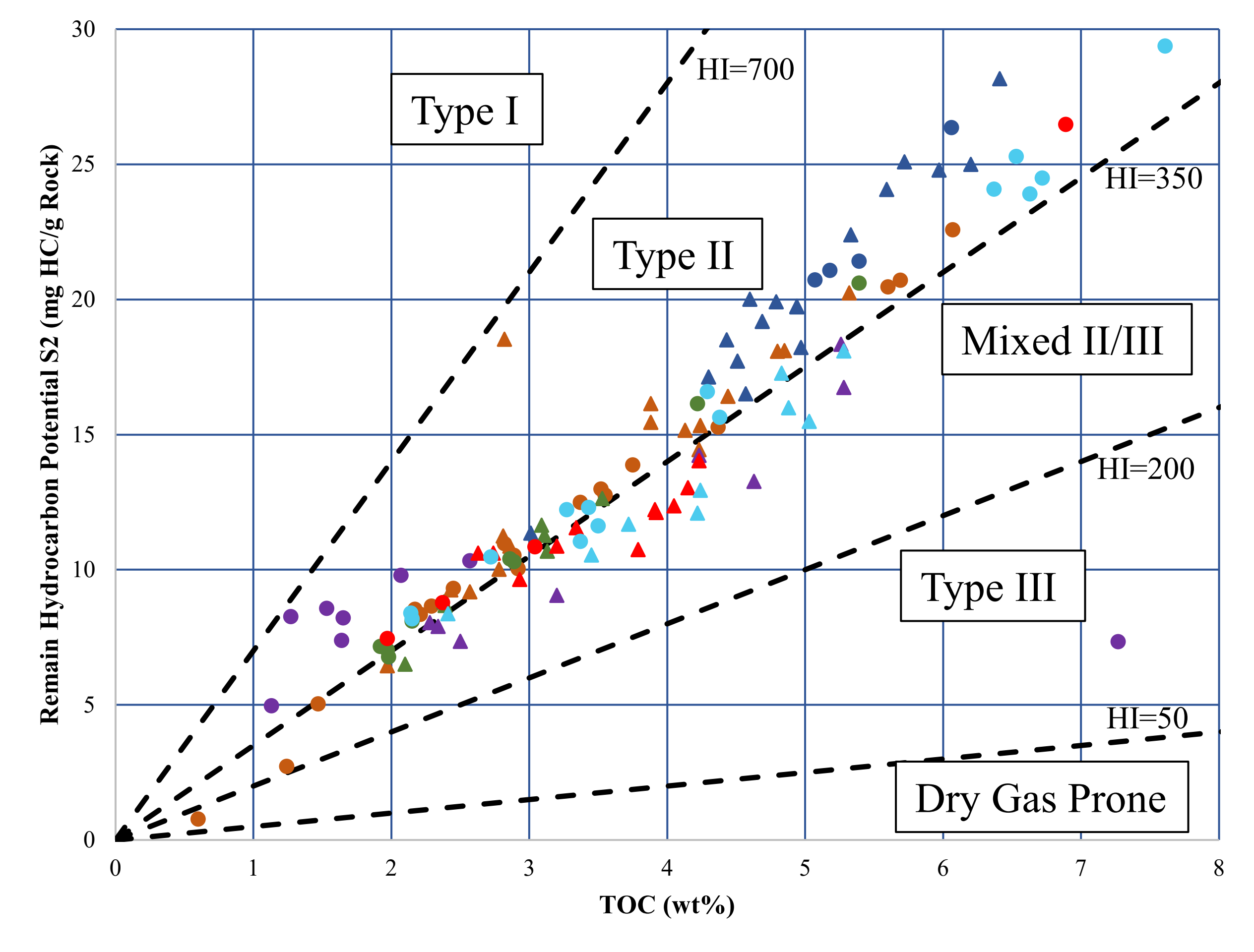
Modified Van Krevelen Diagram





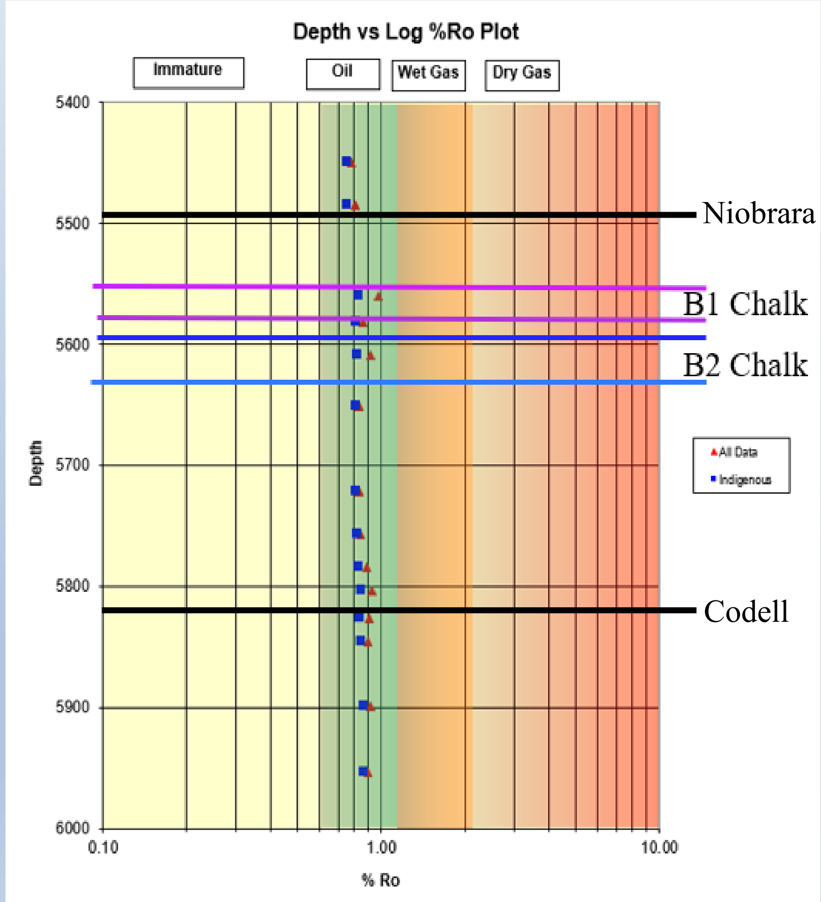
Kerogen Quality Plots



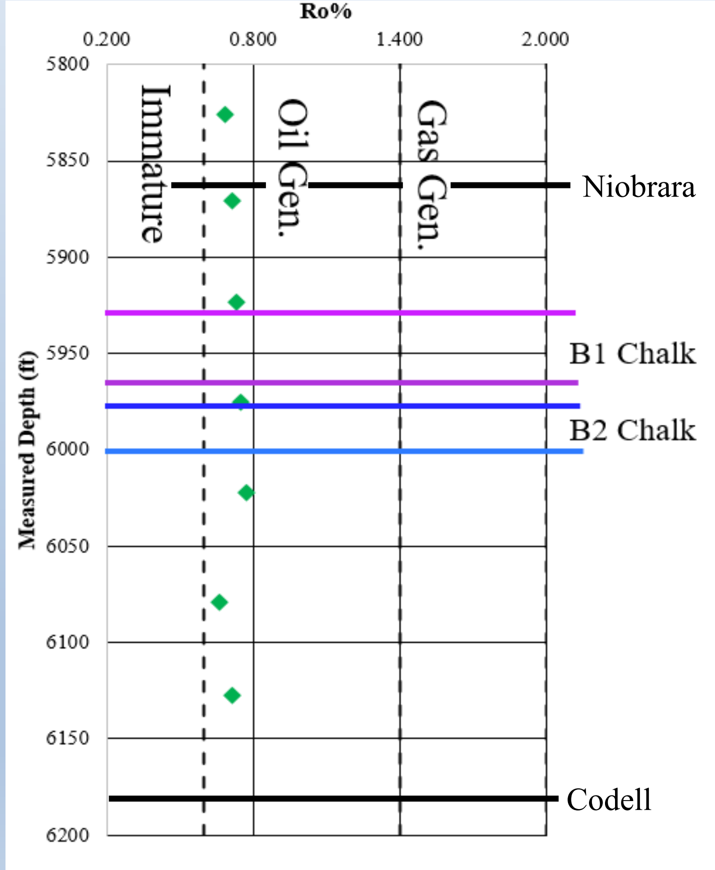


Vitrinite Reflectance

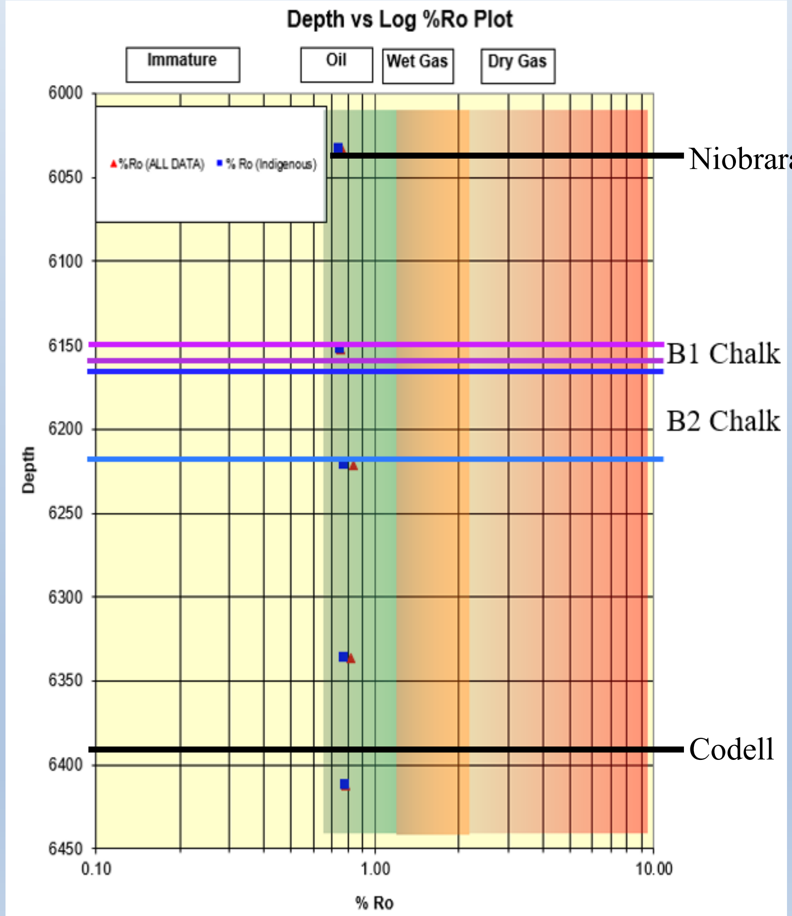
Horsetail
19N-1924M



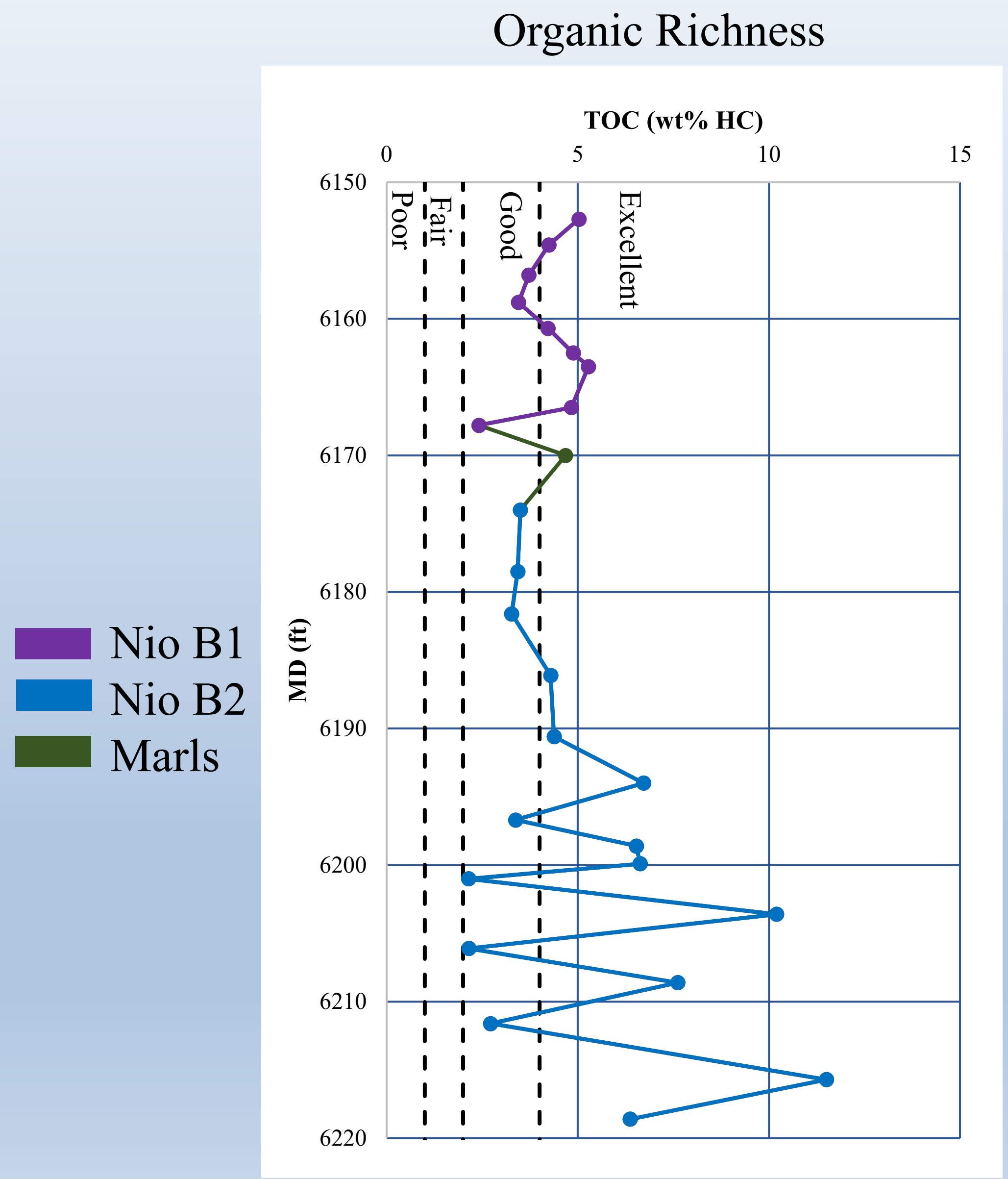
Terrace
36-32M

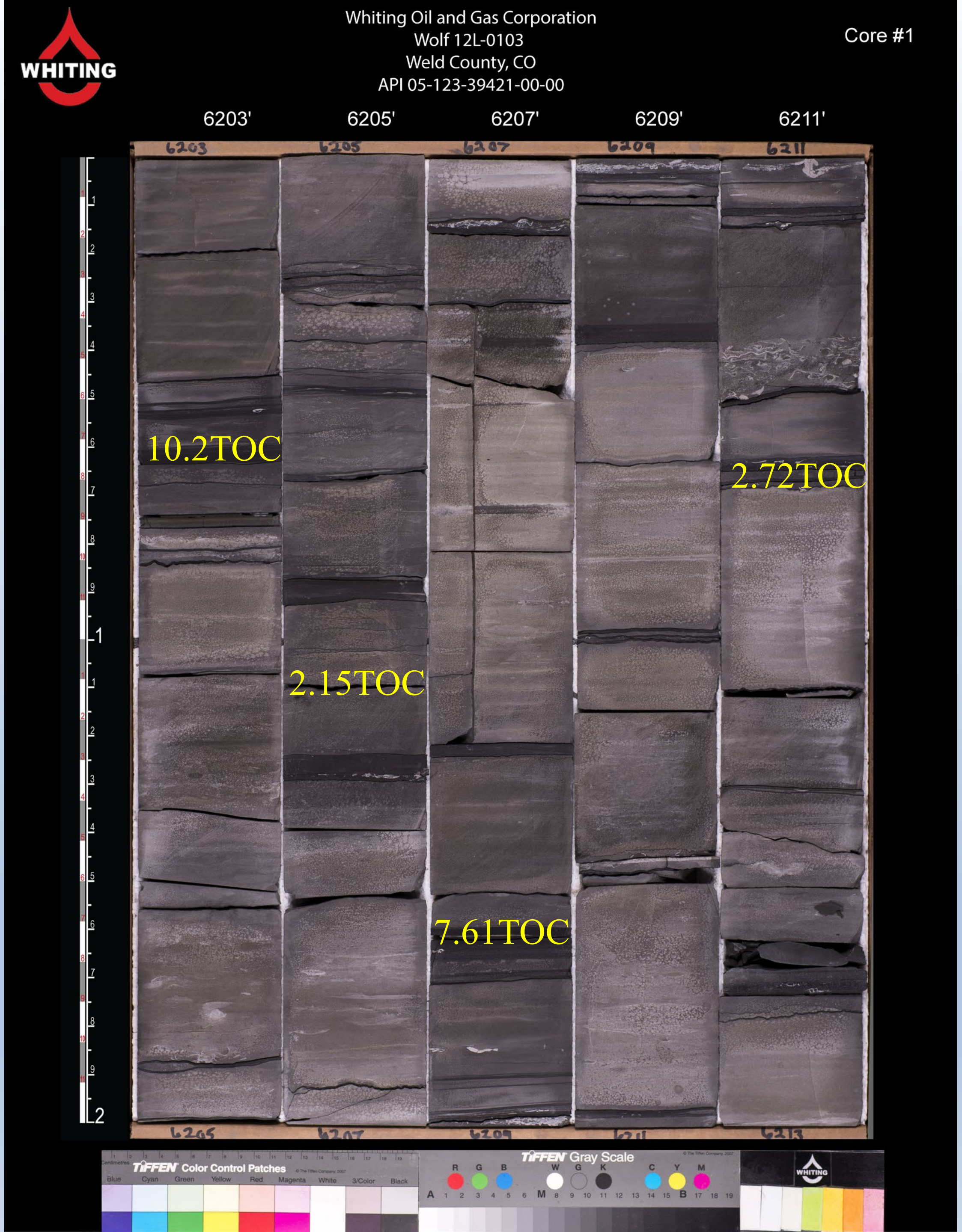


