SAND2016-5041PE

Used Fuel Disposition Campaign

Deep Borehole Field Test
Borehole Characterization

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Used Fuel Disposition Working Group Meeting

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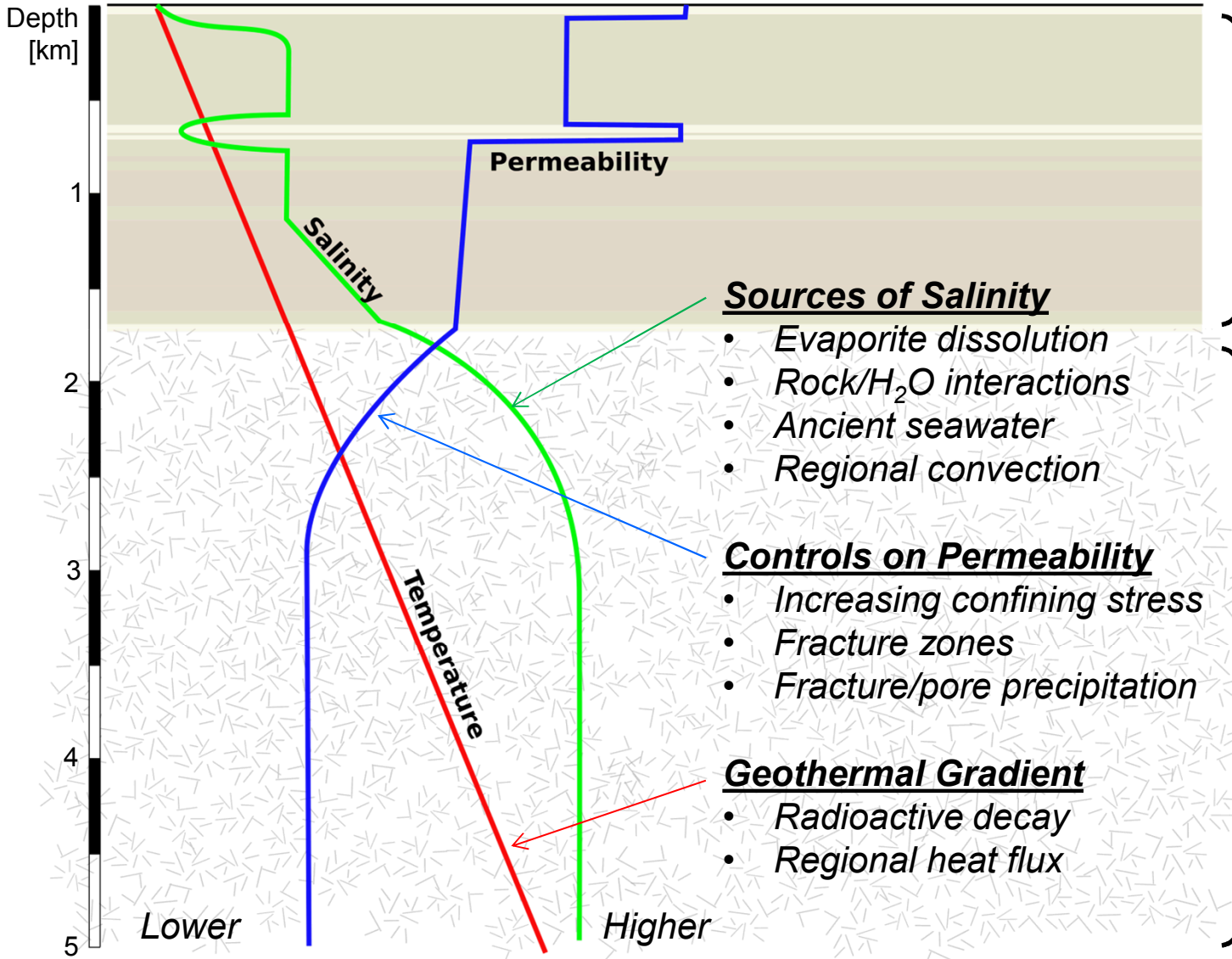
Conceptual Profiles



Sources of Salinity

- *Evaporite dissolution*
- *Rock/H_2O interactions*
- *Ancient seawater*
- *Regional convection*

Controls on Permeability

- *Increasing confining stress*
- *Fracture zones*
- *Fracture/pore precipitation*

