

Mancobrara Stratigraphy Unraveled: A Tale of Mancos to Niobrara Stratigraphic Continuity Across the Upper Turonian to Campanian Western Interior Seaway*

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Abstract

It has long been known that laterally time-equivalent sediments deposited in uppermost Turonian through Campanian time in the Western Interior Seaway vary in composition from west to east. Presently, this once continuous stratigraphic interval has been segmented into basins by Laramide tectonism and geographic areas by governmental entities resulting in many different names being given to the same stratigraphic interval. Complications arise when correlating from one basin to another. There is a desire by many geologists to push the eastern, carbonate-dominated, prolifically oil and gas productive Niobrara Formation name west into the realm of the clastic dominated Blue Gate Member of the Mancos Shale. Work on Western Interior biostratigraphy and radiometric dating confirms that at least part of the Mancos Shale is time equivalent with the Niobrara Formation with no gap in deposition along this west to east transect. In the absence of a clear-cut distinction regarding which formation name to use due to the various lateral lithologies, the lure of a blended name such as “Mancobrara” is strong. This study is a synthesis of the work of many previous authors and is a clarification of the Niobrara to Mancos transition across the Douglas Creek Arch. It presents a western-side-of-the-seaway look at what occurred while the Niobrara Formation was being deposited to the east.

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The slide features abstract green geometric shapes in the background. On the left, a solid green triangle points downwards. On the right, a series of overlapping, semi-transparent green triangles of various shades and orientations create a complex, layered effect. The text is centered in the white space between these shapes.

Mancobrara Stratigraphy Unraveled:

**A tale of Mancos to Niobrara
stratigraphic continuity across the
Upper Turonian to Campanian
Western Interior Seaway**

Why do this?

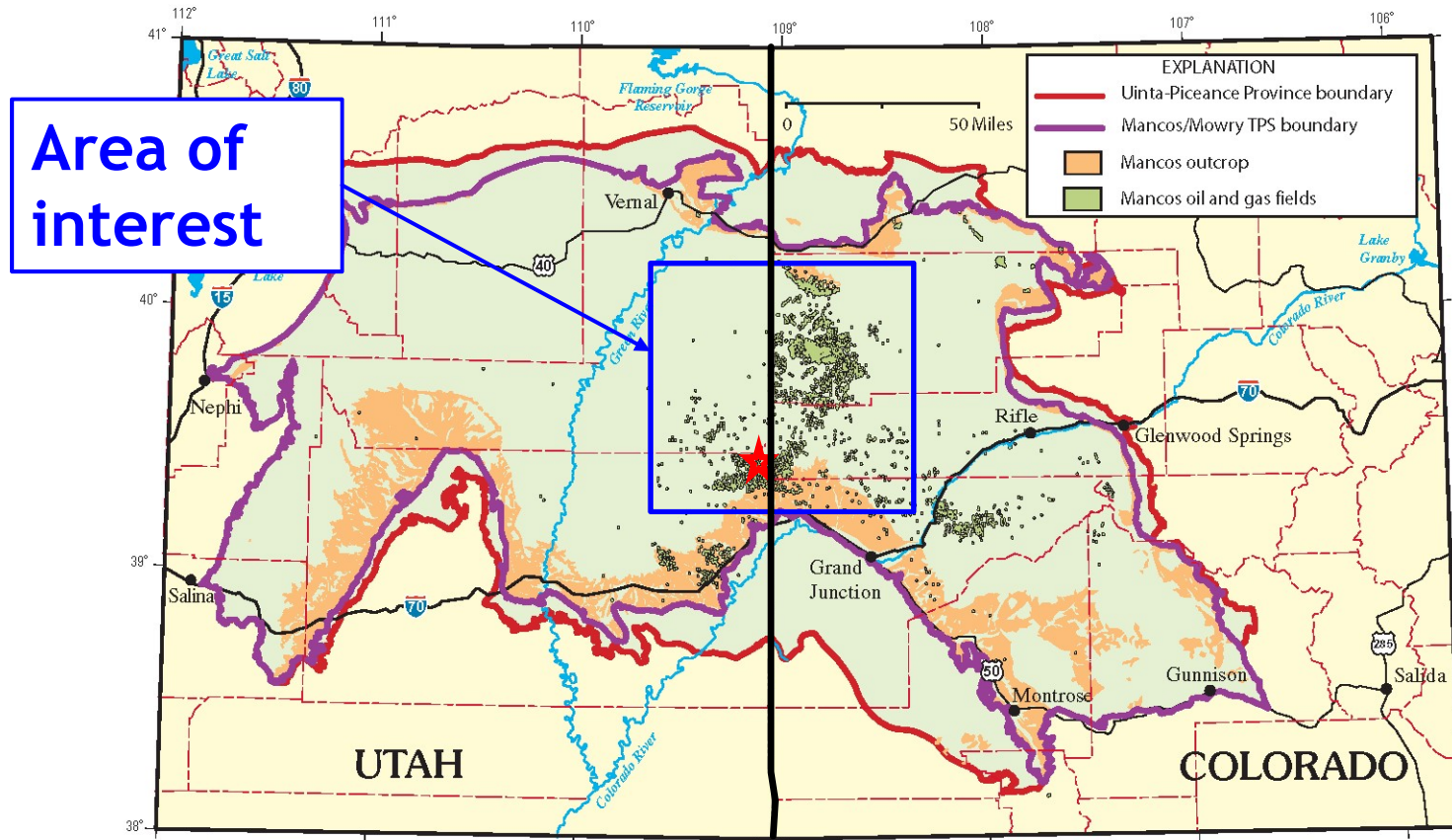
Identify all prospective stratigraphic intervals on the Douglas Creek Arch and in San Arroyo field, Grand County, Utah.

“Can I call it Niobrara if it doesn’t have chalky benches?”

What did I learn?

- Strata time-equivalent to part of the Niobrara formation in the Denver Basin continues and changes composition westward across the Douglas Creek Arch and into the Uinta Basin. Well.... Duh!.
- ✓ The Lower Blue Gate Shale Member/Mancos Shale contains a Niobrara equivalent or “Mancobrara” interval on the Douglas Creek Arch and in the Uinta Basin.

