



# A New Look at North Slope Oil and Gas Potential

*lower Nanushuk Formation*

*upper Torok Formation*

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# USGS Assessments of Undiscovered Oil and Gas Resources

## Existing Assessments

- 1998 Arctic National Wildlife Refuge Coastal Plain (ANWR 1002 Area)*
- 2005 Central North Slope*
- 2008 Circum-Arctic*
- 2010 National Petroleum Reserve in Alaska (NPRA)*
- 2012 Self-Sourced Reservoirs (Shale Oil and Shale Gas)*

## Planned Updates as of October 2016

- Nanushuk and Torok Plays (new discoveries)*

## Secretarial Order 3352 – USGS directed to update North Slope Assessments

- NPRA*
- ANWR Coastal Plain (1002 Area)*
- Central North Slope*
- Western North Slope (west of NPRA)*

# ***Alaska Geological Society Hosts USGS Public Assessment Review***

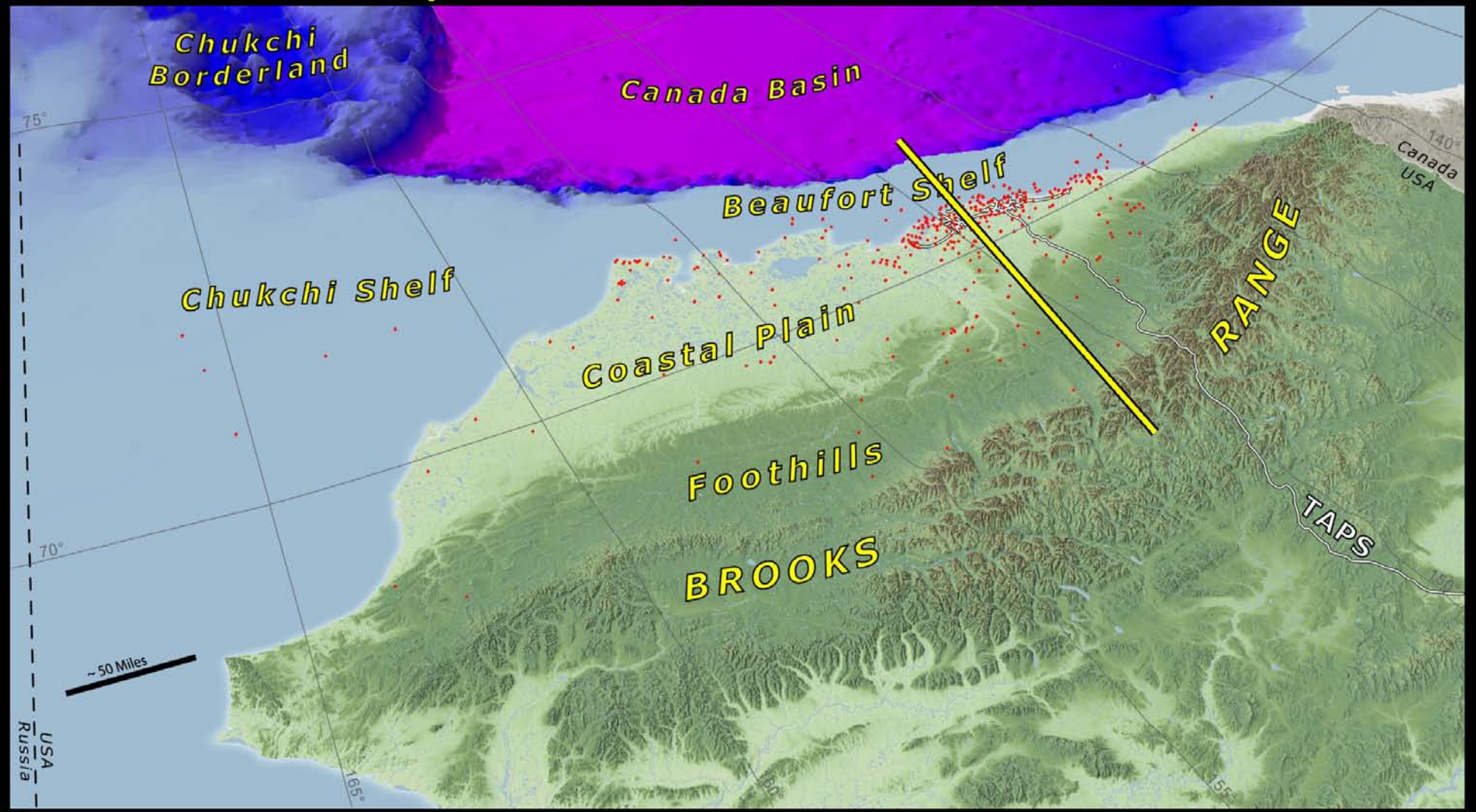


The USGS is conducting an updated assessment of technically recoverable oil and gas resources in the Nanushuk and Torok Formations in NPRA and adjacent state lands and waters. In preparation for the upcoming assessment, a public geology review meeting will be held in Anchorage on **November 7, 2017**. Primary objectives are to (1) present the geological framework on which the assessment will be based and (2) solicit feedback from the geological community regarding the geology and interpretations that represent the foundation of the assessment. An overview of methodology also will be included.

