



# Bureau of Minerals and Petroleum

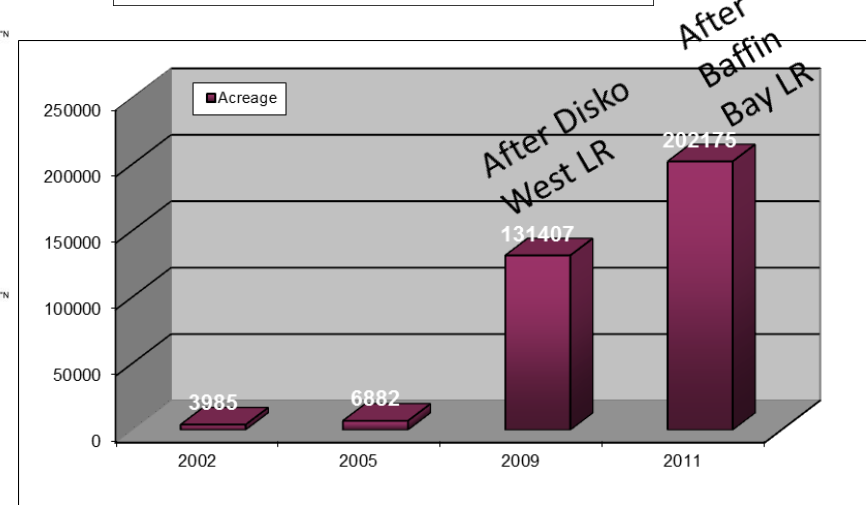
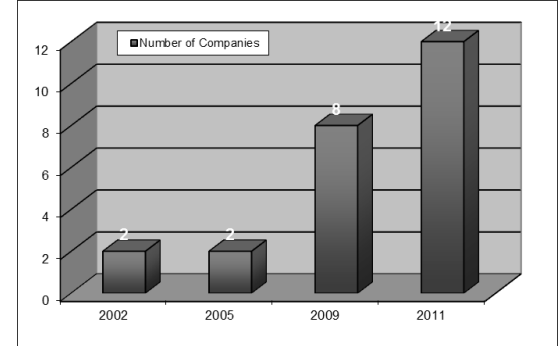
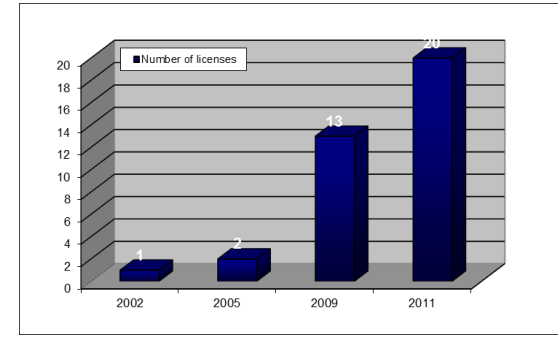
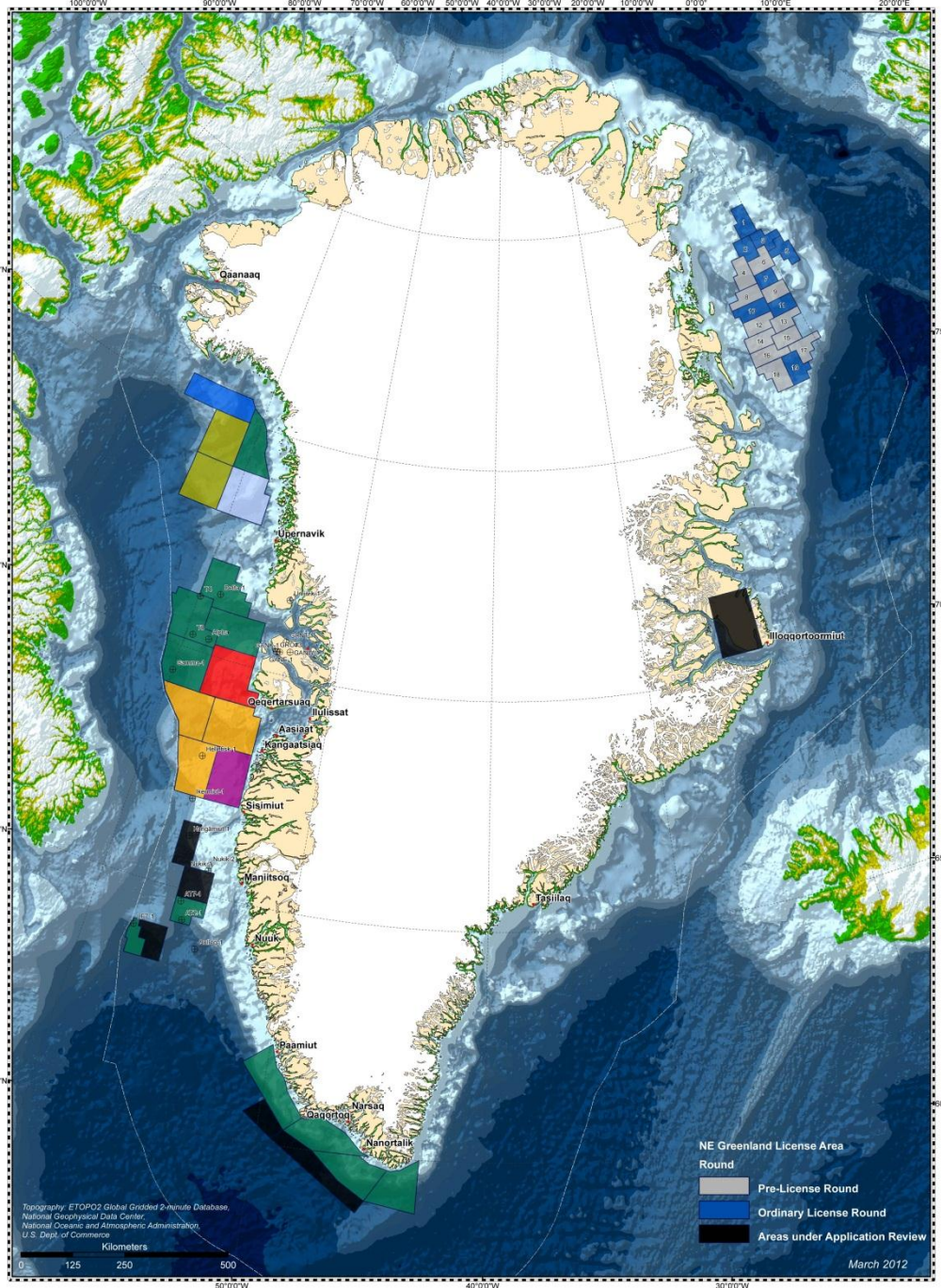


