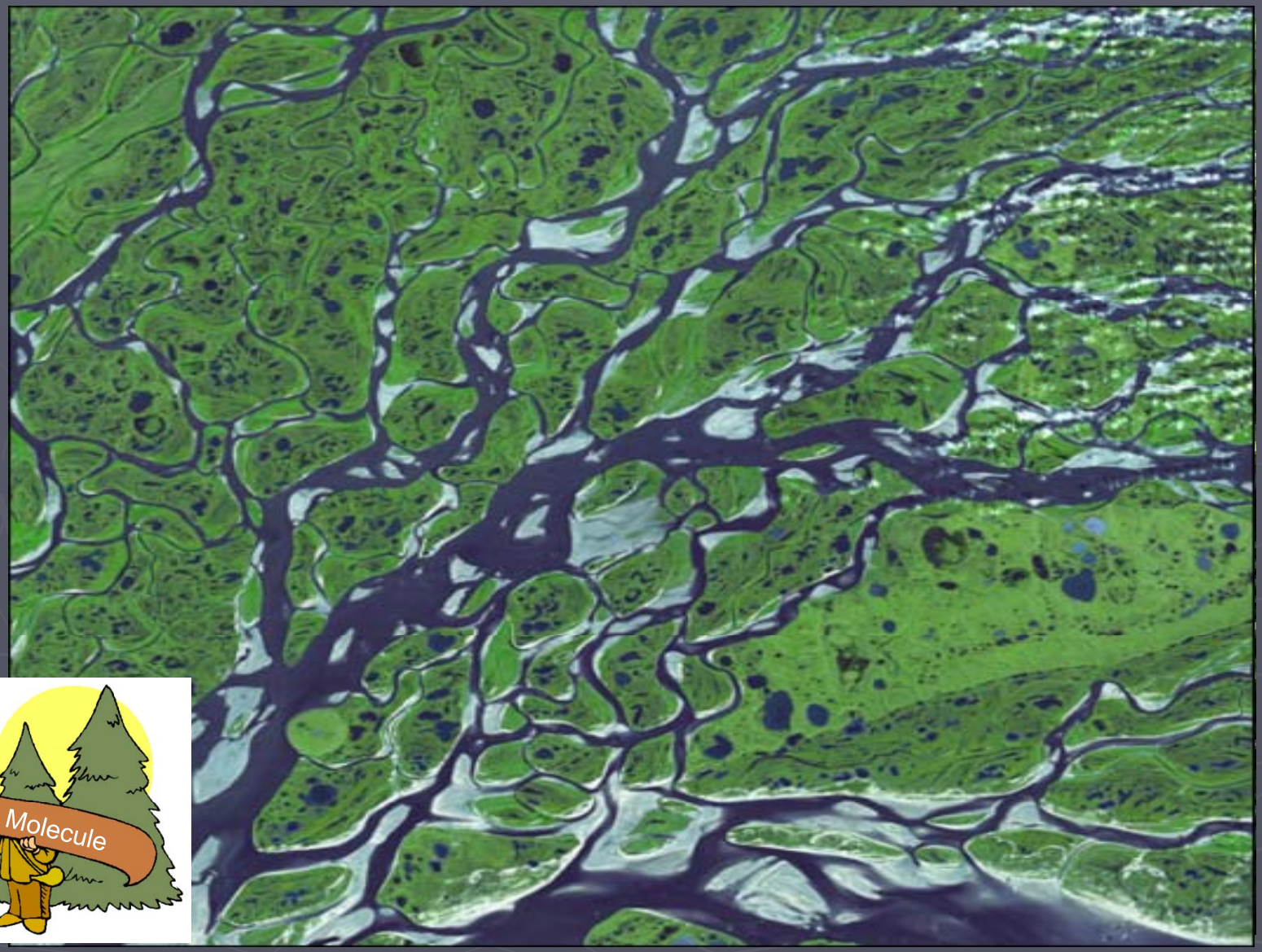
Peters & Co
2010 Energy Conference

Hydraulic Fracture Stimulation in Unconventional Reservoirs

Lake Louise, AB

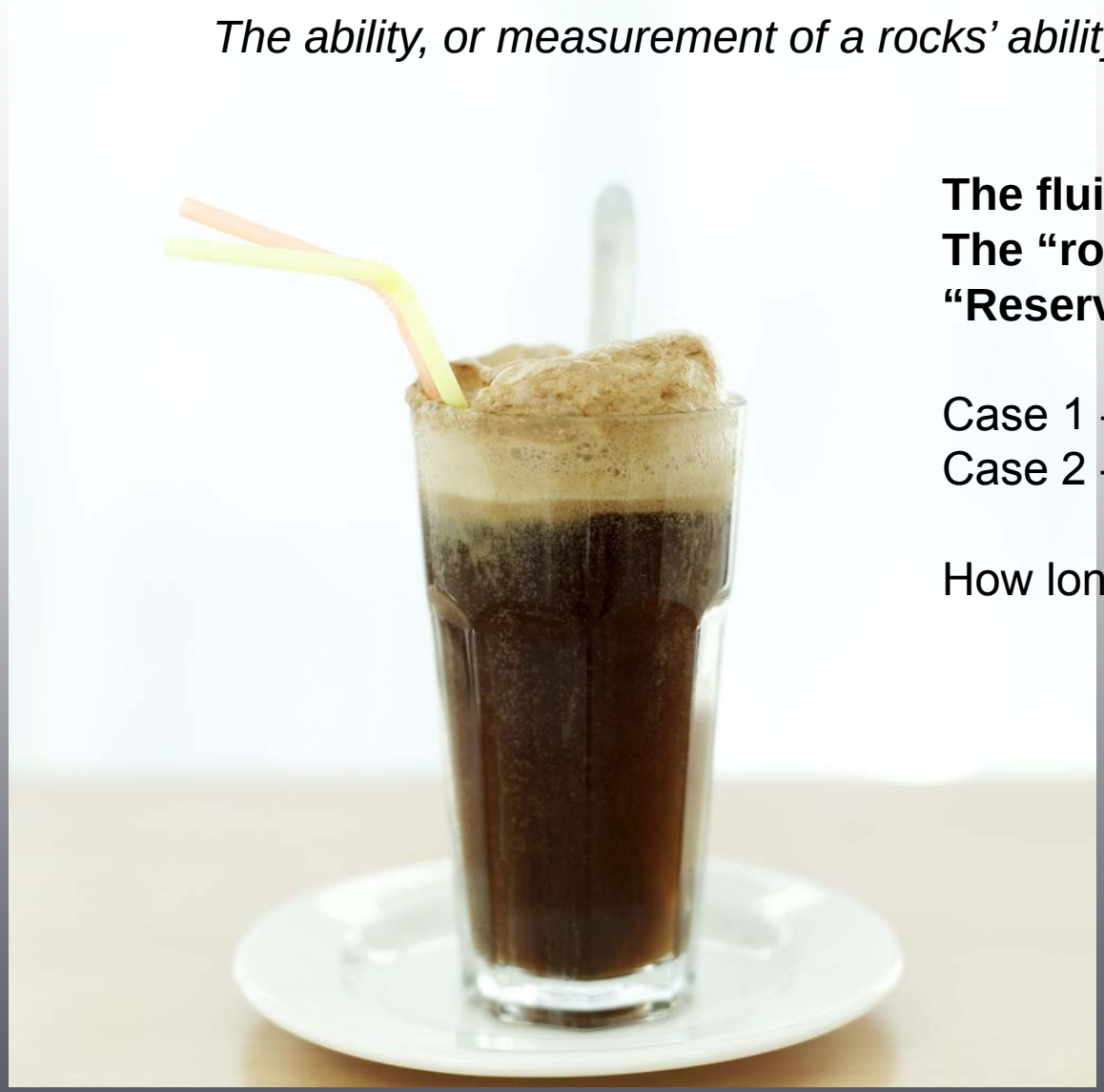
January 28, 2010

Evolution of Fracturing



Permeability – How big is the difference?

The ability, or measurement of a rocks' ability, to transmit fluids



The fluid: 12 oz of your favorite soda
The "rock": 8" long straw
"Reservoir Pressure": 15 psi (1 atm)

Case 1 - Permeability = 1 milliDarcy
Case 2 - Permeability = 1 nanoDarcy

How long to drain the "reservoir"?