Wolf
12L-0103



Wolf 12L-0103

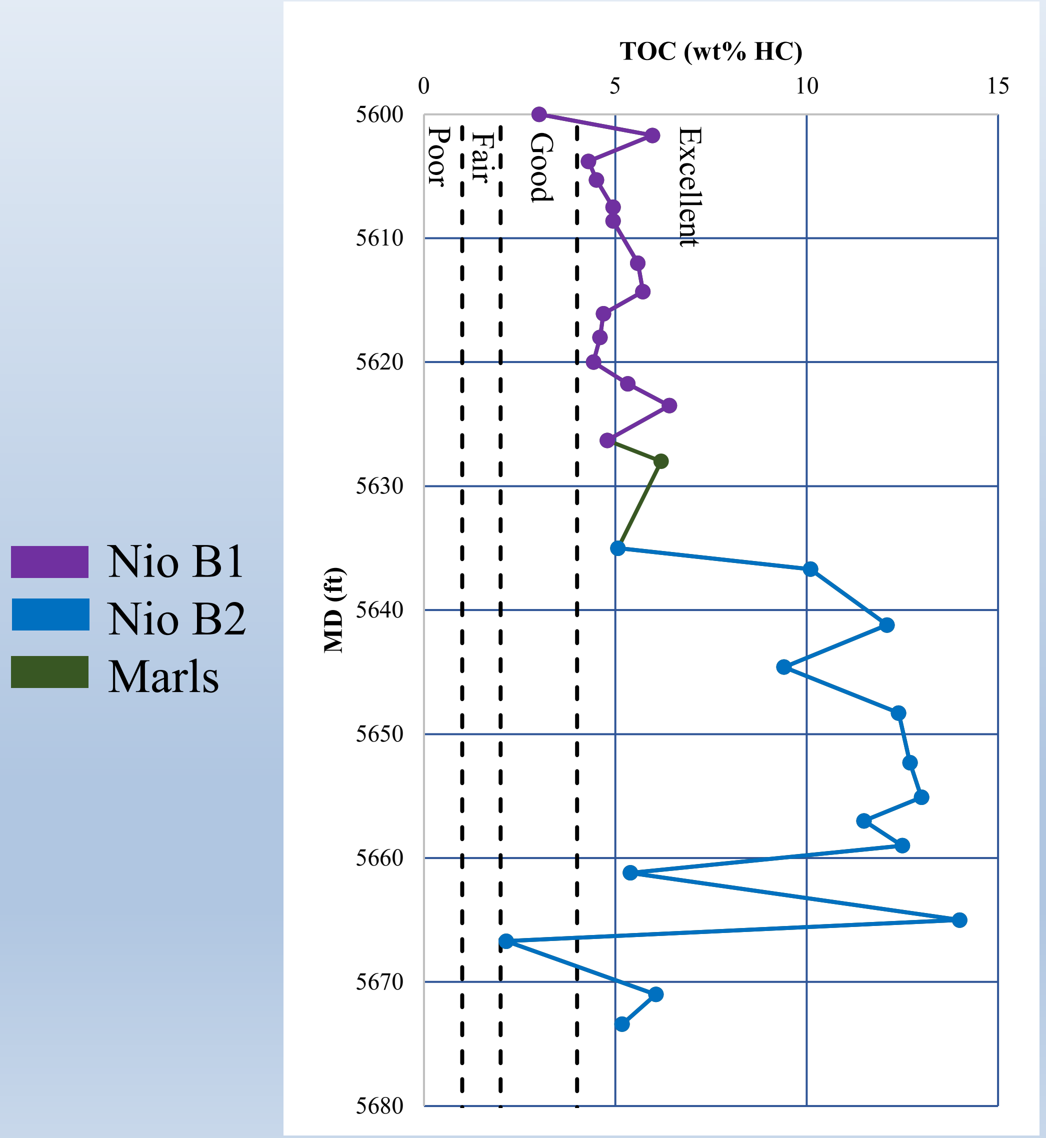


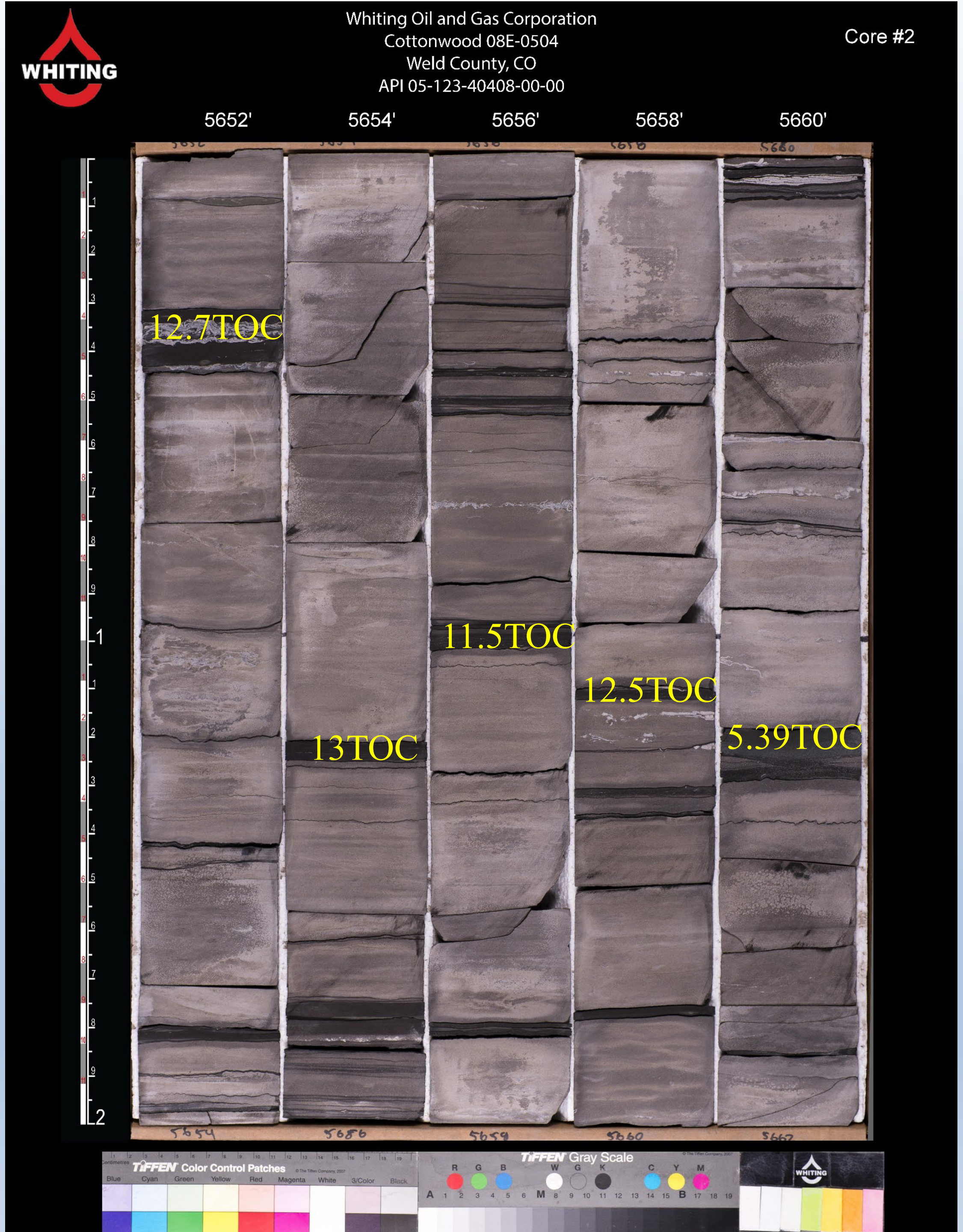


COLORADO SCHOOL OF MINES MUDTOC

Cottonwood 08E-0504

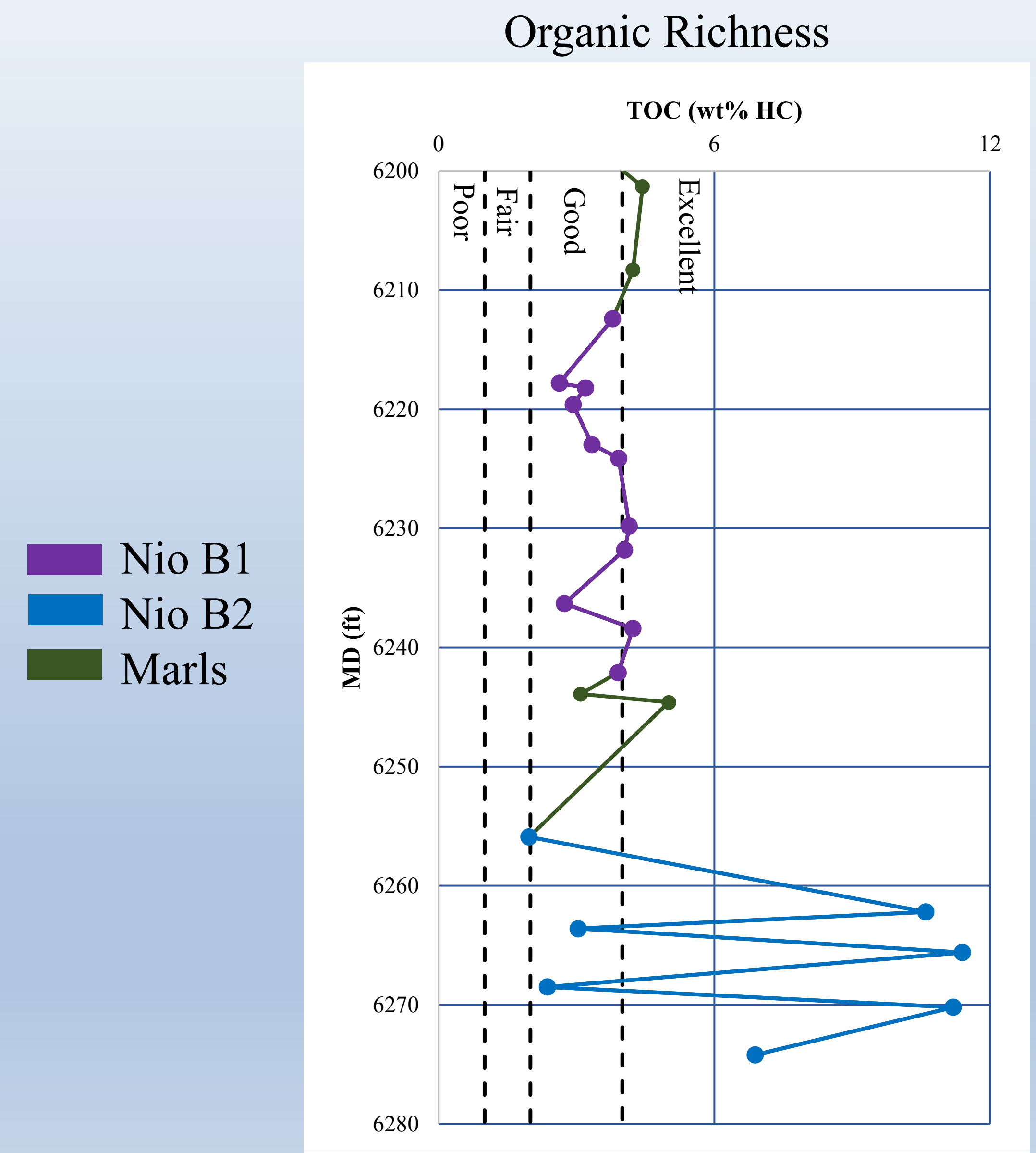
Organic Richness

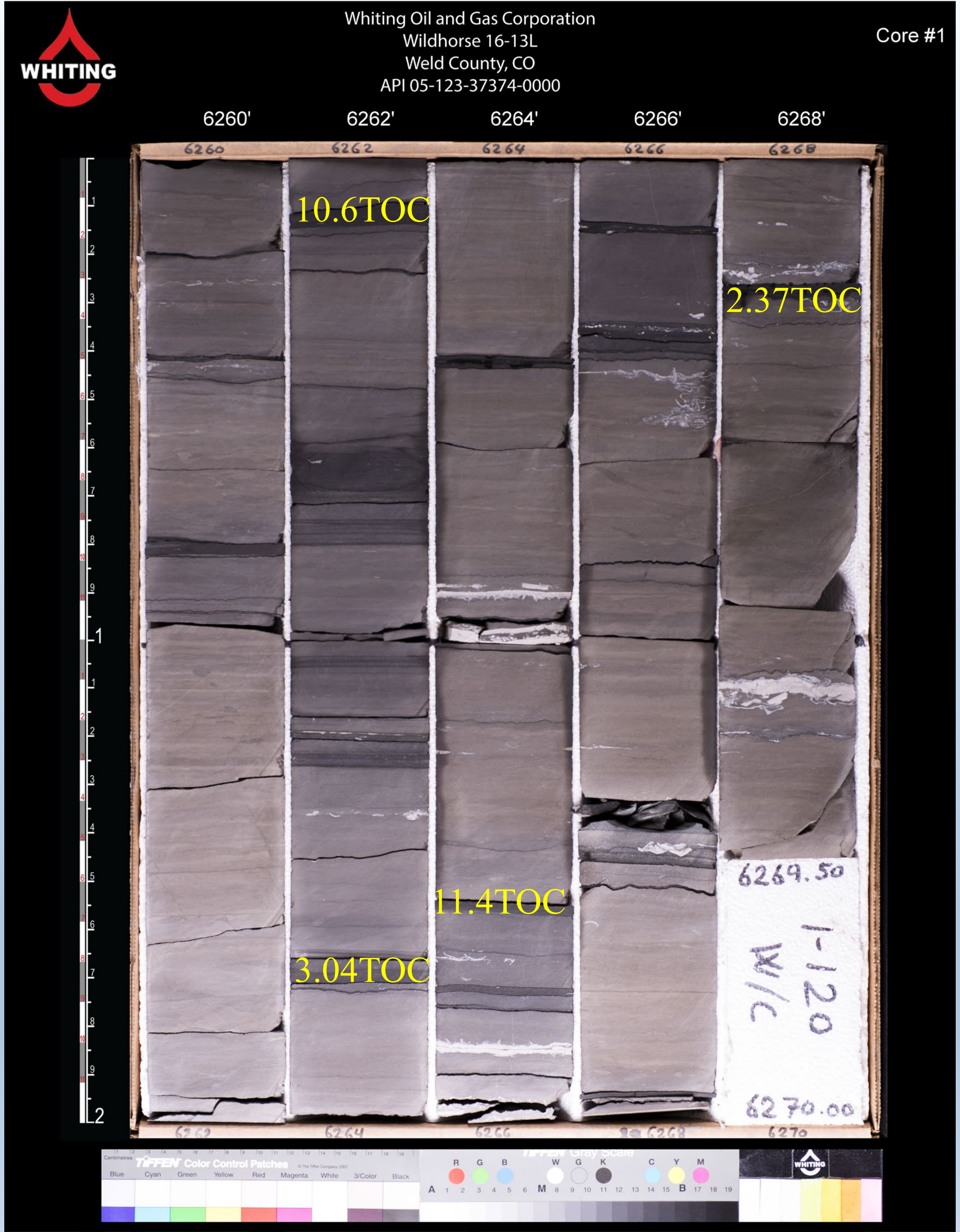




COLORADO SCHOOL OF MINES MUDTOC

