Upper Triassic Shublik Formation of North Alaska — An Eagle Ford Type Shale Reservoir Play?*

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Abstract

The Triassic Shublik Formation in northern Alaska is the dominant source rock for Prudhoe Bay, the largest conventional hydrocarbon accumulation in North America, and also an emerging shale play that has been compared to the Cretaceous Eagle Ford Shale of South Texas. However, not all shale reservoirs are alike due to variations in mineralogy, organic richness and other petrophysical properties. The Eagle Ford and the Shublik appear to have many analogous attributes, but that similarity must be verified before the production characteristics of the Eagle Ford Shale can be used to predict possible reservoir productivity of the Shublik Formation.

The Middle to Upper Triassic Shublik Formation was deposited in an upwelling zone on a shallow shelf that deepened to the S-SW. This heterogeneous formation consists of four zones and fifteen different facies including claystones, sandstones, limestones, and phosphatic rocks. The unit is truncated to the N-NE by a Lower Cretaceous unconformity and depositionally thins to the S-SW, where it transitions into distally equivalent members of the Otuk Formation. Shublik research to date has concentrated on source-rock potential, lithofacies, depositional setting, and bio-, chemo-, and sequence stratigraphy.

This project analyzes the resource potential of the Shublik Formation by combining various data-acquisition and reservoir-characterization techniques (outcrop spectral gamma ray data, basic and advanced openhole logs, core analysis, and geochemistry) to evaluate the petrophysical and geomechanical similarities with the Eagle Ford Shale. Documentation of petrophysical properties of the shale will also allow determination of rock competence by evaluating Young's Modulus, Poisson's ratio and Brinell hardness numbers. By comparing the lithostratigraphy, TOC, bed thickness and mechanical stratigraphy of the two plays, we can establish an effective development approach and estimate ultimate reservoir potential/production performance. This analysis will help determine potential stimulation criteria and completion methodology to better optimize production potential of the Shublik Formation.

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4/24/2012

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS 1917 AAPG

Advanced Instrumentation Laboratory

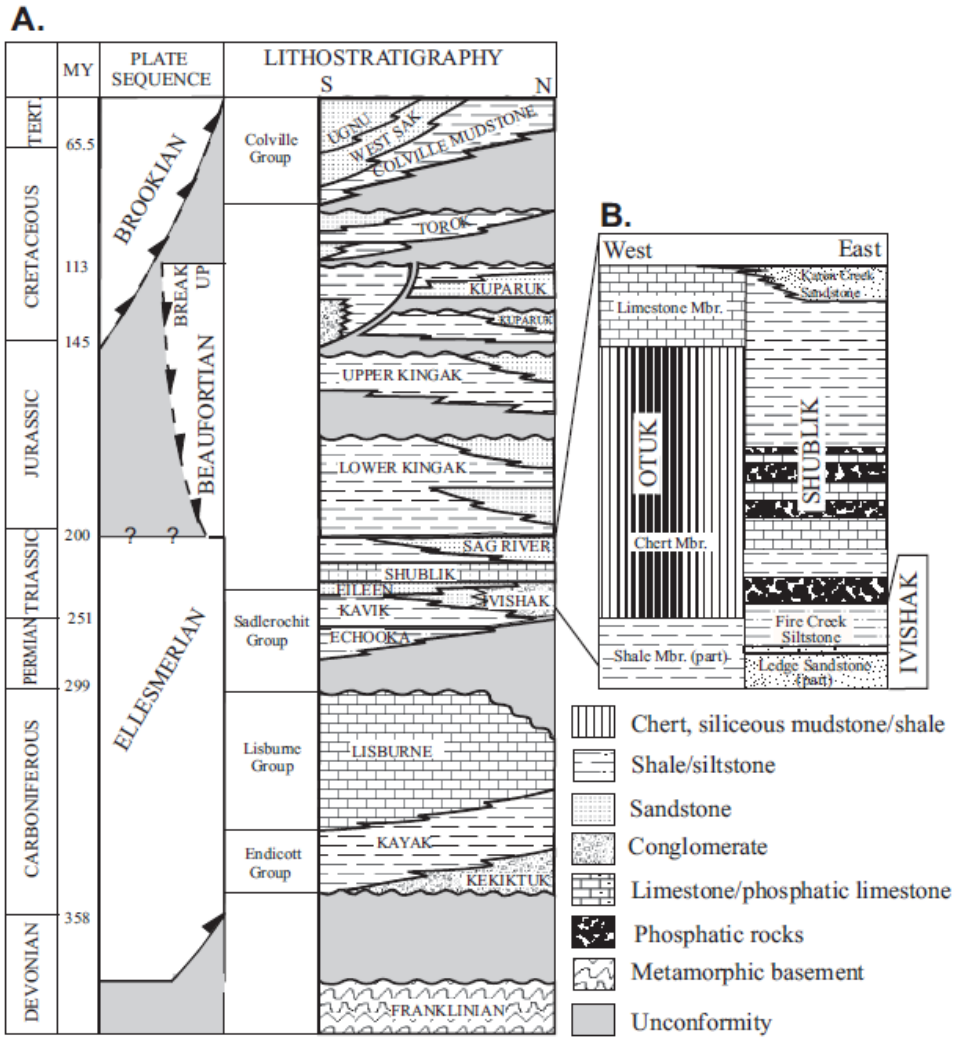
Focus

- **Gathering Data**
  - Existing Log Data
  - Samples and cores
- **Data Analysis**
  - Geochemistry and organic content (TOC)
  - Thermal maturity
  - Sequence stratigraphy
  - Isopach and structure mapping
- **Lithologic comparison of Eagle Ford**
  - Potential analogous parameters

Data Limits

- Wireline logs from ~80 wells
- Petrophysics including Delta Log-R, Young's Modulus and Poisson's Ratio
- Outcrop spectral gamma ray
- Shublik Fm. matrix composition and TOC percentages from outcrop

