

# **Source Rock Characterization of the Lower Cretaceous Ostracode Zone, Southern Alberta, Canada\***

By

**Whitney M. Wheeler<sup>1</sup>, Nicolas B. Harris<sup>1</sup> and David C. Jennette<sup>2</sup>**

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<sup>1</sup>Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO. ([wwheeler@mines.edu](mailto:wwheeler@mines.edu))

<sup>2</sup>E&P Technology, Apache Corporation, Houston, TX.

## **Abstract**

The Lower Cretaceous Ostracode Zone in southern Alberta, Canada represents a potential source interval for hydrocarbons in Mannville reservoirs and has been characterized as a lacustrine to marginal marine environment. It is overlain, and often incised, by the Glauconitic Sandstone reservoir unit and, therefore, has variable presence and thickness across southern Alberta. In the study area (10-25W4, 14-28W4), oil is found updip of gas in Mannville reservoirs. A source rock study of the Ostracode Zone seeks to provide an explanation for this hydrocarbon distribution.

The Ostracode Zone was correlated in cores and logs from across the study area. Two units were distinguished: the Ostracode Limestone and the Upper Ostracode. The basal limestone unit consists of layers of ostracode and gastropod shells, while the overlying unit represents an overall coarsening upward succession that experienced wave influence. Potential source units are considered to be 2 to 5 meter shale intervals interbedded with cherty sandstones within the Upper Ostracode unit.

In addition to stratigraphic correlation across the study area, RockEval / TOC studies are to be completed on collected source rock samples. Results will provide kerogen type and maturity data for the source intervals, which will then be used to model hydrocarbon generation. Biomarker work will also be performed on a select number of source extracts and oil samples. Previous biomarker research has revealed a suite of compounds, denoted as “Q compounds,” that are unique to the Ostracode Zone. The presence of these compounds in the sampled units will qualitatively identify the contribution of hydrocarbons from the Ostracode Zone; however, due to mixing with oils from other sources a statistical evaluation may prove problematic.



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Whitney M. Wheeler, Colorado School of Mines

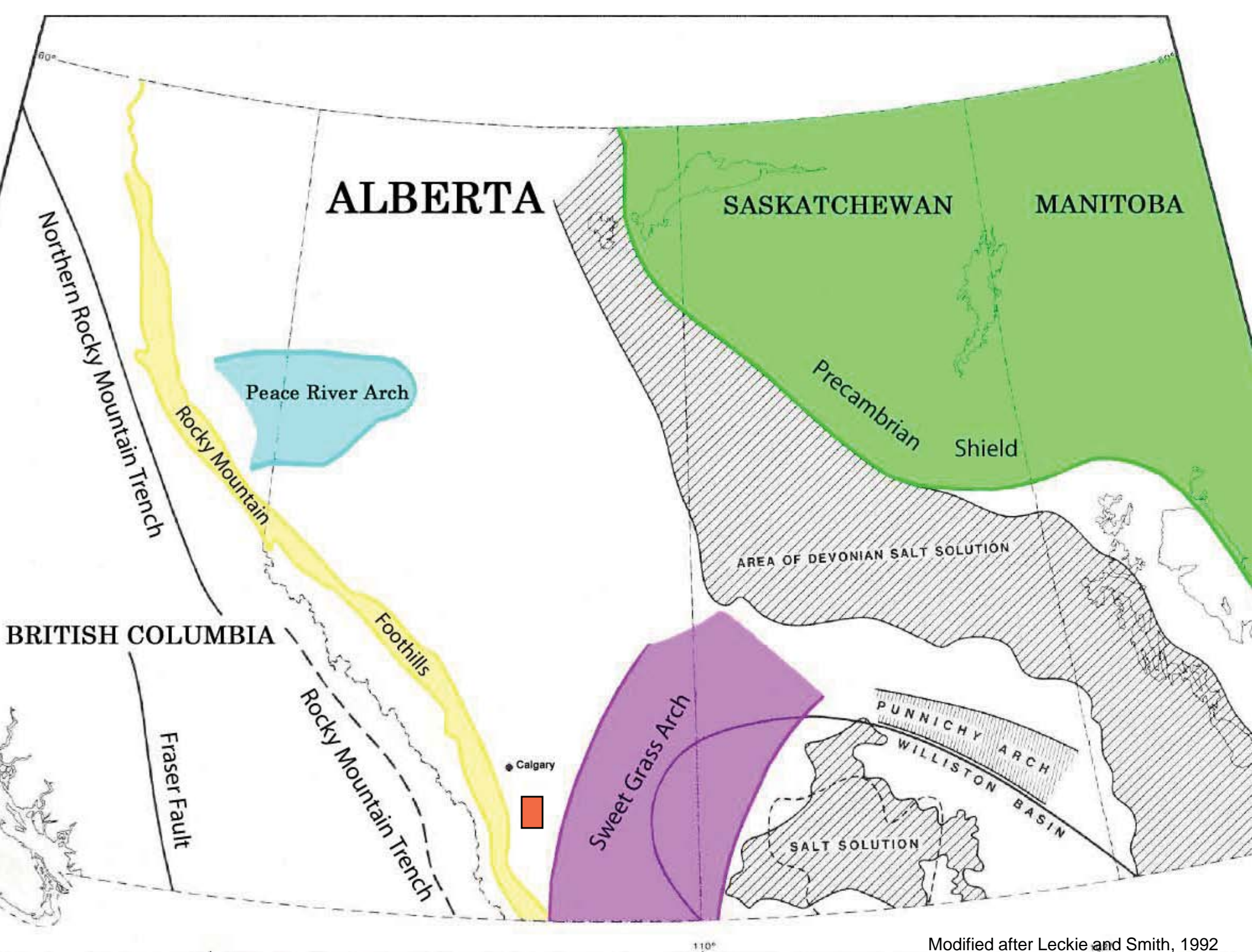
Nicholas B. Harris, Colorado School of Mines

David C. Jennette, Apache Corporation

22 April 2008

# Overview

- Alberta Basin Regional Features
- Study Area and Objectives
- Ostracode Zone Stratigraphy
- RockEval / TOC Data



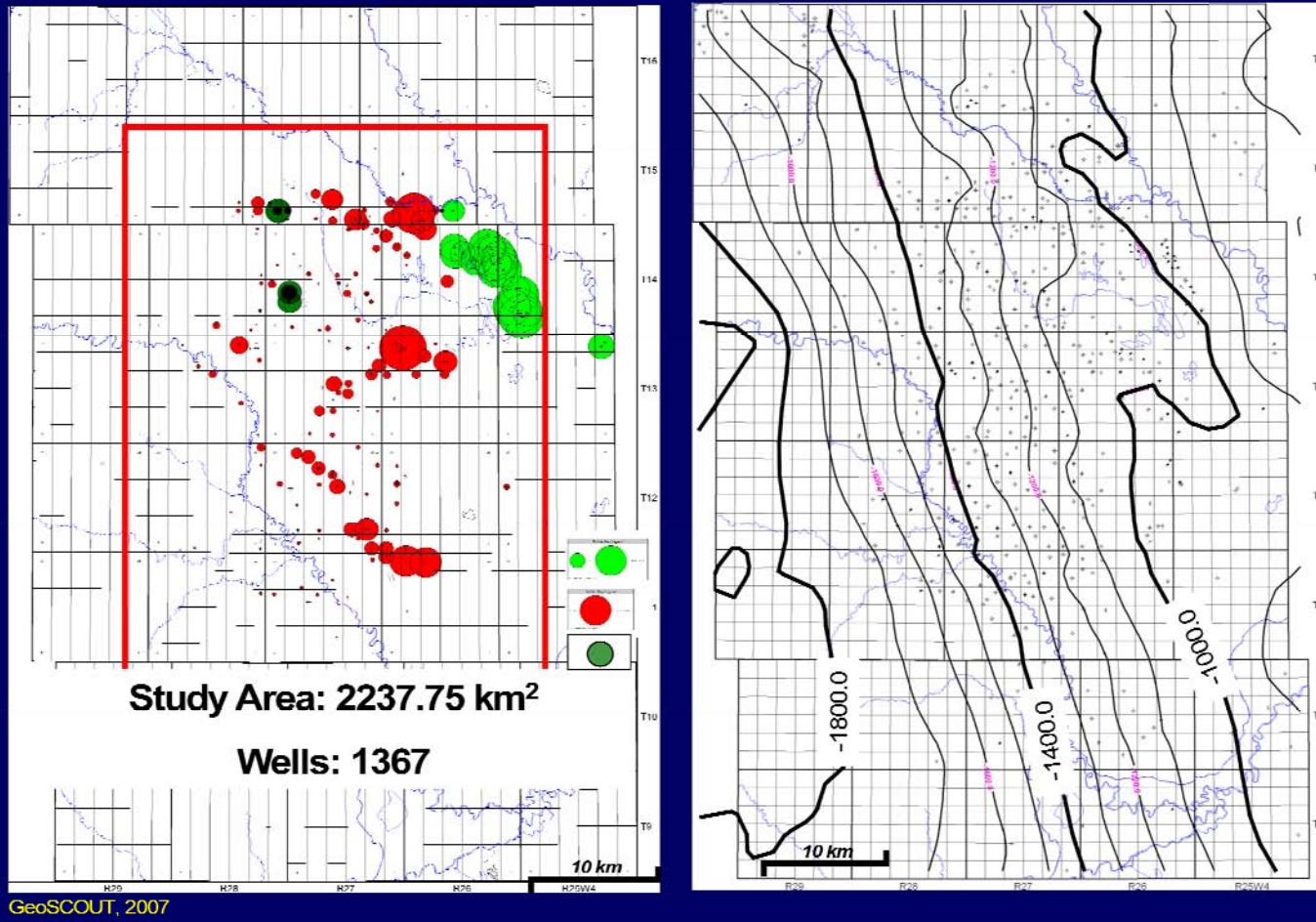
Time		Southern Alberta (Glaister, 1959)		Southern Alberta (Leckie et al., 1997)		Million Years Before Present		
Early Cretaceous	Albian		Colorado Group	Colorado Group				
		Mannville Group	Upper Mannville Fm.	Nonmarine Succession of Greenish Grey to Red Shales				
				Glaucinitic Sandstone Member				Upper
				Calcareous Member				
	Aptian	Mannville Group	Lower Mannville Fm.	Sunburst Sandstone Member		Lower		
				Cutbank Sandstone Member				
				Glaucinitic Ostracode			108	
				Bantry Sunburst				115
	Late	Ellis Shale	Cutbank Taber		126			
			Swift			Masefield		
Middle		Rierdon		Rush Lk.				
Early Mississippian	Madison Formation							