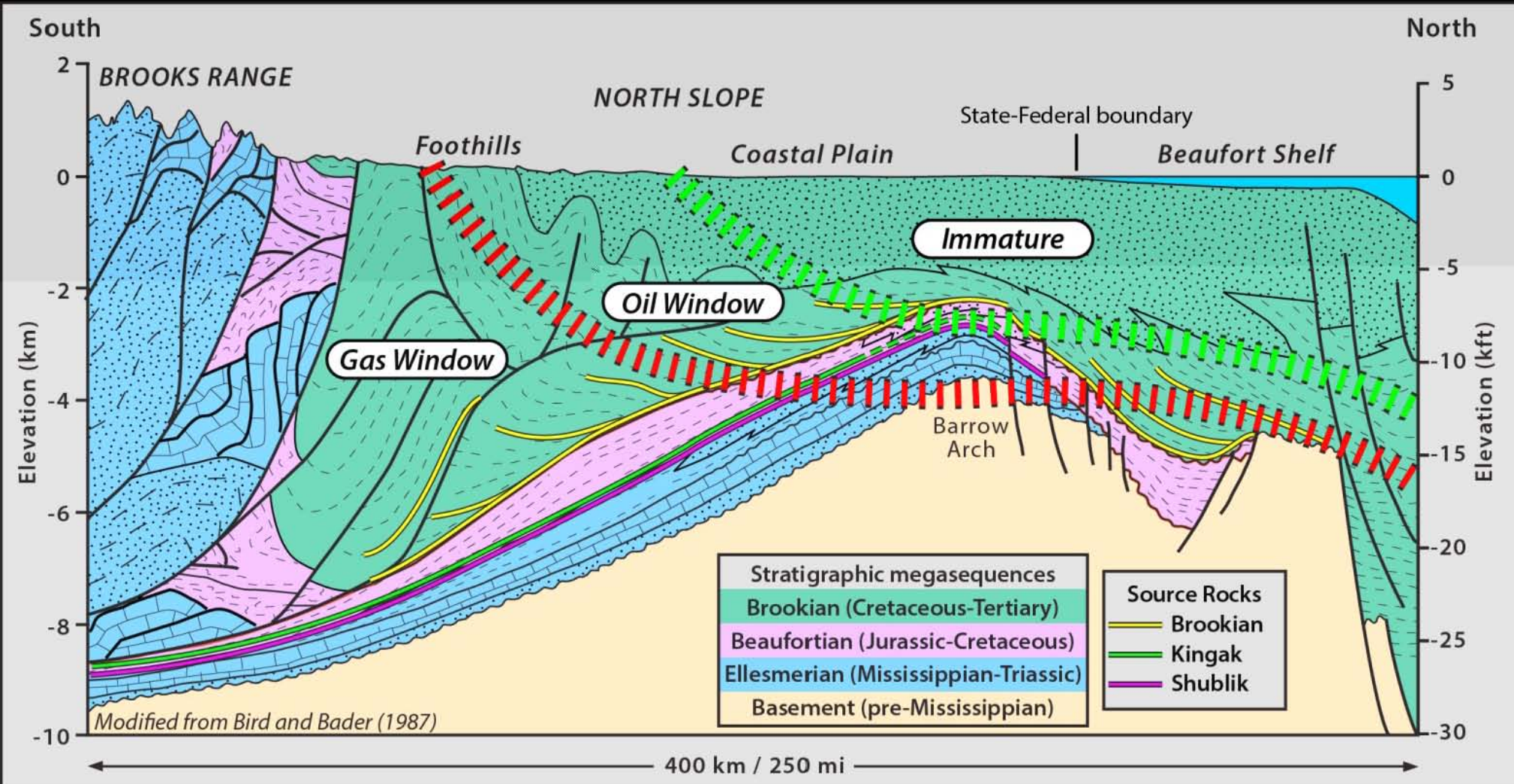
The meeting will be hosted by the AGS and held at the **BP Energy Center**, 900 East Benson Blvd, Anchorage. The presentation and discussion will be held from **8:30 to 11:00 a.m.**, and USGS personnel also will be available for expanded discussions in the same room from 2:00 to 5:00 p.m. Please note the room is NOT available from 11:00 a.m. to 2:00 p.m.

Attendance is open to anyone interested in the scientific foundation on which the assessment will be conducted. Feel free to send any questions to Dave Houseknecht at [dhouse@usgs.gov](mailto:dhouse@usgs.gov)

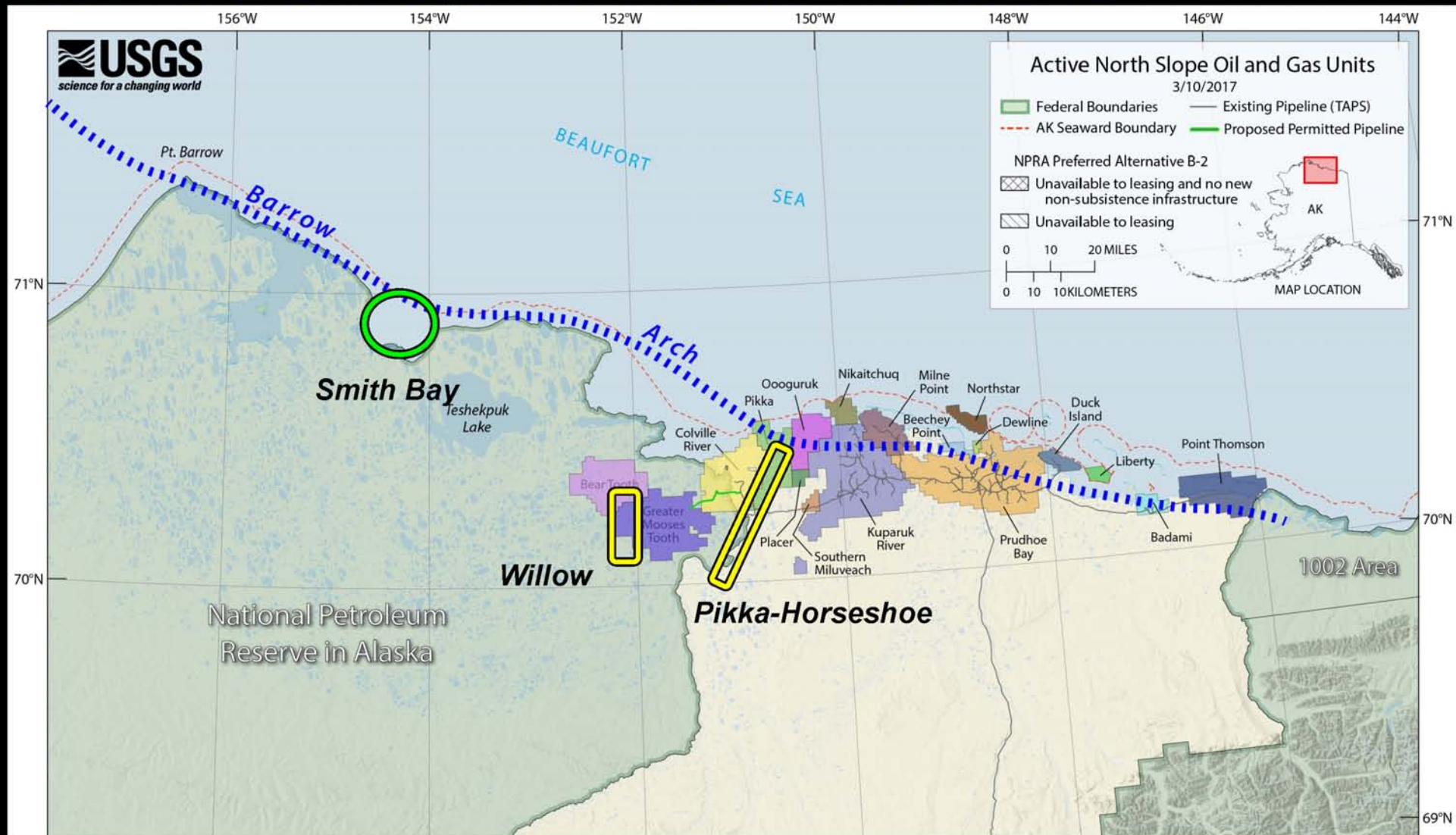
# Arctic Alaska – Under-explored World-class Petroleum Basin



