Rebekah Parks, M.S. Geology, 2022

RESERVOIR CHARACTERIZATION OF THE SHANNON SANDSTONE, SOUTHWESTERN POWDER RIVER BASIN, WYOMING

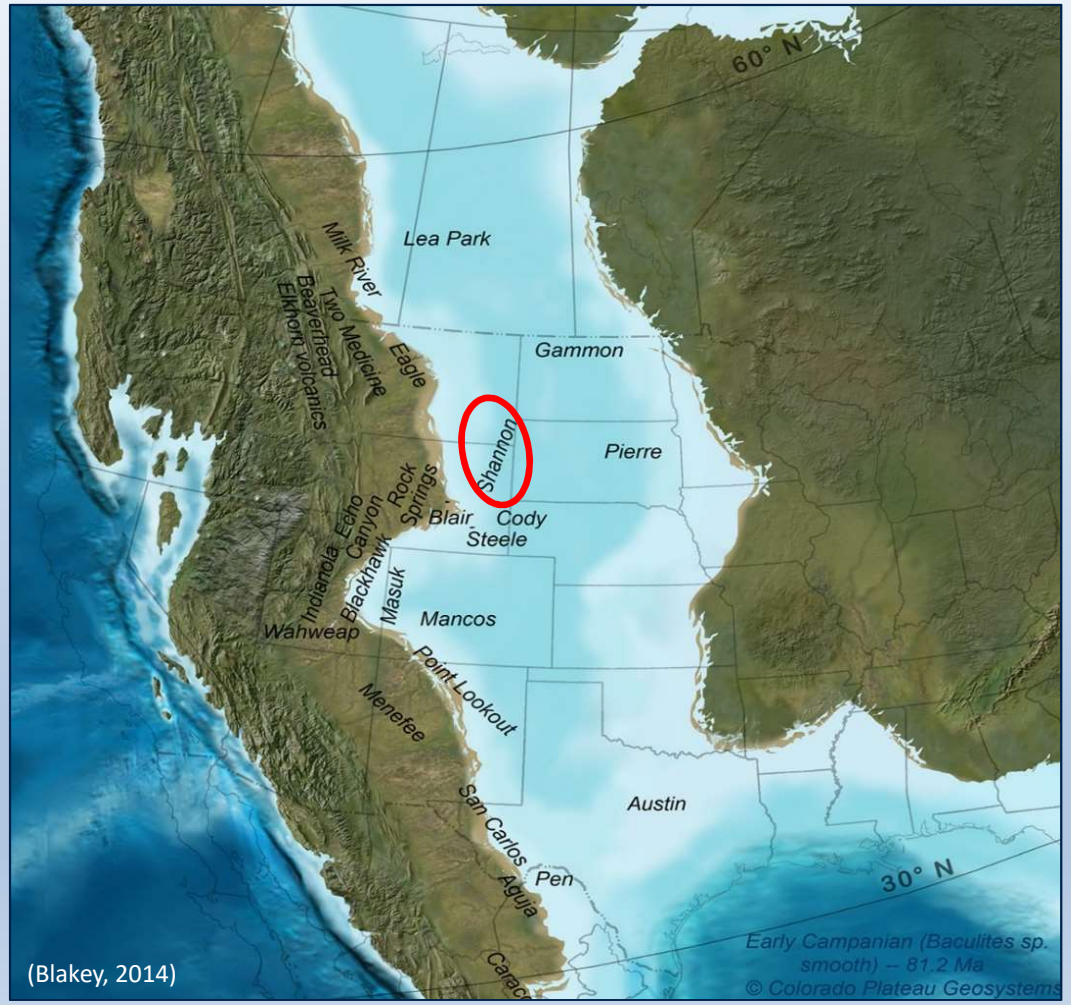
Presentation Outline

- Purpose & Objectives
- Introduction & Regional Geology
- Study Area
- Continued Work

Purpose and Objectives

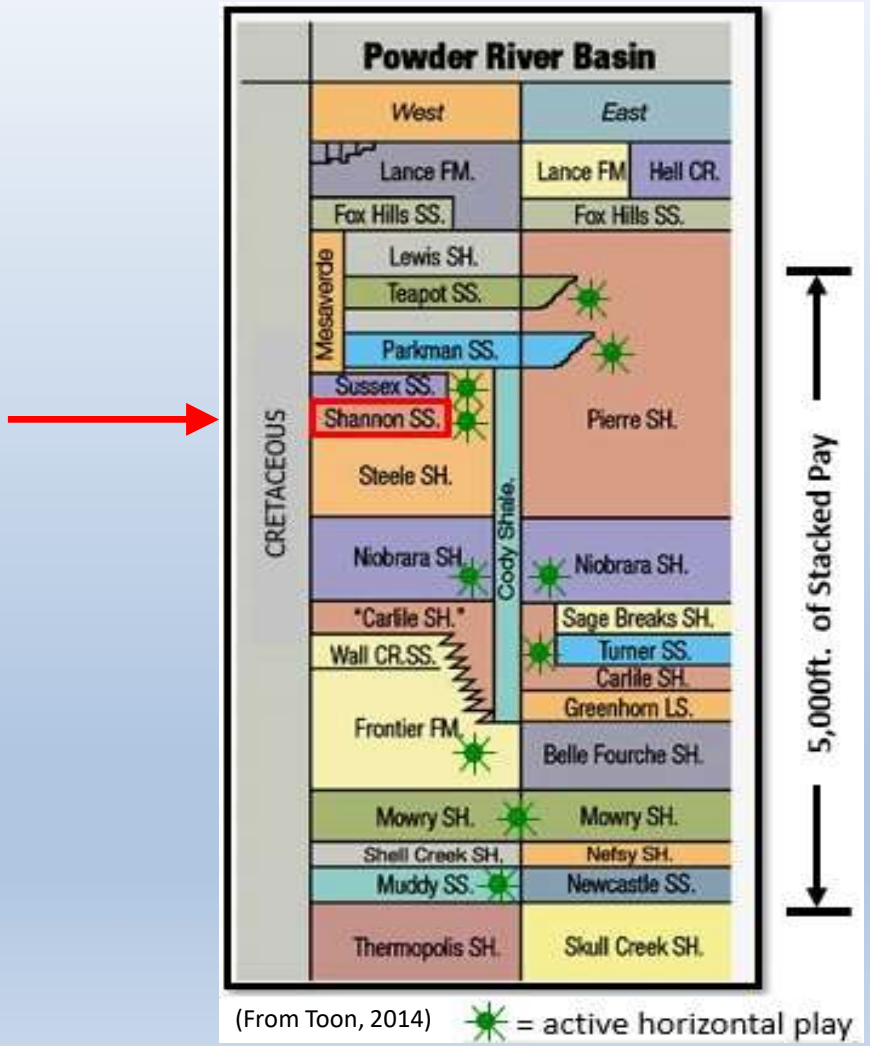
- Reservoir Characterization
  - Define Shannon Sandstone
    - Petrographic analysis
    - Petrophysics analysis
  - Geomechanical properties and stratigraphic interpretation
  - Characterization of lateral and vertical variability
  - Assess petroleum potential
    - Maximize efficiency & production