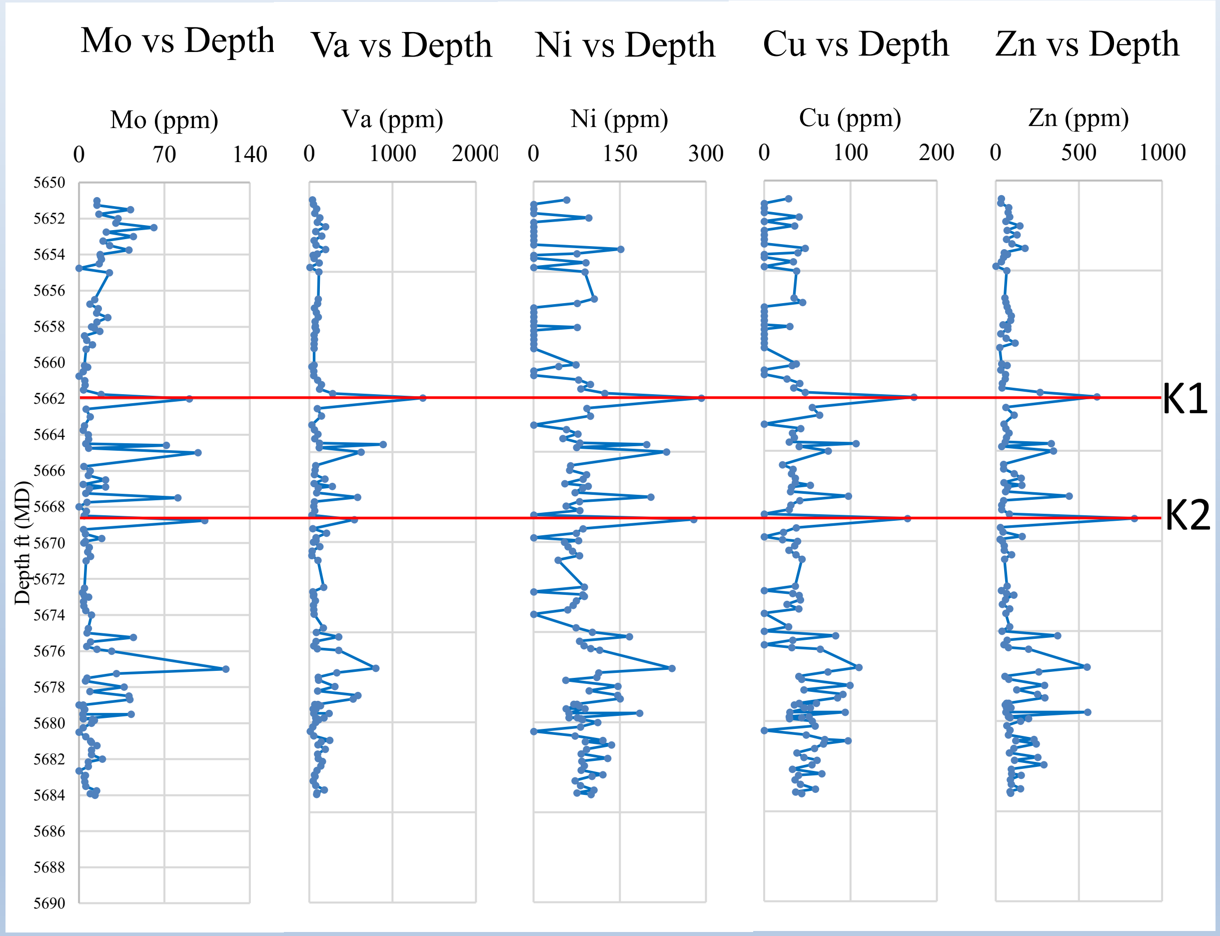
Wildhorse 16-13L

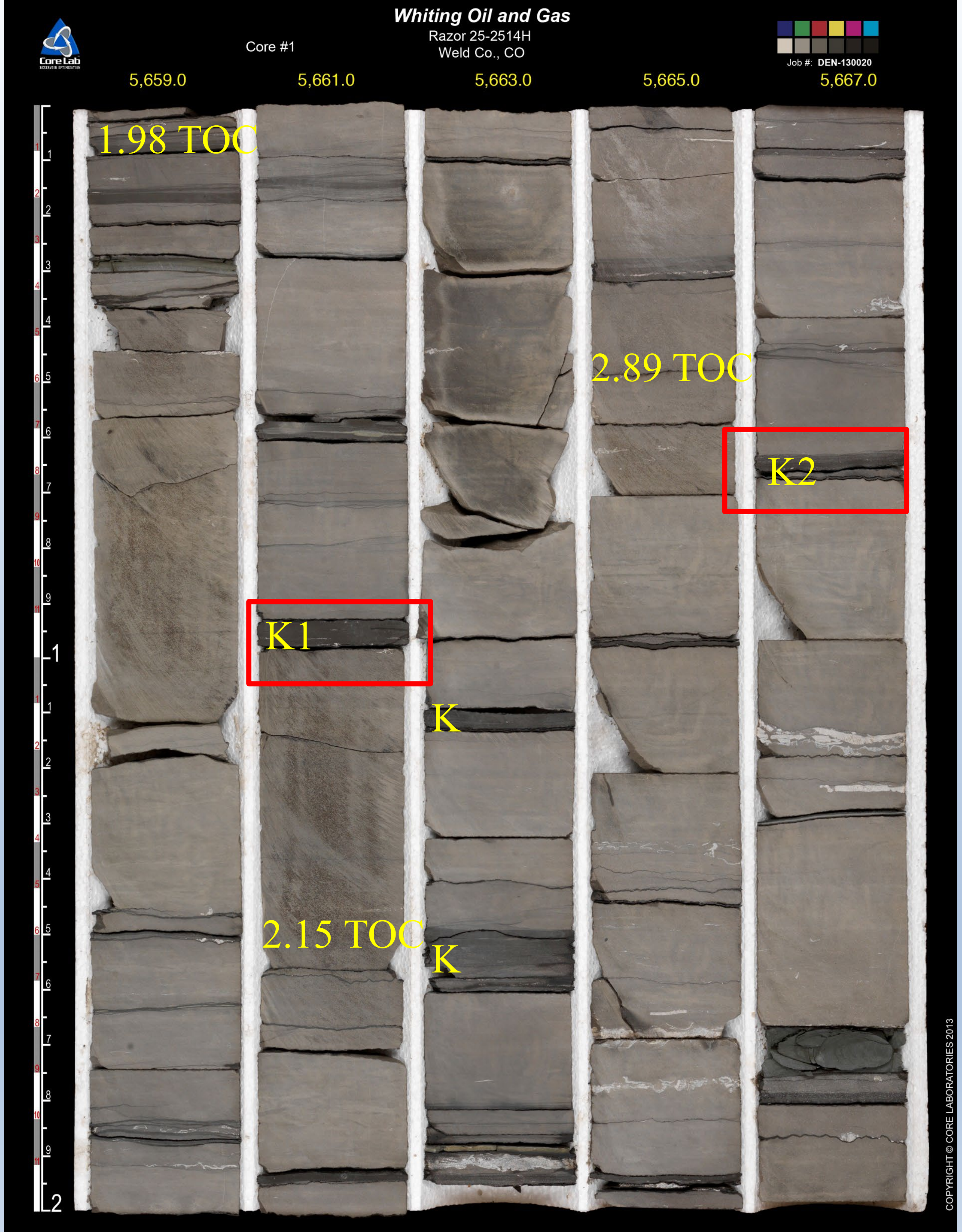




COLORADO SCHOOL OF MINES MUDTOC

Razor 25-2514H B2 Kerogenites



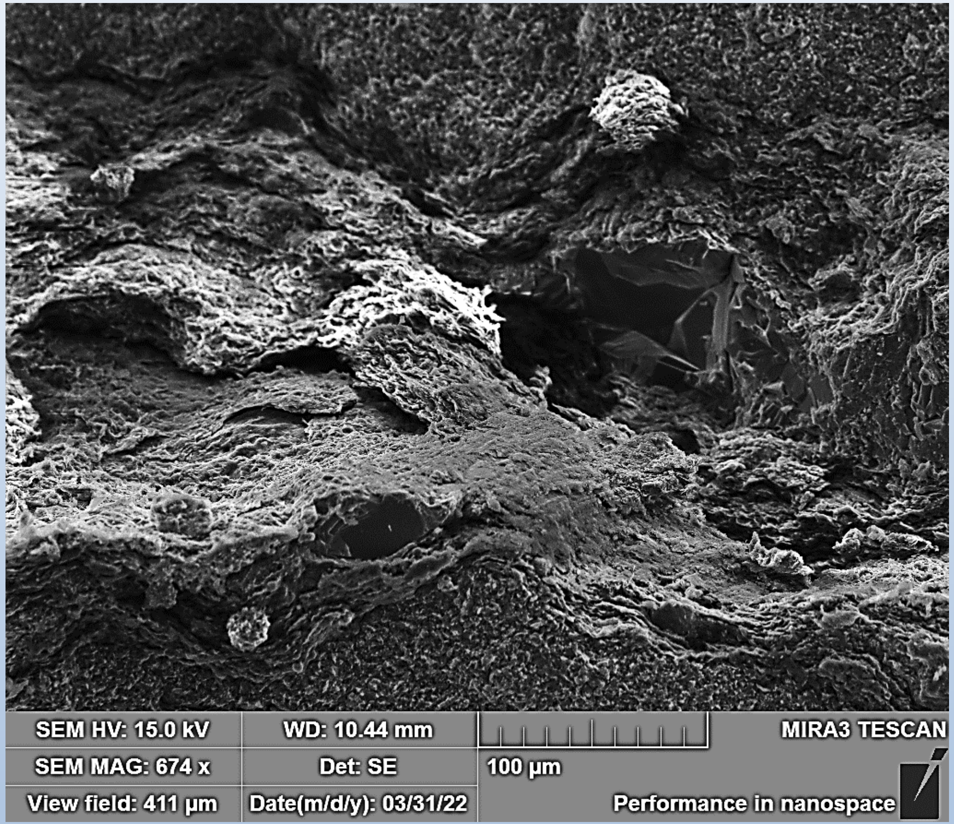


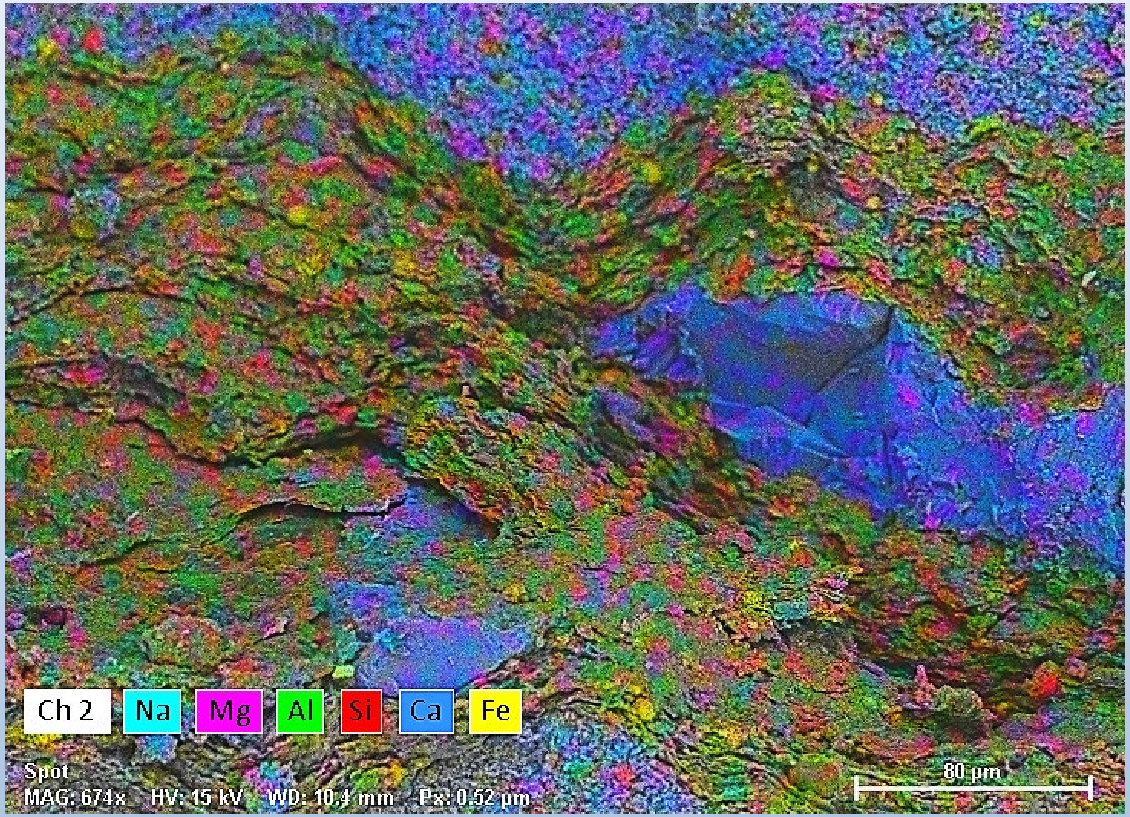
COLORADO SCHOOL OF MINES MUDTOC

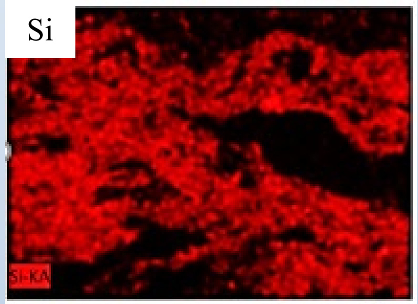
SEM B2 KEROGENITES RAZOR 25-2514H