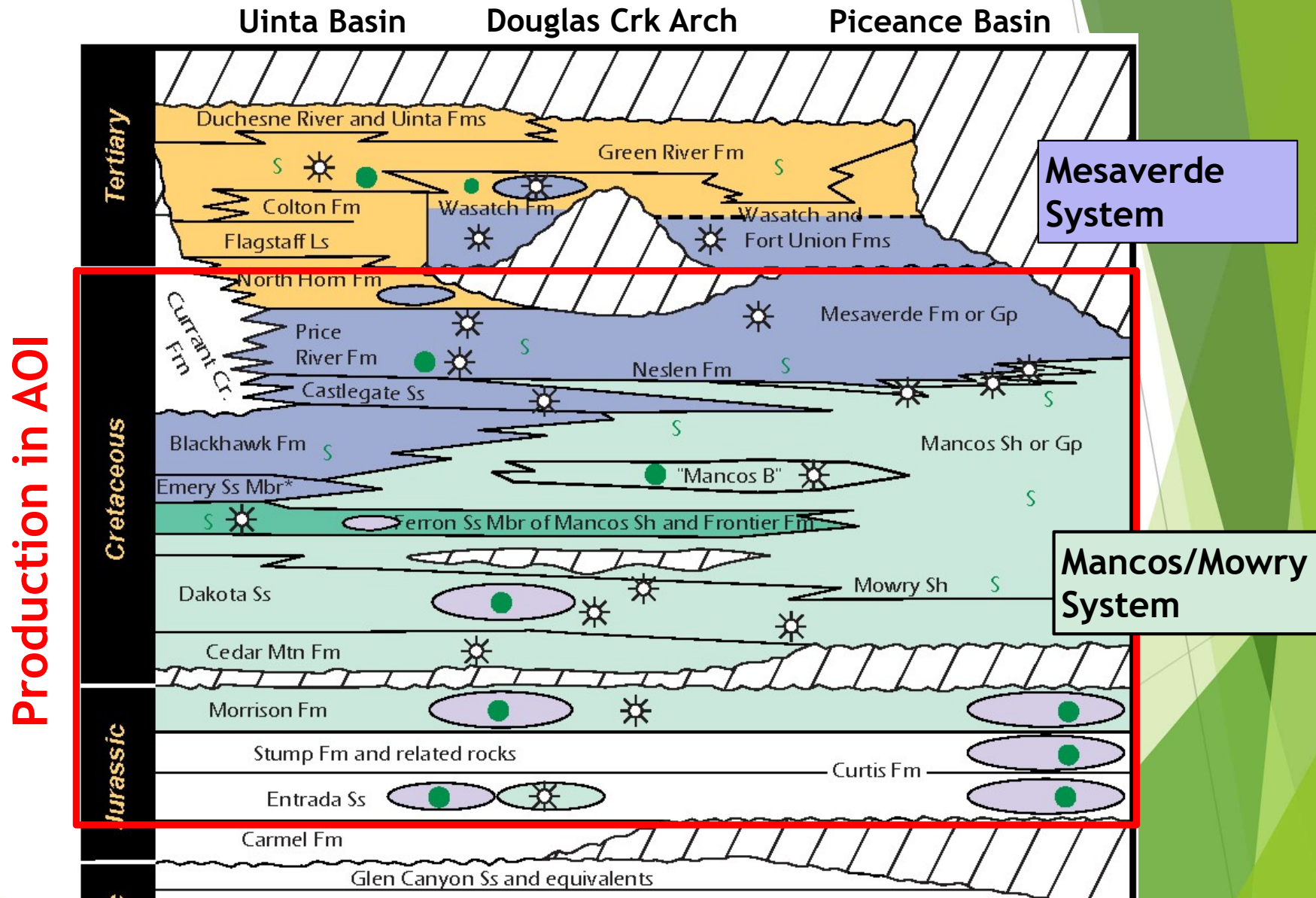
Where: Uinta-Piceance Province



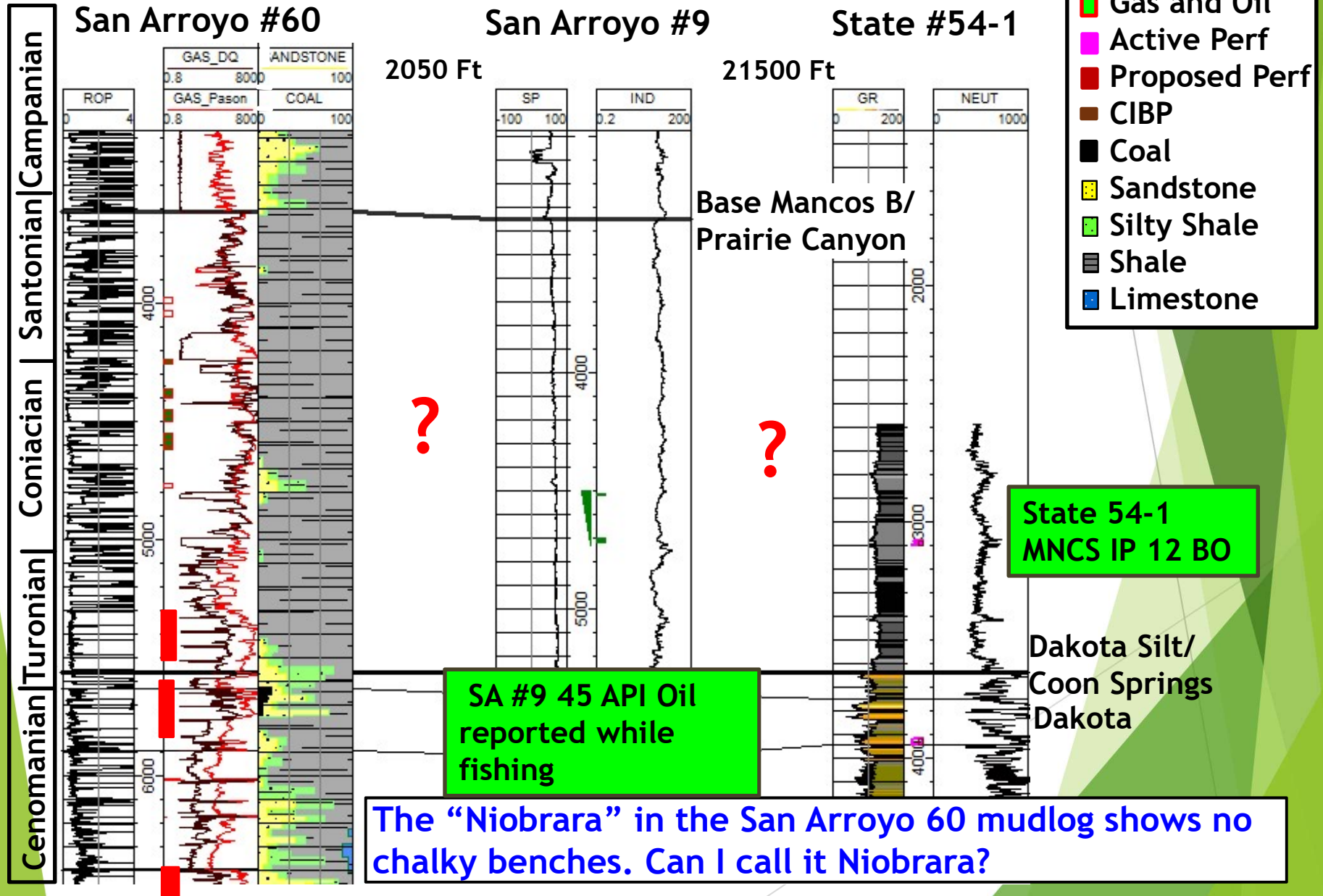
Geologic Assessment of Undiscovered Oil and Gas Resources of the Mancos/Mowry Total Petroleum System, Uinta-Piceance Province, Utah and Colorado By Mark A. Kirschbaum 2003

Chapter 6 of Petroleum Systems and Geologic Assessment of Oil and Gas in the Uinta-Piceance Province, Utah and Colorado in U.S. Geological Survey Digital Data Series DDS-69-B
USGS Uinta-Piceance Assessment Team

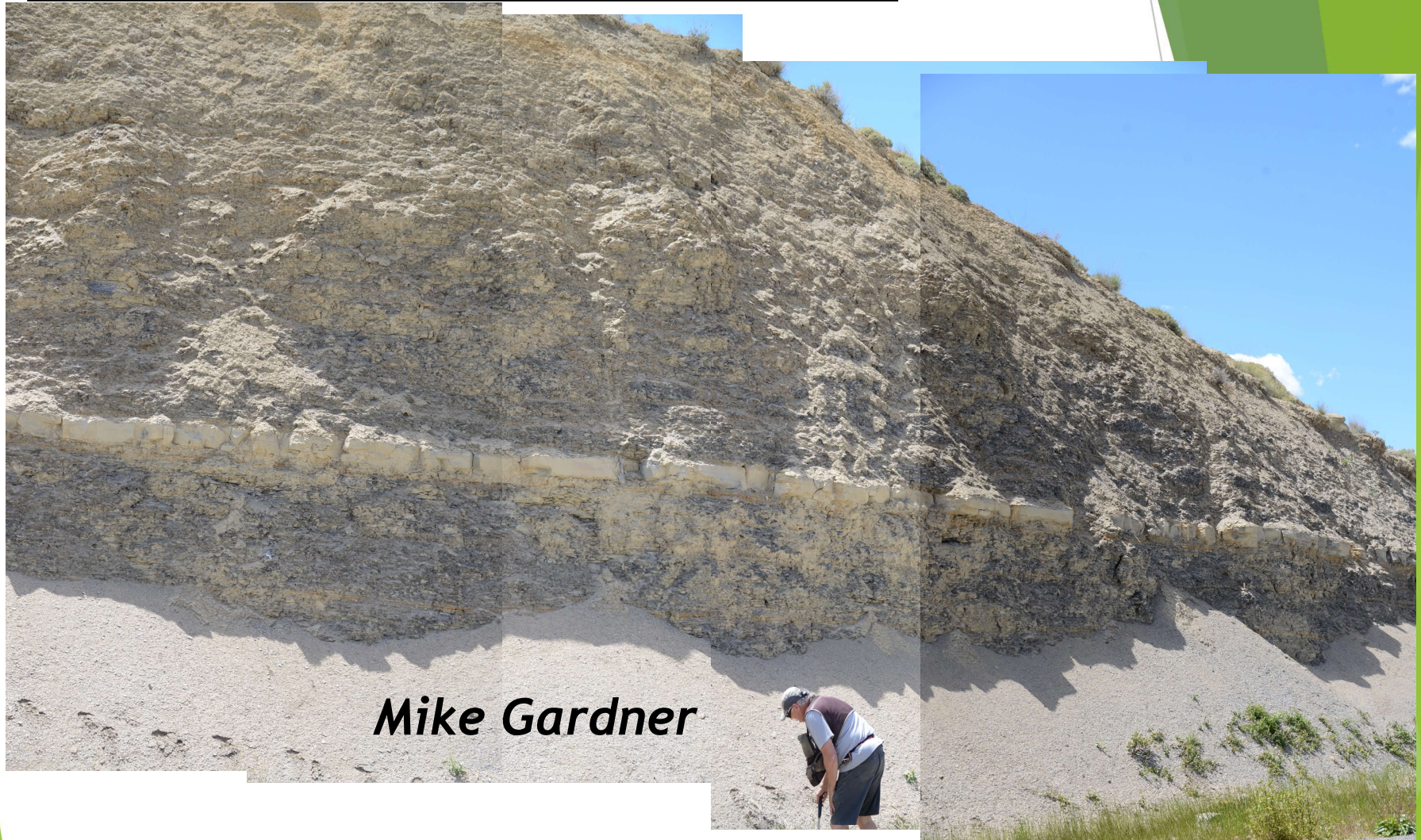
Where: Uinta-Piceance Province cont.



