ROCKY MOUNTAIN OILFIELD TESTING CENTER

DETAILED CORE INTERPRETATION ALLOWS A NEW PERSPECTIVE ON TENSLEEP SANDSTONE CORRELATIONS AT TEAPOT DOME FIELD, NATRONA CO., WYOMING

Mark Milliken and Brian Black

2007 RMS, Snowbird, Utah

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Topics

- Introduction to Teapot Dome (NPR-3)
- Tensleep production history
- Geologic structure at NPR-3
- Tensleep depositional environments
- Core and outrcrop-based Tensleep stratigraphic terminology at NPR-3
- Cap rock character

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Naval Petroleum Reserve No. 3

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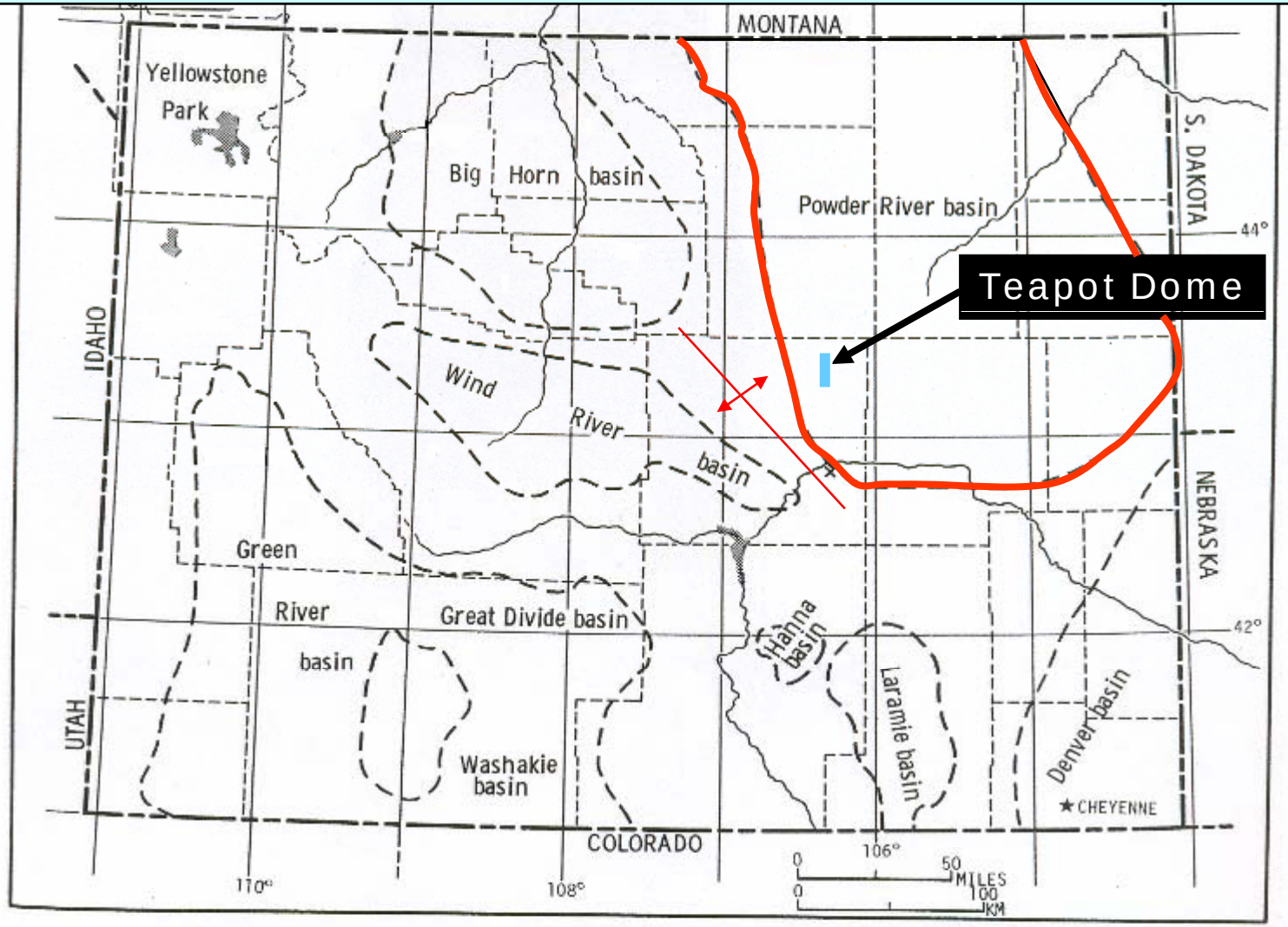
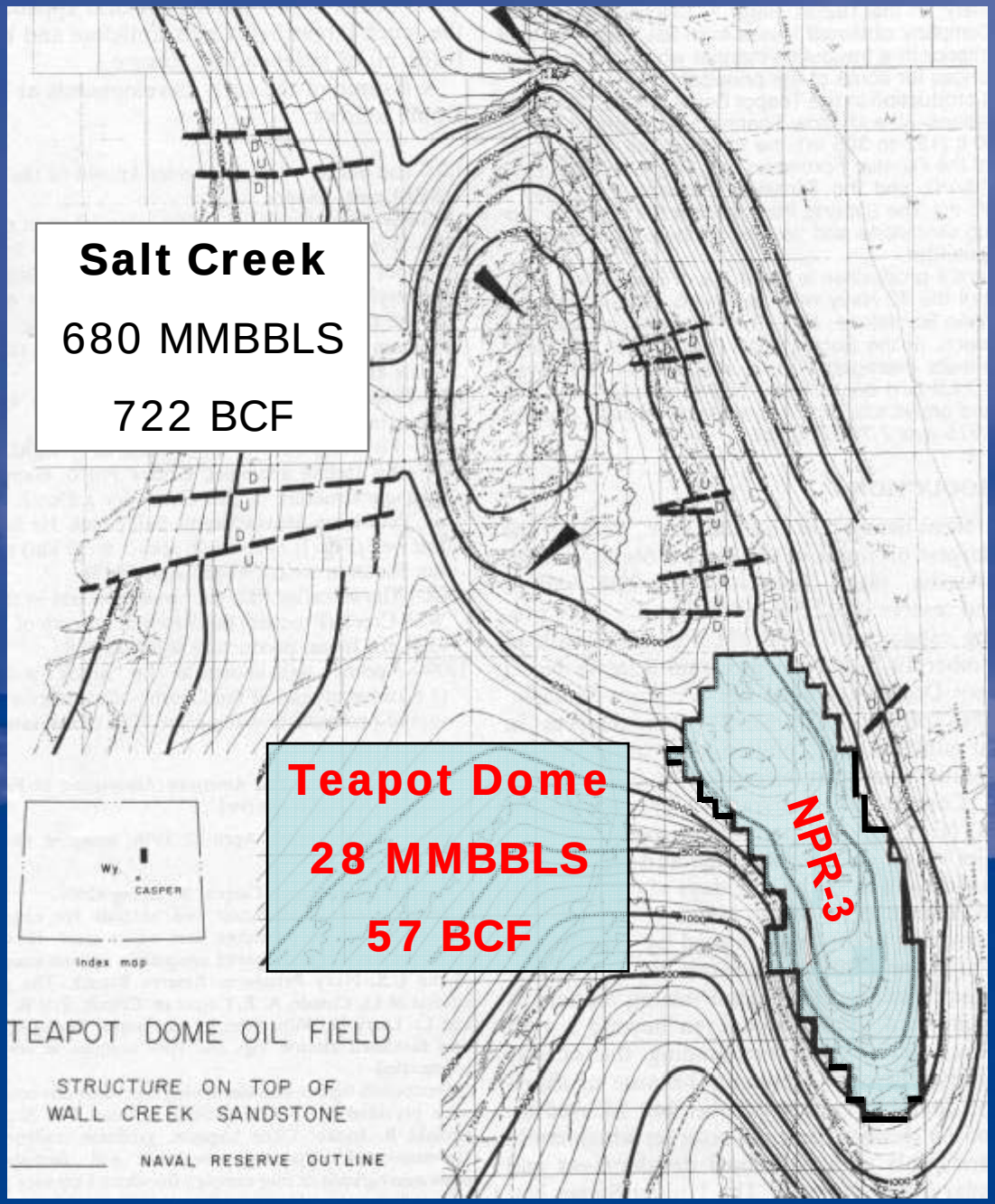
Wyoming Depositional Basin Settings