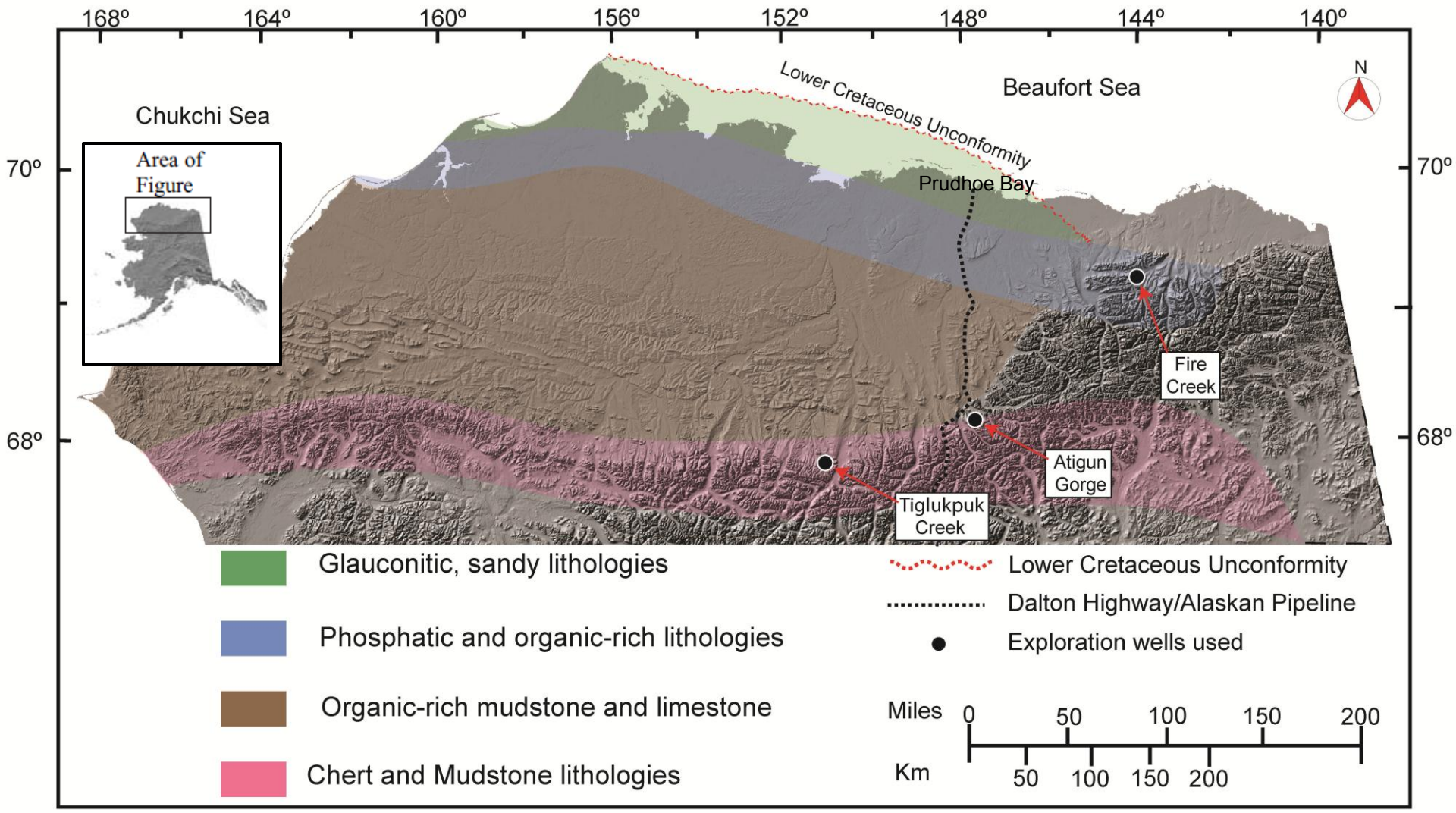
North Slope Stratigraphy



- Franklinian, Ellesmerian, Beaufortian and Brookian mega-sequences.
- Upper Triassic Shublik Fm. and distal equivalent Otuk Fm.

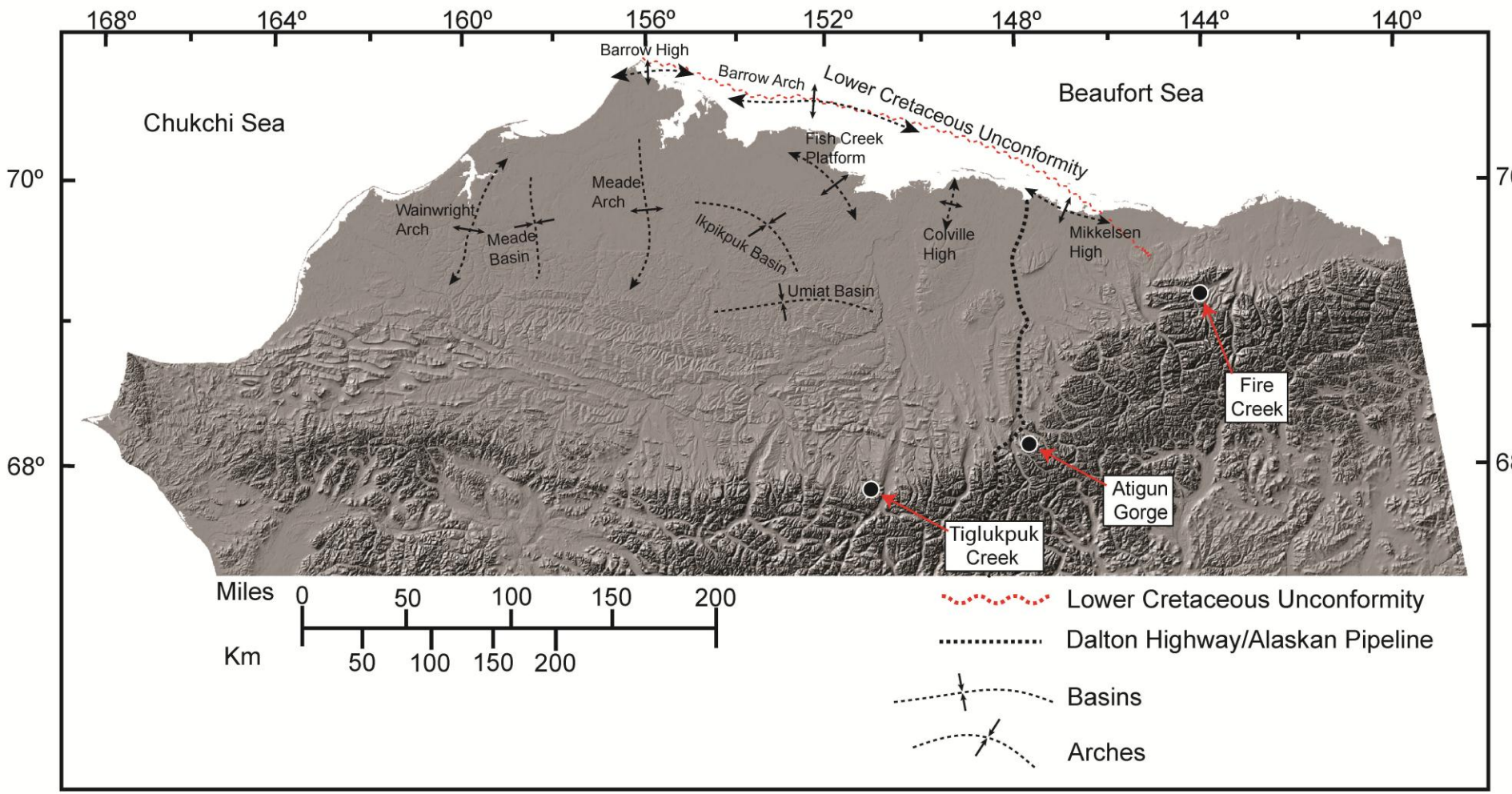
Modified from Kelly et al. (2007), Detterman et al. (1975) and others

