Shale Poromechanics: Heterogeneity, Flow, Failure, and Creep
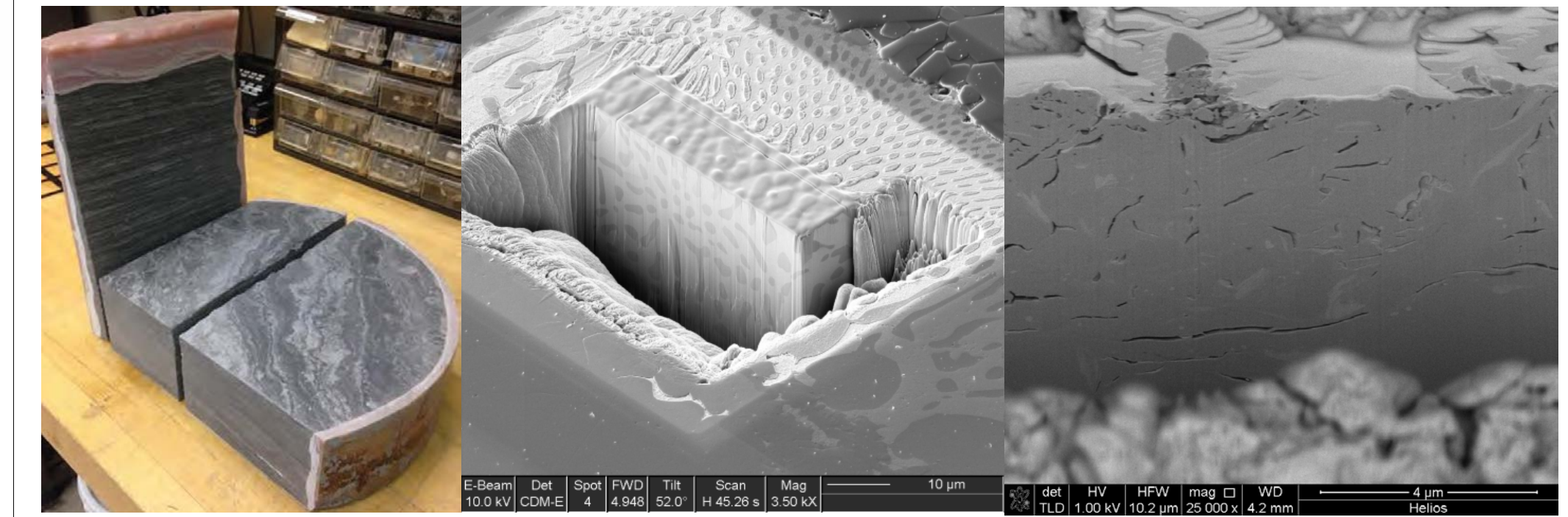
Thomas Dewers (PI), Hongkyu Yoon (co-PI), Jason Heath & Mathew Ingraham (SNL)
Zuleima Karpyn (co-PI) & Shin Liu (Penn State)
Peter Mozley (co-PI) & Alex Rinehart (New Mexico Tech)

Sandia National Laboratories

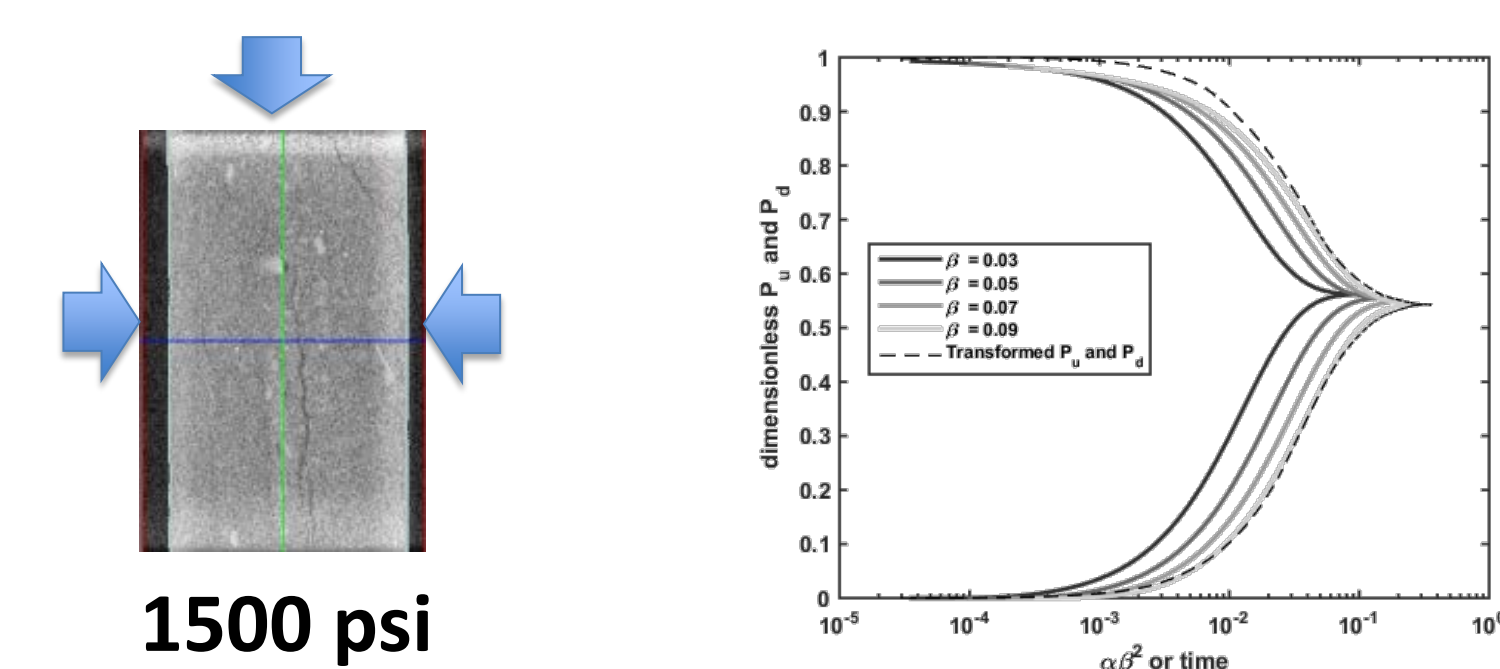*Exceptional service in the national interest*