Regional Geology

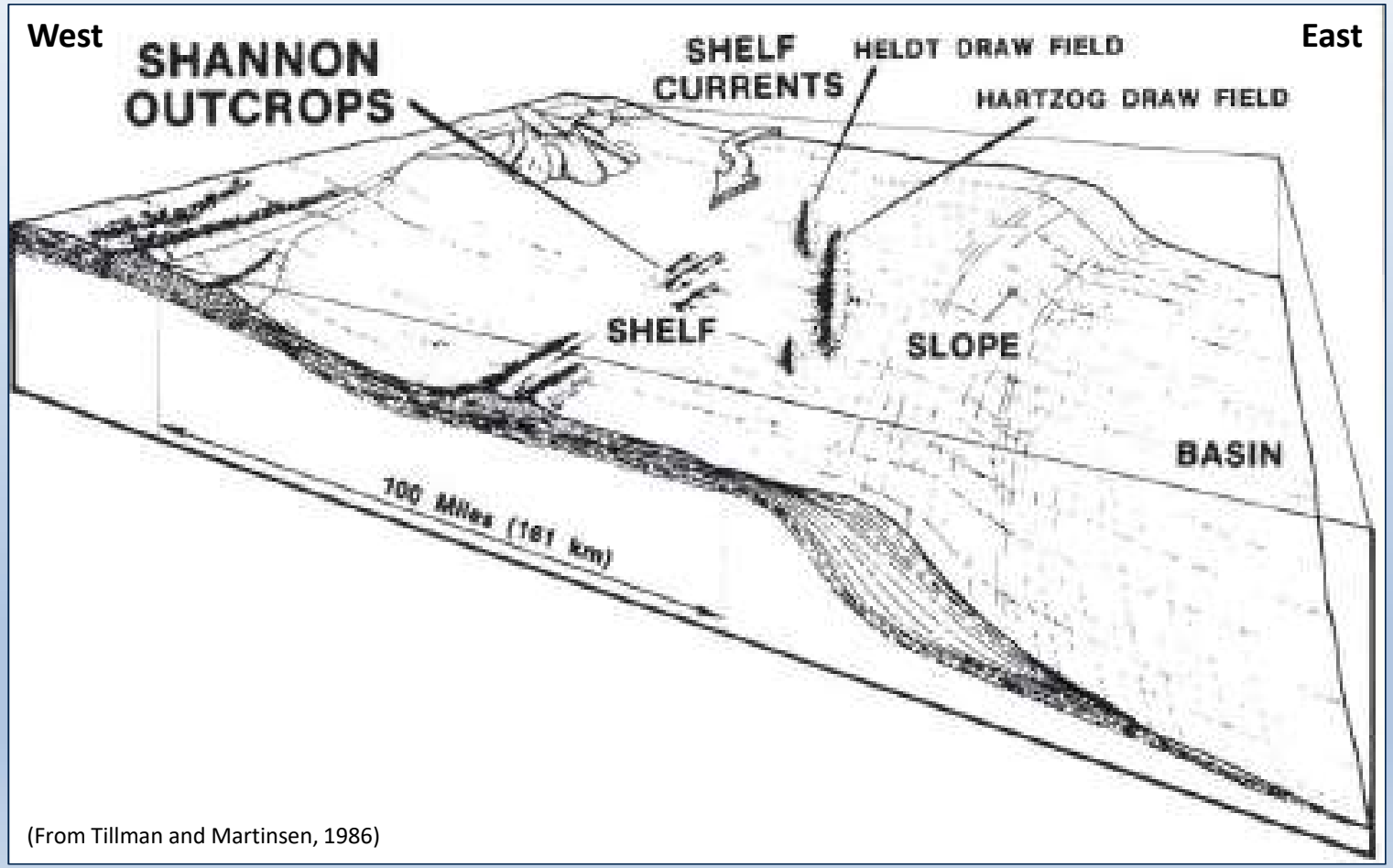


(Blakey, 2014)

Shannon Sandstone



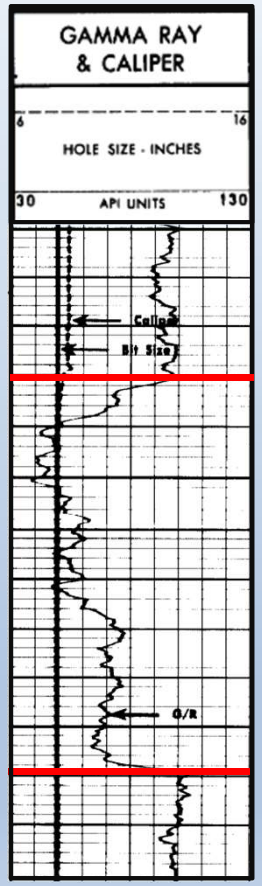
Shannon Sandstone



(From Tillman and Martinsen, 1986)

Shannon Deposition

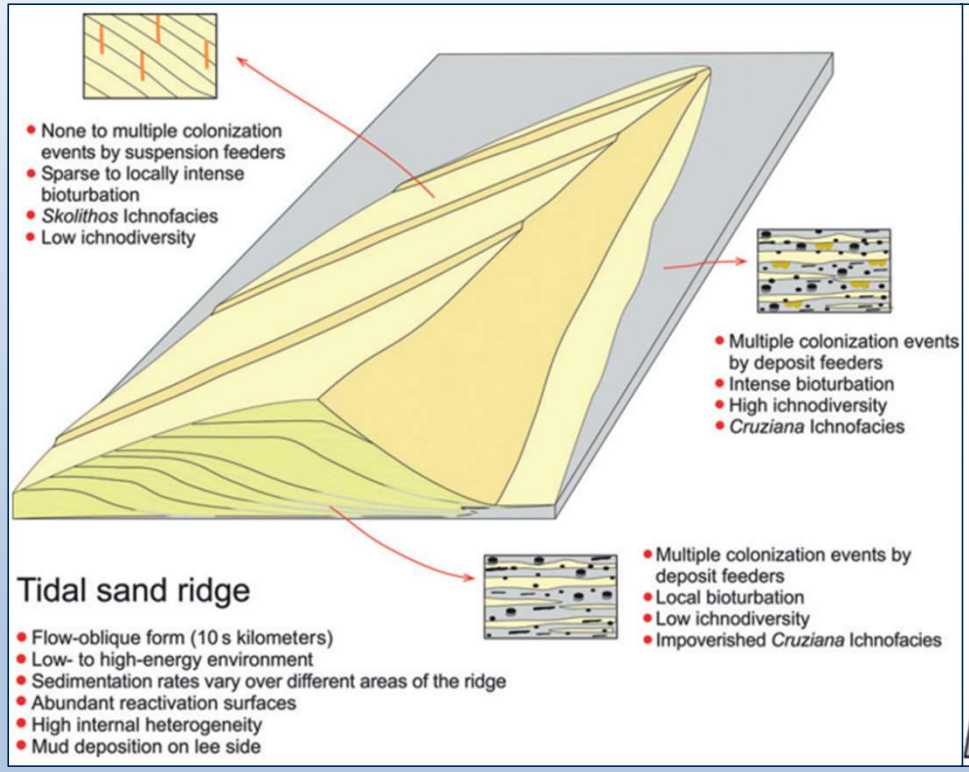
- Varied depositional interpretations
  - Open bay (estuarine) model
  - Shelf ridge model
  - Incised valley fill model
  - Lowstand shoreface model
  - Reworked delta systems

