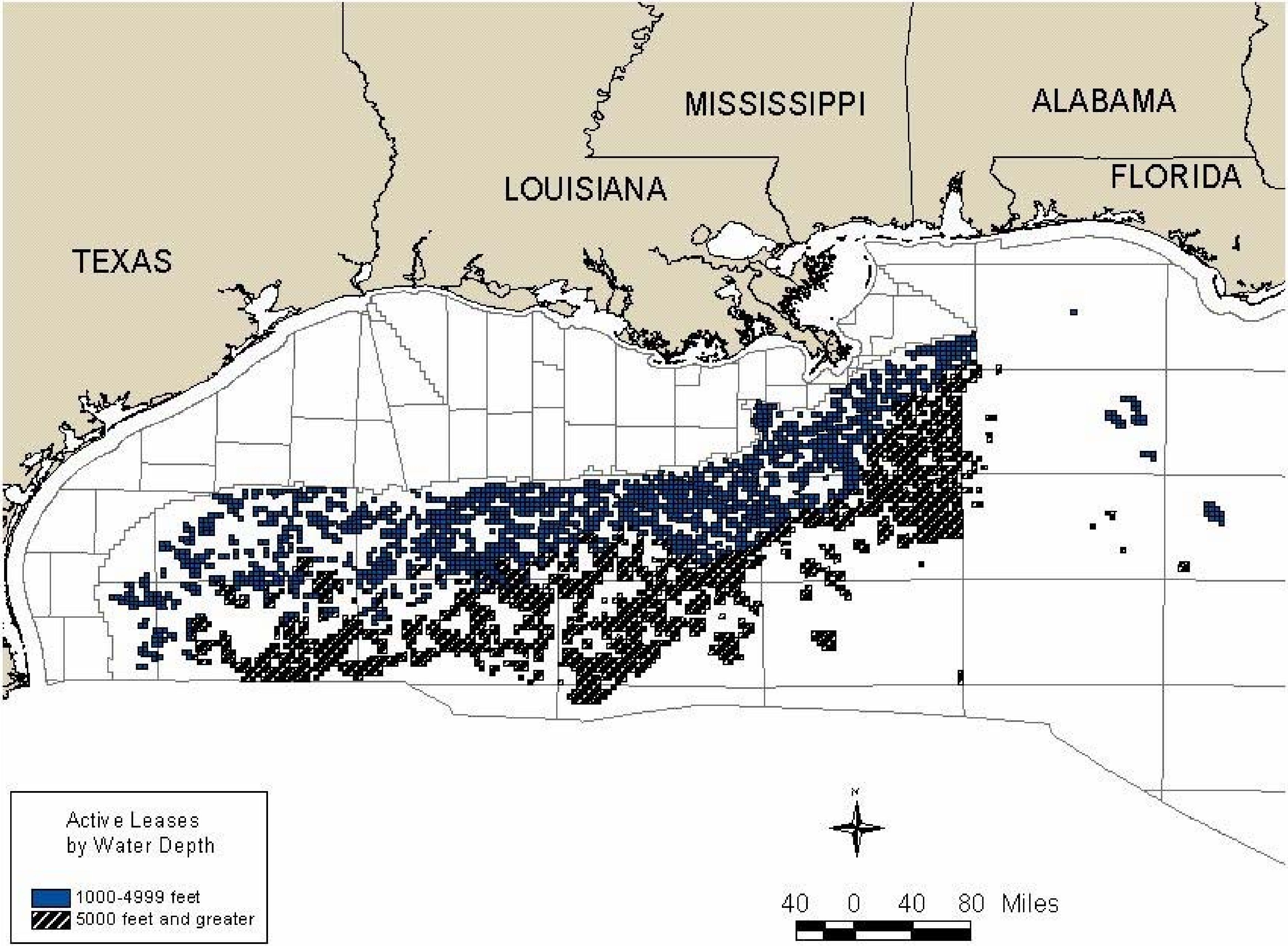
Industry, Government, and R&D - Their Roles in Commercializing Gas Hydrate

Michael A. Smith
(504) 736-2500

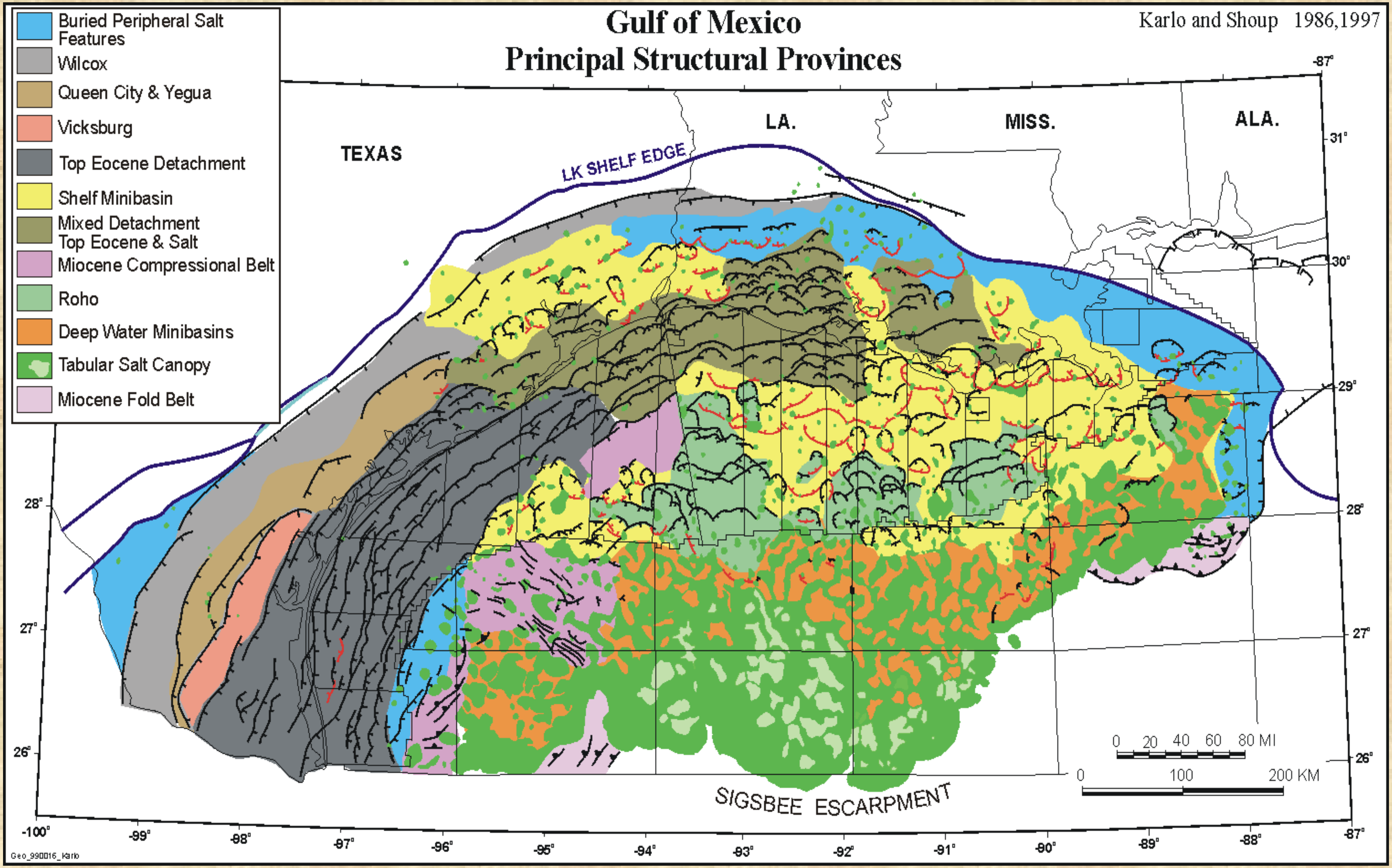
Gulf of Mexico OCS Region
New Orleans, LA