# Brooks Range – North Slope – Beaufort Shelf Cross Section



# The Barrow Arch, North Slope Oil Fields, and New Discoveries

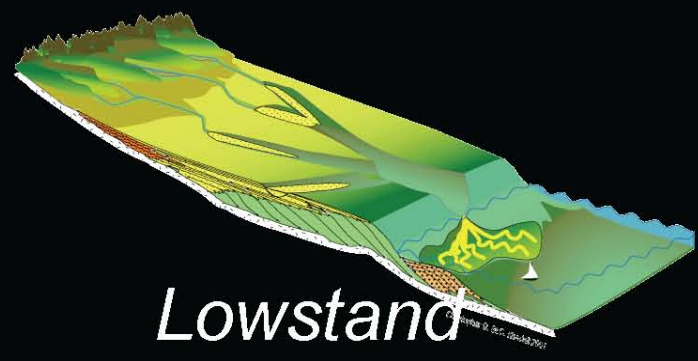
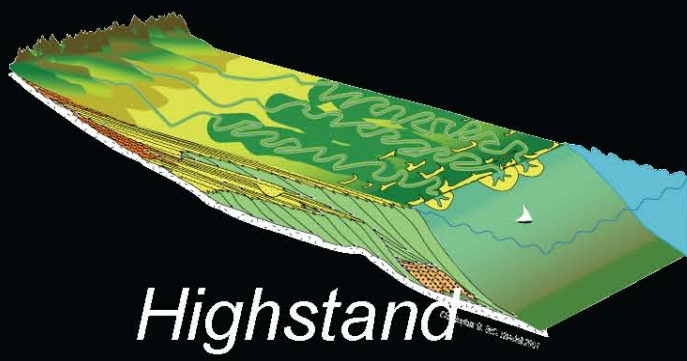
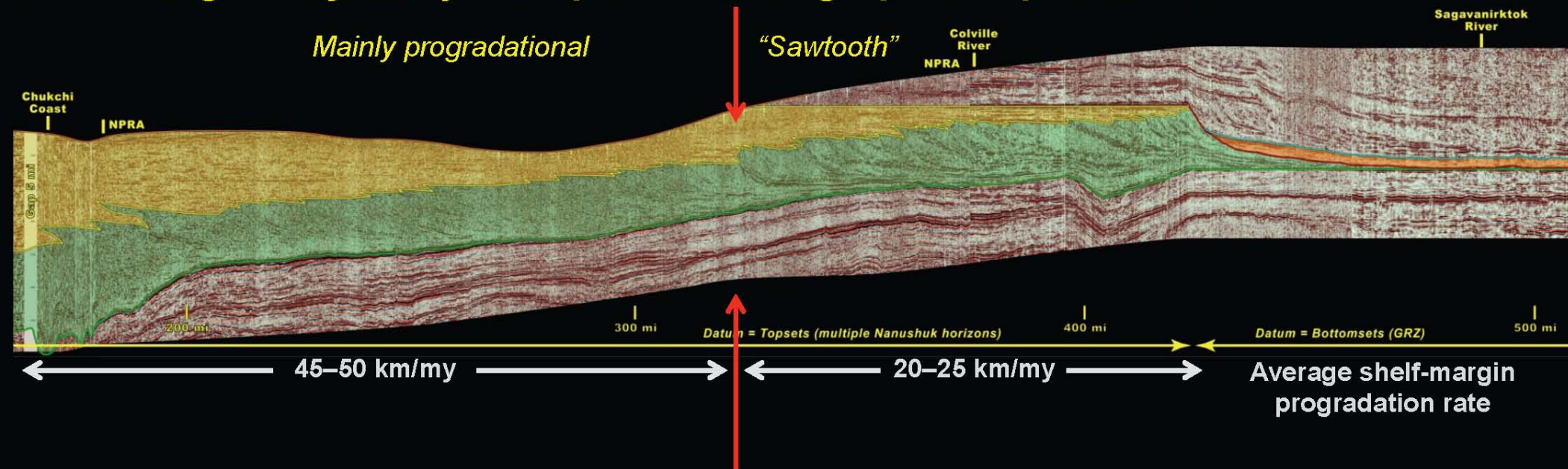


## Recent Oil Discoveries – Nanushuk Reservoirs

Discovery	<b>PIKKA</b>	<b>WILLOW</b>	<b>SMITH BAY</b>
Operators	Armstrong-Repsol	ConocoPhillips	Caelus
Announced	2015	2017	2016
Reservoir	Nanushuk	Nanushuk	Torok
Depth	~4,200 ft	~3,600 ft	~6,000 ft
Net Pay	~200 ft	42 – 72 ft	183 – 223 ft
Oil Gravity	30° API	44° API	40 – 45° API
Volume Reported <u>(uncertainty!)</u>	<b>&gt;1,200 MMBO recoverable</b>	<b>&gt;300 MMBO recoverable</b>	<b>6,000+ in-place (30 – 40% recoverable)</b>

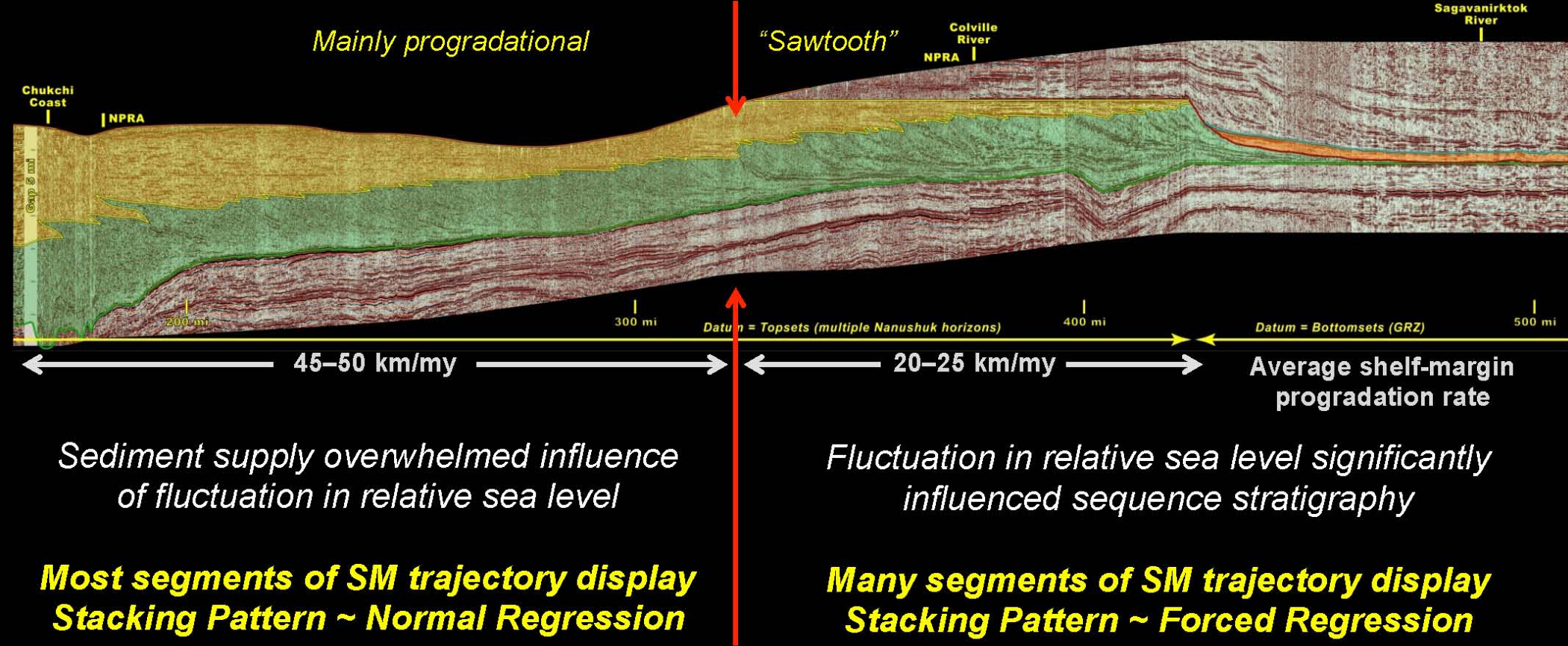
Sources: Armstrong & Repsol press releases; ConocoPhillips press releases; Caelus press release; ADOG 2017 NAPE handout; AOGCC well files