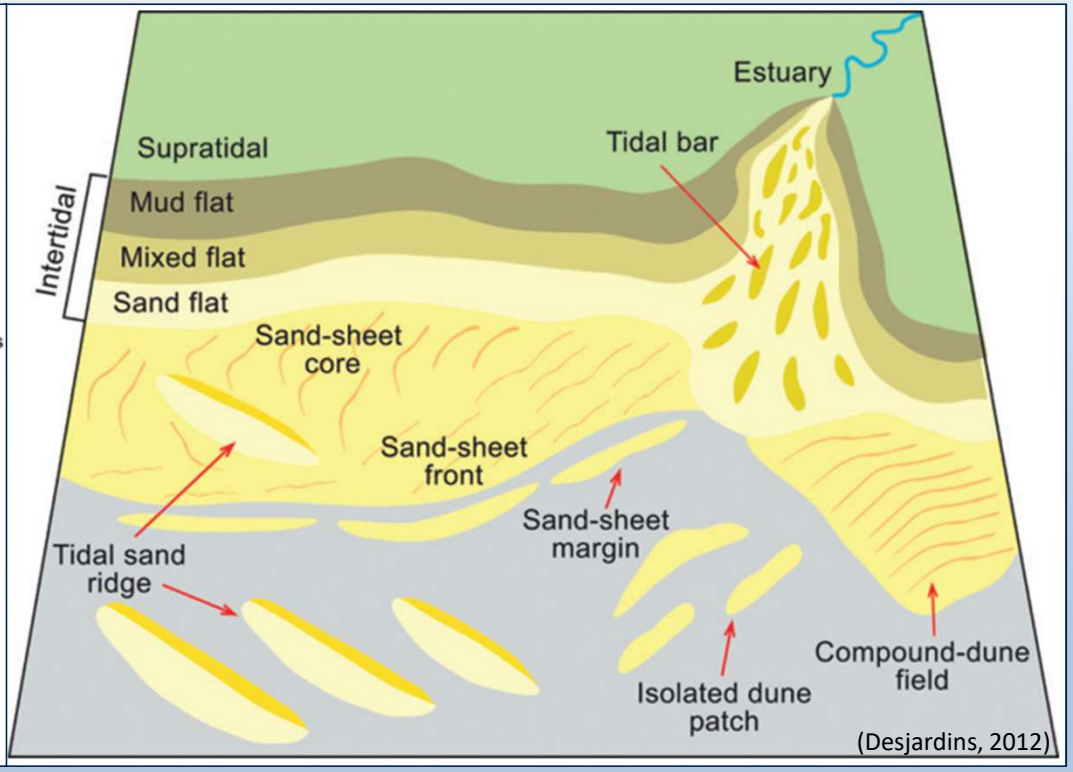


Shannon top

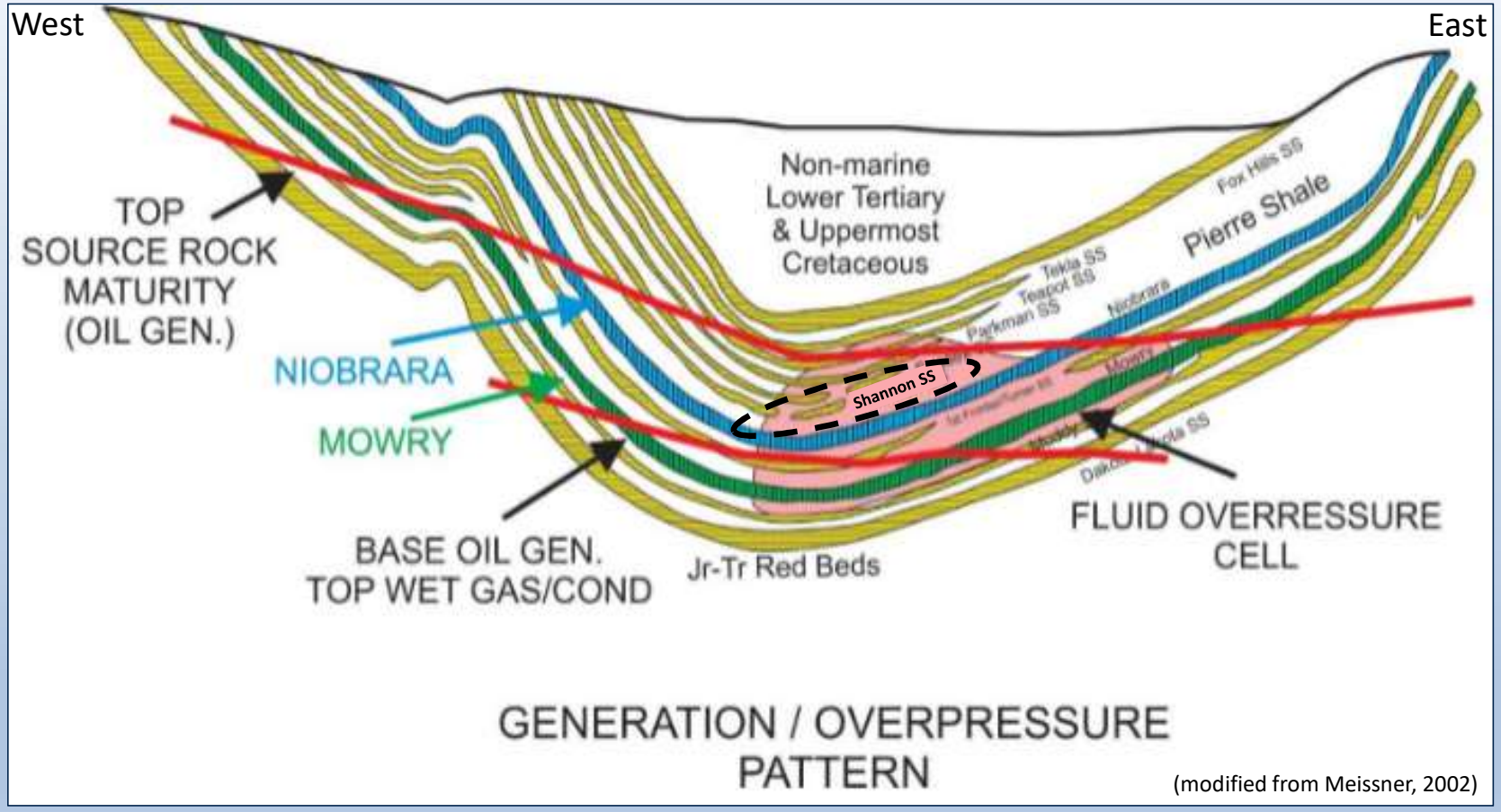
Shannon base

Tidal Sand Ridge Model



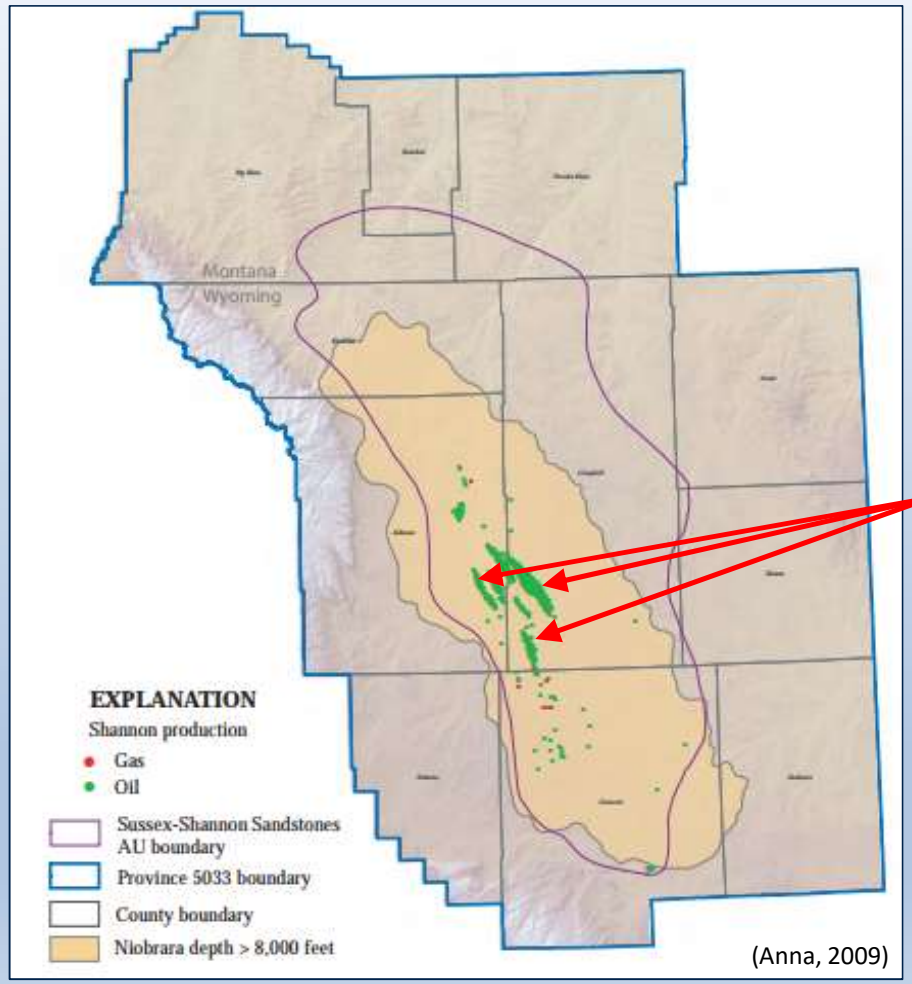


Halo Play



ϕ = ~ 0 to > 20% k = 1 to 100 mD, 20 mD avg

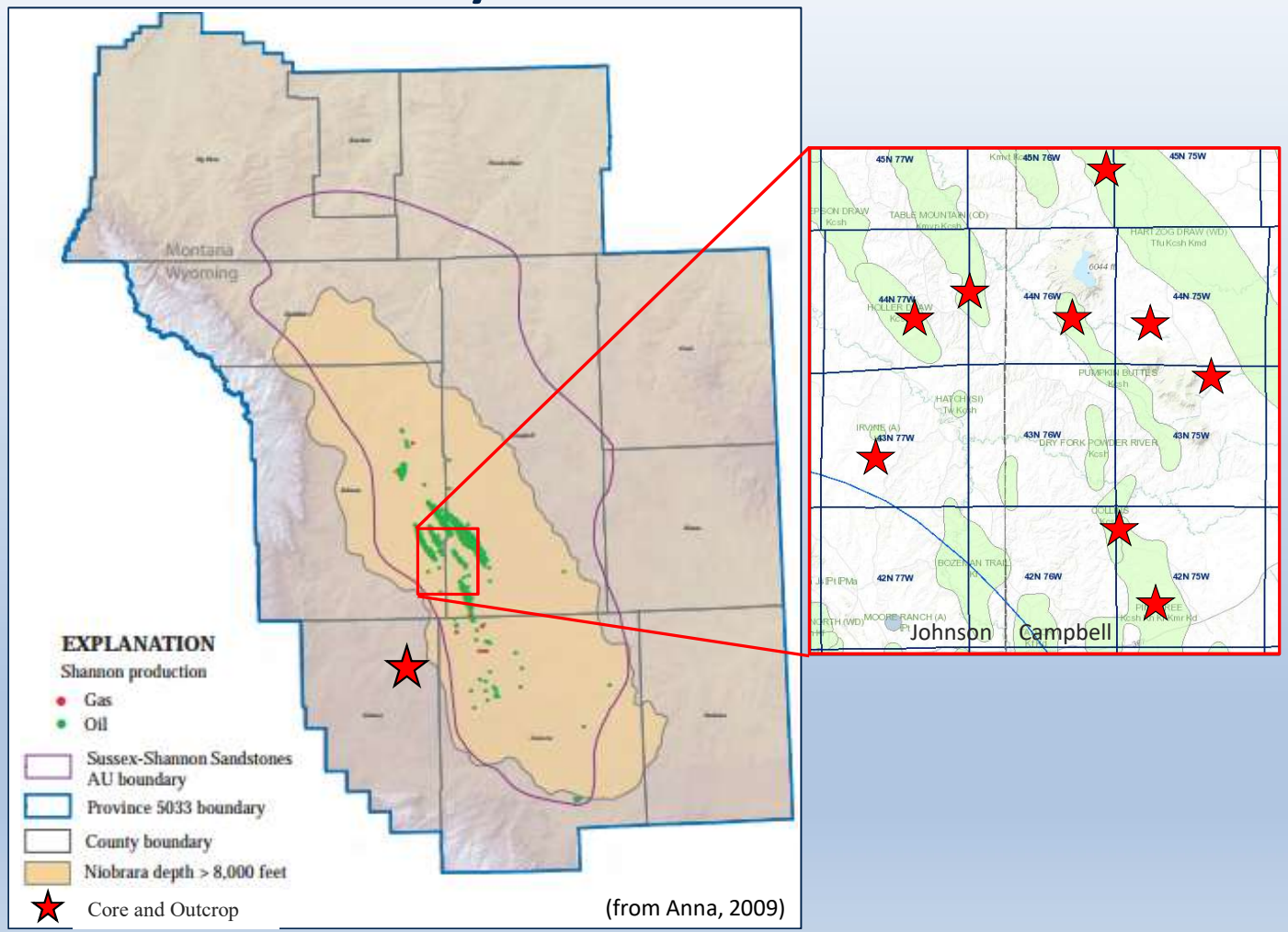
Shannon Production



(Anna, 2009)