Shublik Regional Extent



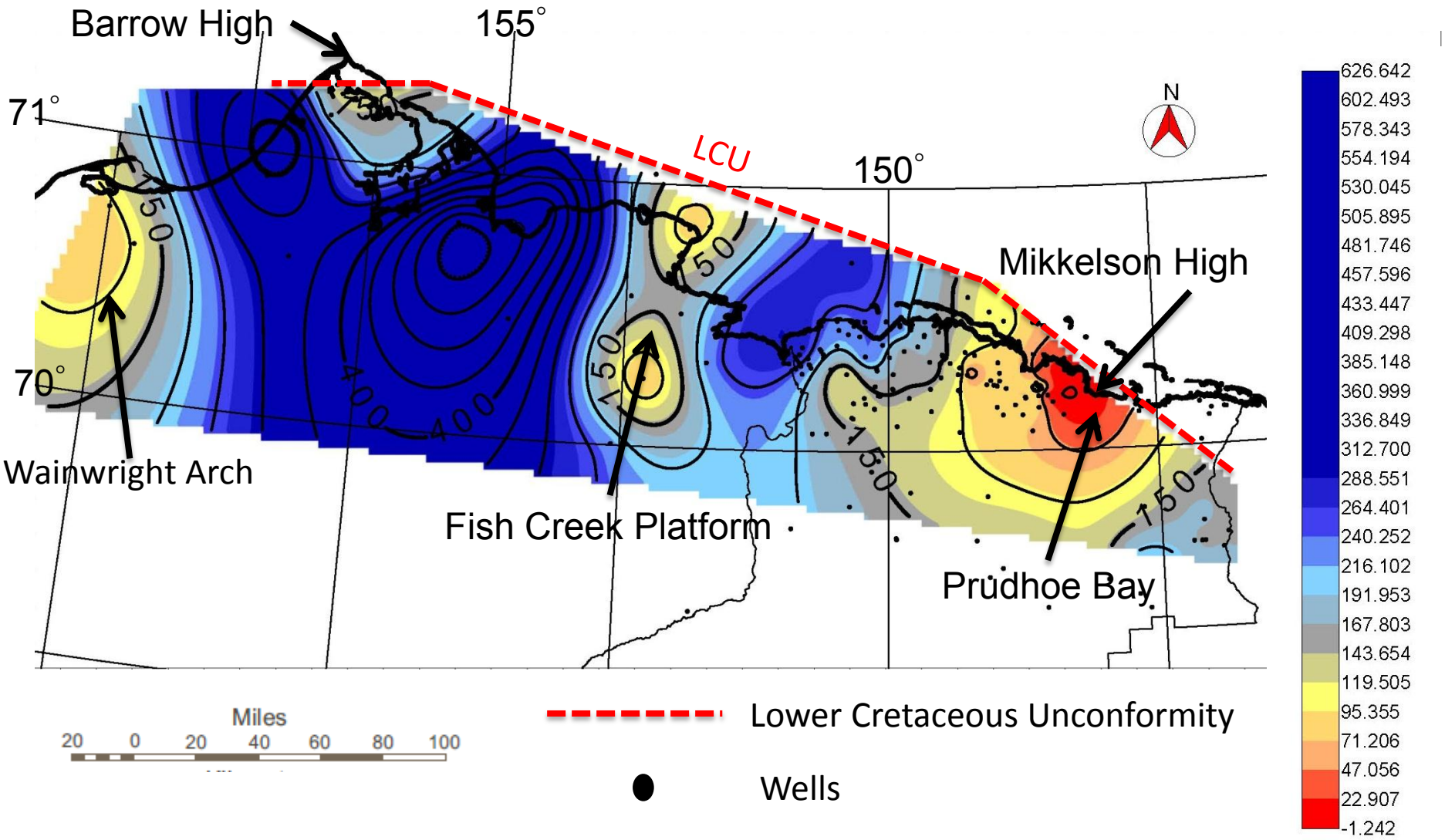
Modified from Kelley et al. (2007)

Structural Features

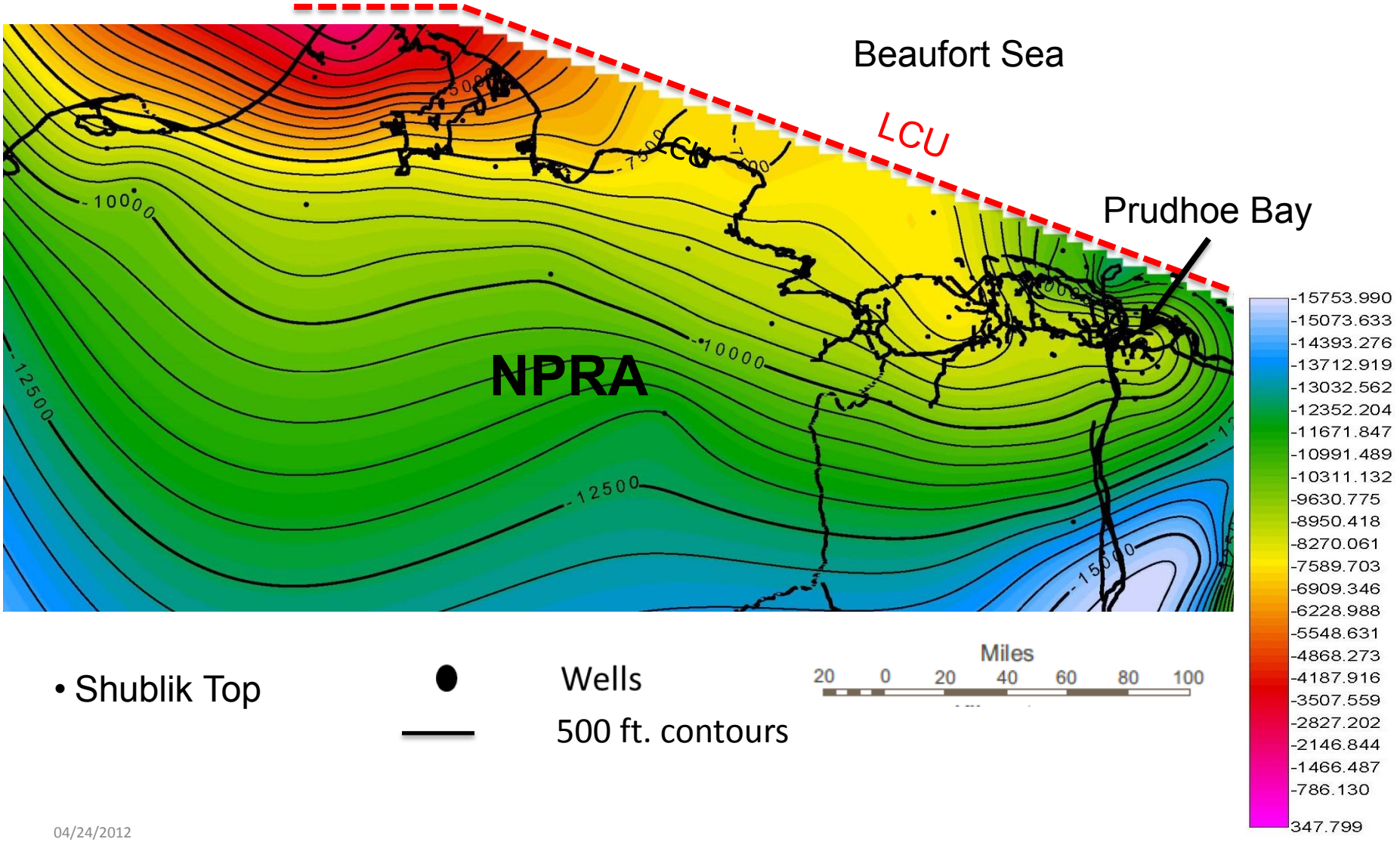


Modified from Bird (1985)