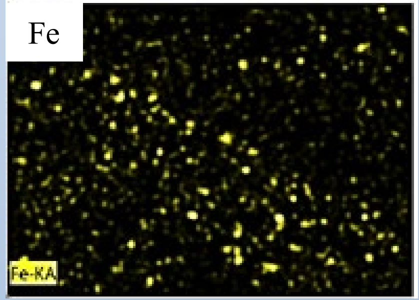
Variations in Particle Orientation

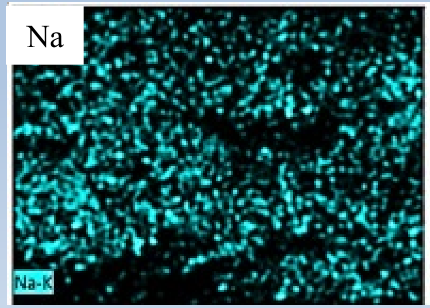
COLORADO SCHOOL OF MINES
MUDTOC

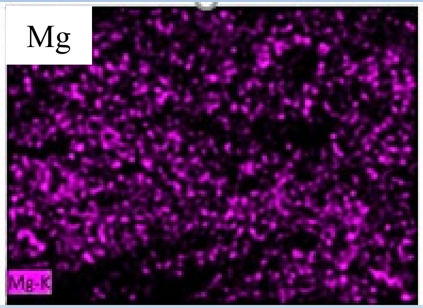


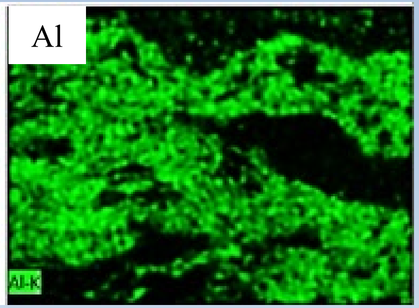


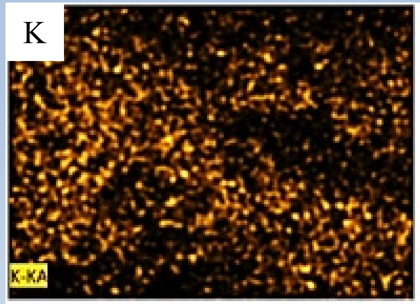


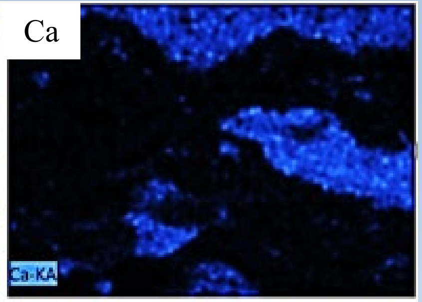




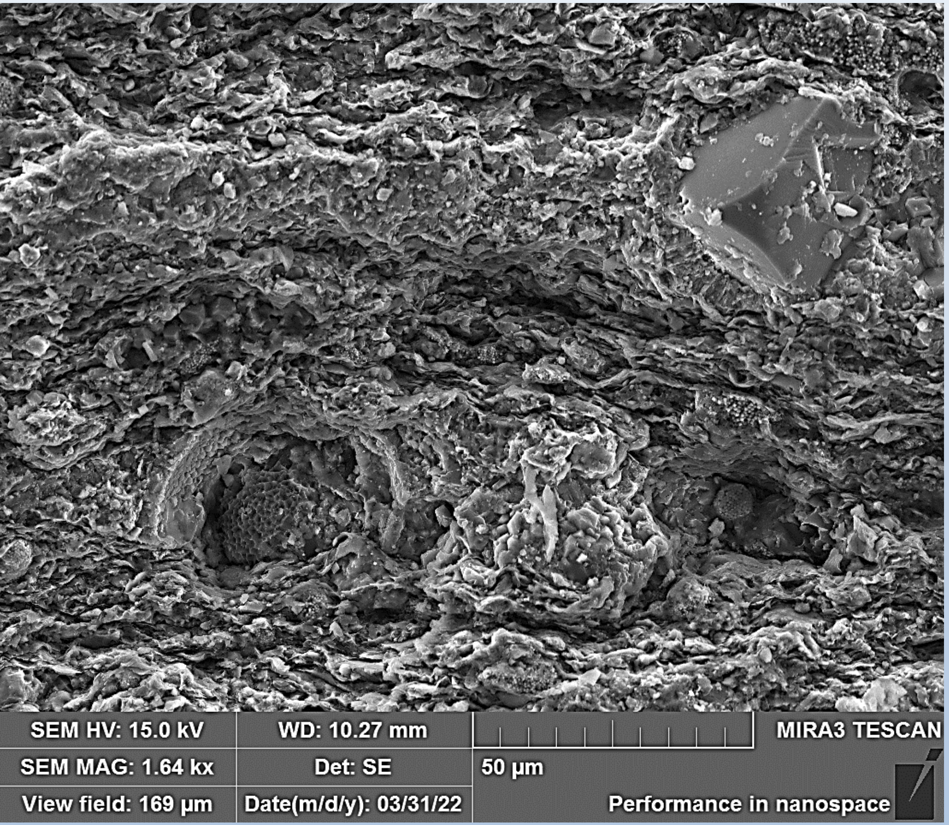