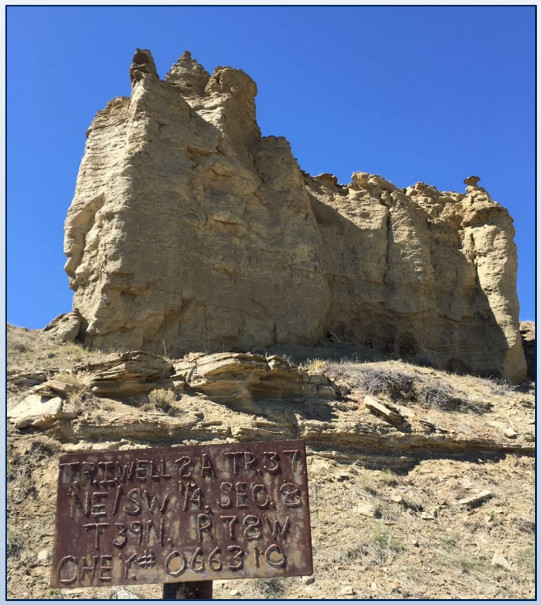
Jepsen-Holler, Hartzog Draw, and Pine Tree fields

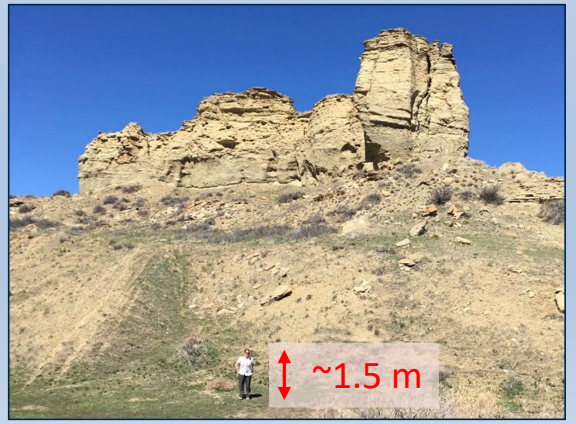
Study Area



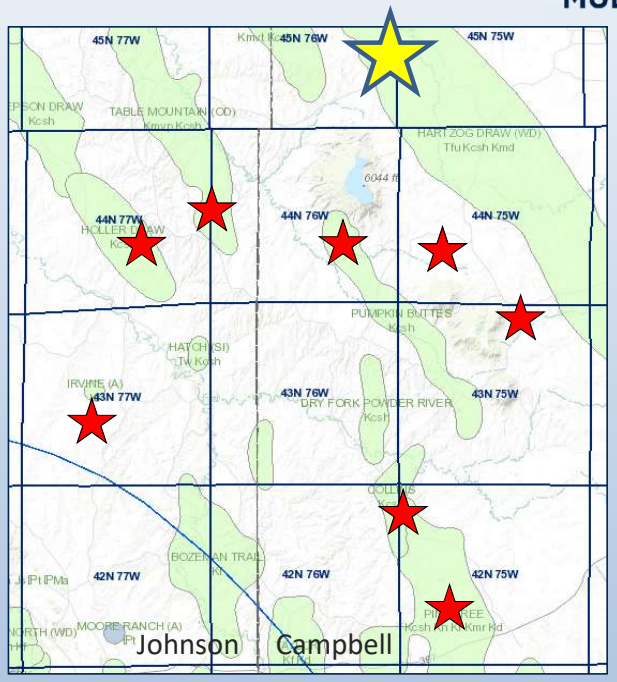
(from Anna, 2009)

Shannon Outcrop





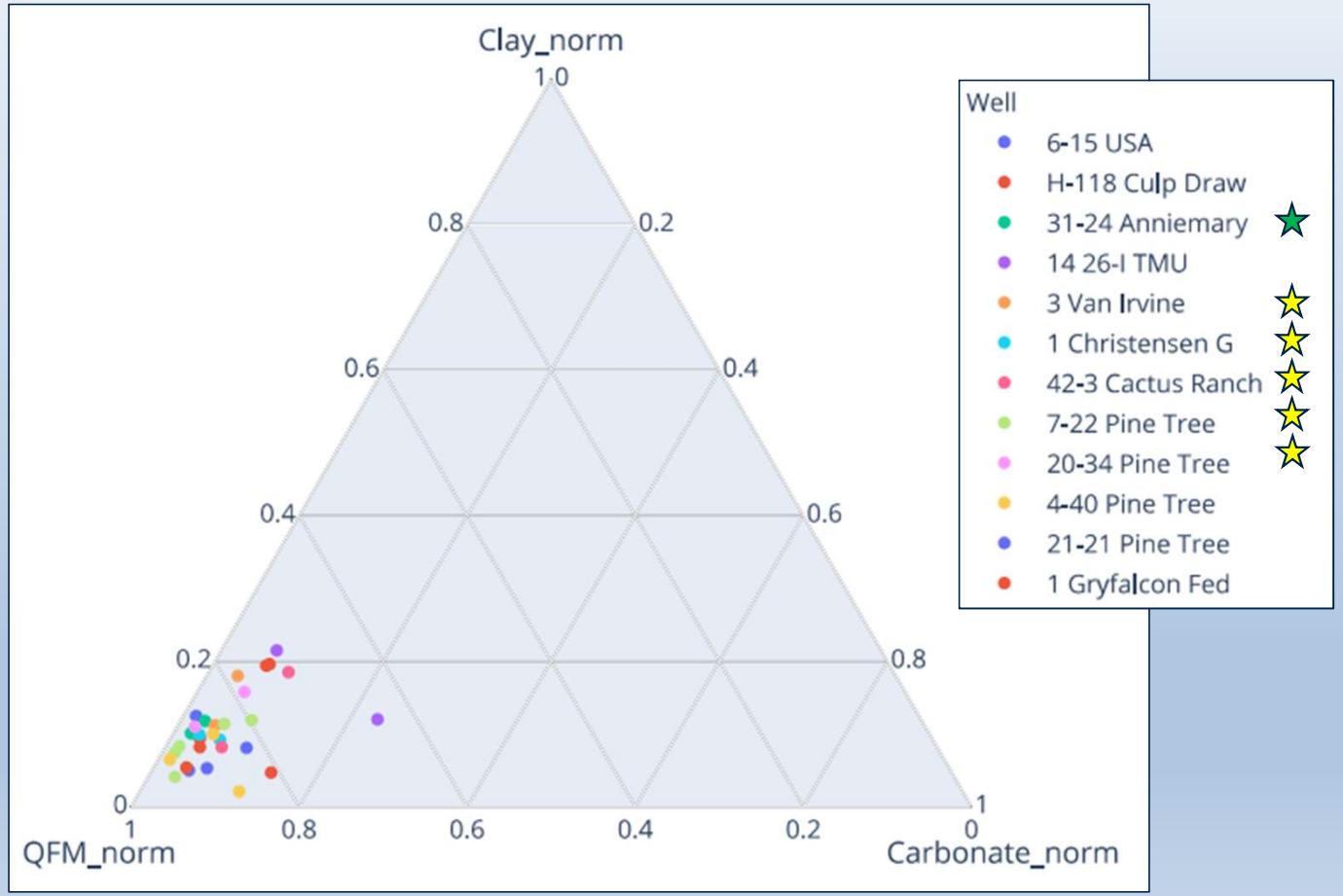
31-24 Anniemary Federal



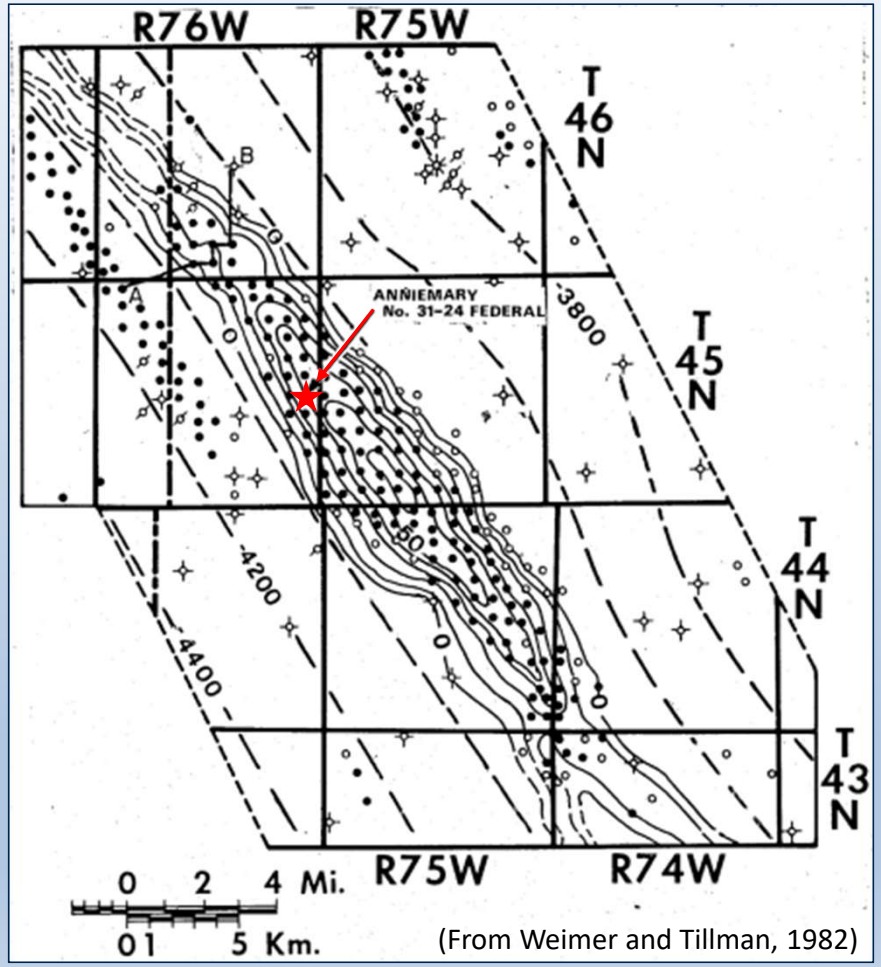
31-24 Anniemary Well

- Northernmost part of the study area
- T45N R76W, Johnson County, section 24
- Available data: XRD, 20 thin sections, and 60’ of core

