Natural Gas Exploration Potential in the Alaskan Arctic

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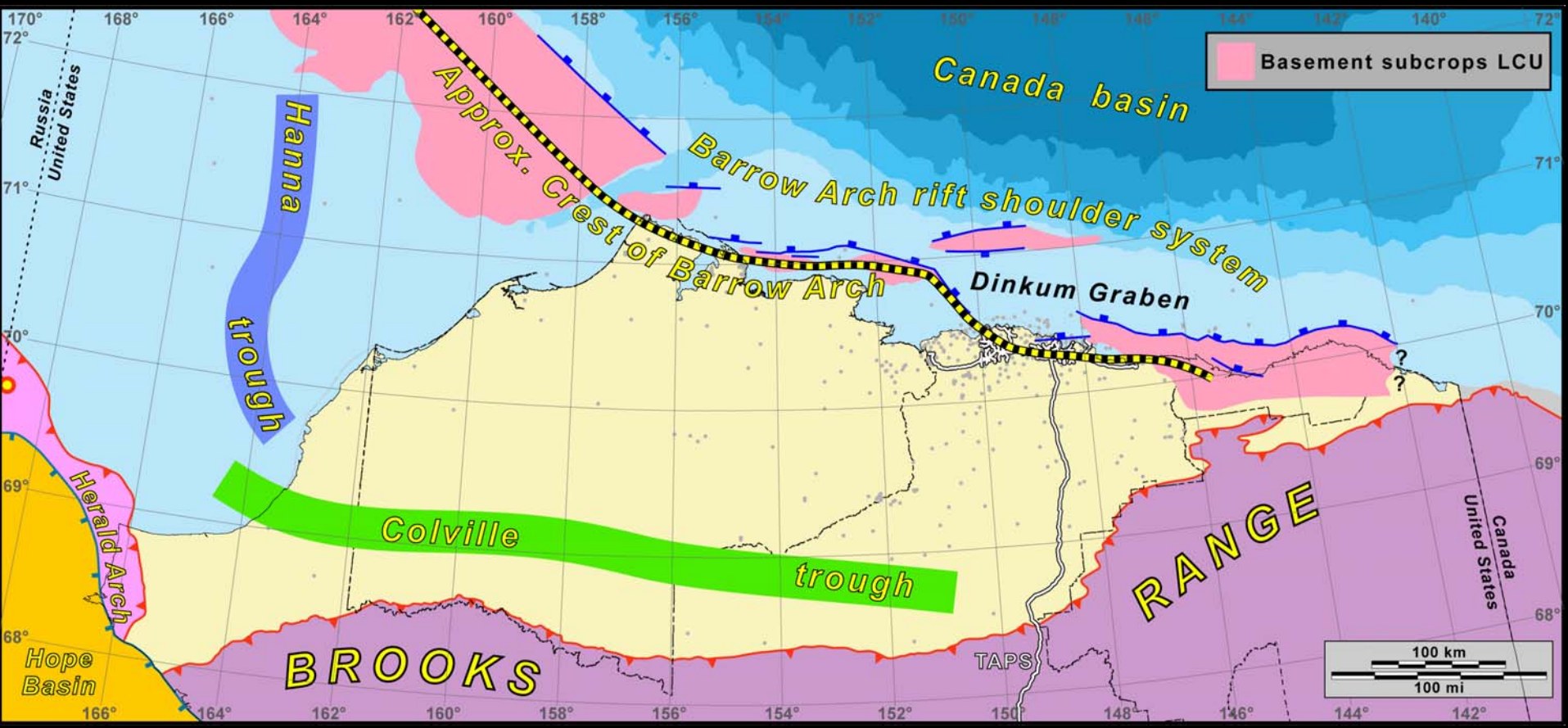
ALASKA GEOLOGICAL AND GEOPHYSICAL SURVEYS

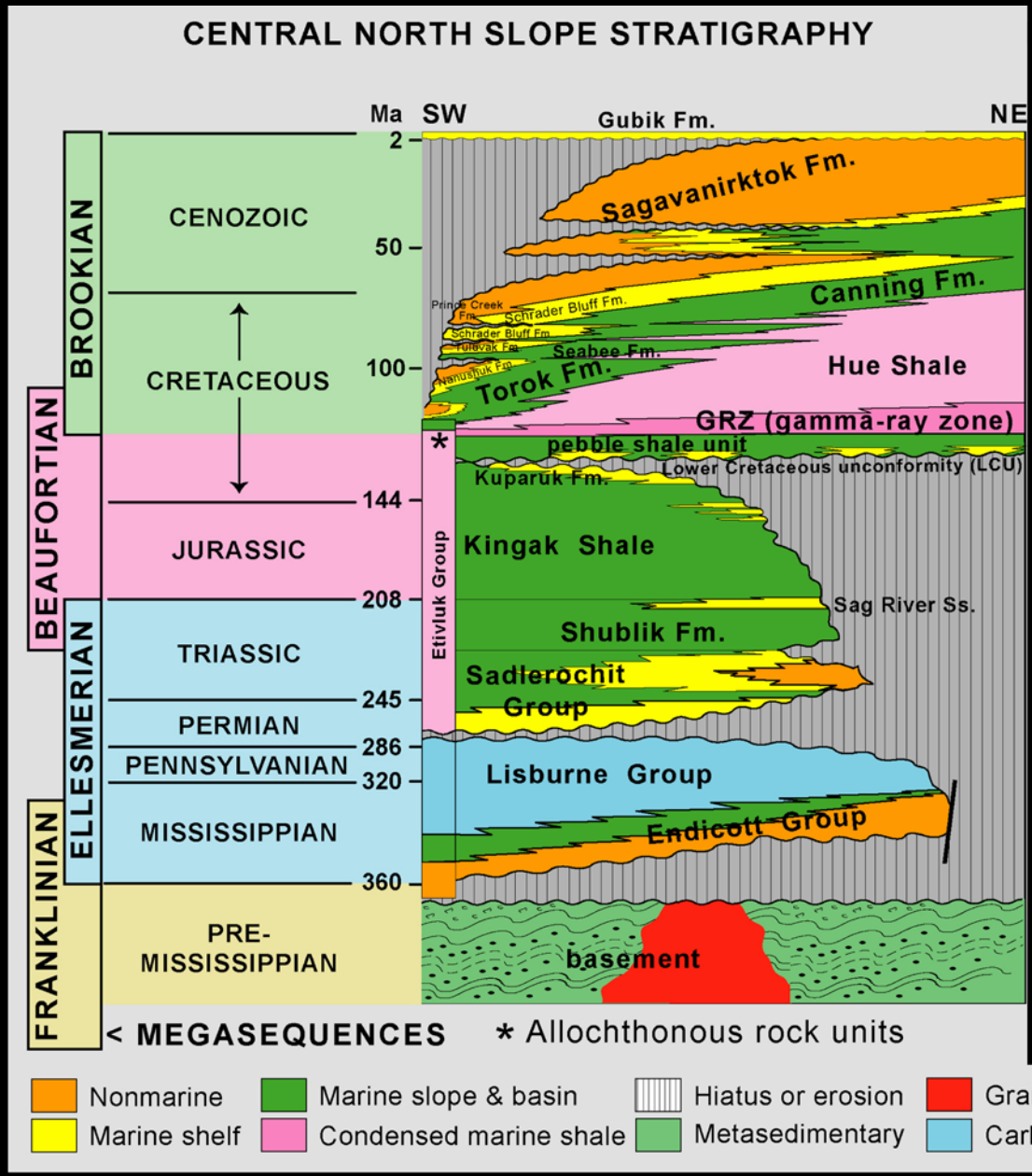
USGS science for a changing world

Gil Mull photo

Arctic Alaska - Key Geologic Features



Stratigraphy – Known & Potential Source Rocks



< Paleogene Canning

< Seabee

< GRZ (HRZ)

< Lower Kingak

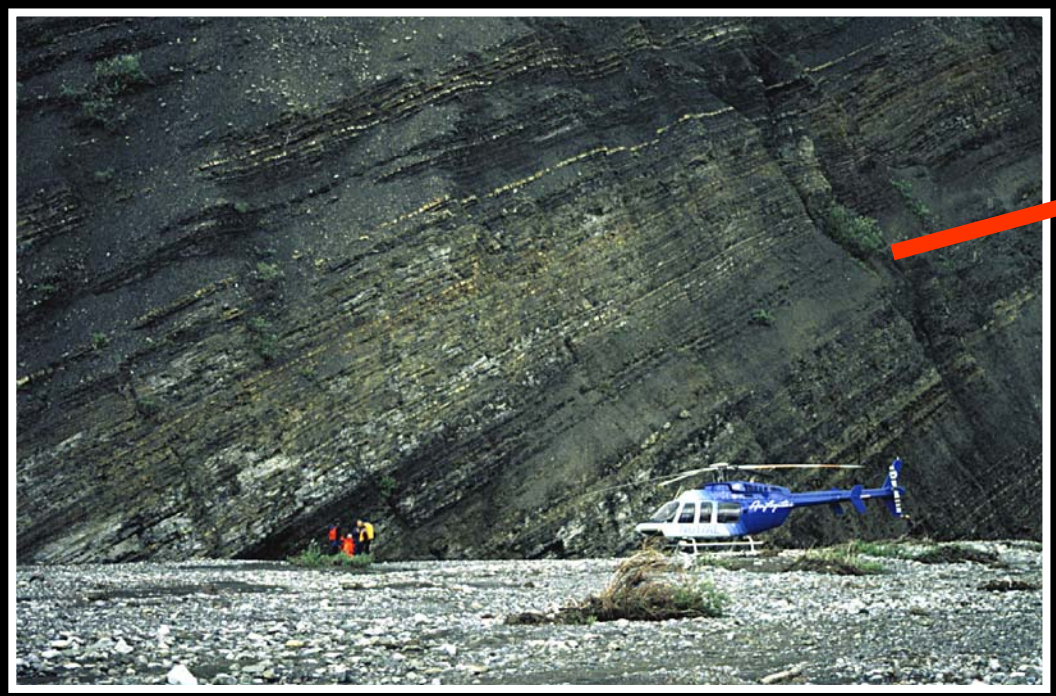
< Shublik

< Lisburne (Kuna)