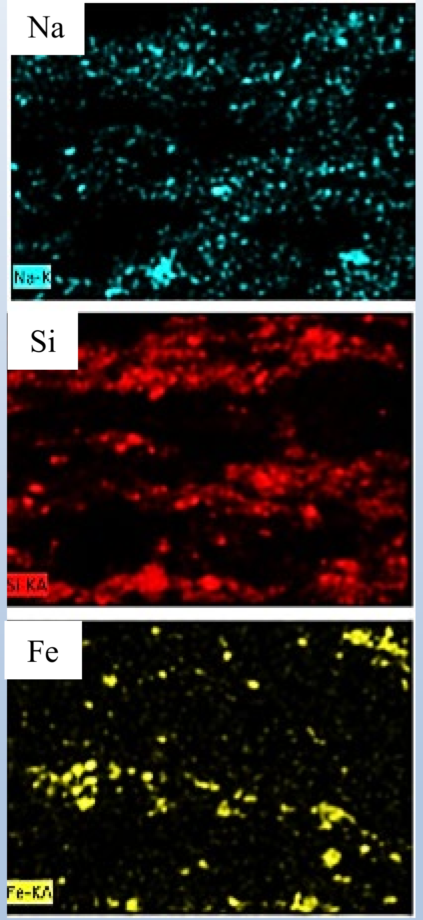


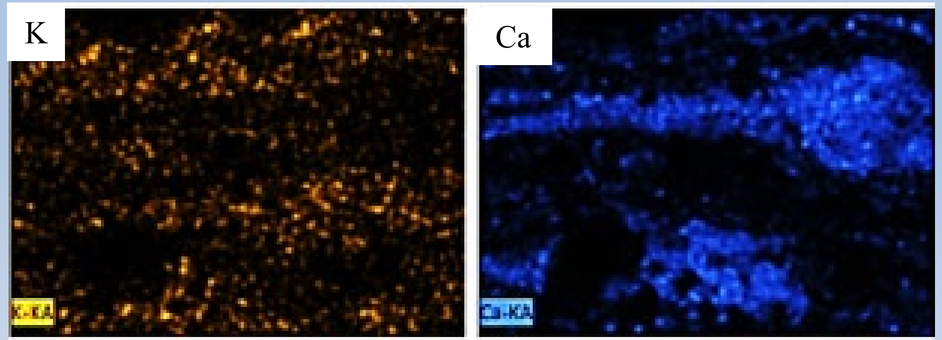


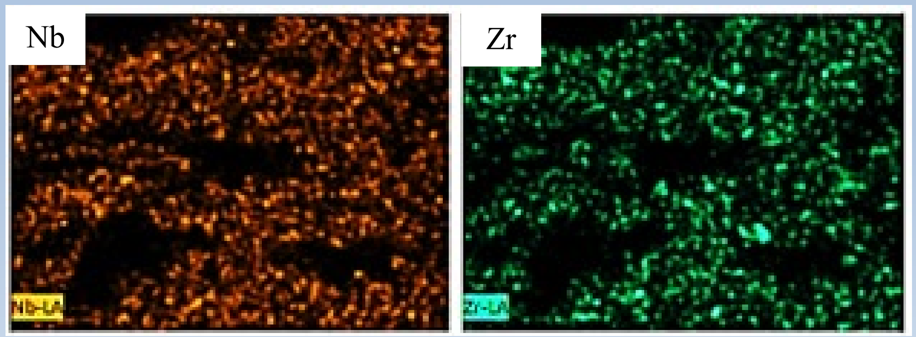


Variations in Particle Orientation

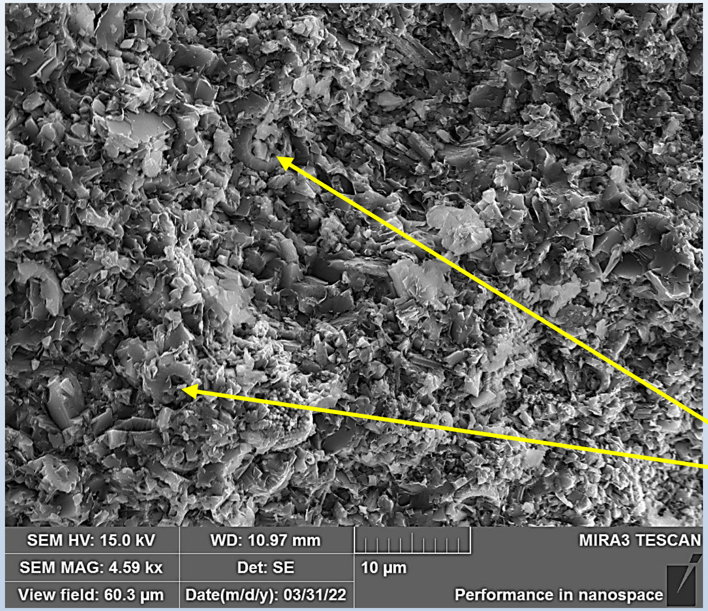








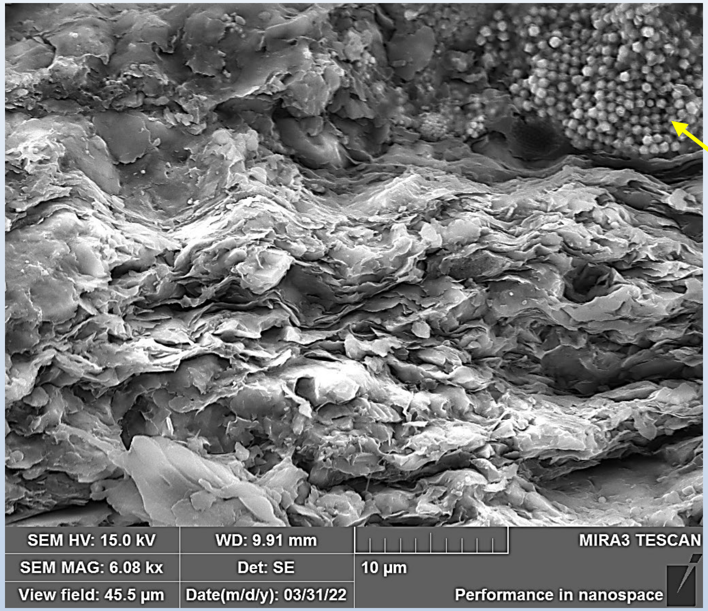
Particle Orientation



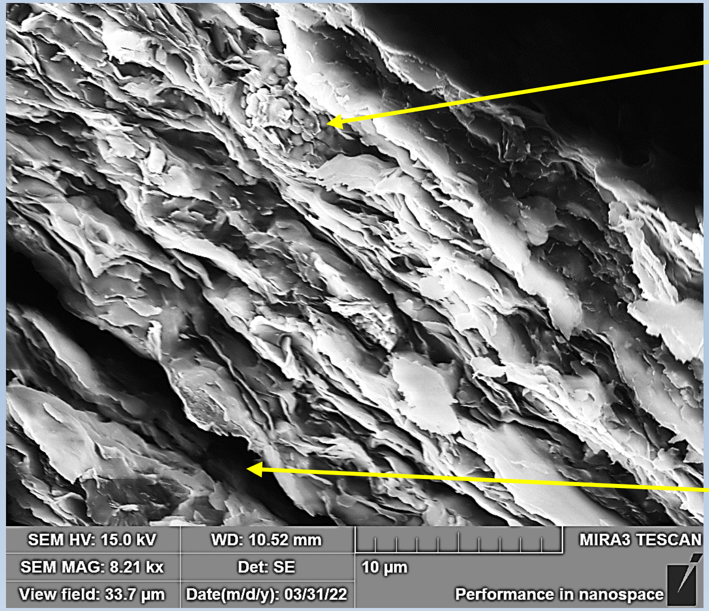
