Exploration and Production of Gas Hydrates

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Fire in Ice: Implications for Energy Development and the Carbon Cycle

Rice University

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What have we learned in Recent Years?

- Hydrates are widespread along continental margins and in Arctic regions
- Shales typically have low hydrate concentrations
- Coarse clastics can have high concentrations of hydrate
- Commercial production of gas from hydrates is most feasible from coarse clastics
- BSRs are not consistent hydrate indicators

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Which Hydrates are Going to Be Produced?

Hydrates occur in a variety of forms:

- Dispersed in shales
- Filling fractures
- Mounds on the seafloor
- Filling porosity in sands and gravels

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What is Required for a Hydrate Prospect?

- Reservoir rock, seal, trap
- Hydrocarbon source, timing, and migration
- Infrastructure
- Access to acreage
- Production technology

Result: Gulf of Mexico and Alaska are the prime exploration targets

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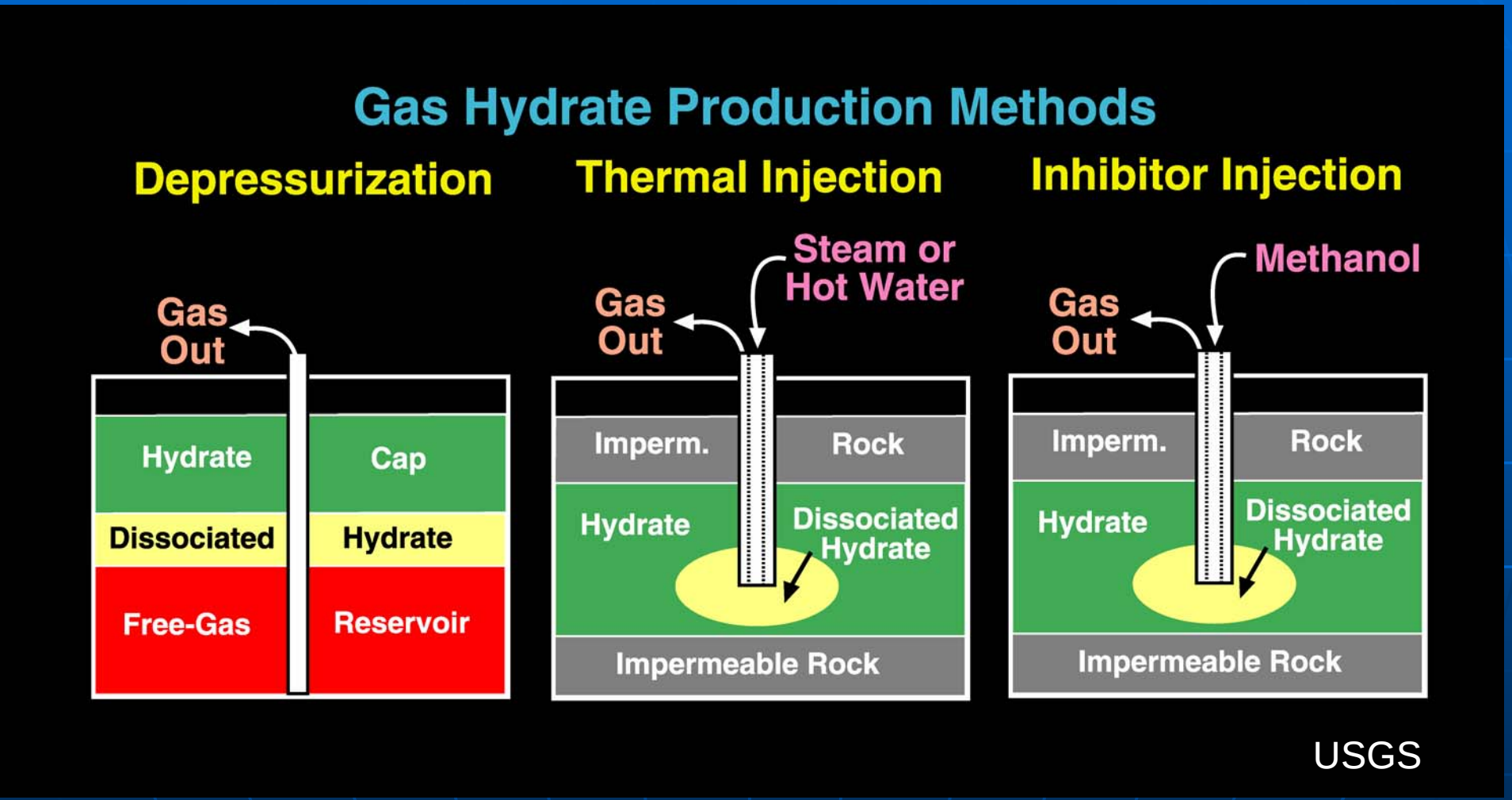
Business Issues