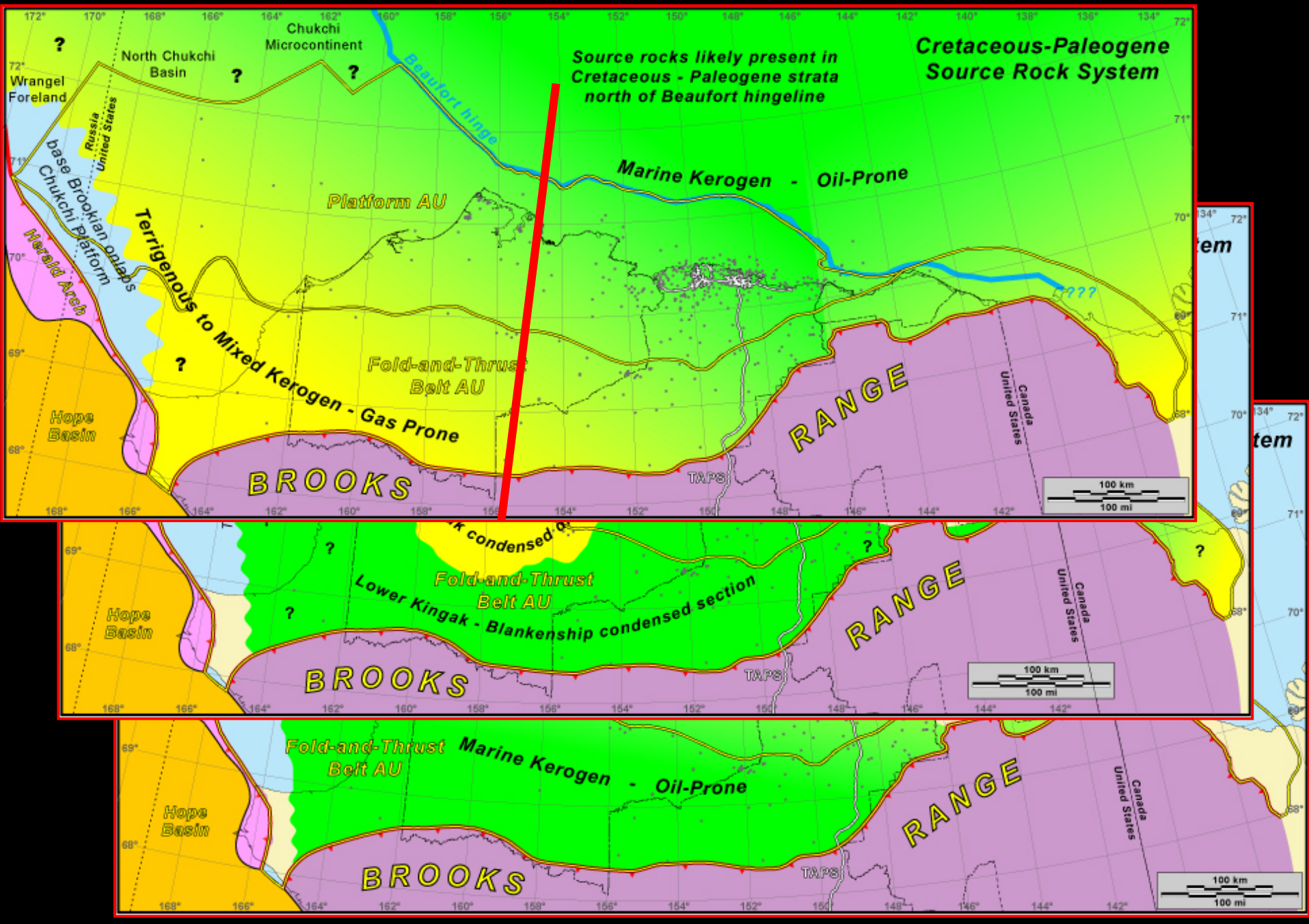
< Kekiktuk

Source Rock & Hydrocarbon Characterization

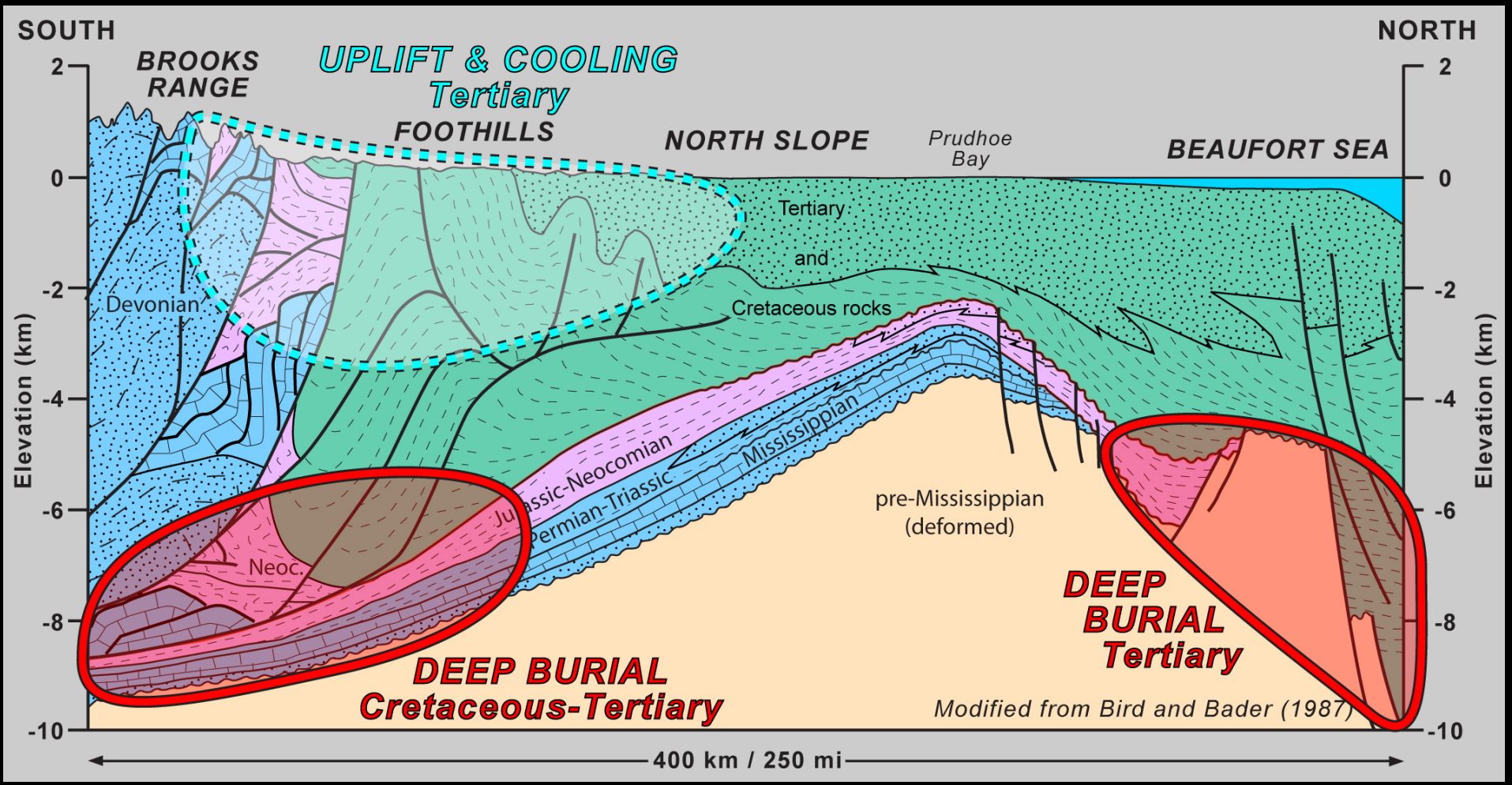
- Synthesizing a decade of organic geochemical analyses and integrate with regional geologic data
- Characterization of hydrocarbon occurrences