Cumulative Production



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NPR-3 STRATIGRAPHY

Production

DEPTH

1000

2000

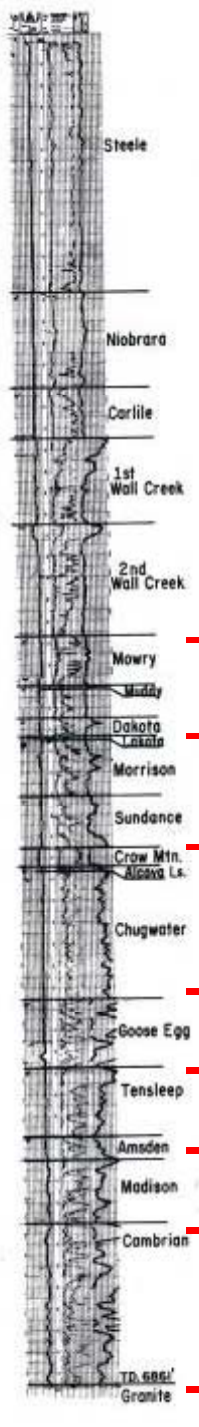
3000

4000

5000

6000

7000



WELL 1-G-10, 1952

UPPER CRETACEOUS

LOWER CRETACEOUS

JURASSIC

TRIASSIC CHUGWATER

PERMIAN GOOSE EGG

PENNSYLVANIAN TENSLEEP

MISSISSIPPIAN MADSION LS

CAMBRIAN SS

PRECAMBRIAN BASEMENT

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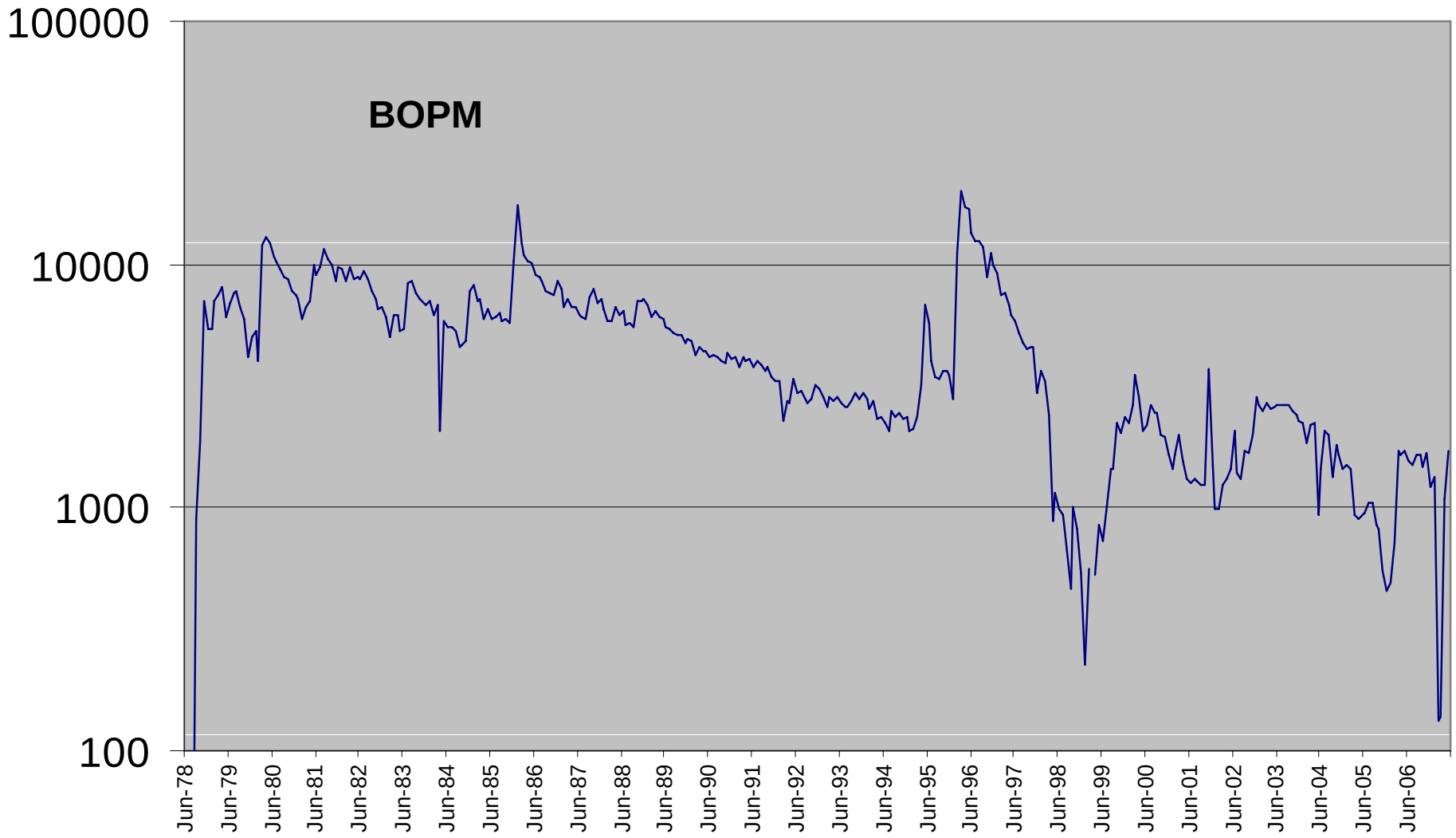
Tensleep Production History



TENSLEEP STRUCTURE

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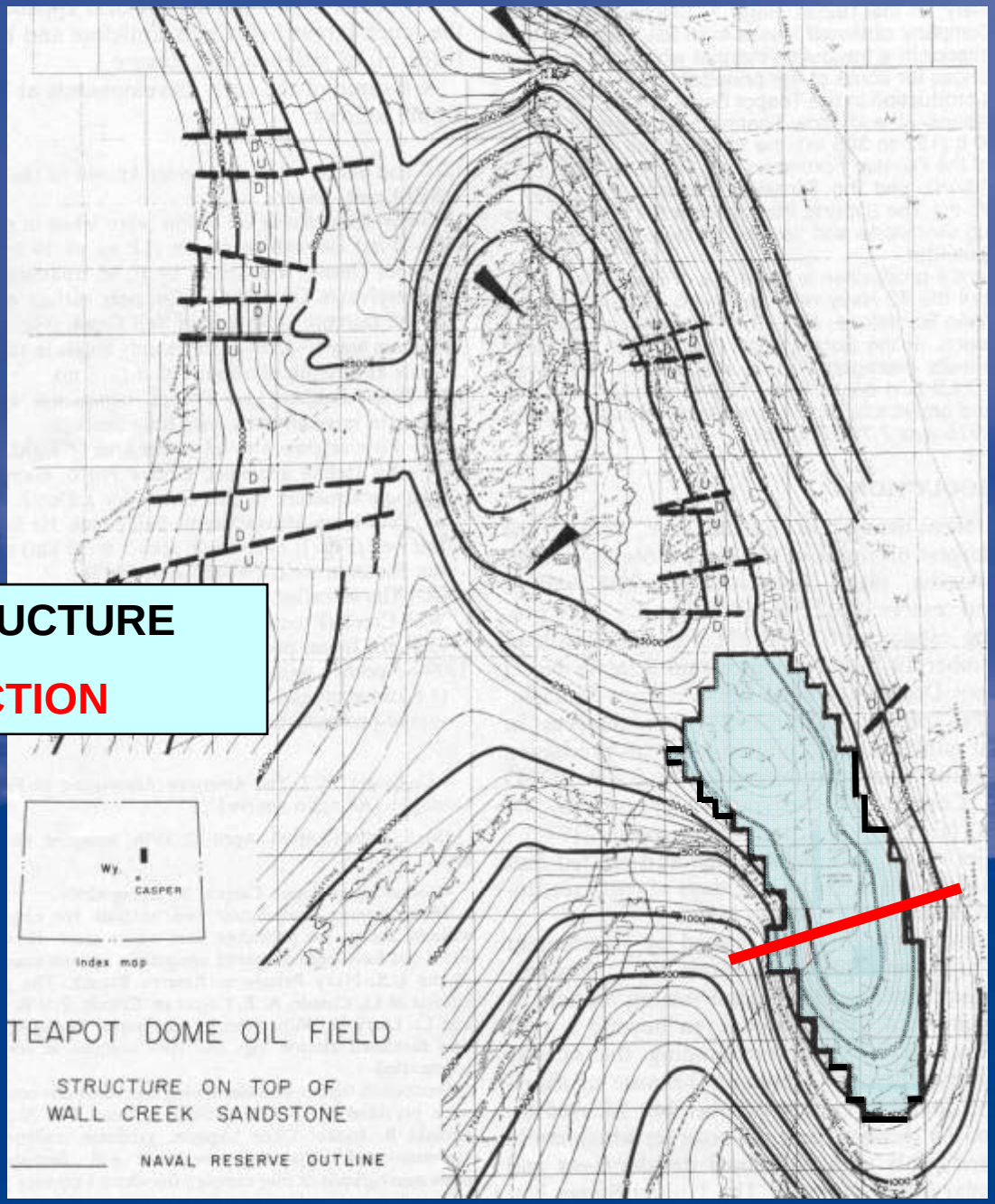
NPR-3 STRUCTURE

DIP SECTION



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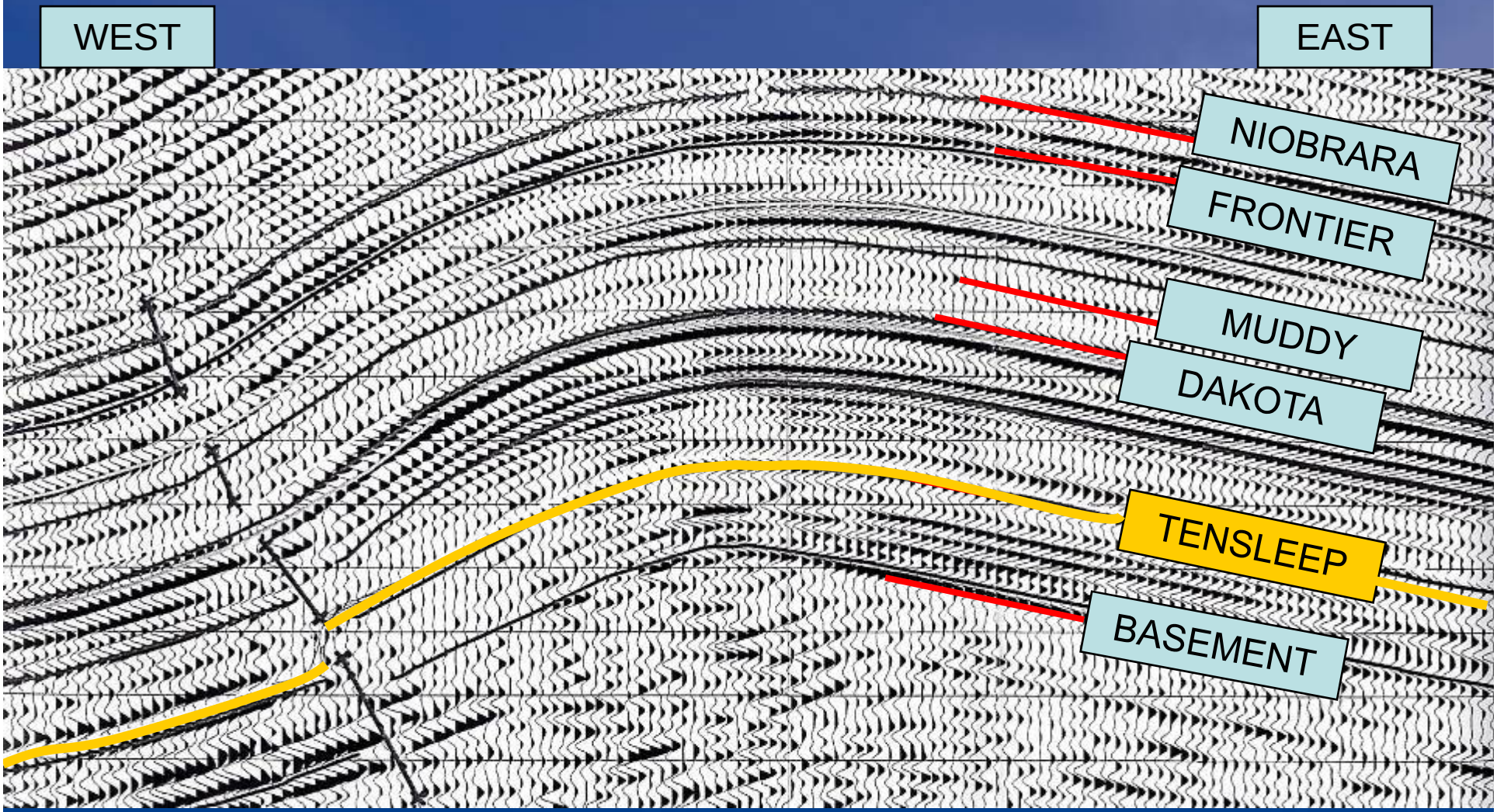
NPR-3 Dip Section



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Tensleep Structure at Alcova Dam: an NPR-3 Analog

