



LOG ANALYSIS



***GOB Final
Hearing
Presentation***

June, 2005

Methodology

1. Calculate shale volume
2. Calculate effective pore volume (shale corrected)
3. Calibrate porosity to available core data
4. Calculate permeability transform from available core data
5. Calculate lithology
6. Calculate water saturation
7. Calibrate water saturation to available core data

Core Calibration

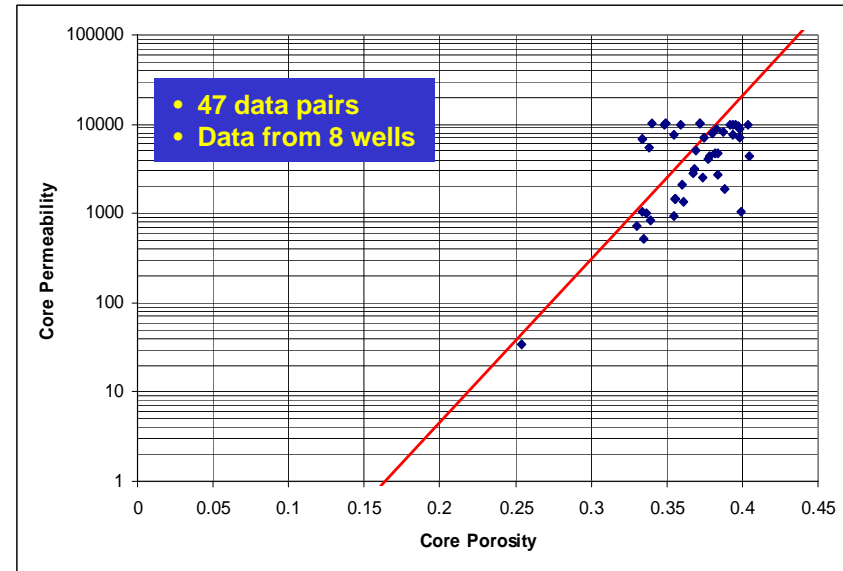
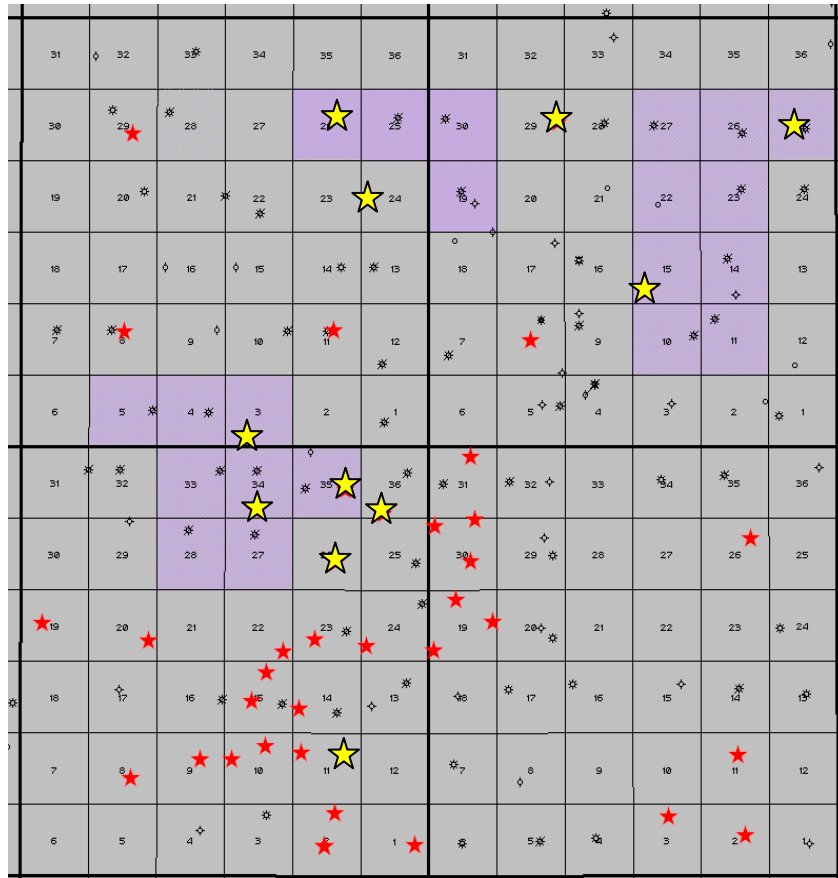
- Core calibration was used to match both porosity and water saturation.
- The porosity match was matched first by varying shale and matrix parameters, and generally the match was found to be very good.
- Water saturation, matched after porosity, and was achieved by varying water resistivity and shale resistivity. The water saturation match was reasonable.
- The degree of calibration between core and log analysis can be visualized by showing core data in a track adjacent to the log analysis answers. Problems with missing core, core to log depth adjustment, and core-derived porosity versus log-calculated effective porosity are some of the reasons why this is an appropriate technique for these data. Crossplot techniques are misleading if the core depth matching has not been performed, and missing core not fully accounted for.