Bringing Natural Gas from Hydrate Accumulations to the Market

- Use knowledge gained from hydrate drilling programs to define the marine hydrate petroleum system
- Define methane flux (source, migration, trap) and lithology (reservoir)
- The deepwater Gulf of Mexico is an attractive province because of current E&P activity, existing infrastructure, and its effective petroleum system



MISSISSIPPI
ALABAMA
LOUISIANA
FLORIDA
TEXAS
Active Leases
by Water Depth
1000-4999 feet
5000 feet and greater
N
40 0 40 80 Miles



Minerals Management Service

Gulf of Mexico Gas Hydrates

- Occur as hydrate mounds, usually at active gas vents, and disseminated in sediment (hydrate sands?) below the seafloor
- Seafloor hydrates are not static and may pose a hazard to offshore pipelines and structures
- MMS has mapped seafloor 3-D seismic amplitude anomalies associated with hydrates, chemosynthetic communities, and carbonate hardgrounds and sampled the hydrate mounds from a submersible
- Current MMS assessment delineates areas with subsurface hydrate potential

Known Seafloor Occurrences of Hydrates

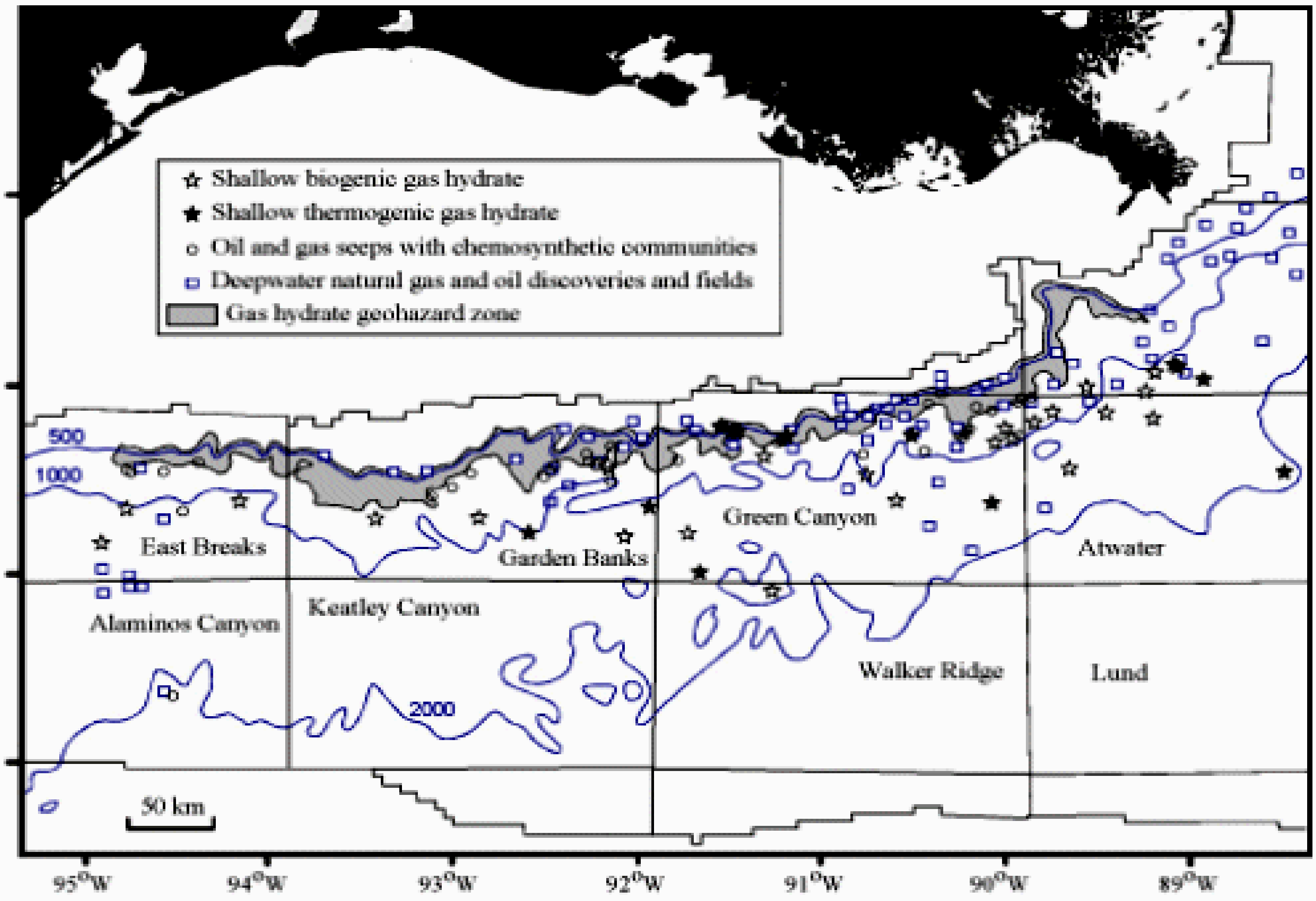
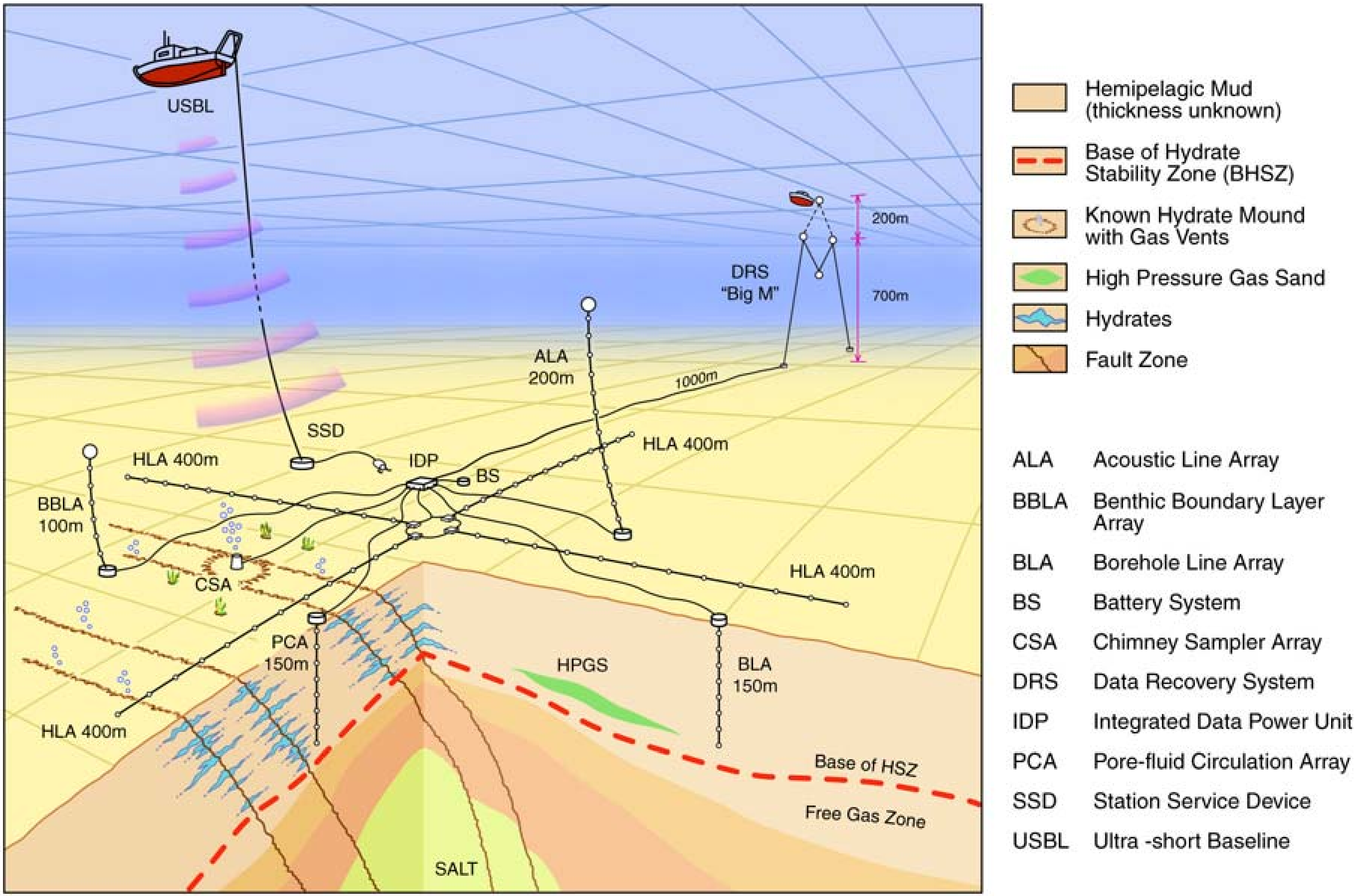