Ternary Plot of Shannon Wells in SW PRB

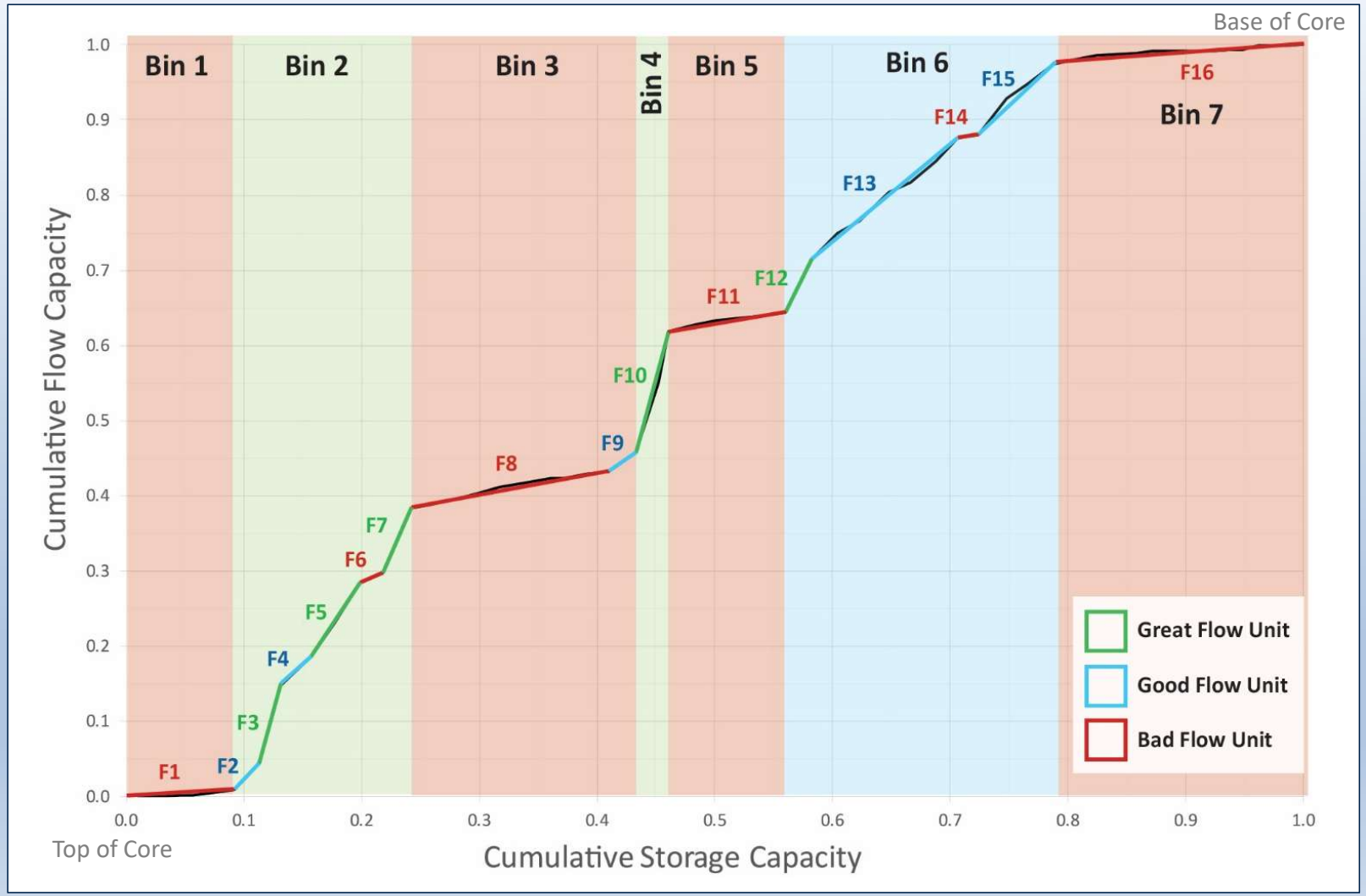


Diamond Shamrock Anniemary #31-24 Federal

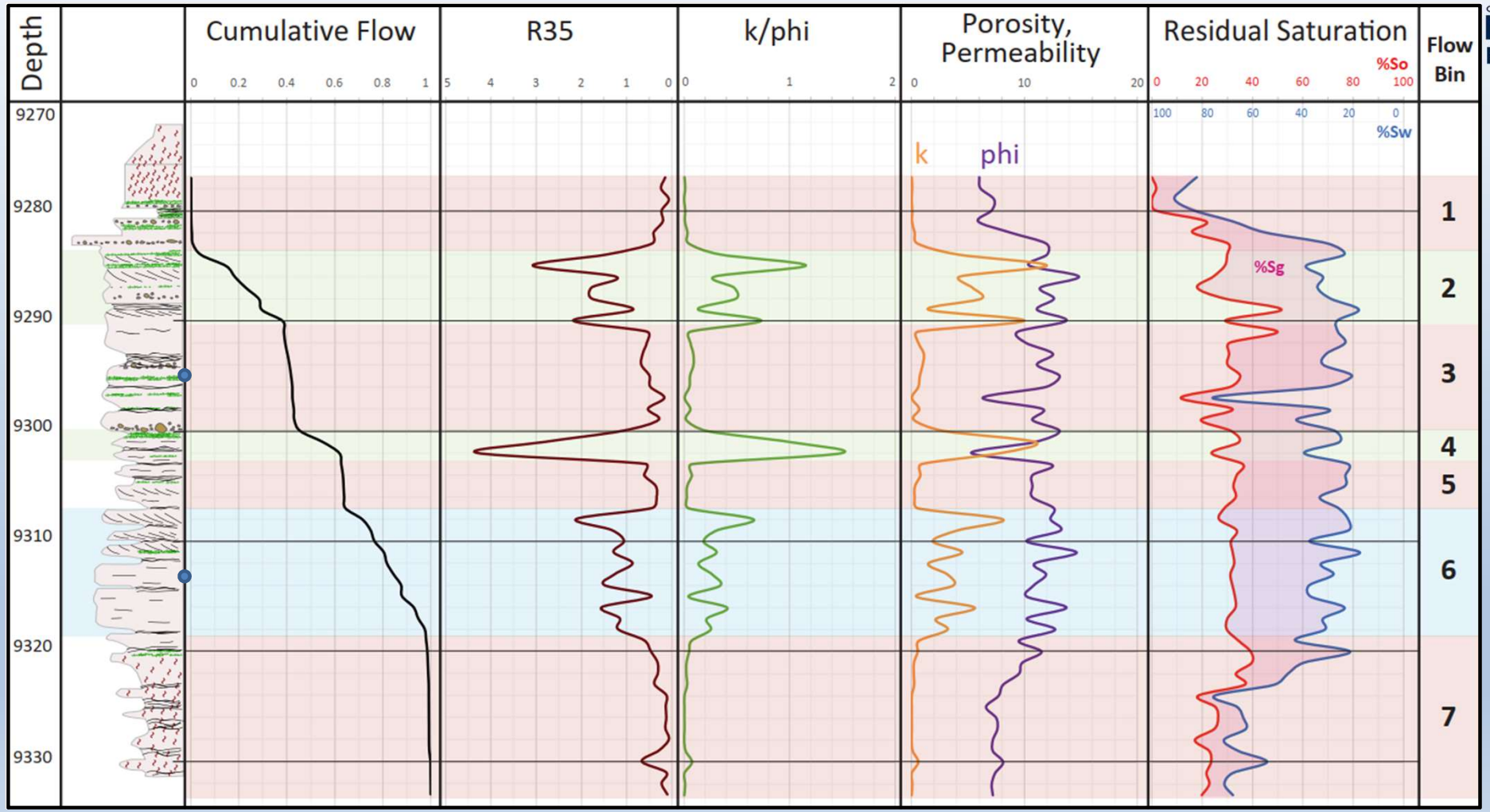


(From Weimer and Tillman, 1982)