Where: San Arroyo field specifics



Where: This interval in outcrop



Mike Gardner

**One thin limestone and silty, calcareous mudstone
Outcrop just west of Mack, CO**

Where: Niobrara Formation - East

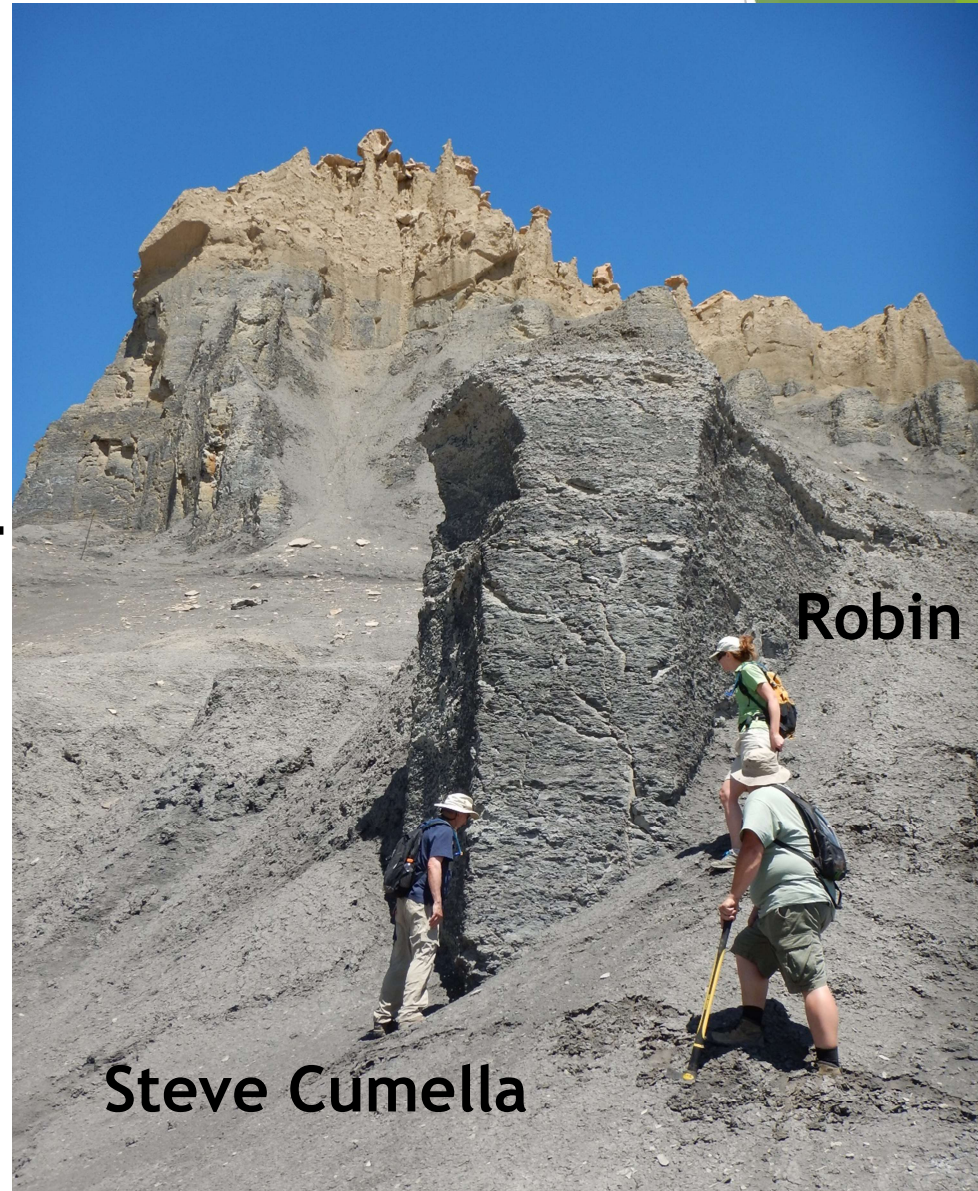


Kelly Bruchez and Nate Rogers measuring section near Kremmling

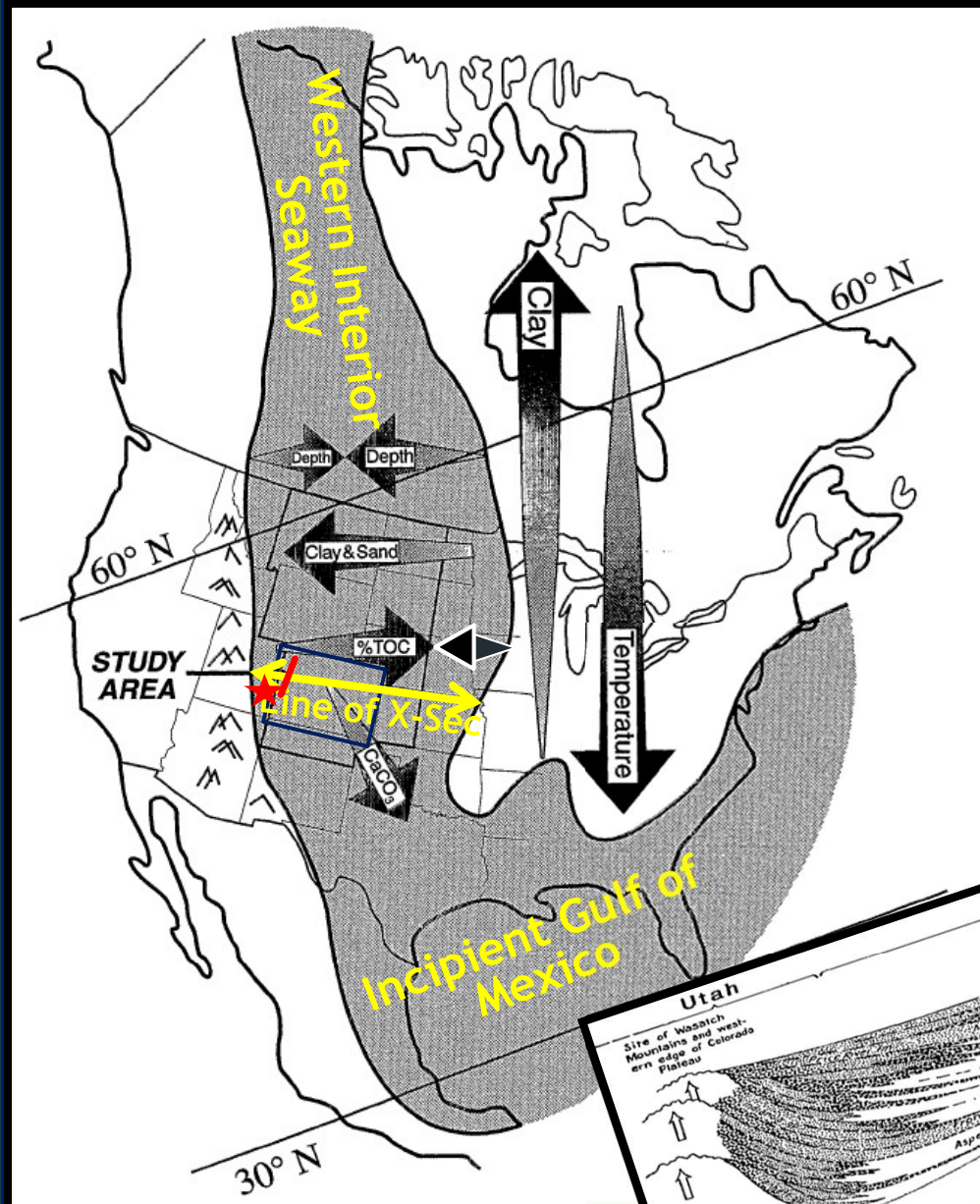
Where: Blue Gate Member/Mancos Shale - West