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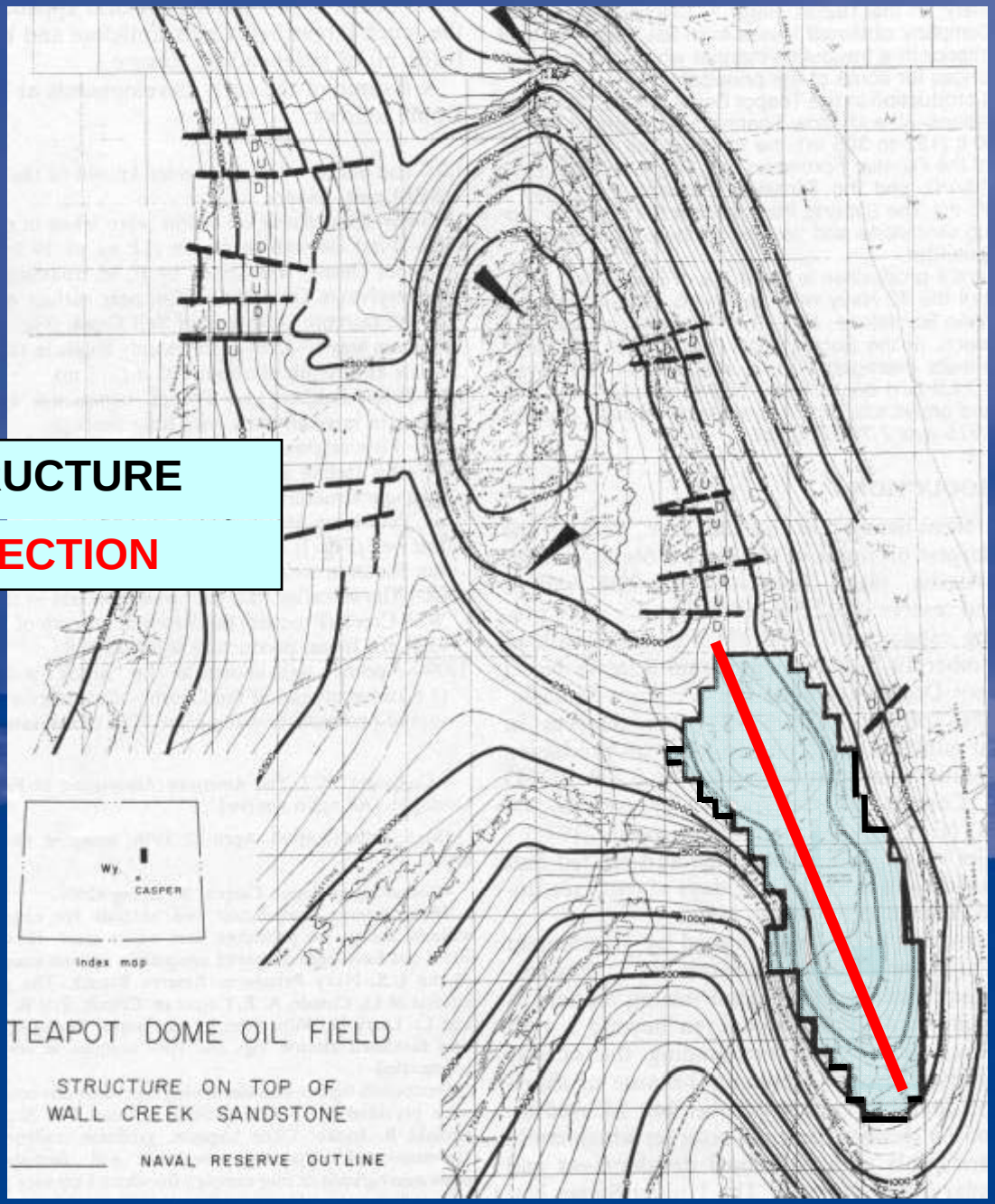
NPR-3 STRUCTURE

STRIKE SECTION



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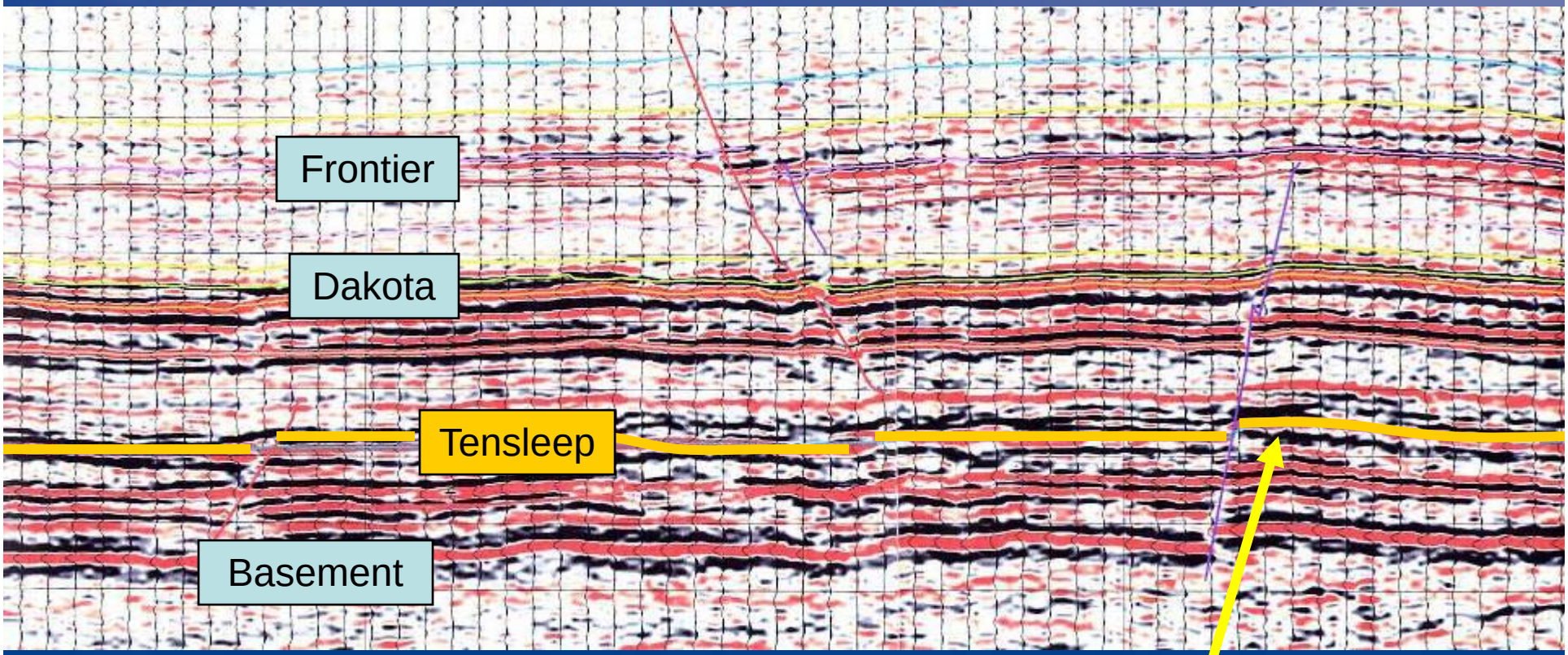
NPR-3 Strike Section



TENSLEEP DEPOSITIONAL ENVIRONMENTS

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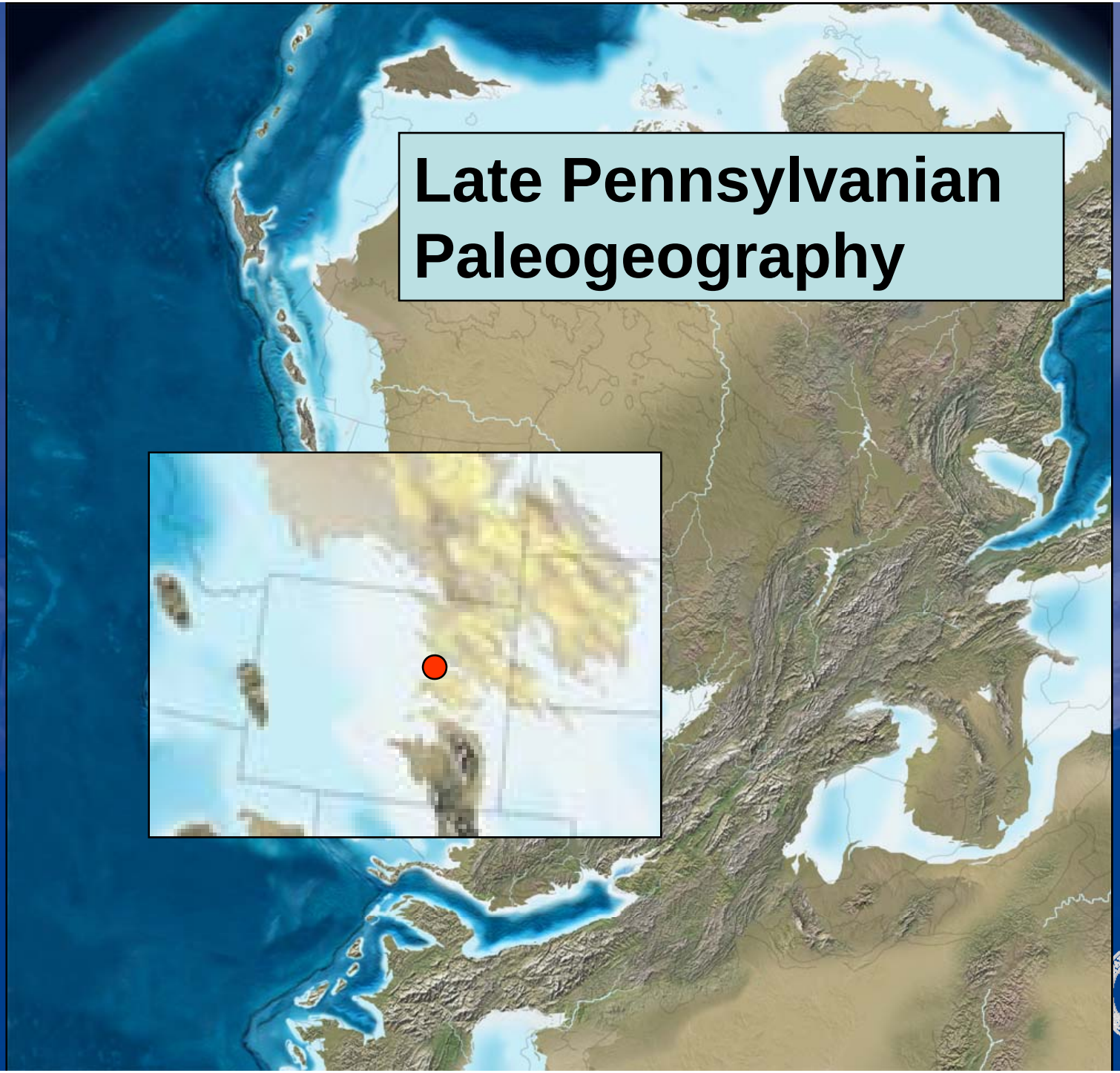
Late Pennsylvanian Paleogeography