# What will not be covered in this talk?



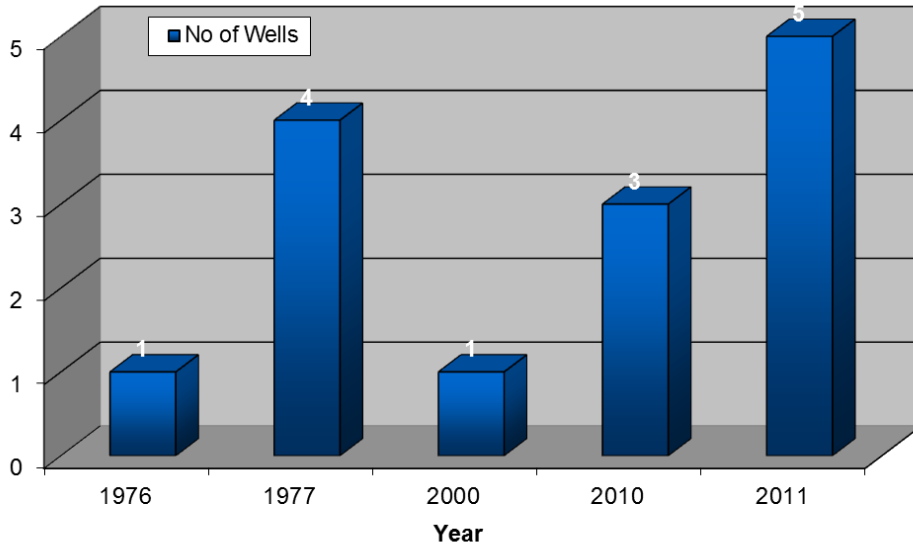
- Licence Terms and Conditions
- Ice Conditions
- Strategic Environmental Impact Assessments

