# DIAGENESIS

## Grand Challenge

From pore to platform, numerically simulation the entire diagenetic history by incorporating sedimentation, chemical & biological alterations, mechanical overprints, fluid flow, etc. These models to capture entire diagenetic system and all of its coupled interactions

For use in

- concept development/hypothesis testing (genetic and case studies)
- education
- prediction of properties and proxies in time and space
    - acidification of oceans
    - injection and production of subsurface fluids (facies, diagenesis and brittle deformation) control the heterogeneity that affects CO2 sequestration, aquifers (production, pollution, storage & recovery), and hydrocarbon reservoirs)

## Current Knowledge Levels

Know in general terms are products and process (observational basis), but ….

Have some, though limited tools

Empirical process / rule based models that link sedimentation and post-depositional diagenesis

RTM platforms

Major shortcomings on 3D distribution of processes & products in time and space (no real benchmarks)

## Knowledge Gaps

What do diagenetic outcomes look like at the full spectrum of scales (thin section to platform) --- validation data sets

When to use transport- vs. reaction-controlled processes

Significant uncertainty in many input parameters

fluids, thermo, and kinetic parameters
mechanical processes
thresholds & coupling
biogeochemical reactions (catalysis, facilitators)

Empirical rules associated with some key processes (esp. cementation)

Capture of more textual/fabric/chemical elements (mineralogy & total porosity not enough)

## Needed Data & Partners

Need access/info from the "right kinds of rocks"

drill cores

3D quantitative data sets --- well constrained outcrops

Software engineers (efficiency of models, optimizing our data collection)

mechanics, crystal surface geochemists, hydrologists/hydro dynamists/ karst /sedimentologists & stratigraphers

Infrastructure

- improved processing times and environments

– long term monitoring sites for seascape alterations (cementation, dissolution) and near surface post-deposition alteration (freshwater, mixing zones, refluxing brine settings)

## Short Term Goals

1. Tool uptake --- need to disseminate current codes to increase user community
2. Develop community libraries of
    a. validation cases
    b. input parameters (get consistency & focus)
3. Improve most problematic of process rules
4. Test existing tools at pore scale
5. partner with and draw in larger community
6. Guide smart data collection
7. Assess progress and define specific medium term goals

## Medium Term

1. Couple 2$^{nd}$ generation diagenetic models with improved sedimentary dynamic models