Case 1: 527 days

Case 2: 9,624 years

Expertise Shift

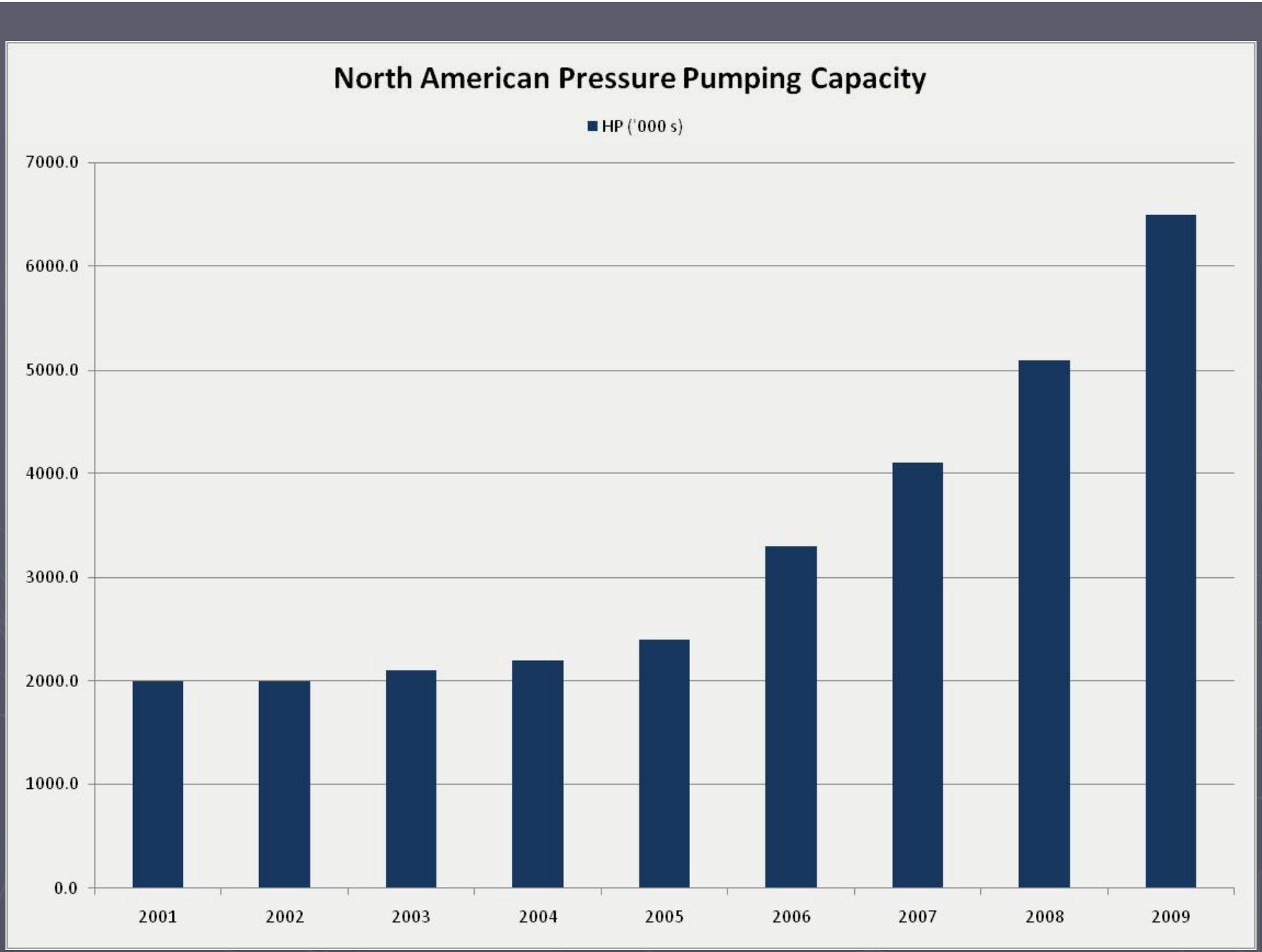
- Conventional reservoirs required specific types of expertise
  - Reservoir exploitation
  - Locating structures and stratigraphic traps
  - Defining fluid contacts
- Unconventional reservoirs shift focus to the completion – primarily hydraulic fracturing