- Total Recoverable per Well
- Rate of Production
- Operating Expense
- Gas Price
- Competition from LNG


Gas Hydrate Production Methods
Depressurization
Thermal Injection
Inhibitor Injection
Gas Out
Hydrate
Cap
Dissociated
Hydrate
Free-Gas
Reservoir
Steam or Hot Water
Gas Out
Imperm.
Rock
Hydrate
Dissociated Hydrate
Impermeable Rock
Methanol
Gas Out
Imperm.
Rock
Hydrate
Dissociated Hydrate
Impermeable Rock
USGS

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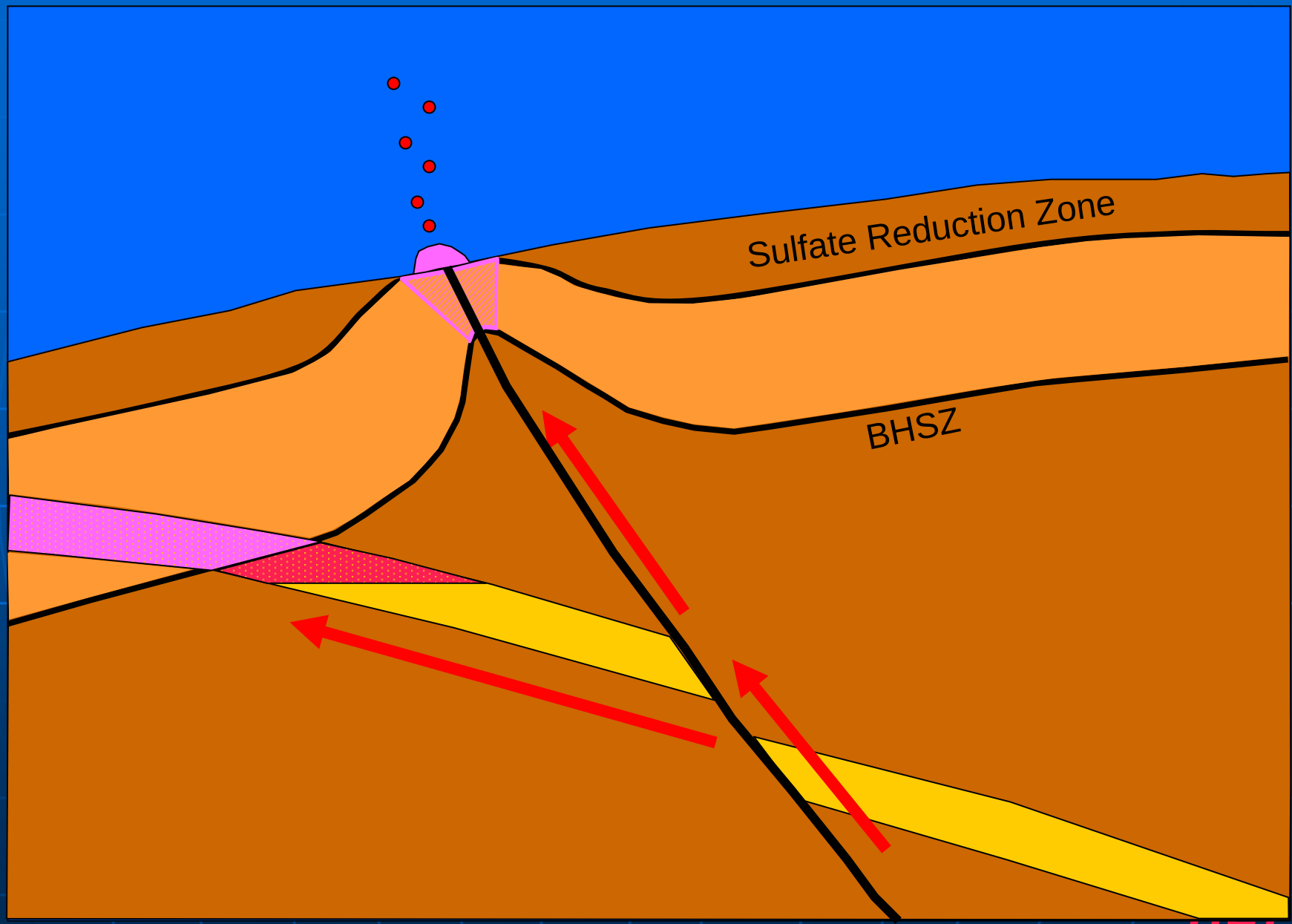
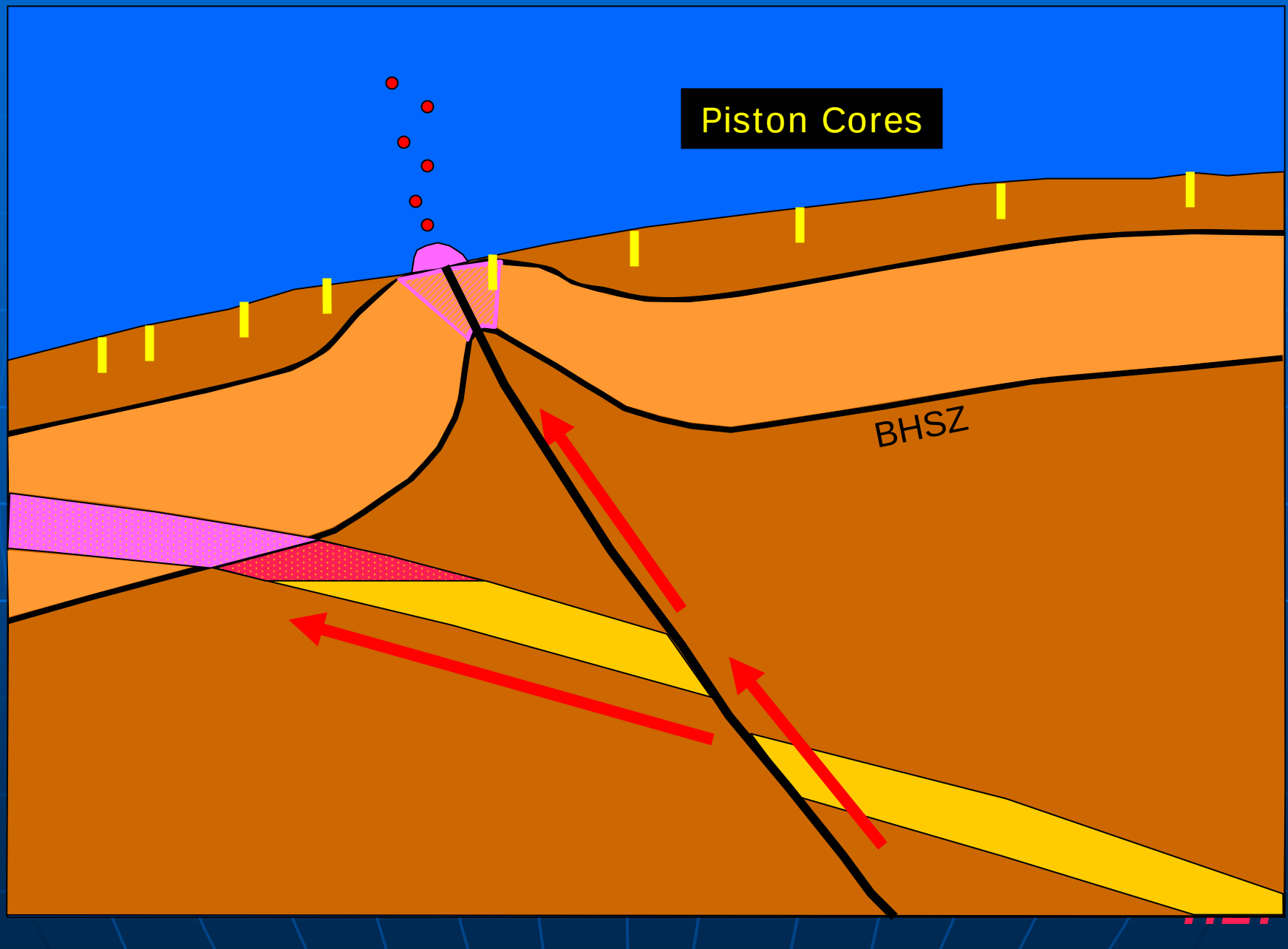