Random Particle Orientation in Calcite Matrix and Coccolith Fragments

Coccolith Fragments

Preferred Particle Orientation with Single Clay Plates Displaying Shale Fabric



Pyrite Framboid

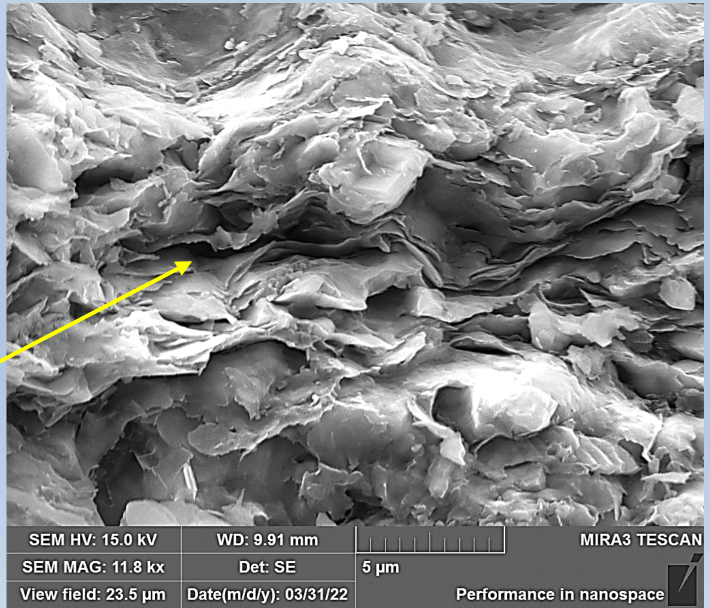


Pyrite Framboid

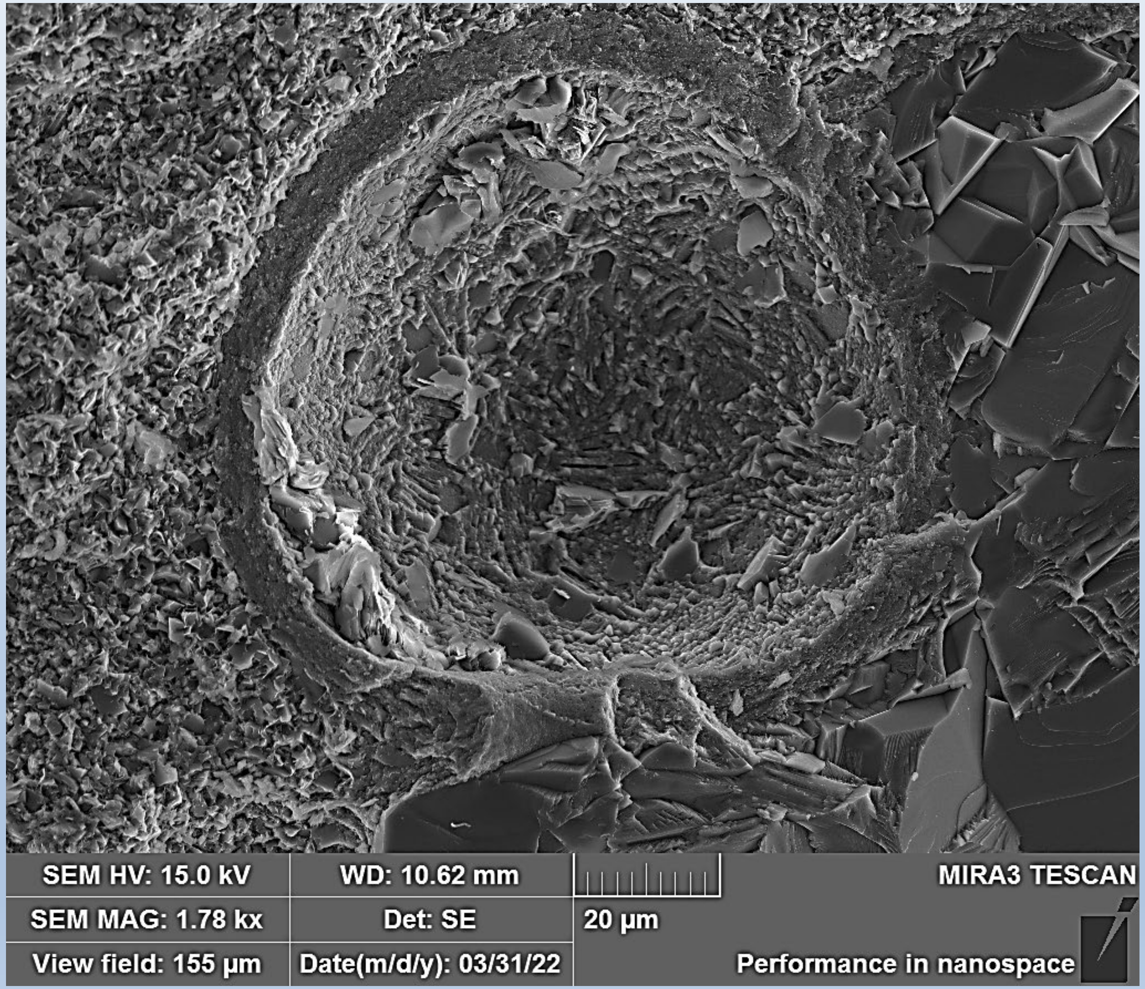
Preferred Particle Orientation with Single Clay Plates Displaying Shale Fabric