Figure 9-3 Location Map Showing Distribution of Gas Hydrate Sites, Oil Seeps, Petroleum Discoveries and Fields, and Potential Hydrate Geohazard Zone in the Gulf of Mexico Continential Slope (modified from Sassen et al., 1999a, b). Water Depth Contours are Shown in Meters (from Milkov et al., 2000)

A seafloor hydrate mound in the northern Gulf of Mexico (© Ian MacDonald)



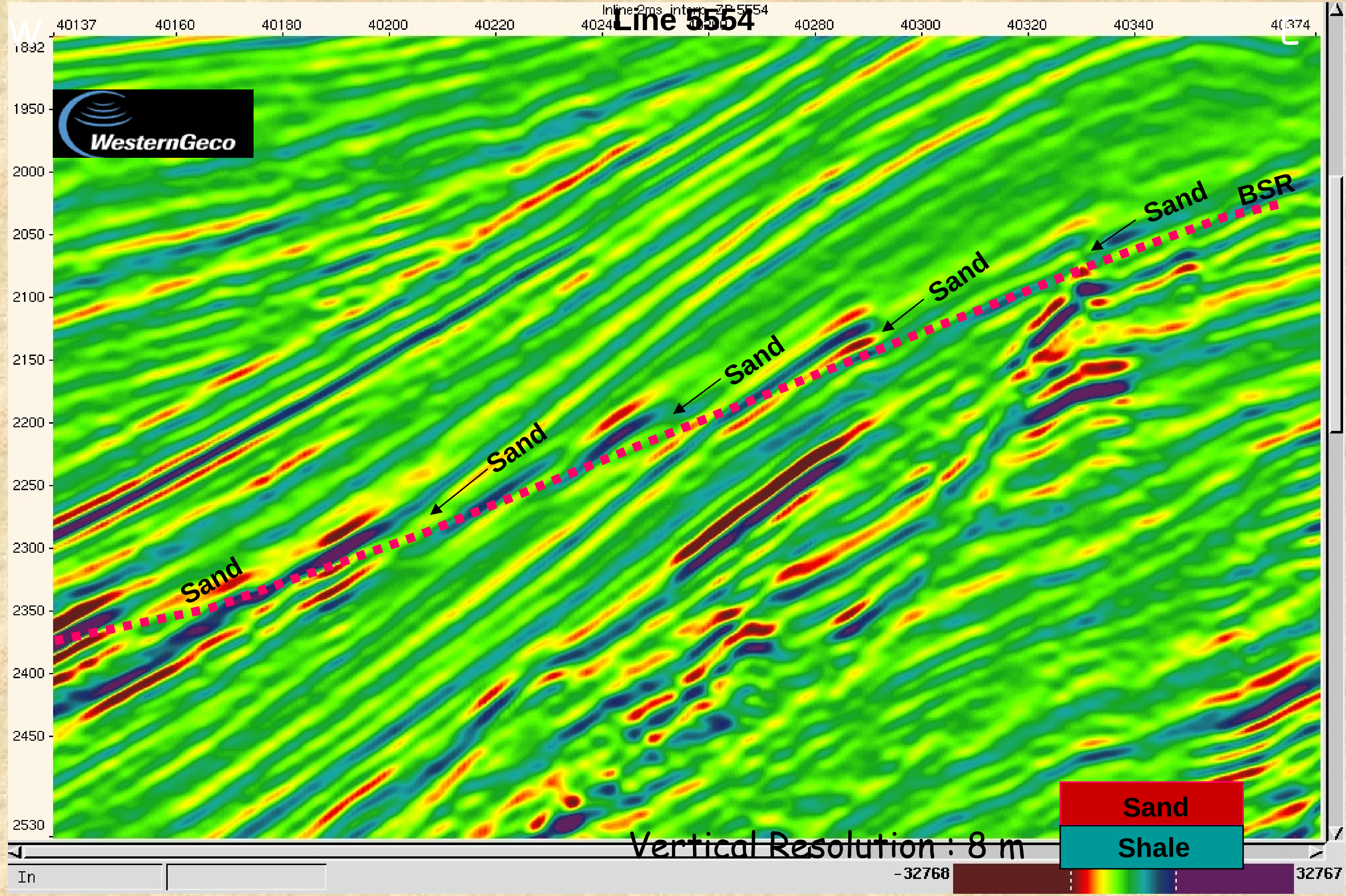
Gas Hydrate Sea Floor Observatory - Mississippi Canyon Block 118

Hydrate Production from Federal OCS Leases

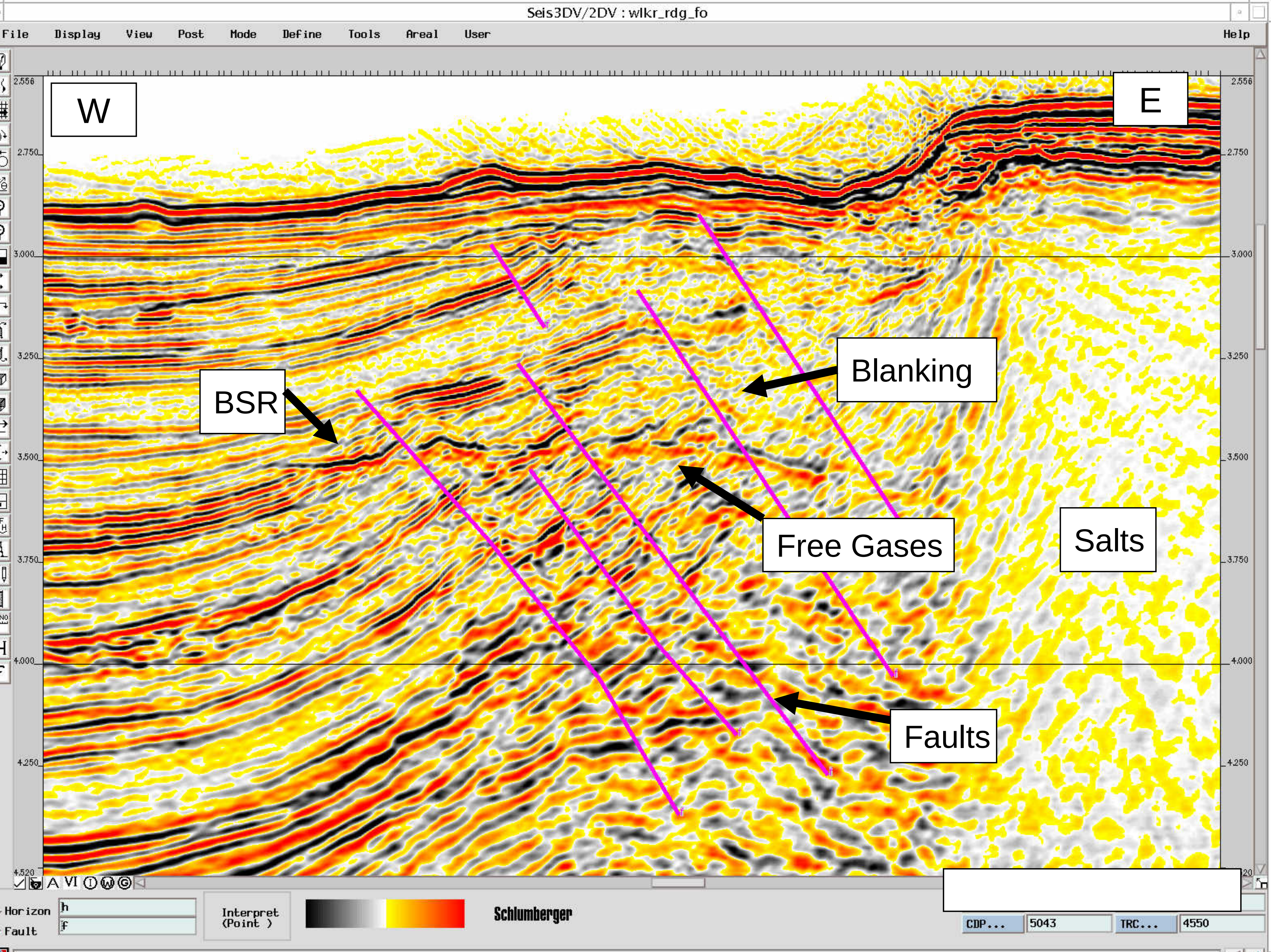
- Hydrate is part of the potential gas resource on deepwater leases
- MMS has not published a regulatory framework for hydrate development
- MMS assessment of the offshore in-place hydrate resource will provide size limits based on existing data
- The Gulf of Mexico Gas Hydrate JIP will target hydrate-bearing sands in its next drilling leg

