### Meso-Scale Clathrate Experiments: Effect of Grain Size on Formation Pathways



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### Motivations

- Massive Carbon and Natural Gas Reservoir
- Possible Climate Contributor
- Large Terrestrial Deposits of Hydrate
- Deposits elsewhere in the Solar System





### Purpose



- Can areas of hydrate formation be located in time and space?
- Is grain size a primary control on hydrate formation?
- Do the sensor planes facilitate hydrate formation?

### **Clathrate Reactions**



### The Seafloor Process Simulator (SPS)

- 72 Liter Volume
- 41 Ports for Instrumentation
- LUNA DSS
- 3000 PSIG Working Pressure
- Hastelloy Construction
- Housed in Cold Room
- Sapphire Viewing Windows



### LUNA DSS



-Described by Jones Calculus -TSV\* inferred from reflected λ \*TSV (Temperature Strain Value)

### The LUNA System



- Fiber optic cables with Bragg gratings
- Optical backscatter reflectometer
- Can read up to 8 fibers
  ~ 15 sec
- Scan rate: 1 scan min<sup>-1</sup>

### Calibration





## **Spiral Gratings**





# T = 279 KPlotting the DataP = 5.75 MPa



### **TSV Plot**

T = 279 K P = 5.75 MPa



### **TSV Plot**

#### T = 279 K P = 5.75 MPa



### Conclusions

- Exothermic hydrate formation allows formation pathways to be determined
- High porosity sediments strongly preferred
- Slow creep across sensor planes observed

DSS Time 2276 Channels 1,4,5,7 First Vertical Sediment Experiment



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