Near Hanksville, UT

No calcareous beds
are evident

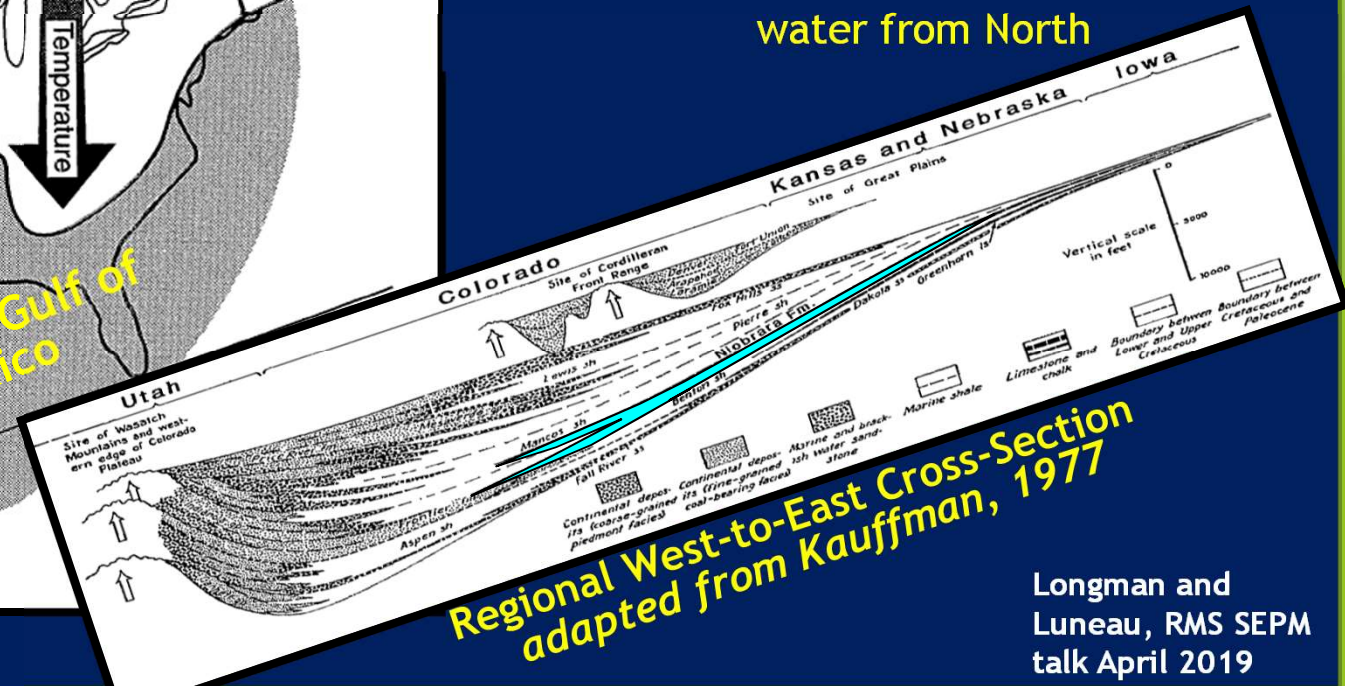


Niobrara (Upper Cretaceous) Depositional Setting



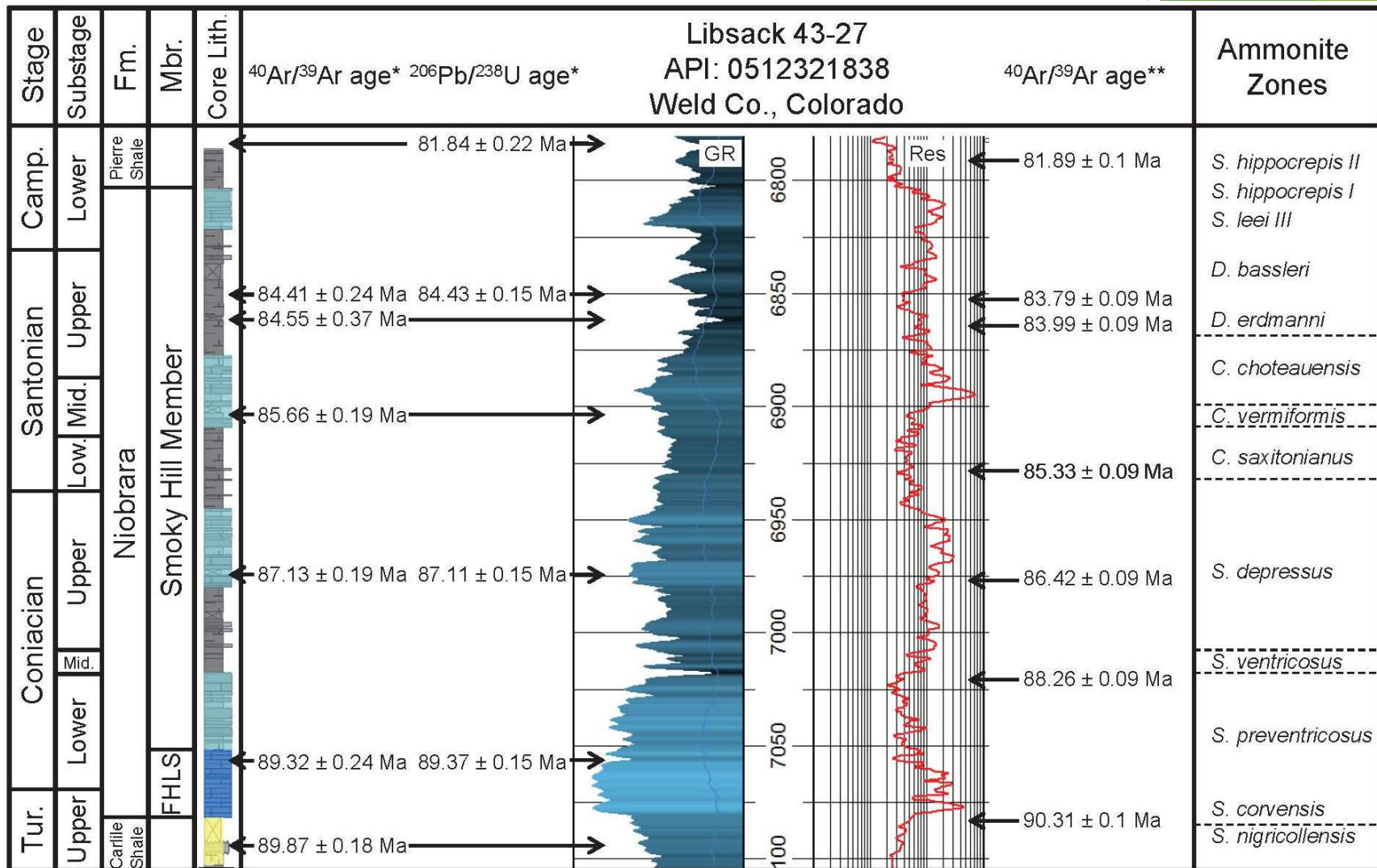
Key Points

1. Major Orogenic Belt to West shedding siliciclastics eastward
2. Broad, flat shelf to East
3. Continuous N/S Seaway with complex and strong current flows
4. Warmer chalk-rich water from South
5. Coccoliths, copepods, & planktonic forams thrive in the warmer waters
6. Cooler, denser, nutrient-rich Arctic water from North



