Comparison of Mechanical and Fracture Stratigraphy between Failed Seal Analouges

Elizabeth S. Petrie  
Utah State University

James P. Evans  
Utah State University

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The presence of discontinuities in seal lithologies affects their mechanical and hydro-geologic properties. We examine the mechanical and fracture stratigraphy of failed Paleozoic and Mesozoic seal analogues in south-east Utah to understand the nature and distribution of fluid flow pathways in various seal lithologies. Outcrop surveys provide data for comparison between each locality to identify relationships between depositional composition, diagenesis, and loading history. These data characterize the distribution and morphology of open mode fractures, with changes in lithology and provide input for accurate quantitative subsurface geomechanical and fluid flow models.

OUTCROP OBSERVATIONS

All localities show:
- evidence for mineralization and fluid flow in the subsurface
- mineralogic differences between host rock and fracture fill
- meso-scopic fault and fracture orientations which follow regional structural trends
- fracture spacing <0.25-0.5 fractures/meter
- fracture densities and morphology which vary with lithology and bed thickness

REFERENCES


Young's Modulus: Derived from in-situ log
- Field data based on lithology
- Variability in column scale

INPUT DATA FOR GEOMECHANICAL MODELING

Estimates of dynamic Young’s Modulus derived from uniaxial log
- Field based on lithology and compression strength also show lateral scale variability
- Variability in elastic moduli will be used in future geomechanical modeling

CONCLUSIONS

Stratigraphic variability and resulting changes in mechanical properties influence the variability of fracture morphology and density over the cm to m scale.

Understanding fracture morphology in different seal types, across interfaces, and in various structural settings is key to understanding how seals respond to hydraulic failure.

Calculated variability in elastic moduli correlates to the mechano-stratigraphic variability observed in outcrop --- the variations in elastic moduli will be modeled to quantify their effects.

Overpressue during burial (lithostatic loading) can induce open-mode tensile failure that can effect future seal integrity: Are most seals fractured then re-cemented/re-sealed in some way?