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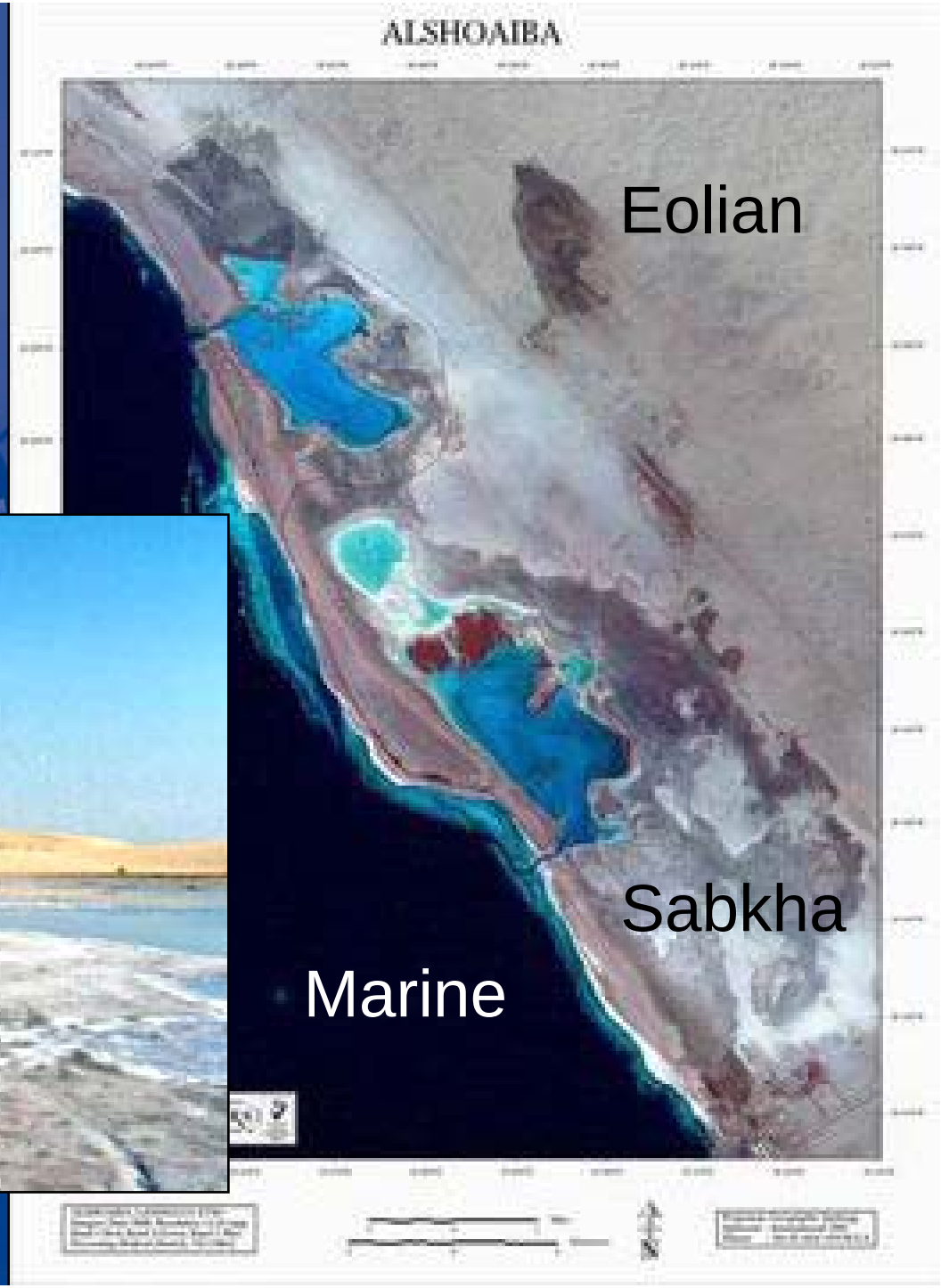
Modern Day Depositional Analog



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CORE AND OUTCROP-BASED TENSLEEP STRATIGRAPHIC TERMINOLOGY AT NPR-3

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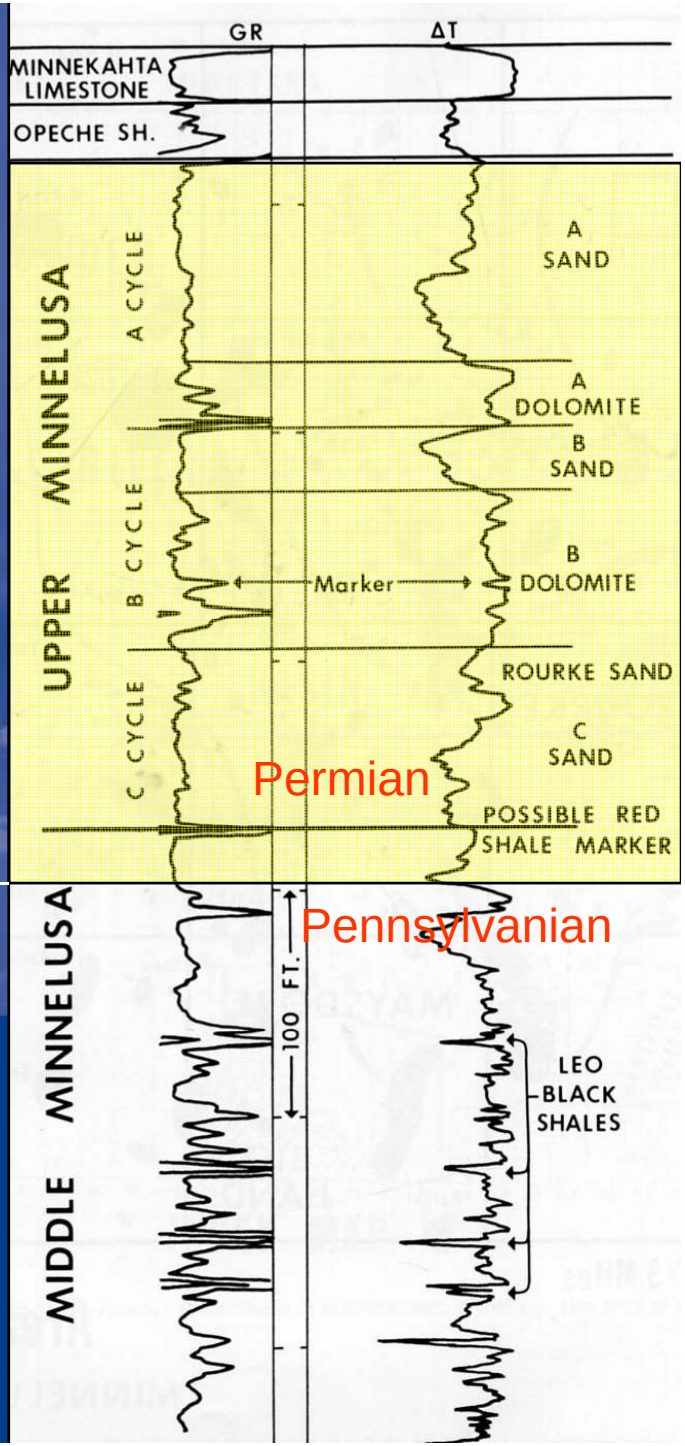
TYPICAL POWDER RIVER BASIN MINNELUSA STRATIGRAPHY