# Shelf-Margin Trajectory – Sequence Stratigraphic Implications



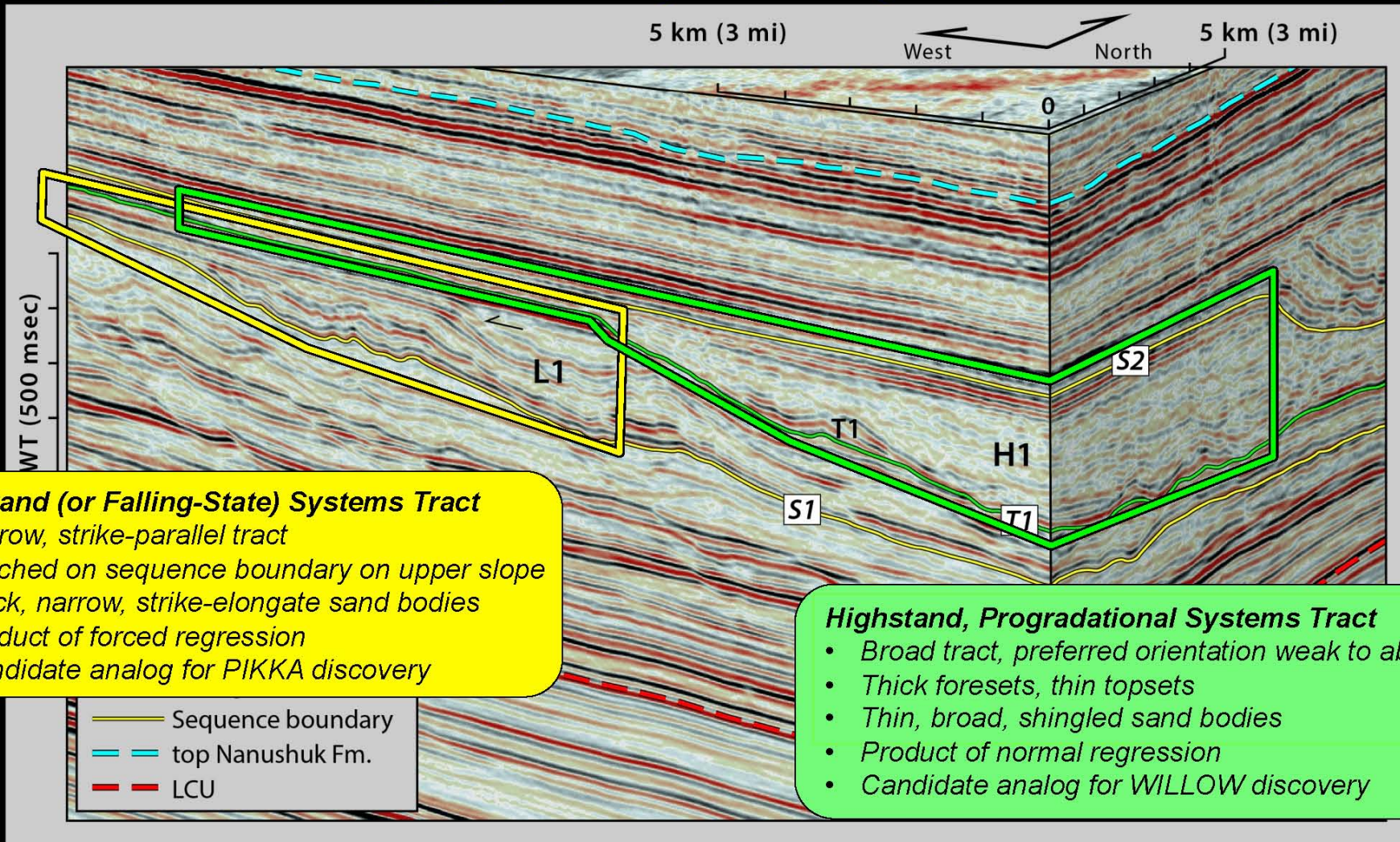


# Shelf-Margin Trajectory – Sequence Stratigraphic Implications



Documentation of provenance signature and shelf margin ages from Richard Lease (USGS)

# Nanushuk – Inferred Stratigraphic Trap Geometry



## Lowstand (or Falling-State) Systems Tract

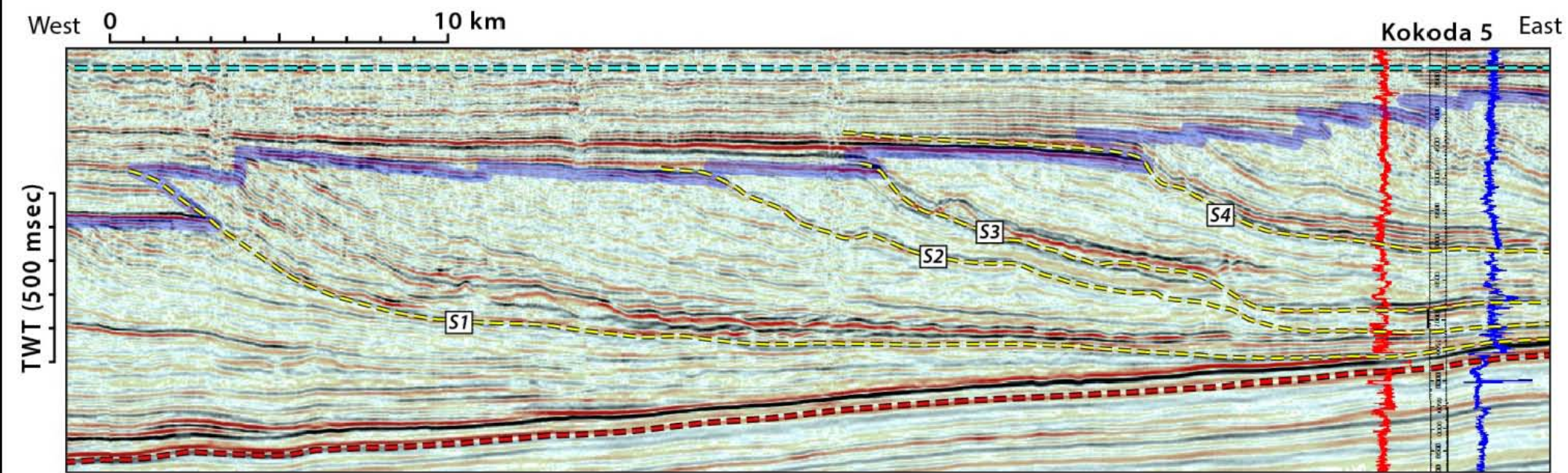
- Narrow, strike-parallel tract
- Perched on sequence boundary on upper slope
- Thick, narrow, strike-elongate sand bodies
- Product of forced regression
- Candidate analog for PIKKA discovery