Shublik Isopach



Shublik Fm. Structure Map

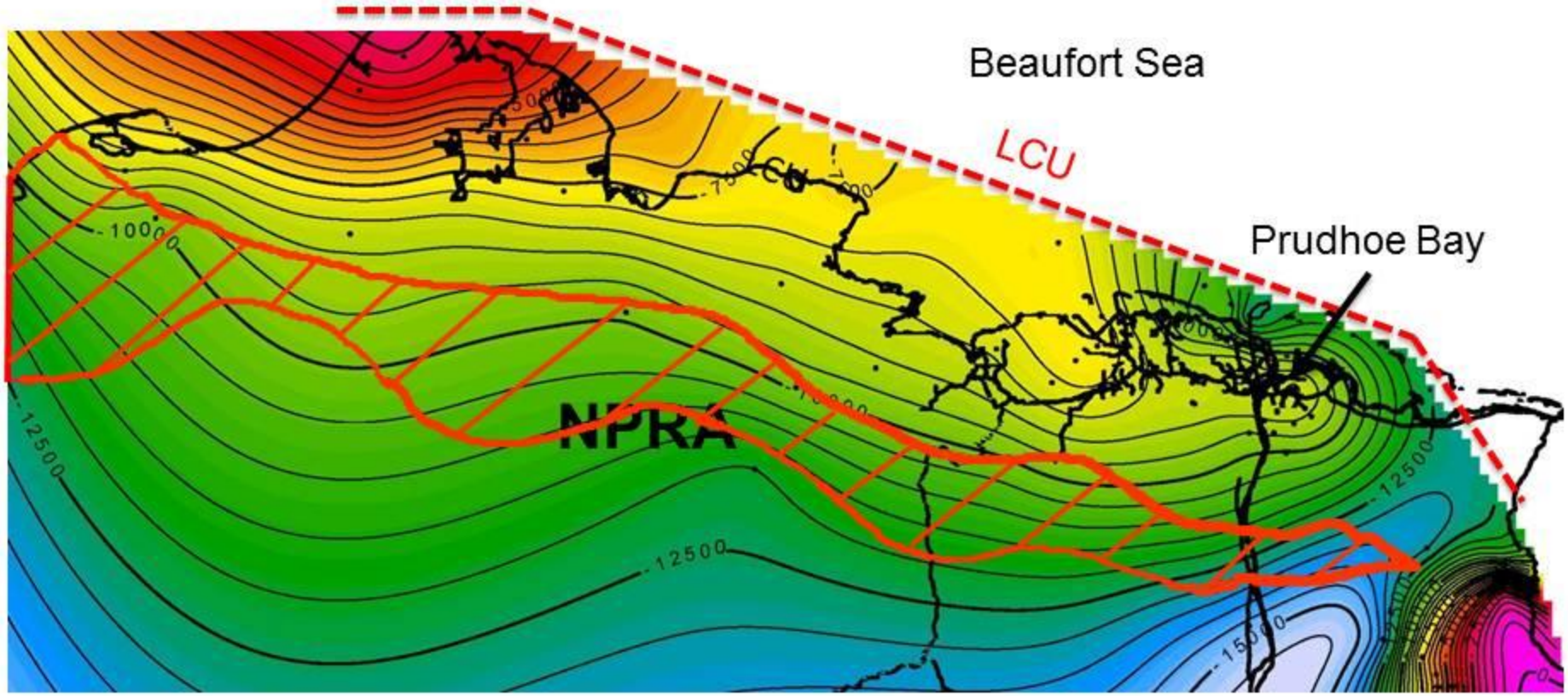


- Shublik Top

Wells

500 ft. contours

Mature Zone from Ro Data



- Shublik Top

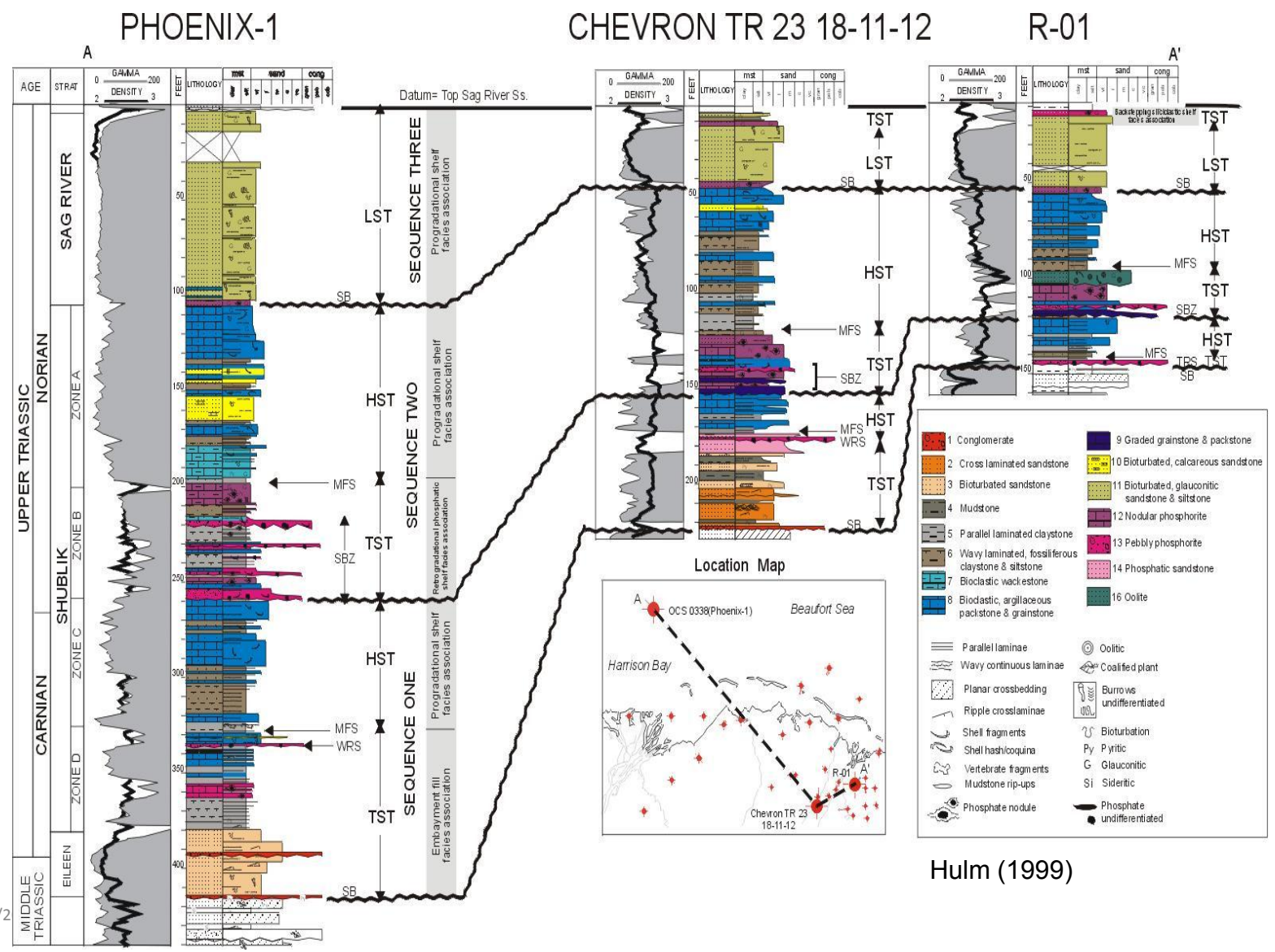