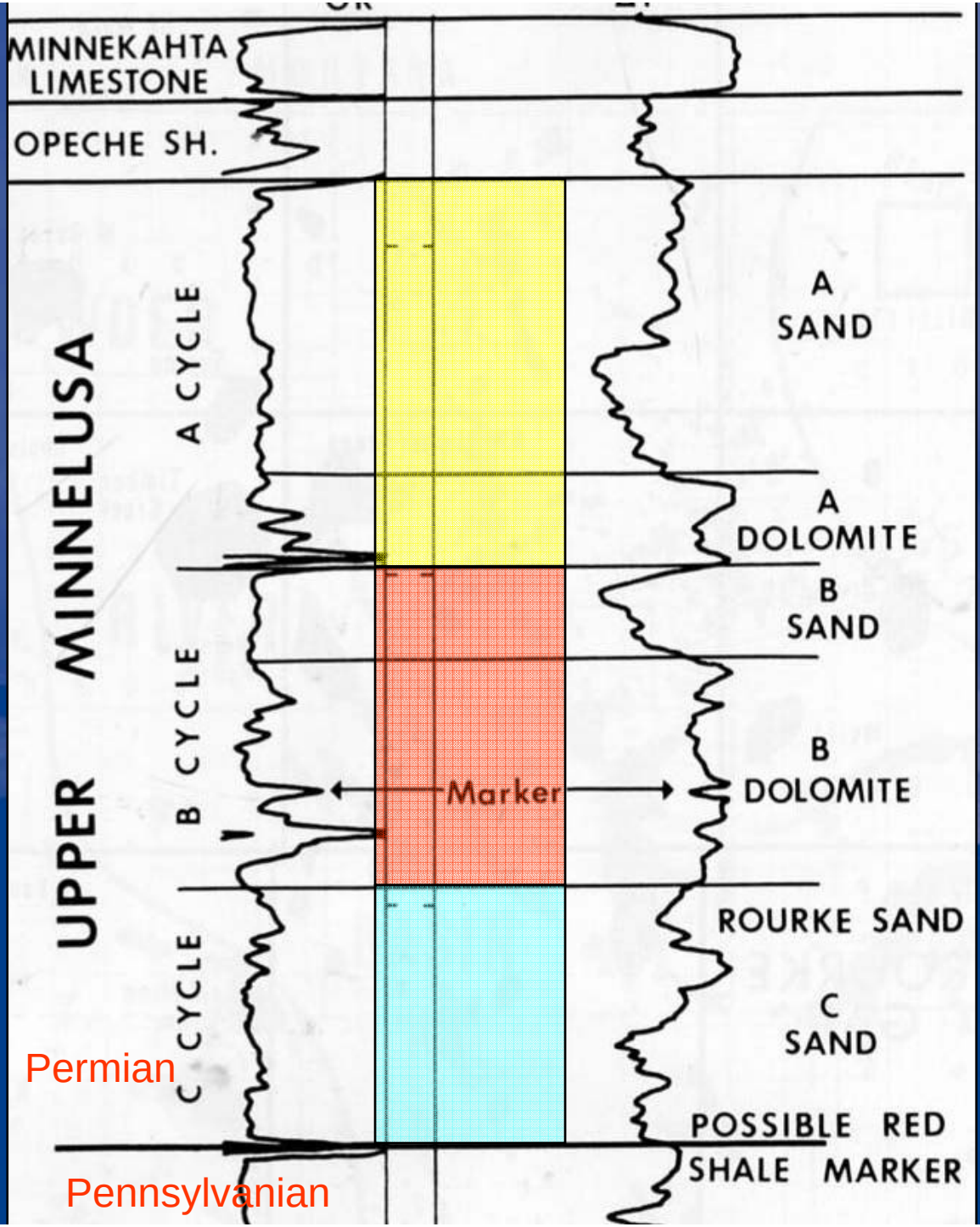


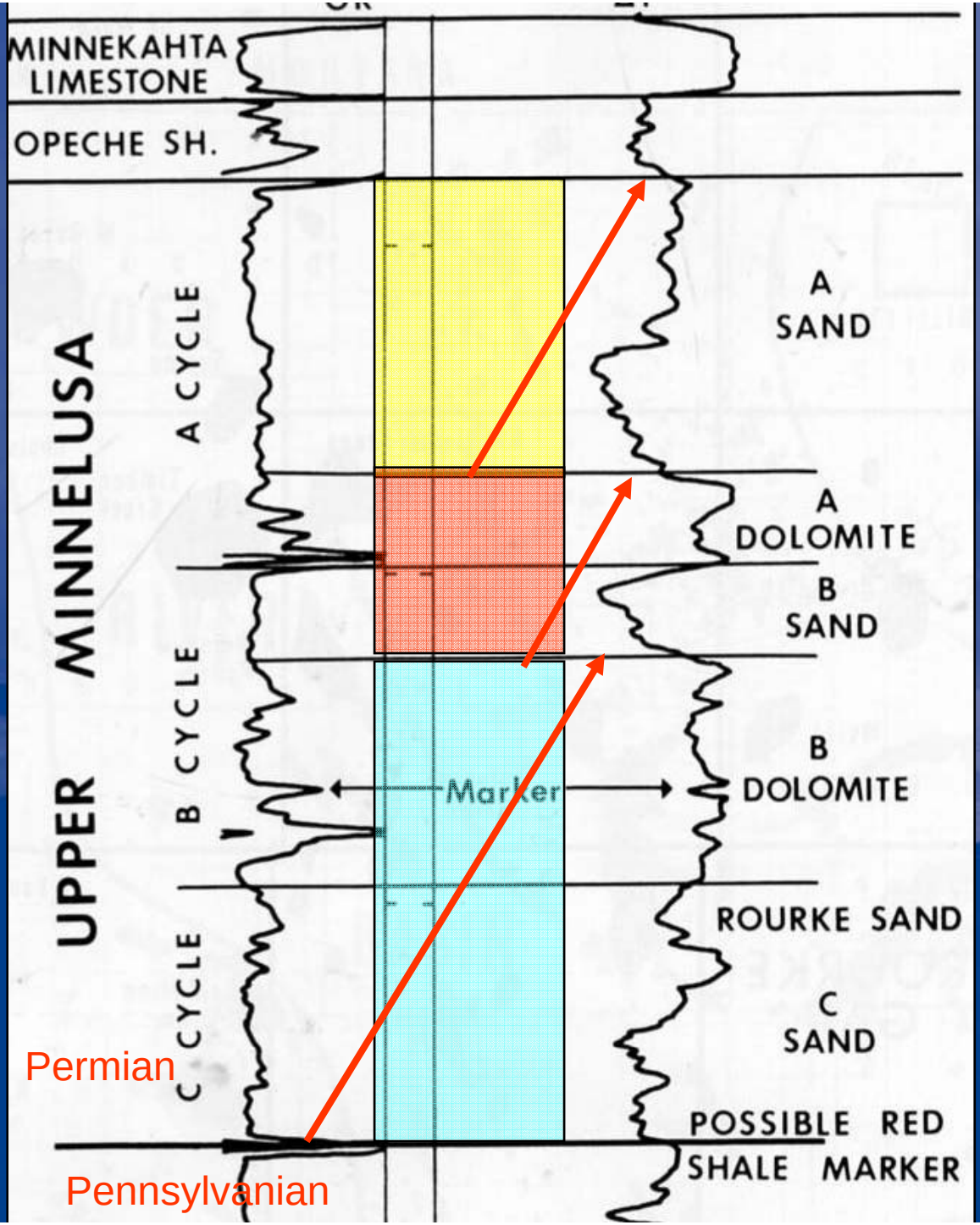
Wolfcampian

Des Moinsian, Missourian, Virgilian (Trotter, 1984)

Type log From George, 1984

Used by permission.


MINNEKAHTA LIMESTONE
OPECHE SH.
UPPER MINNELUSA
A CYCLE
B CYCLE
C CYCLE
A SAND
A DOLOMITE
B SAND
B DOLOMITE
Marker
ROURKE SAND
C SAND
POSSIBLE RED SHALE MARKER
Permian
Pennsylvanian


MINNEKAHTA LIMESTONE
OPECHE SH.
UPPER MINNELUSA
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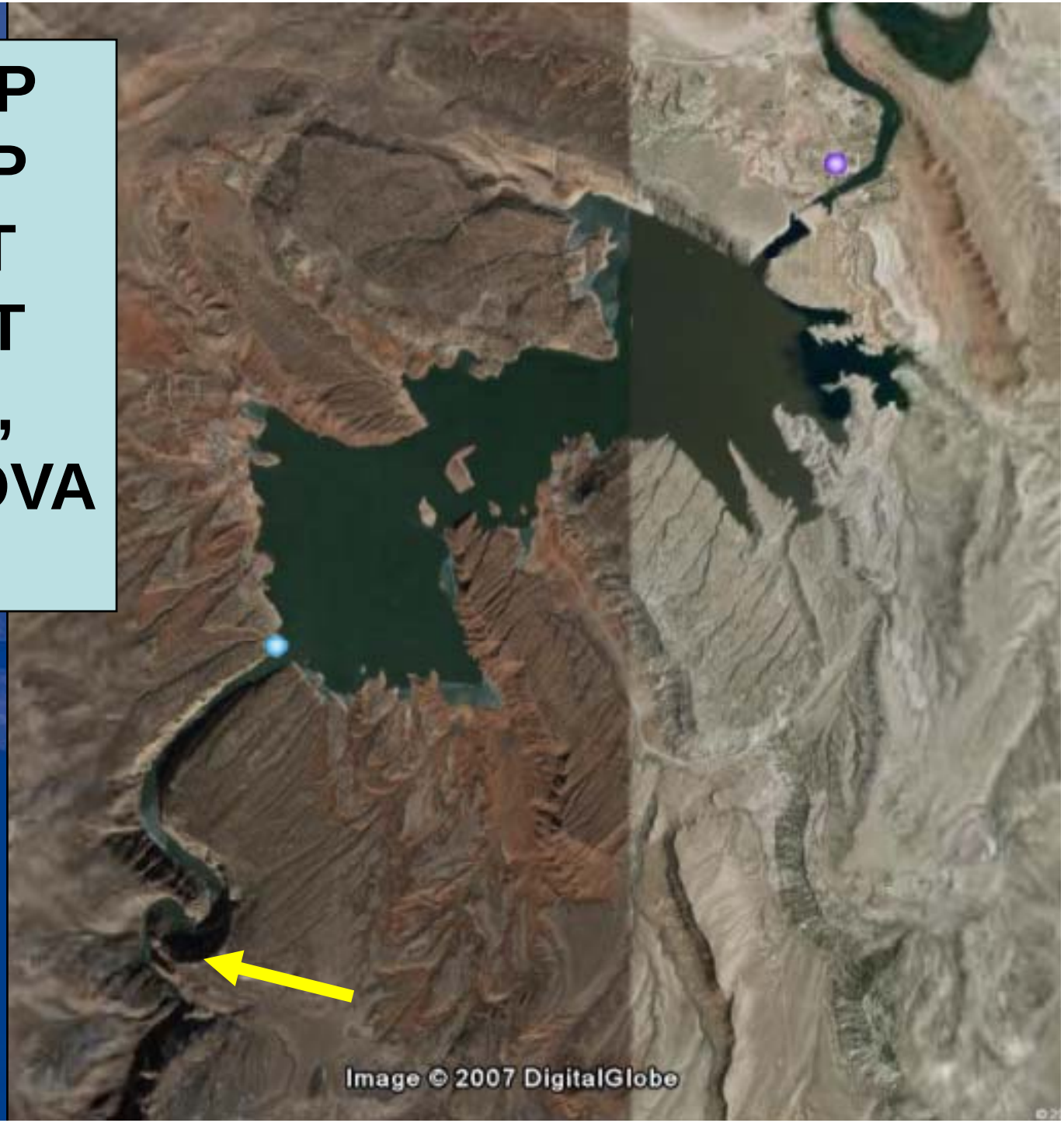
B CYCLE
C CYCLE
A SAND
A DOLOMITE
B SAND
B DOLOMITE
Marker
ROURKE SAND
C SAND
POSSIBLE RED SHALE MARKER
Permian
Pennsylvanian

TENSLEEP OUTCROP WORK AT FREMONT CANYON, LAKE ALCOVA



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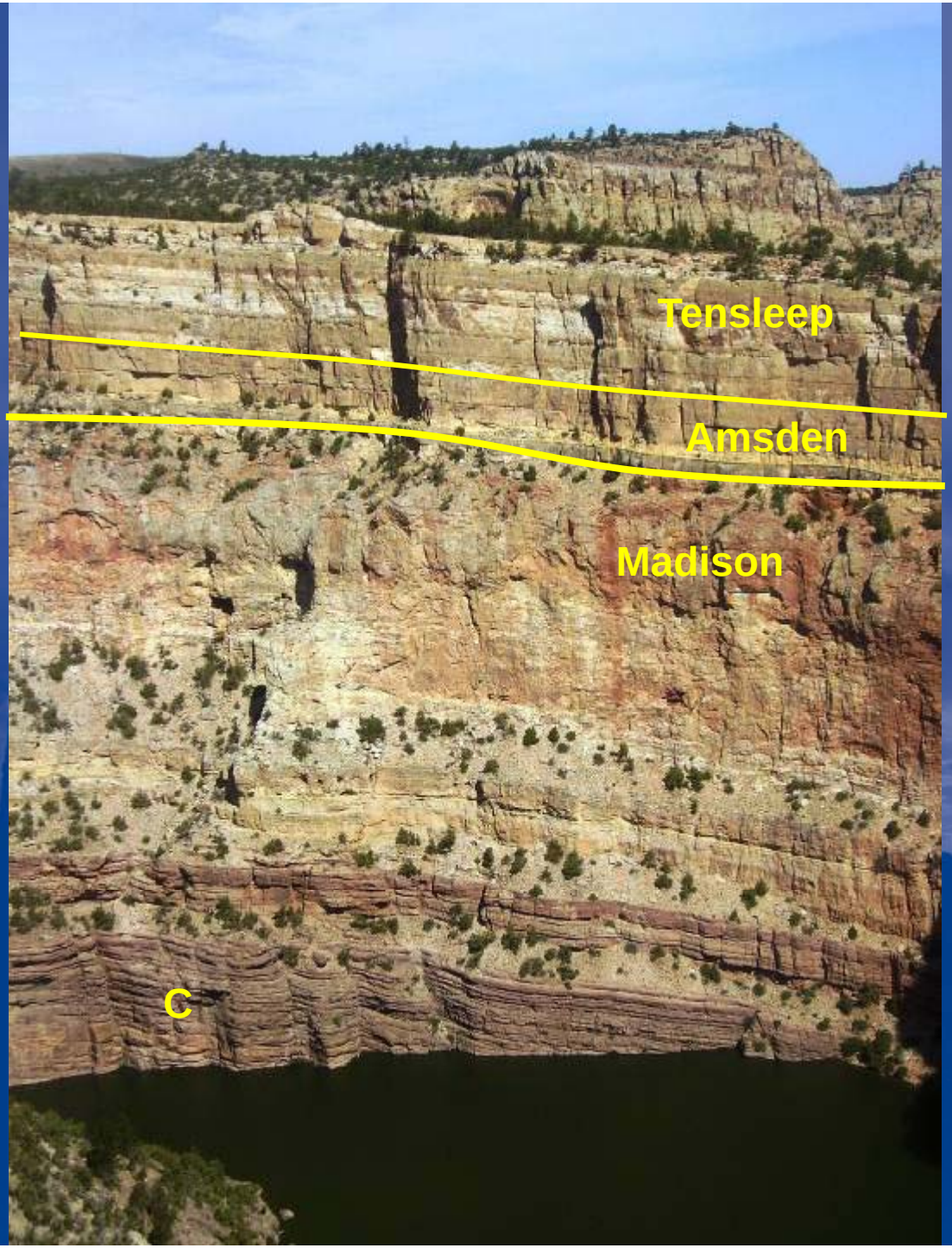

