

# The Seafloor Process Simulator (SPS)

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# ORNL Pressure Vessels

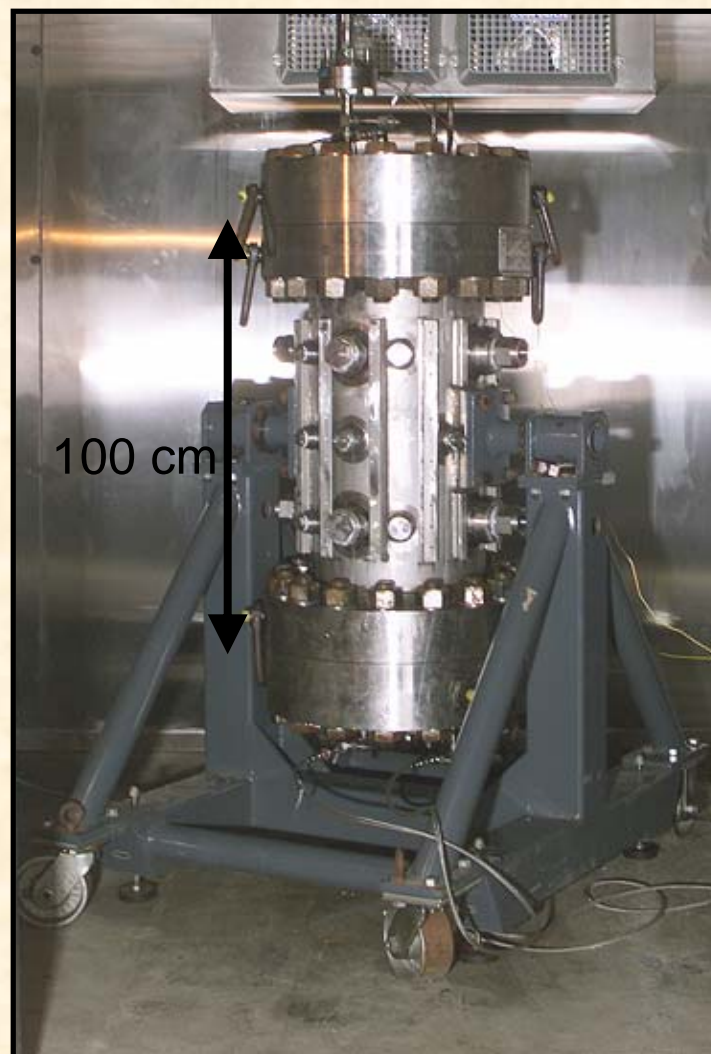
- **Single crystal sapphire pressure cell for use with neutron powder diffractometer (7.8 mL)**
- **Small scale vessel made by Parr Instrument Company (450 mL)**
- **Seafloor Process Simulator (SPS) is a large scale pressure vessel (72 L)**



← Small Volume Large Volume →

# Seafloor Process Simulator (large scale)

- 72 liter vessel
- Sapphire windows
  - Visual observation
  - Raman spectroscopy
- 41 access ports
- Hastelloy
- Max pressure = 3000 psi (2 km)
- Explosion proof cold room
- LabView used for data acquisition

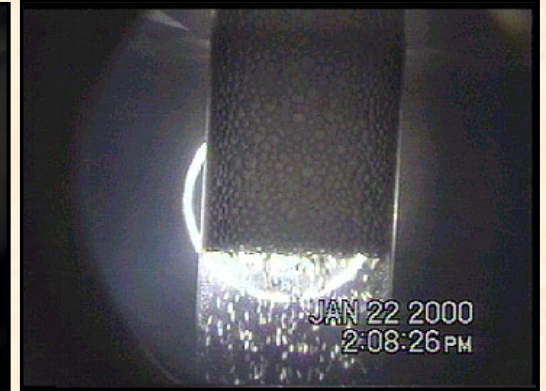
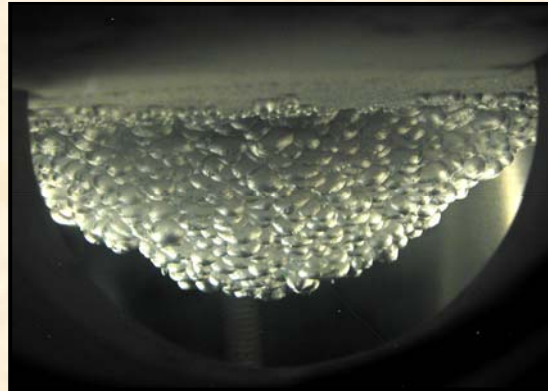