Modified after David Smith &  
Larry Meckel, Canadian  
Hunter Ltd, Calgary

# Southern Grant Lands



Note homoclinal dip direction -> expounds the problem of updip oil or gas

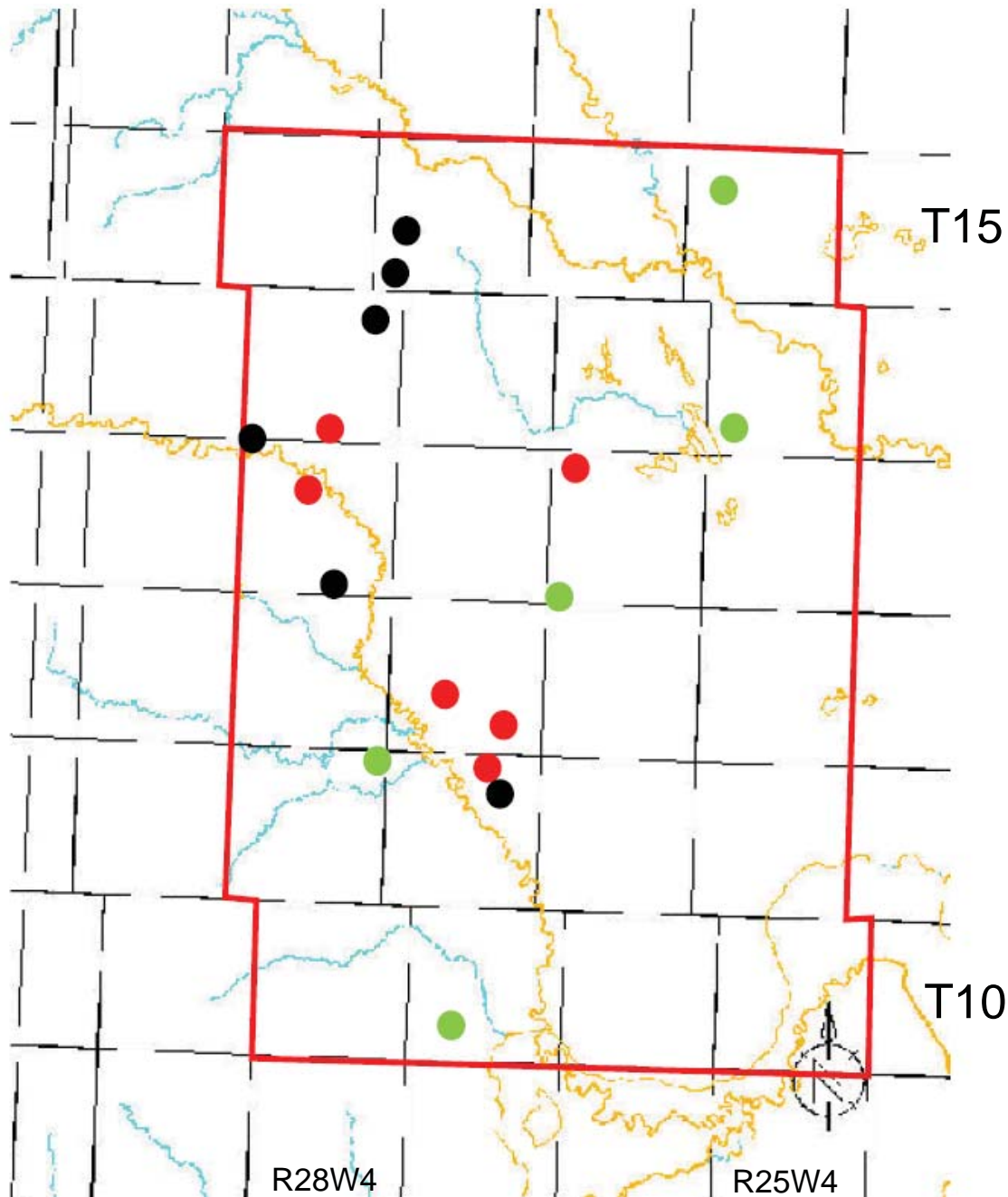
There is very little structure in the area; therefore, the hydrocarbon accumulation cannot be accounted to a single structure

# Research Objectives

- Determine the depositional environment of the Lower Cretaceous Ostracode Zone.
- Distinguish the source rock characteristics (type, quality, distribution, and maturity) of the Ostracode Zone.
- Model the burial history of the area to determine the timing of hydrocarbon generation and migration
- Assess if the Ostracode Zone is a practical source rock for hydrocarbons in Mannville reservoirs.
- Determine the role of the Ostracode Zone in the distribution of updip oil on gas.



# Described Core Locations



## Well Legend



Oil

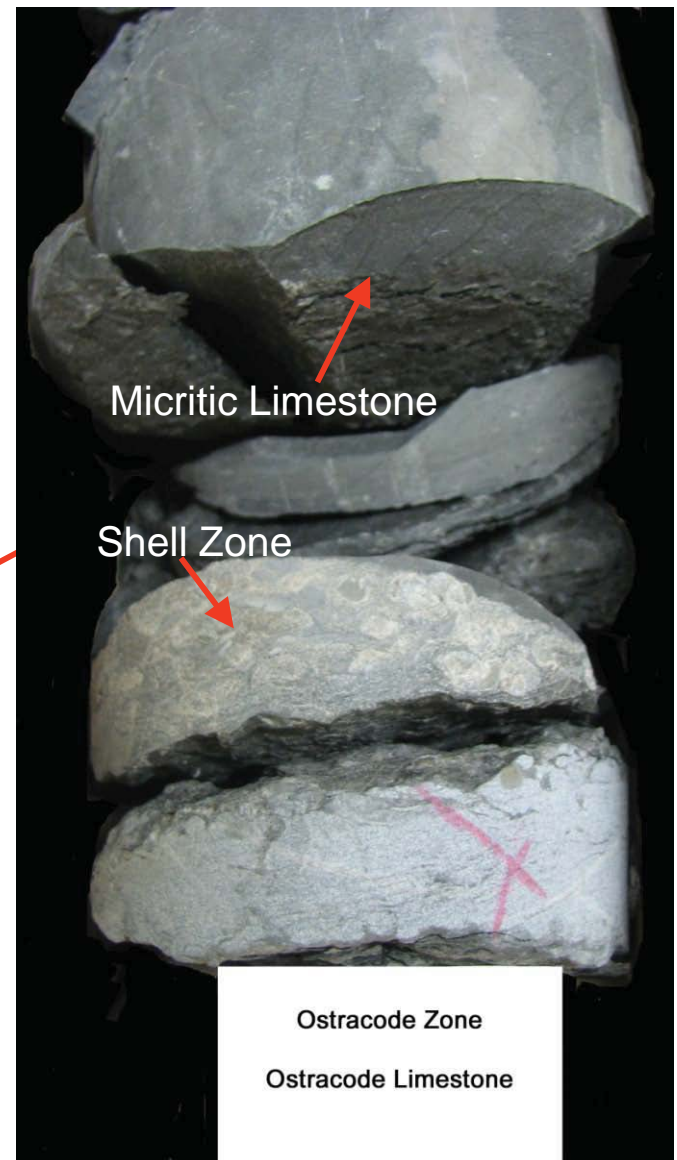
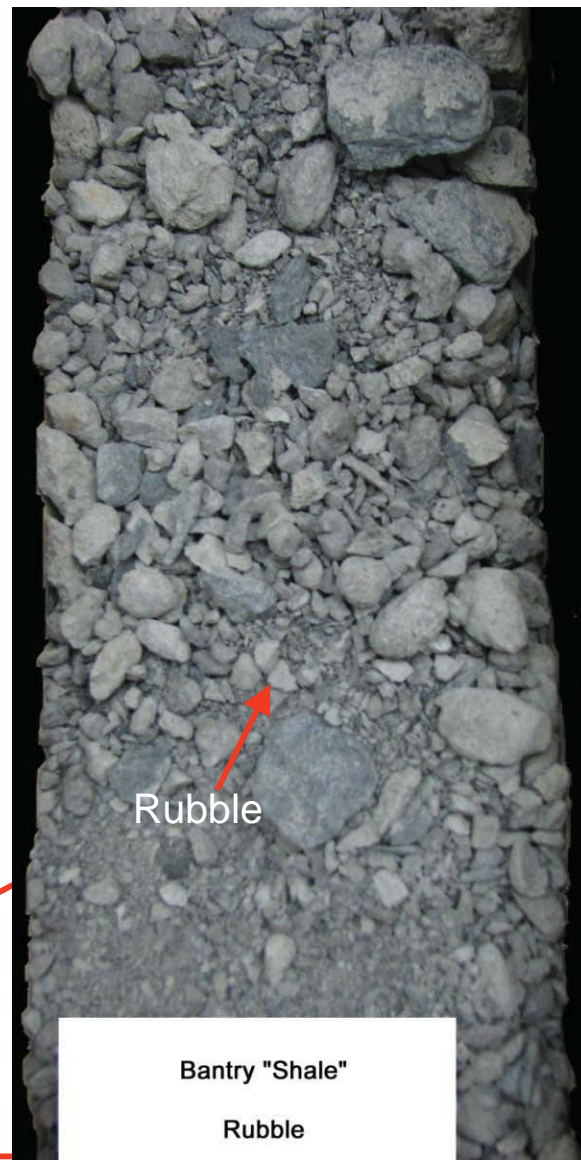
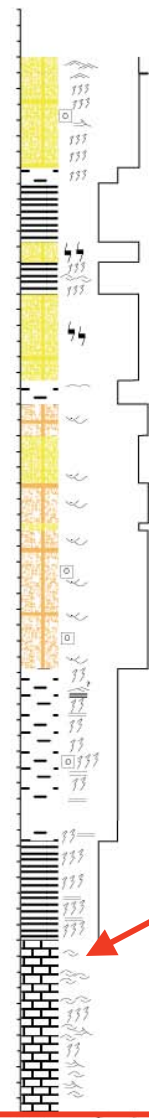
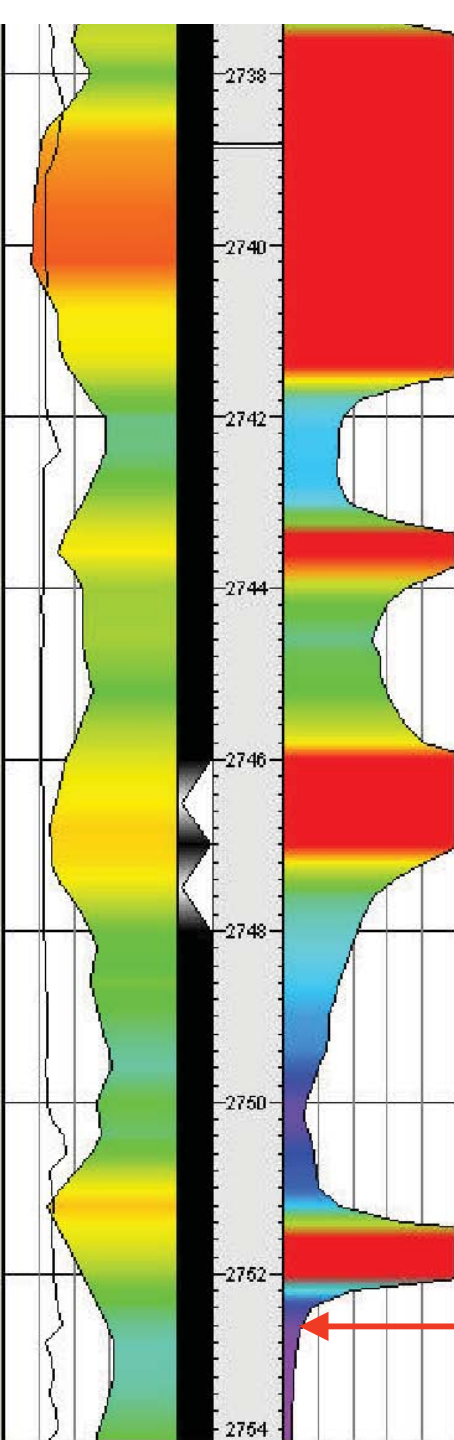