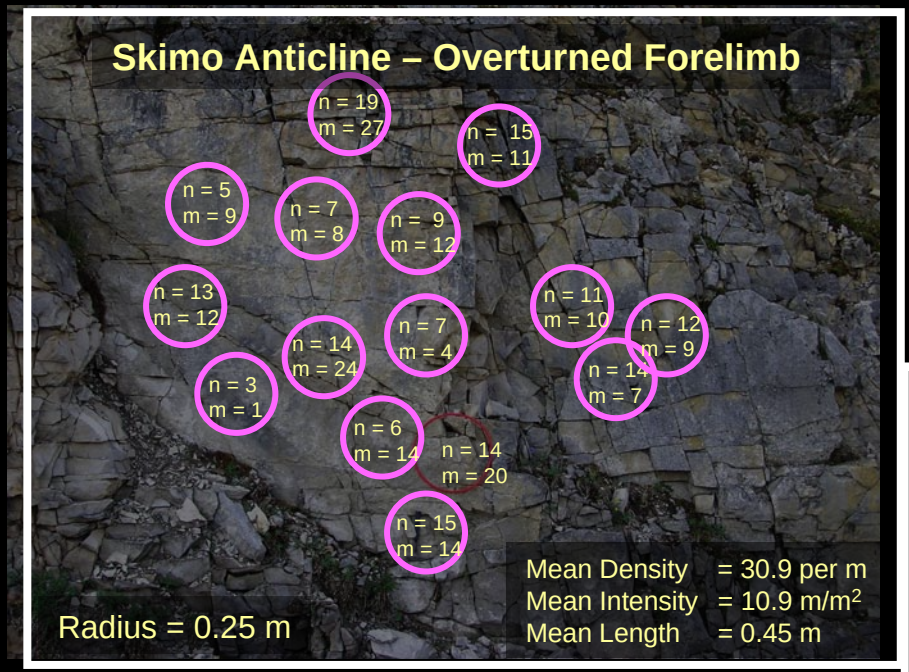
Arctic Alaska Source Rock Systems

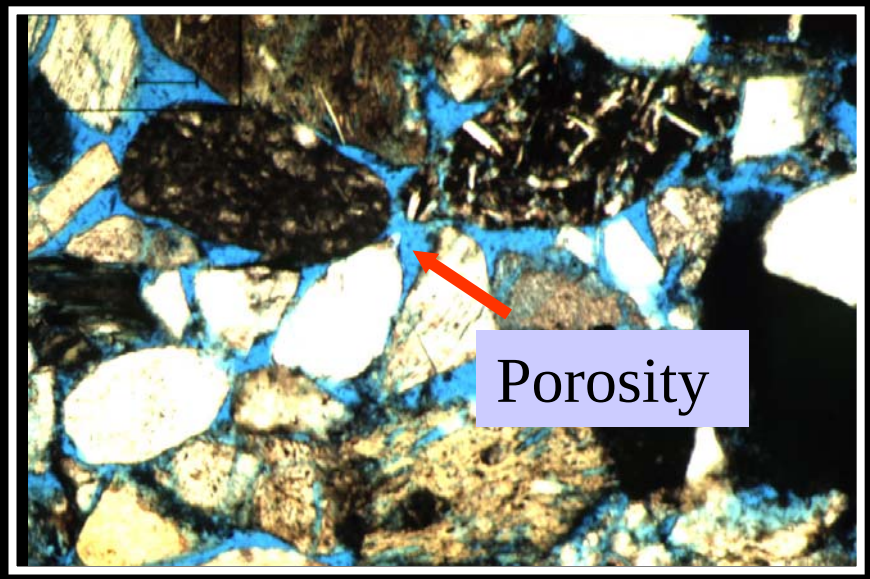


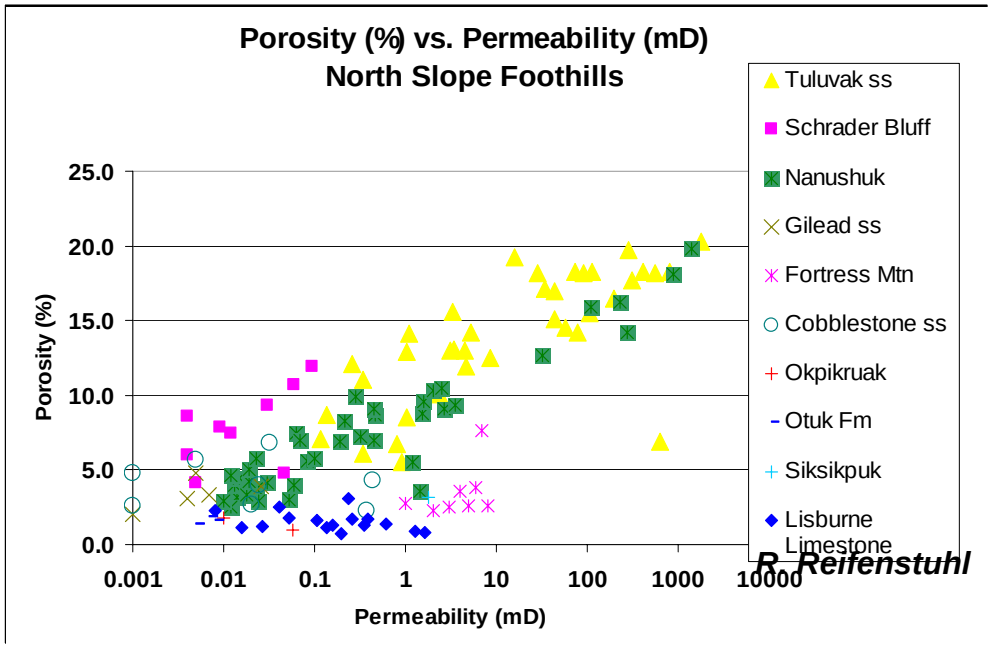
Overview of Regional Geology



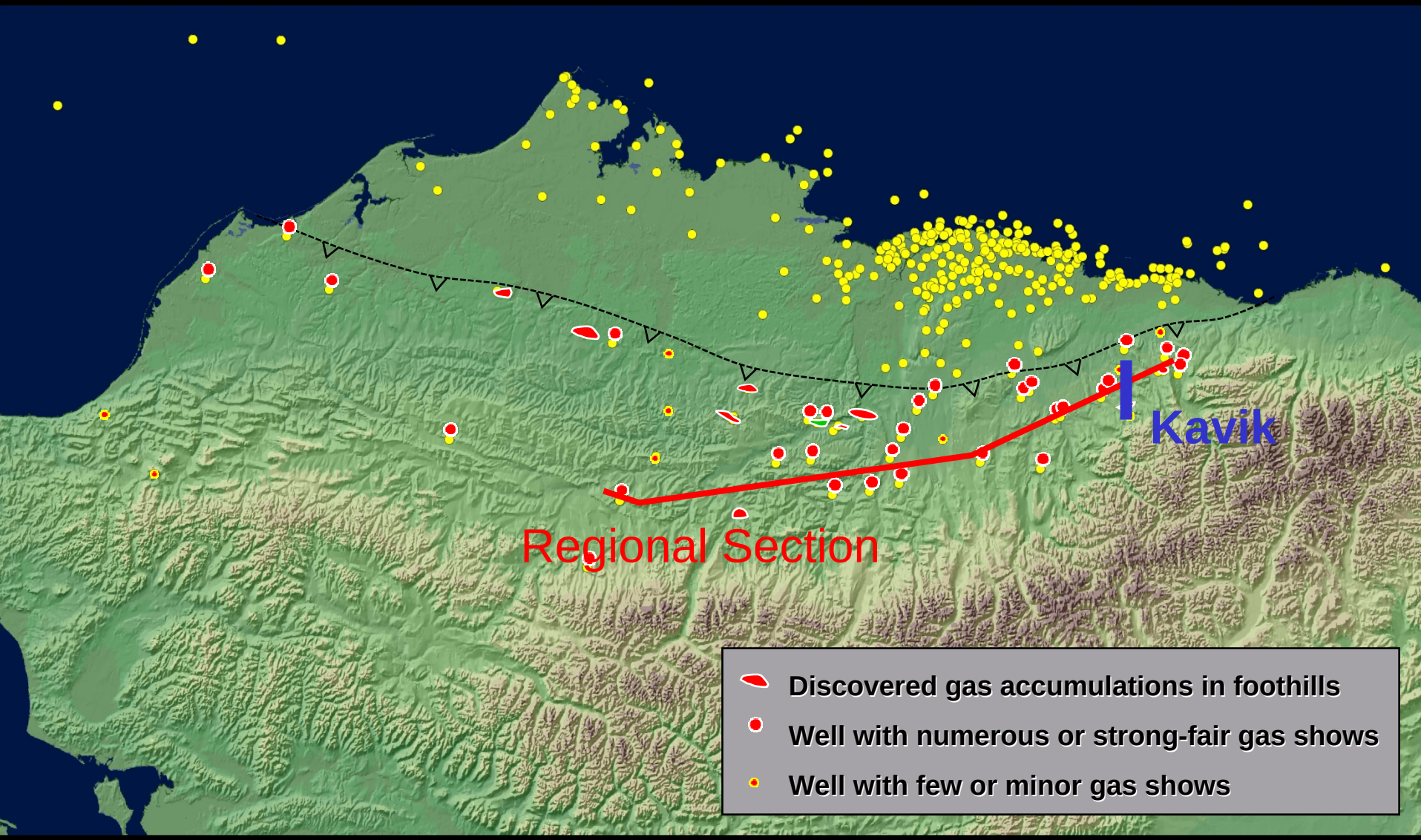
- **Reservoir quality studies**







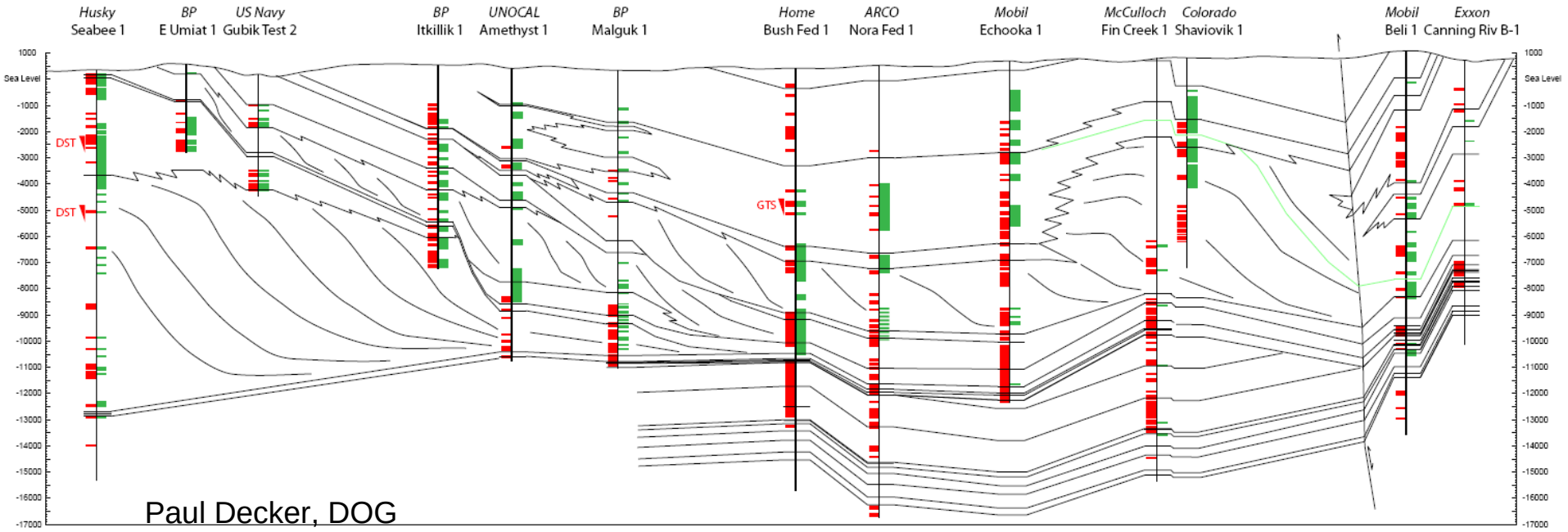
Foothills Drilling and Gas Occurrences



Foothills Cross Section - Oil and Gas Shows

West

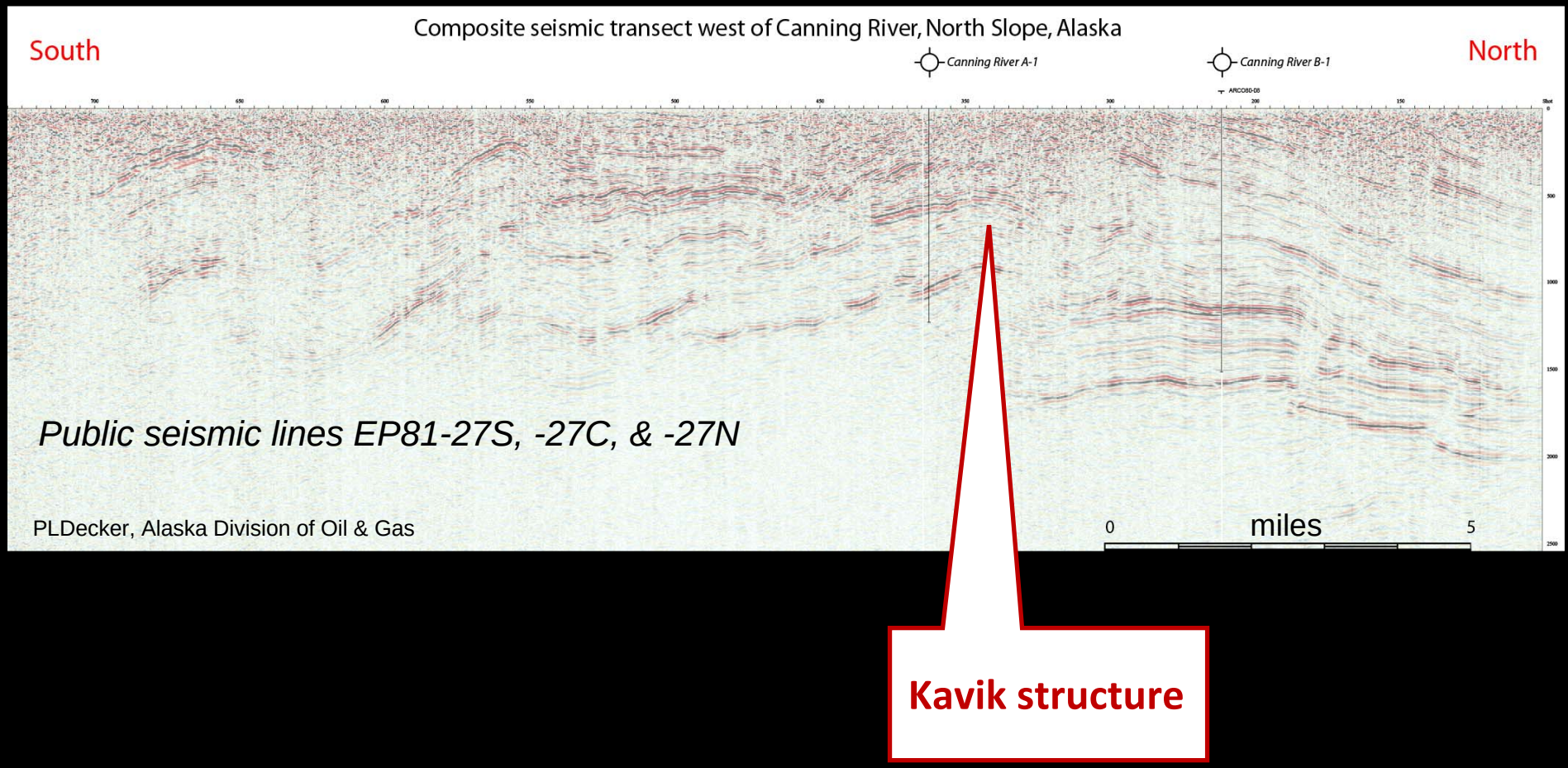
East



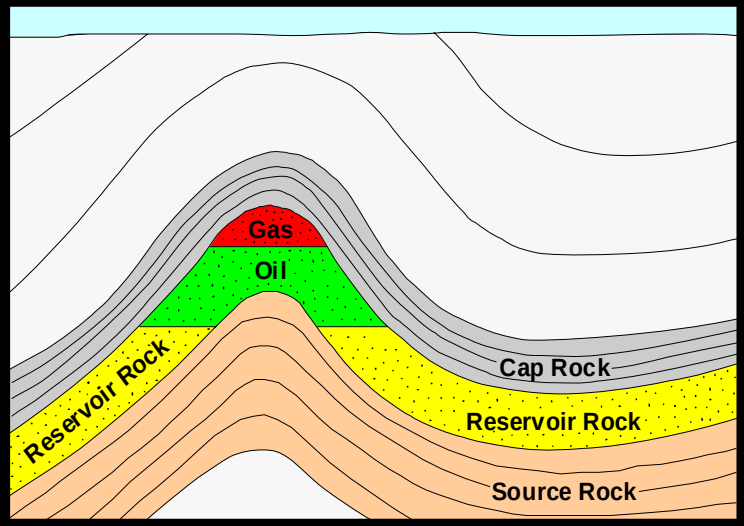
Paul Decker, DOG

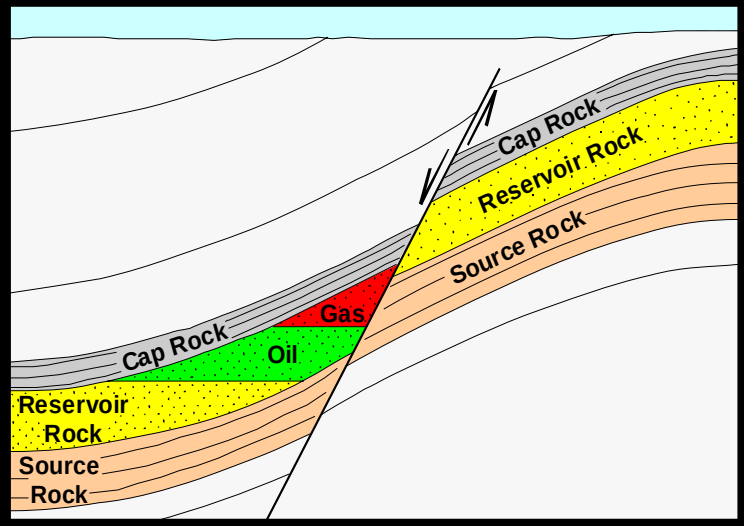
