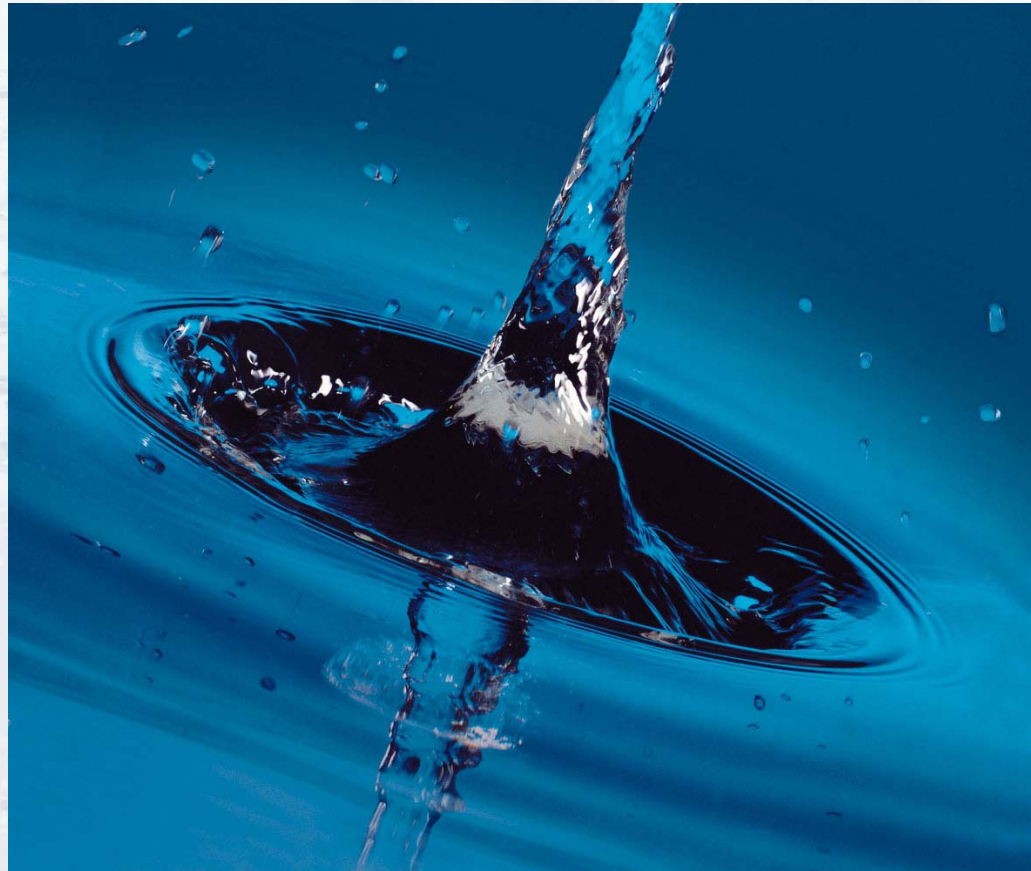


Water Control Needs for the Wells of the 21st Century

Richard Hutchins

Schlumberger



Current and future wells: a general characterization

More horizontal sections: some without cemented casing