Gas



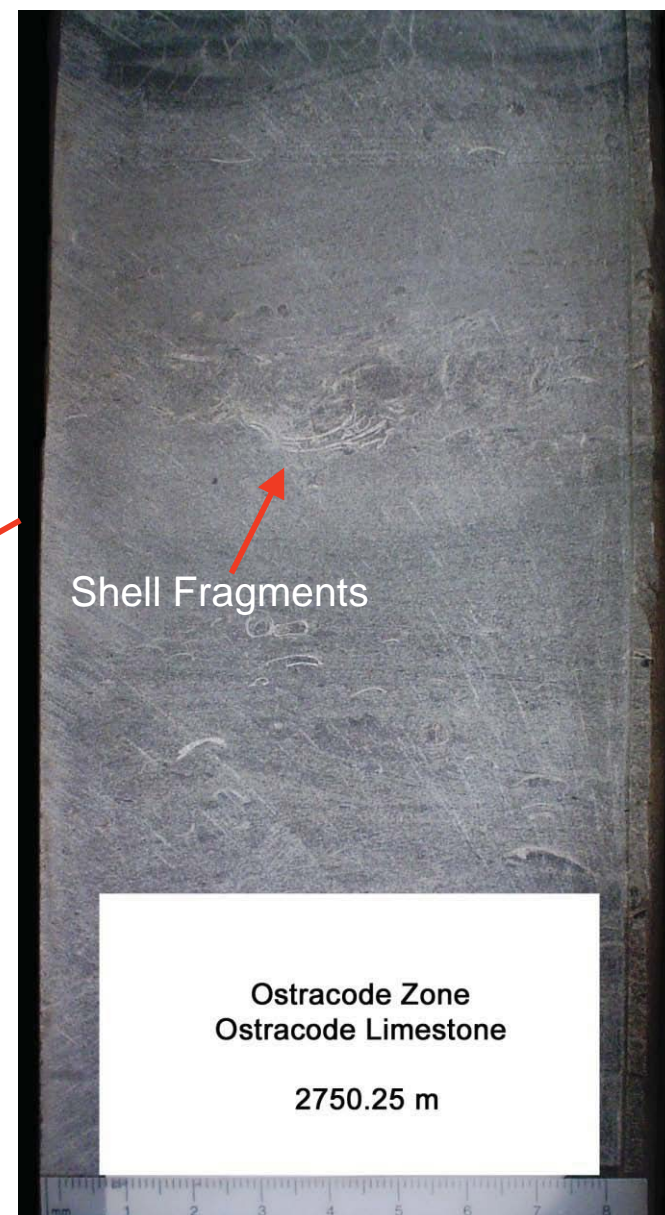
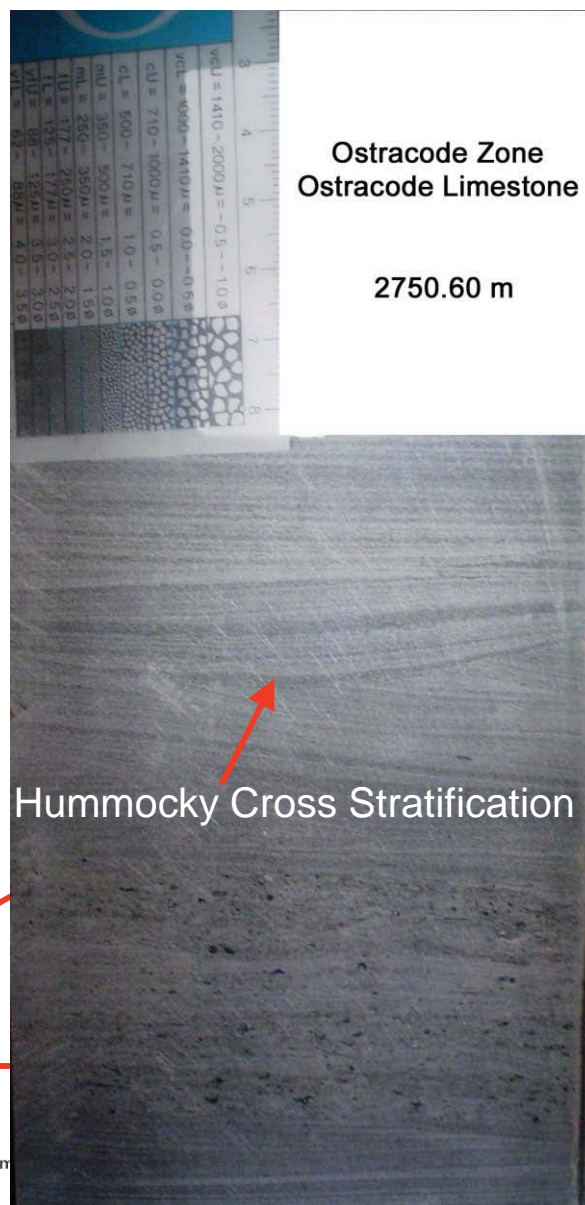
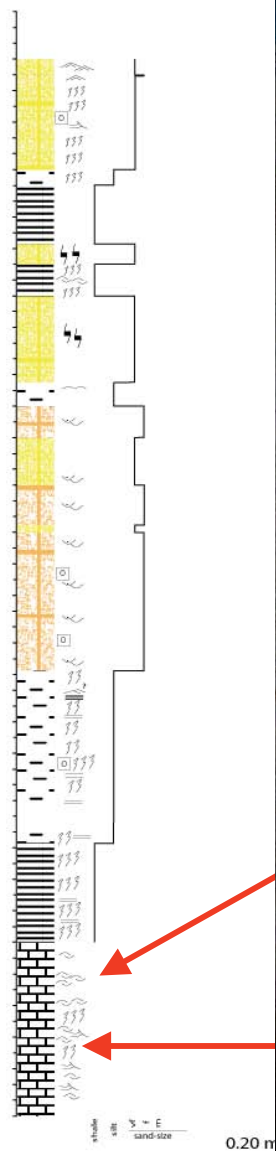
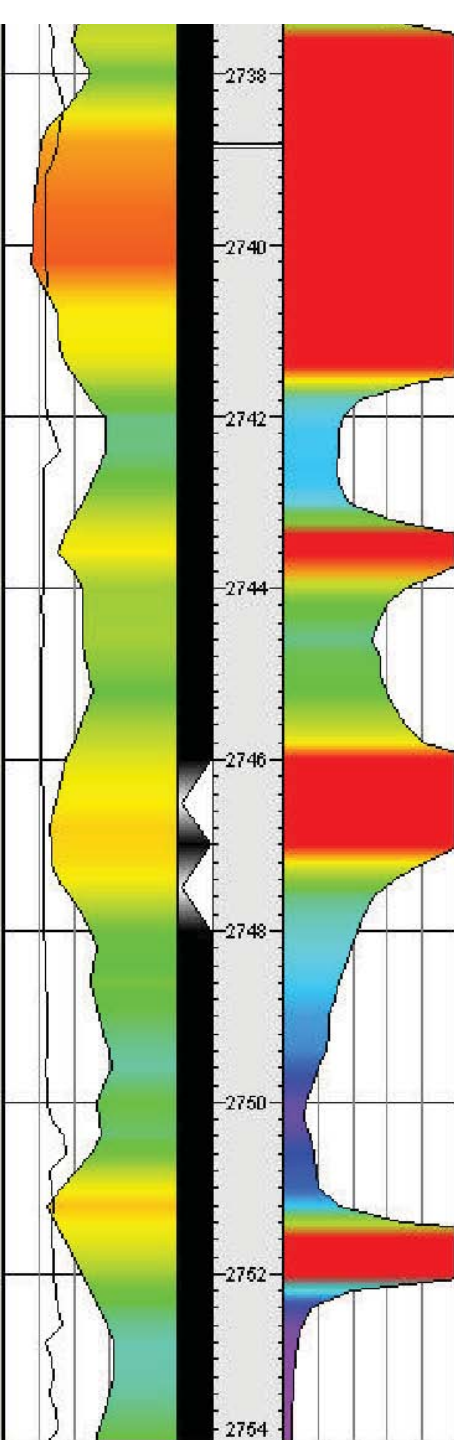
Plugged or Undefined

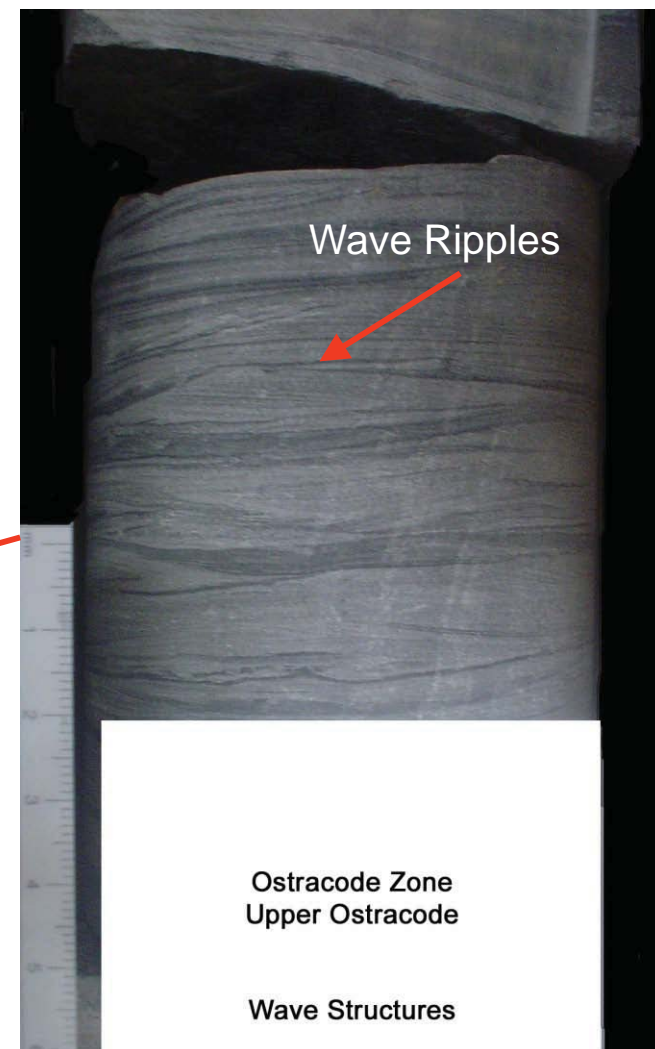
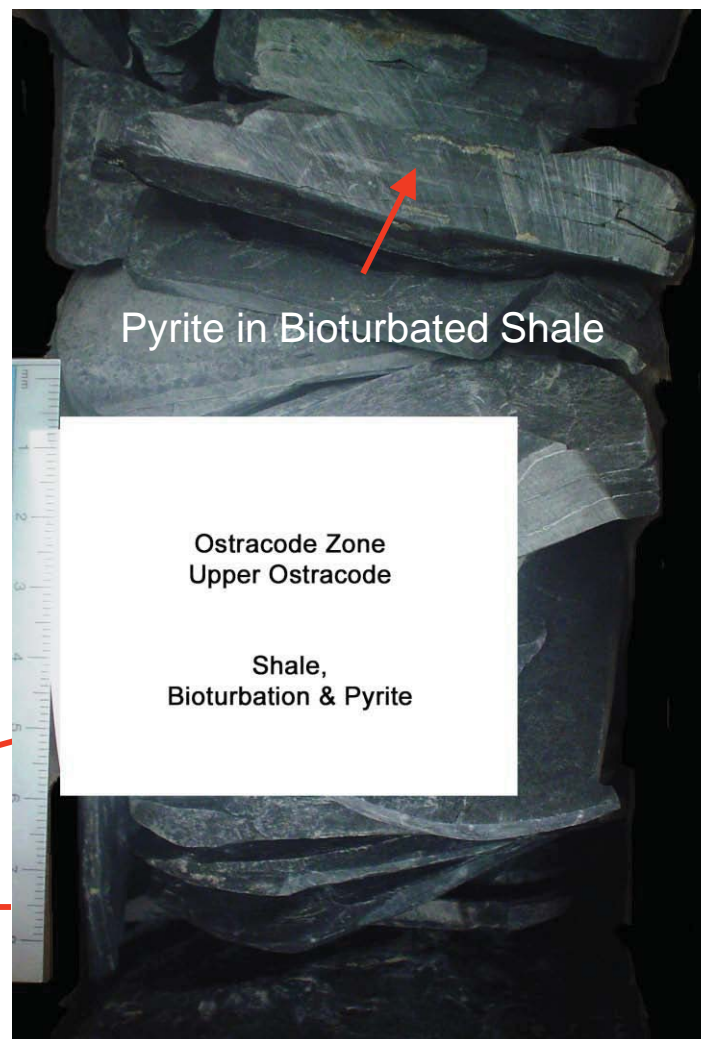
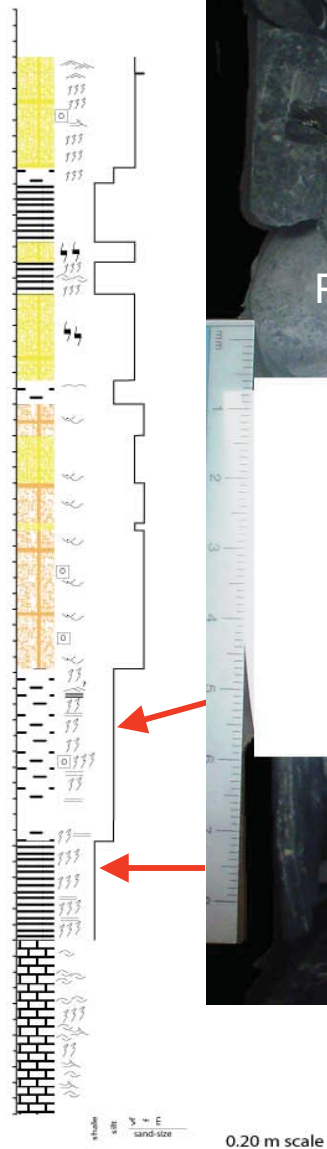
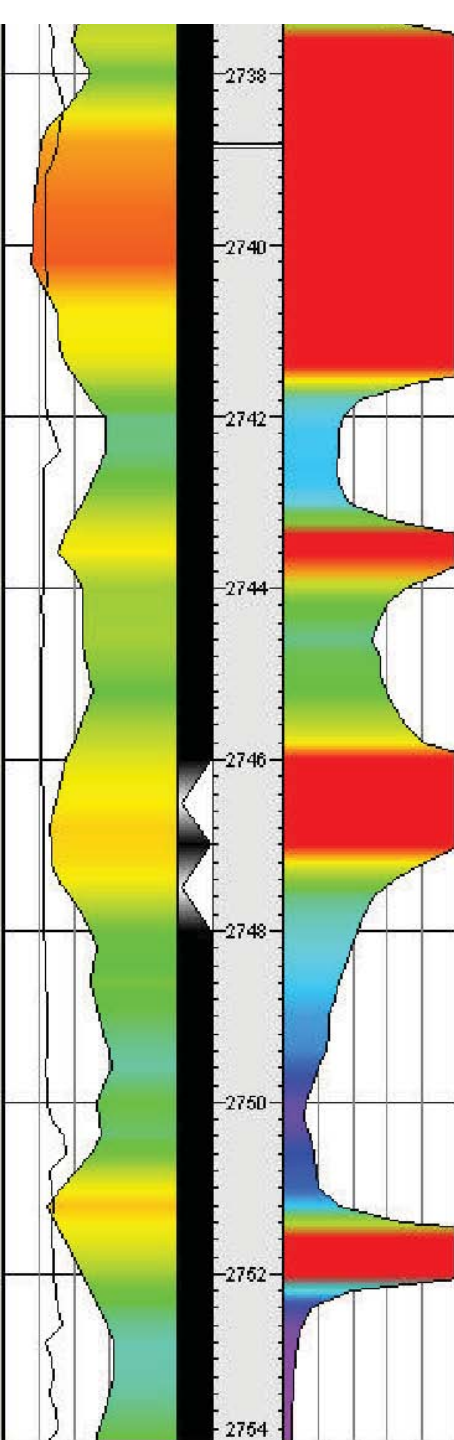
~150 m total core examined