The BSR as a Hydrate Indicator

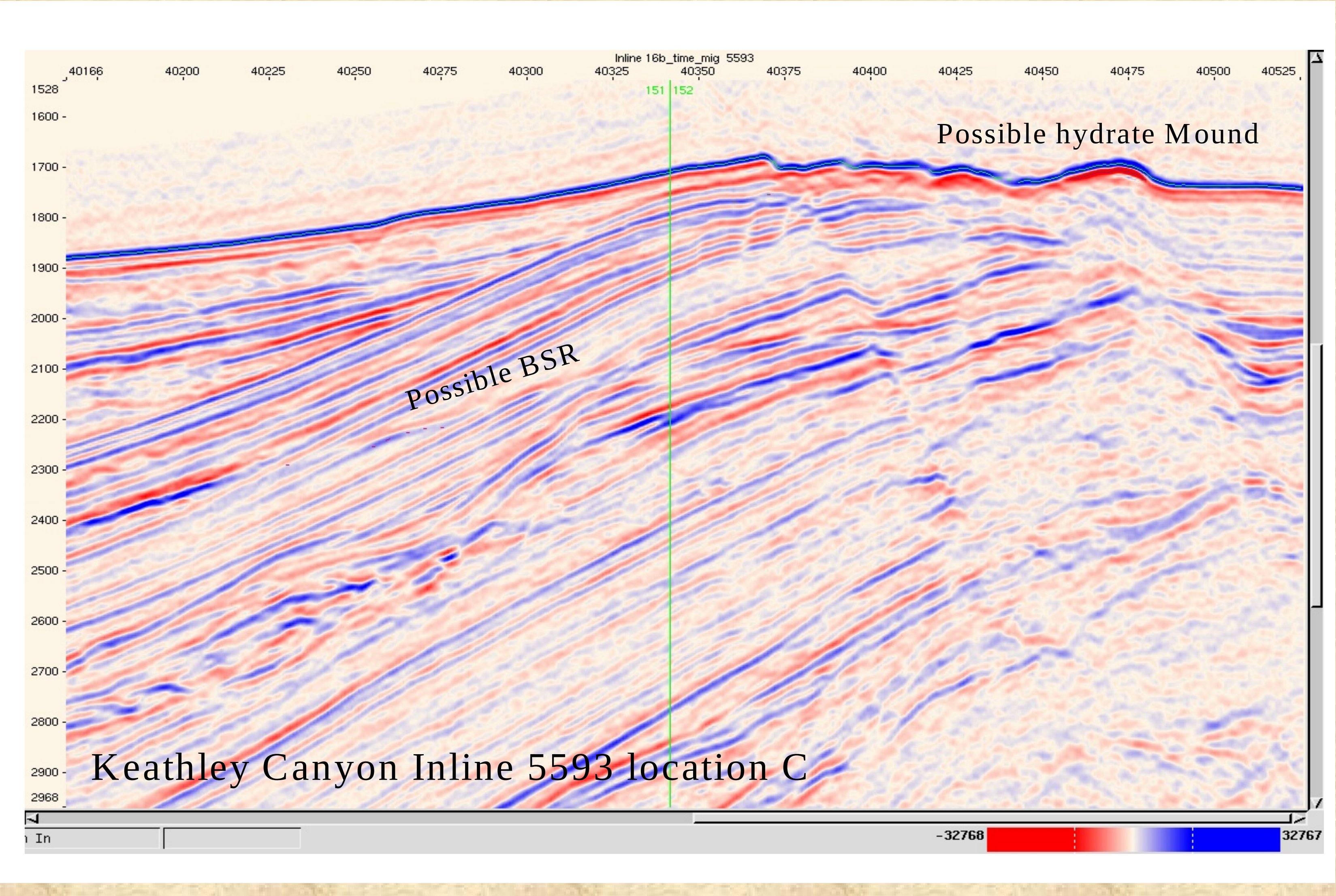
- Bottom simulating reflectors are not ubiquitous in the Gulf of Mexico
- In clayey sediments, hydrate concentrations are low and fracture or vein-filling hydrate will be difficult to produce
- A BSR indicates a phase contrast at the base of the zone of hydrate stability but doesn't define a viable hydrate reservoir
- How do we compare the Gulf of Mexico to offshore areas with well-developed BSRs?