Foothills Structural Plays

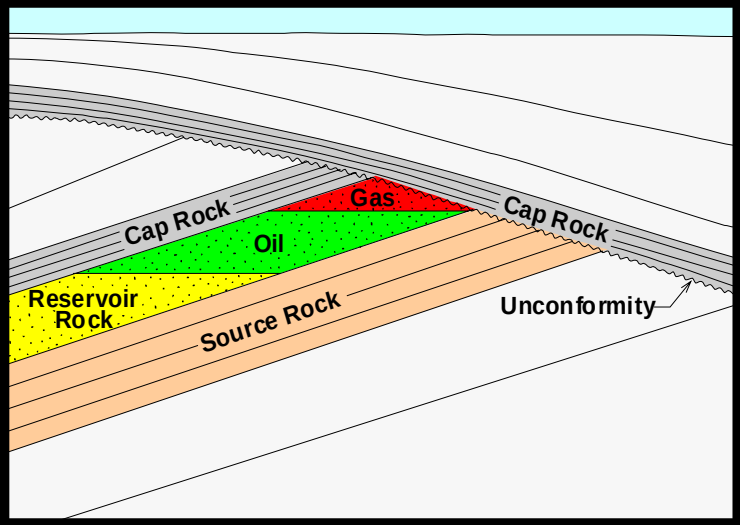
Seismic Interpretation

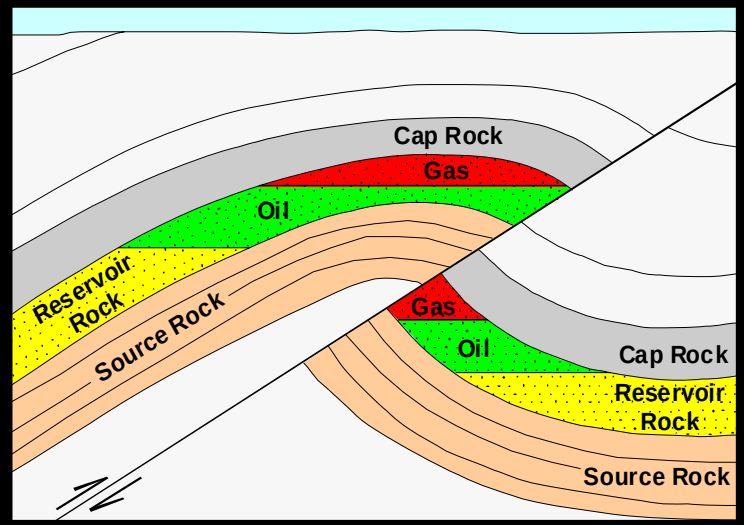


Conventional Exploration Play Types









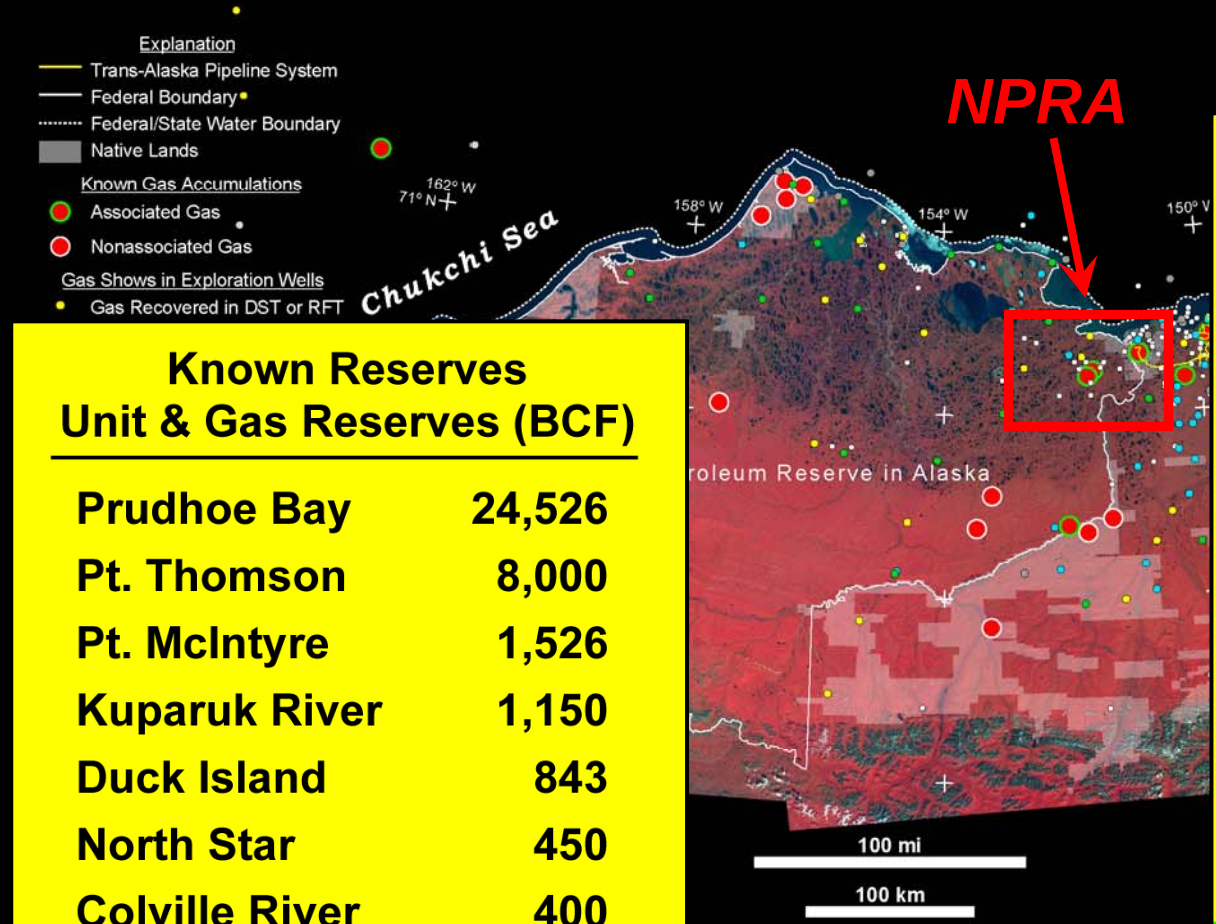
Oil and Gas Trapping Mechanisms

USGS Role

dhouse@usgs.gov

USGS

Known Gas Accumulations in Arctic Alaska



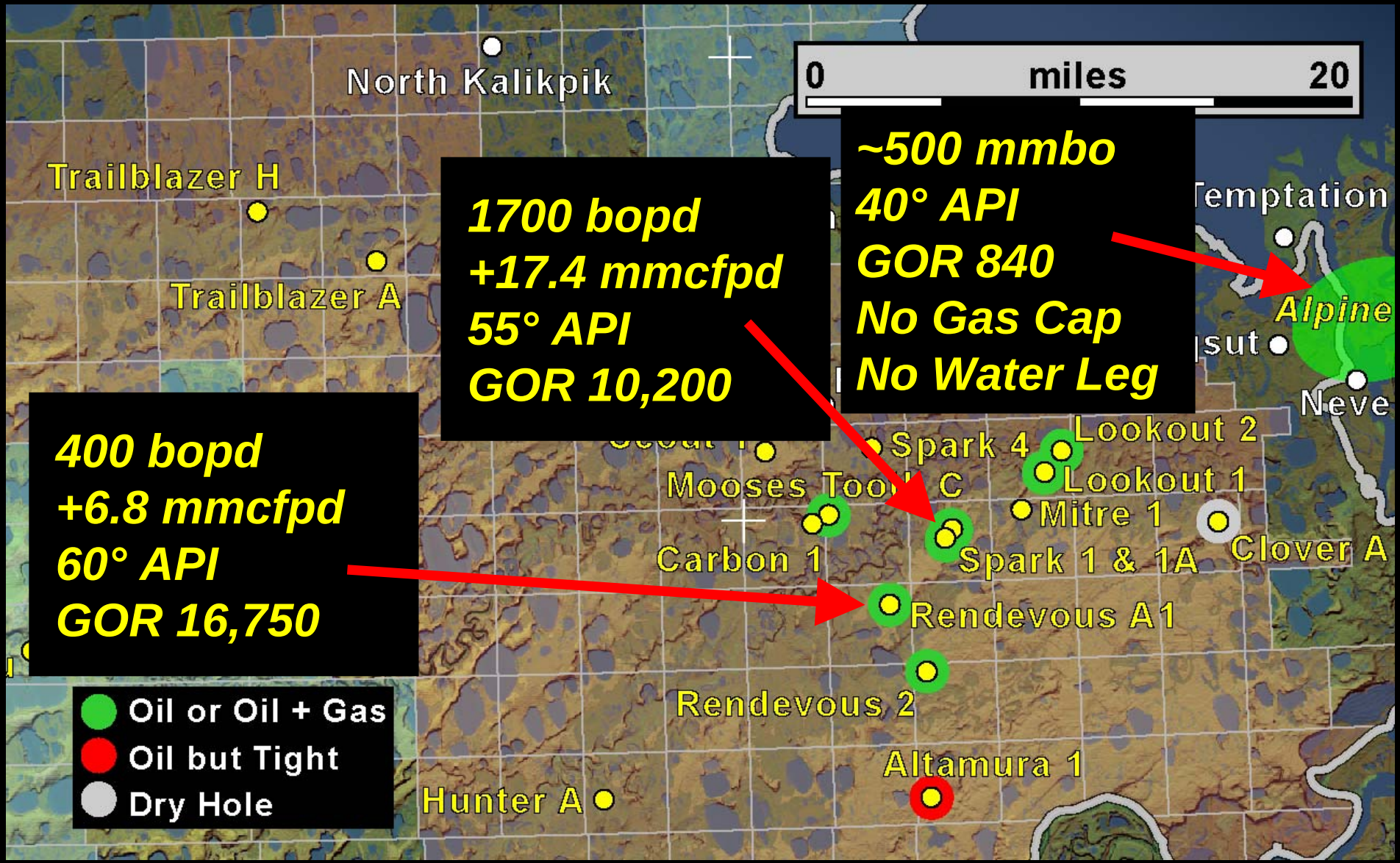
Known Reserves Unit & Gas Reserves (BCF)	
Prudhoe Bay	24,526
Pt. Thomson	8,000
Pt. McIntyre	1,526
Kuparuk River	1,150
Duck Island	843
North Star	450