## Highstand, Progradational Systems Tract

- Broad tract, preferred orientation weak to absent
- Thick foresets, thin topsets
- Thin, broad, shingled sand bodies
- Product of normal regression
- Candidate analog for WILLOW discovery

— Sequence boundary  
 - - - top Nanushuk Fm.  
 - - - LCU

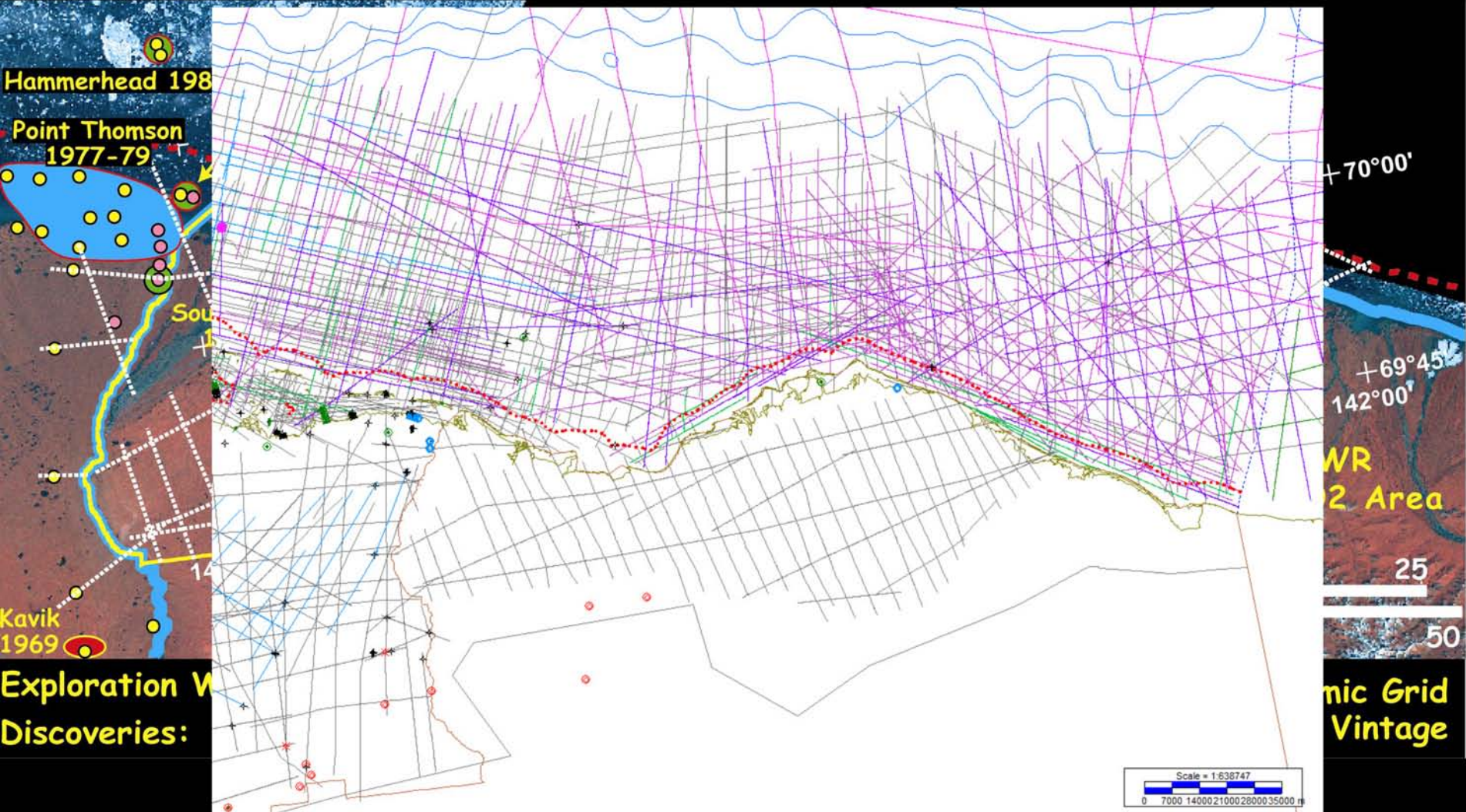
# Torok – Composite Lowstand Systems Tracts



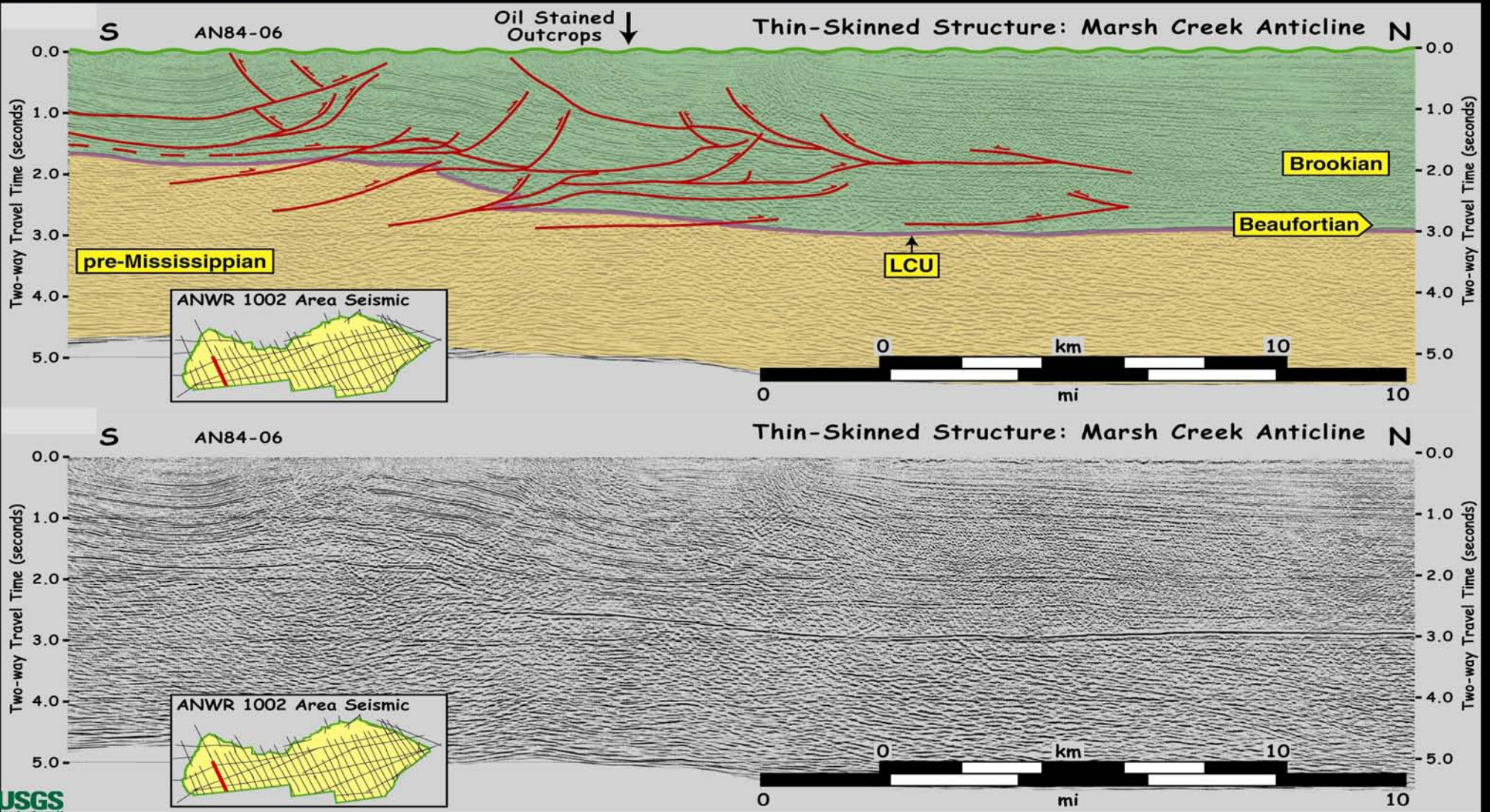
# Arctic National Wildlife Refuge Coastal Plain (1002 Area)