BSR defined by termination of bright sands

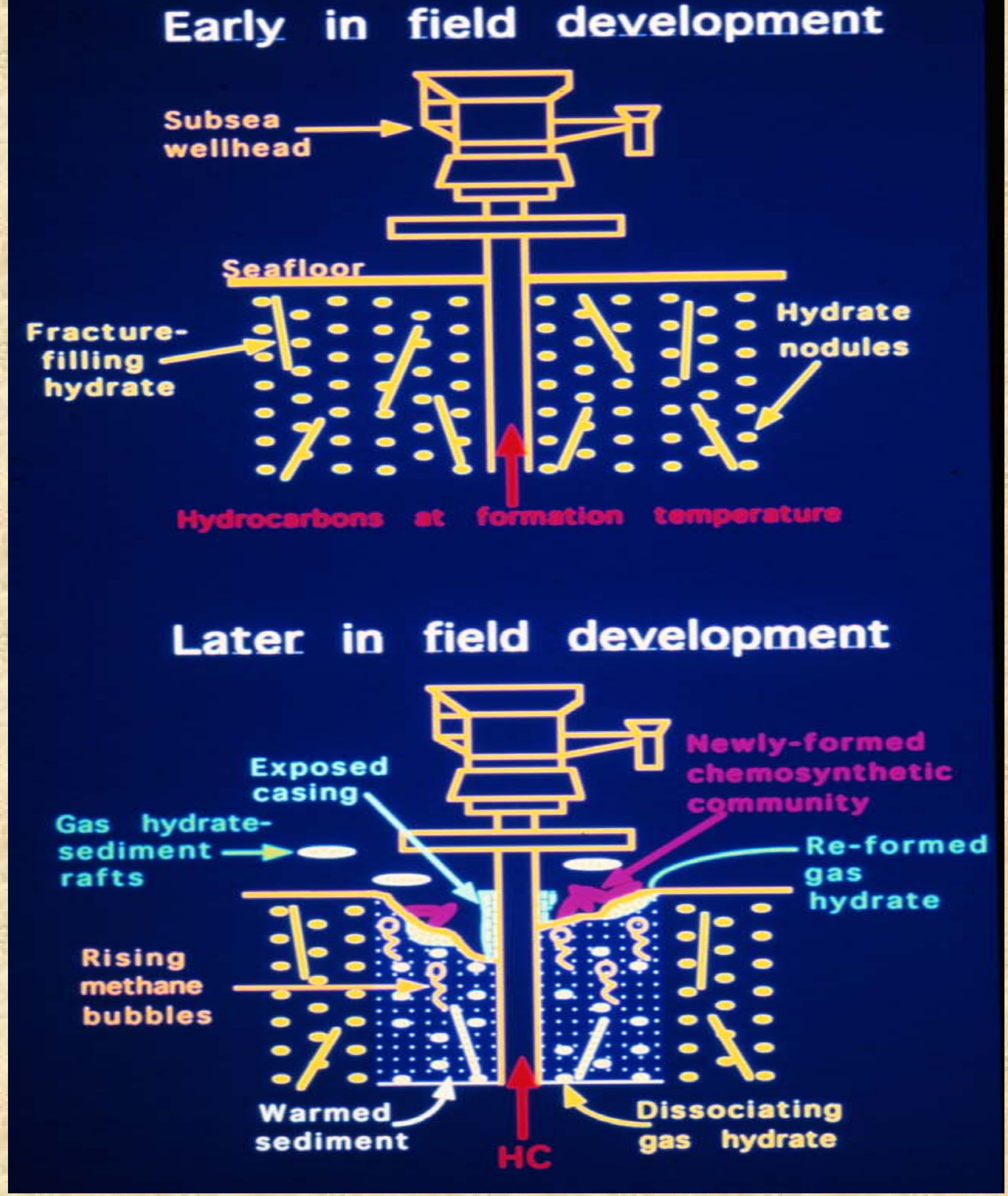


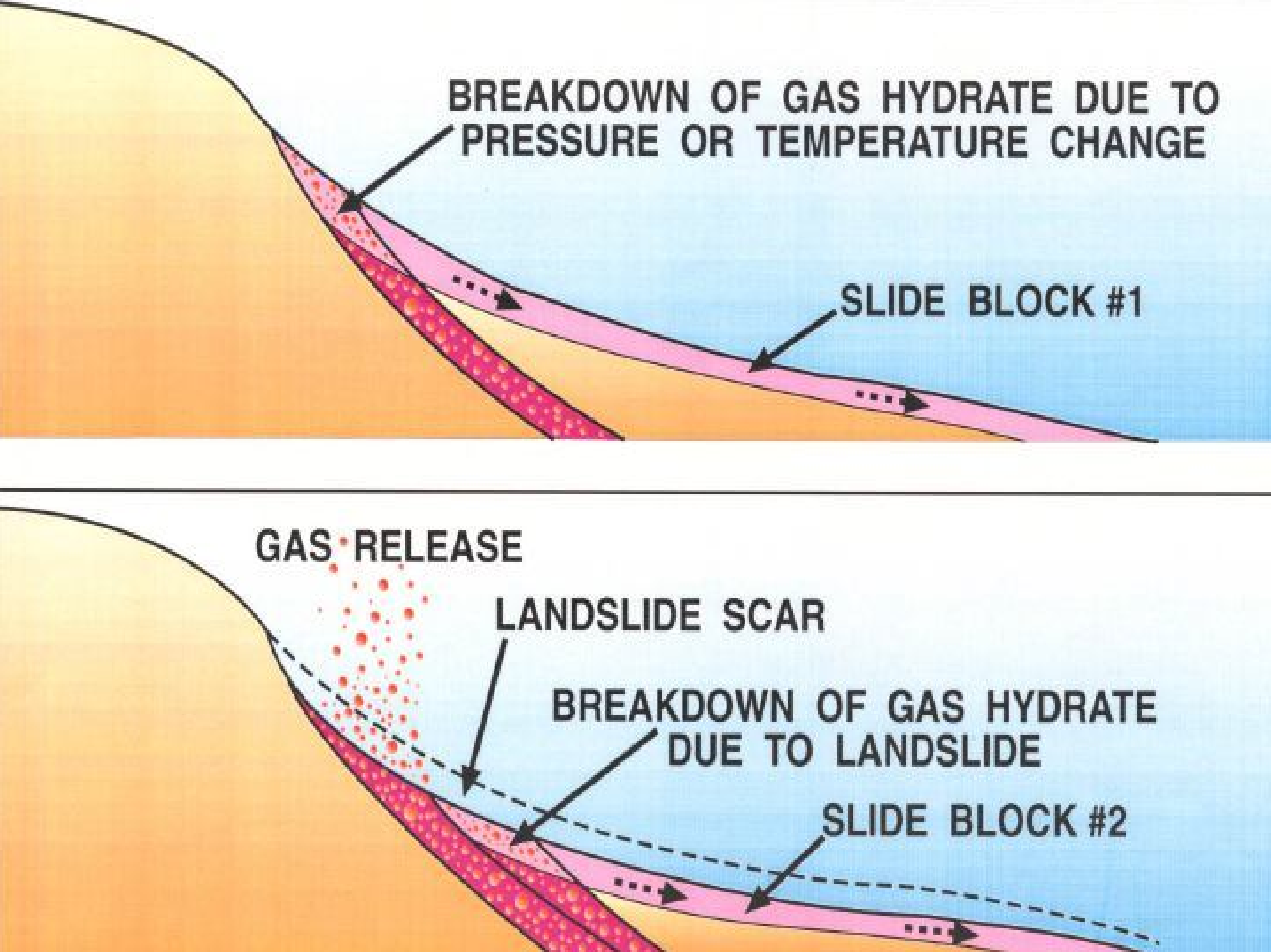
Seis3DV/2DV : wlkr_rdg_fo
File Display View Post Mode Define Tools Areal User Help
W
E
BSR
Blanking
Free Gases
Salts
Faults
2.556
2.750
3.000
3.250
3.500
3.750
4.000
4.250
Horizon h
Fault f
Interpret (Point)
Schlumberger
CDP... 5043
TRC... 4550