Colville River	400
Barrow-Walakpa	34
Milne Point	14
TOTAL	35,417

Data from AK-DOG Annual 2006 Rpt.

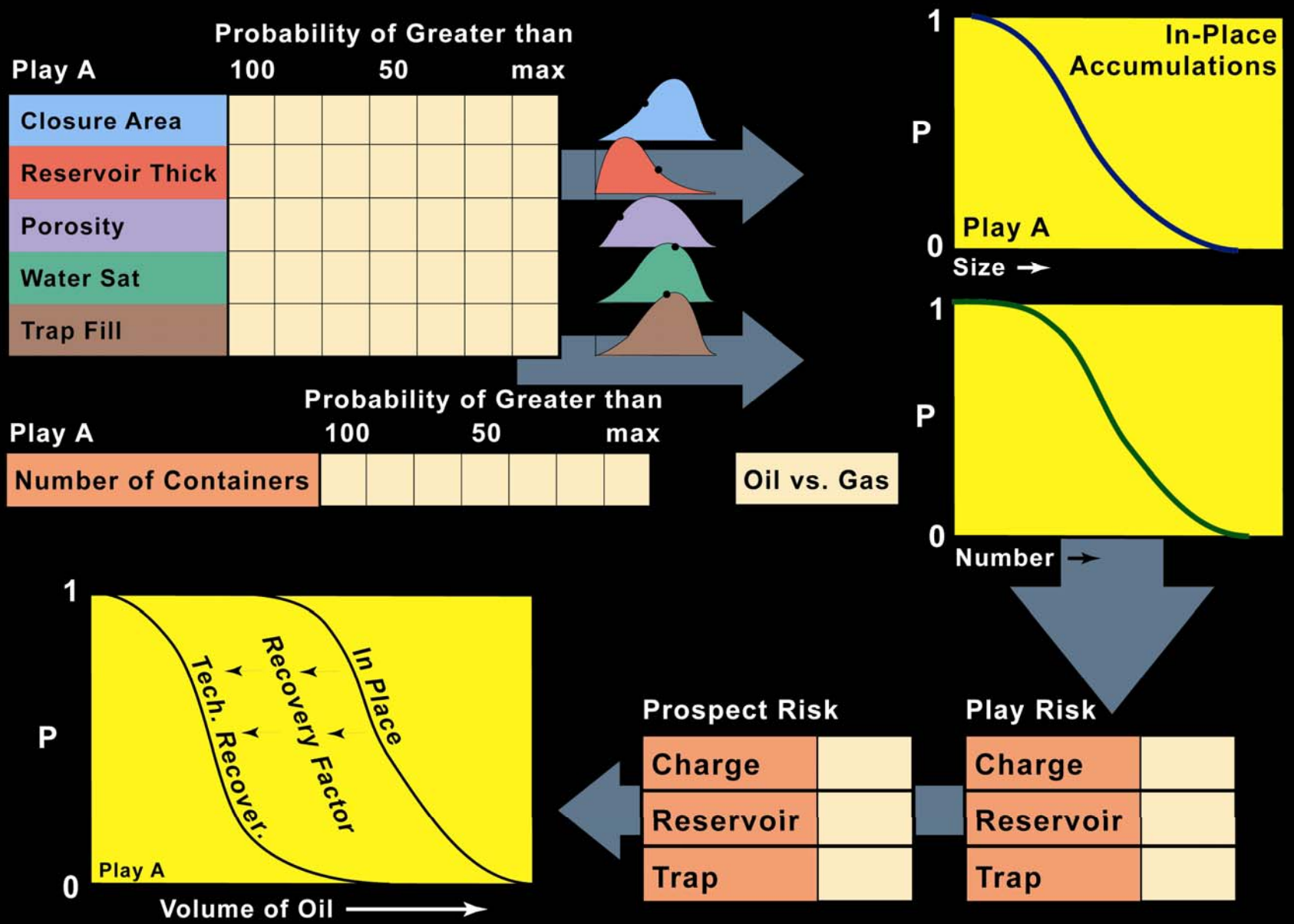
Other Known Accumulations Possible Gas Reserves (BCF)	
Onshore	
Gubik	600
Kavik	115
Square Lake	58
Meade	20
Umiat	5
East Umiat	4
East Kurupa	?
Kemik	?
Wolf Creek	?
Offshore - OCS	
Burger	14,000
Sandpiper	?

Data from Thomas et al., 1996 (DOE)
Craig & Sherwood, 2004 (MMS)
Bird, pers. comm., 2008 (USGS)

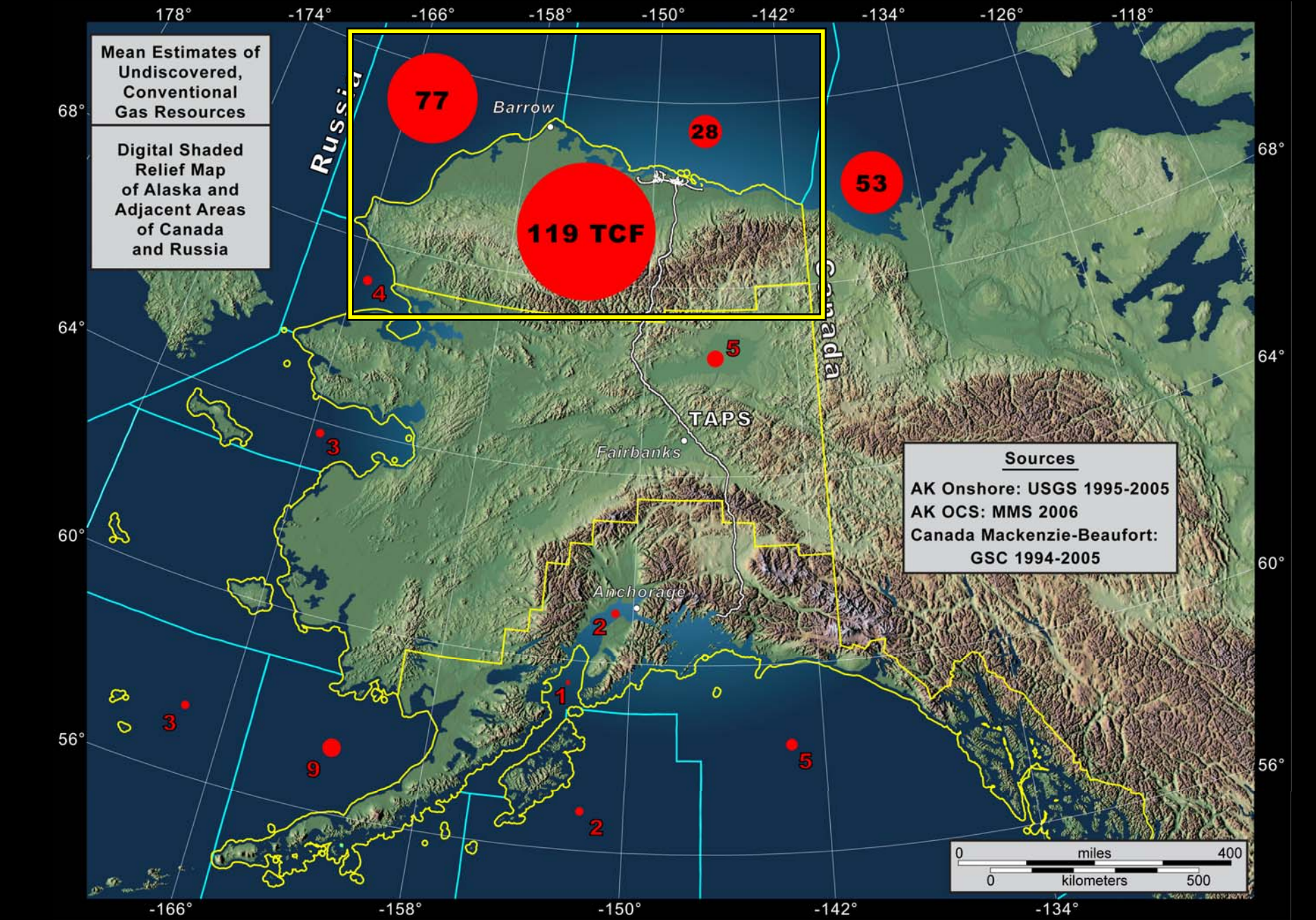
Alpine Play in NPRA – More Gas than Oil?