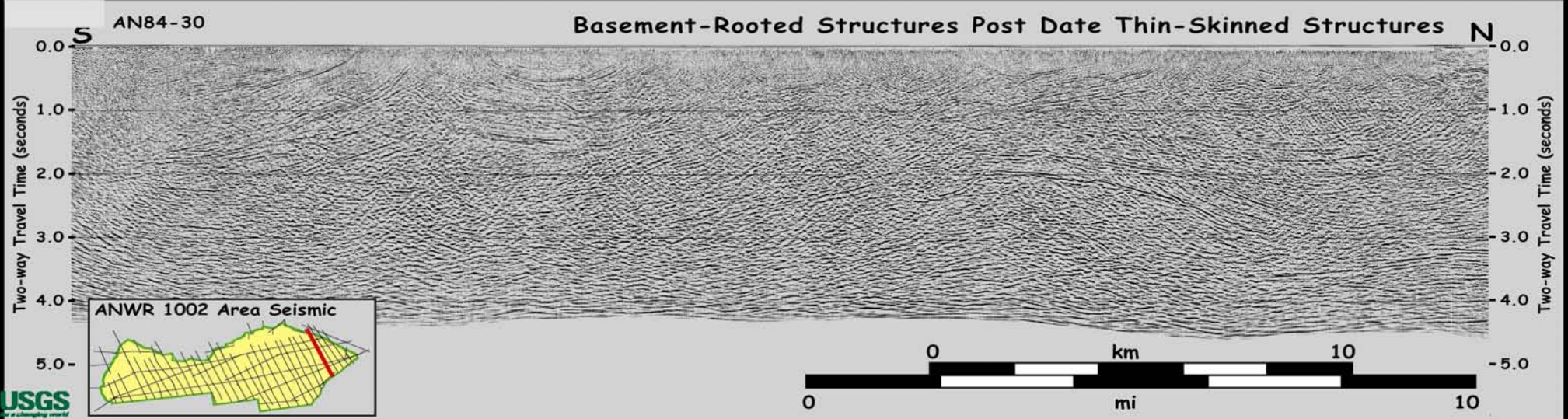
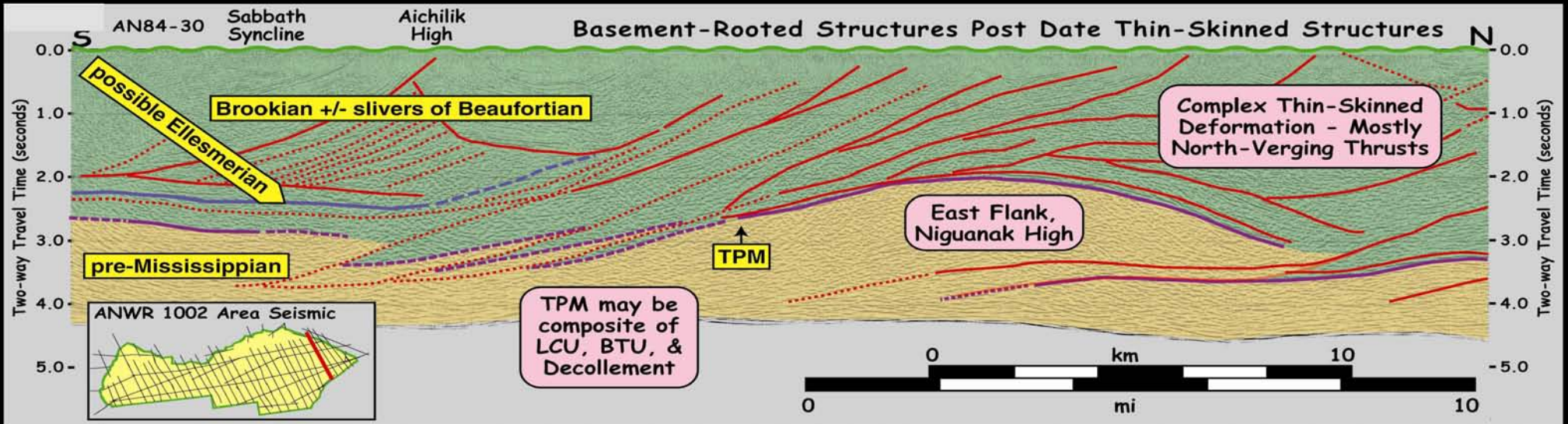
# Area and Data