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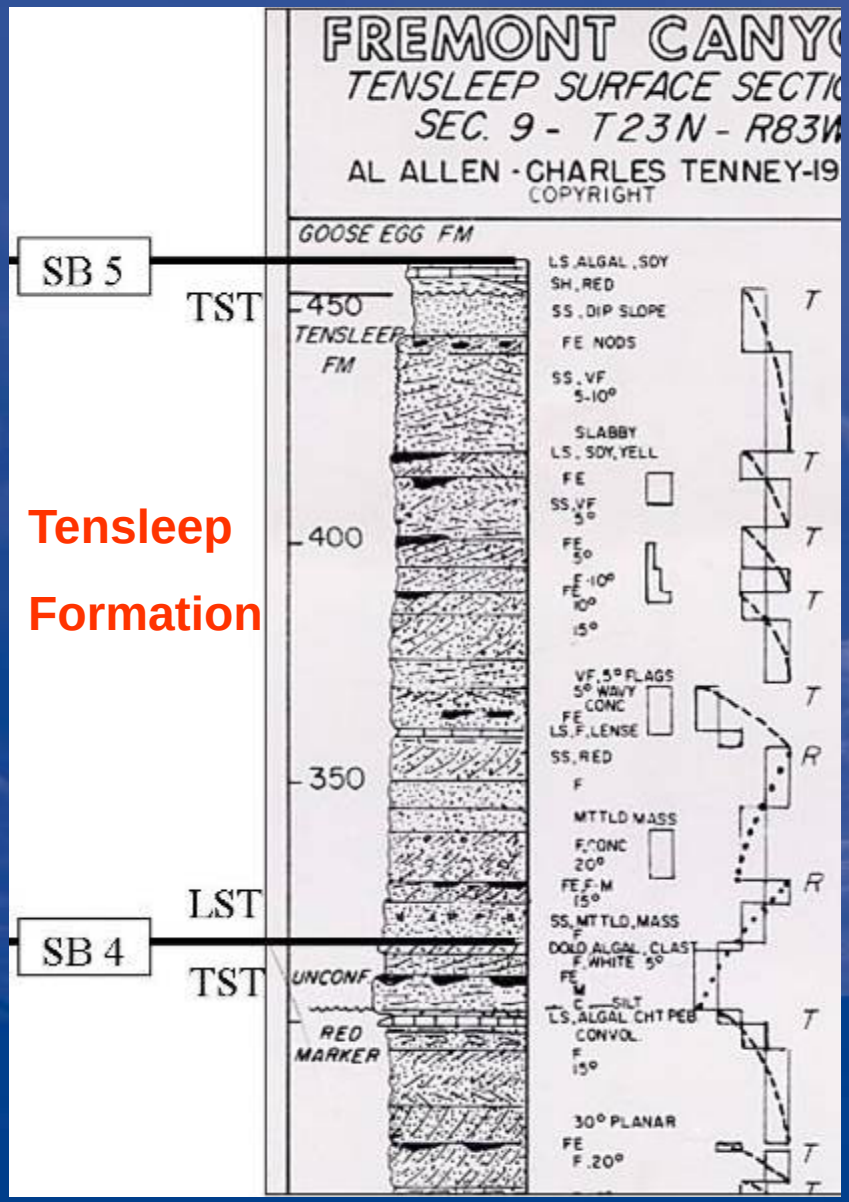
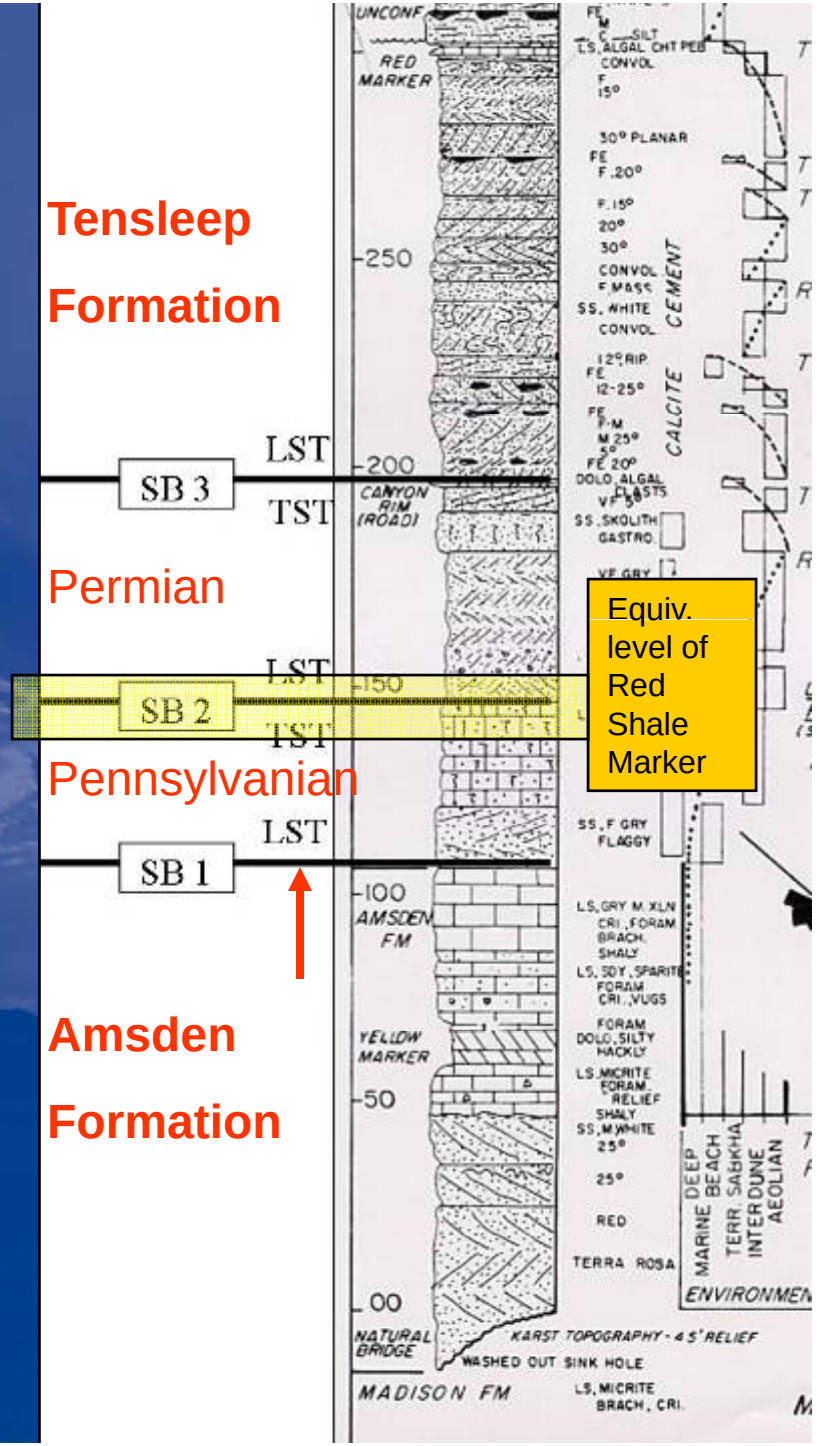


Tensleep Formation



Tensleep Formation

Permian

Pennsylvanian

Amsden Formation

Equiv. level of Red Shale Marker

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Al Allen and Charles Tenney, 1986
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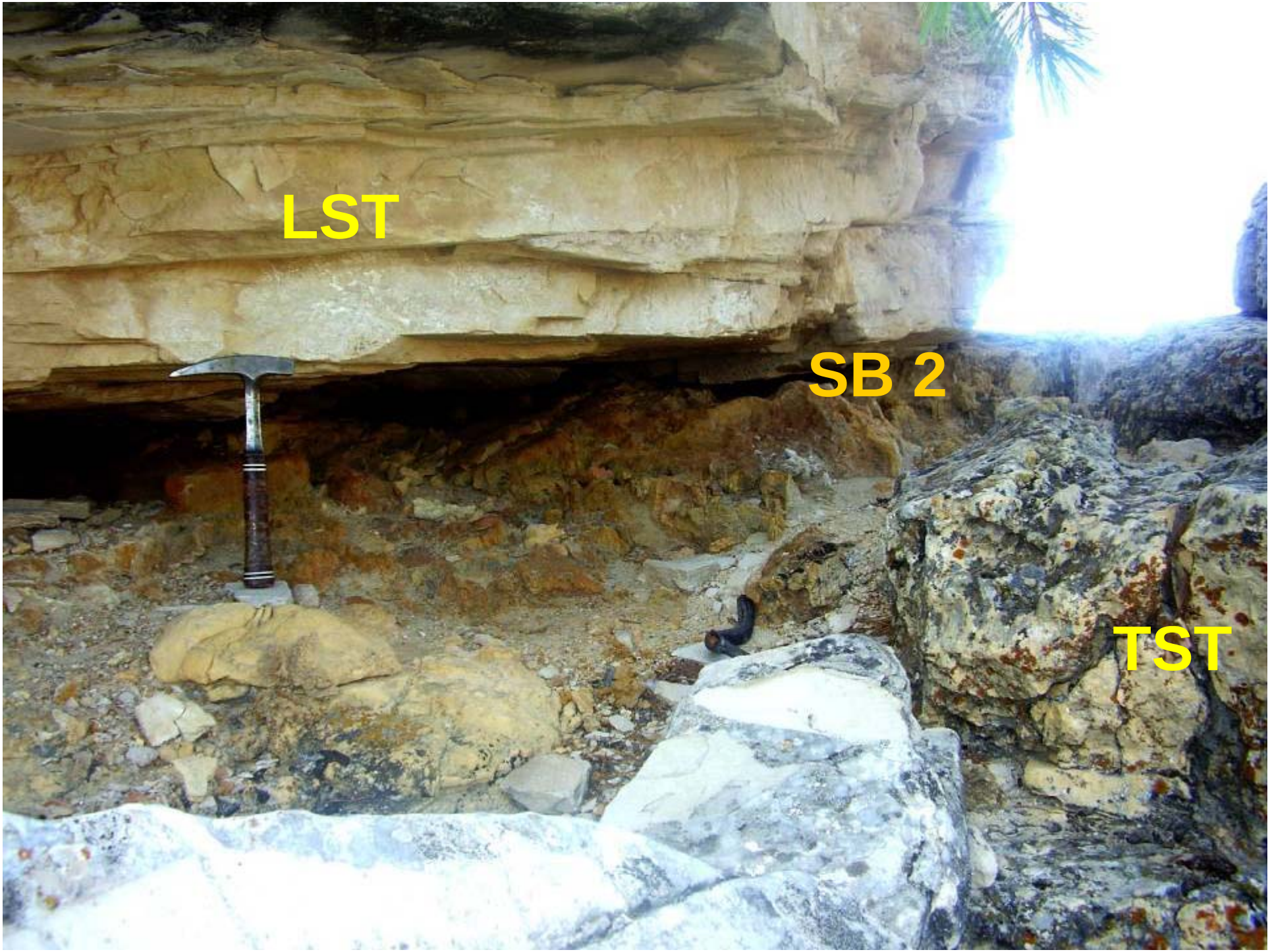
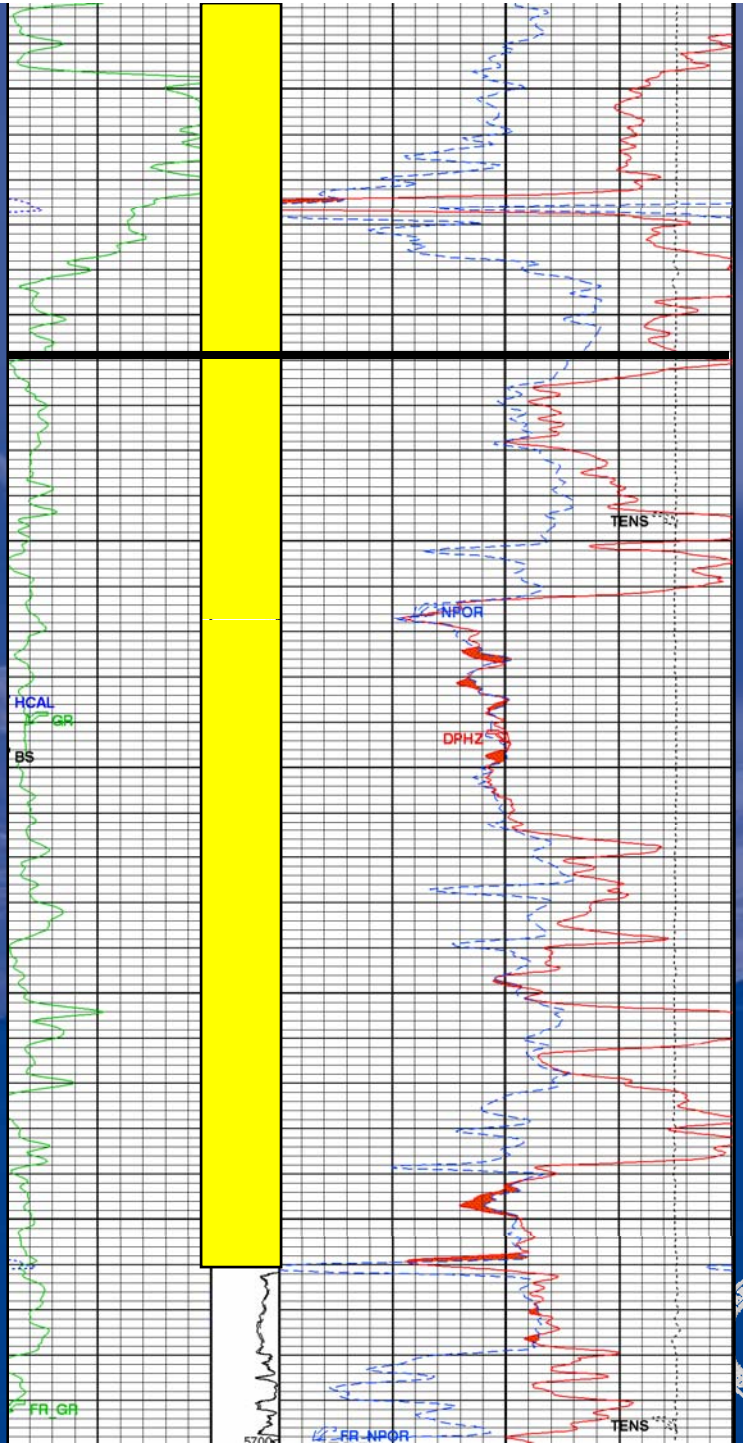
Modified by Tor H. Nilsen, 2005