Geothermal Gradient

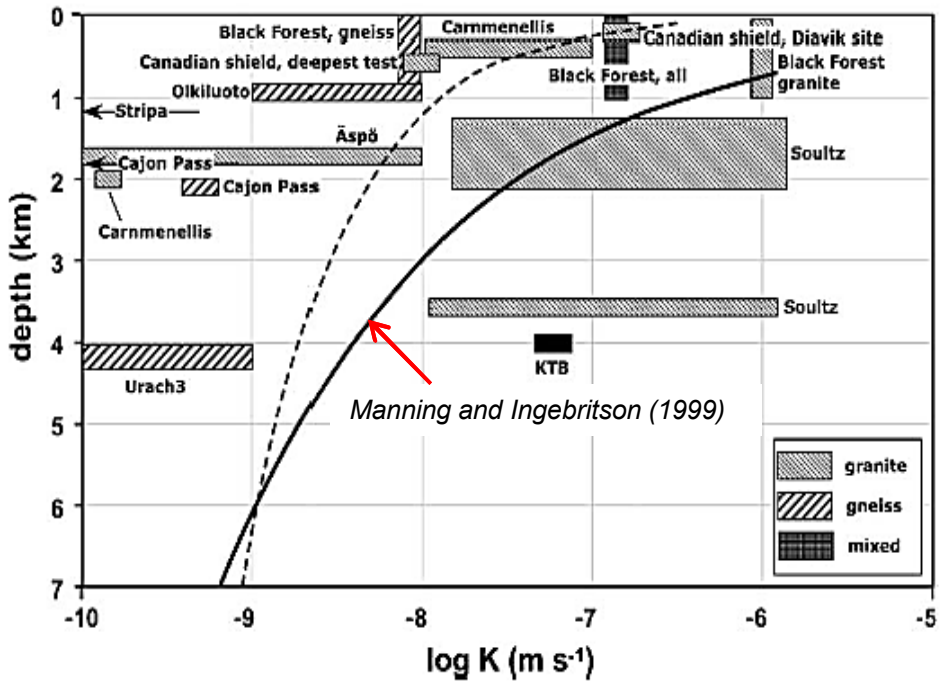
- *Radioactive decay*
- *Regional heat flux*

Sedimentary Overburden ≤ 2 km

Crystalline Basement ≥ 3 km

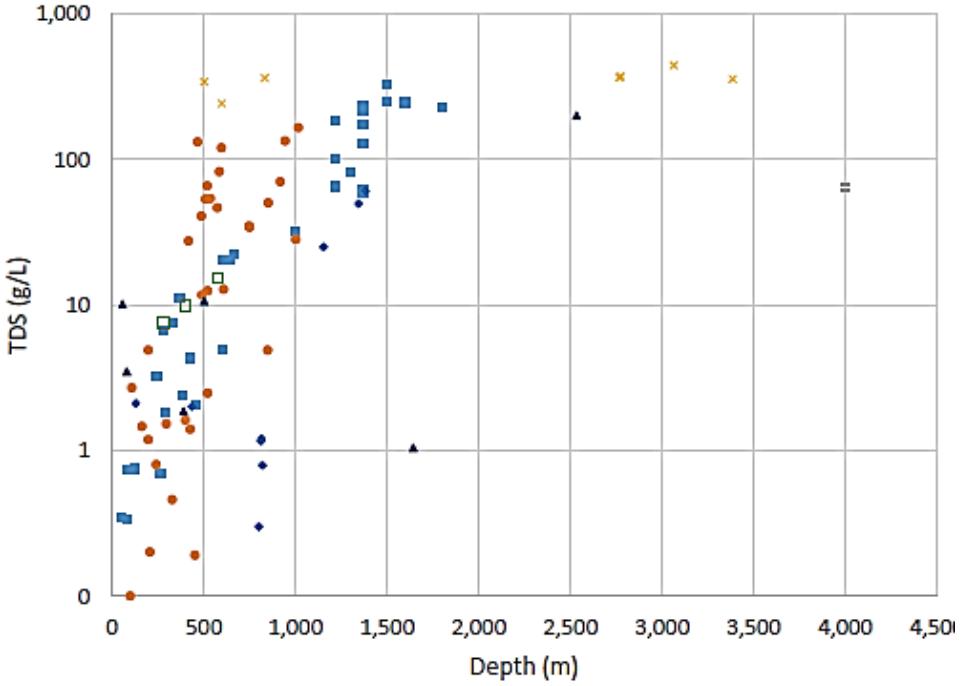
Supporting Data

Rock Permeability Decreases with Depth



Stober and Bucher (2007)