Assessment Methodology – Geologic Basis



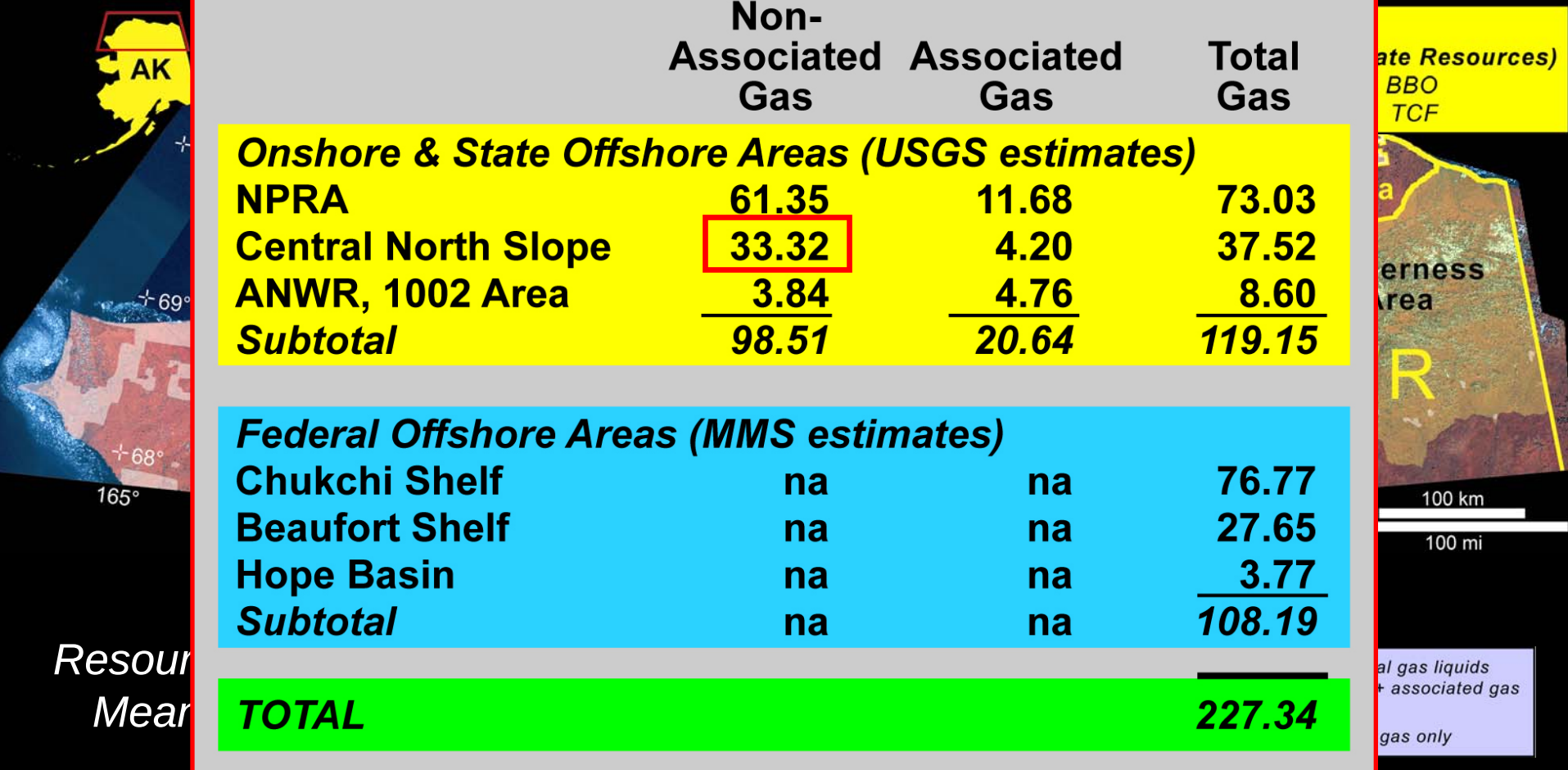
Undiscovered Conventional Gas Potential



Potential for Undiscovered Petroleum in Arctic Alaska

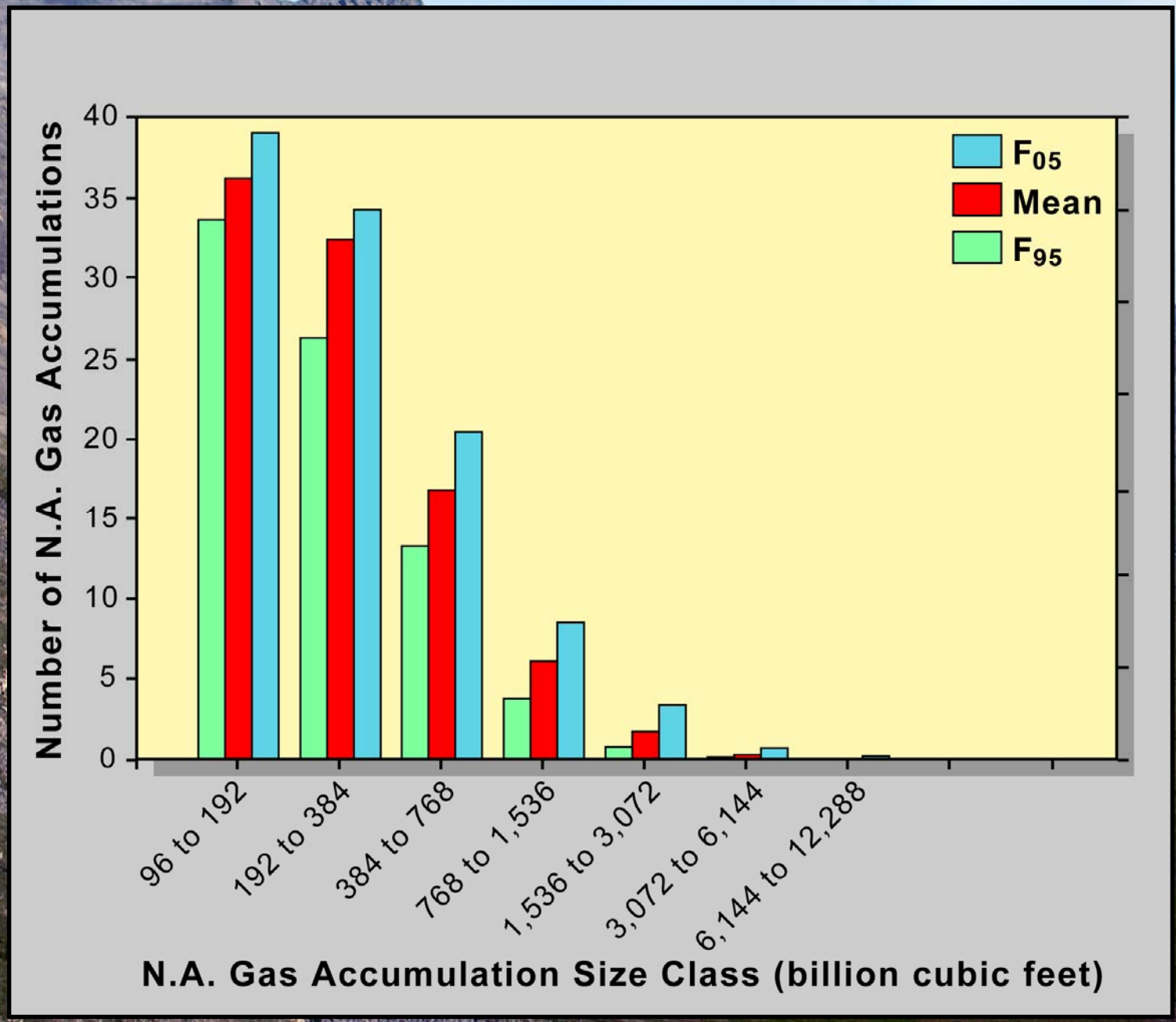
Mean Estimates of Undiscovered, *Conventional* Natural Gas in Arctic Alaska (trillion cubic feet)

	Non-Associated Gas	Associated Gas	Total Gas
Onshore & State Offshore Areas (USGS estimates)			
NPRA	61.35	11.68	73.03
Central North Slope	33.32	4.20	37.52
ANWR, 1002 Area	3.84	4.76	8.60
Subtotal	*98.51*	*20.64*	*119.15*
Federal Offshore Areas (MMS estimates)			
Chukchi Shelf	na	na	76.77
Beaufort Shelf	na	na	27.65
Hope Basin	na	na	3.77
Subtotal	na	na	*108.19*
TOTAL			***227.34***



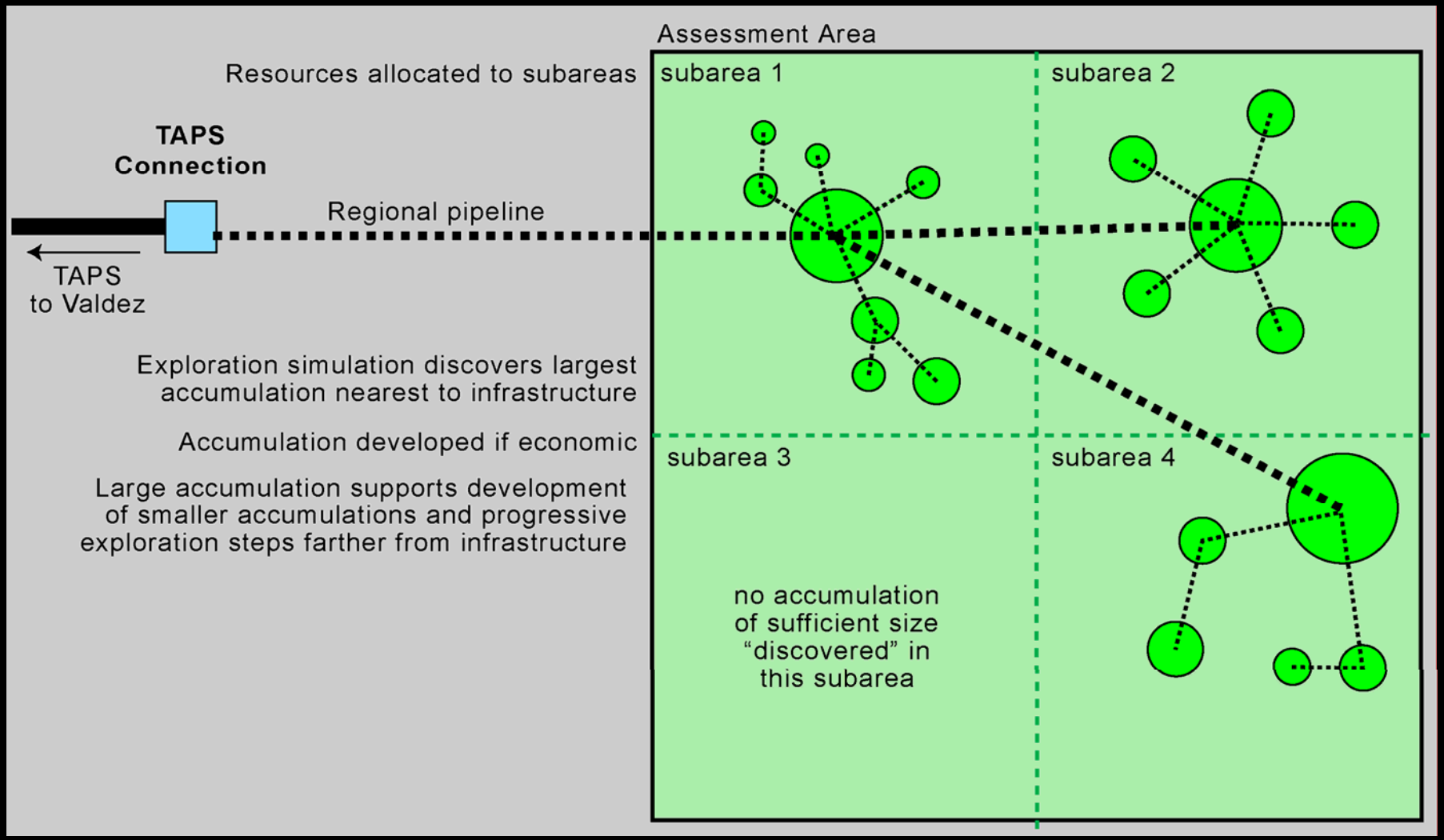
Sources: OCS estimates from MMS; onshore & state waters estimates from USGS