LST
SB 2
TST

48-X-28
N-D POROSITY

Cored Interval

5300-5653



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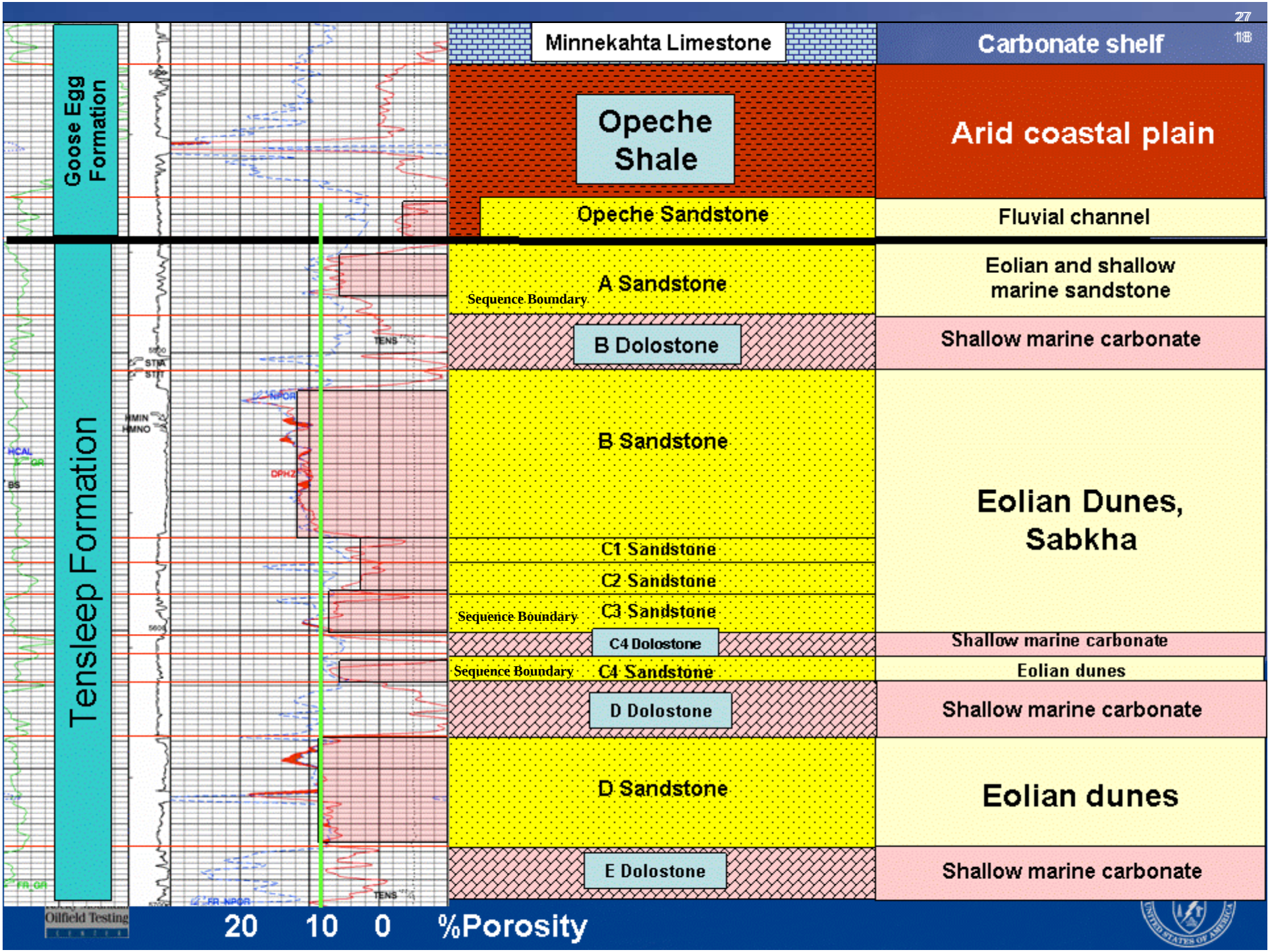
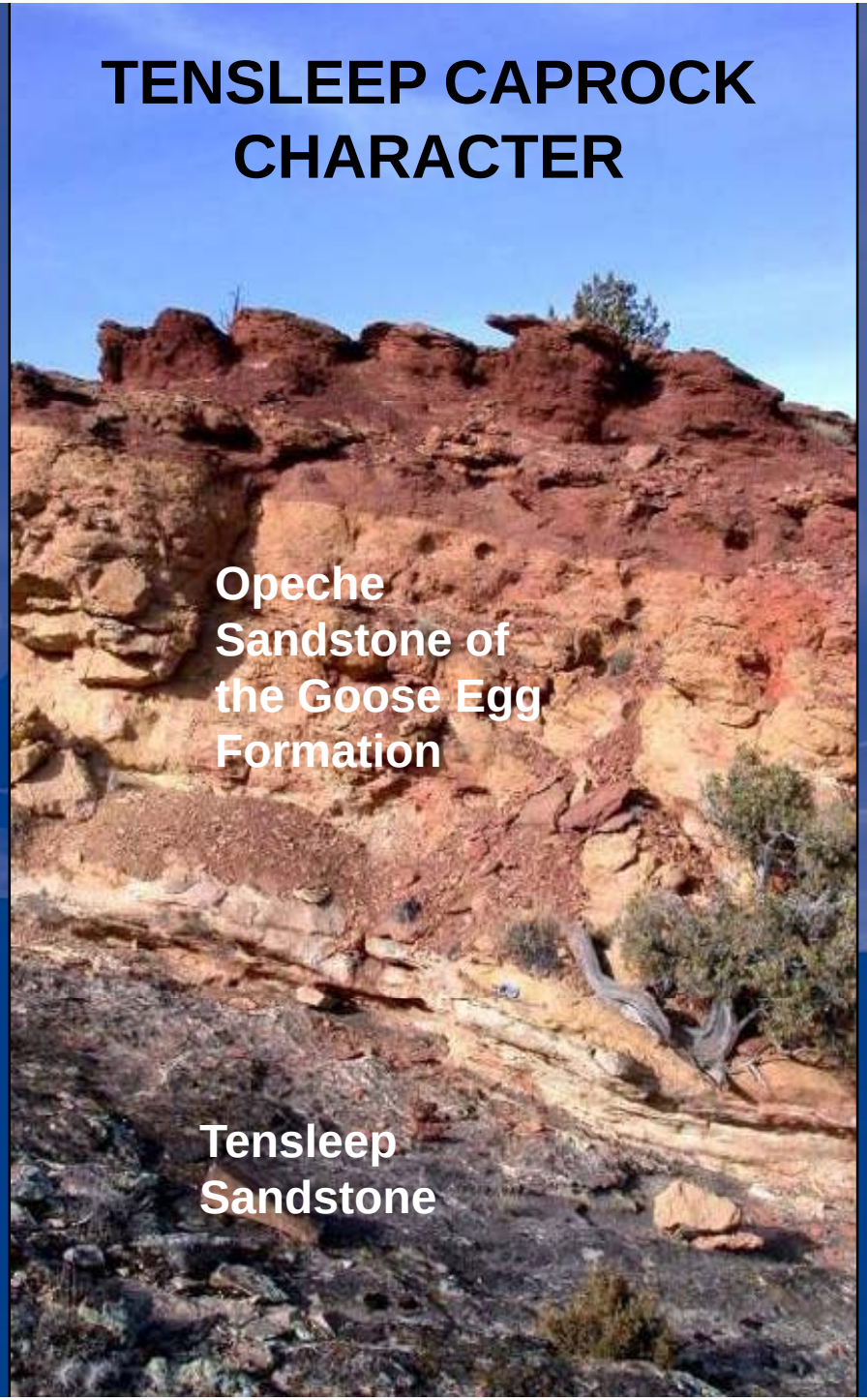

Goose Egg Formation
Tensleep Formation
Minnekahta Limestone
Carbonate shelf
Opeche Shale
Arid coastal plain
Opeche Sandstone
Fluvial channel
A Sandstone
Sequence Boundary
Eolian and shallow marine sandstone
B Dolostone
Shallow marine carbonate
B Sandstone
Eolian Dunes, Sabkha
C1 Sandstone
C2 Sandstone
Sequence Boundary
C3 Sandstone
C4 Dolostone
Shallow marine carbonate
Sequence Boundary
C4 Sandstone
Eolian dunes
D Dolostone
Shallow marine carbonate
D Sandstone
Eolian dunes
E Dolostone
Shallow marine carbonate
Oilfield Testing
20
10
0
%Porosity