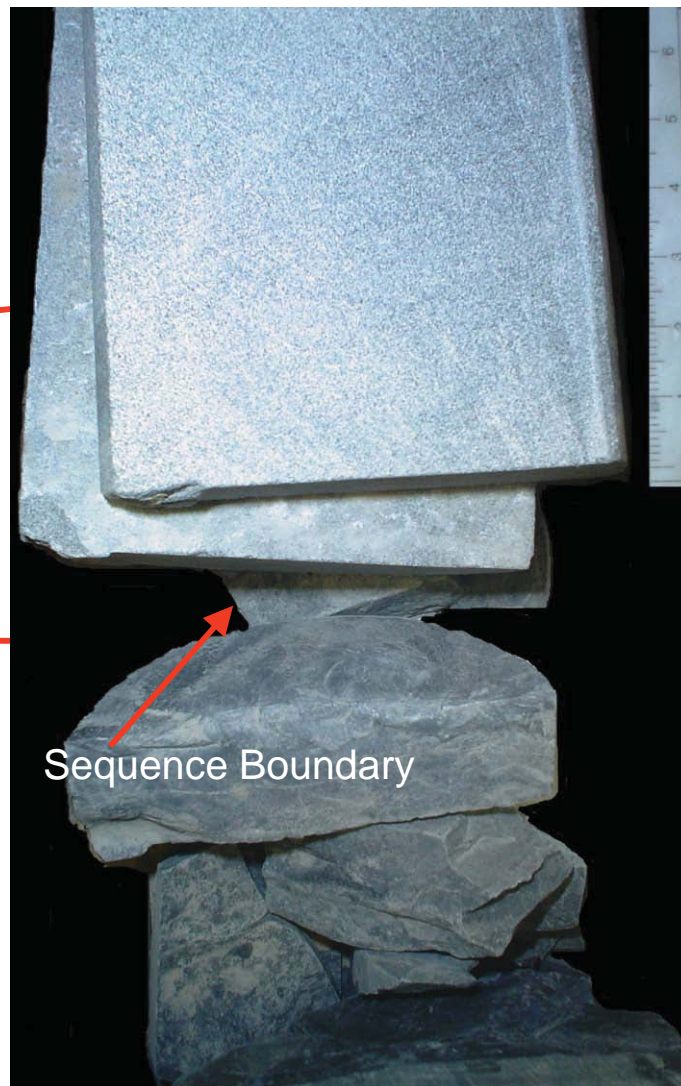
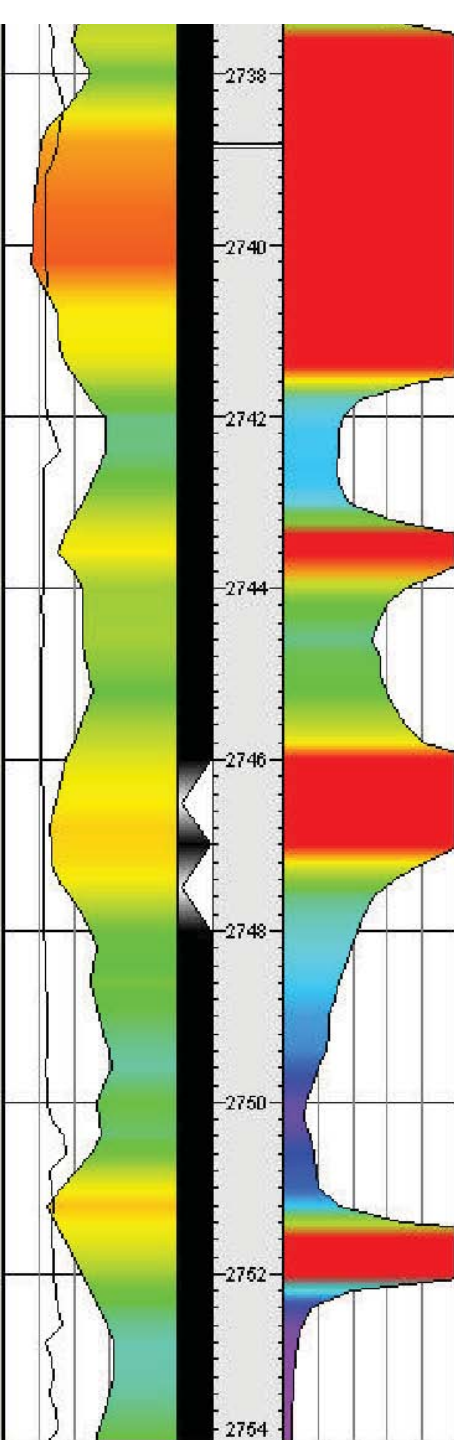
0.20 m scale