Subsea completions with pipelines to a gathering system

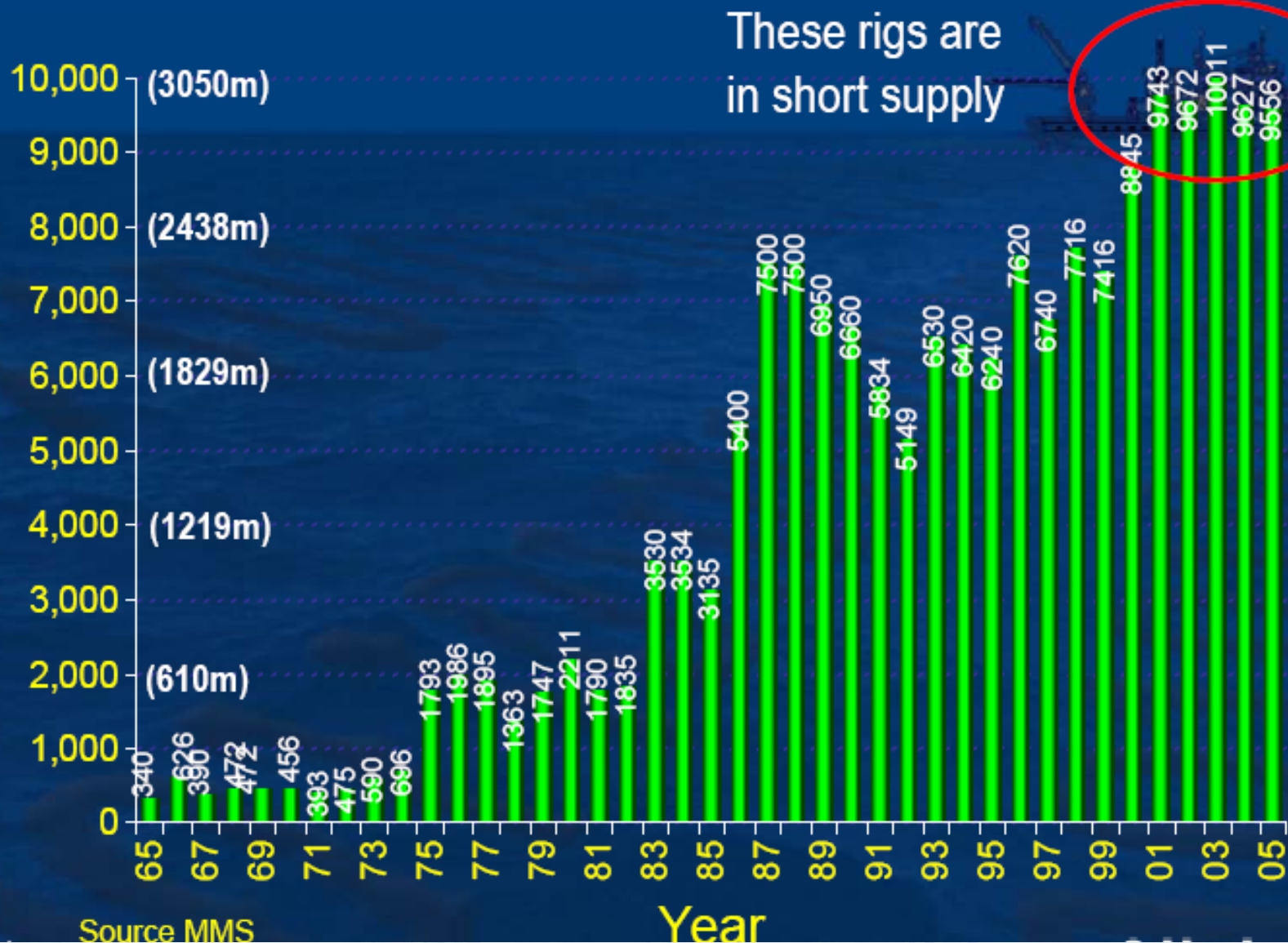
High rate producers which may begin sanding when water production starts

Heavier oil wells

Deeper and hotter gas wells

Maximum Water Depth

Maximum Water Depth (ft and m)