Anniemary – Modified Lorenz Plot



Anniemary – Core Analysis Plots



Anniemary Facies

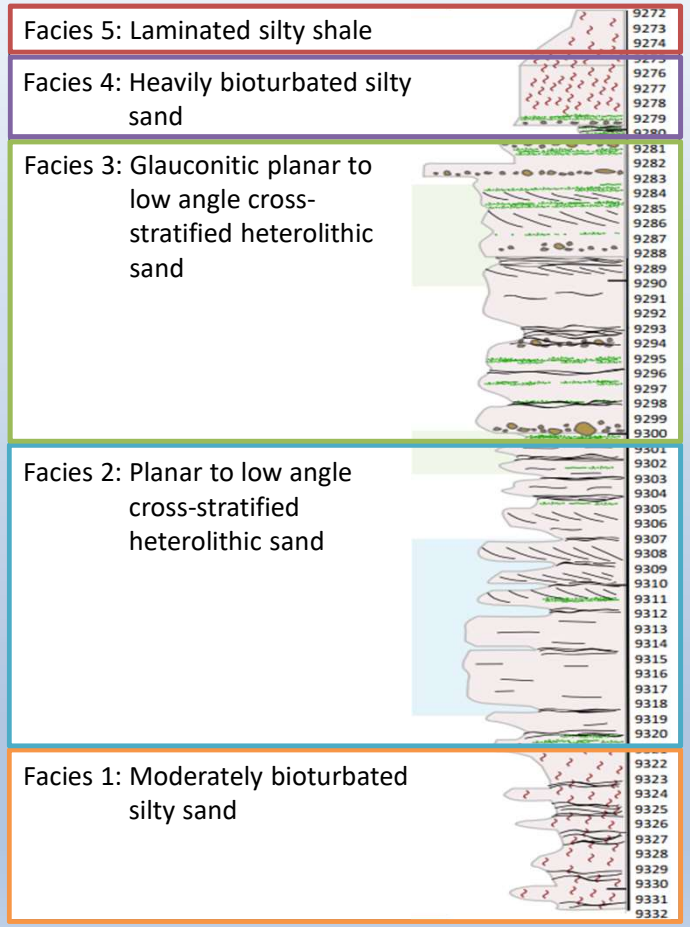
Facies 5: Laminated silty shale

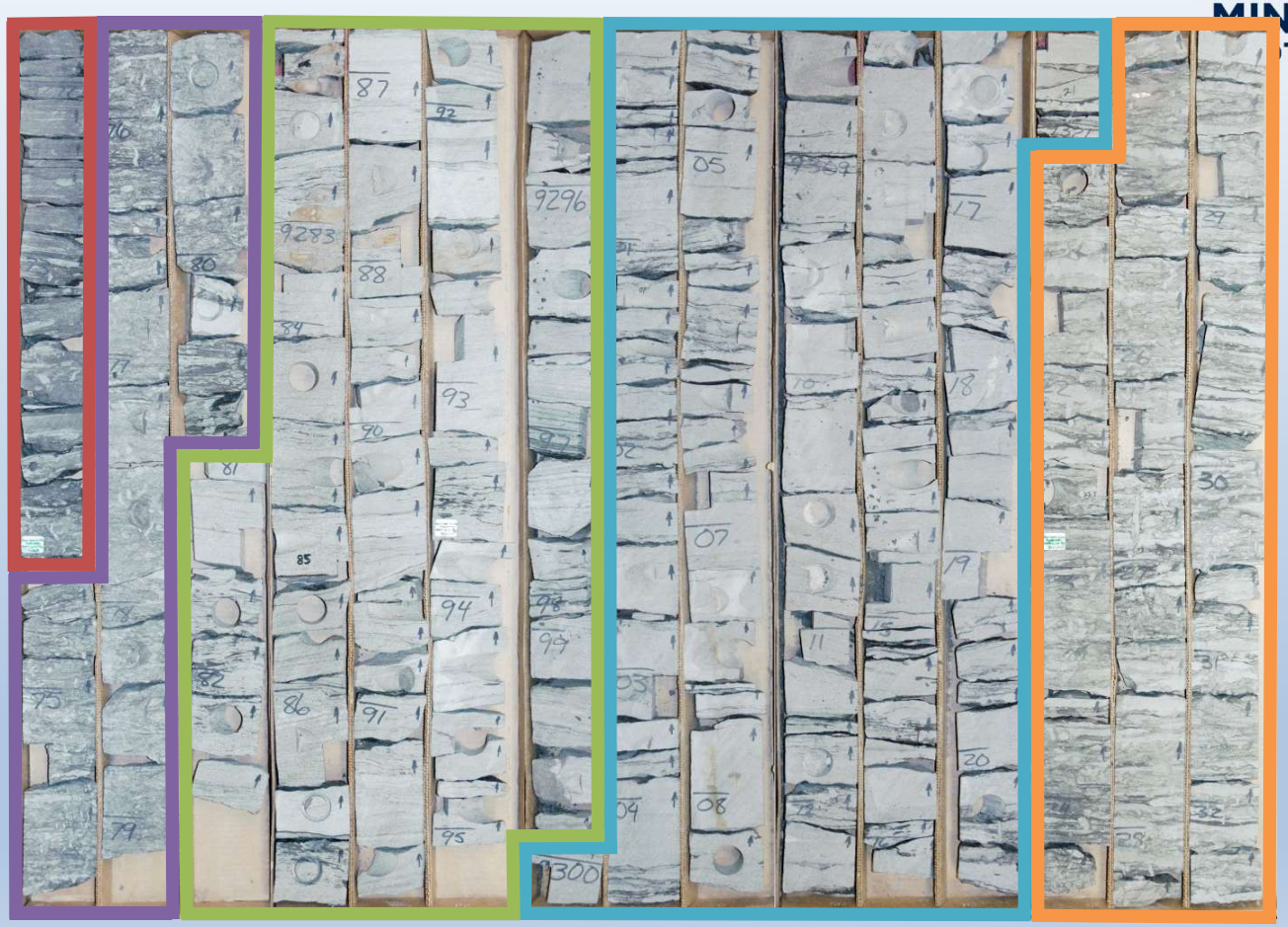
Facies 4: Heavily bioturbated silty sand

Facies 3: Glauconitic planar to low angle cross-stratified heterolithic sand

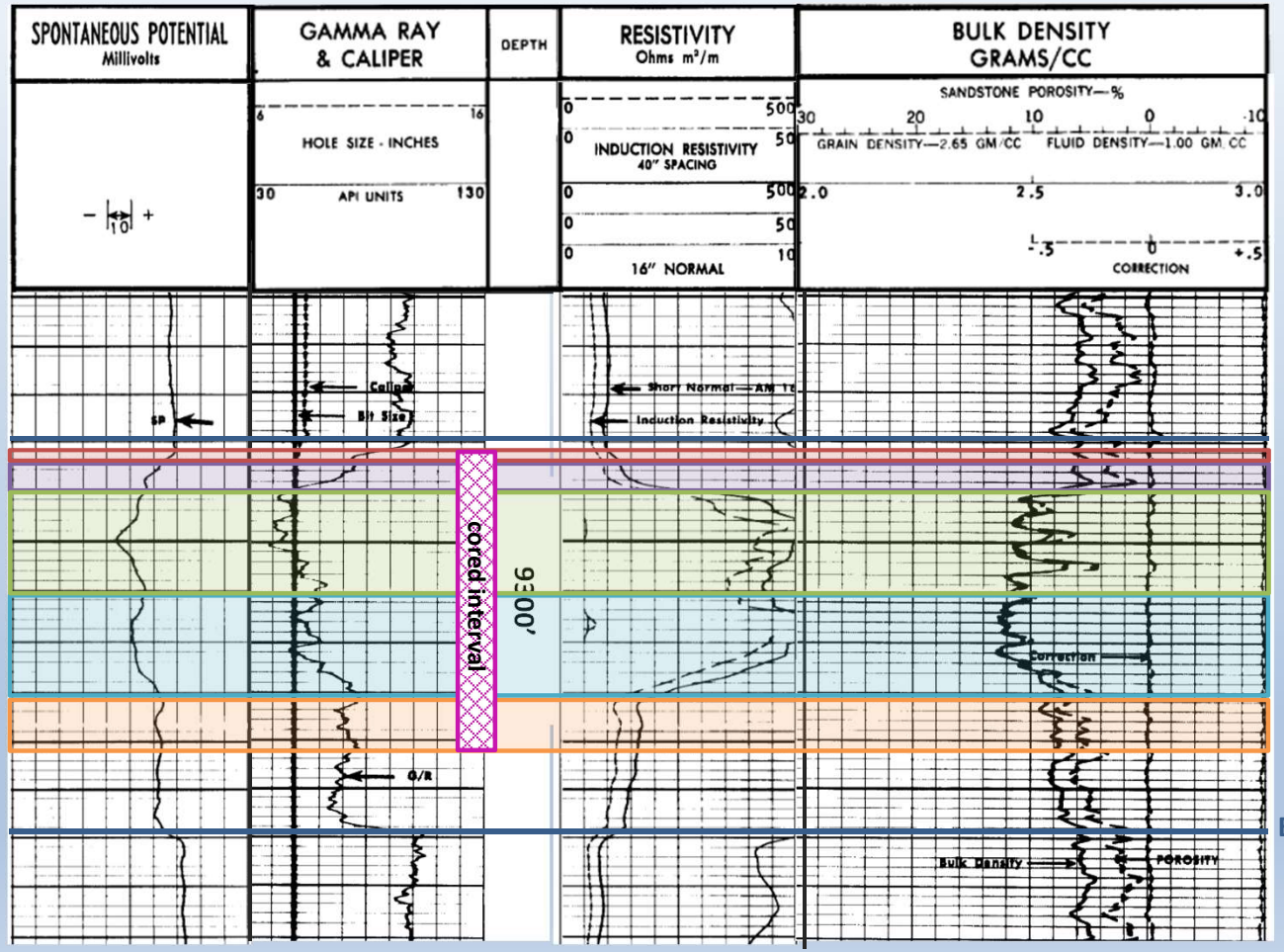
Facies 2: Planar to low angle cross-stratified heterolithic sand