But please visit our stand # 1824 in the International Pavilion for more information

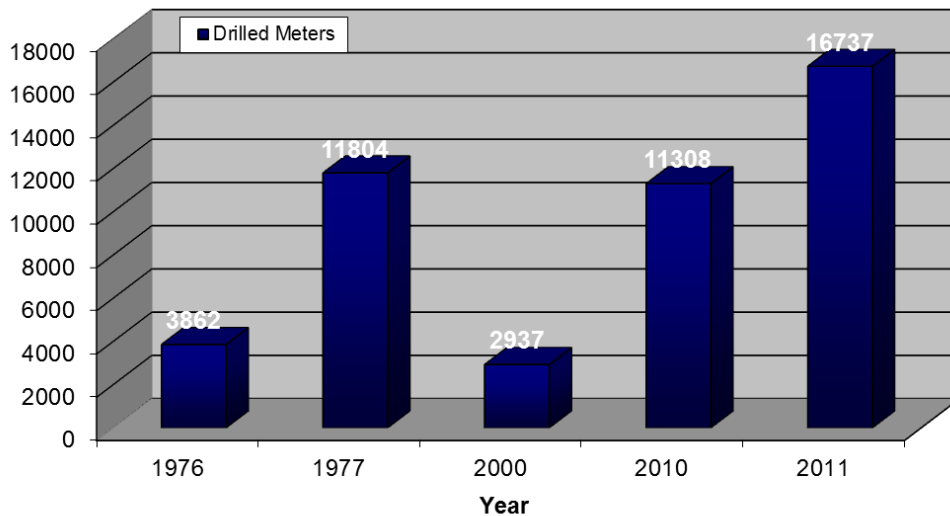




# Well Statistics



A total of 14 wells have been drilled offshore Greenland.



A total of 46,649 meters have been drilled.



