COMPREHENSIVE AND INTEGRATED RESEARCH TO DEVELOP PREDICTIVE MODELS FOR SHALE OIL AND GAS RESERVOIRS IN TEXAS

OBJECTIVE
Describe the evolution of the physical, chemical, and mechanical state of unconventional reservoirs in order to develop predictive models that will:

- Identify optimal stratigraphic horizons in which to place (land) horizontal wells
- Yield realistic natural and hydraulic fracture models and their micro-seismic response
- Optimize well spacing and completions

APPROACH

APPROACH (cont.)
Geologic and reservoir models will form the basis to produce intermediate deliverables that lead to the desired objectives, and these include predictions of:

- Stratigraphic facies variations away from wellbore
- Physico-chemical changes to mechanical state of reservoir
- Time-dependant changes in fracture and matrix (including nano-pore scale) contributions to fluid flow
- Geophysical techniques to characterize changes in mechanical properties including micro-seismic and other methods to calibrate models
- Recoverable volumes with uncertainty
- Quantification of uncertainty in reservoir models
- Optimize well spacing
- Optimize well completions

KEY PROGRAM ELEMENTS

- Based on two comprehensive data sets: Permian Basin and Eagle Ford/Eaglebine
- Participation by more than 25 faculty and their graduate students from geosciences and engineering
- Open membership to industry with industry-guided research and steering committee
- Contractual mechanism to safeguard proprietary information
- Gated research deliverables
- $90k/year (same as current Crisman members)
Project Mapping

- Predictive Reservoir Simulation Models
- Predictive Geologic Models of Reservoir Evolution
- Optimum Field Development
- Predictive Fracture Propagation Models
- Permian Basin & Eagle Ford/Eaglebine Datasets
Eagle Ford/Permian Basin Evaluations

- Facies & Stratigraphic Interpretation of The Woodbine-Eagle Ford Strata in Leon, Madison, Grimes & Brazos Counties, TX

- XRF Delineation and Correlation of Eagle Ford Strata, W. TX

- Integrating Outcrop & Core Data w/Zircon Geotechnology

- Stratigraphic Correlation Techniques

- Solid and Soluble Products of Water/Rock Interactions

- Mechanical-Stratigraphic Model of The Eagle Ford Formation Based on Experimental Rock Deformation of Core & Outcrop Samples

- Foram Paleocommunity Analysis of Eagle Ford Strata, W. TX

- Ash Bed Analysis of the Cretaceous Eagle Ford Shale Using ID-TIMS U/Pb Methods: Implications for Biostratigraphic Refinement & Correlations w/the Western Interior Basin

- Digital Outcrop Mapping of Eagle Ford Strata in Lozier & Antonio Canyons, W. TX

- 1.02.16

- 1.03.16

- 1.04.16

- 1.11.15EP

- 1.12.15EP

- 1.13.15EP

- 1.14.15EP

- 1.15.15EP

- 1.16.15EP
Predictive Reservoir Simulation Models

- Better 3-D Reservoir Models
- Production Data Analysis
- Optimization
- Nano Science
- Probabilistic Modeling for UCRs
Impact of Nano Pores on Saturation Pressure & PVT

Experimental Study of PVT in Nano Pores

Complex Nano Fluid Wettability Alteration

Transport in 3D Kerogen Pore Network

Development of Molecular Simulation Software mPVT

Improved Recovery from Enhanced Phase Behavior & Porosity Molding

Permeability Estimation Using Mercury Injection

Water – Clay Interactions

Stochastic Modeling & Upscaling in Organic Shale

Thermos Viscoelastic Properties

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Production Data Analysis

- Improved Procedures for Reserve Determination 4.03.16
- Boosting Reserves by Faster Engineering 4.04.16
- History Matching of Production & Well Interference Data 4.02.16
- Mechanistic Model Validation of Production Decline Curves 4.15.16
Optimization

- Practical Rules for Optimum Well Spacing & Wellbore Length
- Fast & Accurate Proxy Models
- Optimization of Infill Wells Using Stress Management
- Optimizing Production from UCRs
Predictive Fracture Propagation Models

- Fracture Diagnostics
- Fracture Conductivity
- New 3D Propagation Models

- X-Ray Tomography of Fluids w/Surfactants
  2.5.22EP
- Fracturing Behavior Across Spaced Scales
  2.5.25EP
- Integrated Framework for Re-Fracturing
  3.10.16
- Experimental Geomechanics
  3.14.16
Fracture Diagnostics

- Use of Distributed Acoustic Sensors
  - 2.4.27EP
  - 2.5.21EP
  - 3.05.16

- Geomechanical Modeling of Microseismicity
  - 3.15.16

- Controlled Source Electromagnetic Monitoring
  - 3.16.16
Fracture Conductivity

Impact of Mechanical Properties on Conductivity
3.03.16
3.07.16

Impact of Fibers on Proppant Transport
3.01.16
3.06.16

Proppant Transport Modeling
3.04.16
New 3D Propagation Models

- Integrated Model Coupling Fluid Flow, Geomechanics, and Microseismicity 3.02.16
- Integration of Diagnostics, Production and Fracture Modeling 3.13.16
- Numerical Model of 3D Fracture Propagation of Multiple Fractures 3.11.16