Wells

500 ft. contours

Mature Zone

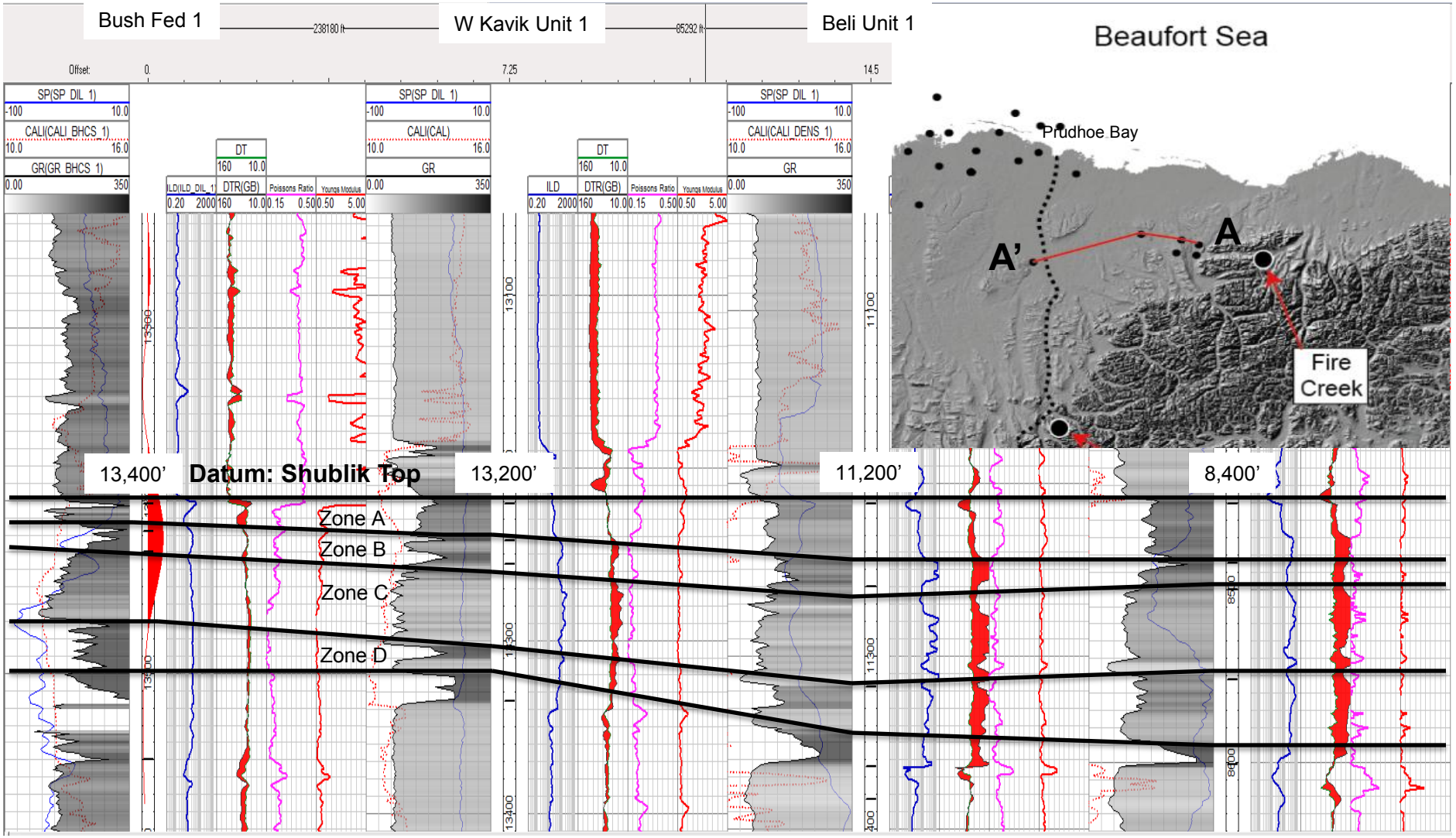
Miles
20 0 20 40 60 80 100

Subsurface Sequence Stratigraphy

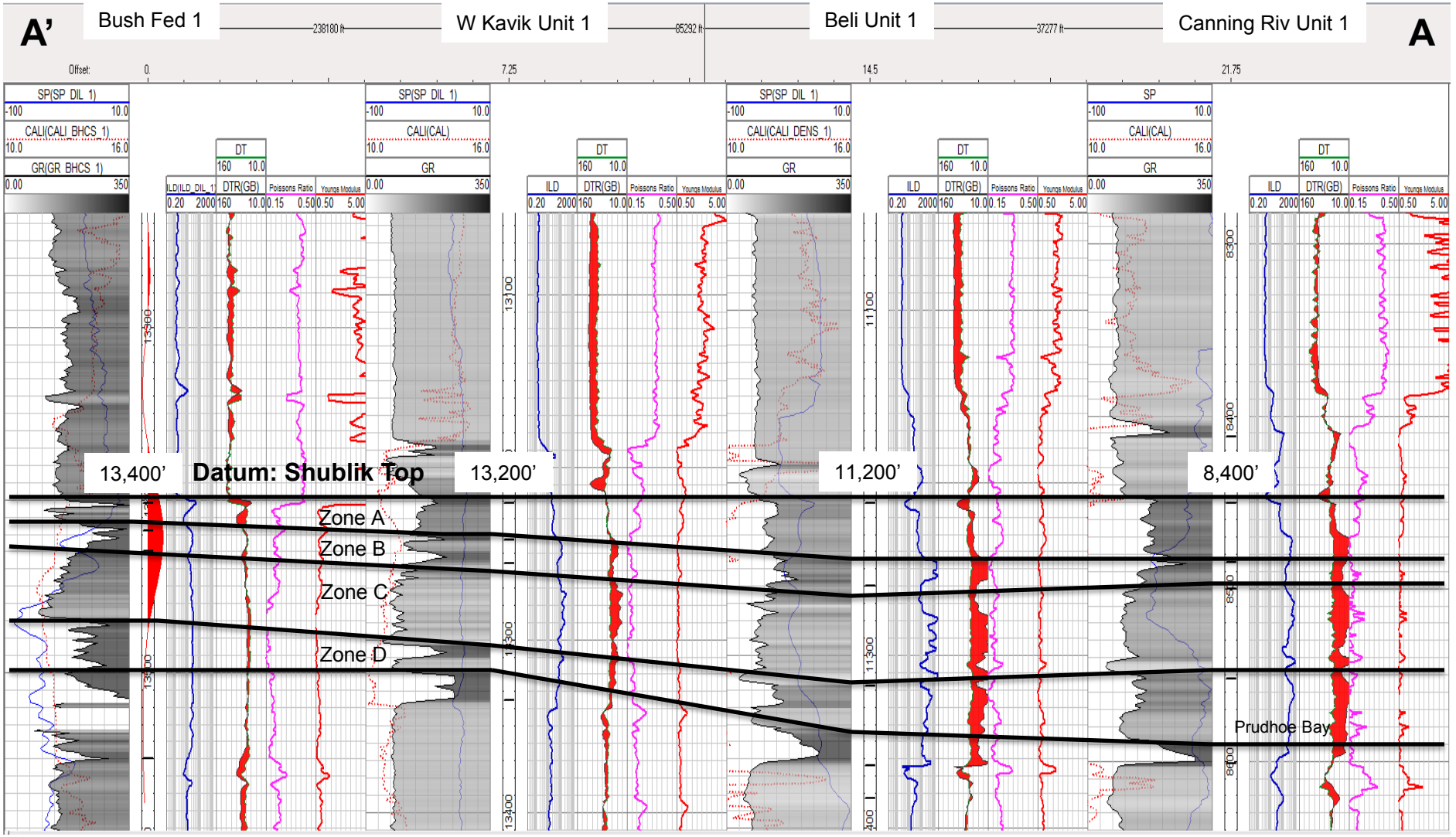


Hulm (1999)