# Western Deformed – Undeformed Transition

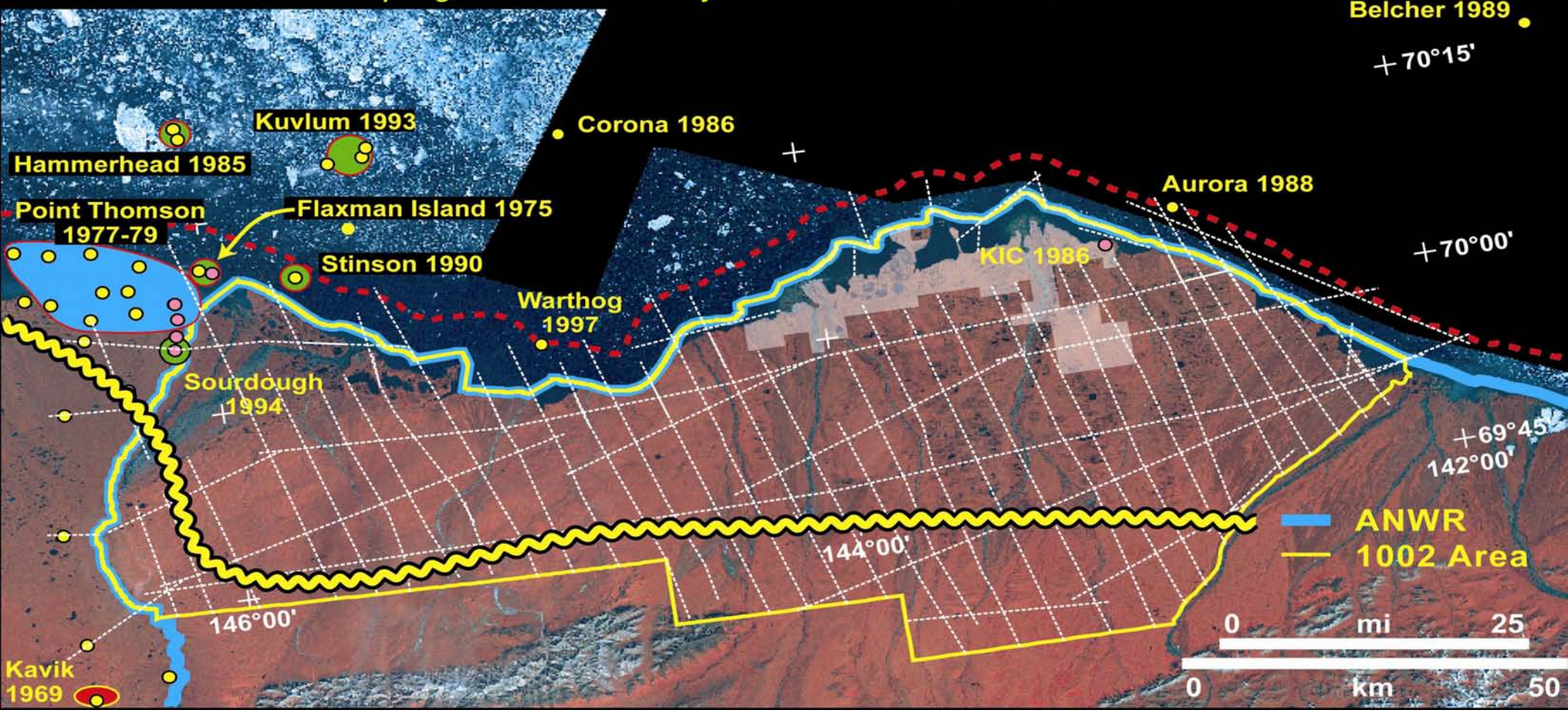


# Eastern Deformed Zone



# Truncation of Ellesmerian Strata

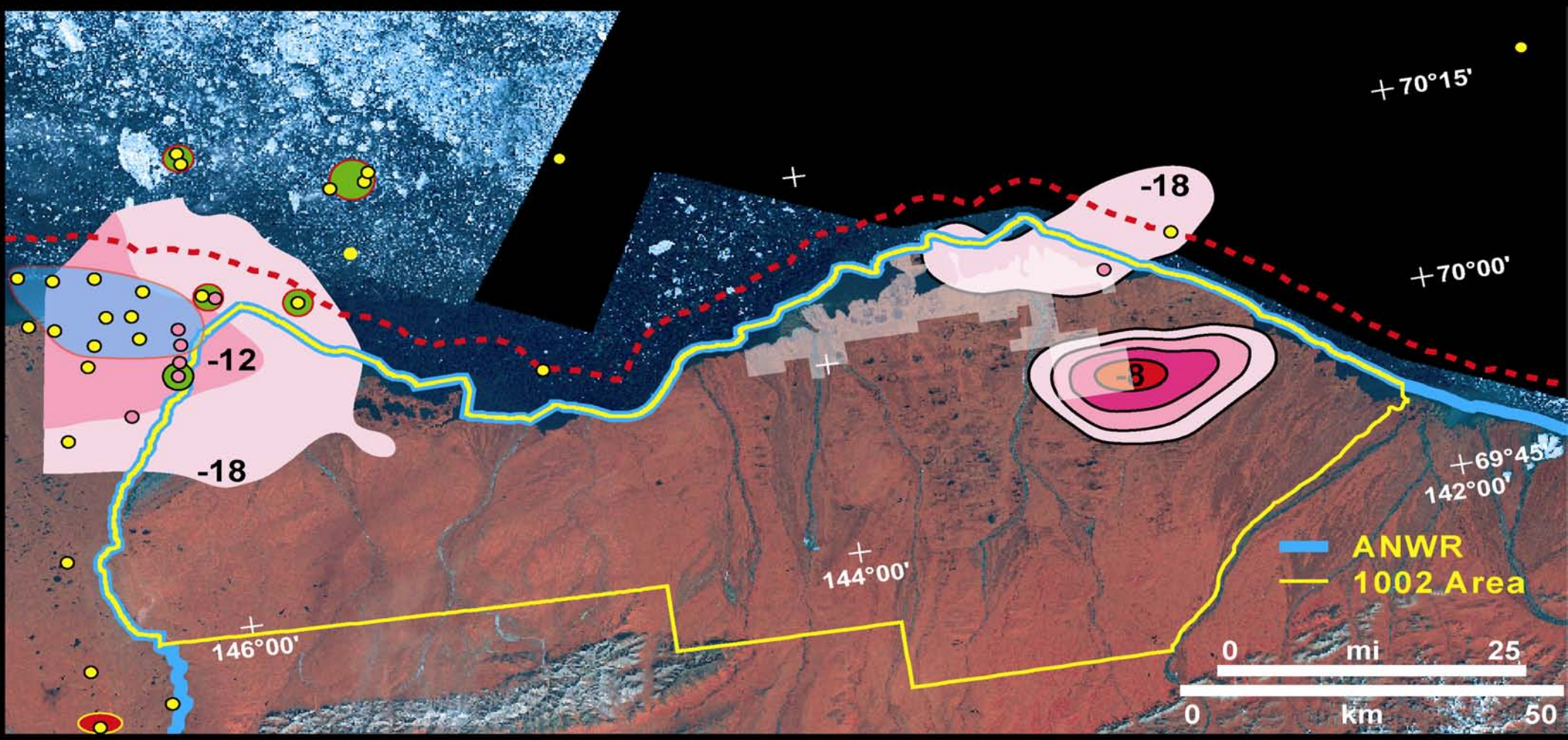
Reservoir rocks in supergiant Prudhoe Bay field are absent across most of area