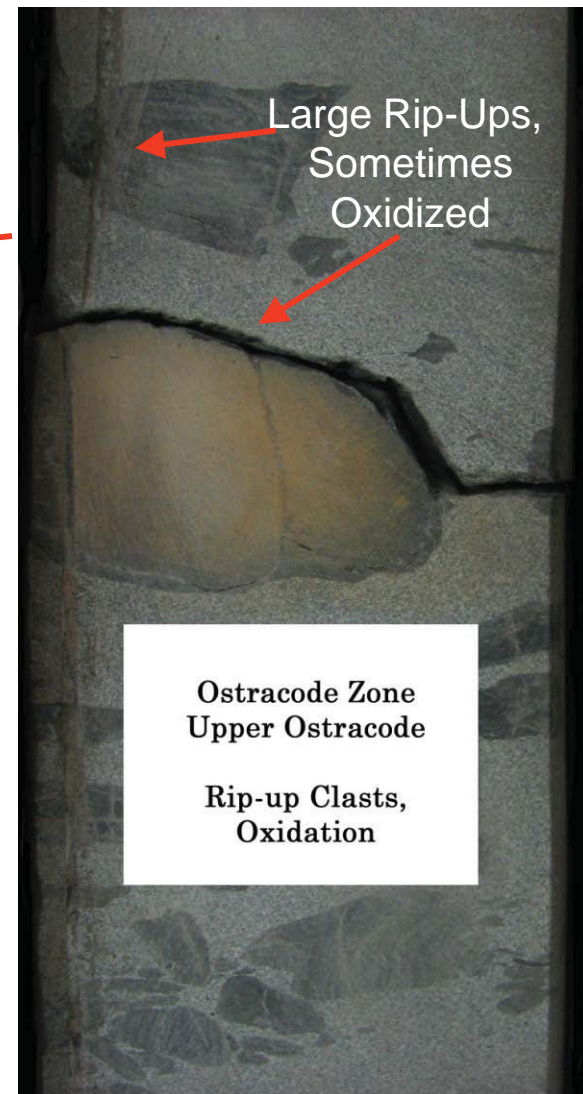








Sequence Boundary

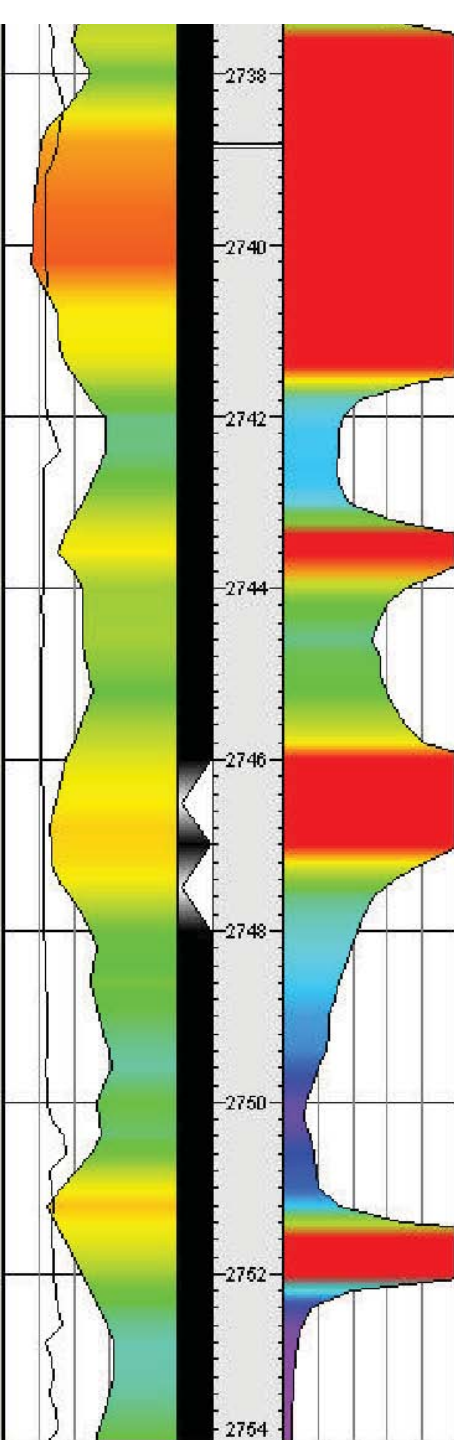


Large Rip-Ups,  
Sometimes  
Oxidized

Ostracode Zone  
Upper Ostracode

Rip-up Clasts,  
Oxidation

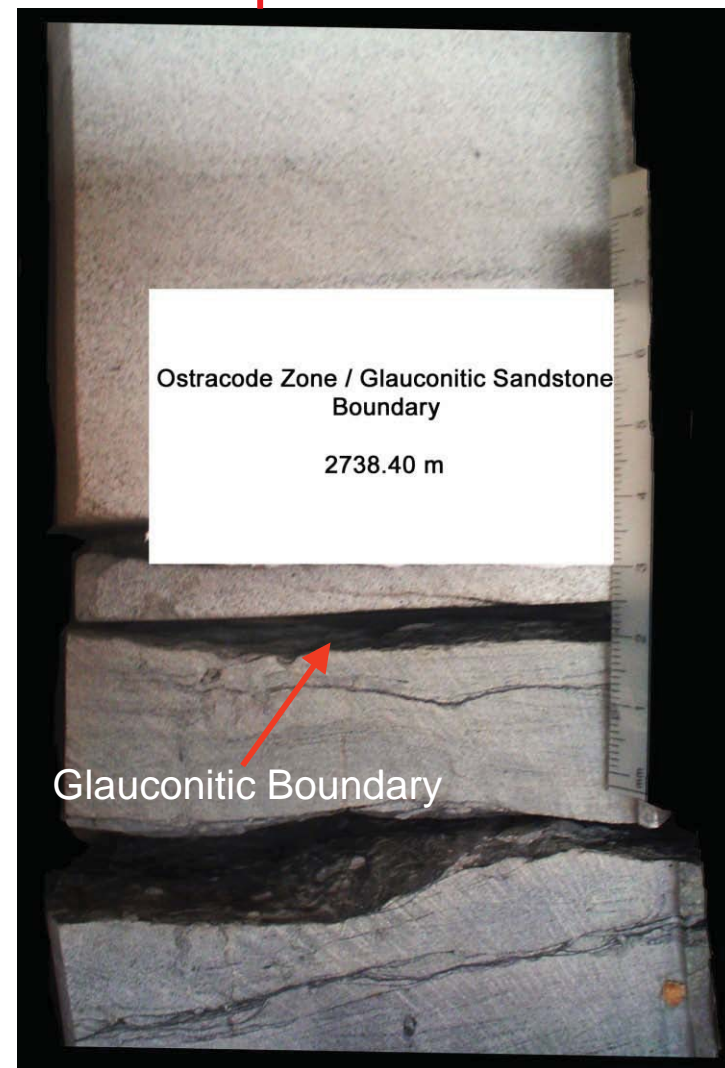
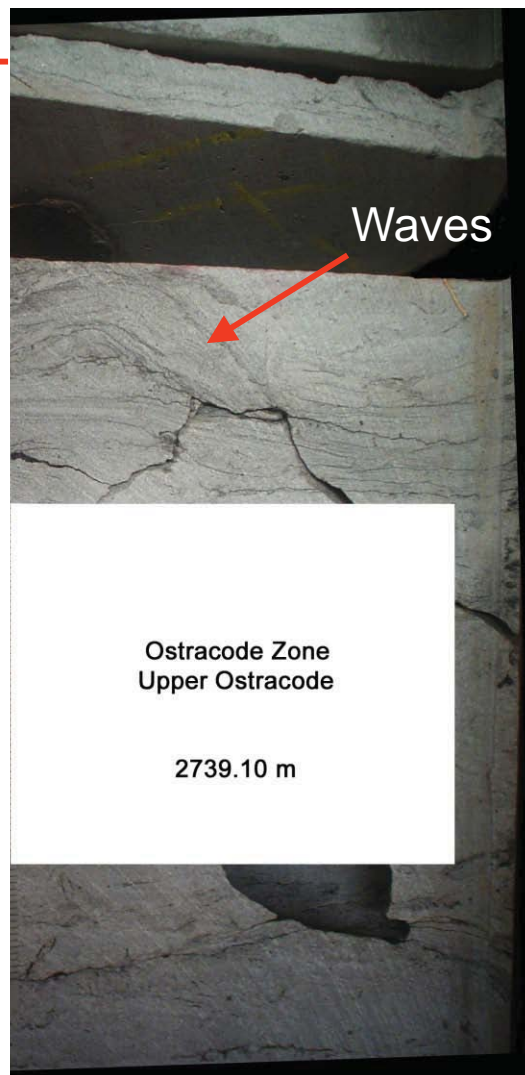
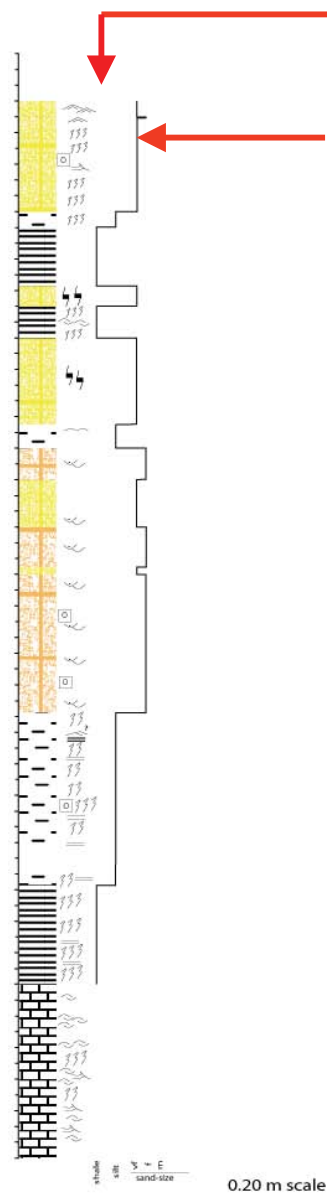
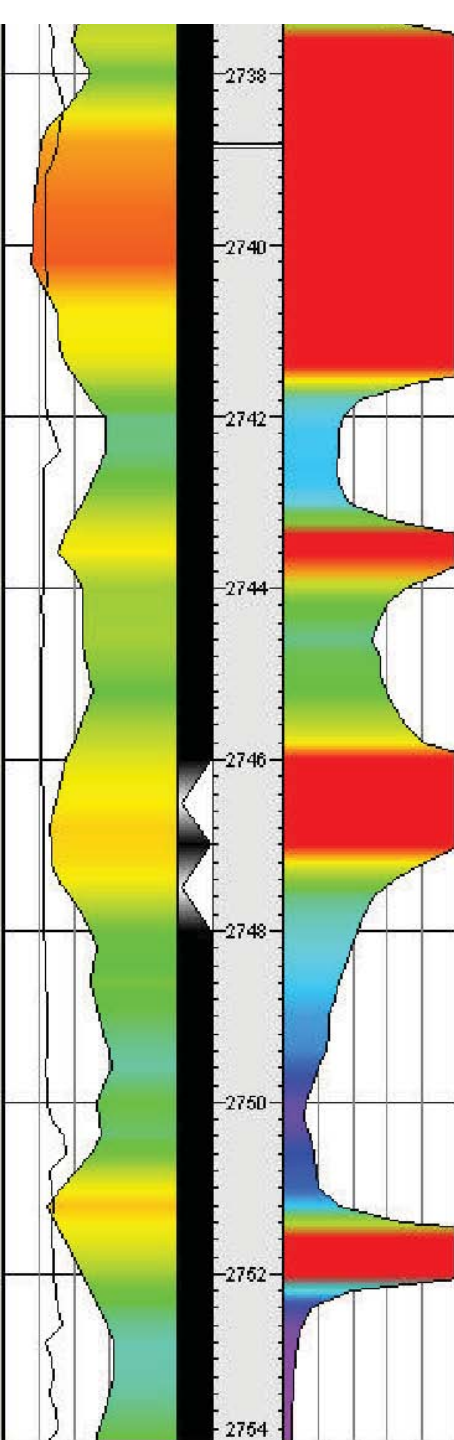