**Longman and
Luneau, RMS SEPM
talk April 2019**

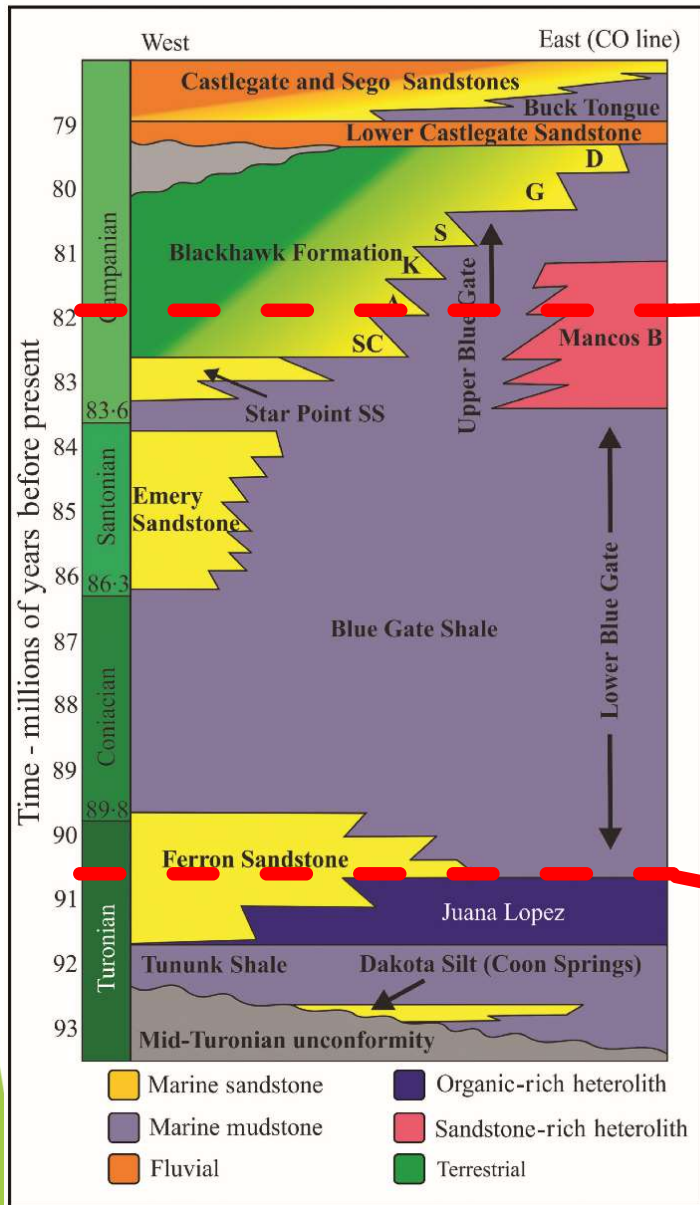
How: The Denver Basin Niobrara Formation



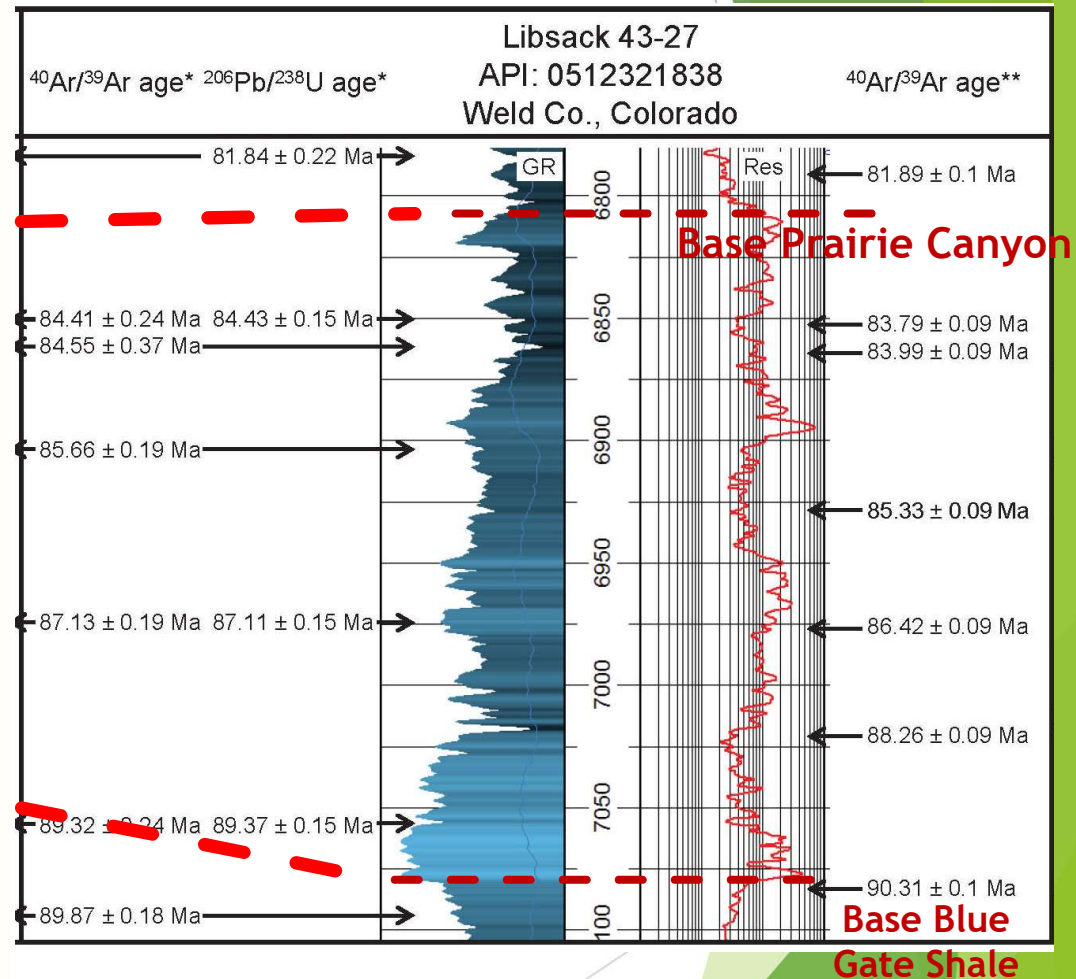
Modified from Locklair and Sageman (2008), *Siewert et al. (in review)

**Age dates (Ogg et al., 2004) are recalibrated bentonite ages (Obradovich, 1993), imported after Locklair and Sageman (2008).