# Why Make a 72 Liter Vessel?

- **Scalability**
  - Various vessel sizes in the our lab provides for a smoother transition to field experiments
- **Multiple samples**
  - A variety of samples can be placed in the SPS simultaneously
- **Oversized samples**
  - Drill cores
- **Data acquisition**
  - SPS provides more ports for various instruments

# A Variety of Experimental Designs have been used in the SPS

- **SPS can accommodate a variety of experimental designs**
  - Massive hydrate formation
  - Controlled hydrate formation and dissociation in a column
  - Hydrate formation and dissociation in sediment cores
  - Novel equipment for rapid and controlled hydrate formation



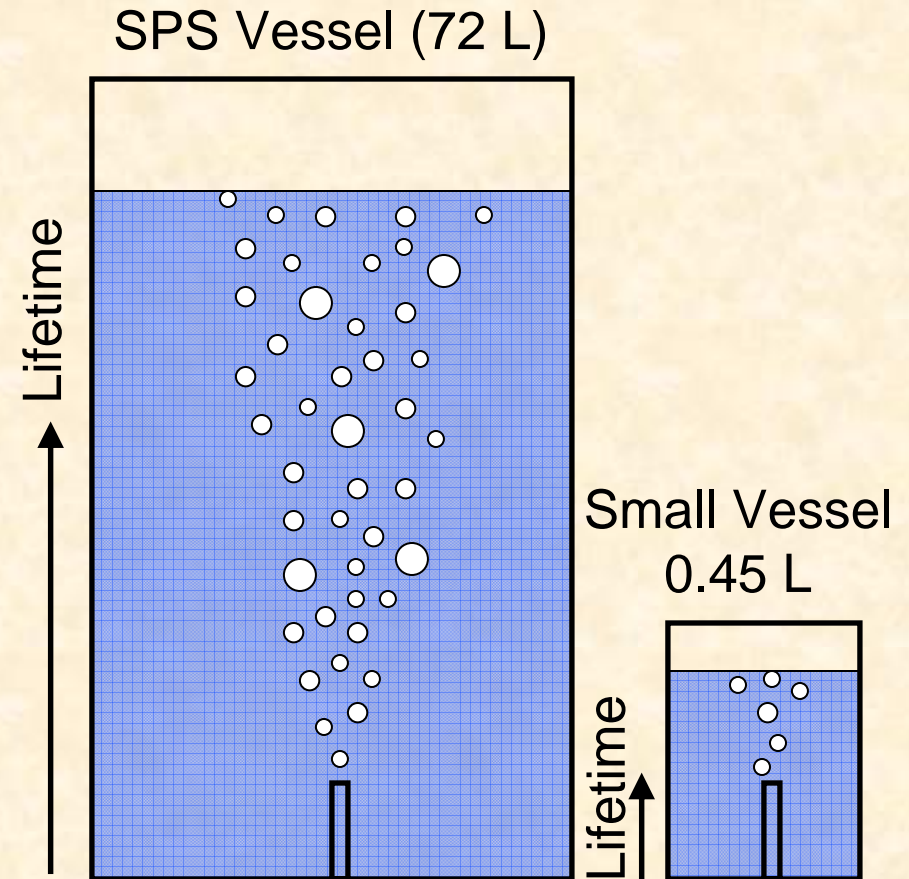
# Characteristics of Hydrate Formation in the SPS

- **Observations**

- **Smaller overpressures in SPS**
- **Shorter induction times in SPS**
- **Smaller standard deviations of overpressure and induction time in SPS**

- **Why?**

- **Bubble surface area?**
- **Lifetime of bubbles? (~9:1)**
- **Gas/water interface surface area? (24:1)**
- **Total volume? (160:1)**



# Planned Research using the SPS

- **Continued research on CO<sub>2</sub> sequestration techniques**
- **Effects of nucleators and inhibitors**
- **Biogeochemically characterize natural sediments containing methane hydrate (i.e. cores from the Gulf of Mexico and the Mallik field)**
- **Test desalination techniques which involve hydrate formation**
- **Raman spectroscopy of hydrate forms**