Pore Water Salinity Increases with Depth



DeMaio and Bates (2013)

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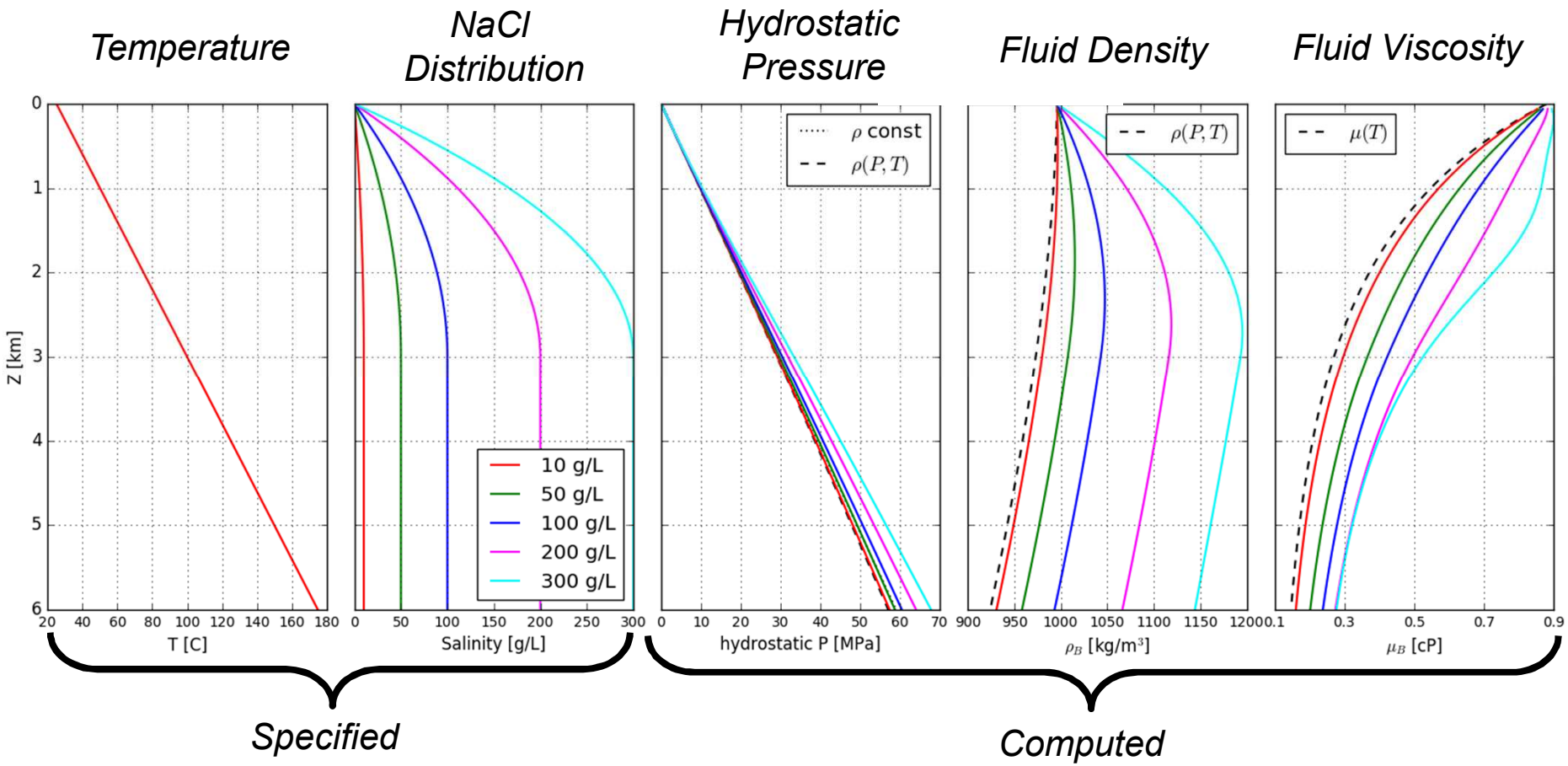
Simple Density Profiles



No-flow steady-state profiles

Density equation of state: Batzle and Wang (1992)