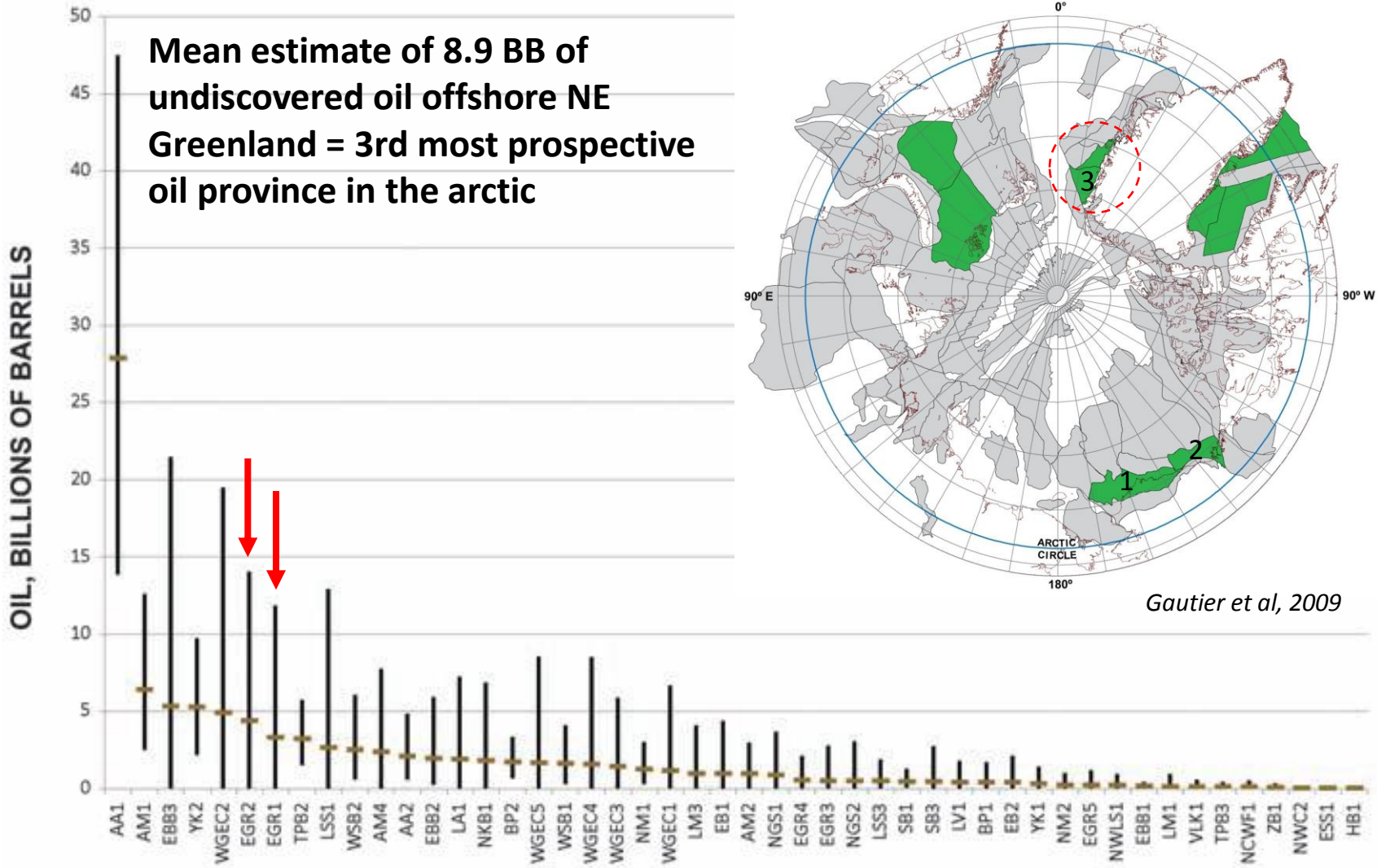


# Bureau of Minerals and Petroleum

## The Greenland Sea Licence Rounds 2012 and 2013



# Estimated undiscovered oil resources

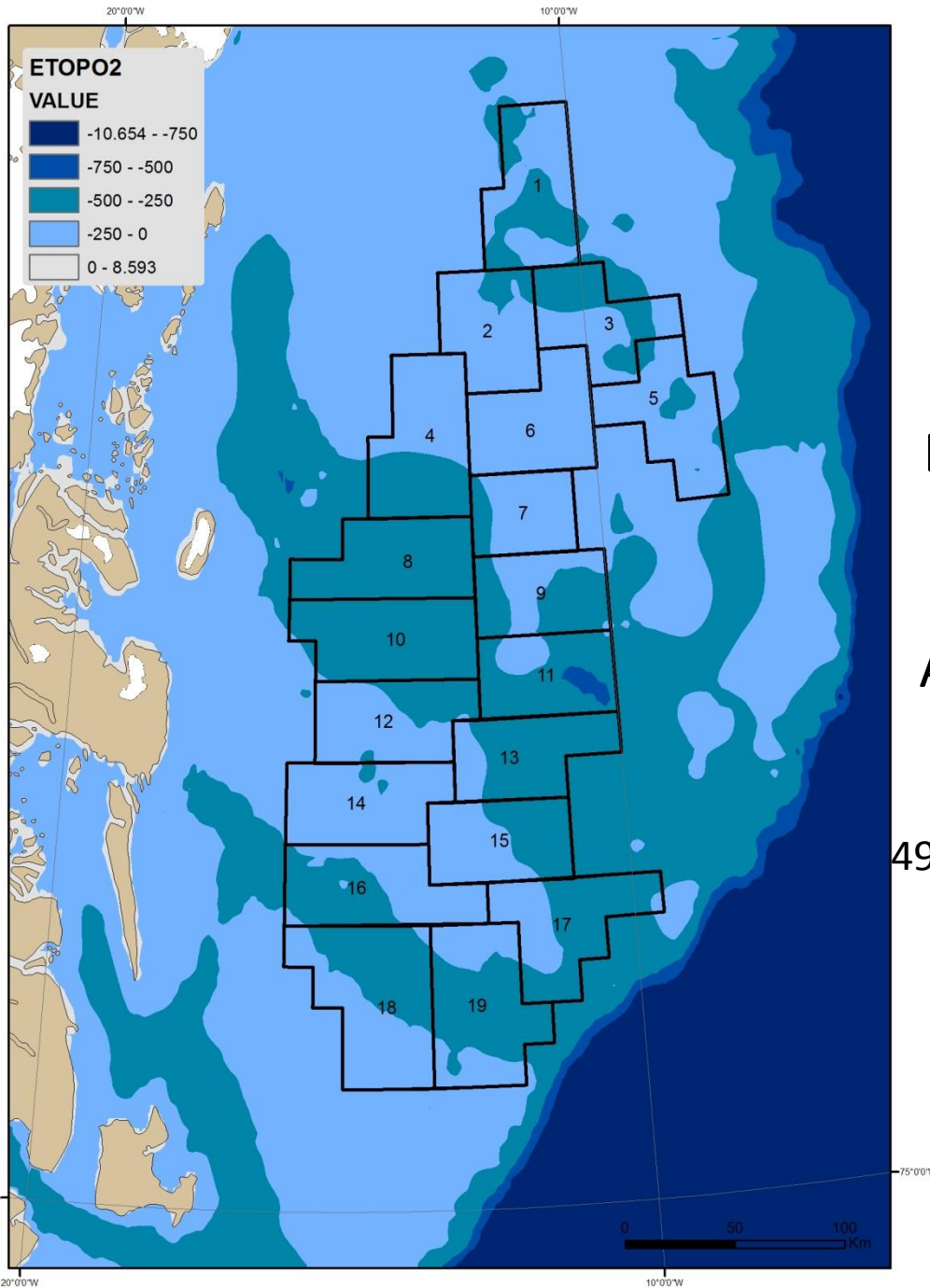


# Impact of recent offshore data leap to future assessment



- More than 20,000 km 2D seismic data has been acquired since the USGS assessment (proprietary & multi-client). And a dense grid of airborne gravimetric and magnetic data today covers the E Greenland shelf.
- A number of offshore shallow cores have been collected by the Kanumas group.
- Major onshore field campaigns focusing on Jurassic, Cretaceous and Paleogene stratigraphy and tectonic, uplift, volcanism and provenance, etc.
- Onshore study of the critical U. Jurassic potential source rock interval, incl. retrieval of >800 m of core targeting the interval.
- Coring of a speculated mid-Cretaceous potential source interval onshore.





Bathymetric conditions within the licence area.

-

Average water depth is 300-400 m

0.5 % of licence area: water depth >500 m.