Preferred Particle Orientation with Single Clay Plates Displaying Shale Fabric

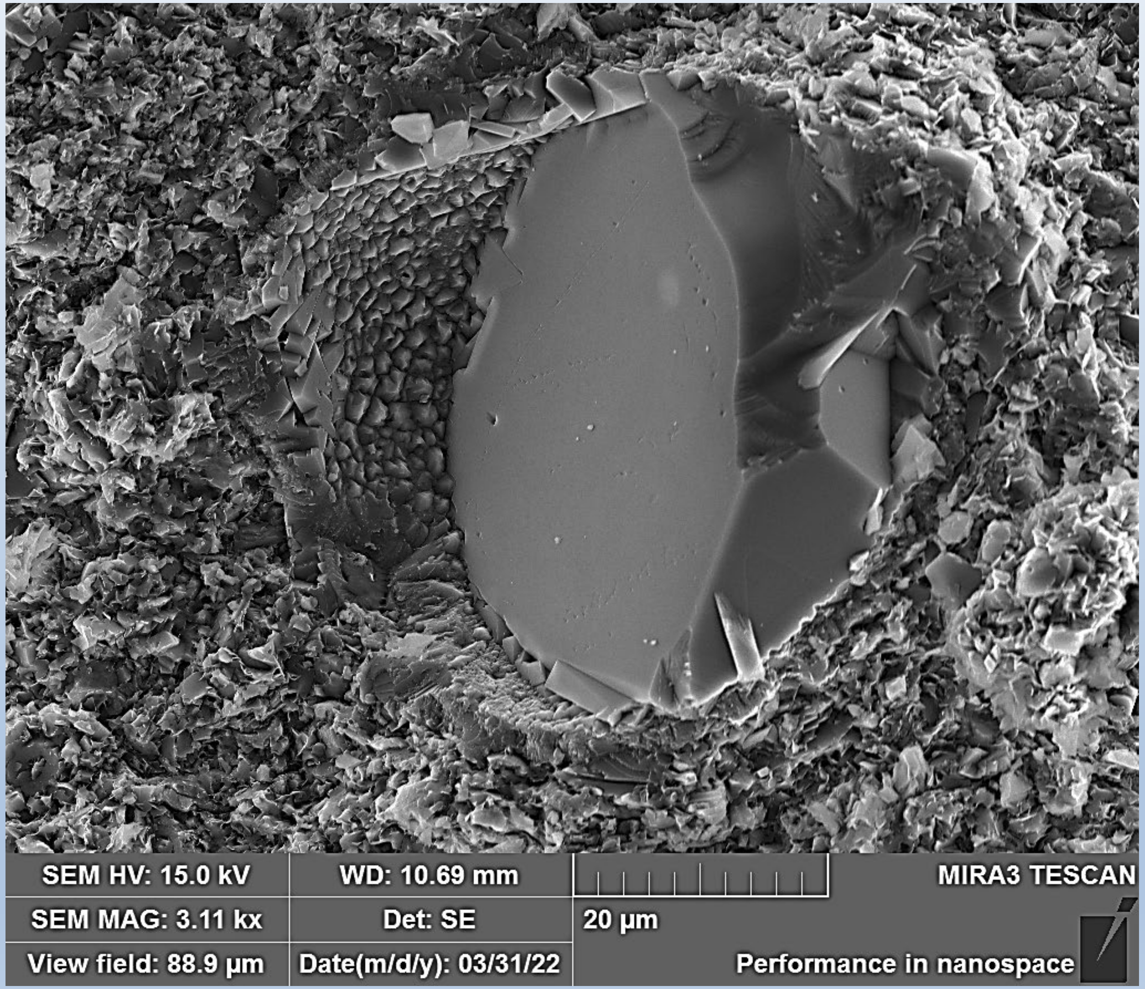
Organic Matter



Foram Variations



Empty Foram with Only Calcite Shell



Foram Showing Calcite Cement on Outer Shell and is Half Filled with a Calcite

Foram Alteration

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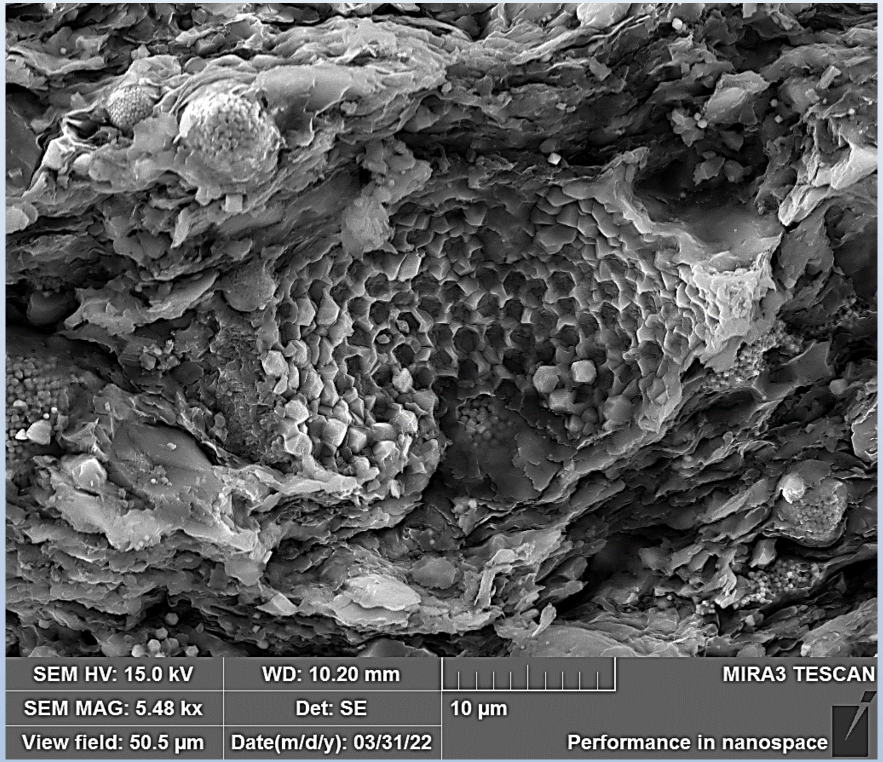
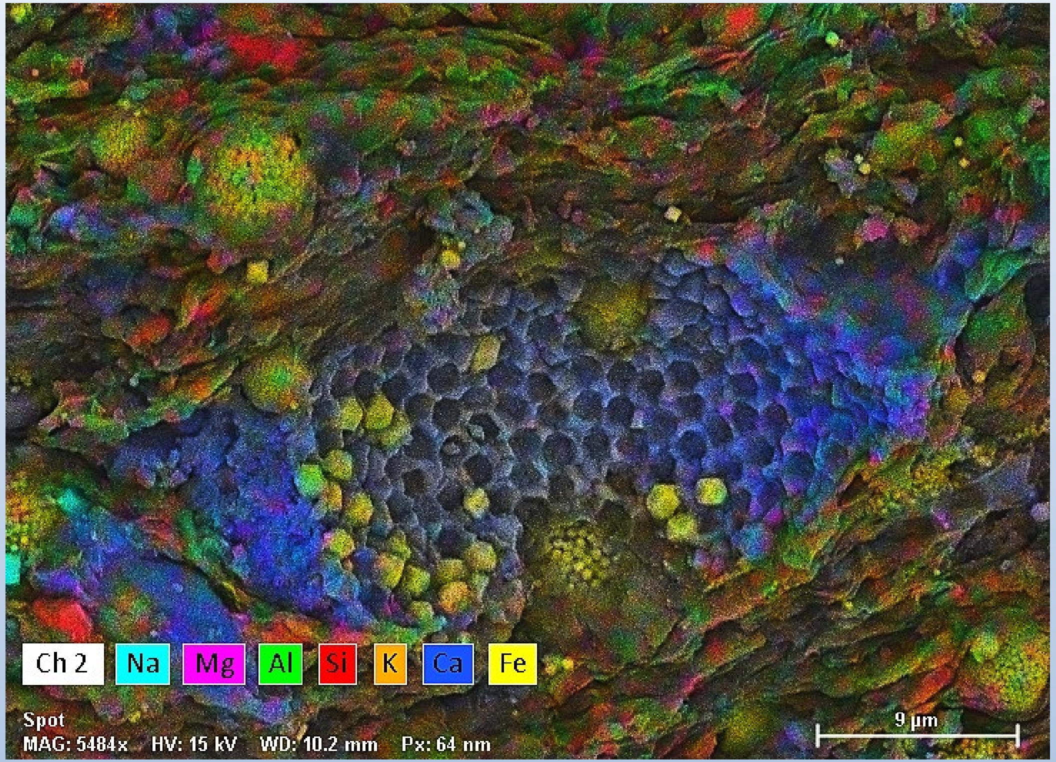
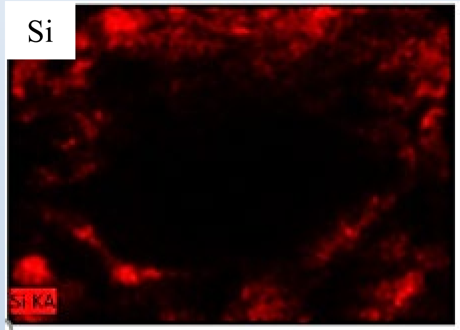
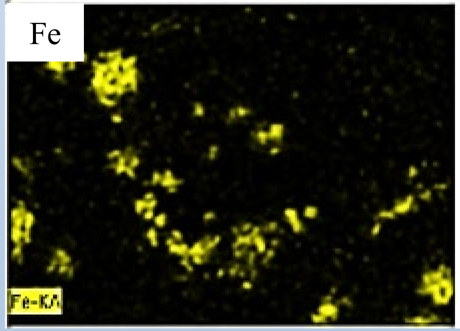
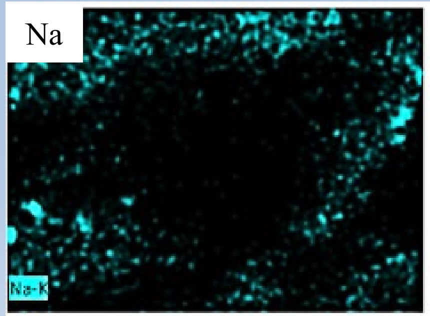
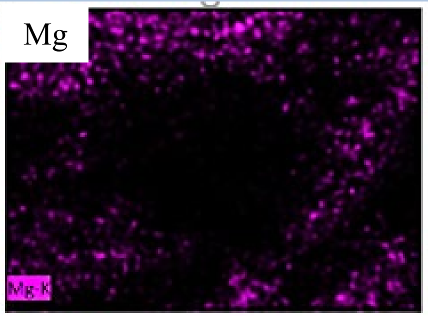