Common Issues with Dean Stark Analysis & Core Analysis

- In shaly sandstone samples, the clays liberate bound water during drying, making grain mass incorrect, core porosity too high, and oil saturation too low.
- A small tar volume equates to small tar mass, which is more prone to inaccurate measurement of tar mass, leading to inaccurate porosity calculation.
- Bed resolution of logs is 2-3 feet in porosity logs, and 4-8 feet for resistivity logs, whereas core is within inches
- Core see 1.5 inches, density sees 18 inches
- Core handling requires freezing, thawing, condensation and evaporation processes, which can lead to incorrect water volumes (therefore porosity is reduced and oil saturation increases)
- Density values used in Dean Stark are usually assumed and not measured
- Depth control
- Missing core
- Upside down core
- Misplaced core

Core Calibration – Porosity to Permeability

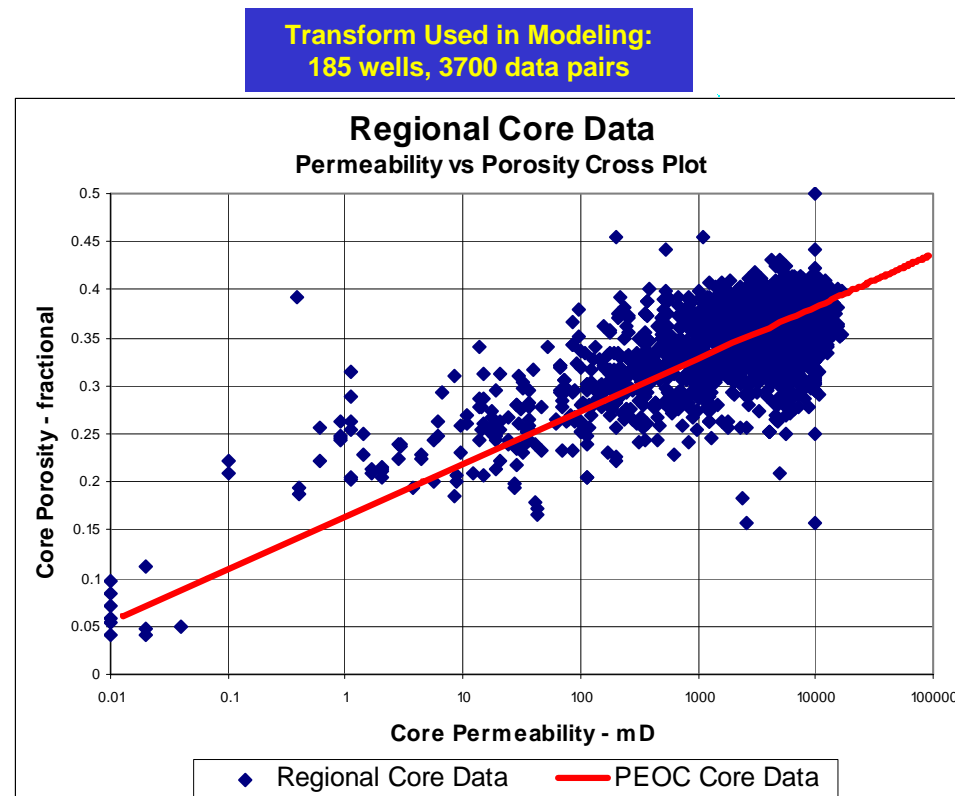
★ McMurray Core ★ Core used in PEOC studies



- All available core within each pool was used to calibrate log response
- There are virtually no core porosity samples below 20% porosity
- Almost all permeability data has been taken on rock with porosity greater than 33%
- Many samples with porosity between 20% and 33% have not had permeability measurements taken.