TENSLEEP CAPROCK CHARACTER



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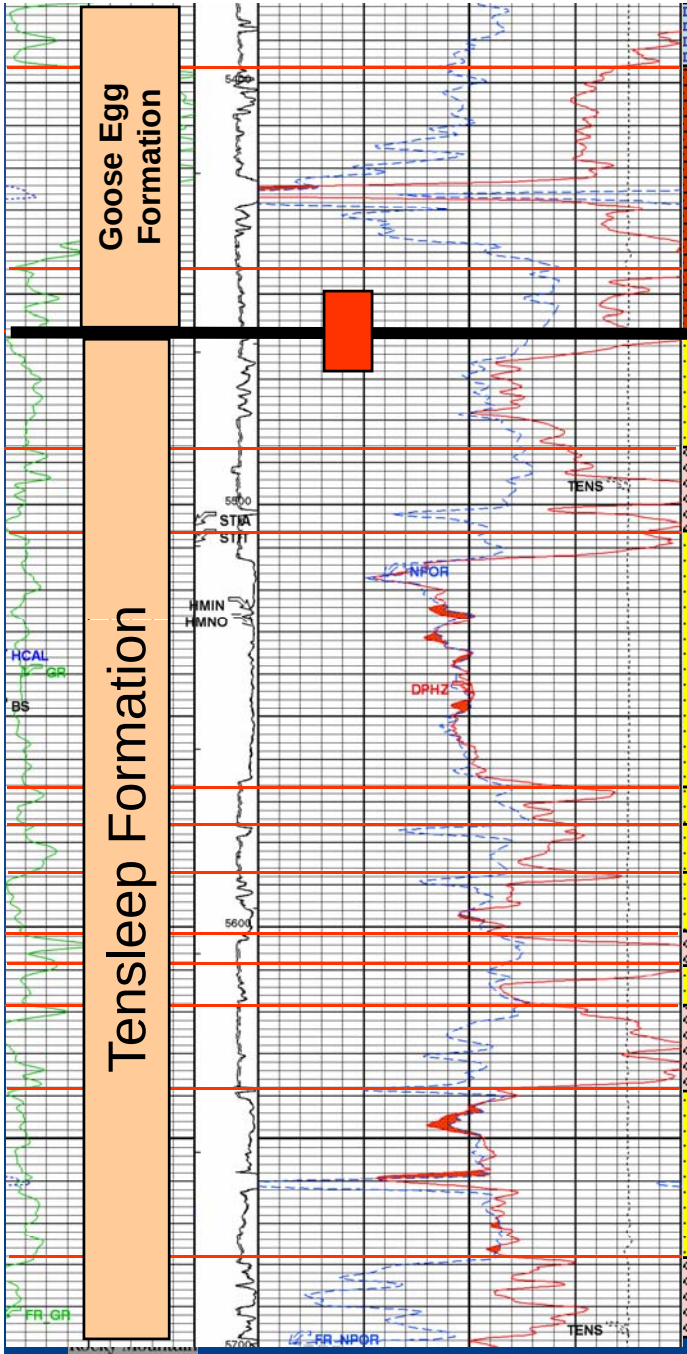
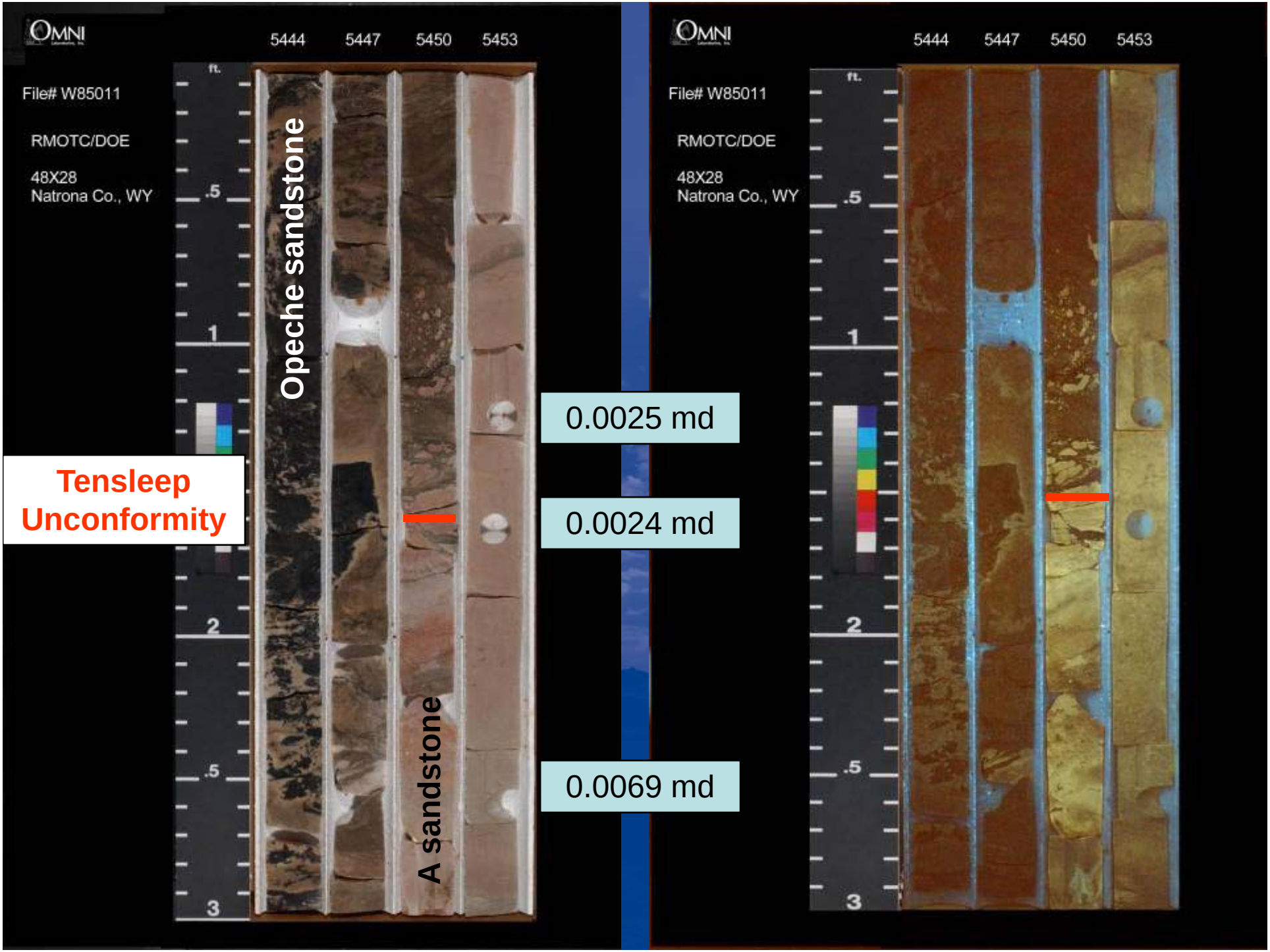


Minnekahta Limestone	Carbonate shelf
Opeche Shale	Arid coastal plain
Opeche Sandstone	Fluvial channel
A Sandstone	Eolian and shallow marine sandstone
B Dolostone	Shallow marine carbonate
B Sandstone	Eolian Dunes
C1 Sandstone	
C2 Sandstone	
C3 Sandstone	
C4 Dolostone	
C4 Sandstone	Eolian dunes
D Dolostone	Shallow marine carbonate
D Sandstone	Eolian dunes
E Dolostone	Shallow marine carbonate

Oilfield Testing CENTER


OMNI
5444
5447
5450
5453
File# W85011
RMOTC/DOE
48X28
Natrona Co., WY
ft.
.5
1
2
.5
3
Opeche sandstone
A sandstone
Tensleep Unconformity
0.0025 md
0.0024 md
0.0069 md
OMNI
5444
5447
5450
5453
File# W85011
RMOTC/DOE
48X28
Natrona Co., WY
ft.
.5
1
2
.5
3

Benefits of a Revised Tensleep Stratigraphic Hierarchy

- Log lithology models developed for wells not cored,
- Improved correlation among Tensleep wells,
- Improved identification and quantification of lost sections due to faulting,
- Determination of large scale flow units limited by sequence boundaries,
- Significant cap rock quality for CO_2 containment.

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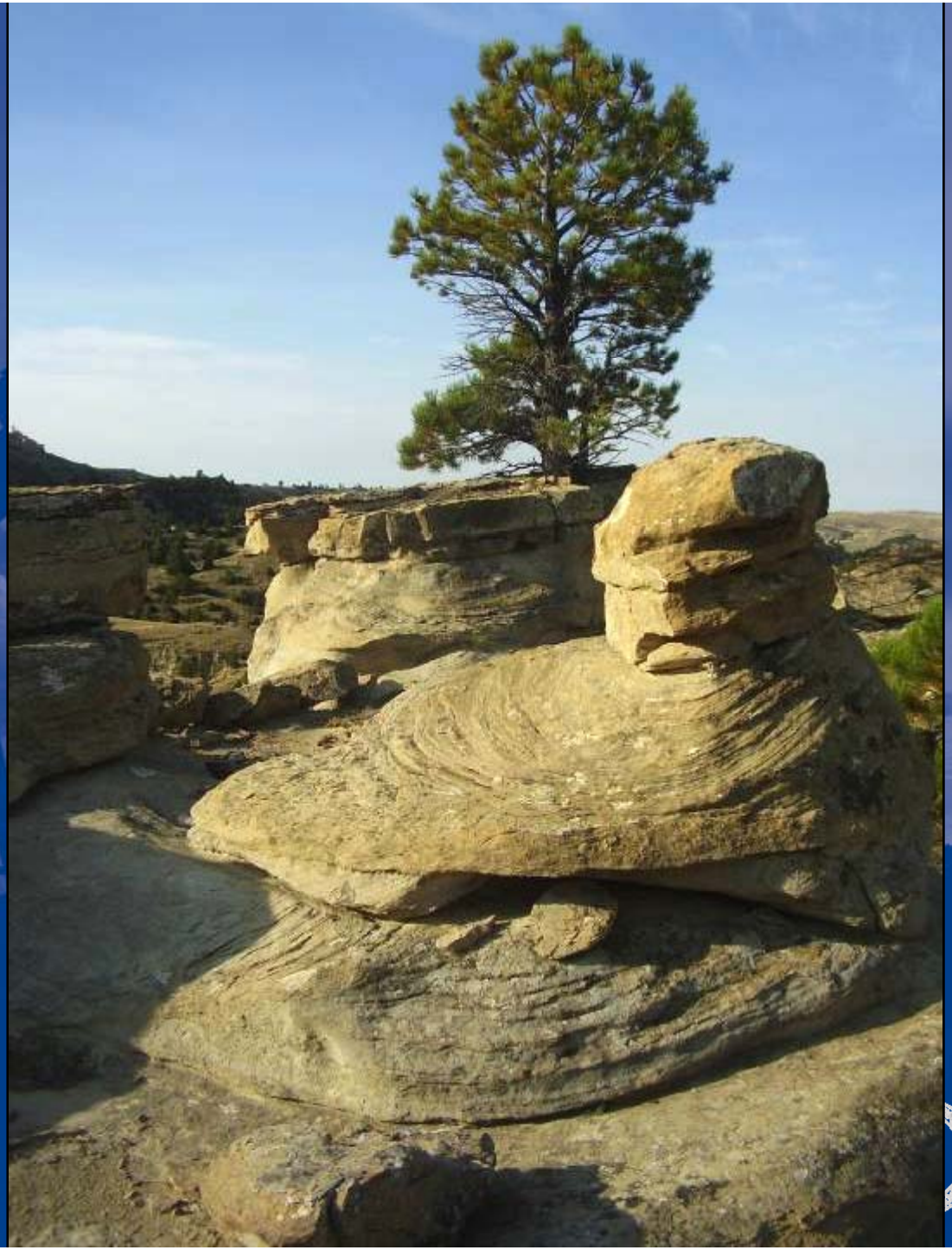
Thank you