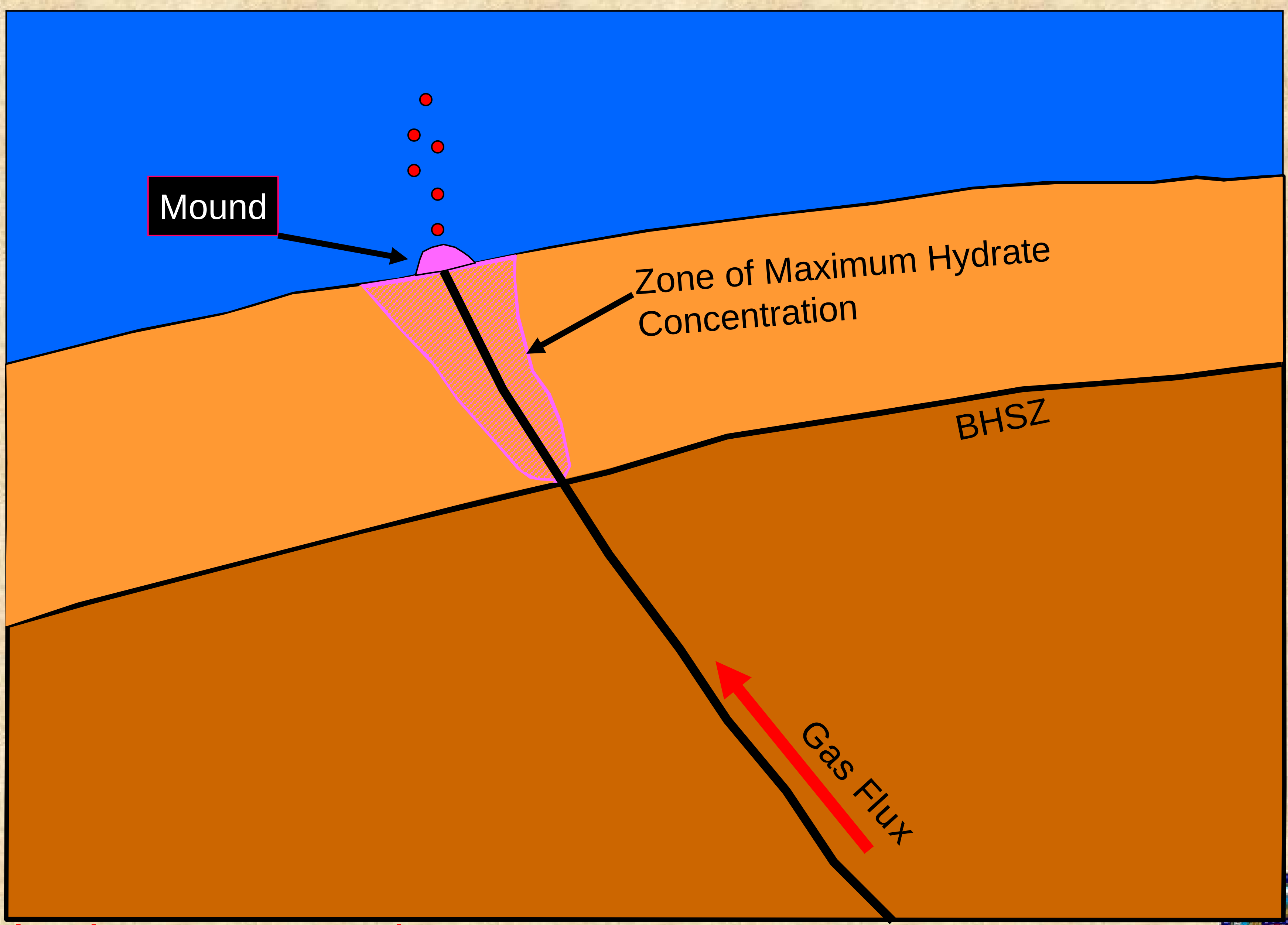

Inline 16b_time_mig 5593
40166
40200
40225
40250
40275
40300
40325
40350
40375
40400
40425
40450
40475
40500
40525
151
152
1528
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
2968
Possible hydrate Mound
Possible BSR
Keathley Canyon Inline 5593 location C
-32768
32767

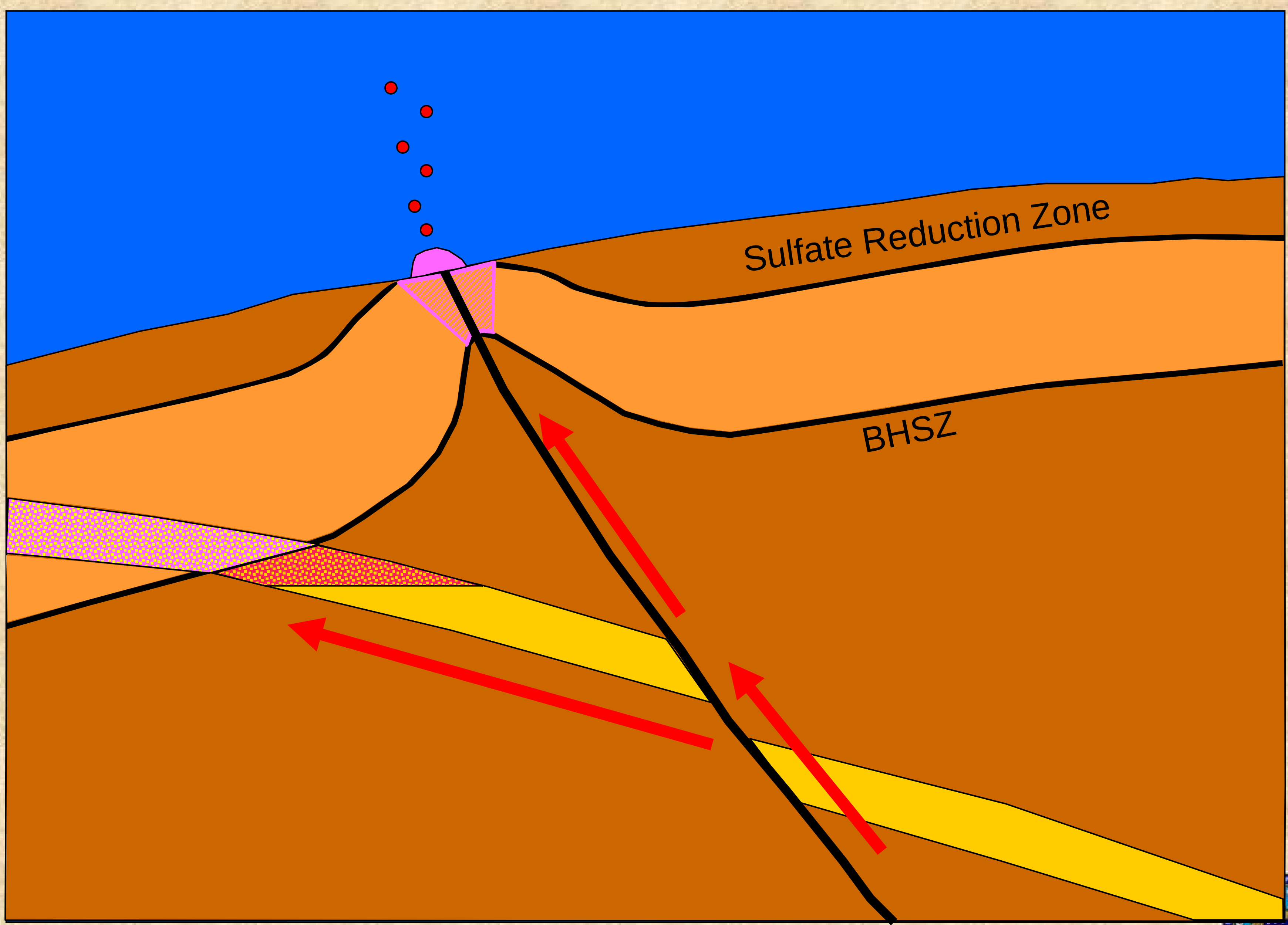
Potential Geohazards and Hydrate-Related Safety Issues

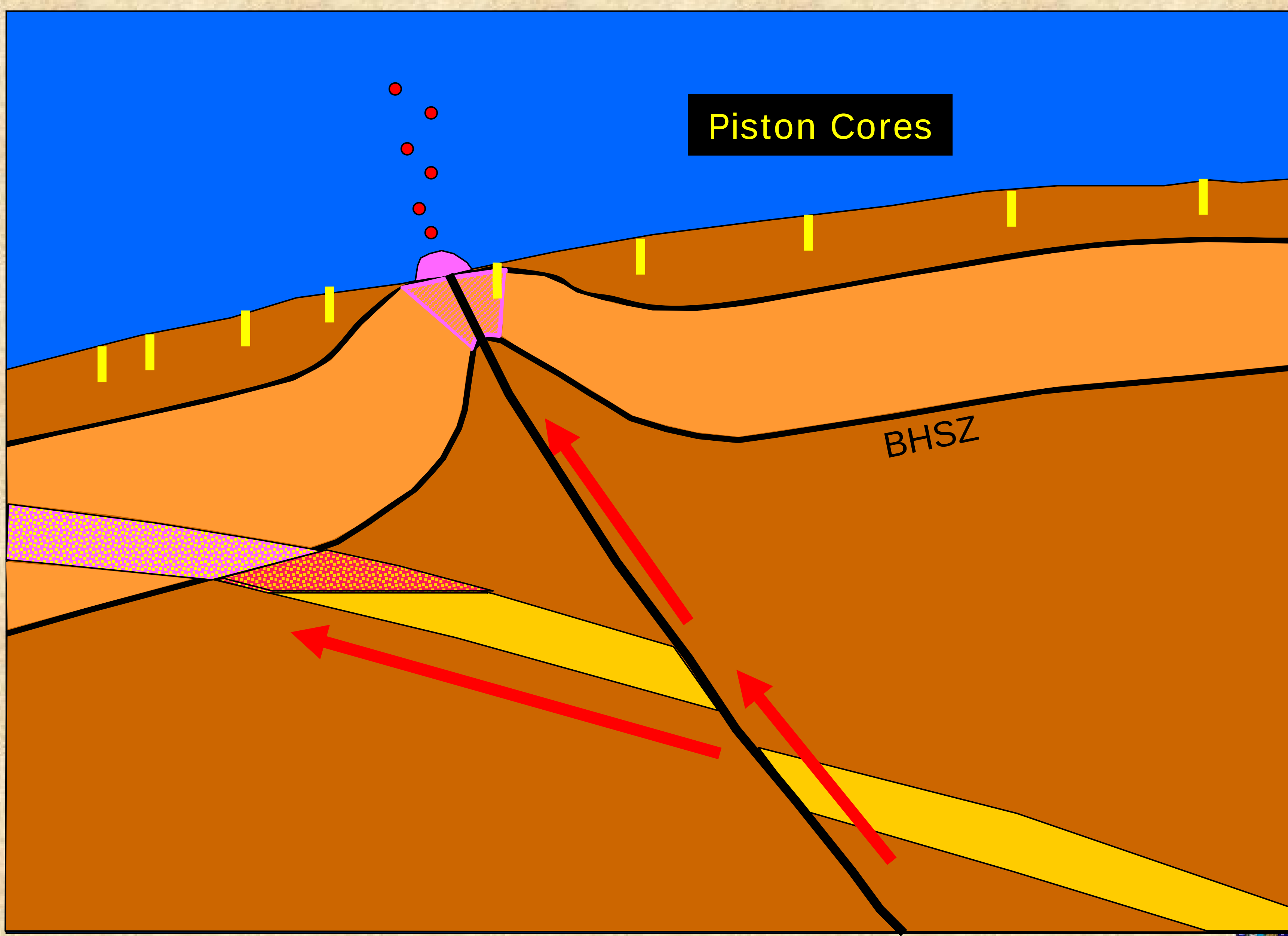
- To date, drilling through gas hydrates has not been considered a high-risk situation
- Hydrate dissociation will release free gas and weaken overlying sediments, possibly resulting in slumping
- Processing hubs, like the Shell Perdido Regional Host, will be located in areas with hydrate indicators
- Geotechnical studies are needed to define the properties of hydrate-bearing sediment and the long-term thermal effects of subsea activities