49 % of the licence area: water depth 250-500 m

50.5% of licence area: water depth 0-250 m

# Two licence calls in the Greenland Sea



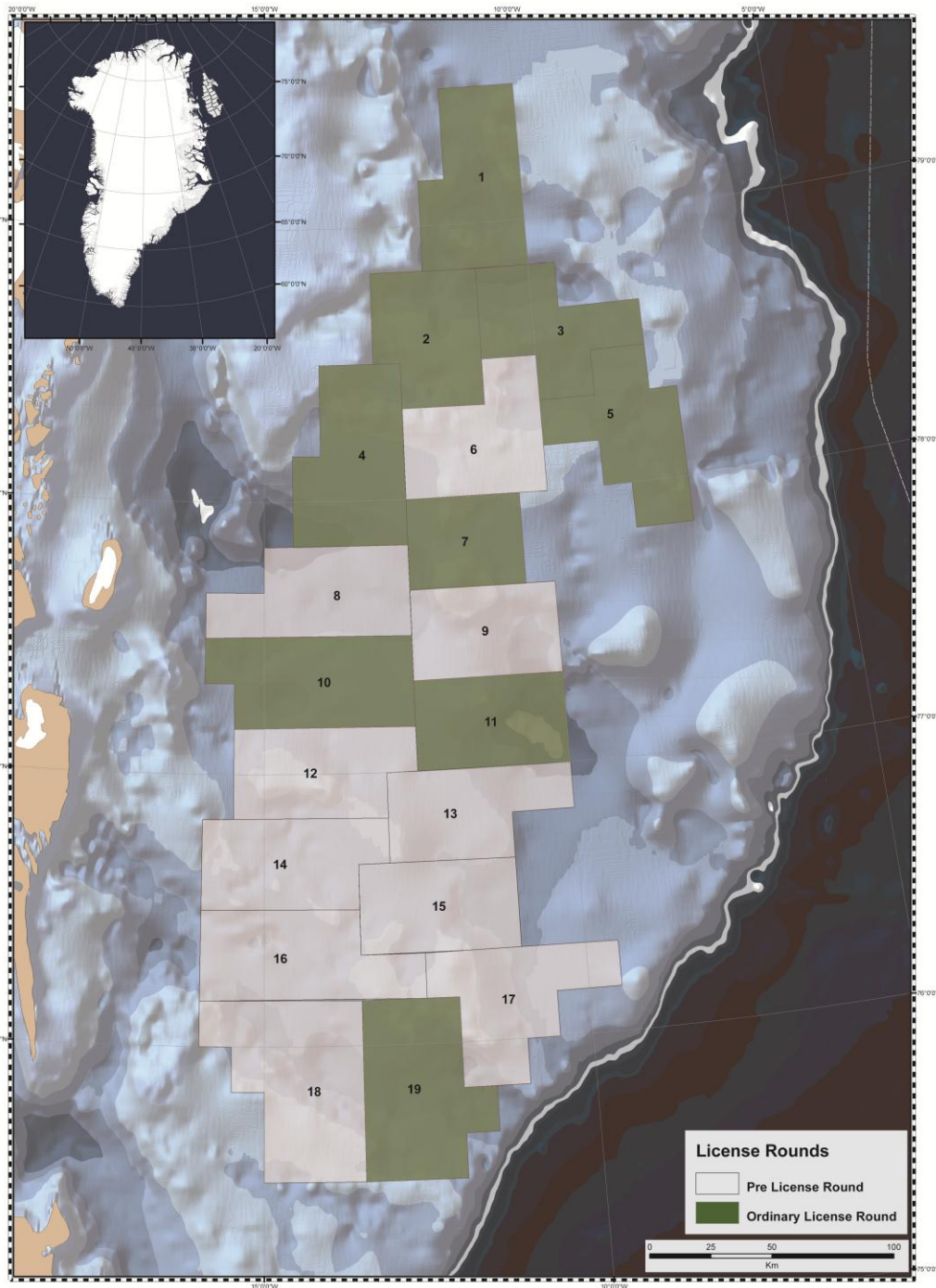
- A **Pre-licence Round** reserved for consortiums consisting of at least one paying member of the KANUMAS Group or a 100% affiliated company
- An **Ordinary-licence Round** following after the Pre-licence Round which is open to any company or group of companies

# Greenland Sea ordinary-licence round - Important dates and actions



Important Dates	Actions and decisions
December 15 <sup>th</sup> 2012	Deadline for licence applications in the Pre-licence Round
March 15 <sup>th</sup> 2013	The Government of Greenland shall determine whether licences shall be awarded in the Pre-licence Round
<p><b>After completion of the Pre-licence Round, those parts of the total area, which are not covered by licences is offered in the subsequent Ordinary-licence Round. Any company or group of companies may participate without limitations in the Ordinary-licence Round</b></p>	
July 1 <sup>st</sup> 2013	Deadline for submission of non-obligating Pre-qualification application
August 15 <sup>th</sup> 2013	Decision on the Pre-qualification can be expected from the Greenland authorities
October 15 <sup>th</sup> 2013	Deadline for licence application for companies or groups of companies (maximum 3 companies plus NUNAOIL A/S)
January 15 <sup>th</sup> 2014	Decision from the Greenland Government on whether any licences shall be awarded in the Ordinary-licence Round