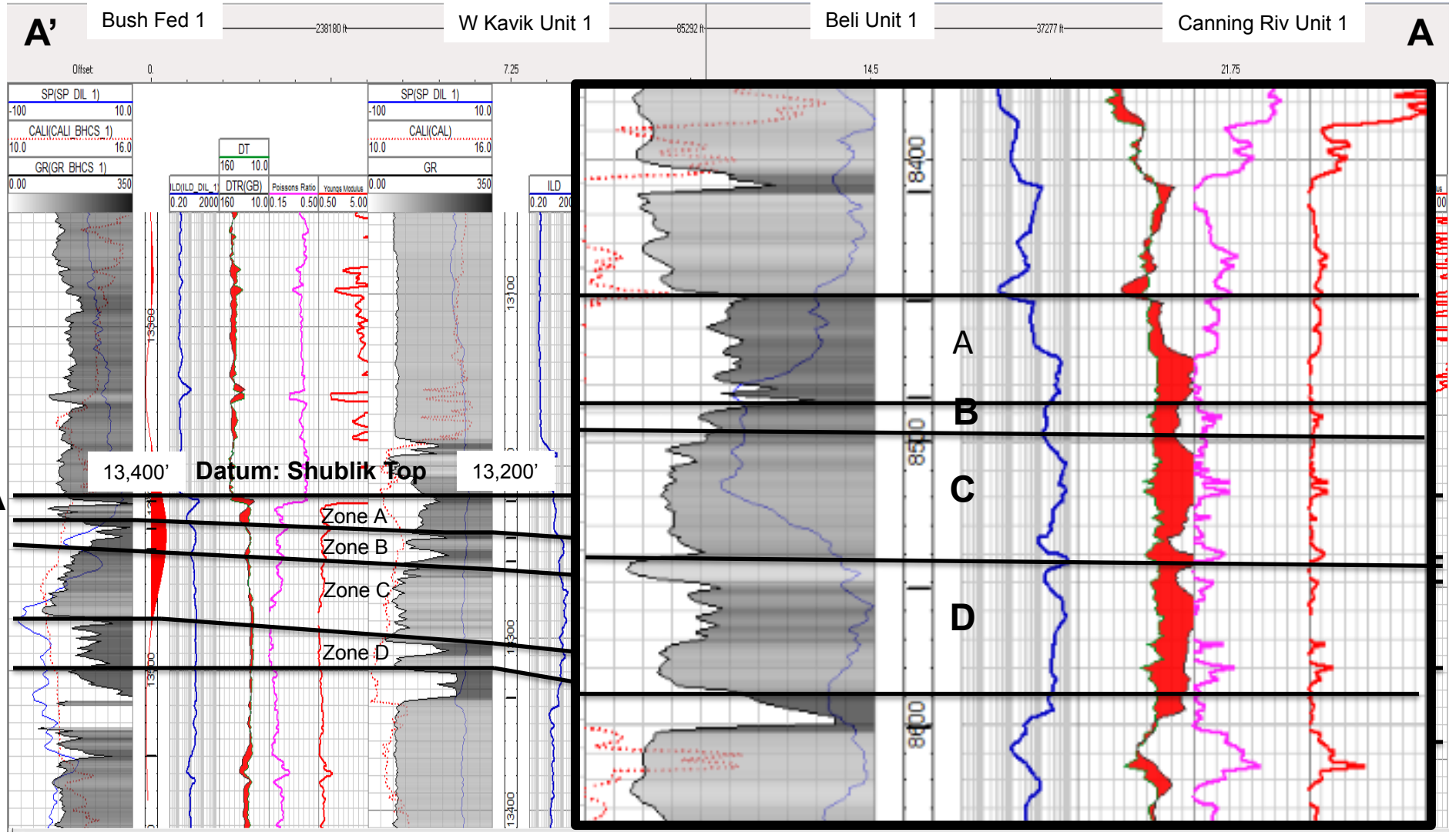
Well Correlation



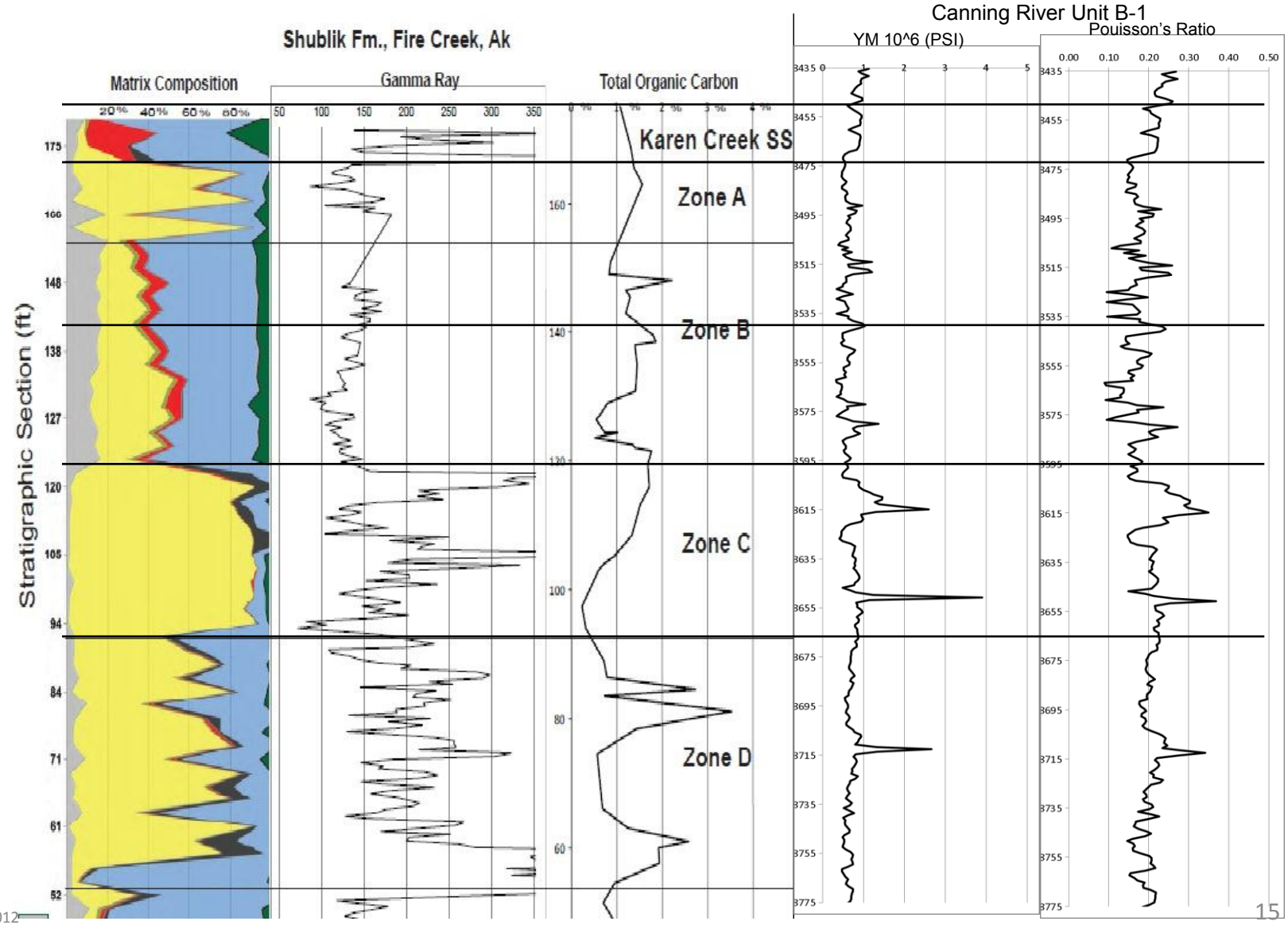
Well Correlation



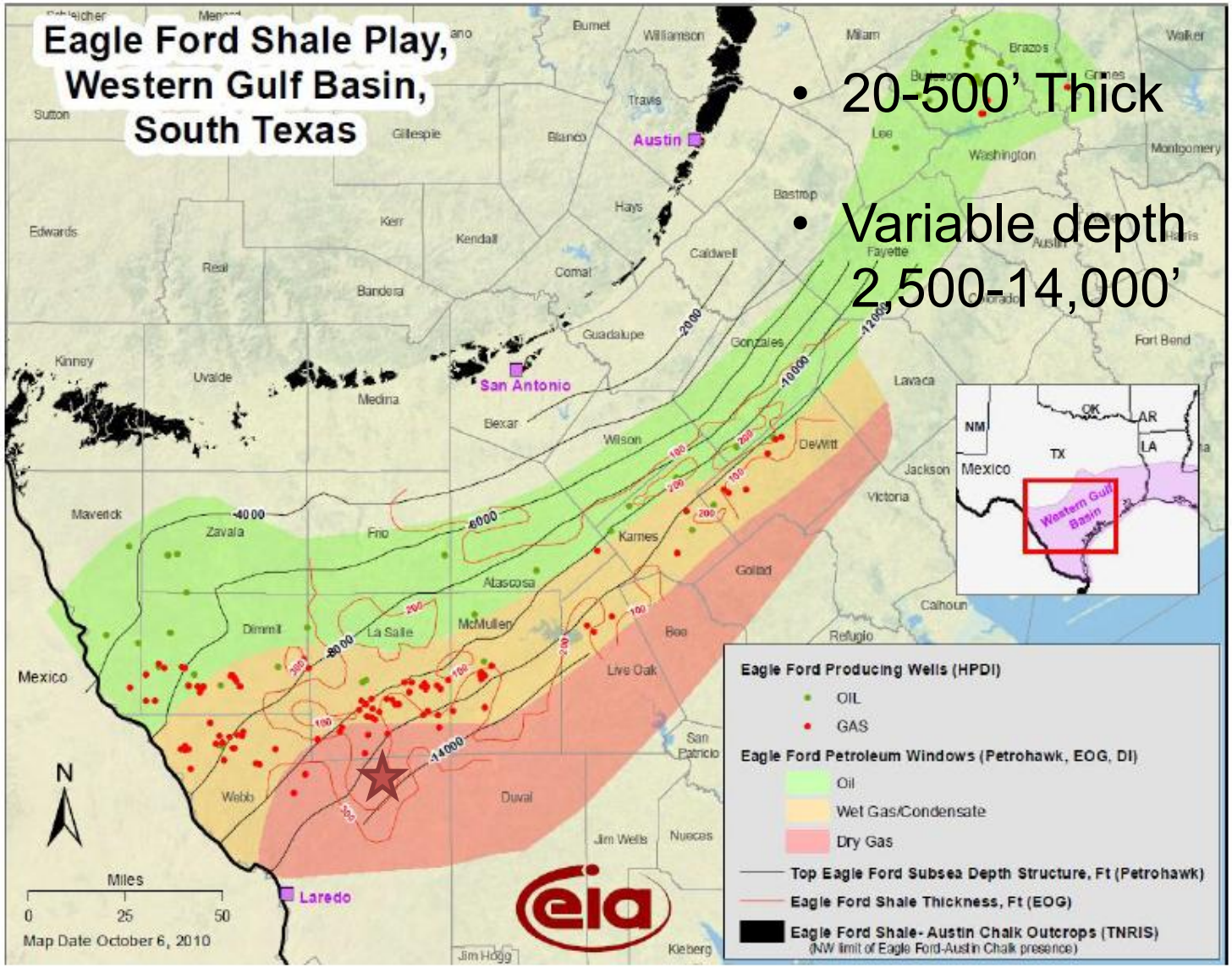
Well Correlation



XRF Composition Fire Creek Outcrop

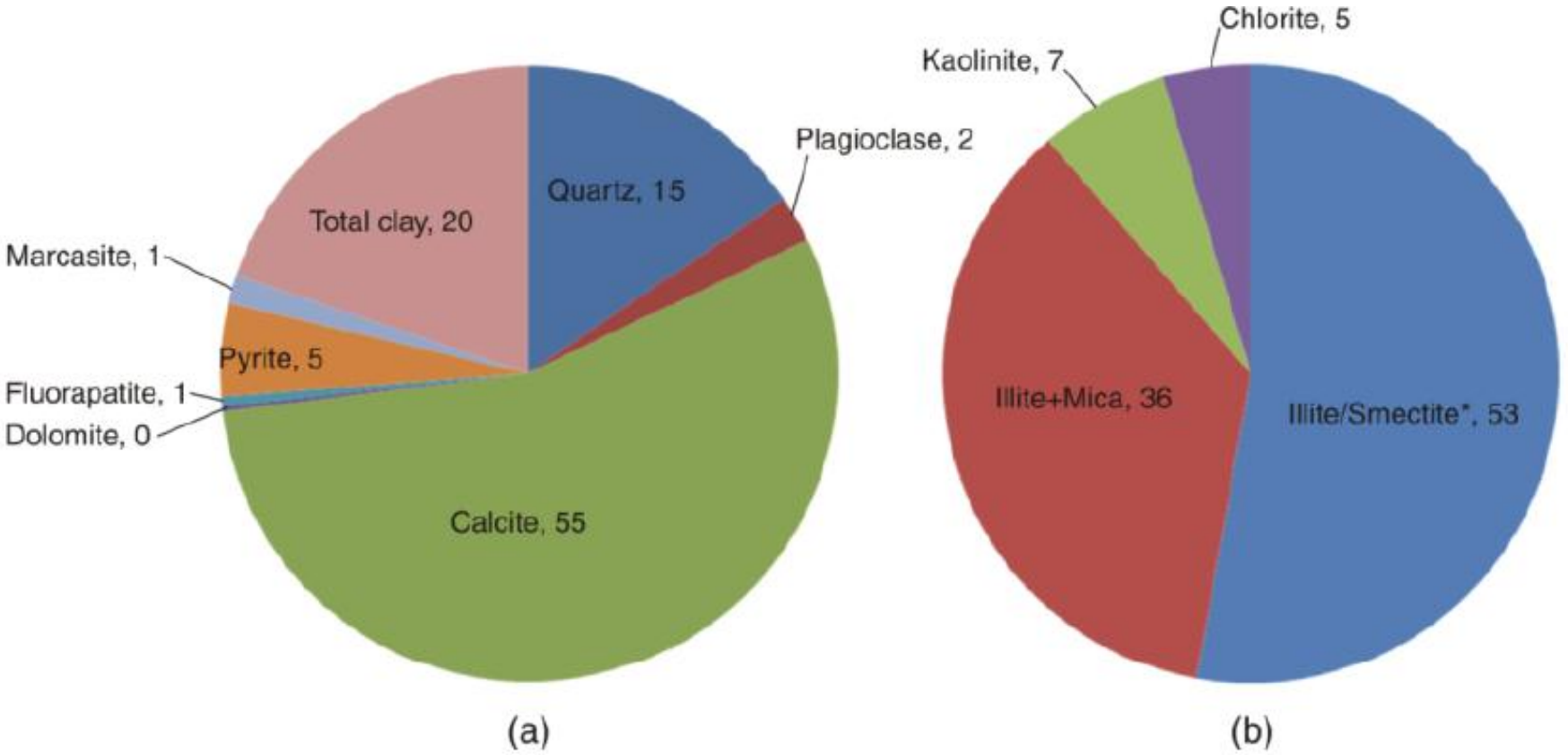


Eagle Ford Regional Extent



EIA (2010)

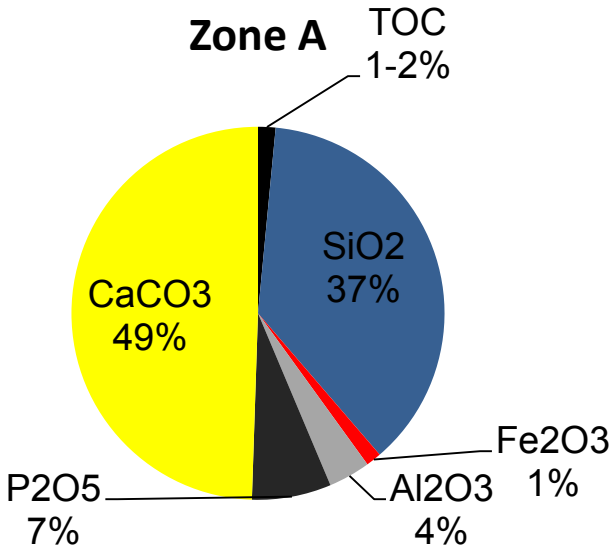
Eagle Ford Mineralogy

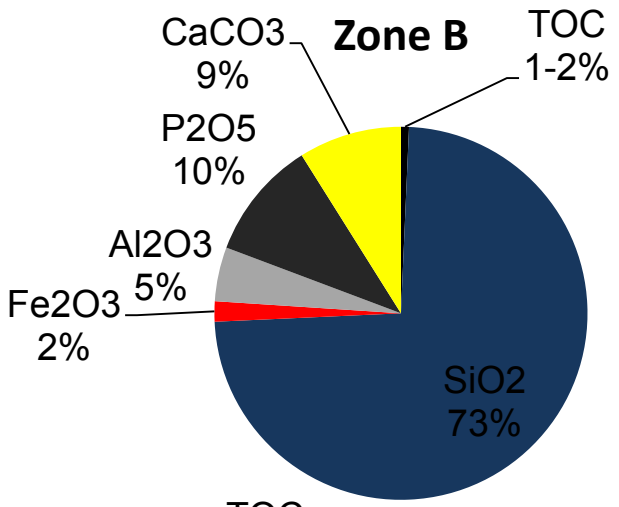


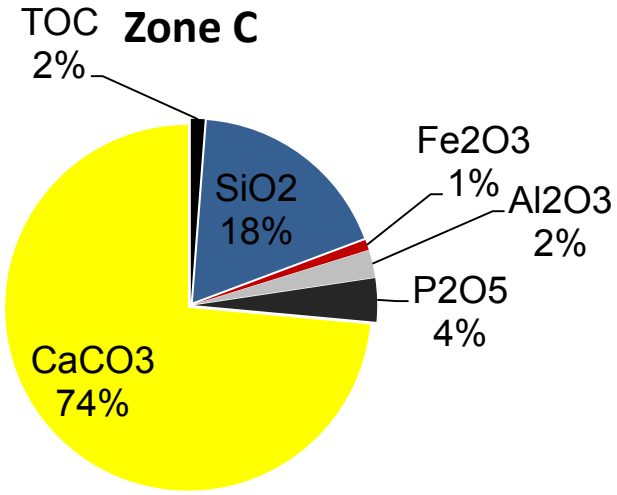
(a) Average Mineralogy (b) Clay-component percentages

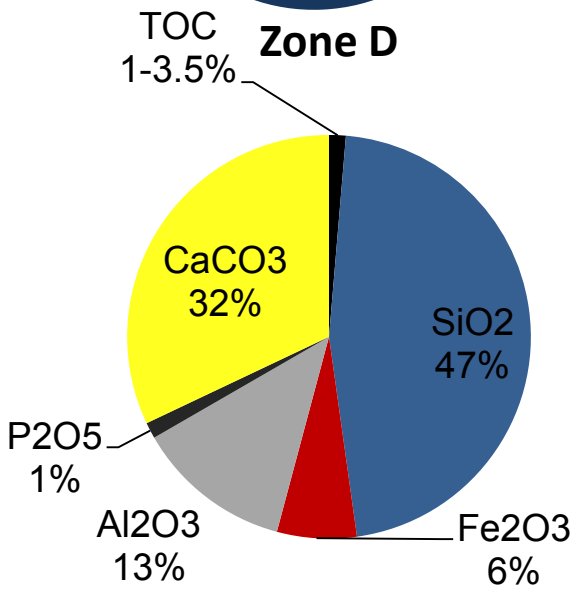
Modified from Mullen et al. (2010)

Shublik Fm. Composition, Fire Creek









Physical Properties

Property	Shublik Fm.	Eagle Ford
Mineralogy	Varies from Siliceous to Carbonate rich	Up to 70 % Calcite
Thickness	0-500’ thick varies by zone	50-250’ thick Potentially all pay
Thermal Maturity	Basin-wide	Basin-wide
TOC	2-6.73%	2-7%
Porosity	5-20%	8-18%

Conclusions

- Both the Eagle Ford Shale and the Shublik Fm. have similar physical properties such as burial depth, thickness and TOC content.
- The Shublik is separated into four lithologically distinct zones whereas the Eagle is divided into two distinct zones (upper burrowed mudrock, lower organic-rich mudrock).
- Both have highly variable ranges in thickness controlled in part by remnant structures.
- To effectively use the Eagle Ford Shale as an analogue, further well control and reservoir characterization must done on the Shublik Fm. to identify potential packages with similar lithology.
- The heterogeneous nature of the Shublik Fm. and age differences could set the two units far enough apart to require entirely different completion strategies.

Questions ?

Aknowledgements

- Co-Authors: Dr. Mike Whalen, Donne Agboada, Dr. Cathy Hanks

- Great Bear Petroleum

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