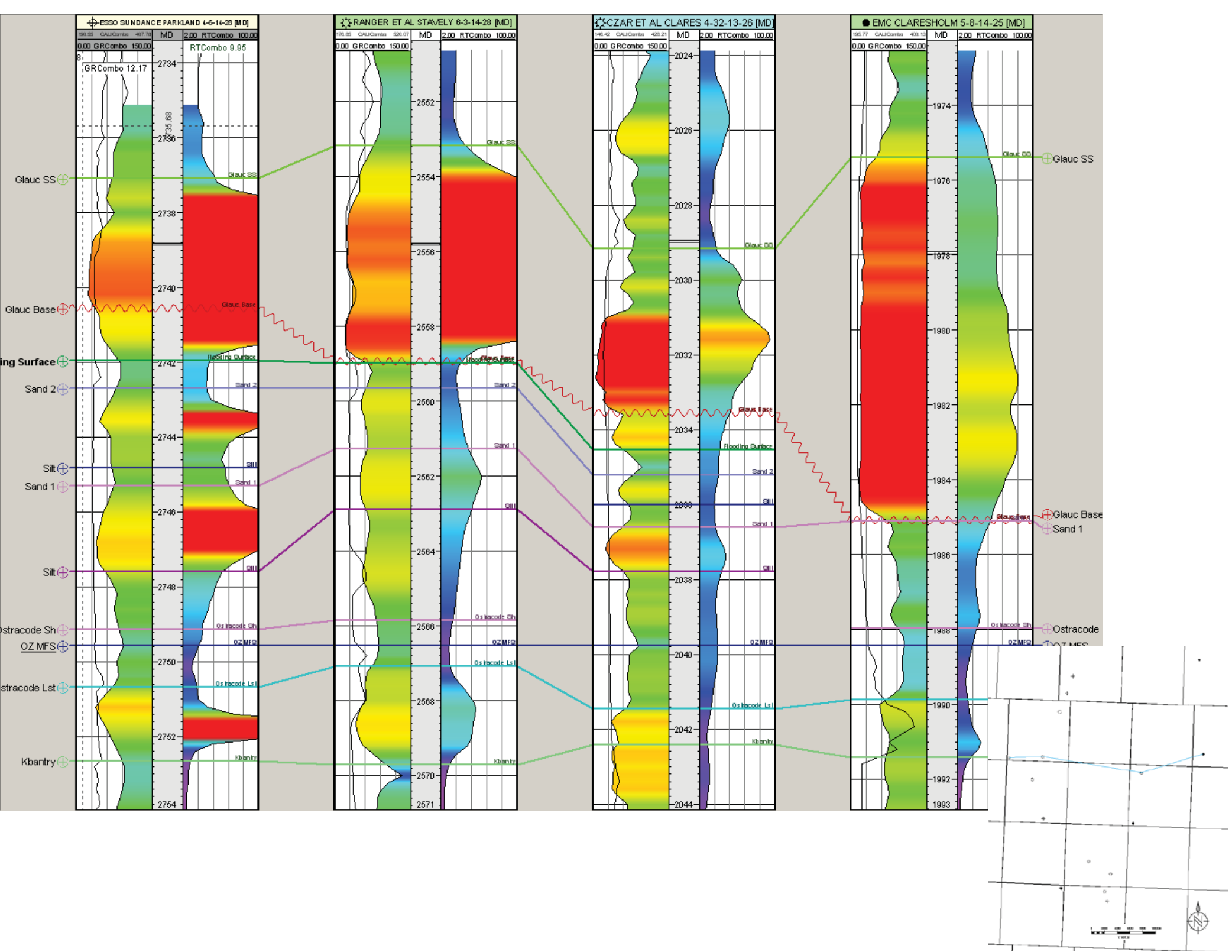


Ostracode Zone  
Upper Ostracode

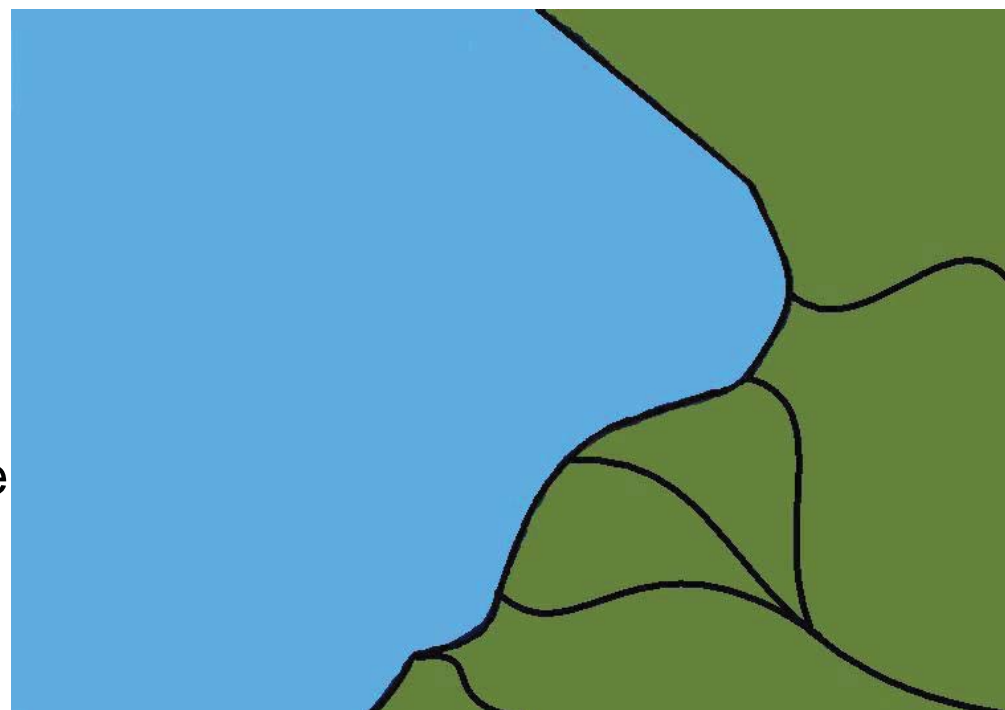
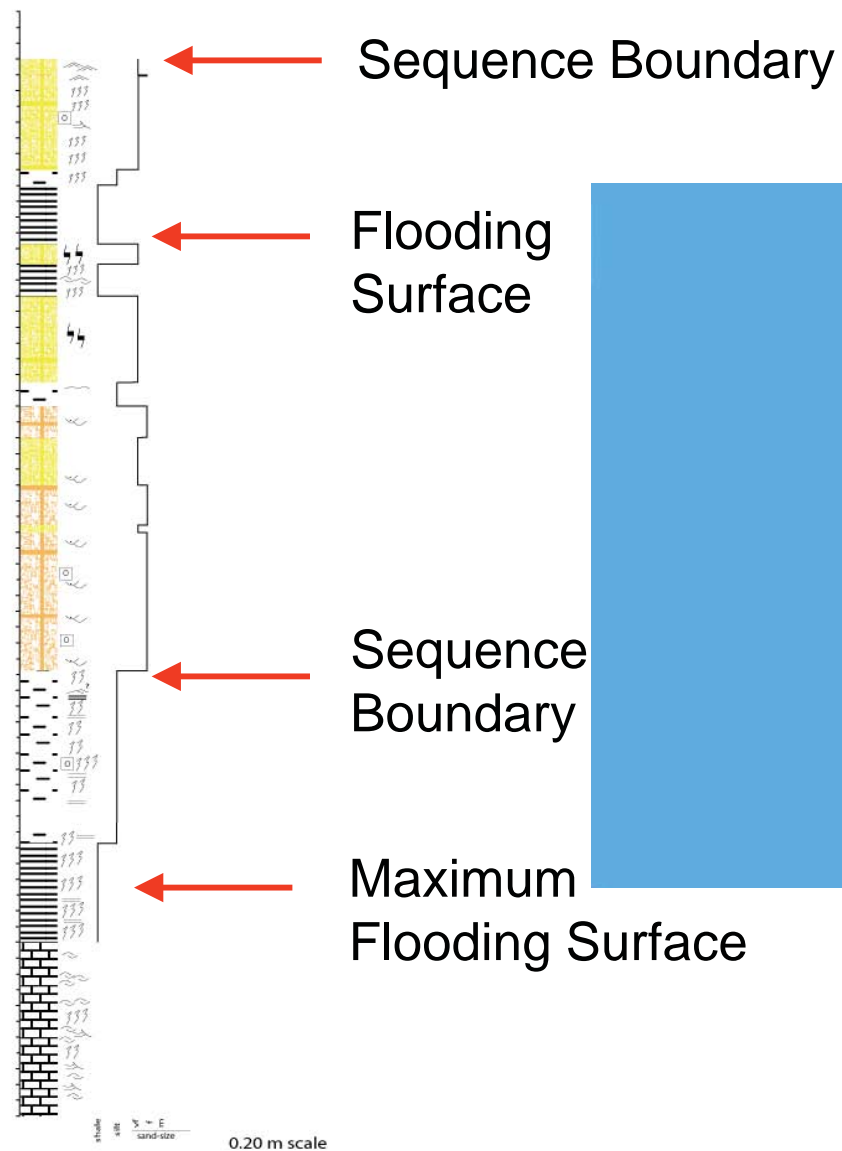
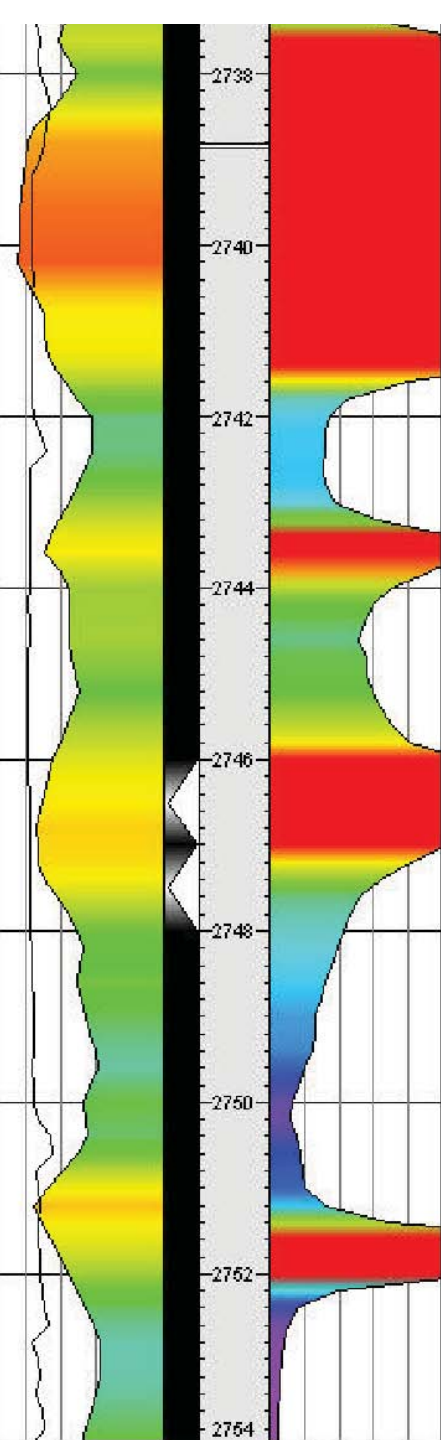
Cross-bedded sandstone

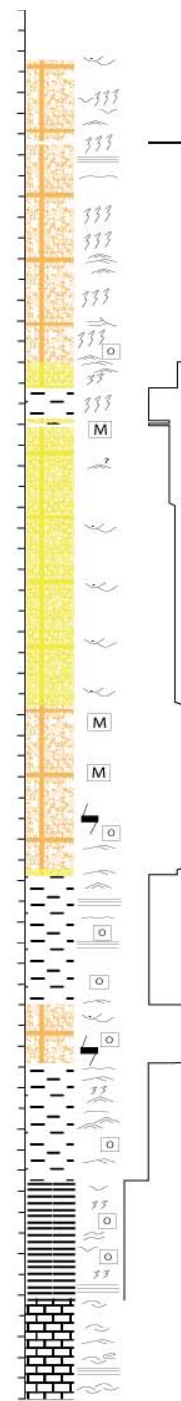
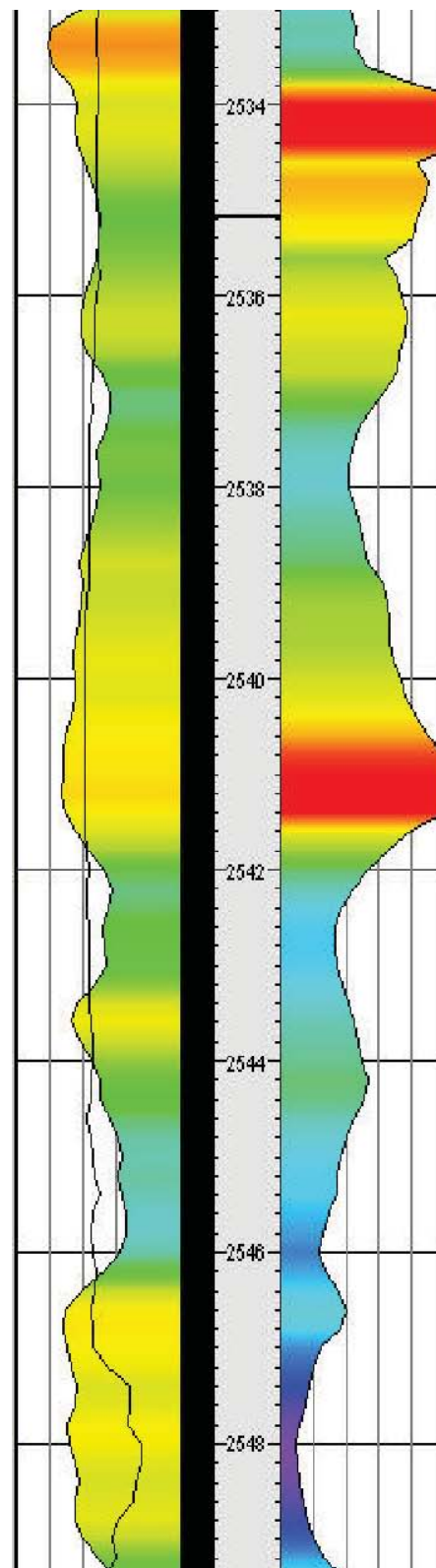






