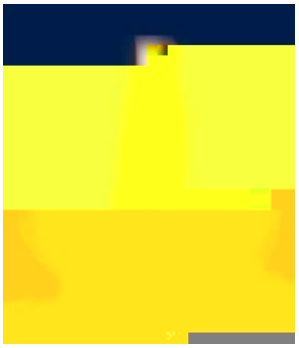
Gas Hydrate: Future Ocean Resource



United Nations Open-ended
Consultative Process
on Law of the Sea – 2004

Presented by Edith Allison
June 9, 2004

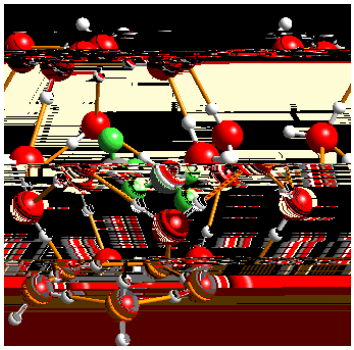
Introduction to Gas Hydrates

- **What are they and how are they formed?**
- **Where are they found?**
- **How much may exist?**
- **Why hydrate is significant**
  - Energy Resource
  - Seafloor Stability
  - Specialized Biota
  - Global Climate Change
  - Fresh Water
- **Next Steps**

What is Gas Hydrate?

Hydrate is a crystalline solid consisting of gas molecules, usually methane, each surrounded by a cage of water molecules

Each volume of hydrate contains up to 160 volumes of methane (natural gas)



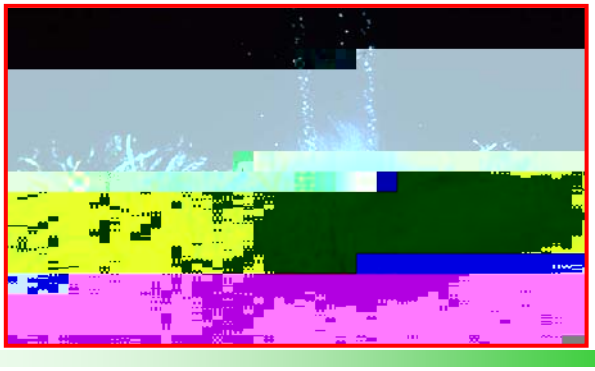
Where does the gas come from?

Biogenic Hydrate ~99 %

Microbial activity in the upper several hundred meters of shelf sediment

Thermogenic Hydrate

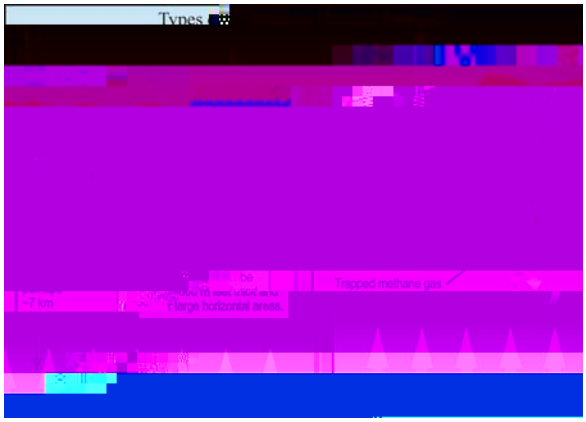
Thermal breakdown of organic material at greater depths, similar to conventional oil and gas.



Where does gas hydrate exist?

Where gas and water are present at:

- Moderately low temperatures and Moderately high pressures

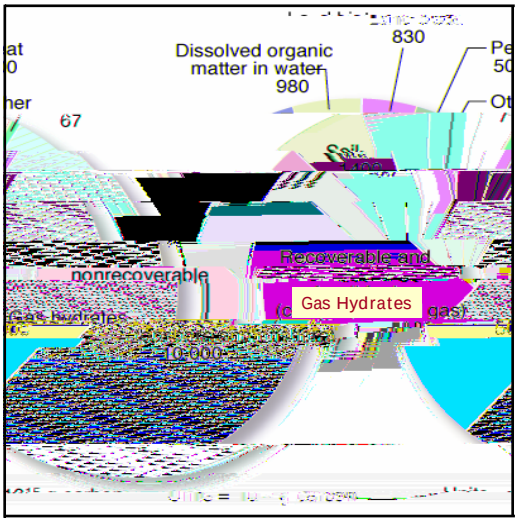


Where are hydrates found on Earth?

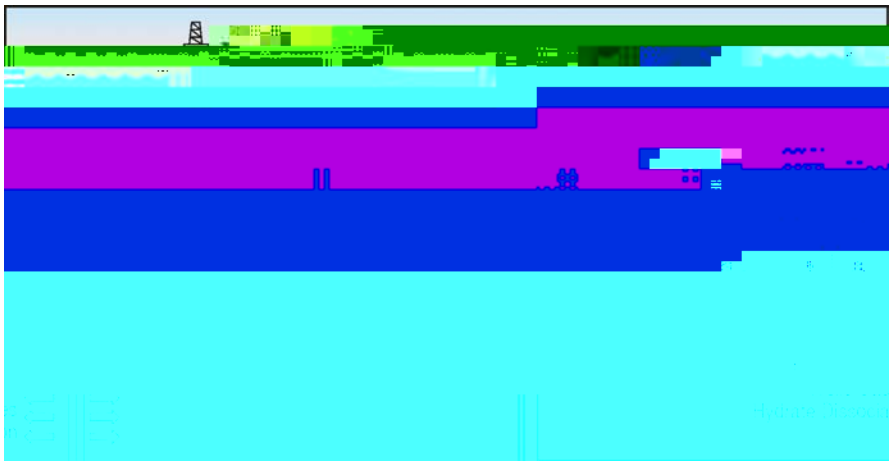
Hydrate forms on continental shelves and in the arctic

How much may exist?

Hydrate binds immense amounts of methane in sediments.



Hydrates as a Hazard



Hydrate and Global Climate Change

- Methane is a powerful greenhouse gas
- Hydrates

Unique Biological Communities at Hydrate Mounds and Methane Seeps

Community on a hydrate mound.

© Georgia Tech School of Biology

Mussels at Blake Ridge - the size of American footballs

Multi-national Research

- Demonstrated the feasibility of methane production from hydrate deposits
- Japan, US, Canada, India, EU and others are developing the technology needed for commercial production of methane from hydrate by 2015

  and understanding the role of hydrate deposits in global climate change and seafloor stability

Hydrate as a Fresh Water Resource

- Each volume of gas hydrate contains 0.8 volumes of fresh water
- Massive marine hydrate formations may contain some solids, such as diatoms and clay that would need to be filtered from produced water
- Salts may be trapped in the formations adjacent to hydrates, remixing salts into water during production.

Application of Hydrate for Desalination

- Current technology includes reverse osmosis or distillation
- Worldwide desalination capacity is over 6 billion gallons per day
- Gas Hydrate desalination is being investigated – may have lower energy requirements than other technologies
  - Gas mixed with saline water at depths >100 meters forms hydrate which rises buoyantly. It then separates into fresh water and gas, which can be recycled.

Next Steps

- International Methane Hydrate Research