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# Fossil Energy Subsurface Activities

Grant S. Bromhal, PhD

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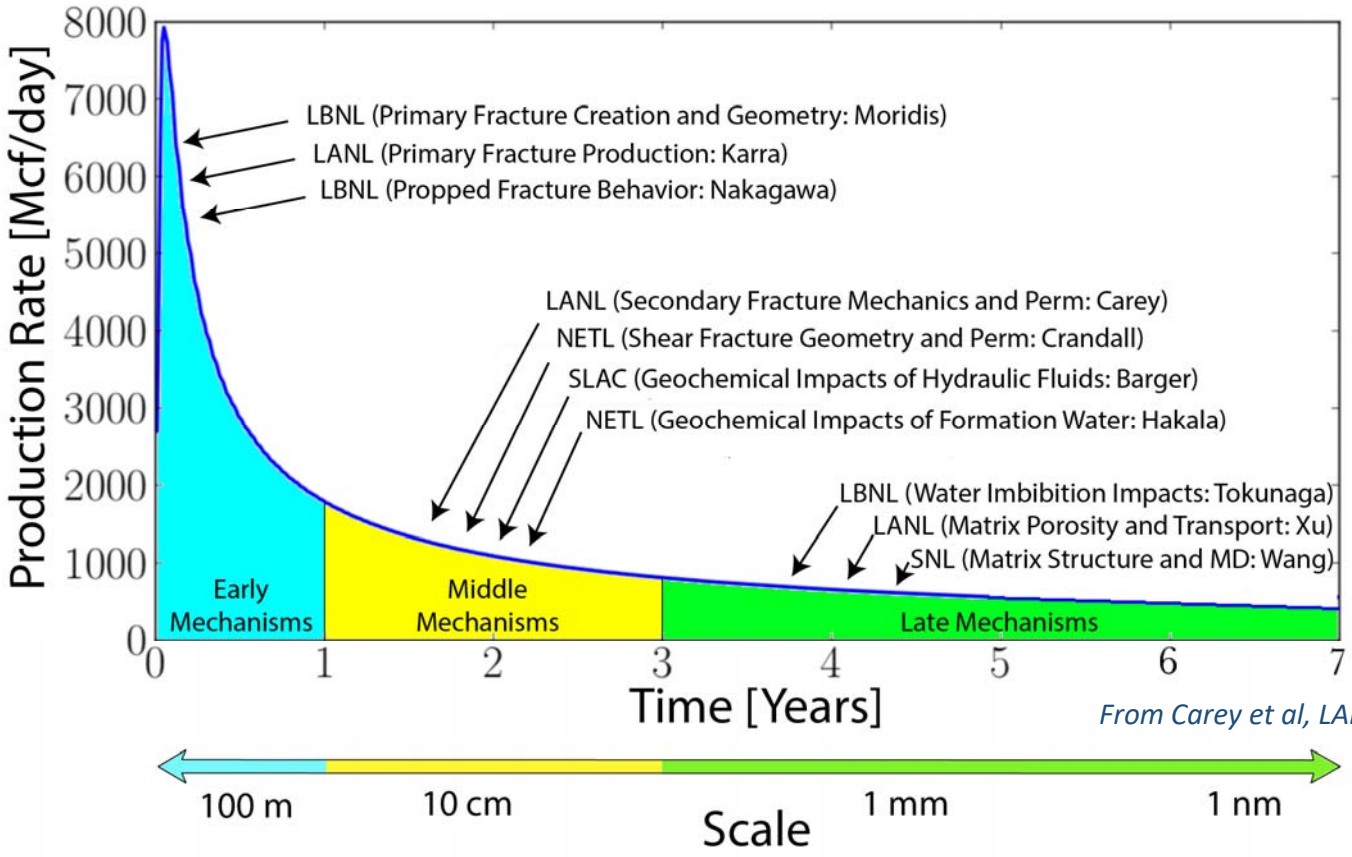
NATIONAL ENERGY TECHNOLOGY LABORATORY