The offered licence area covers

**49.949 km<sup>2</sup>**

and is split into

**19 blocks**

With average block sizes between

**2.000 - 3.000 km<sup>2</sup>.**



## The Pre-licence Area

Contains

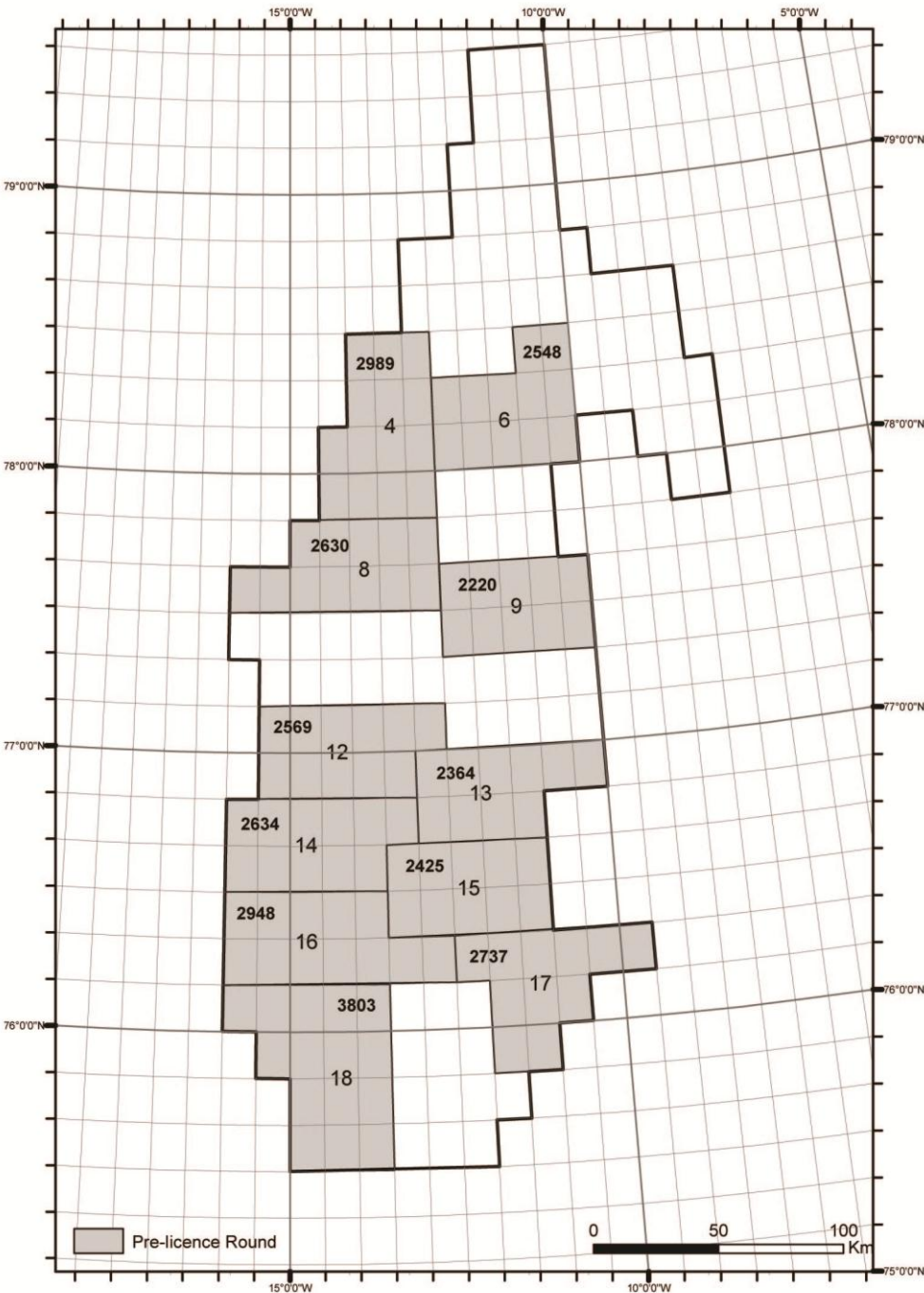
**11 blocks**

covering an area of

**29.868 km<sup>2</sup>**

with block sizes ranging from

**2.220 km<sup>2</sup> to 3.803 km<sup>2</sup>**





## The Ordinary-licence Area

Contains