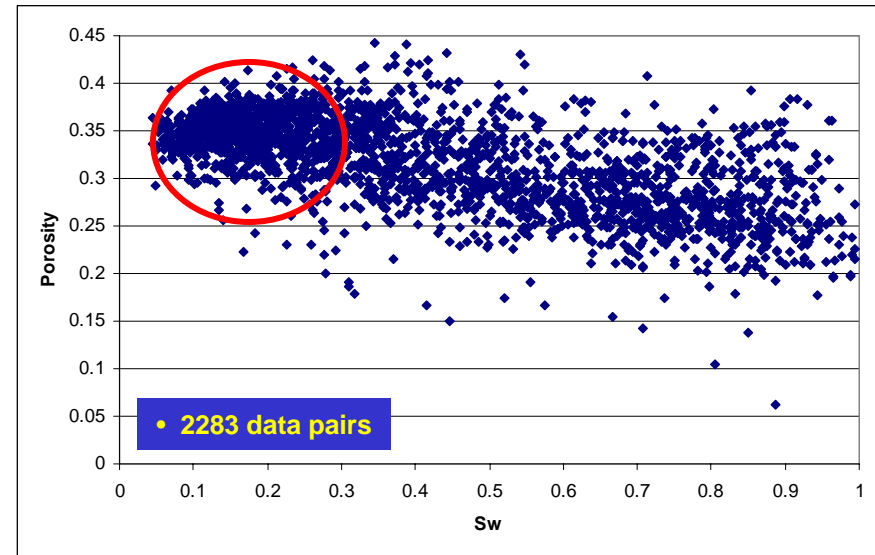
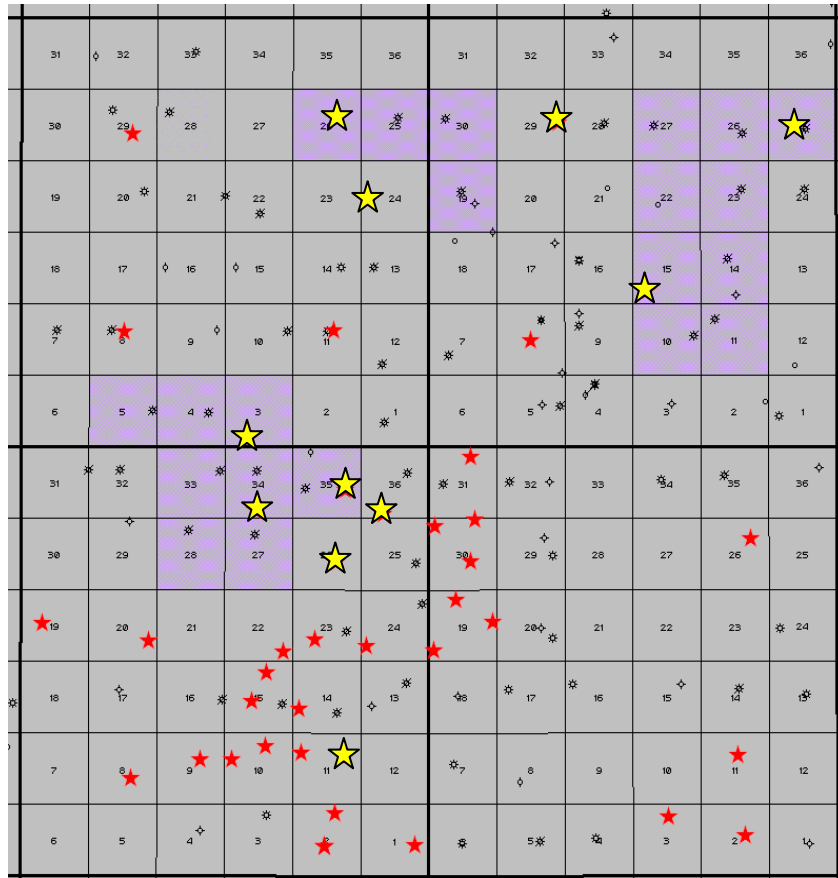
Horizontal Permeability

- The transform between core porosity and core permeability that was developed and used was verified using core data from a much larger area than originally planned.