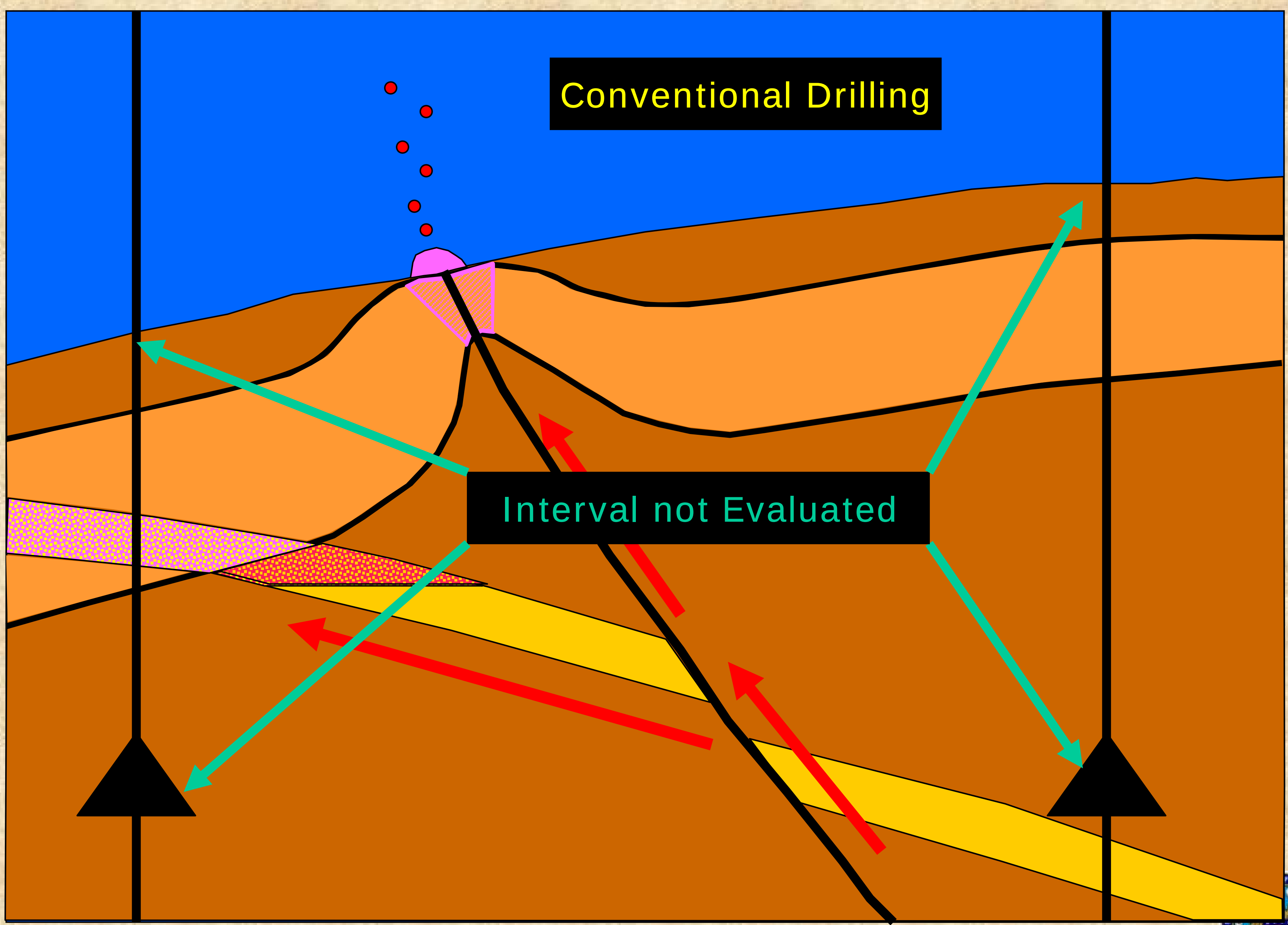

Early in field development
Subsea wellhead
Seafloor
Fracture-filling hydrate
Hydrate nodules
Hydrocarbons at formation temperature
Later in field development
Exposed casing
Newly-formed chemosynthetic community
Gas hydrate-sediment rafts
Re-formed gas hydrate
Rising methane bubbles
Warmed sediment
HC
Dissociating gas hydrate


BREAKDOWN OF GAS HYDRATE DUE TO PRESSURE OR TEMPERATURE CHANGE
SLIDE BLOCK #1
GAS RELEASE
LANDSLIDE SCAR
BREAKDOWN OF GAS HYDRATE DUE TO LANDSLIDE
SLIDE BLOCK #2