 **Approx. Ellesmerian Truncation Edge**

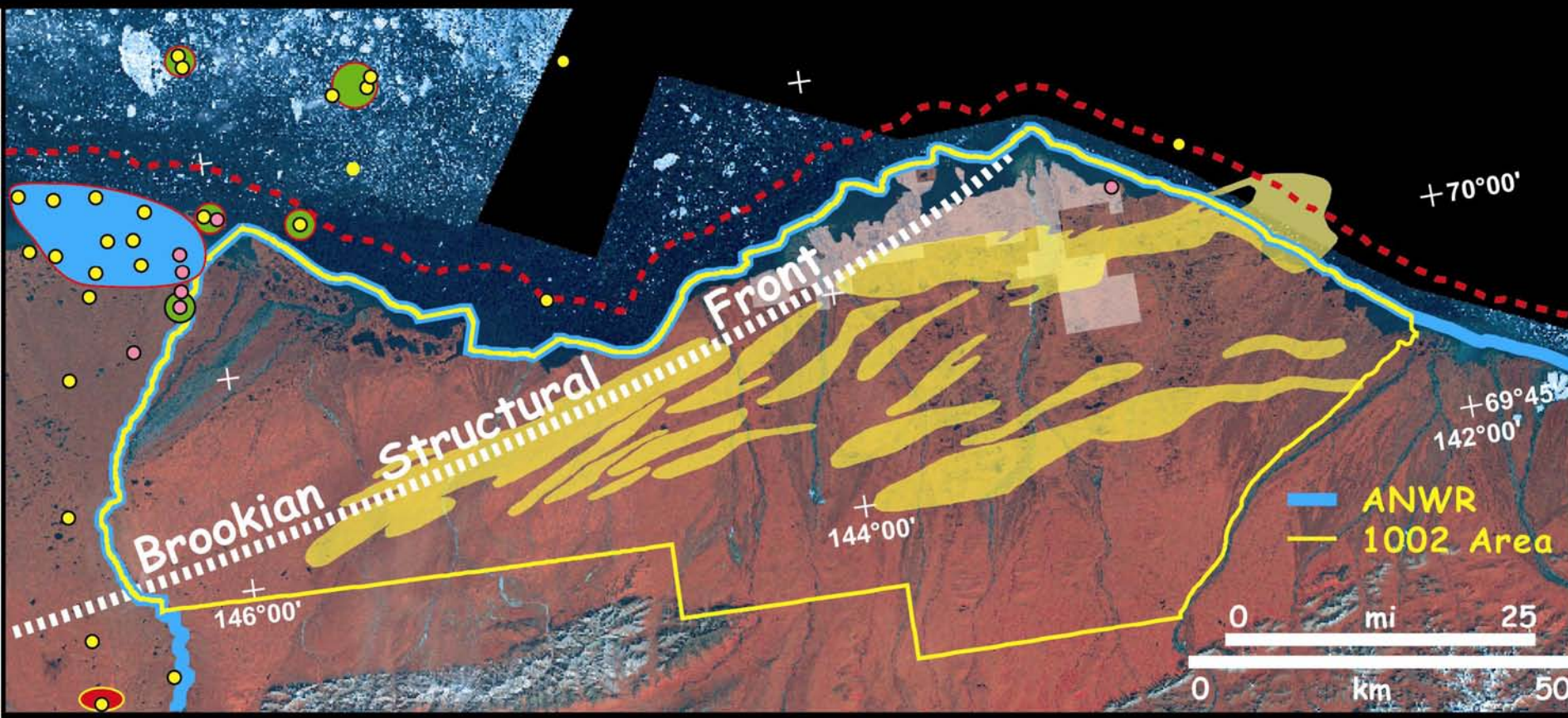


# Big Structures in East Drove 1987 Assessment



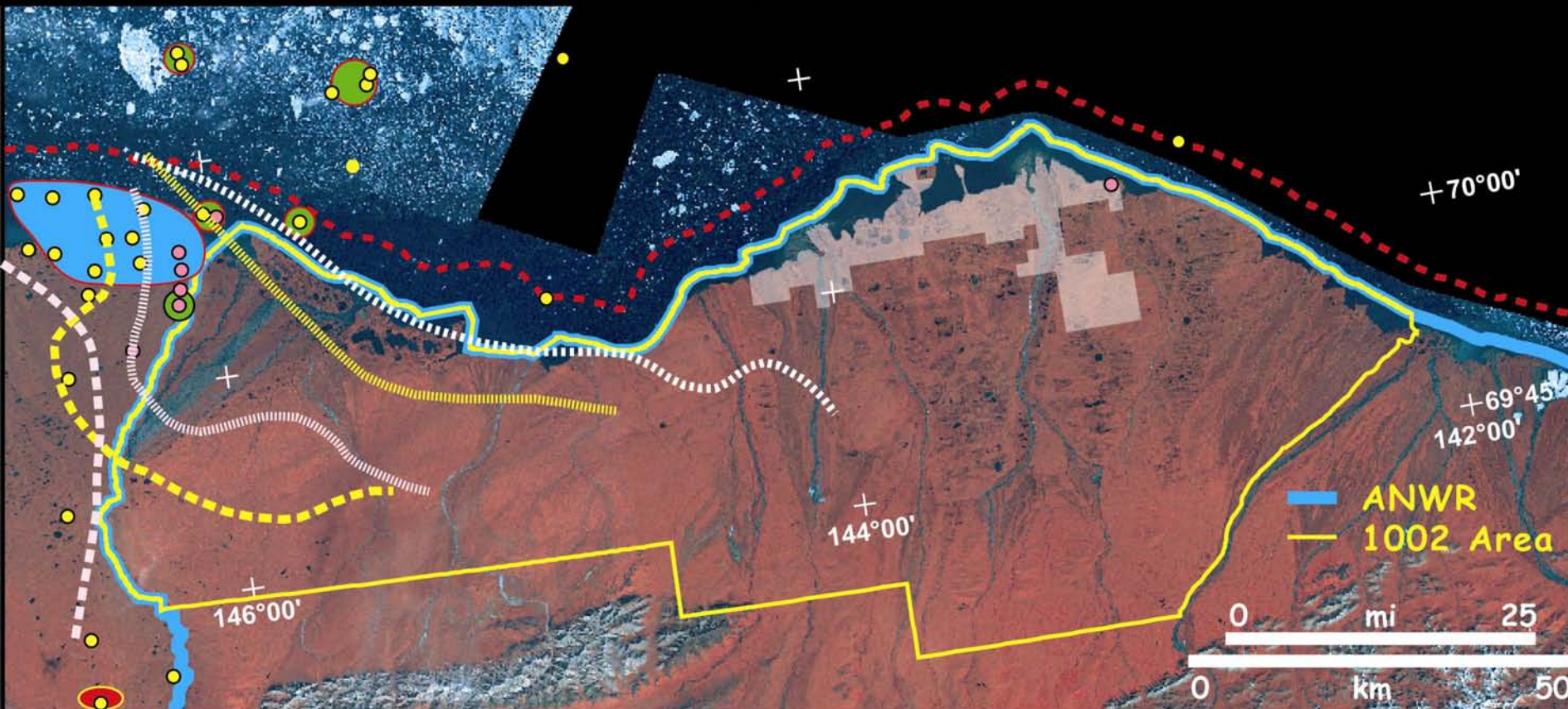
# Brookian Strata – Undeformed vs. Deformed Areas

## Stratigraphic vs Structural Traps



# Brookian Strata – Undeformed vs. Deformed Areas

*Brookian shelf margins - stratigraphic and combination traps*



A wide river delta with a person on the bank and a cliff in the foreground. The river flows from the top right towards the bottom left, branching into many smaller channels. The banks are sandy and light-colored. In the foreground, there is a steep, rocky cliff face. In the background, there are green hills under a clear blue sky.

## Summary:

### Nanushuk – Torok

- Dozens of untested shelf margins in northeast
- How far west will prospectivity extend?
- Reservoir quality could be challenge, especially in Torok

### ANWR Coastal Plain

- No significant new data in past 20 years
- Seismic reprocessing results could significantly impact perspective of resource potential

***Thanks for your attention!***



***Nanushuk – Torok contents have been accepted for publication in AAPG Bulletin – manuscript should be posted “Ahead of Print” late 2017 or early 2018.***

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