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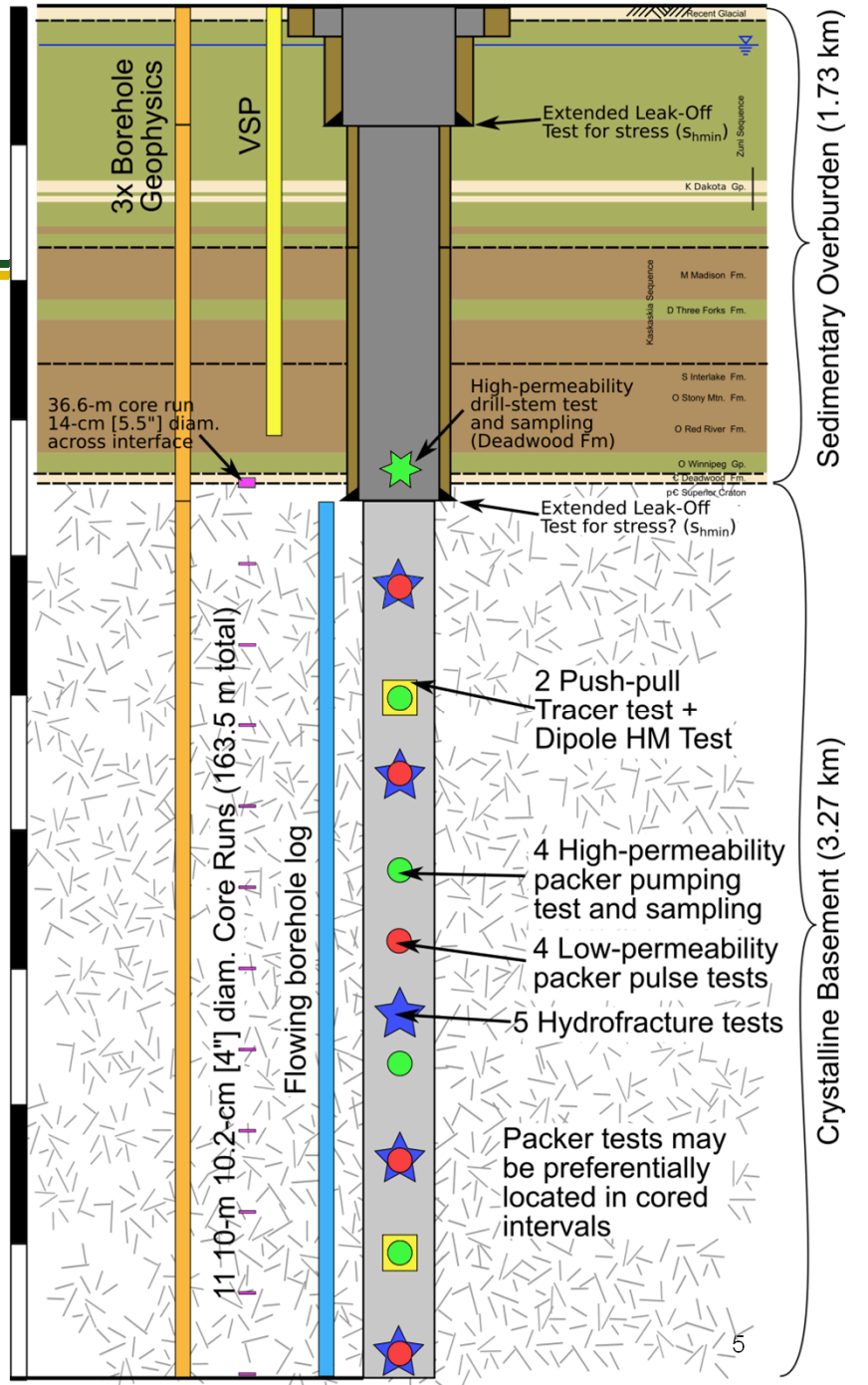
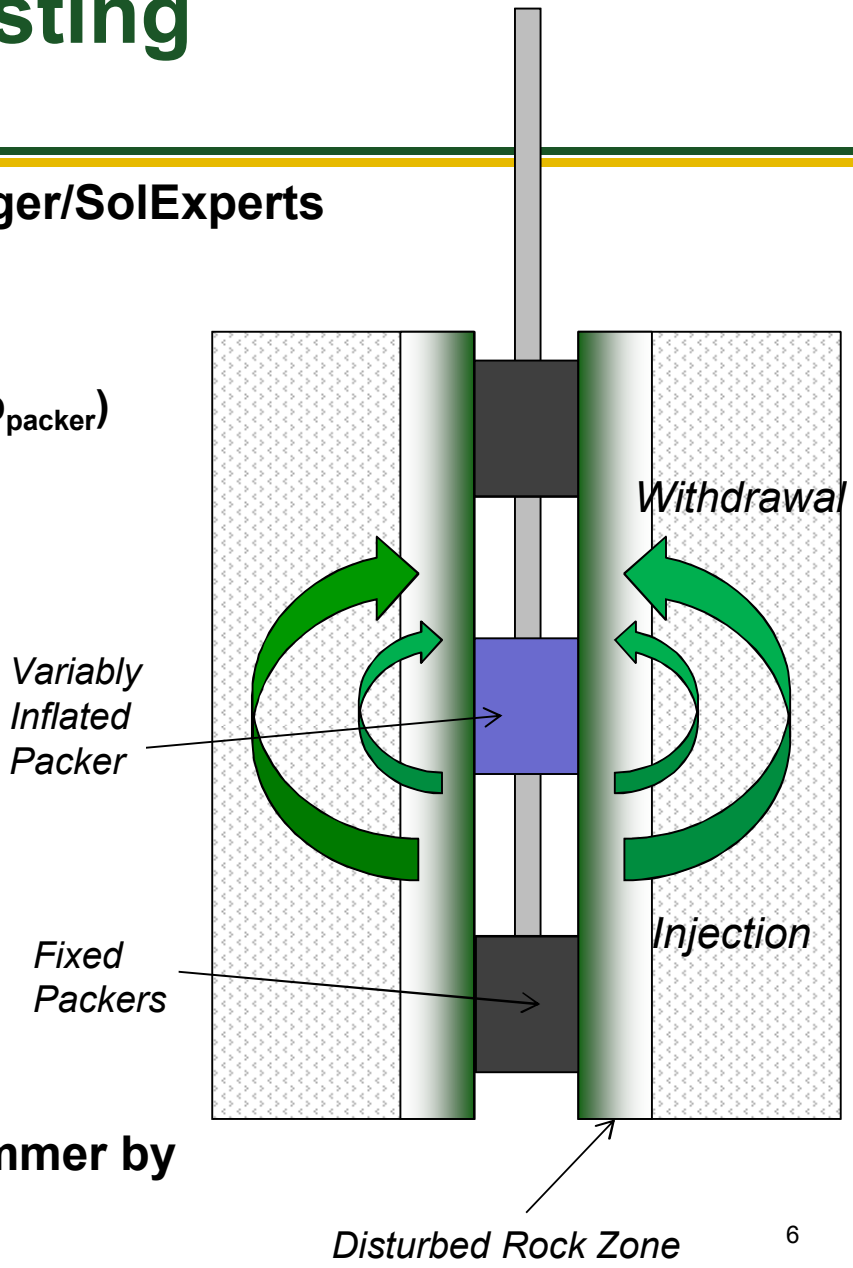
Sampling Profiles