Mound
Zone of Maximum Hydrate Concentration
BHSZ
Gas Flux


Sulfate Reduction Zone
BHSZ


Piston Cores
BHSZ

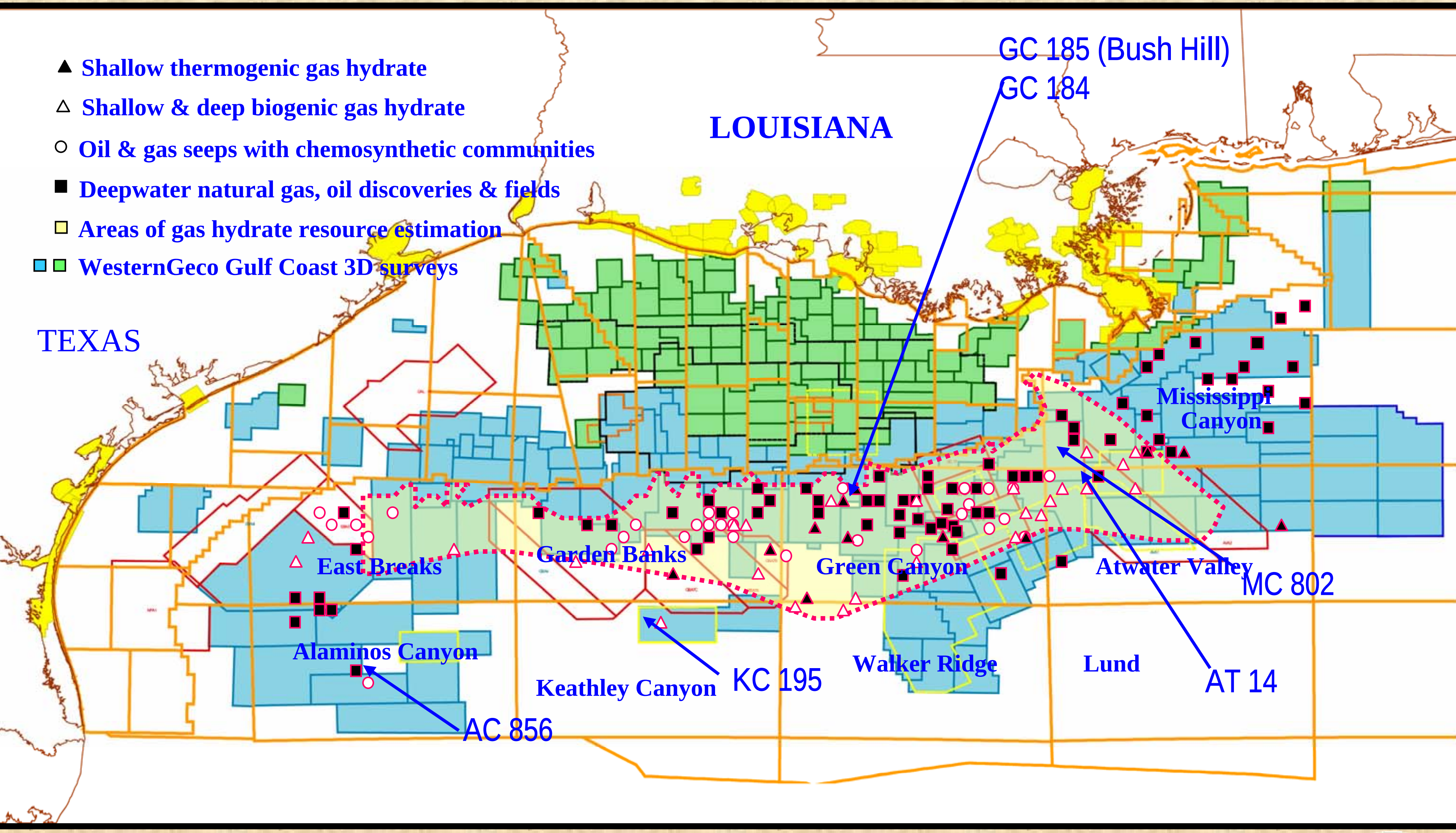

Conventional Drilling
Interval not Evaluated

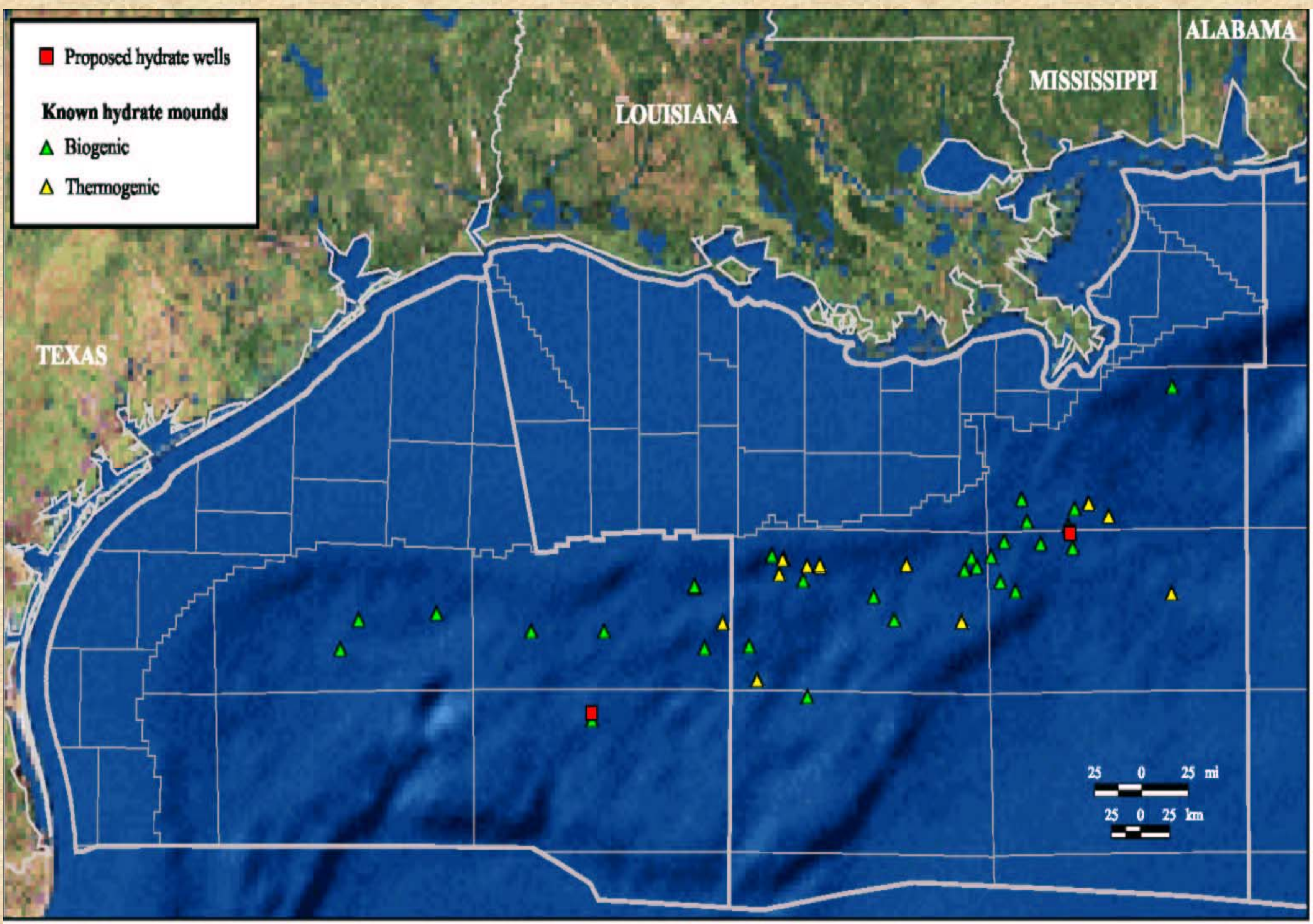
Gulf of Mexico Gas Hydrate JIP

- Five 1,000 to 2,000 ft, 8 1/2” diameter hydrate wells at two localities and two 100 ft coreholes were drilled in the spring of 2005
- A standard LWD assembly (GR/RES/DN/MR) was used to obtain as much information as tool capabilities allowed
- LWD data was used to pick coring and measurement points in offset boreholes
- Cores and electric logs from these wells provided calibration of geophysical data as well as geological and geotechnical data characterizing buried gas hydrates
- Additional drilling is planned in 2007 and 2008

Cal Dive DSV *Uncle John*

WesternGeco Non – Exclusive 3D Surveys With Known GOM Gas Hydrate Locations




Proposed hydrate wells
Known hydrate mounds
Biogenic
Thermogenic
LOUISIANA
MISSISSIPPI
ALABAMA
TEXAS
25 0 25 mi
25 0 25 km

New Technology Requirements for Hydrate Commercialization

- Hydrate cannot be produced as shale gas or from tight sands
- Sands crossing the base of hydrate stability can be produced with existing technology
- Developing E&P technology is the key for hydrate production
- “If this were gold, everyone would have a shovel. Science is important, but it is technology that drives the Japanese and Indian programs which are the most proactive.” (Ken Wright, 5th International Workshop on Methane Hydrate R&D, October 2006)

Hydrates Path Forward

- Cooperation between industry operators, government agencies, and other stakeholders is needed to accelerate the path to hydrate commercialization
- Most new hydrate E&P technology will probably be developed at universities, government laboratories, and other organizations with financial support from industry and the federal government
- Production tests are needed to prove the viability of hydrate as a resource