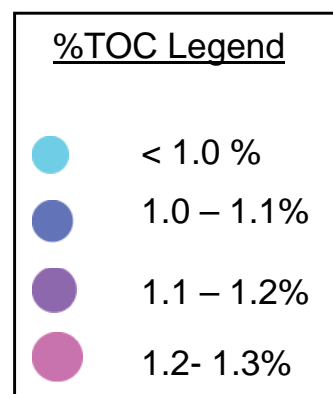
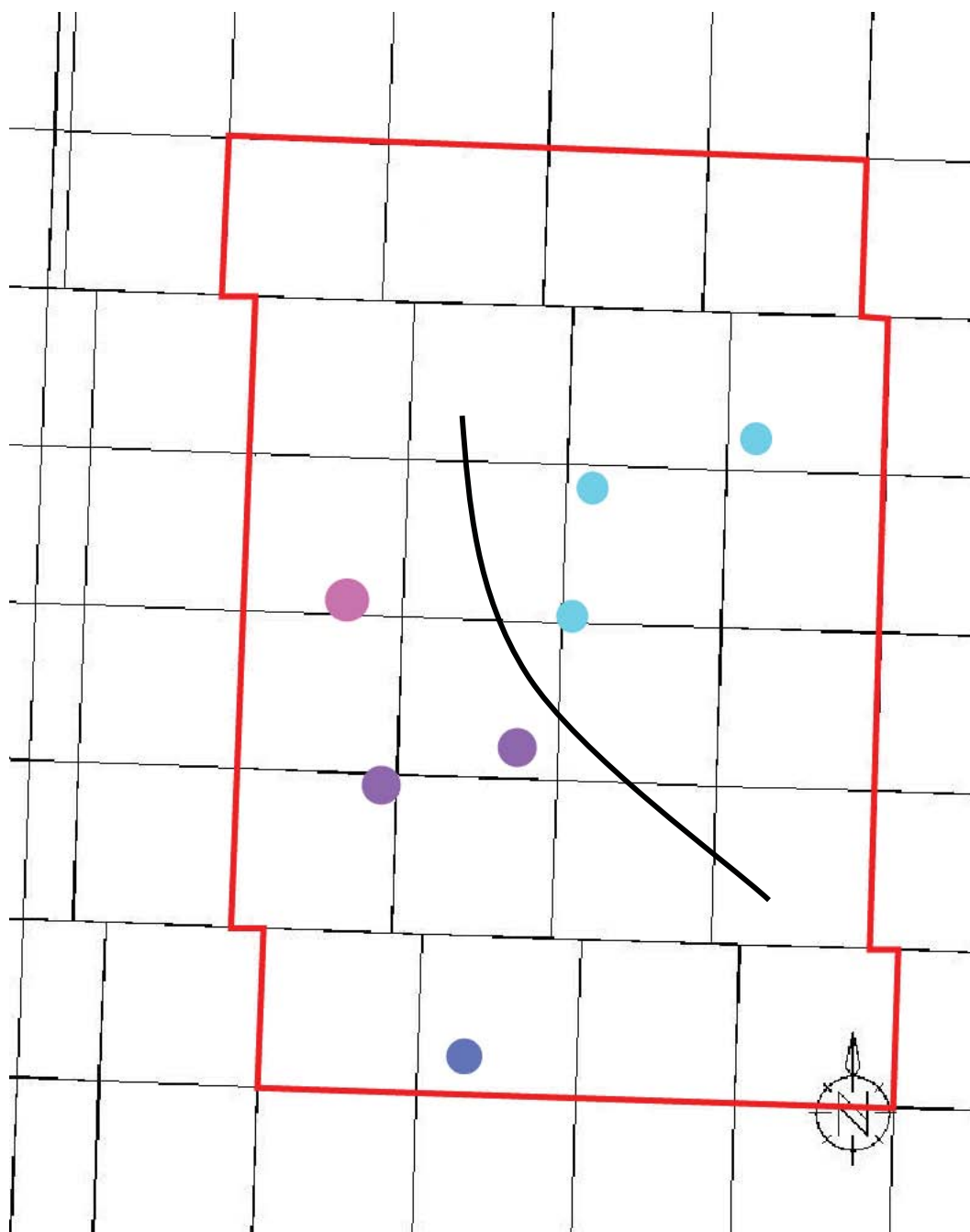


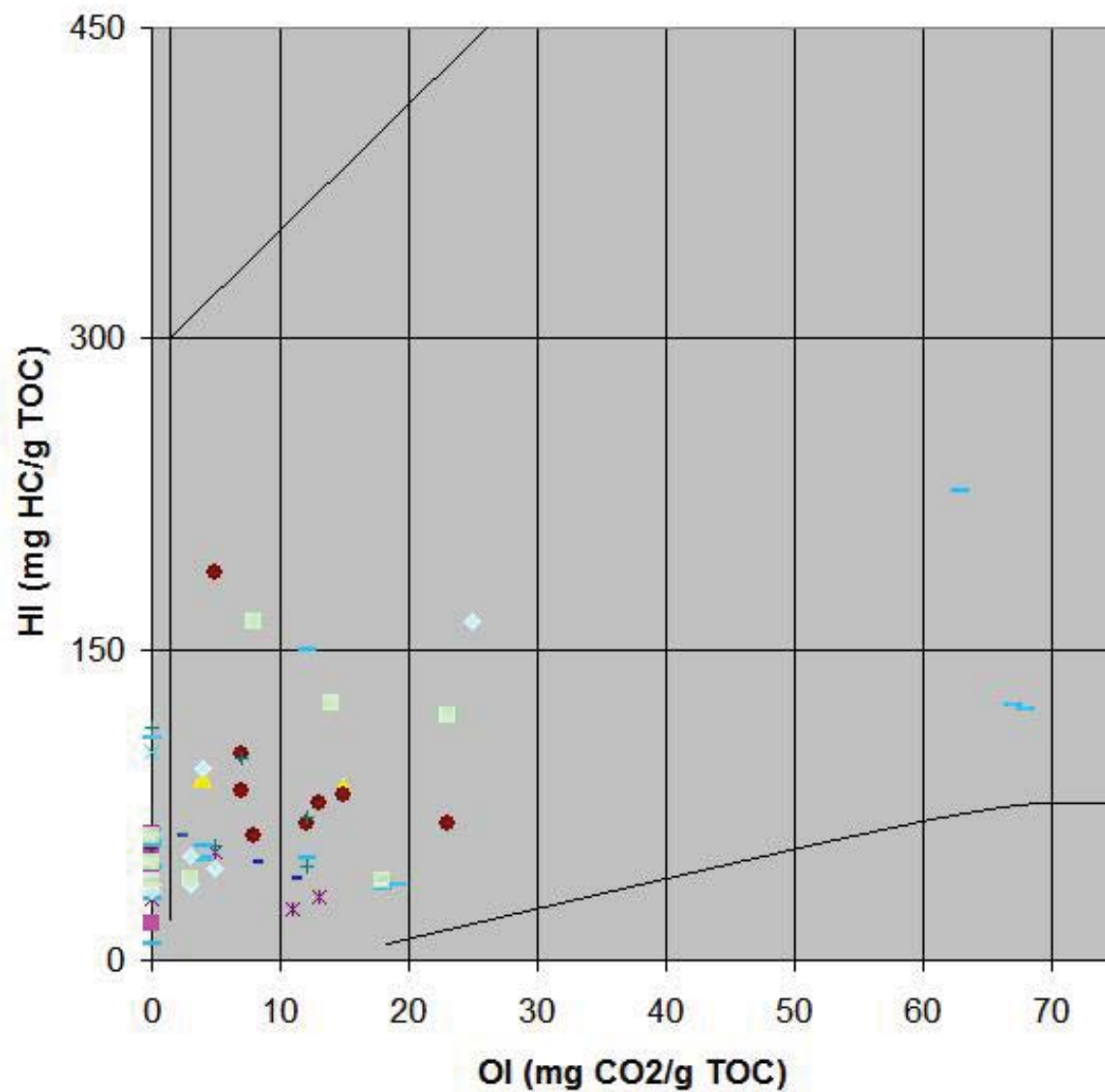
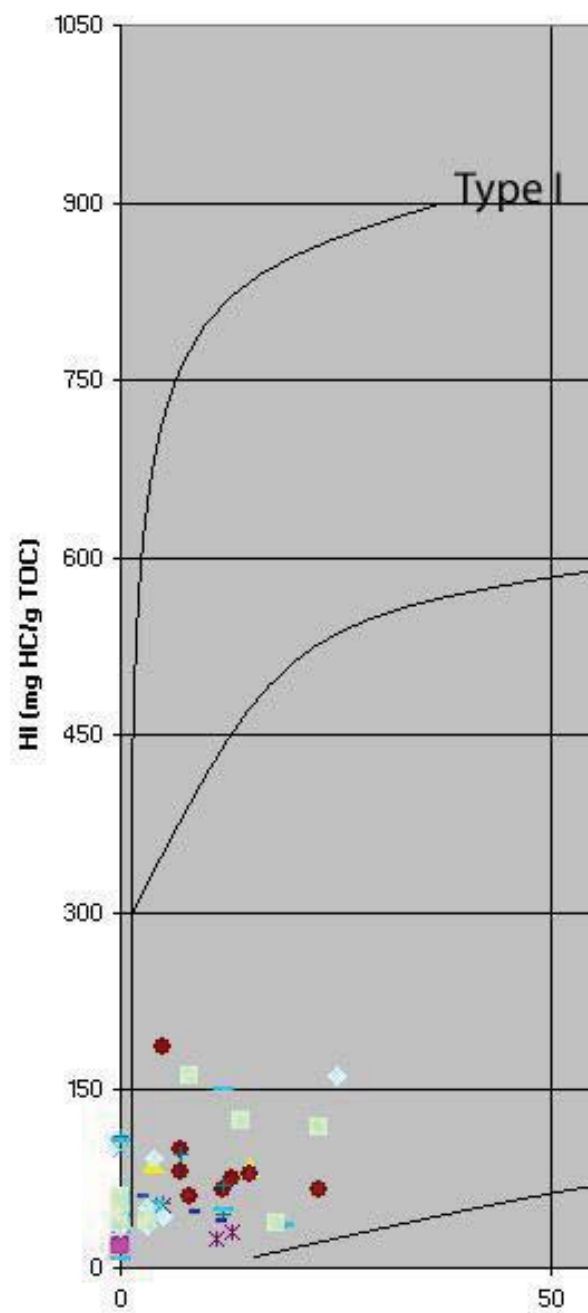




