
7. *Carolyn Ruppel, Georgia Institute of Technology*

Dynamics of the Gas Hydrate Reservoir in the Gulf of Mexico

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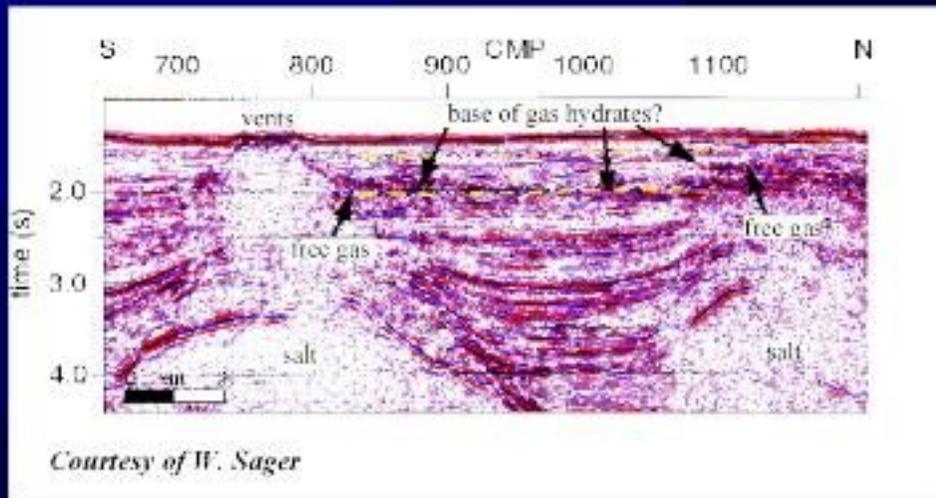


Gulf of Mexico Hydrates Sites

- **Massive gas hydrate**
- **Very high fluid/gas flux**
- **High heat flow**
- **Mixture of hydrocarbons**
- **Salt tectonism**



Spatial Heterogeneity

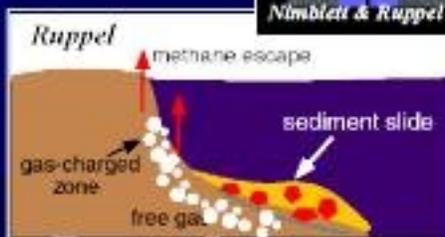


Gulf of Mexico: Unique Characteristics

- **Three-dimensional heterogeneity**
- **Lack of widespread BSR**
- **Higher order hydrocarbons**
- **Ephemeral nature of deposits**
- **Seafloor seepage of gas and oil**
- **Association of gas hydrate deposits and fluid conduits**

Problem-Solving

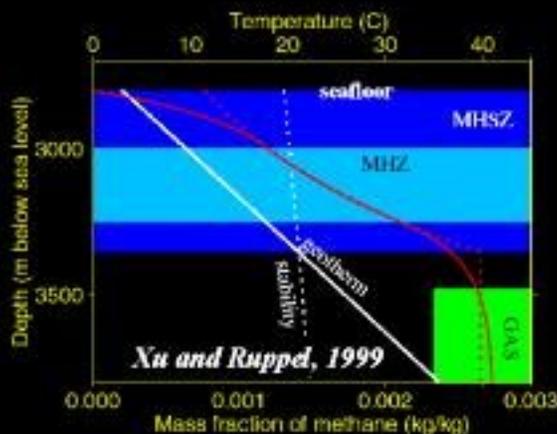
- Detect deposits with remote sensing methods
- Predict evolution of gas hydrate/free gas zones
- Evaluate seafloor stability



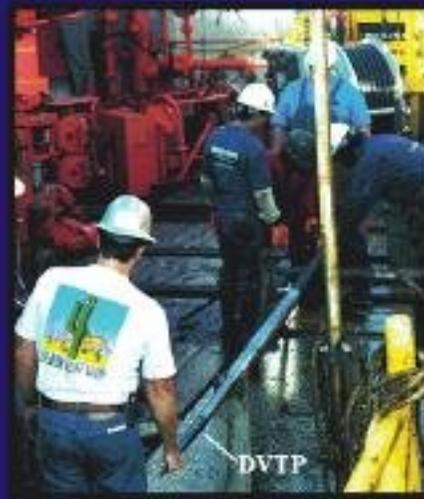
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Predicting Gas Hydrate & Free Gas Distributions

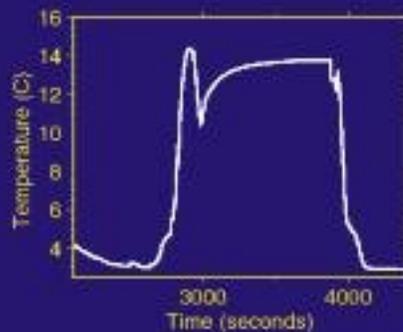
- Multiphase numerical model
- Conservation of mass, momentum, and energy
- Steady-state, purely vertical transport



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RAW DATA



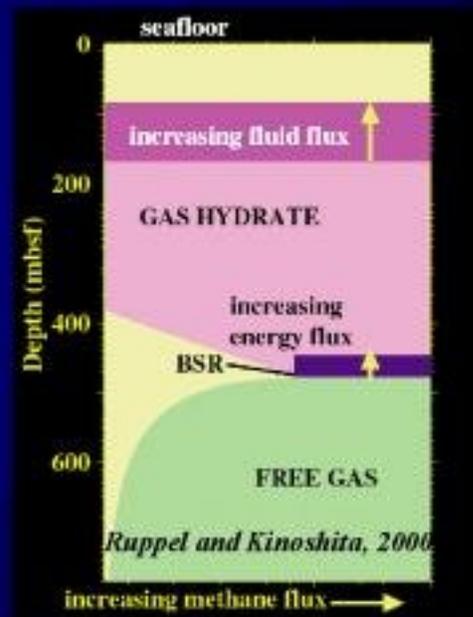
Fundamental Physical Properties

- Seismic velocities
- Thermal conductivity
- Thermal diffusivity
- Mechanical strength



Reservoir Dynamics: Physical Controls

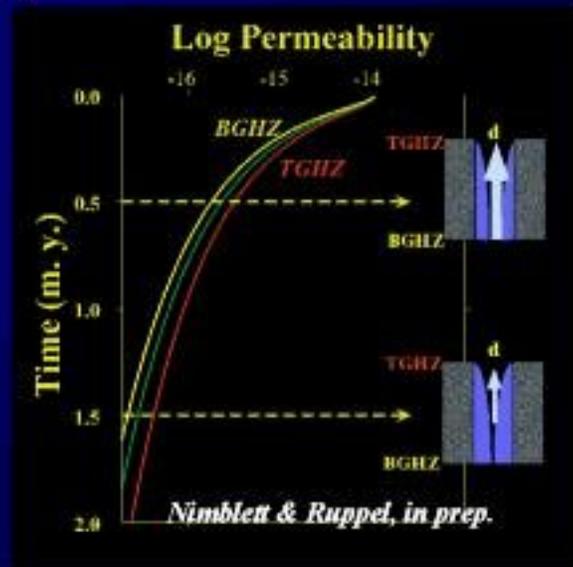
- Energy (heat) flux
- Fluid flux
- Gas flux



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Reservoir Dynamics: Time Scales

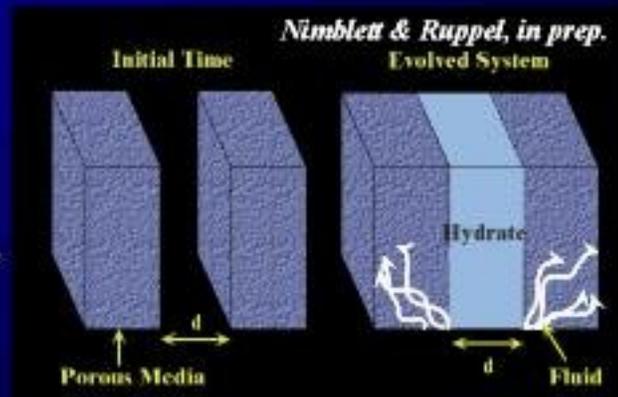
- Regeneration time
- Stability
 - short-term
 - long-term
- Global climate change



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Fluid Conduits and Permeability Clogging

- **Porous media**
 - disseminated hydrate
- **Channel flow**
 - seafloor hydrate mounds
 - fracture fills



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Conclusions

- Gas hydrate reservoir dynamics depends on energy, fluid, and gas fluxes
- Overlapping field, laboratory, and modeling approach most effective
- Faults (high flux zones) are critical loci of gas hydrate concentration
- Seafloor stability assessments require better information about engineering properties of hydrate+sediment and gas + sediment

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