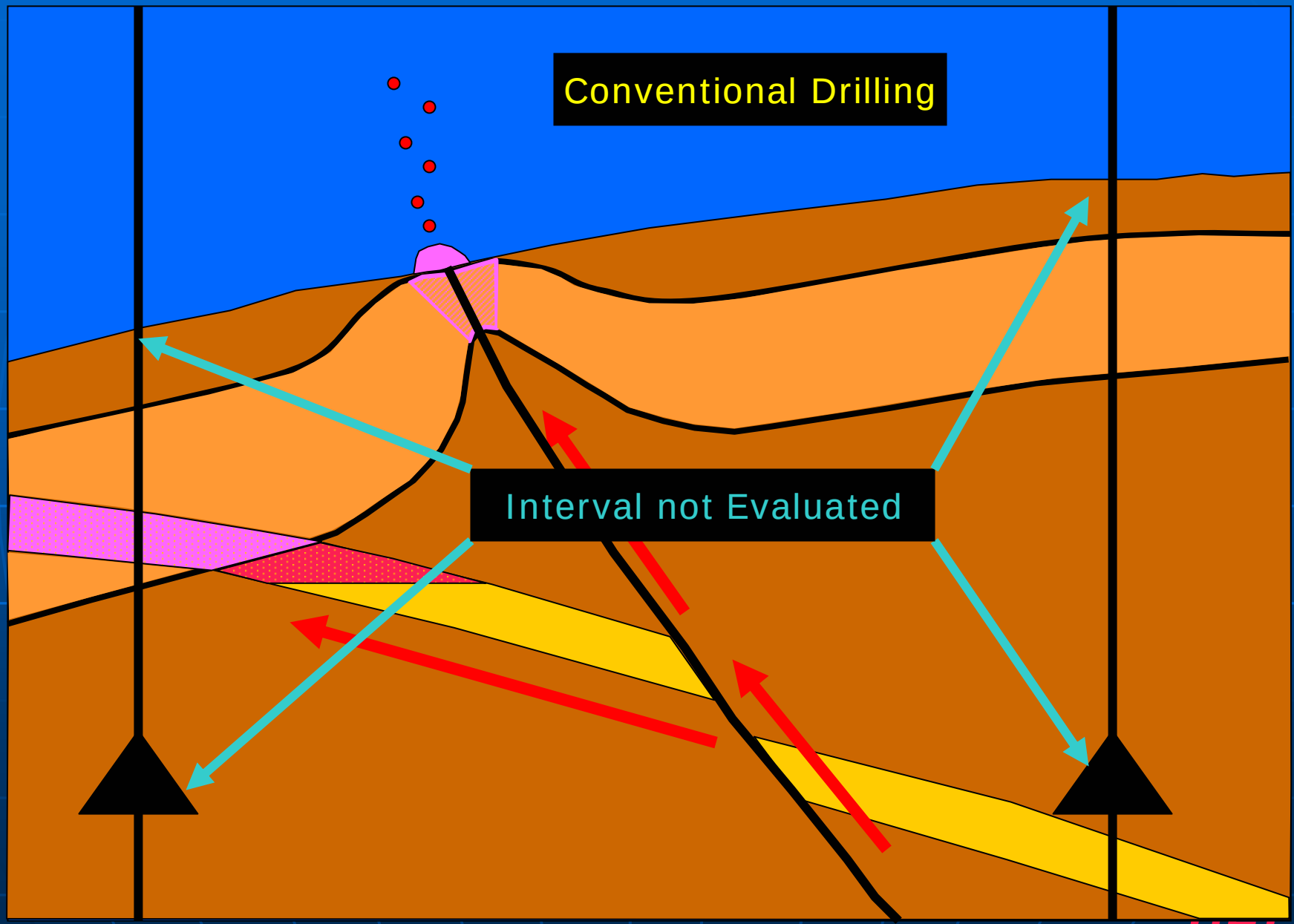
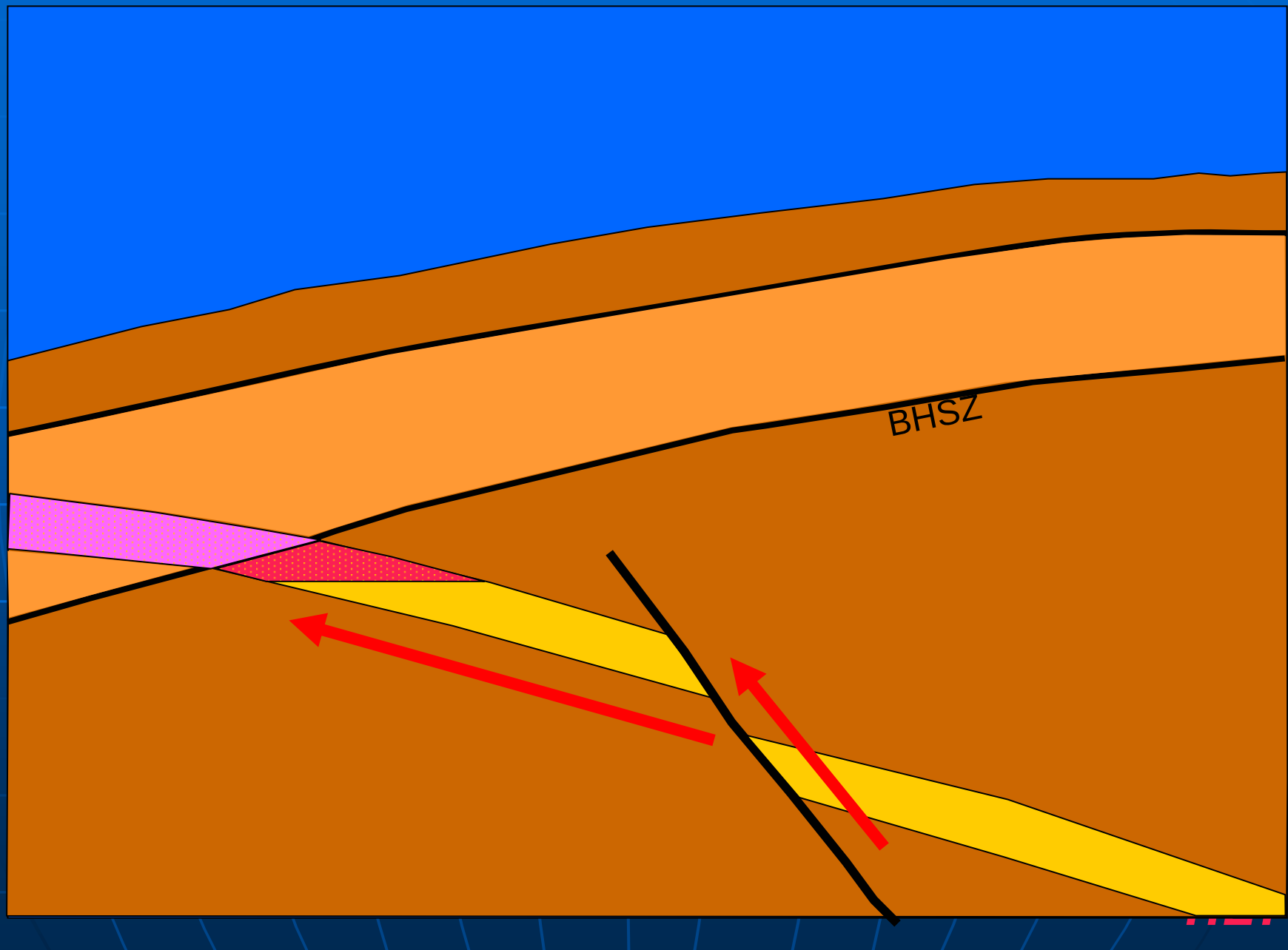
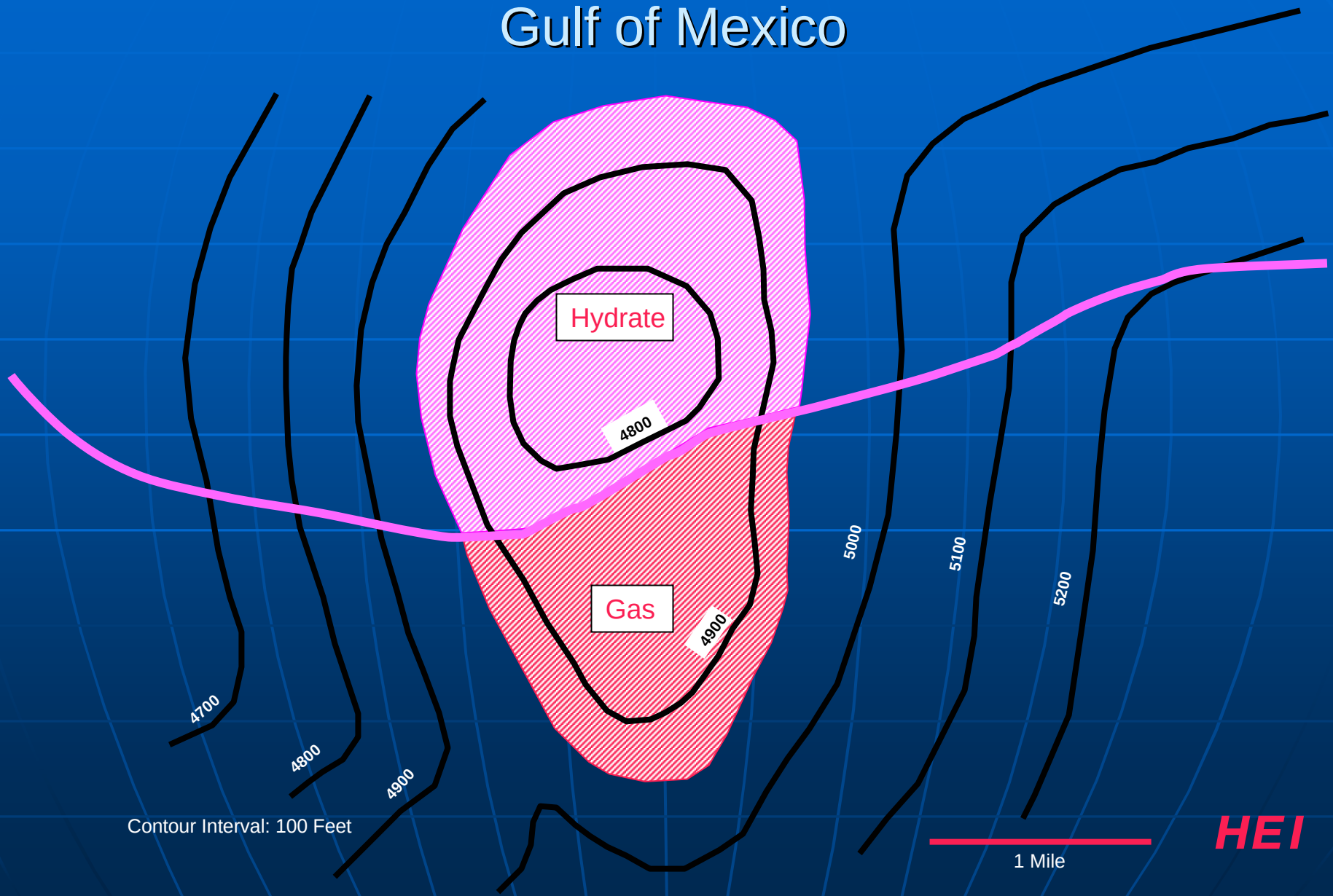