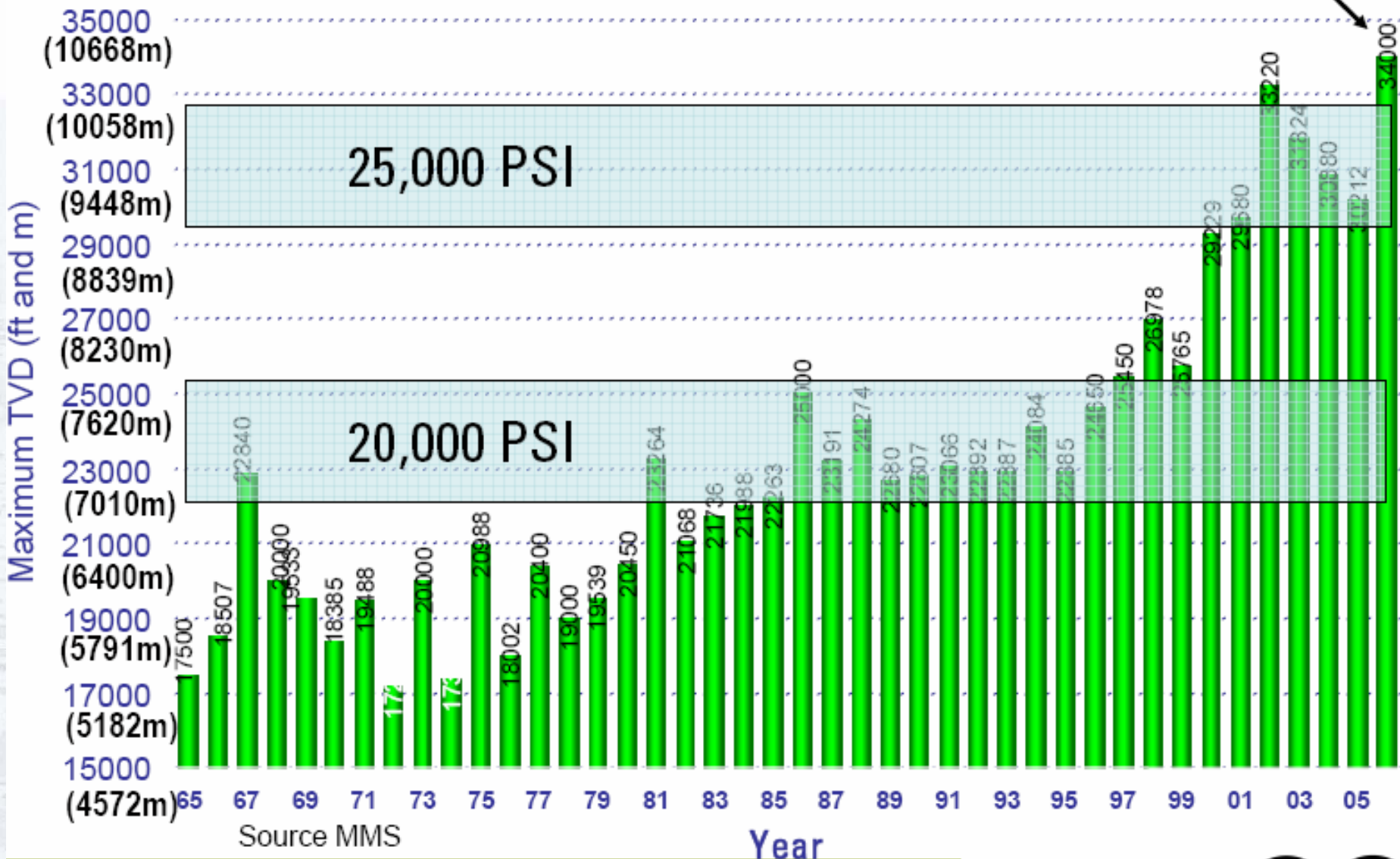
Source MMS

Year

GOM USA Maximum Well Depth

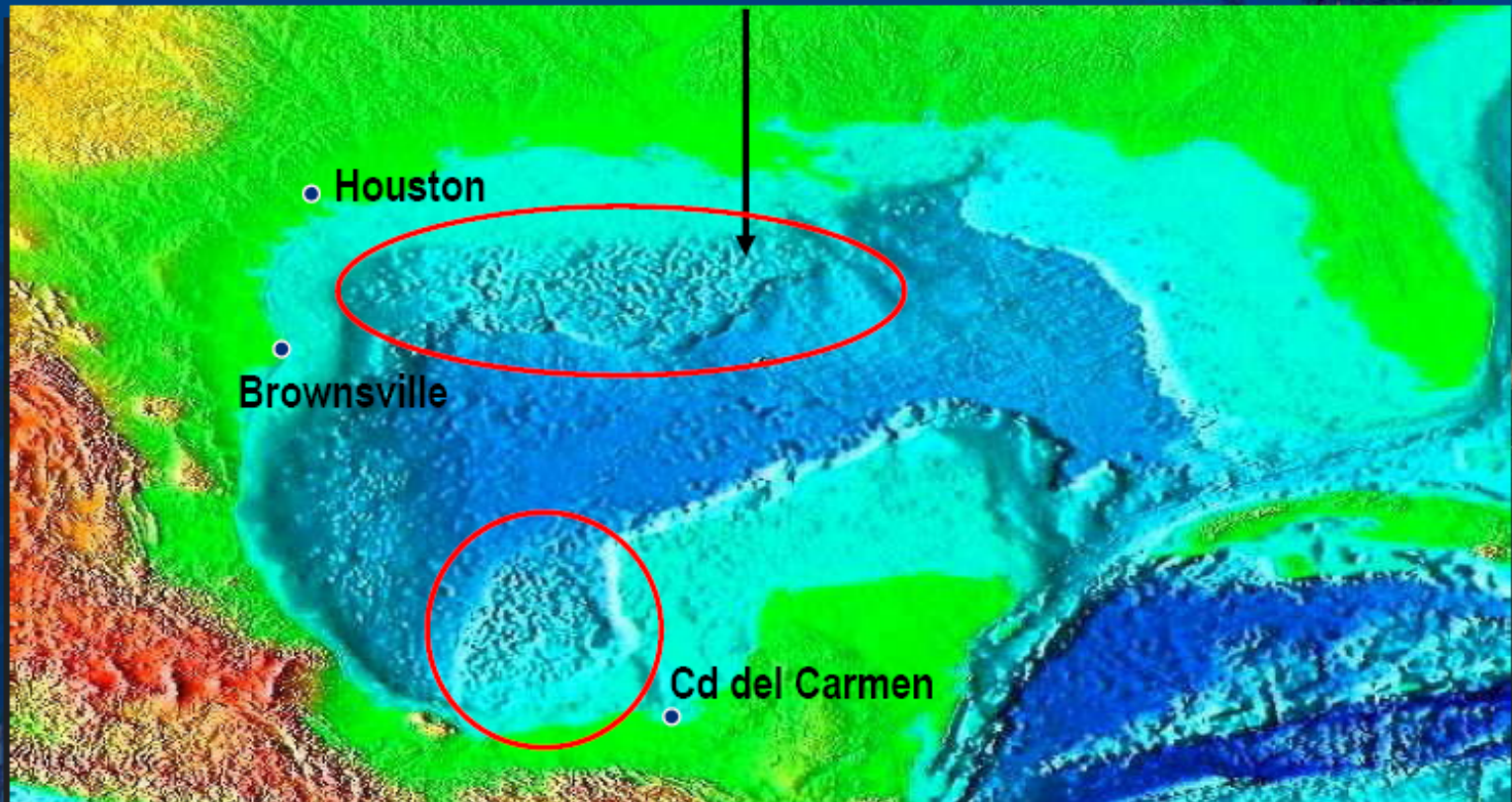
10,363 m

GOM Record



Deepwater GOM in Global Perspective

Gulf of Mexico



From: <http://www.staff.amu.edu.pl/~zbow/glob/glob1.htm>

Scale formation and prevention

Main concern is for scaling of wellbores and pipelines
Access is extremely limited for satellite wells or subsea completions
Scale inhibition techniques have been researched but new methods with longer lasting effects are needed for isolated wellbores.