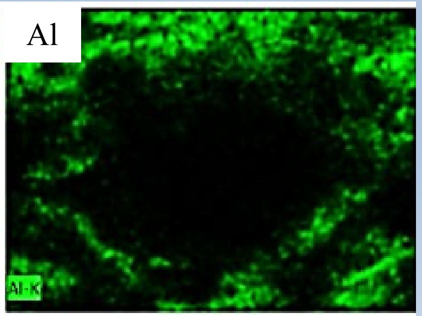


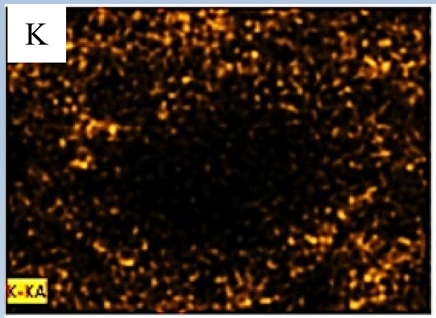


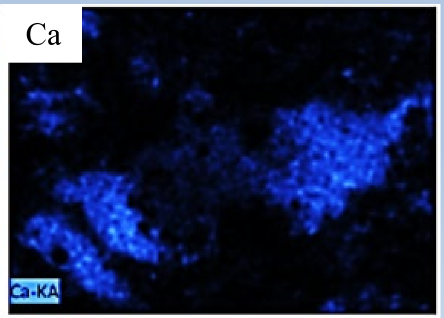




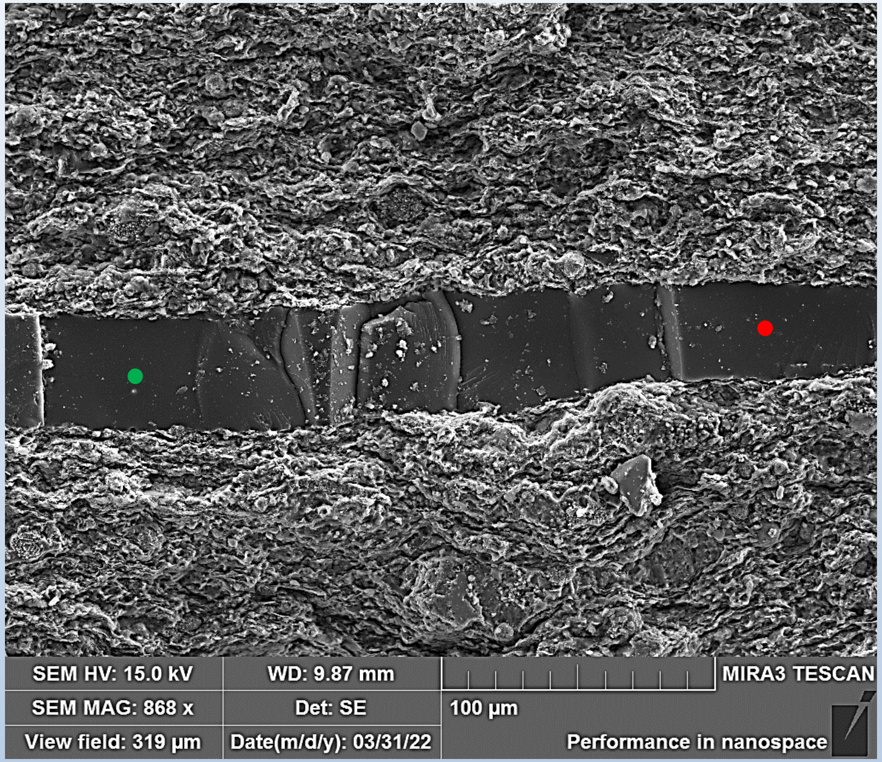


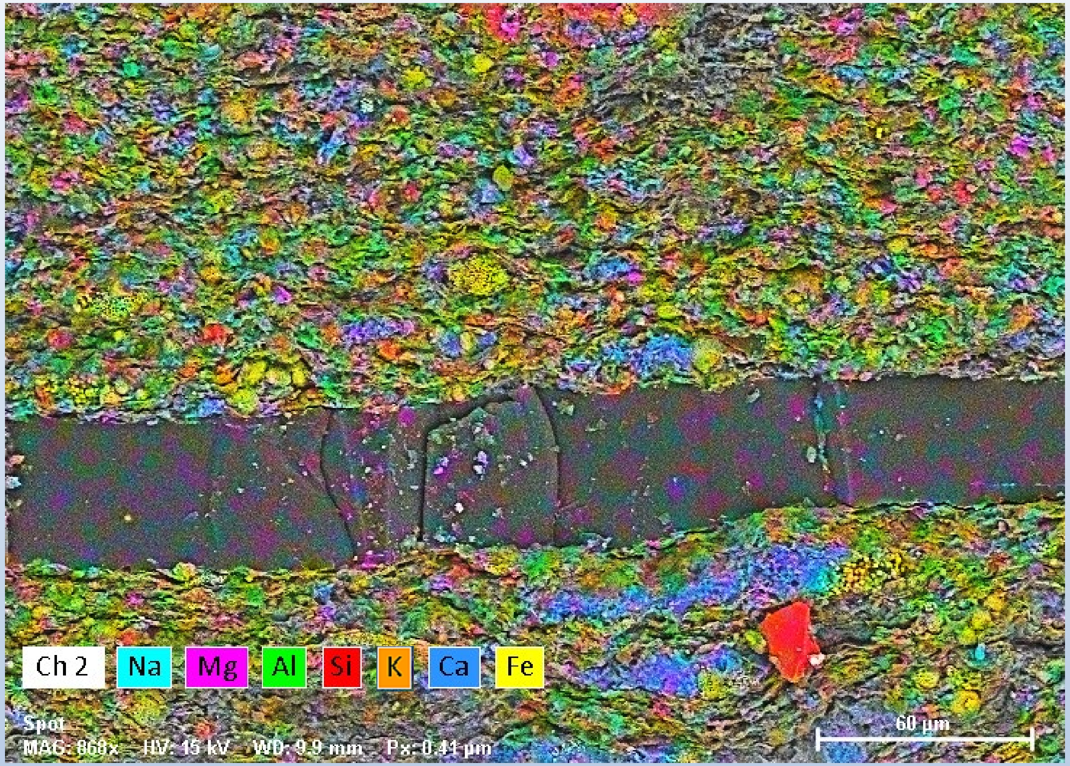


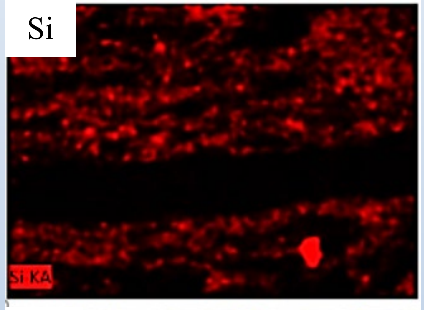


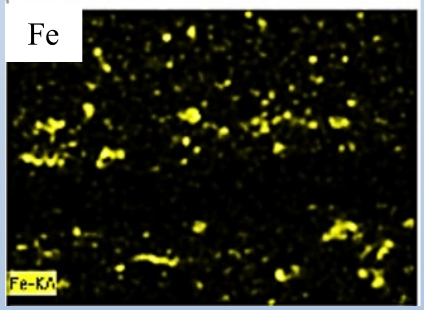


Organic Carbon







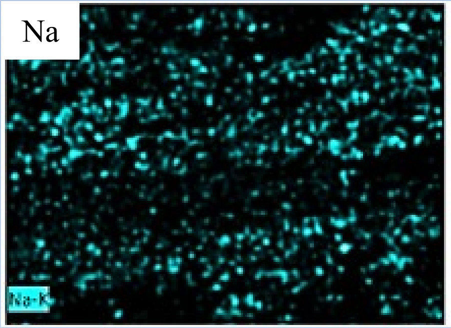


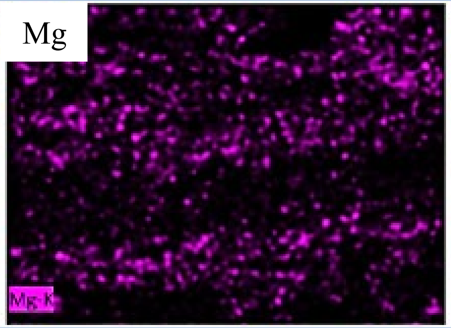
Spot 1

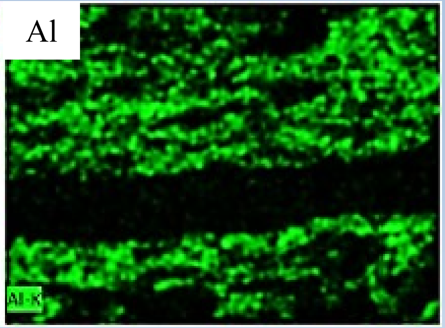
Spectrum	N	O	Al	S	Cl	Ti	Zr	Nb
Spot 1194	3.0	5.2	0.2	2.3	0.9	0.9	1.3	4.9

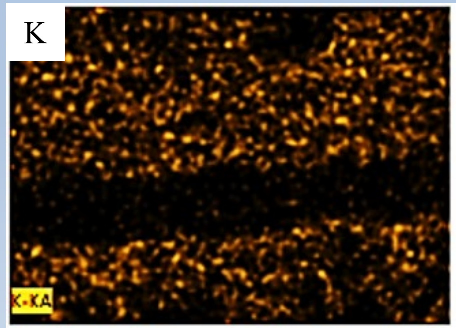
Spot 2

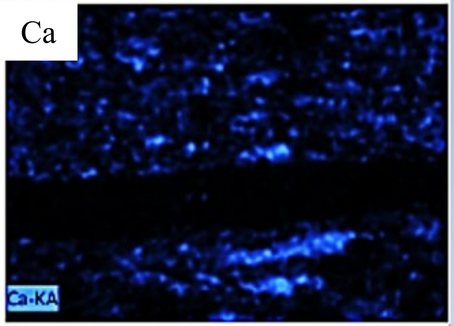
Spectrum	N	O	S	Cl	Ti
Spot 1195	1.6	4.9	2.2	0.4	0.6











Future Work

- Look into FMI logs to study the natural fractures within the Niobrara
- Go into more detail of the kerogenites in each well using SRA, FE-SEM, and XRF
- Further study into kerogenites and depositional history, duration of deposition and reason for sporadic anoxic/euxinic environments

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Spring 2022

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