0.80% TOC	HI 52
0.73% TOC	HI 51
0.78% TOC	HI 41
0.77% TOC	HI 18
1.11% TOC	HI 61

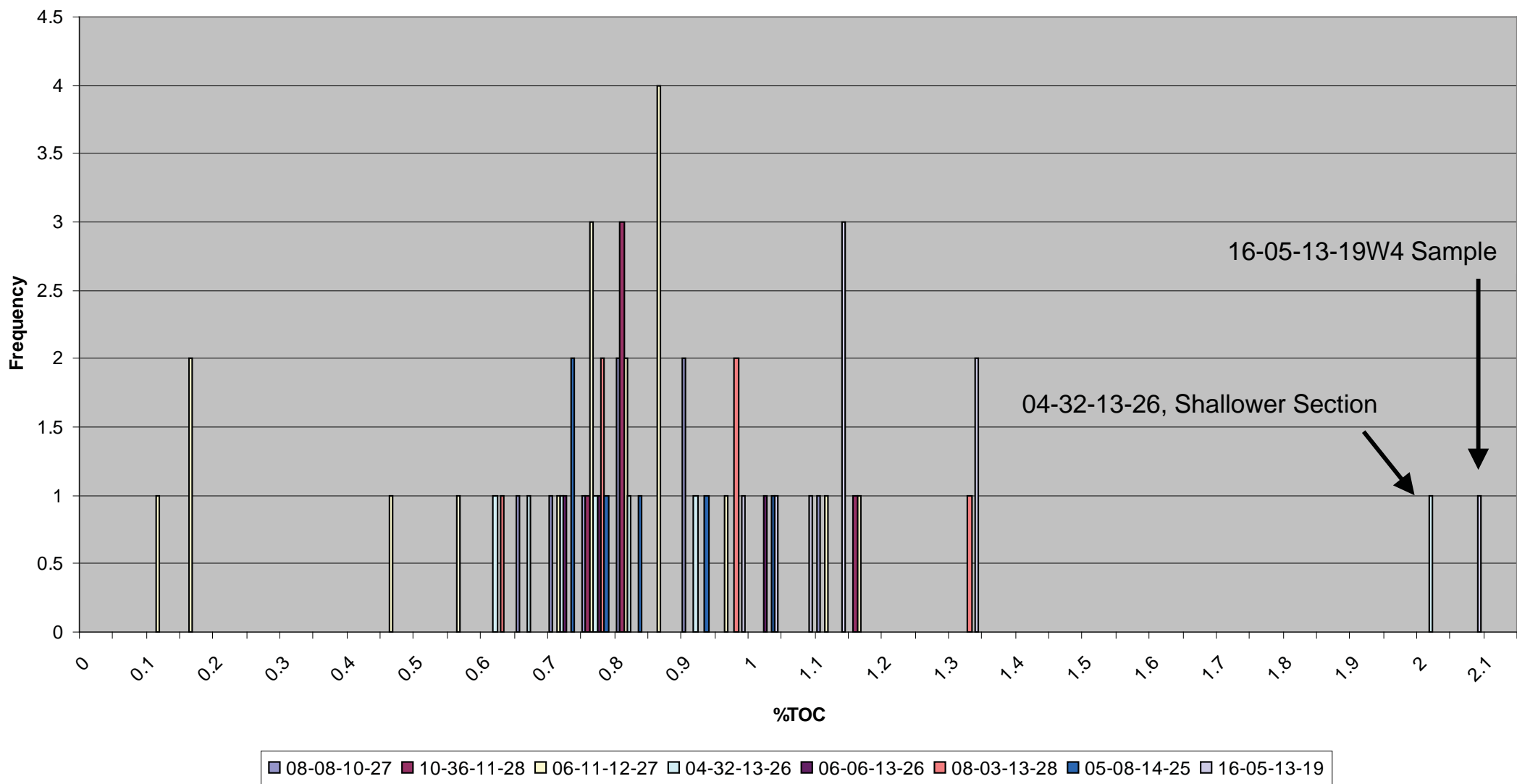


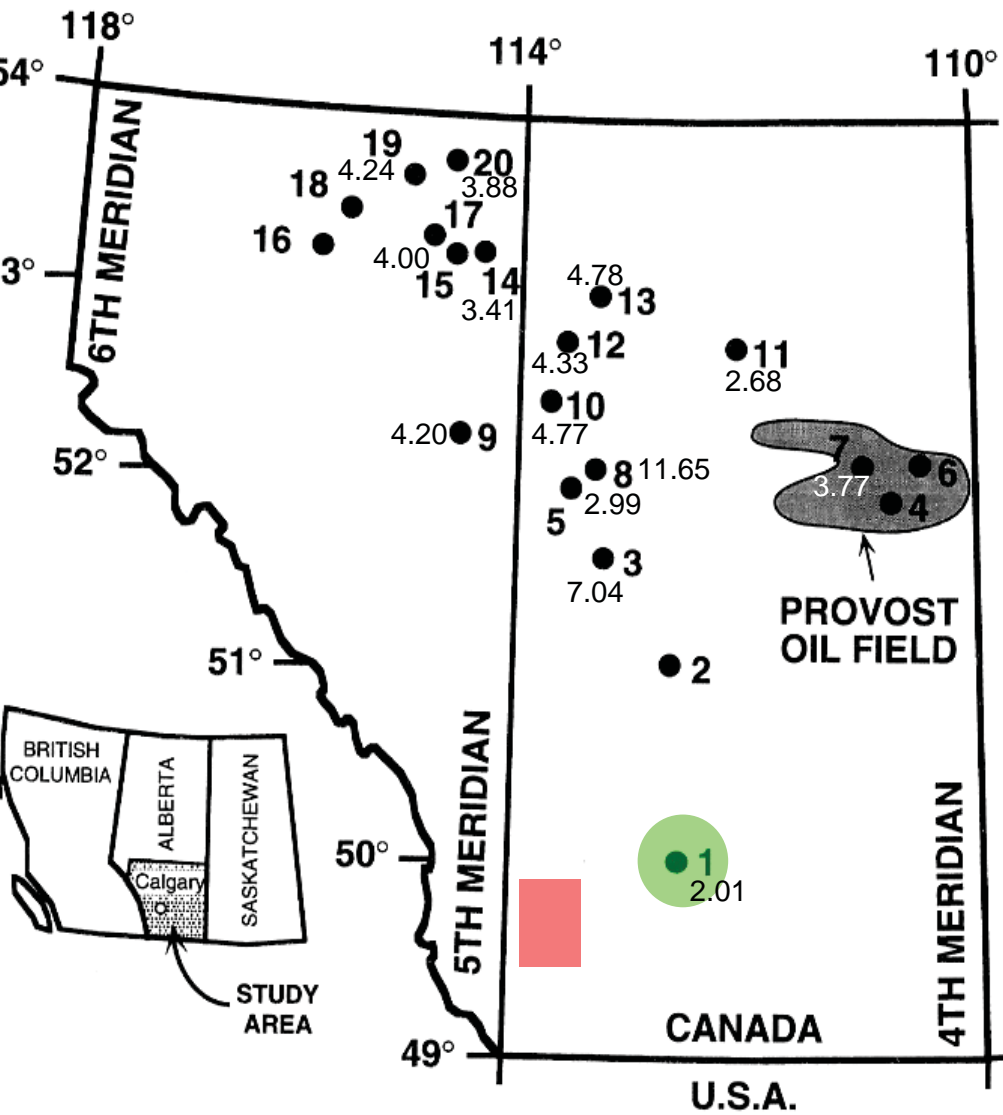


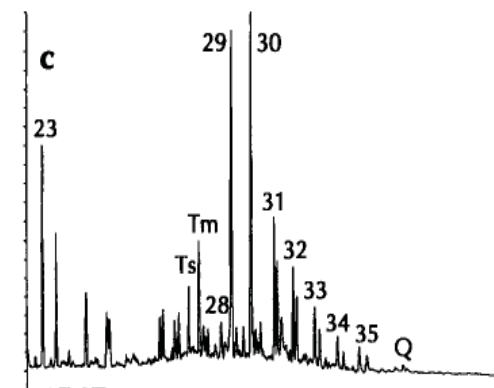
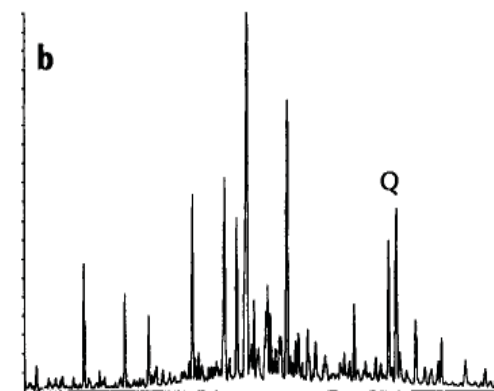
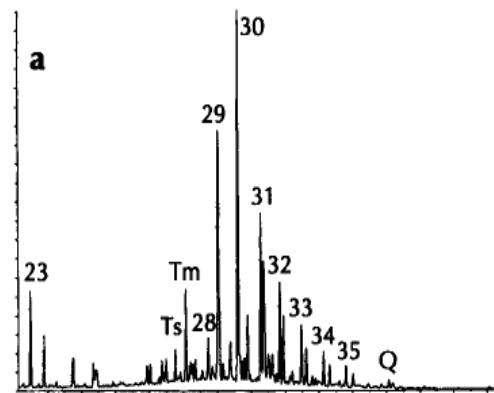
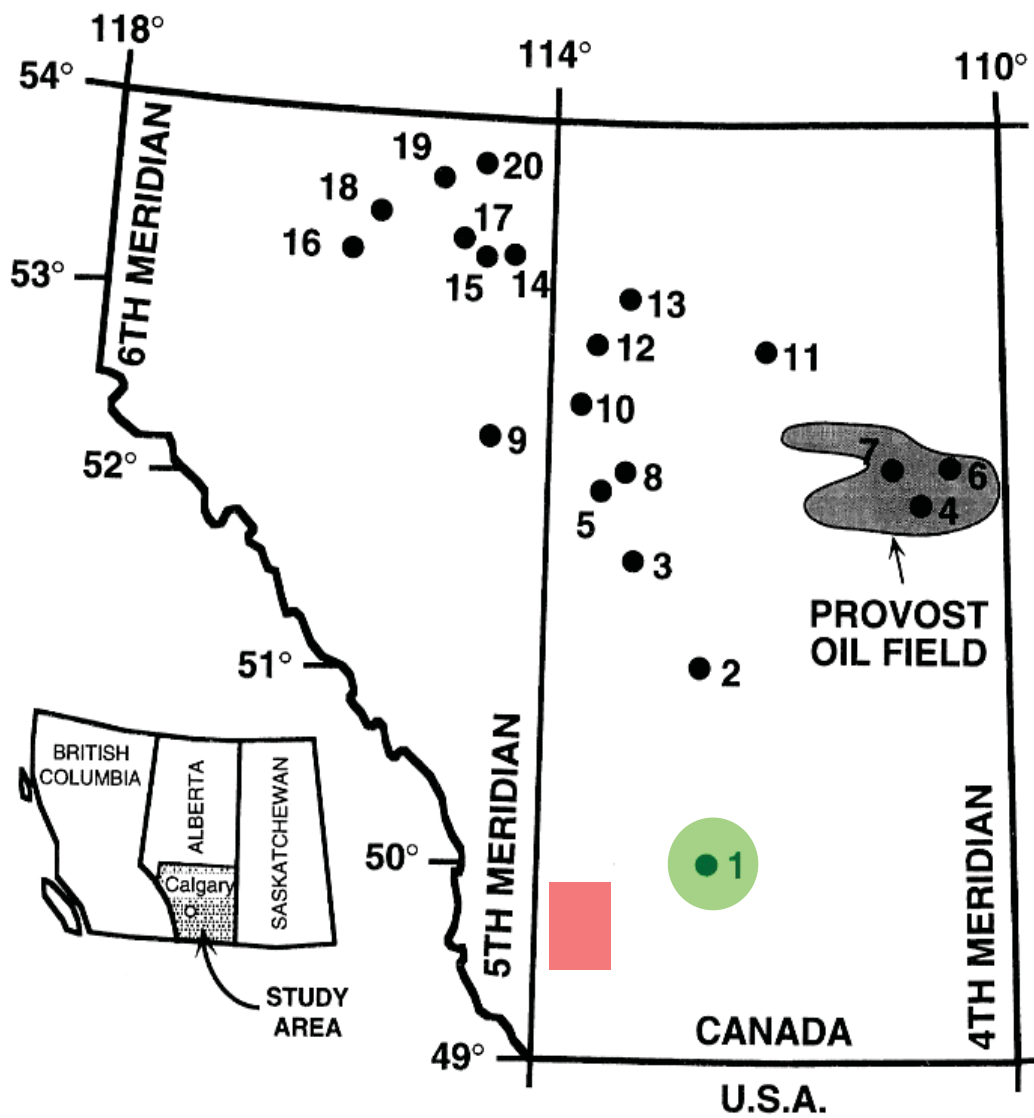


■ 10-36-11-28W4    ▲ 08-29-30-23W4    × 07-01-37-24W4    \* 08-03-13-28W4    ● 16-05-13-19W4    + 05-08-14-25W4    - 06-06-13-26W4  
 — 06-11-12-27W4    ◆ 04-32-13-26W4    ■ 08-08-10-27W4

%TOC Histogram









# Conclusions

- The Ostracode Zone consists of two units: the transgressive basal Ostracode Limestone and the Upper Ostracode.
- The Upper Ostracode represents a shallow marine environment that is periodically incised and filled by fluvial systems.
- There is a clear link between the depositional environment and Rock Eval / TOC data.
- It has yet to be determined if there is a correlation between Mannville oils and Upper Ostracode extracts in the study area.

# Acknowledgements

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- David C. Jennette, Apache Corporation
- Paul G. Lillis, United States Geological Survey
- Dennis R. Price, ExxonMobil

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Thank You!