Core Calibration – Water Saturation

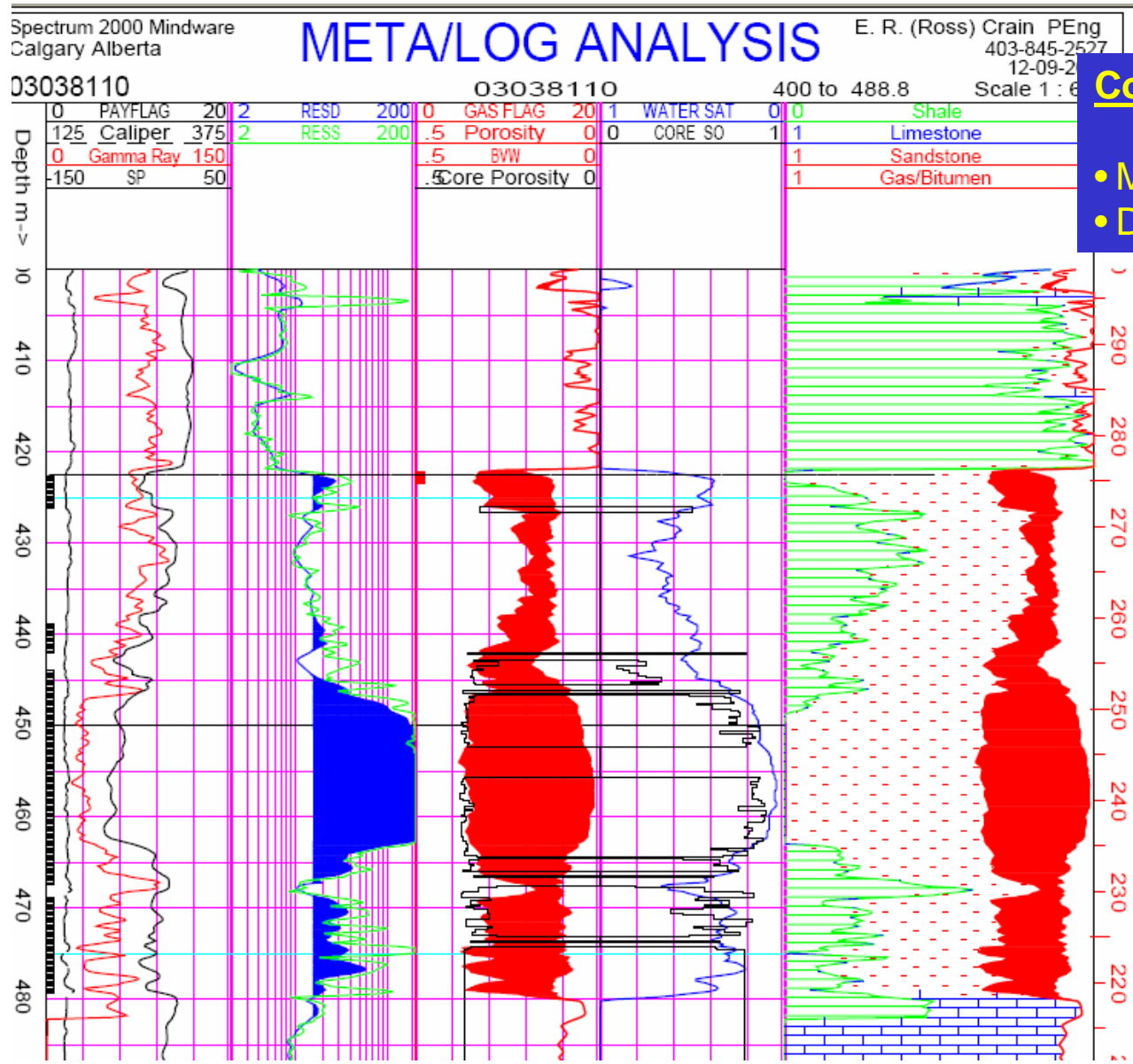
★ McMurray Core ★ Core used in PEOC studies



- Majority of data has Sw between 5% and 30% where the porosity is greater than 32%
- Data has not been screened to remove water zone data
- There is a general trend between lower porosity correlating with higher water saturation (lower oil saturation)
- There are very little data from samples with porosity less than 20%

3-3-81-10W4 CORE CALIBRATION

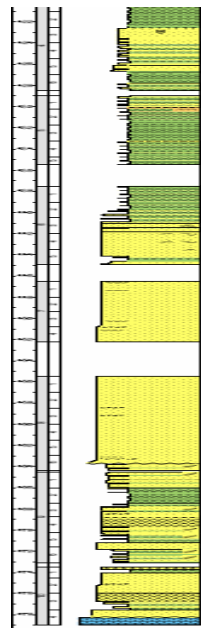
Log Analysis



Core Match Issues:

- Missing core
- Depth match

Core Logging Plot



8-35-80-10W4 CORE CALIBRATION

Log Analysis



Spectrum 2000 Mindware
Calgary Alberta

META/LOG ANALYSIS

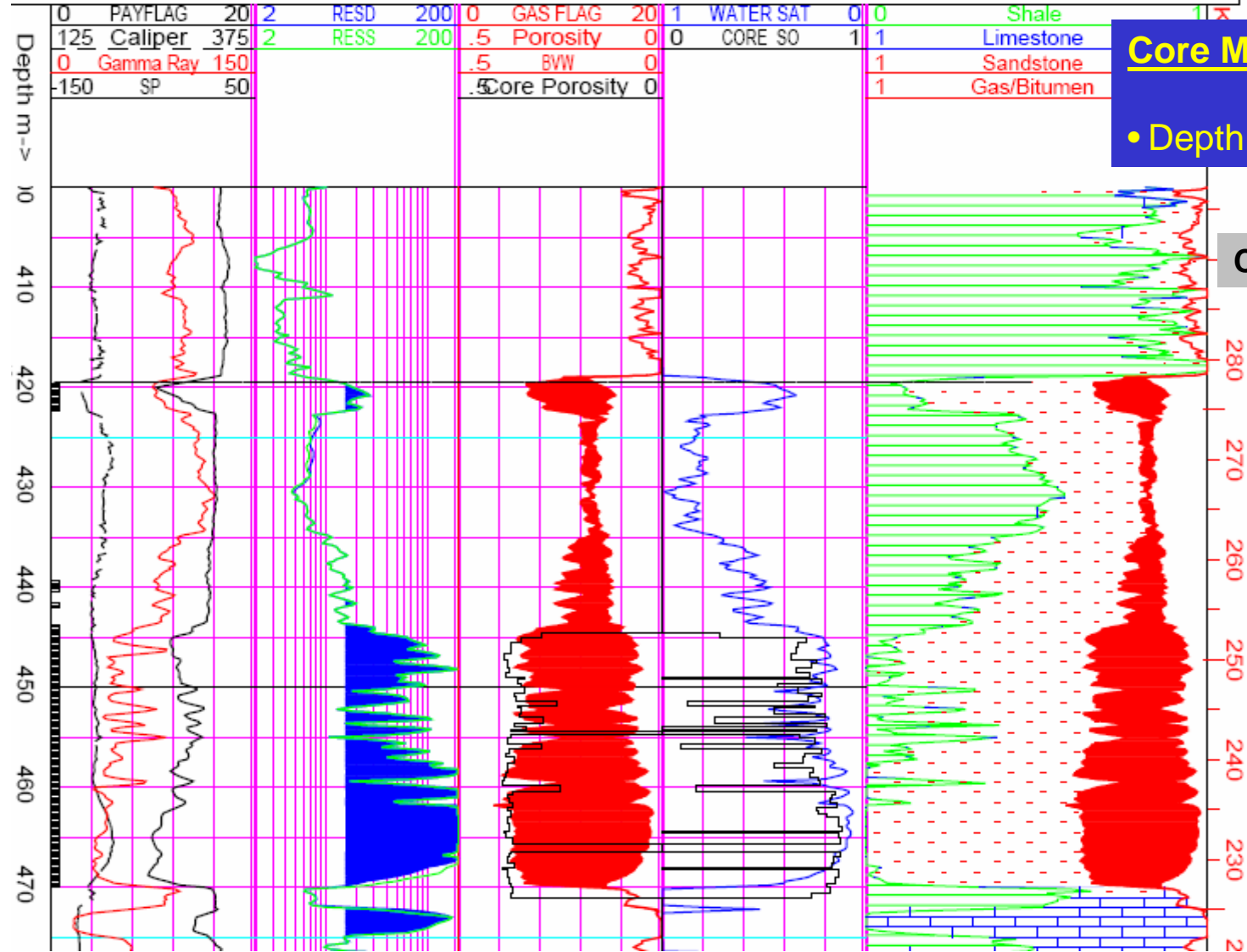
E. R. (Ross) Crain PEng
403-845-2527
12-09-2004

08358010

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400 to 479.8

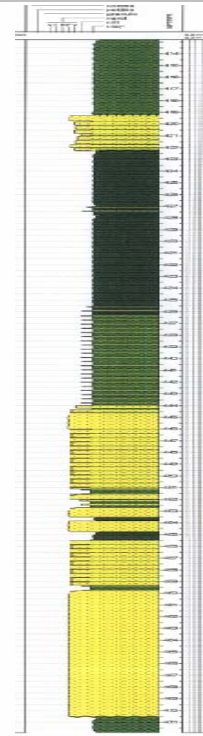
Scale 1 : 600



Core Match Issues:

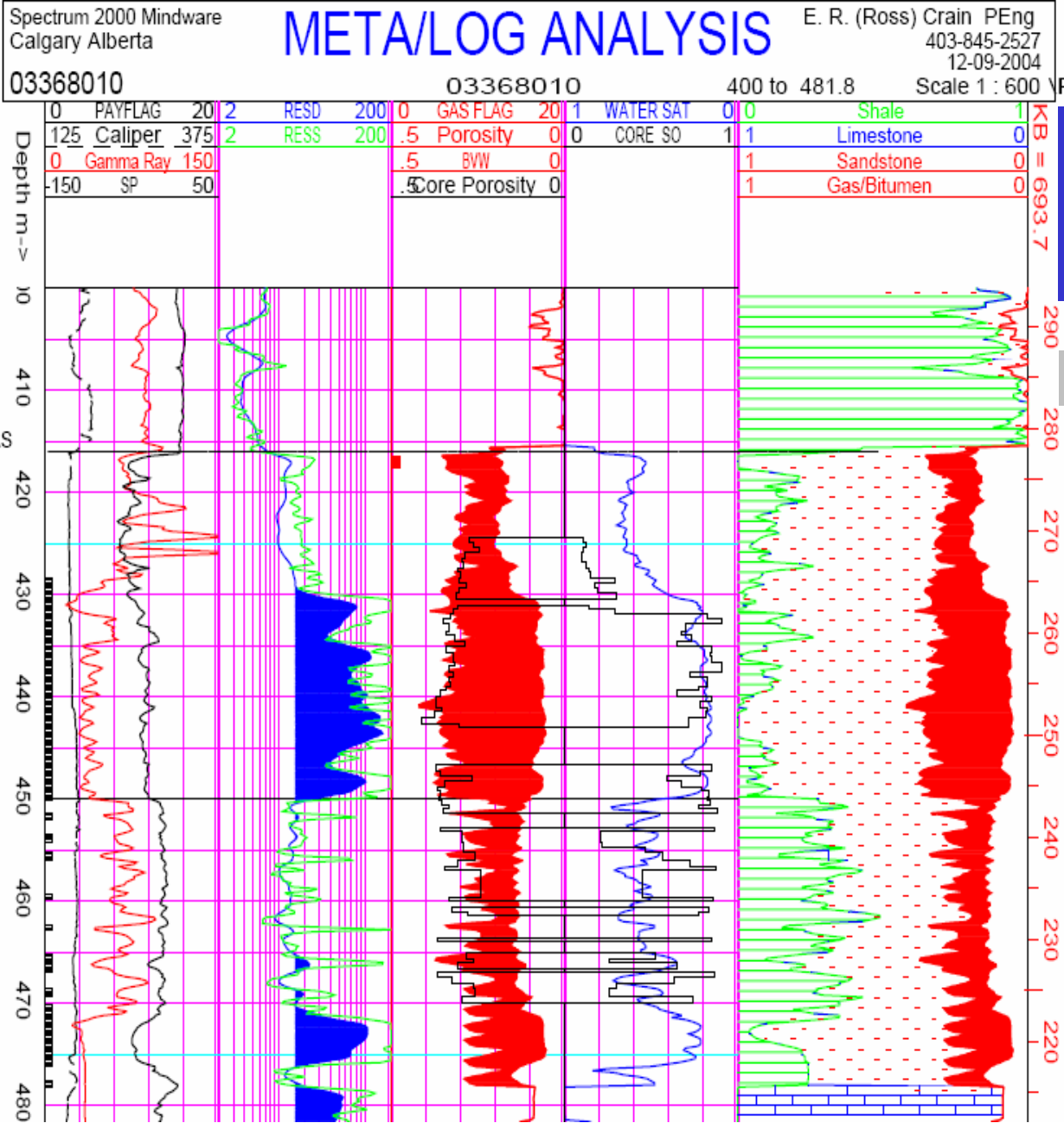
- Depth match

Core Logging Plot



3-36-80-10W4 CORE CALIBRATION

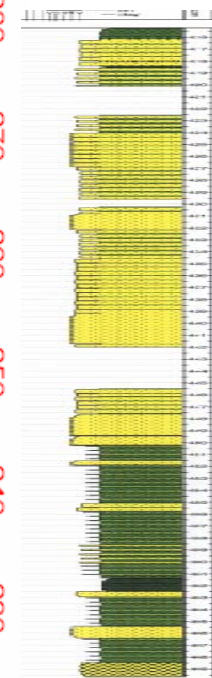
Log Analysis



Core Match Issues:

- Missing core
- Depth match

Core Logging Plot



6-25-81-9W4 CORE CALIBRATION

Log Analysis



Spectrum 2000 Mindware
Calgary Alberta

META/LOG ANALYSIS

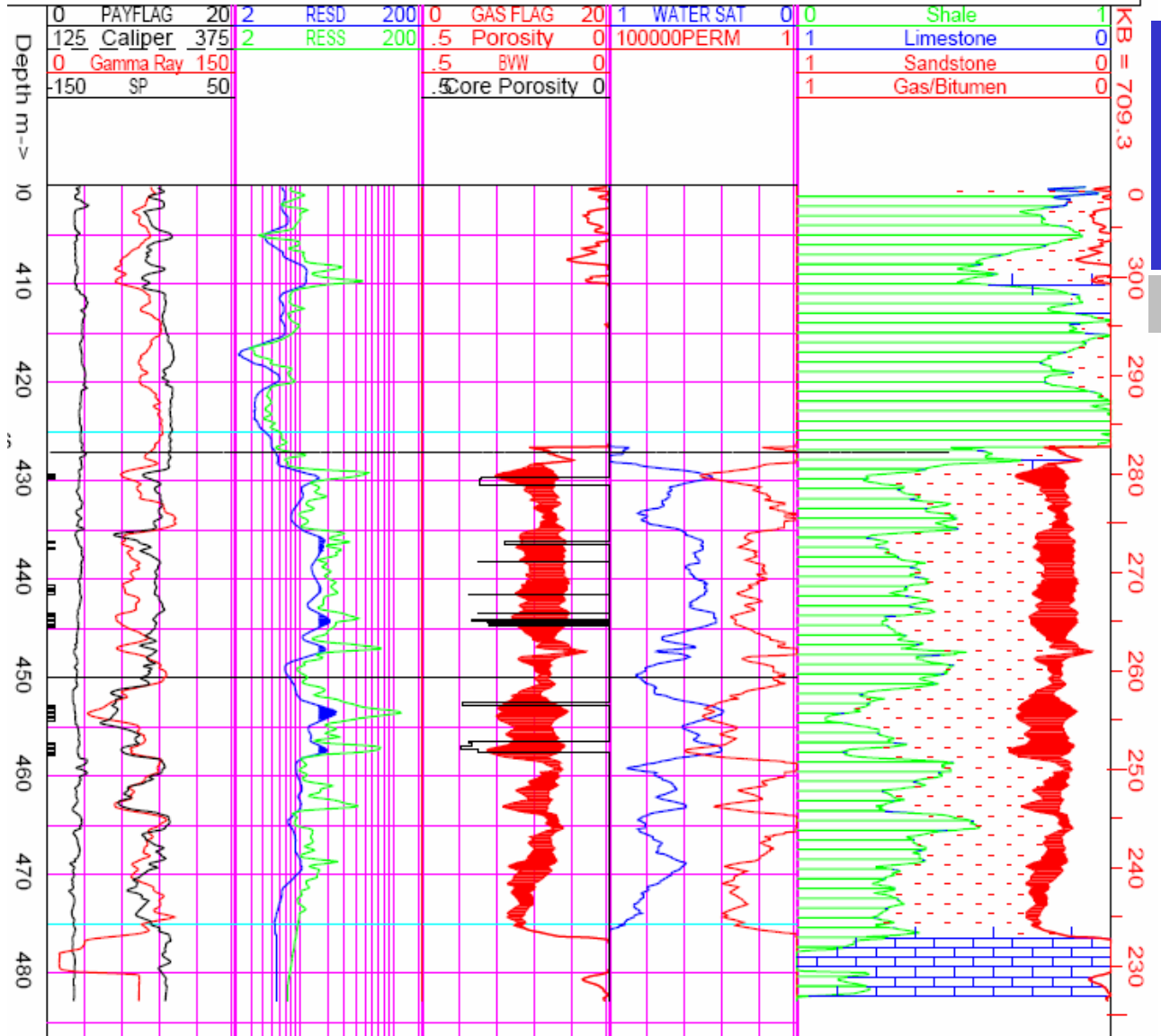
E. R. (Ross) Crain PEng
403-845-2527
12-06-2004

06258109

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400.2 to 482.9

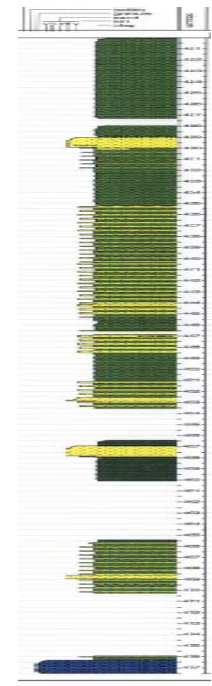
Scale 1 : 600



Core Match Issues:

- Missing core
- Sample bias
- Shaley Sand

Core Logging Plot

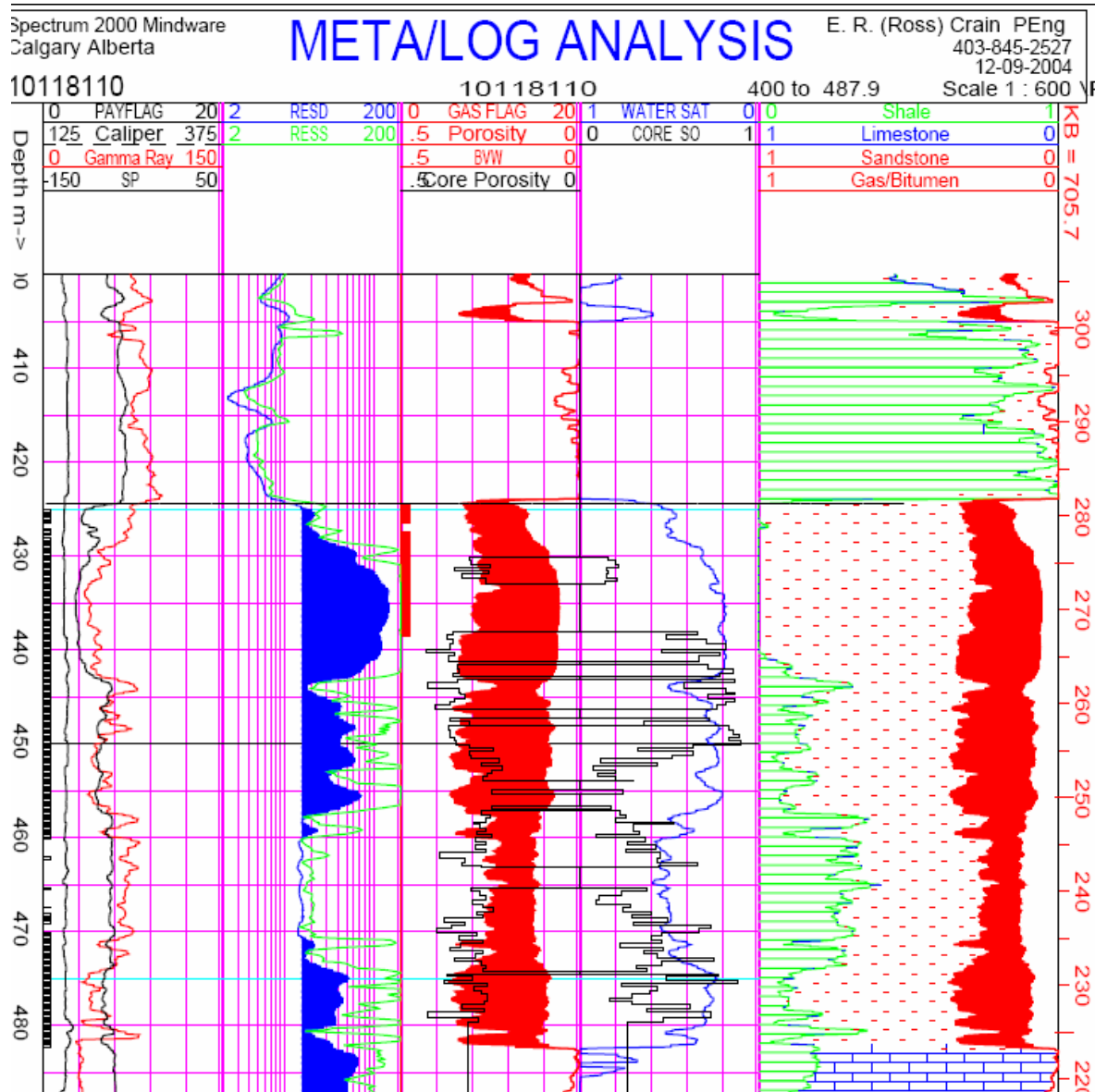


10-11-80-10W4 CORE CALIBRATION - MISMATCHED CORE

Log Analysis



00/10-11 WELL

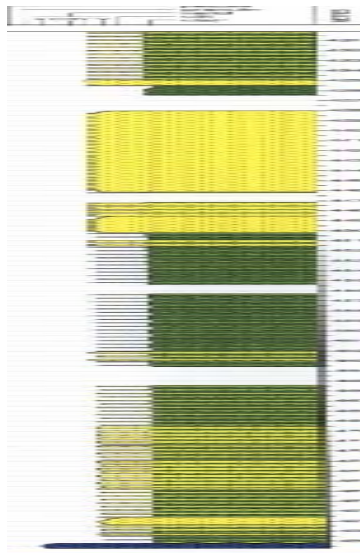


Core Match Issues:

- Core and well logs not from same well
- Core is ~200 m apart from well logs

Core Logging Plot

AA/10-11 WELL
(no logs available)



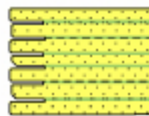
LEGEND FOR FACIES PROFILES



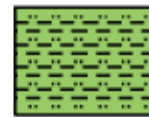
SAND / MARINE SAND



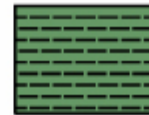
BRECCIA



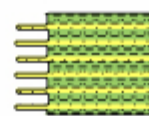
INTERBEDDED SAND



MARINE MUD



MUD PLUG



INTERBEDDED MUD