Estimates of Gas Accumulation Sizes



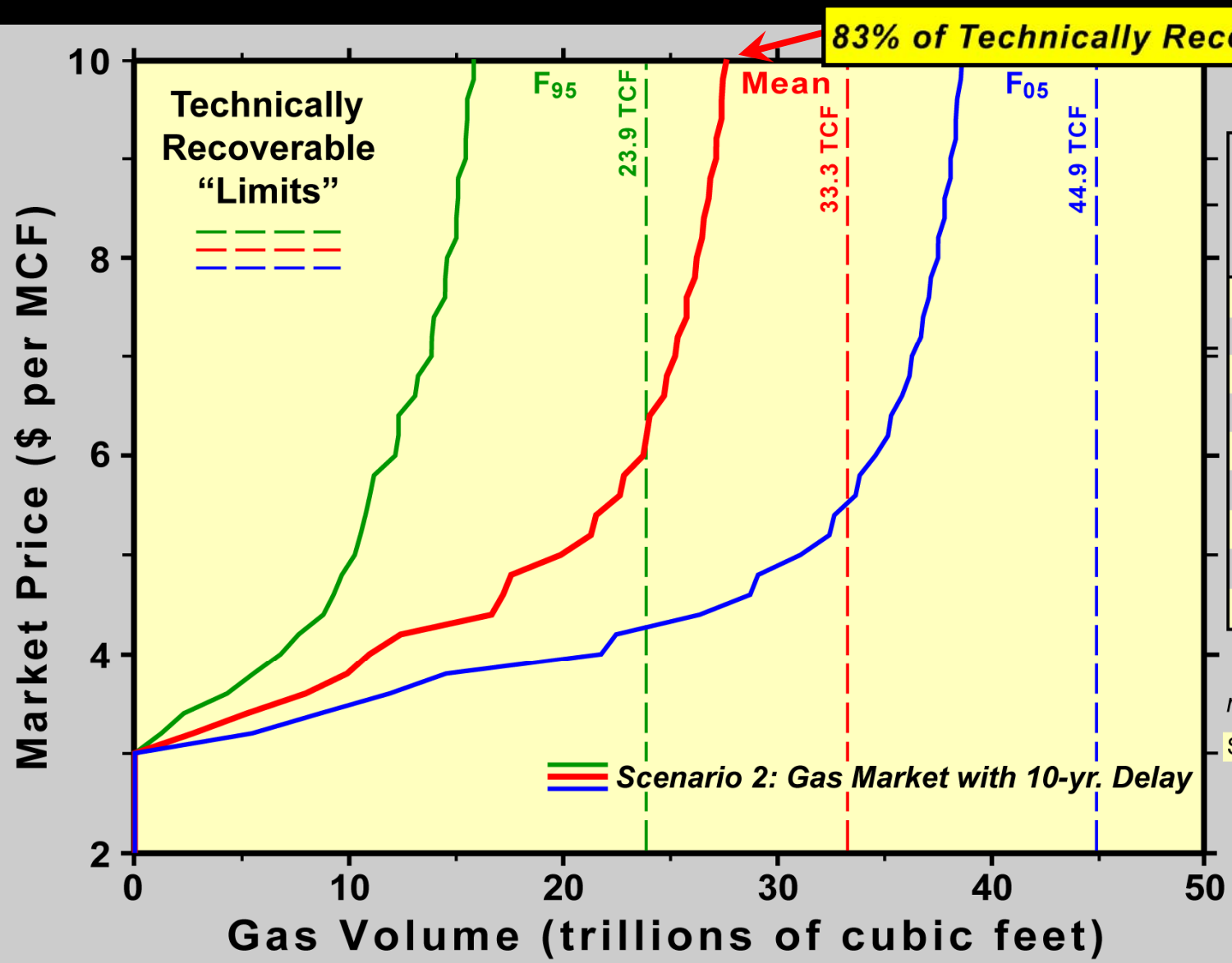
USGS

Economic Analysis Simulates Exploration and Development



Central North Slope Economically Recoverable Gas

Undiscovered, Non-Associated Natural Gas Resources



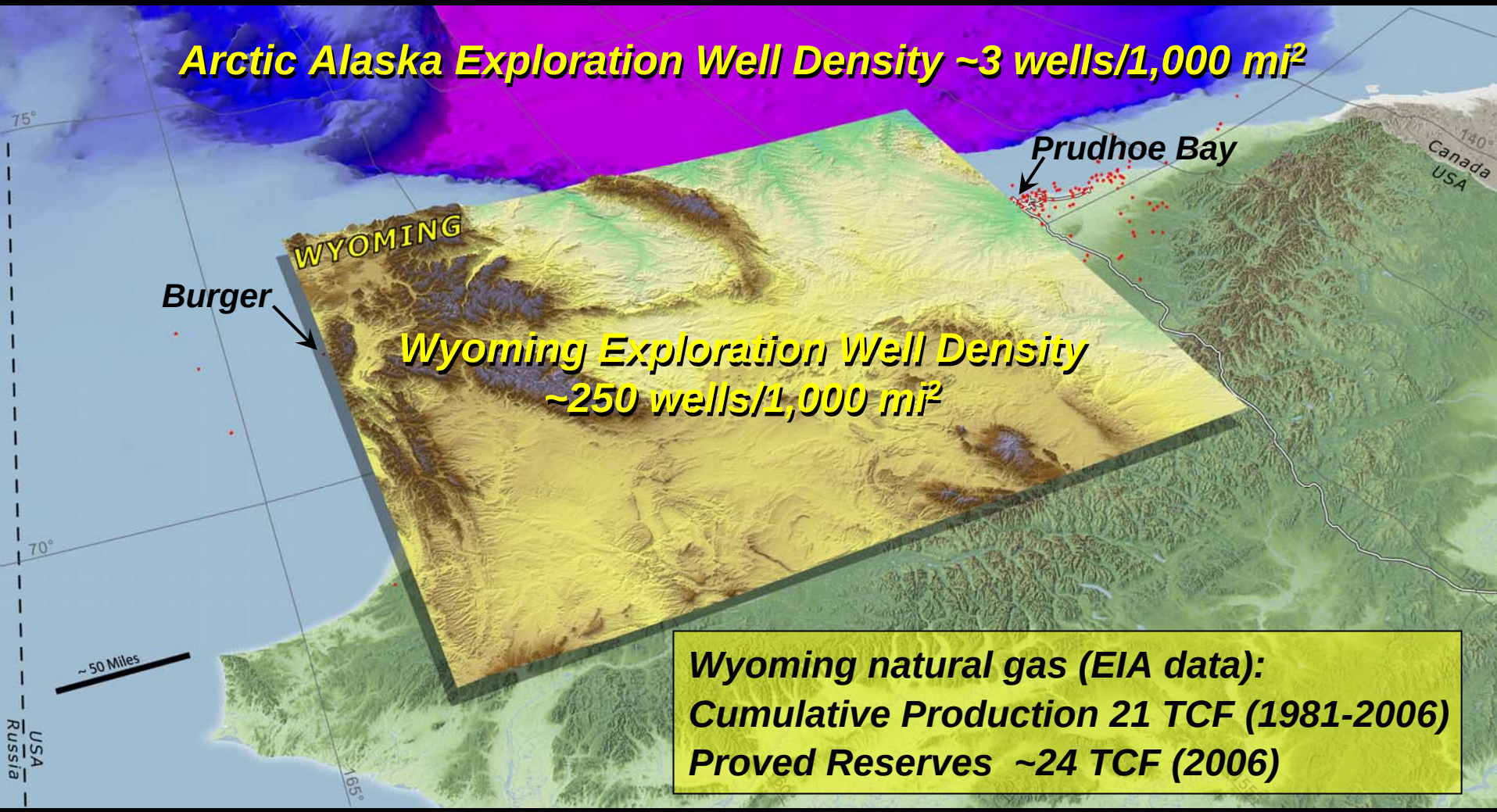
Market Price ($/MCF)	Economically Recoverable Gas (trillion cubic feet) Sc. 2
2	0
3	0
4	10.9
5	19.9
6	23.7
7	25.2
8	26.2
9	27.1
10	27.6