Facies 1: Moderately bioturbated silty sand





Anniemary Logs

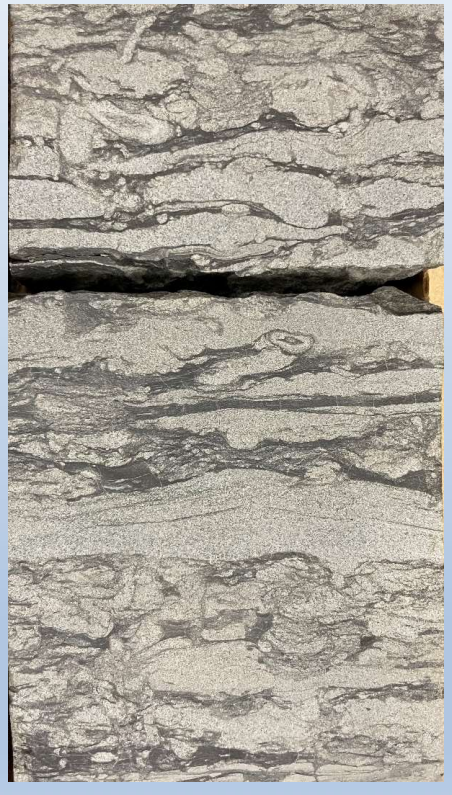


Top of Shannon

Base of Shannon

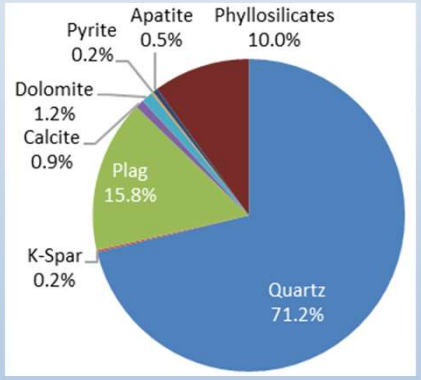
Anniemary Facies

Facies 1: Moderately bioturbated silty sand



Anniemary Facies

Facies 2: Planar to low angle cross-stratified heterolithic sand

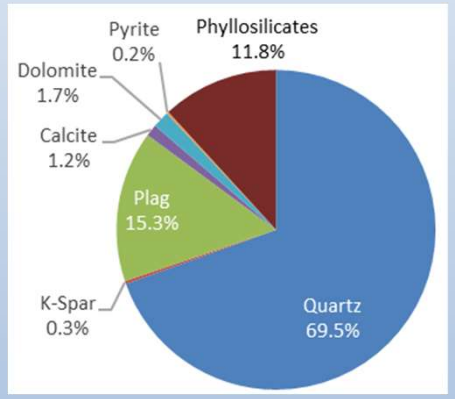


$\phi = 10.8\%$

$k = 3.7mD$

Anniemary Facies

Facies 3: Glauconitic planar to low angle cross-stratified heterolithic sand



$\phi = 11.9\%$

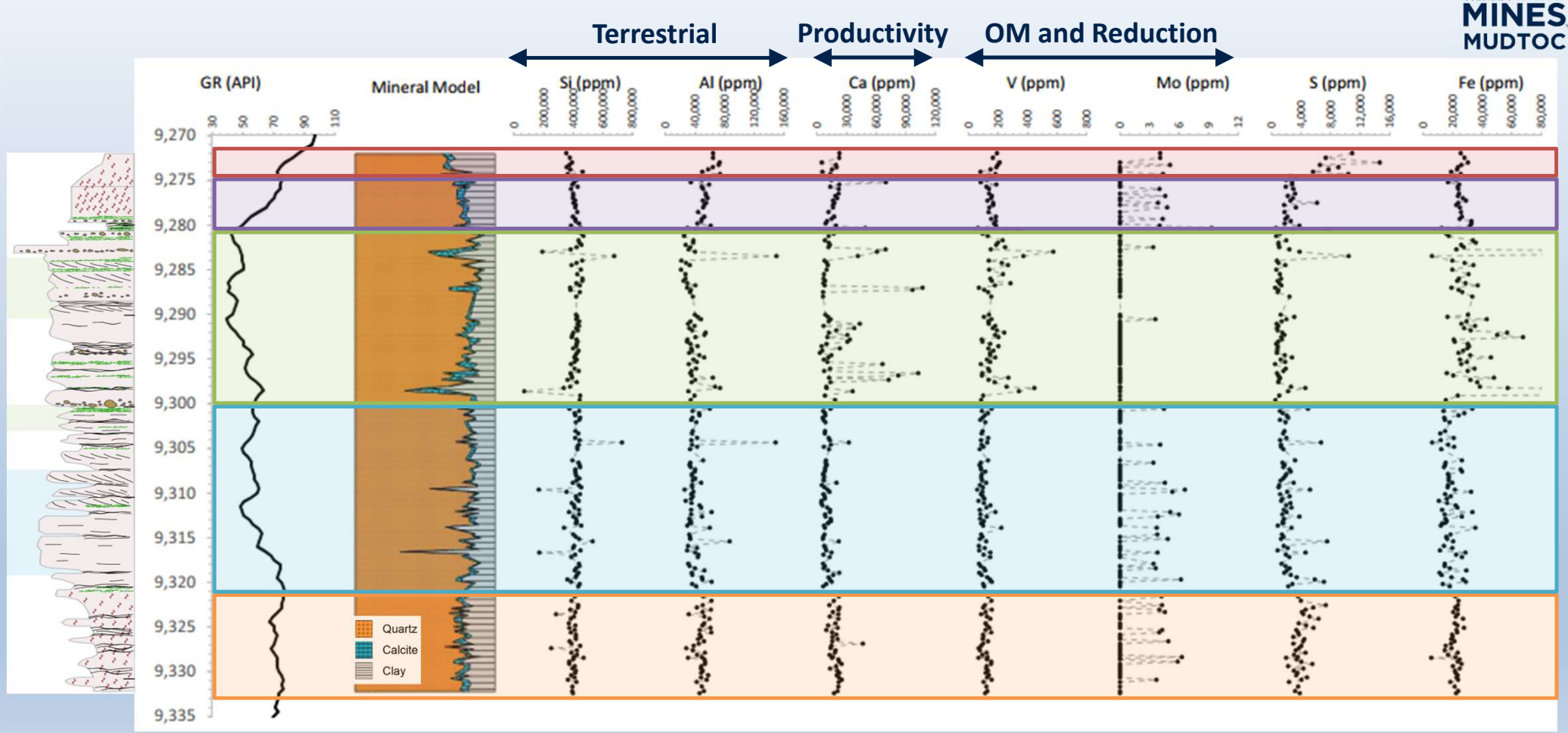
$k = 0.61mD$

Anniemary Facies

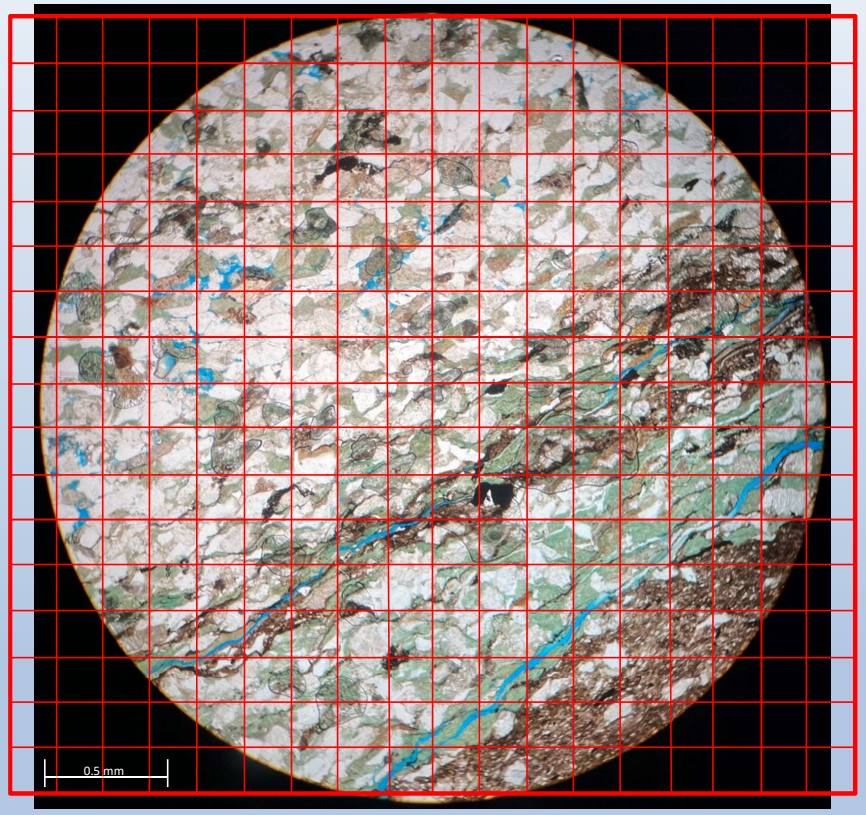
F4: Heavily bioturbated silty sand

F5: Laminated silty shale

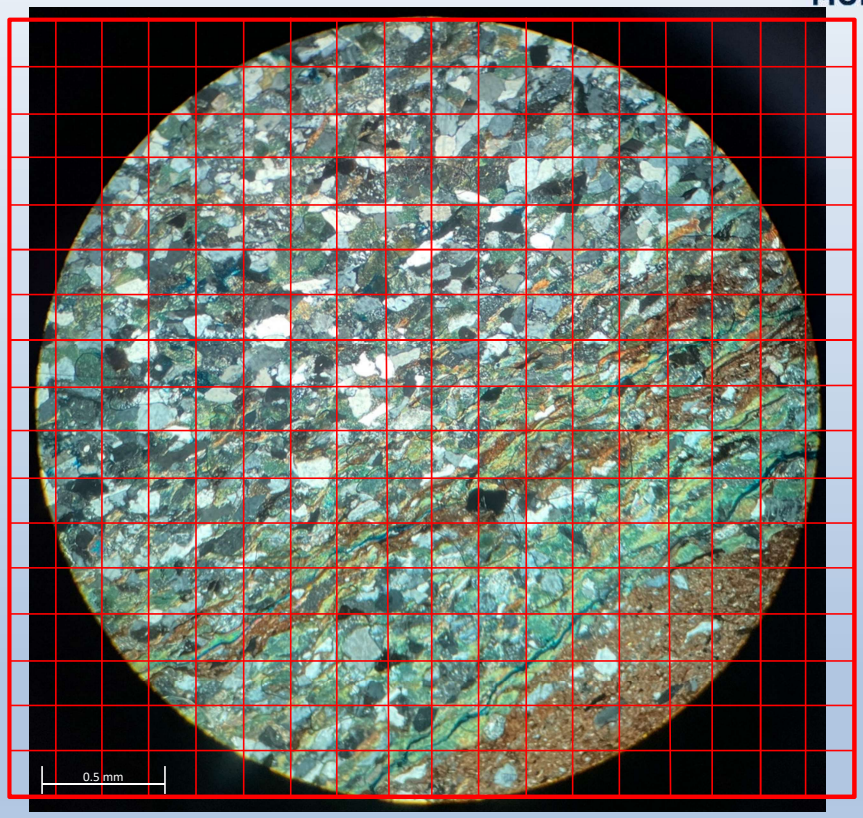
Chemostratigraphy of the Shannon Sandstone



Point Counting

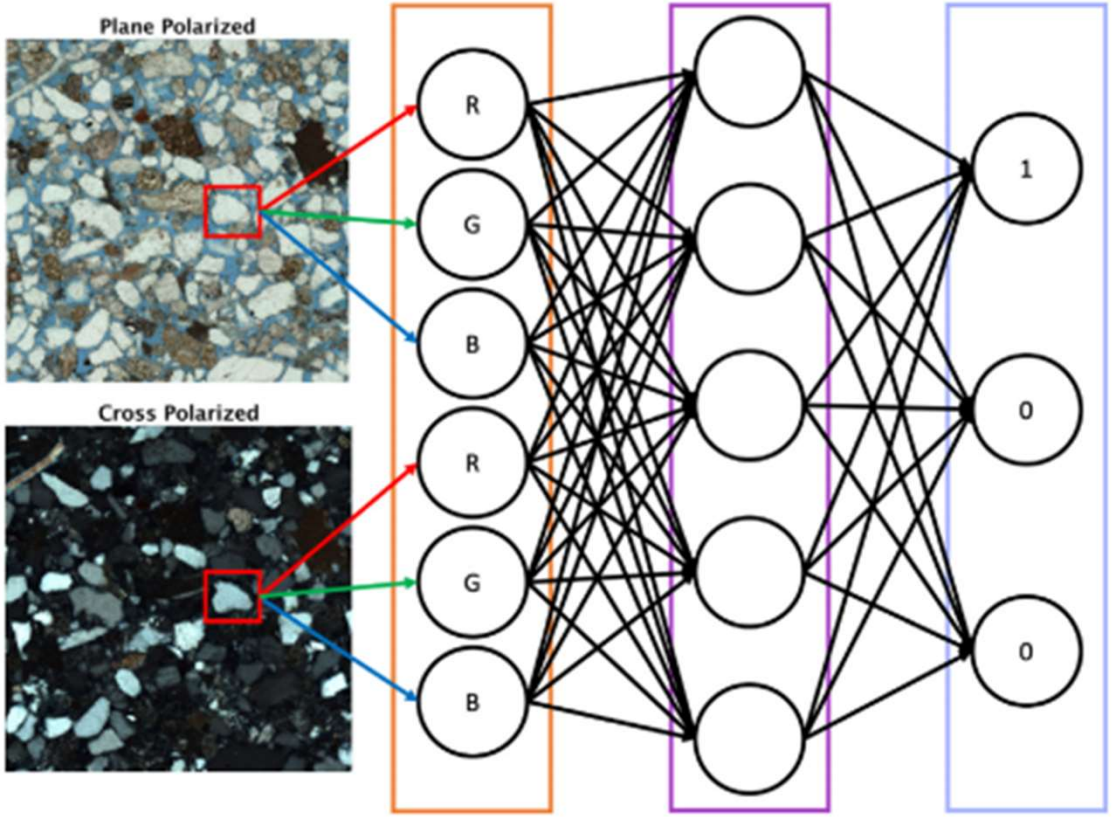


Plane polarized light

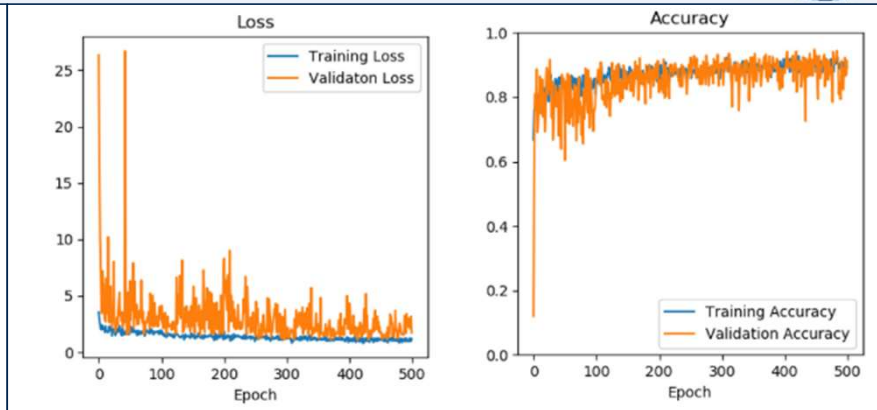


Cross polarized light

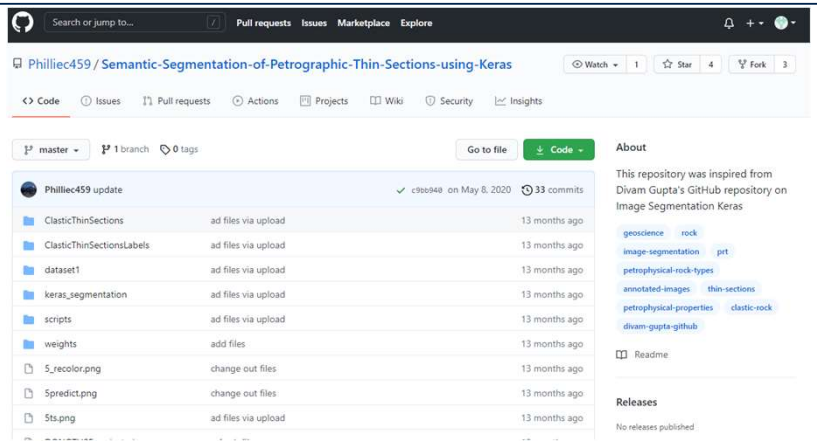
Machine Learning for Point Counting



Supervised machine-learning method used to automate the point counting process (Tang et al. 2020).



Model accuracy & loss (Tang et al. 2020).



Craig Phillips' Github Repository for Segmentation of Petrographic Thin Sections (2020).

Continued Work

- Core and outcrop analysis
  - Facies identification, lithology, trace fossils, depositional energy, flow units, ichnofacies, texture, grain size, color, and structure
- Thin section analysis
  - mineralogy, stratigraphy, and petrographic characteristics
  - FESEM, detrital characteristics, diagenesis, porosity, organic matter, and mineralogical features
  - Python machine learning neural network for point counting and segmentation
- XRF and XRD
  - Elemental data analysis and mineralogical composition
  - Terrestrial vs marine influence
  - Clay characterization
- Subsurface analysis
  - Log analysis
  - Subsurface Mapping and 3D seismic investigation
  - Pressure Systems Analysis
  - Trapping Mechanisms
- Characterization of lateral and vertical variability

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