Sulfate Reduction Zone
BHSZ


Piston Cores
BHSZ


Conventional Drilling
Interval not Evaluated


BHSZ

Hydrate Prospect Example
Gulf of Mexico



Joint Industry Program (JIP)

- Led by ChevronTexaco
- Partners include US and International companies and agencies
- Major funding by the Department of Energy
- Focus on safety of offshore facilities
- Drilling & coring scheduled for 2nd Quarter of 2004

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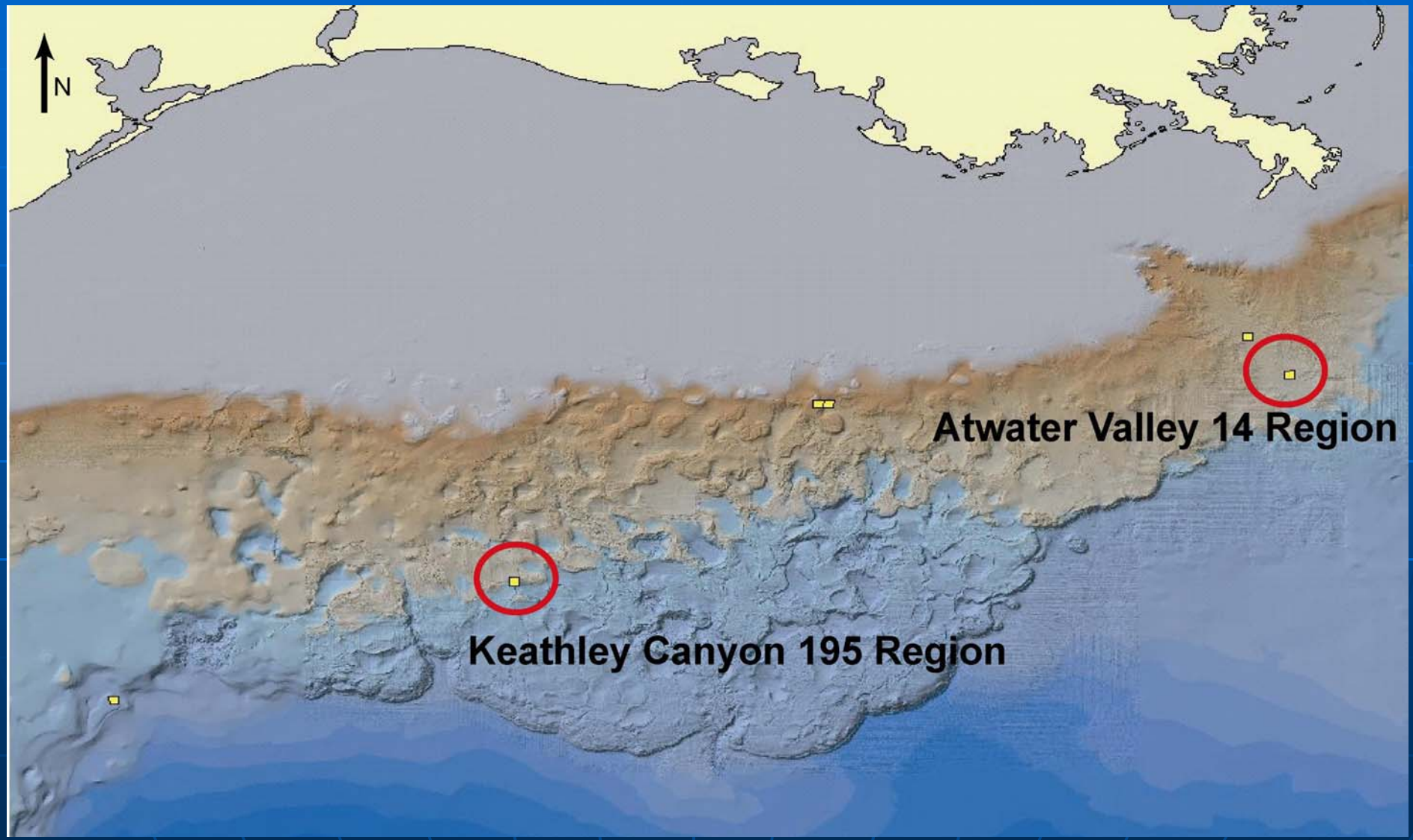
JIP Sites



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Summary

- Commercial hydrate production will (at least initially) involve producing free gas beneath the phase boundary.
- There is good evidence for sands in the Gulf of Mexico that cross the phase boundary.
- By the middle of next year the JIP should have an excellent new data set for modeling.

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