# National Lab efforts providing paths to improved recovery

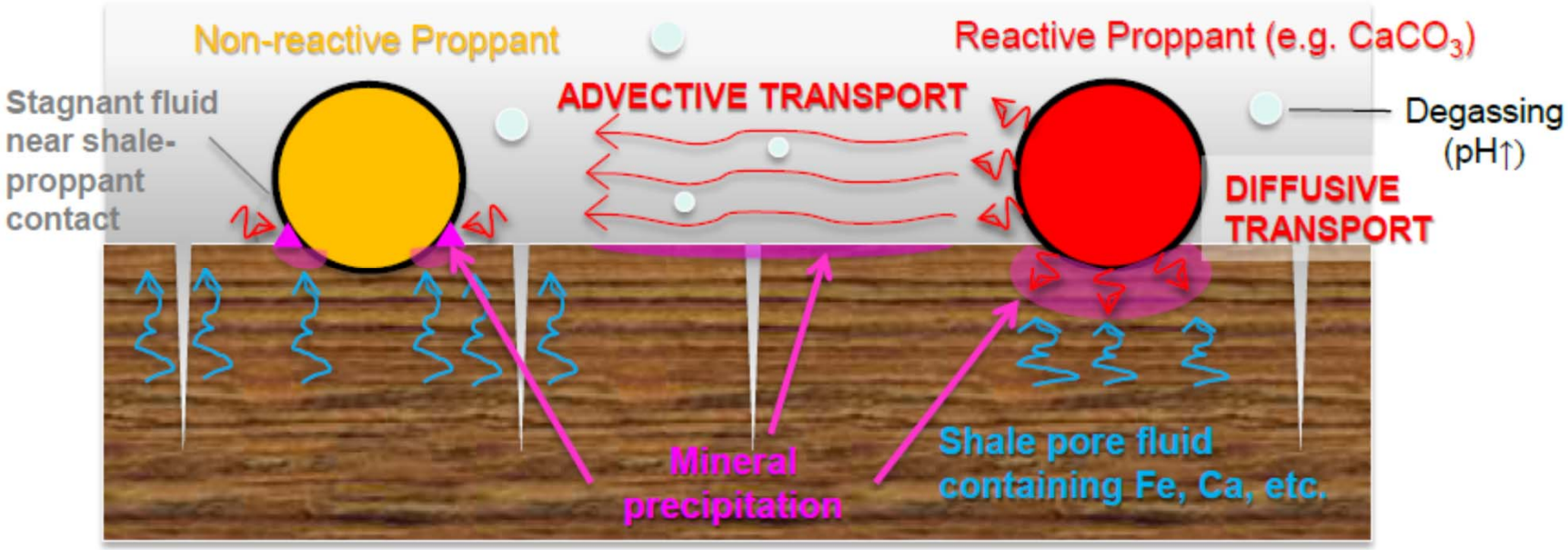



*From Carey et al, LANL*

FE R&D targets increasing recovery from unconventional oil and gas formations

(Cartoon for illustration)

# Control sustainability of hydraulic fracture permeability in ductile shales




Reduce fracture deformation and proppant embedment via mineral precipitation.

# A Three Pronged Approach to Real-Time Control in the Subsurface

***Common FE Vision for Exploiting Machine Learning to Transform Subsurface Operations***

## Real-Time Visualization

*"CT" for the Subsurface*

**Vision:** Transform reservoir management via dramatic improvements in subsurface visualization, exploiting ML to achieve speed and enhanced detail.

## Real-Time Forecasting

*"Advanced Control Room"*

**Vision:** Transform "human-in-the-loop" decisions on reservoir management by rapid visualization of forecasted behavior for different operational decisions.

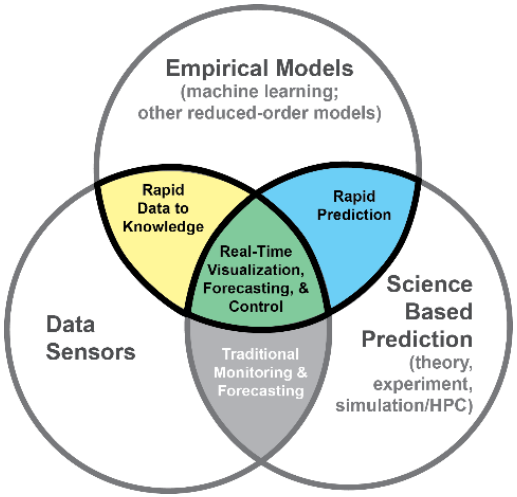
## Rapid Data to Knowledge

*Autonomous Monitoring*

**Vision:** Enable the extraction of more information at lower cost from subsurface environments via smart sensor systems, edge–cloud analysis platforms, etc.

*Big Data Management*

**Vision:** Generate protocols and tools to allow access, transfer, curation, quality control, and maintenance of public and private datasets.




## Rapid Prediction

*Virtual Learning*

**Vision:** Enable a virtual learning environment for exploring and testing strategies to optimize reservoir development, management, & monitoring prior to field activities.

# Questions?

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## Grant Bromhal

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