How: Meanwhile, in the Uinta Basin

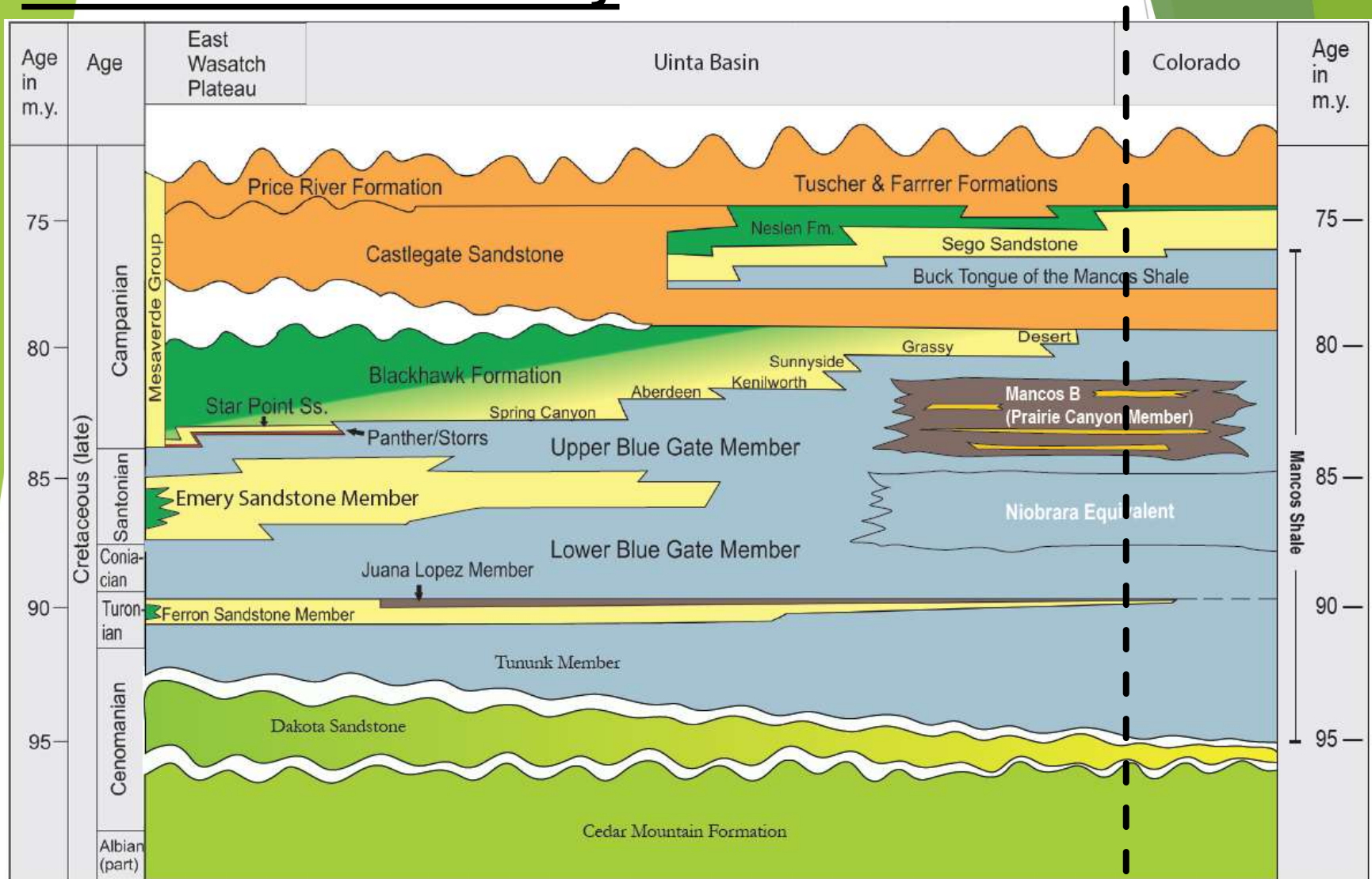


Birgenheier et al., 2017

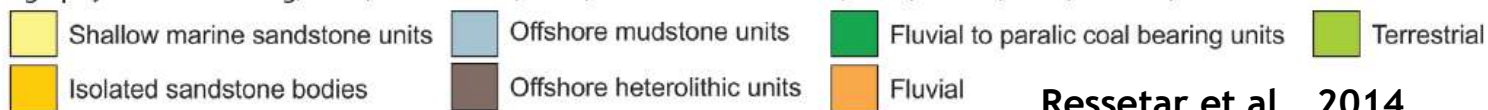


Modified from Drake and Hawkins, 2012
Cole et al., 1997

How: The middle way

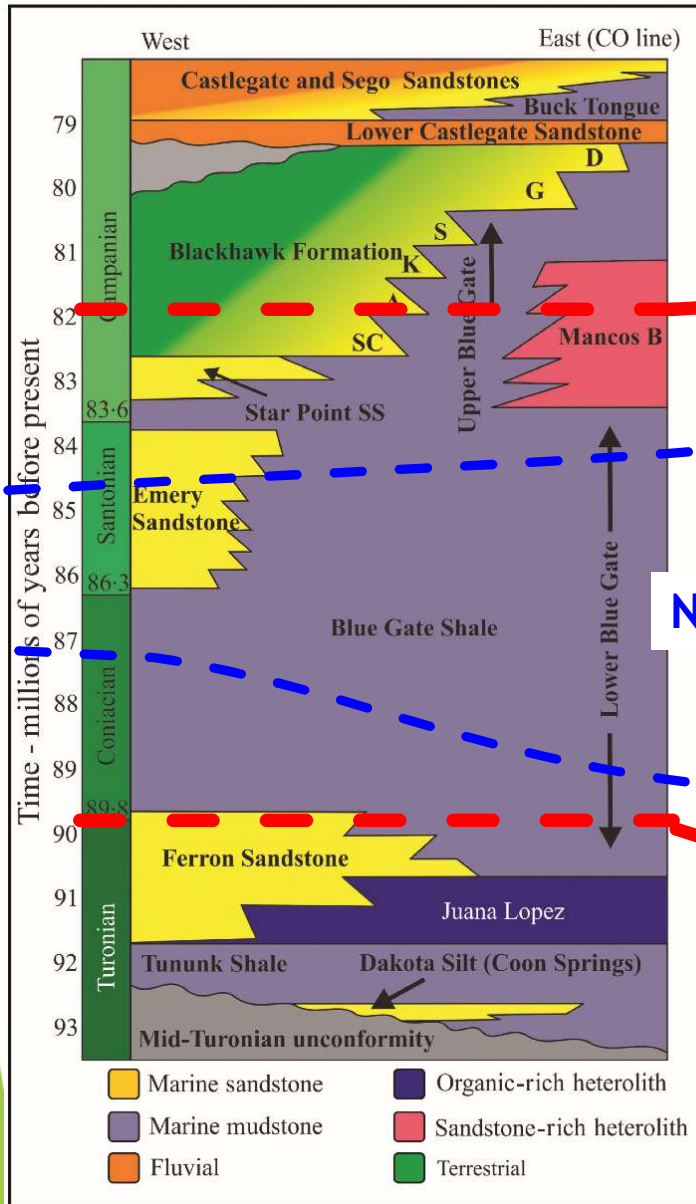


Stratigraphy based on Young, 1955; Kirschbaum, 2003; Johnson and Roberts, 2003; Dubiel, 2003; Kuzniak, 2009.

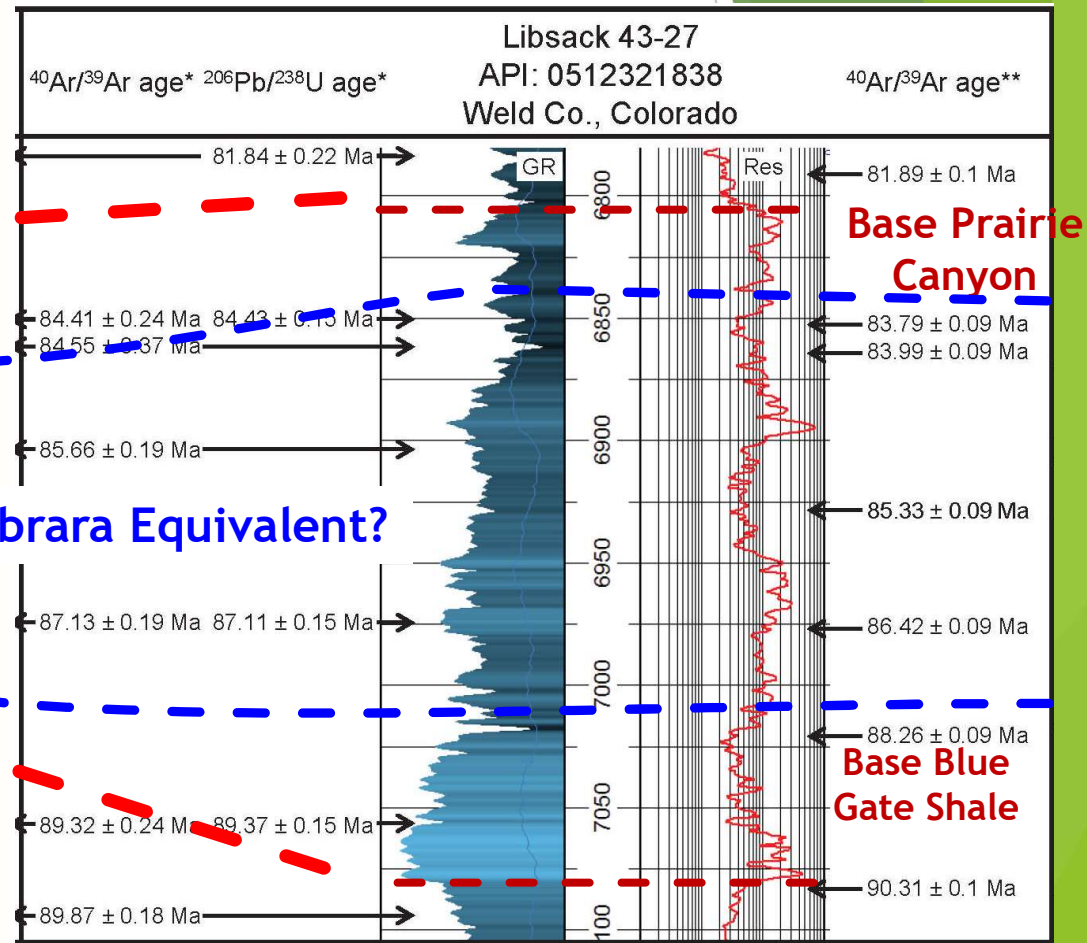


Ressetar et al., 2014

How: Niobrara equivalent is equivalent to?



Birgenheier et al., 2017



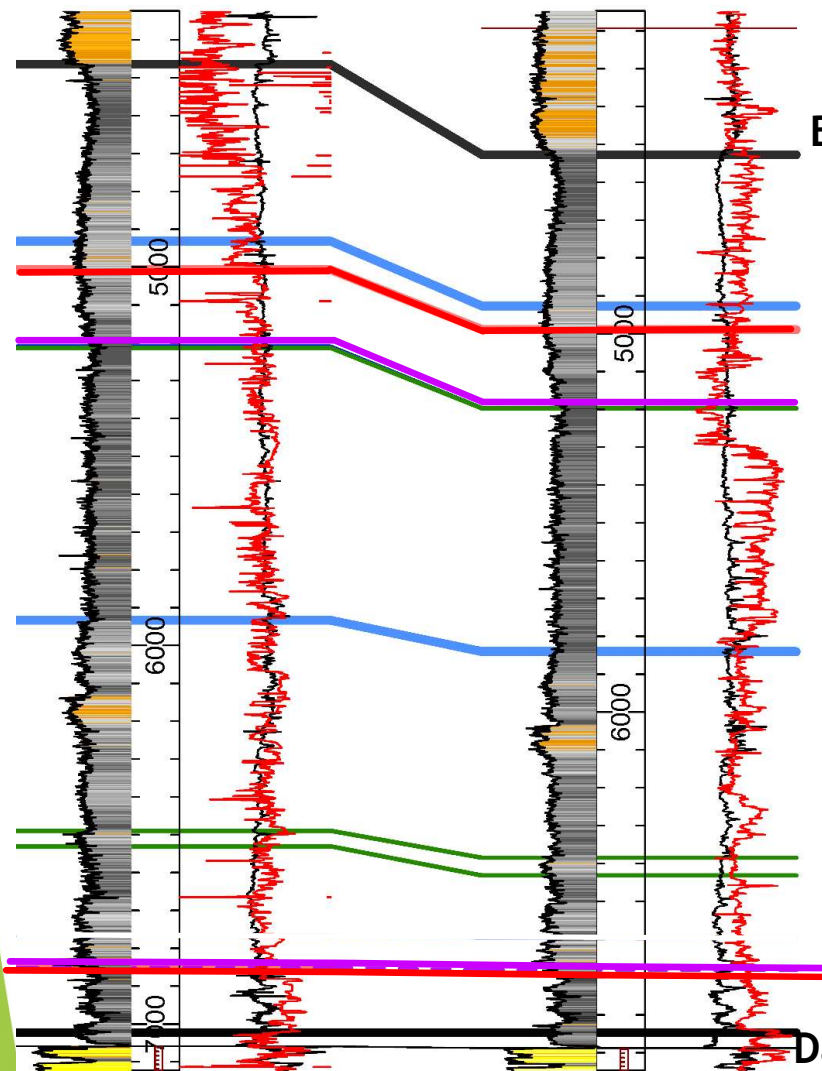
Modified from Drake and Hawkins, 2012
Cole et al., 1997

How: Correlation schemes at Hell's Hole Field

Hell's Hole #9126

Hell's Hole #9131

1.5 Miles



Base Mancos B/Prairie Canyon (UGC)
Latest Niobrara DJ ~82 Ma

Fisher

Resetar

Vincelette and Foster

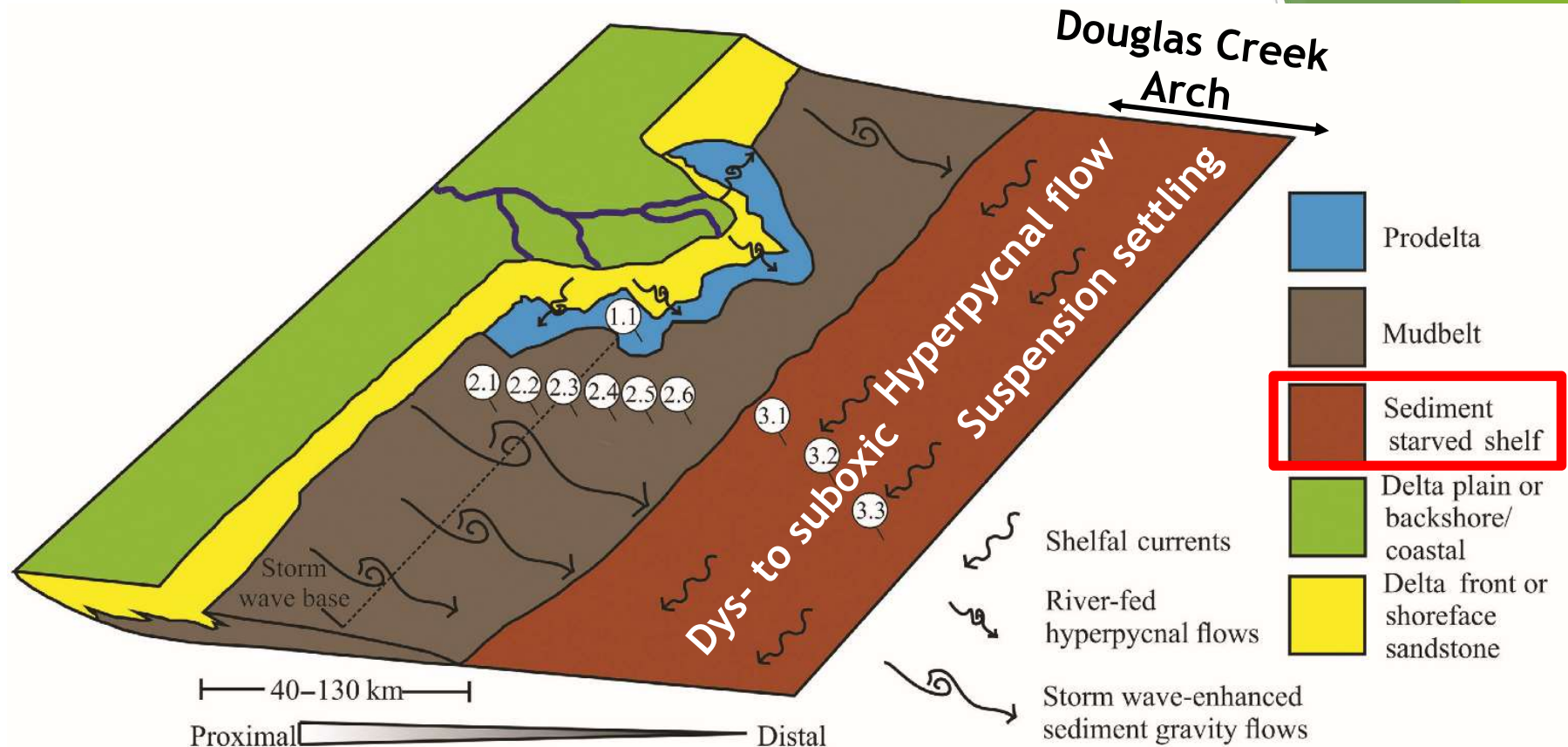
Rogers

84.3+/-1 Ma

89.3+/-1 Ma

Earliest Niobrara DJ ~89 Ma
Dakota Silt/Coon Springs

How: A useful Lower Blue Gate Shale model

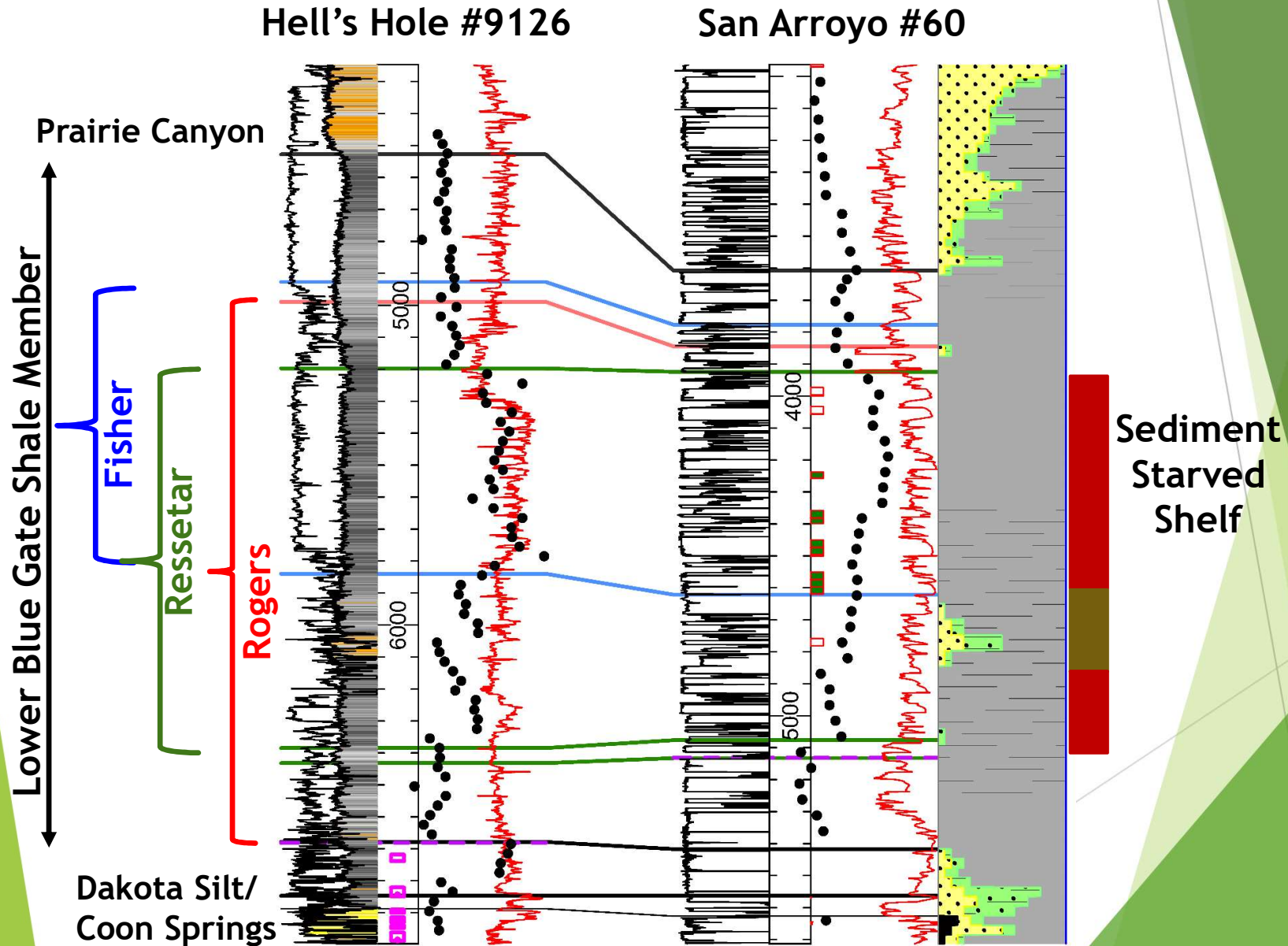


Sediment starved shelf deposits:

- Coccolithophores present indicating suspension settling of tests and fecal pellets containing tests. Highest calcite content.
- Highest likelihood place for Type II kerogen and mixed Type II-III.

San Arroyo

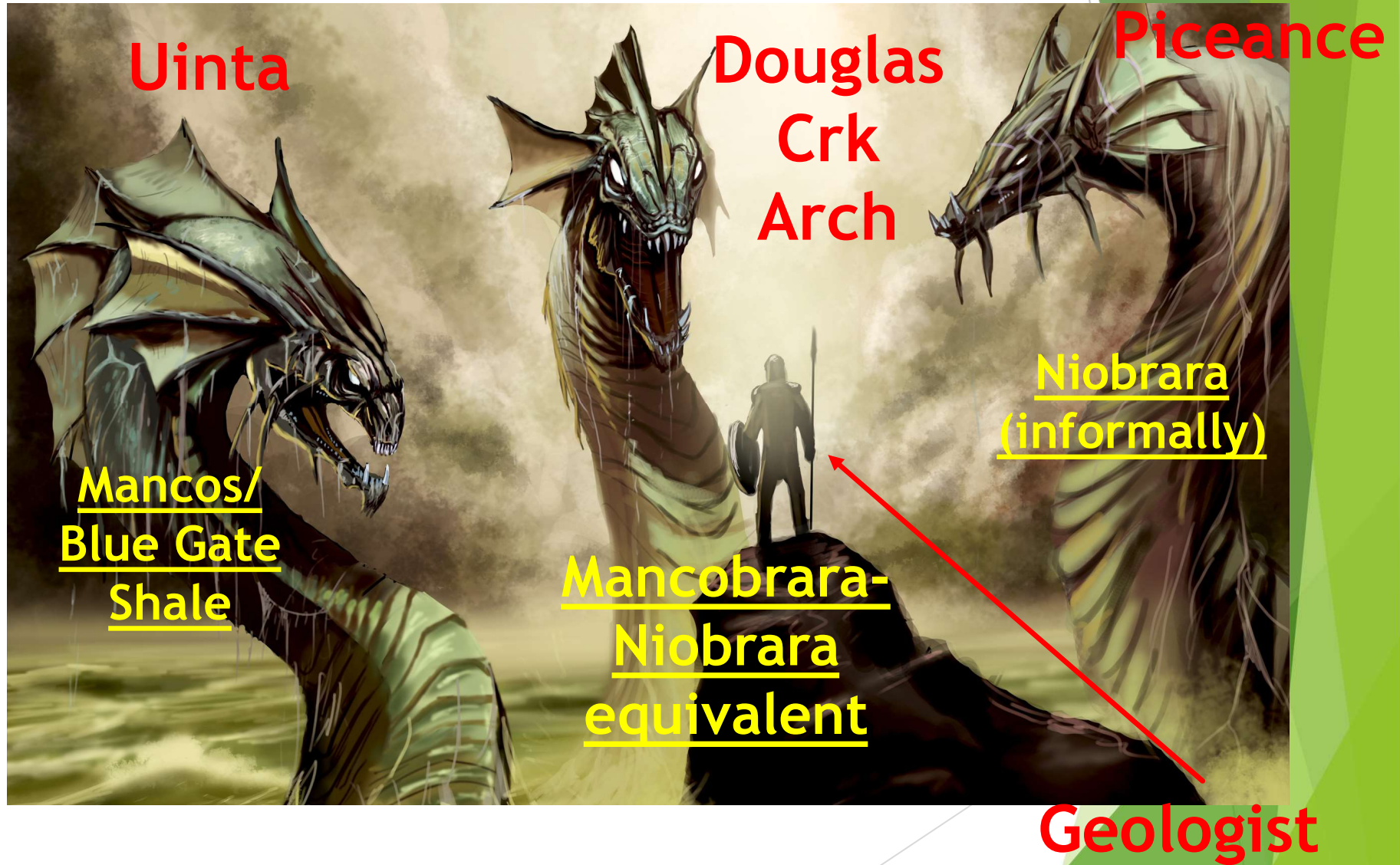
How: Cross Section - Hell's Hole to San Arroyo



What did I learn revisited:

- Strata time-equivalent to part of the Niobrara formation in the Denver Basin continues and changes composition westward across the Douglas Creek Arch and into the Uinta Basin.
- ✓ The Lower Blue Gate Shale Member/Mancos Shale contains a Niobrara equivalent or “Mancobrara” interval on the Douglas Creek Arch and in the Uinta Basin.

All the same beast below the surface



THANK YOU

Utah Gas Corporation

- Tyson Foutz
- Norm Schwalm



Contributors offering crucial guidance:

- Donna Anderson
- Peter Bucknam
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- Mark Longman
- Katie Joe McDonough
- Larry Rasmussen
- Nate Rogers
- Rob Sterling

NAMASTE