Fluid Systems

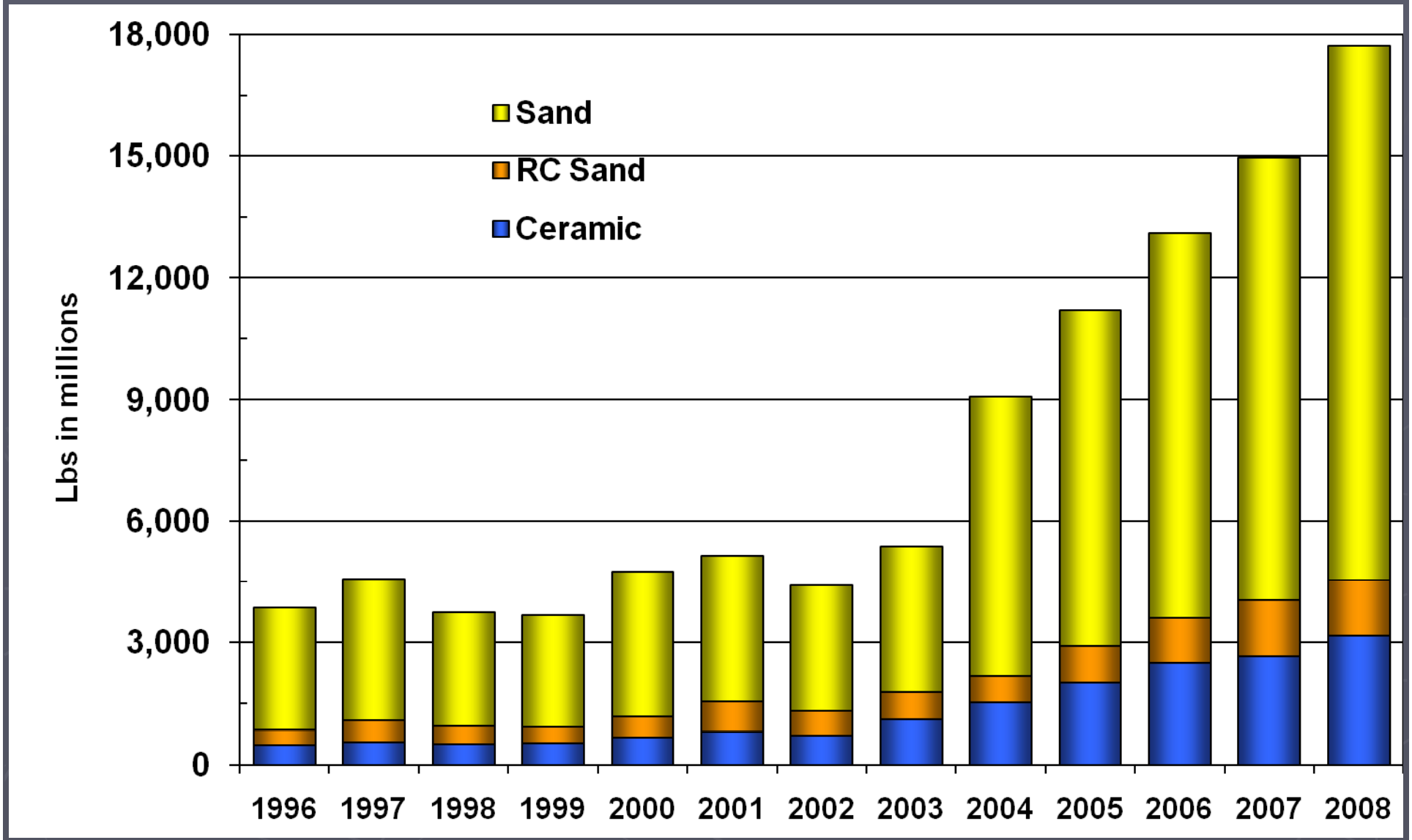
- Shale gas stimulation being done with slickwater systems
  - Inexpensive
  - Little or no damage
  - Poor proppant transport
  - Less fluid testing typically required

Job Design

- Significantly increased fluid volume
- Significantly increased rate
- Low sand concentrations
- Increased number of stages
- Less concern about proppant strength
- Less expensive fluid systems


North American Pressure Pumping Capacity
HP ('000 s)
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
2001
2002
2003
2004
2005
2006
2007
2008
2009

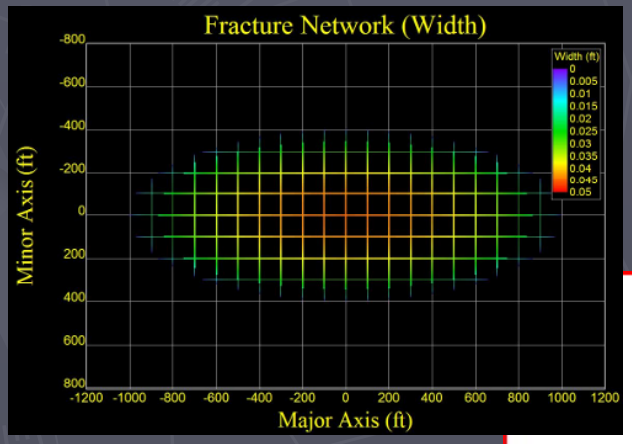
Worldwide Proppant Utilization



Source: CARBO Ceramics and PropTesters, Inc. 2006 Proppant Market Study

Current Challenges

- Public perception
- Current models limited in ability
- Environmental considerations
- Logistical considerations
- The McFrac...



Courtesy Meyers & Associates

"We've not included any drilling in New York while we wait to see how the environmental issue gets resolved."

TALISMAN ENERGY PRESIDENT AND CEO JOHN MANZONI

Fracking under fire

Opportunities

- Optimization of stimulation design
  - Better models/advanced understanding
  - Integration with reservoir simulators
  - Microseismic and other monitoring technologies
  - Increased aerial contact
    - More stages
    - More complex fractures
  - Improved proppant transport