Based on mean estimates of technically recoverable oil resources

Scenario 1 - No Gas Market

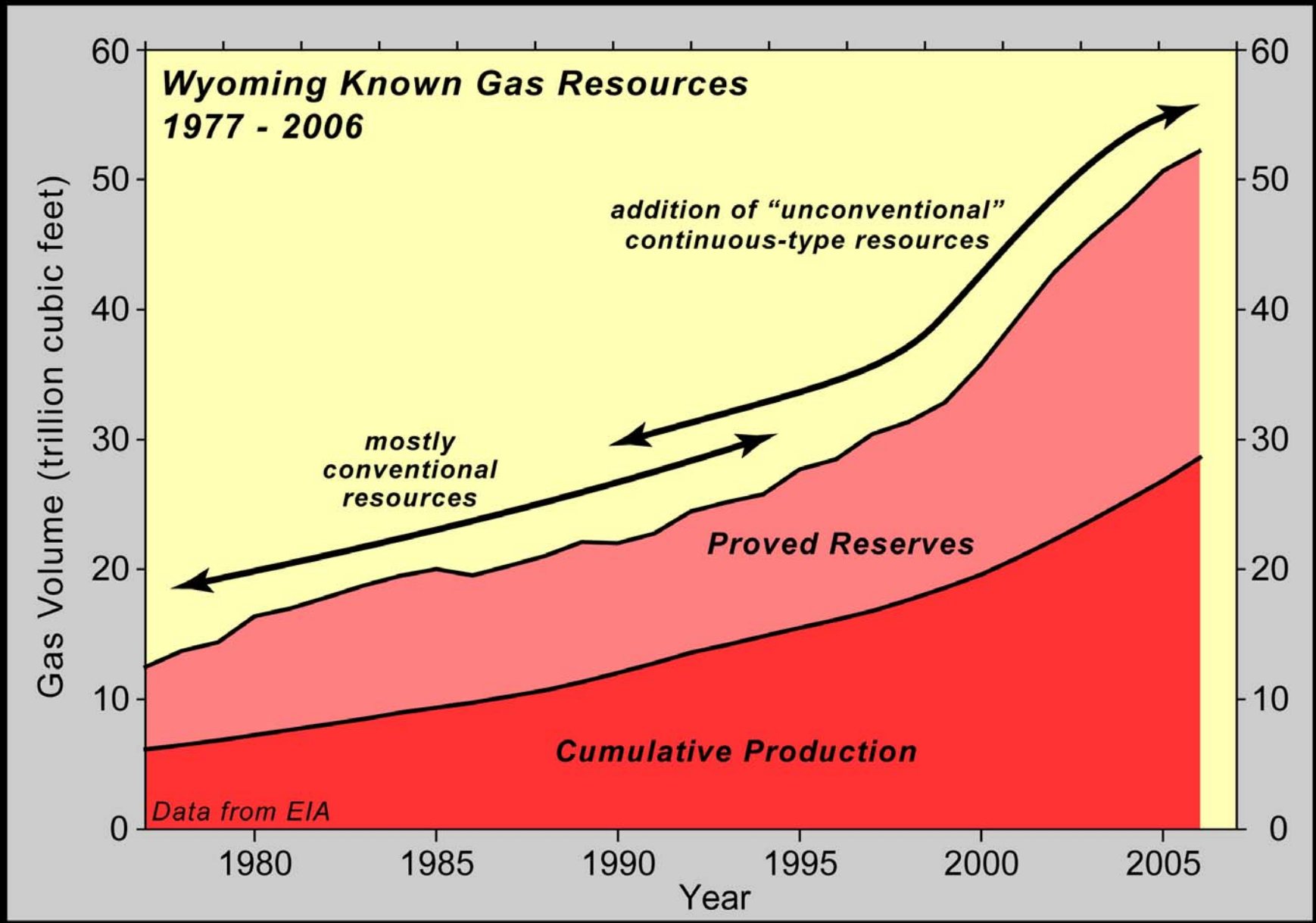
Arctic Alaska Exploration Maturity

- *Prospective area onshore & offshore shelves ~ 150,000 mi² (~400,000 km²)*
- *Fewer than 500 exploration wells (red dots)*



- *Entire state of Wyoming ~100,000 mi² (~250,000 km²)*
- *Petroleum-prospective area ~75,000 mi² (~250,000 km²)*
- *~19,371 exploration wells*

Wyoming Gas Reserves & Production History

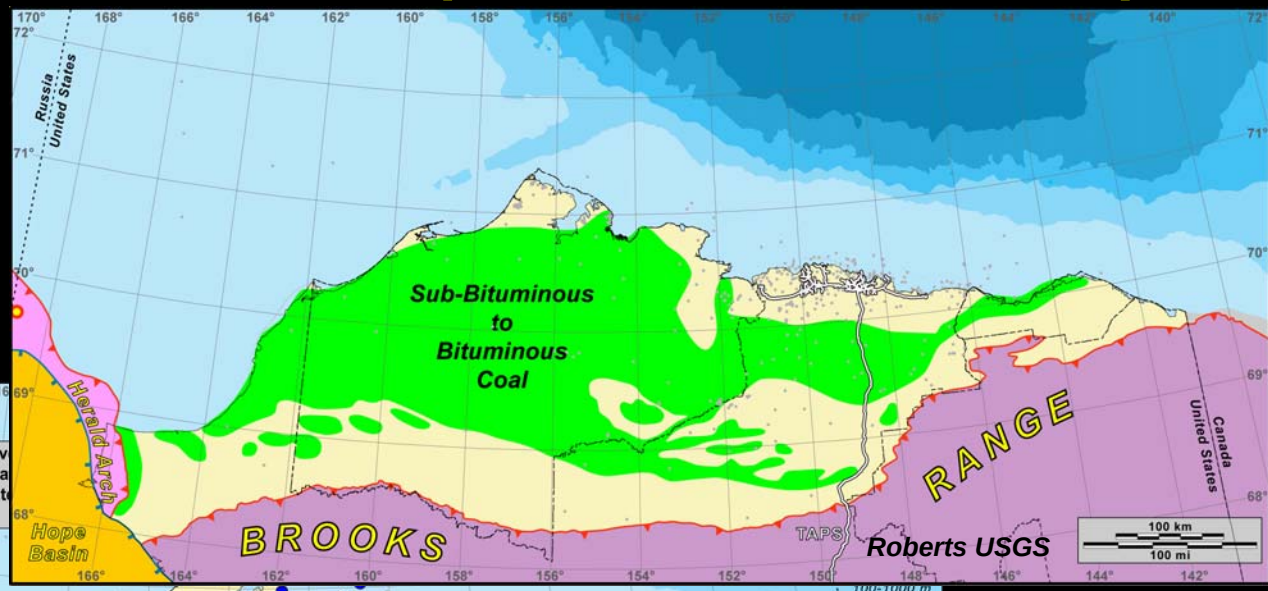


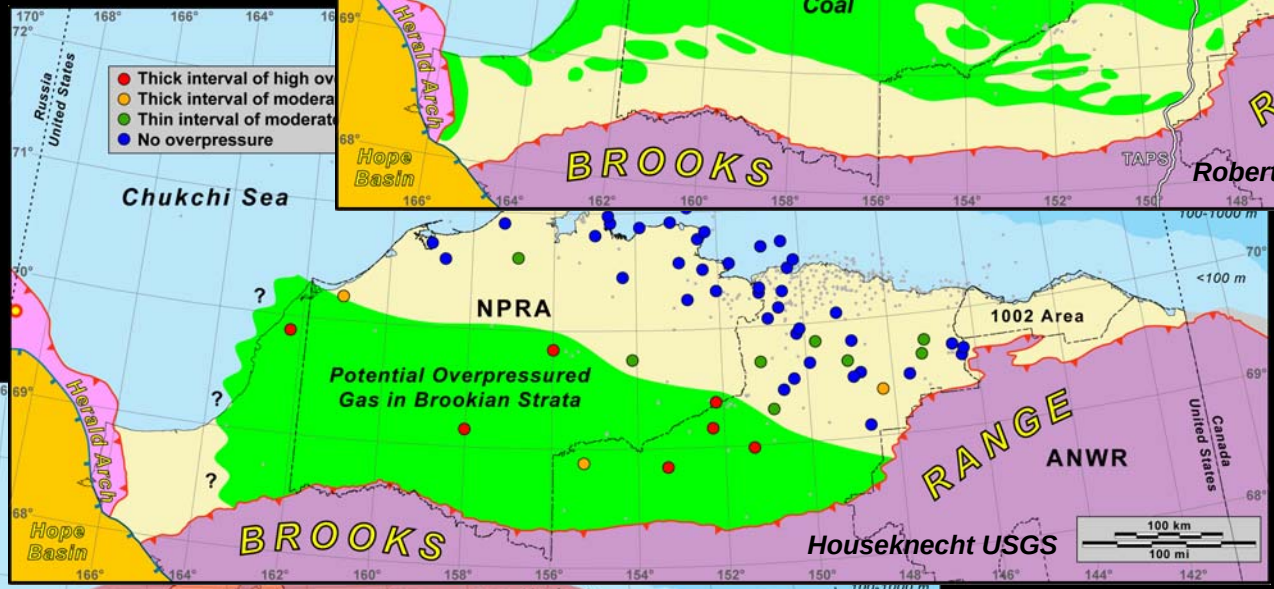
“Unconventional” Gas Resources (continuous resources)

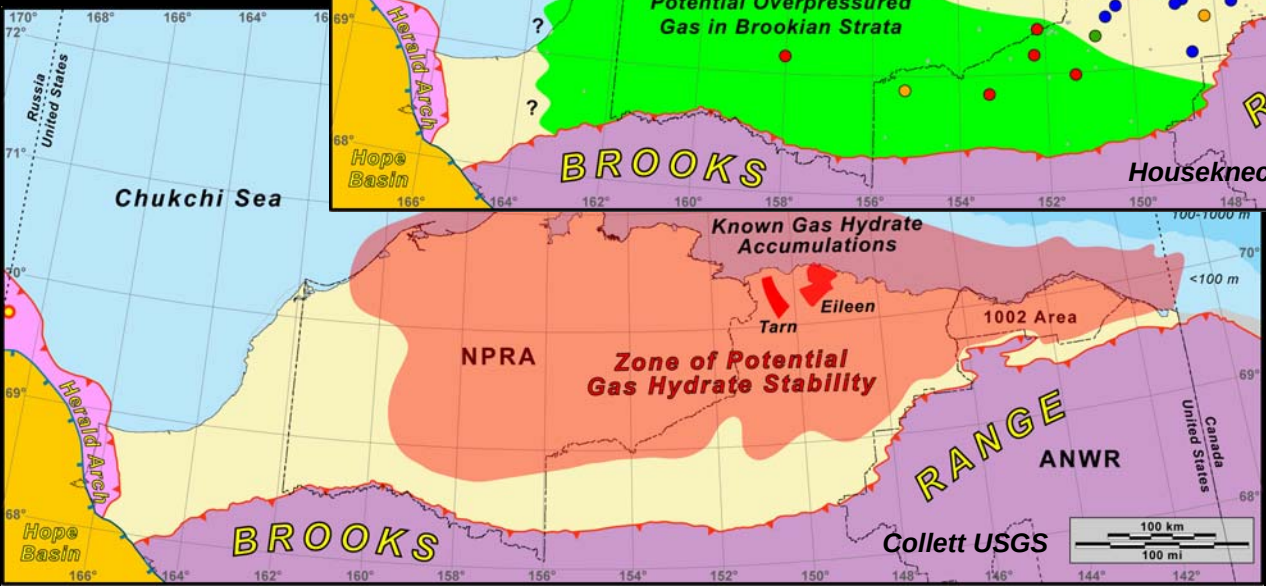
Coalbed Gas

Overpressured, Basin-centered Gas

Gas Hydrates







Summary

Arctic Alaska Natural Gas Resources

- Arctic Alaska supercharged hydrocarbon basin grossly under explored with respect to gas
- More than 35 TCF proved reserves
- Federal mean estimates of undiscovered, *conventional* gas resources: 119 TCF onshore & state waters plus 108 TCF federal offshore
- Huge upside potential in “unconventional” gas resources not included in estimates
  - gas hydrates
  - overpressured basin-centered gas
  - coalbed gas