Hydrates

Hydrates, which require water to form, represent a serious problem as they can offer serious pressure control issues when sudden melting occurs.

- Expected from satellite wells with lower temperatures in the flowlines
- Expected in main lines flowing to shore or FPSO vessels

Prevention strategies can use further development

Suggested Topics for Hydrate Mitigation

Develop better kinetic inhibitors

- Bind them in place with slow release at effective concentrations

Remove water to prevent hydrate formation

- Reaction of water with added chemicals
- Removal via mechanical methods

Shallow Water Flows

Cause casing collapse and loss of wellbore integrity

Must be addressed during drilling

Can be located using 3D seismic

Some solutions involve gels to stabilize the sand

Pipeline Ideas

Coated or smooth pipe to force precipitates into an amorphous state that can be transported and not deposited

Reduce friction loss via coating

Reduce friction by a combination polymeric hydrate inhibitor and drag reducer

Keeping fluids warm

Examine methods for minimizing heat loss for long pipelines to prevent icing.

Develop a “hand warmer” chemistry to heat fluids and prevent hydrate formation inside the pipe.

Investigate water absorbing material that could be used in pipeline spool bypasses which are installed every few miles. Spool could be isolated and regenerated periodically without shutting down the flow.

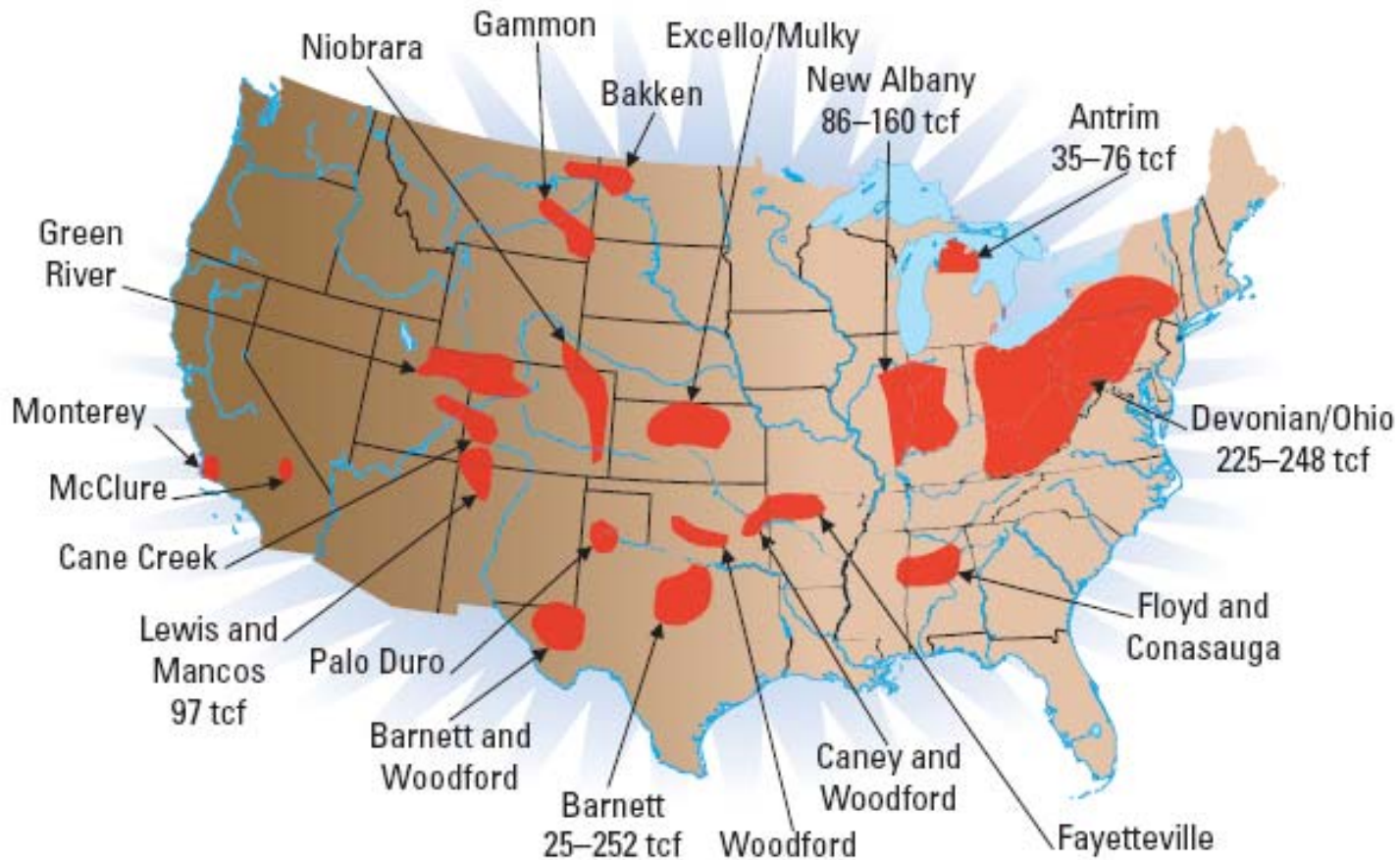
Unconventional Gas Production



Much of the unconventional gas is found in tight shales.

Shales are well known to have compatibility problems with water in reservoirs and during drilling.

Yet, we commonly fracture shales with water-based fluids and have no understanding of their impact on damage to the permeability.



Major shale gas basins in the United States with total resource potential of 500 to 1,000 tcf.

Shale compatibility project

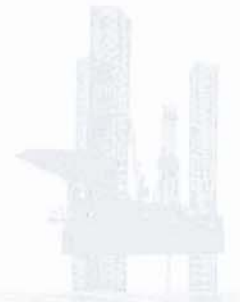
Determine a method for sampling the shales without exposure to damaging water-based fluids

Establish a protocol for shale analysis to predict water sensitivity

Conduct tests to demonstrate compatibility of shale with various fluids – brines, water with inhibitors, alcoholic fluids, etc.

Recommend new base fluid for stimulating shales by fracturing or an inhibiting fluid to use as a prepad

SUMMARY



Some thoughts on Water Control

Improved diagnostic tools are needed

- A water detection log that can be run in pumping wells
- Prediction methods for anticipating water problems and correctly defining the underlying cause
 - Expert systems: cased base reasoning, neural networks
 - Useful for the novice
 - Leads the user to a logical solution based on input data

More advanced fluid systems for shutting off water

Selective fluids that do not harm mixed oil/water layers

Better delay chemistry for right angle sets on demand

Lower viscosity fluids for ease of application
through small diameter tubing/orifices

Green chemicals with less environmental footprint

Stronger gels to reduce volumes needed

Diversion techniques for small volume chemicals and
long treatment intervals

Techniques to cleanup horizontal wells



Many wells have production from a small portion of the well length which limits sweep and recovery

Drilling and completion damage removal needed that works along entire length of well

Isolation techniques in uncased holes to treat water problems and early water breakthrough

- Applied during well construction for future use
- Applied in a remedial fashion when a problem arises

Deep Water Ideas Summary



Investigate non-interventional methods for extending scale inhibition other than traditional squeeze treatments

Focus on hydrate prevention by removing access to water or kinetically inhibiting the hydrate formation

Develop pipe coatings that prevent scale deposition and reduce friction, including a combination drag reducer and inhibitor.

Investigate methods to absorb water or separate it from gas flow and find ways to chemically heat ice plugs

Unconventional Gas Summary

The background of the slide features a composite image. The upper right portion shows an offshore oil platform with several tall derrick structures against a light sky. The lower portion is a satellite-style map of a coastal area, likely the Gulf of Mexico, showing intricate patterns of land, water, and possibly oil fields or infrastructure.

Develop methods for sampling, characterizing and predicting compatibility between shales and water-based stimulation fluids