Objectives

- Understand shale poromechanics from the nanopore scale physical basis for upscaled deformational and transport constitutive behavior
- Develop novel and cutting edge techniques and workflow for a linked imaging, experimental, and modeling-based advancement of shale poromechanics
- Through a physics-based understanding, contribute to efforts to reduce dependence on foreign oil and increase security and resilience of US energy infrastructure
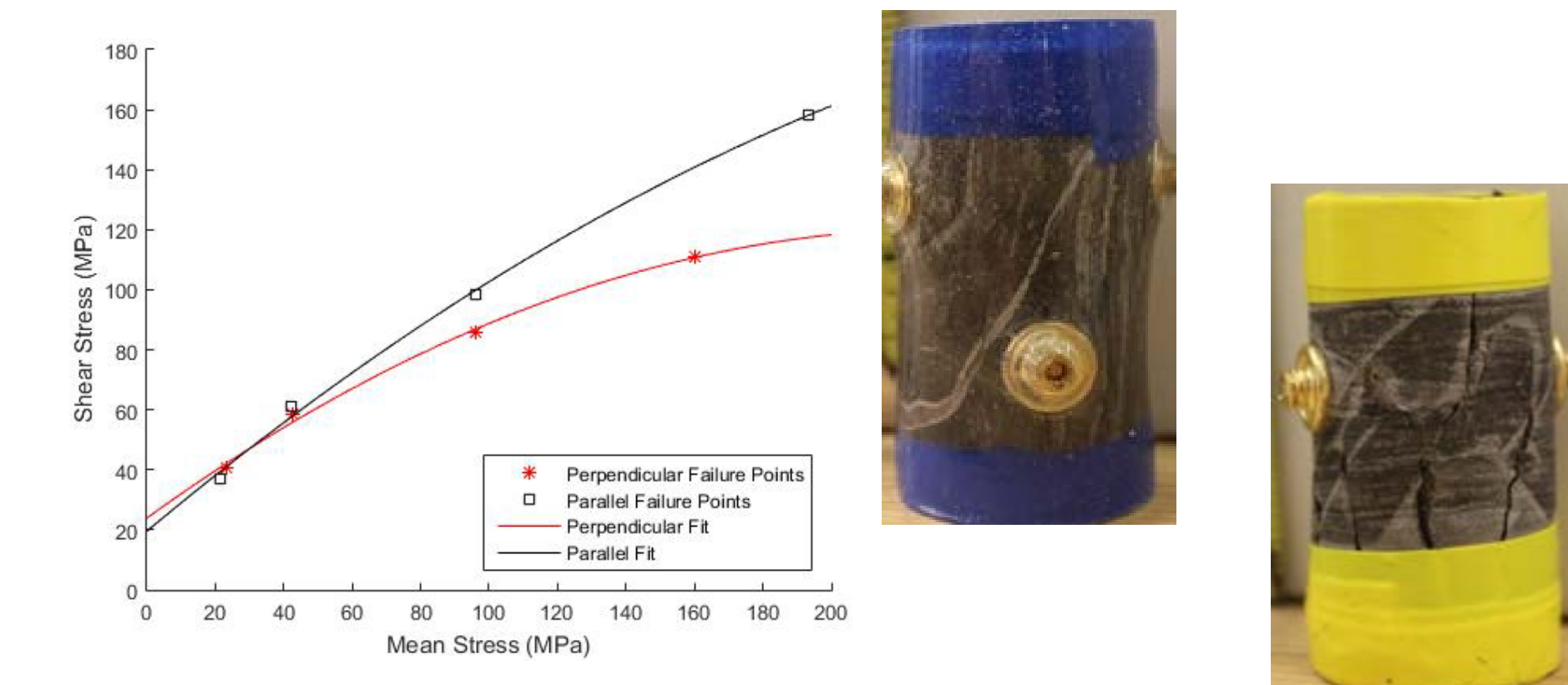
Task 1: Shale Mechanics Across Scales

Task 2: Transport Modeling & Experiment

1500 psi

Task 3: Visco-elasto-plasticity and strain partitioning

Developed Capabilities and Interim Results

Micromapping of lithofacies with fluorescent/laser microscopy

1 inch diameter

Micropillar Compression

Load vs. Displacement Slope Rock Pillar Experiments

In situ neutron scattering with oedometric deformation

1 m 10^{-3}m 10^{-6}m 10^{-9}m

Constant Humidity Triaxial Testing

Specimen 14B

Triaxial Xray CT Capability

(For SNL)

Electron Nano tomography with AC-STEM

GEOSCIENCE · **CONSEQUENCE EFFECTS** · **CLIMATE**

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration