Center for Nanoscale Controls on Geologic CO_2

New Insights on CO_2 Trapping
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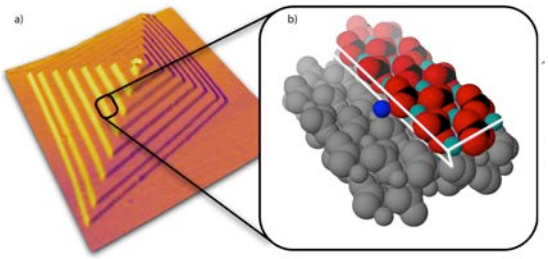
CENTER FOR NANOSCALE CONTROL OF GEOLOGIC CO_2 (NCGC)

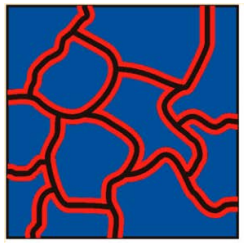
NCGC Mission Statement

Enhance the performance and predictability of subsurface storage systems by ***understanding the molecular and nanoscale origins of CO_2 trapping processes***, and developing ***computational tools to translate to larger-scale systems.***

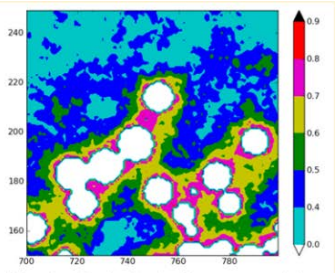
esd.lbl.gov/research/facilities/ncgc/



Molecular-to-nanoscale characterization and models



Calibration of computer simulations to experiments



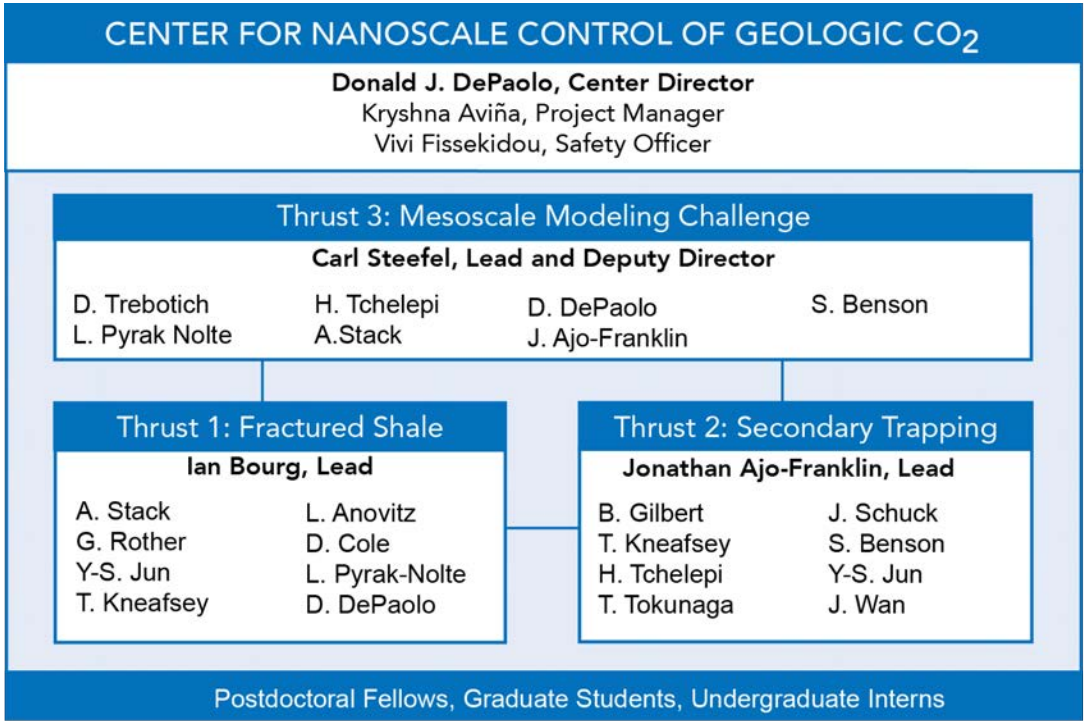
RESEARCH PLAN

Experimental investigations probe nanoscale fluid-fluid and fluid-mineral interactions and their effects on CO_2 trapping. ***Characterization and experiments are integrated with mesoscale chemical-mechanical-hydrologic modeling and simulation*** toward a transformational predictive capability for stratigraphic- and reservoir CO_2 trapping efficiency and long-term reliability.

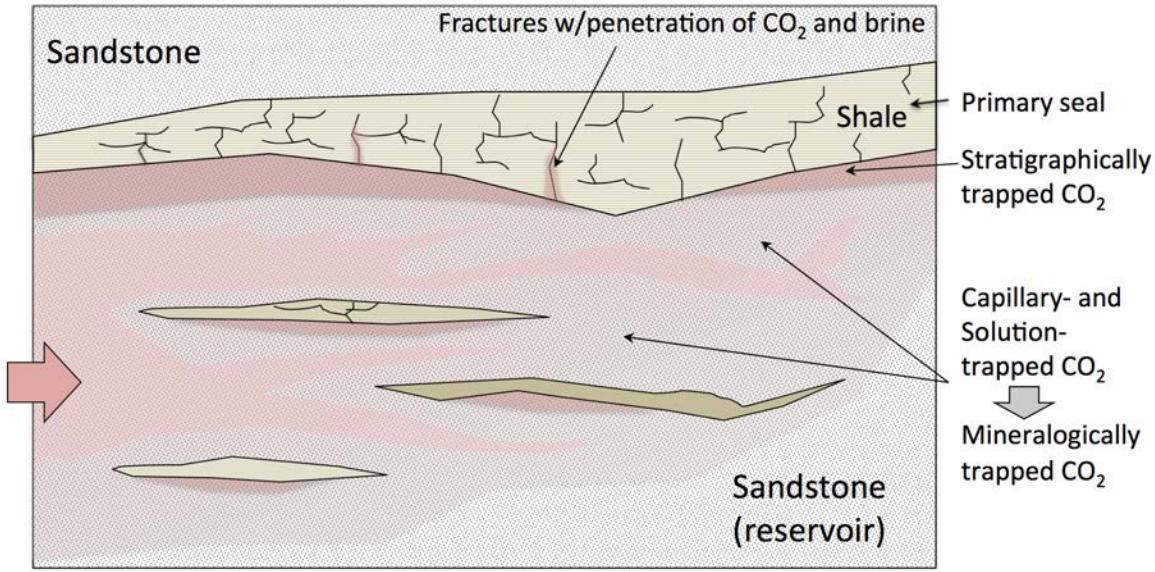
BERKELEY LAB · OAK RIDGE National Laboratory · THE OHIO STATE UNIVERSITY · PRINCETON UNIVERSITY · PURDUE UNIVERSITY · Washington University in St. Louis School of Engineering & Applied Science

CENTER ORGANIZATION

- Brings together a diverse group of highly qualified researchers (geochemists, physicists, and computer modelers) with a broad range of expertise in characterizing and studying rocks at the nanoscale.
- Access to advanced analytical and computing facilities
- The collaboration is generating progress in our research at a rapid rate



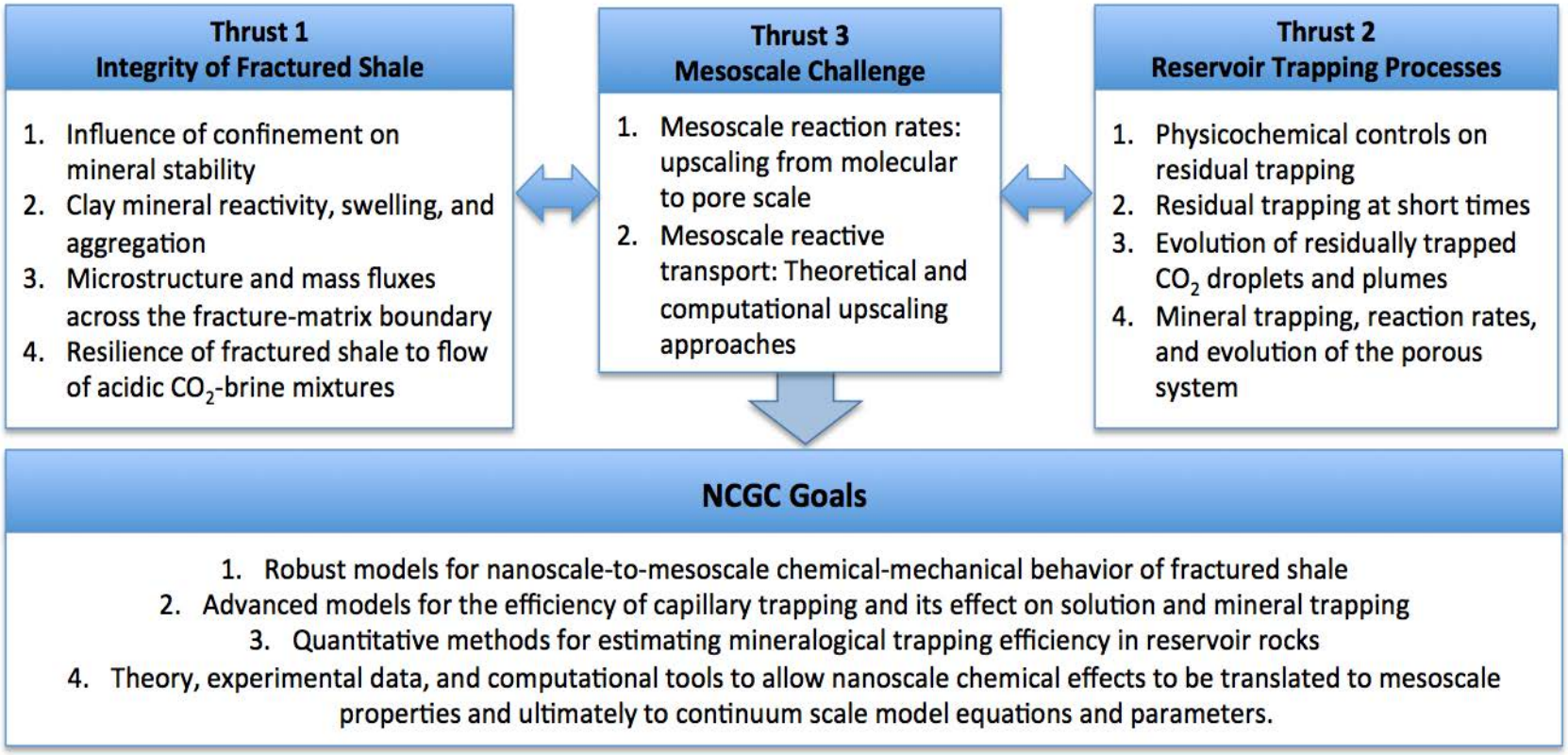
KEY QUESTIONS FOR NCGC…..



Questions:

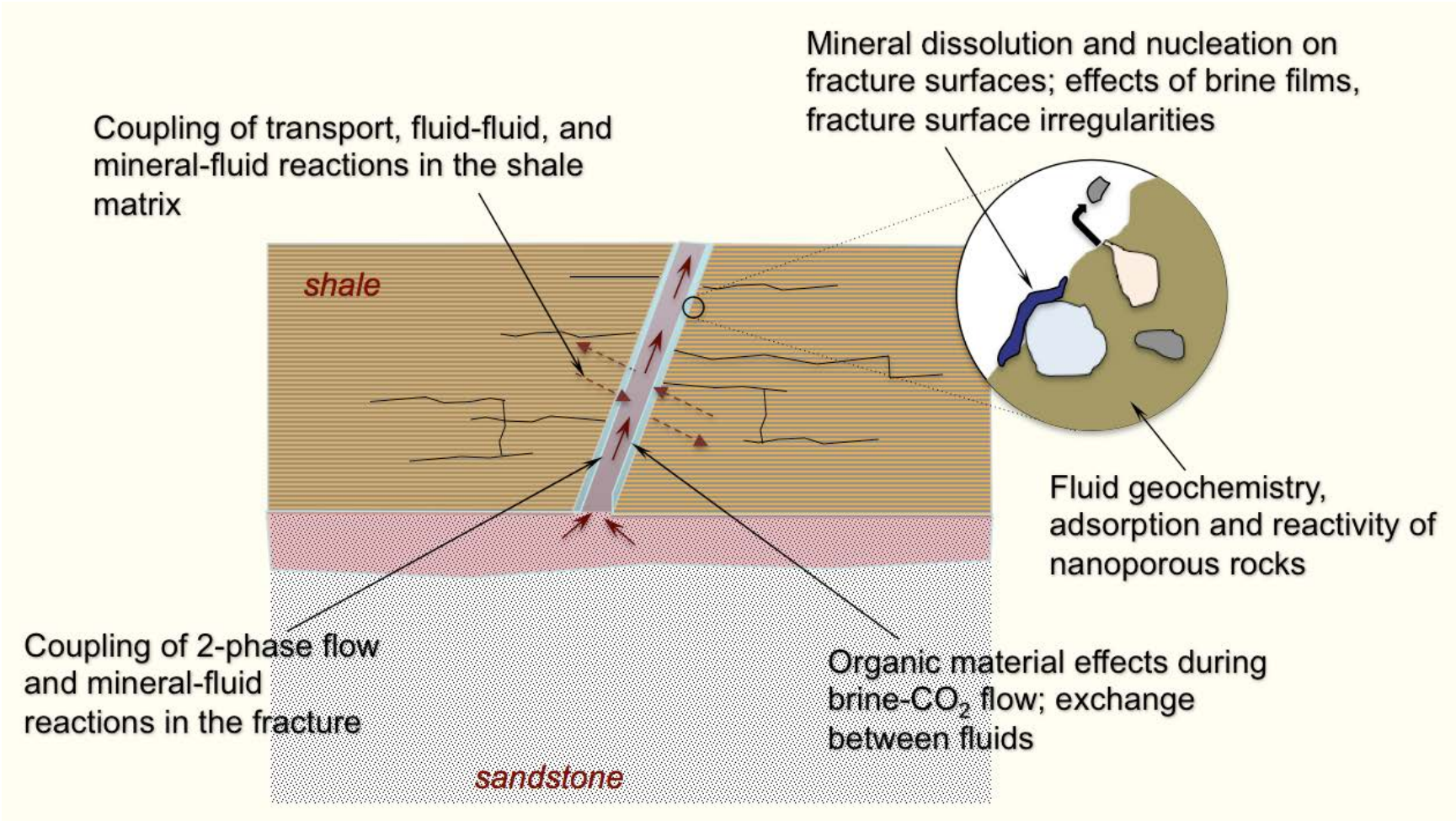
1. How much CO_2 is likely to be accounted for by capillary trapping? What factors does it depend on and how well can it be predicted?
2. Is capillary trapping permanent, or can it break down on longer timescales due to more slowly acting chemical processes?
3. Will geochemical reactions affect the capacity and security of shale seals if they are fractured or faulted and/or fractured during injection?
4. Can a significant fraction of the injected CO_2 be converted to carbonate on a 1000-year time scale?

RESEARCH APPROACH

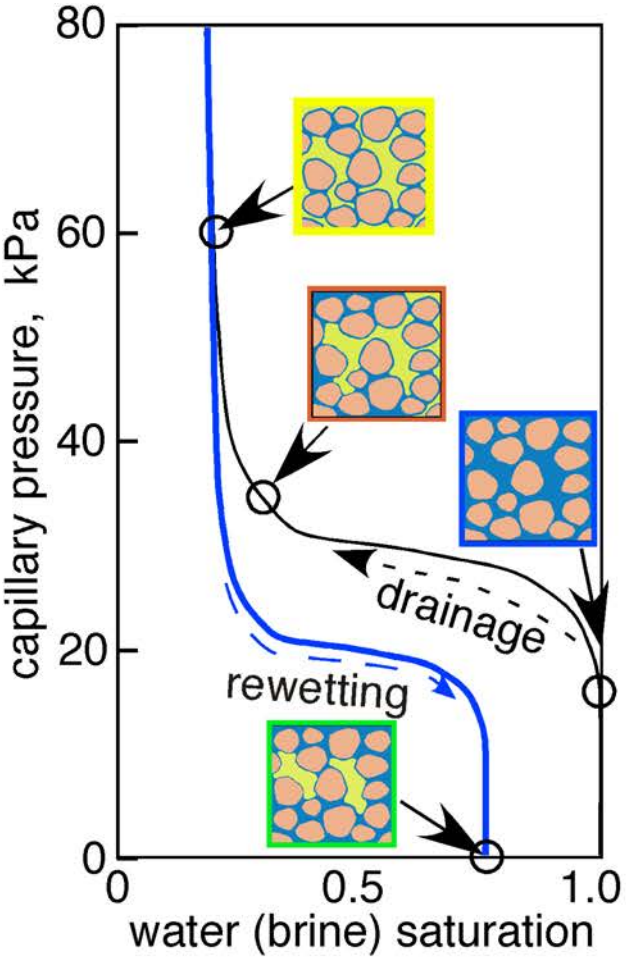


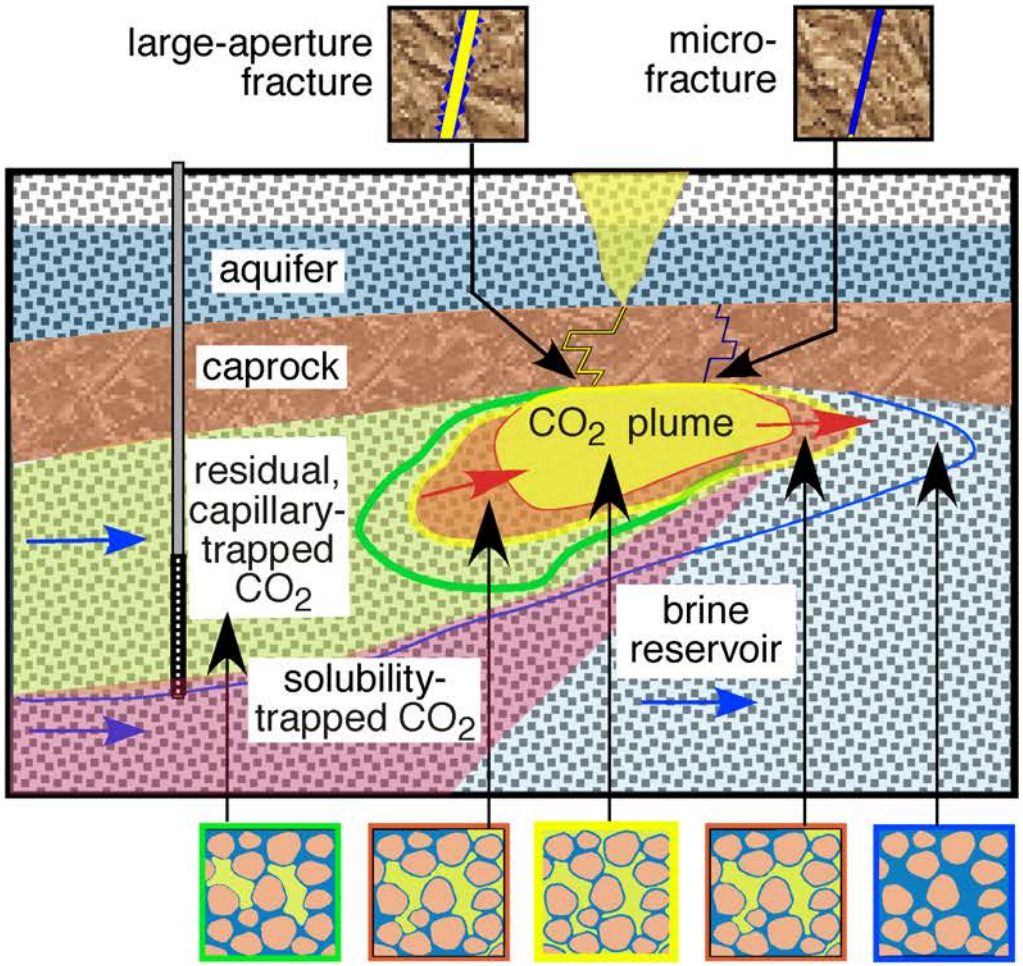
The Center leverages BES-funded characterization and computational facilities at LBNL (ALS, MF, NCEM, NERSC), ORNL (SNS, HFIR, CNMS) and other synchrotron facilities (APS, SSRL, NSLS-II). We use purpose-built experimental equipment and modeling tools developed in the first funding period.

THRUST AREA 1

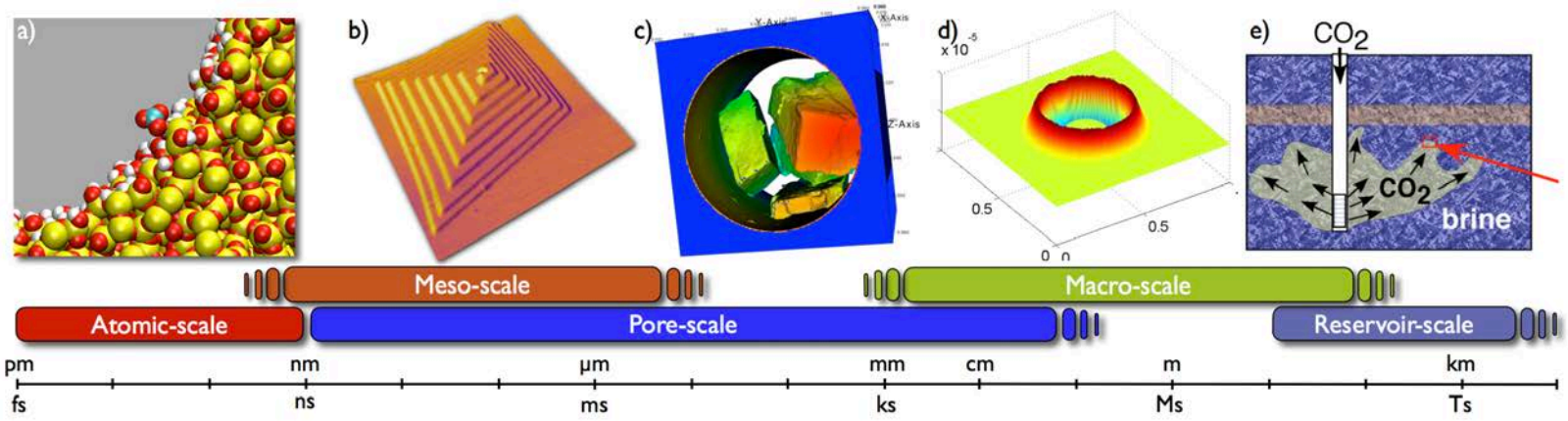


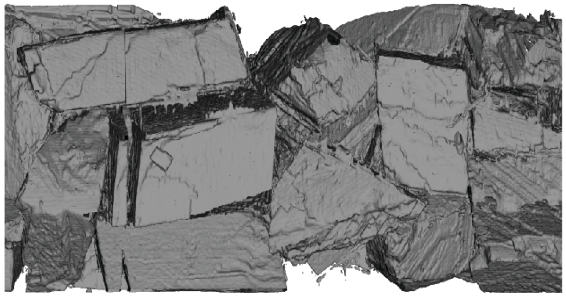
THRUST AREA 2

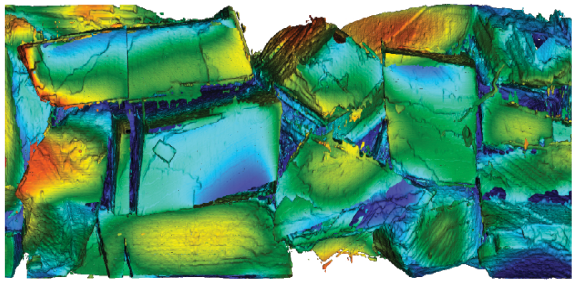


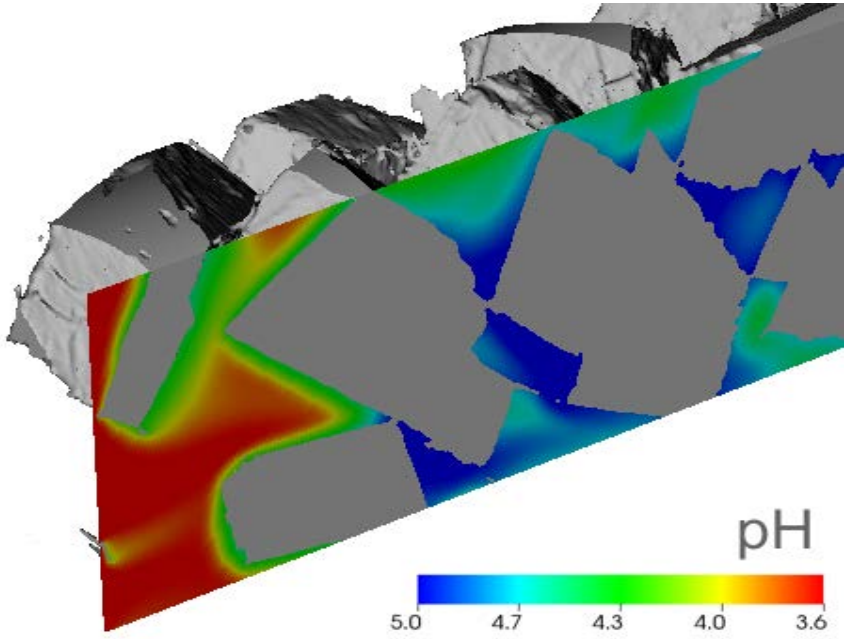


THRUST AREA 3









NCGC POSTERS AT CARBON STORAGE R&D MEETING

Center for Nanoscale Controls on Geologic CO_2:
New Insights on CO_2 Trapping
Donald J. DePaolo (Lawrence Berkeley National Laboratory)

Effects of Wettability on CO_2 Behavior in Mineral Media
Tim Kneafsey (Lawrence Berkeley National Laboratory)

Impact of Mineral Reactive Surface Area Approximations on Predictions of Mineral Dissolution Rates in a CO_2 Injection Experiment
Elizabeth Mitnick (Lawrence Berkeley National Laboratory)

Properties of Bulk and Pore-Confined CO_2 and CO_2-Rich Fluids:
New Experimental Approaches
M. S. Gruszkiewicz (Oak Ridge National Laboratory)

Direct Numerical Simulation of Pore-Scale Two-Phase Flow
Moataz Abu AlSaud (Stanford University)

Nanoscale Aspects of CO_2 Storage in Geologic Formations
Gernot Rother (Oak Ridge National Laboratory)

Multi-scale X-Ray Microtomography Imaging of Immiscible Fluids after Imbibition
Charlotte Garing (Stanford University)

Thank You.