- Borehole Geophysics
- Logging During Drilling
  - Mud fluids/solids/tracers/dissolved gases
  - Torque, weight-on-bit, etc.
- Basement Rock Samples
  - Coring (150 m total)
  - Cuttings/Rock Flour (XRD + XRF)
- Basement Pore Fluid Samples
  - Fluid density/temperature/major ions
  - ^{4}He sampling from cores
  - Stable water isotopes
  - U/Sr isotope ratios
  - Samples from
    - *In Situ (packers) from high K zones*
    - *Extracted from cores in low K zones*
- Flowing borehole log



In Situ Testing

- **Test Design with Battelle/Schlumberger/SolExperts**
  - **No heater test**
  - **No dipole tracer test**
  - **New hydromechanical dipole test: $k(p_{packer})$**
- **Hydrologic Tests**
  - **Static formation pressure**
  - **Permeability / compressibility / skin**
  - **Sampling in high K intervals**
- **Tracer Tests**
  - **Single-well injection-withdrawal**
- **Hydraulic Fracturing Tests**
  - **σ_h magnitude**
  - **Estimate stress tensor via existing fractures**
- **Drilling & Testing Plan ready this summer by Battelle/Schlumberger/SolExperts**



Deep Borehole Field Test

- **Characterization *different from*:**
  - **Mined waste repositories characterization**
    - ***Single-phase fluid flow***
  - **Oil/gas or mineral exploration**
    - ***Low-perm Crystalline basement vs sedimentary rocks***
  - **Geothermal exploration**
    - ***Low geothermal gradient***
- **Deep Borehole Performance:**
  - **Less reliance on engineered barriers**
  - **More dependence on basin-scale geologic conditions**
- **DBFT Purpose:**
  - **Demonstrate ability to sample and test at depth**