**8 blocks**

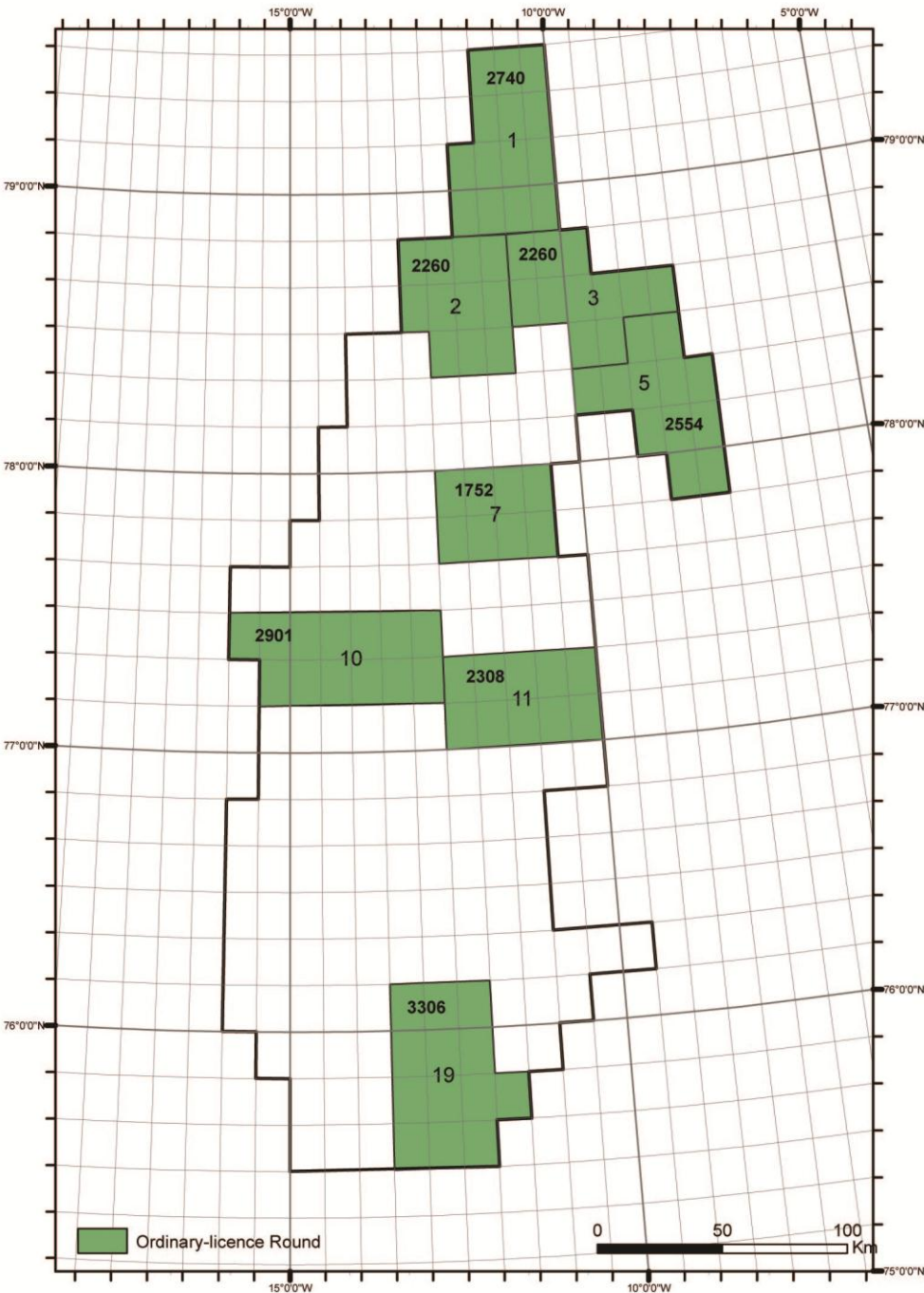
covering an area of

**20.081 km<sup>2</sup>**

with block sizes ranging from

**1.752 km<sup>2</sup> to 3.306 km<sup>2</sup>**

But will also include blocks *not* awarded in the Pre-licence Round





# Rational behind block division



- A balanced distribution of prospects between the two different licence rounds
- Each block shall contain at least one prospect of a size which makes exploration feasible
- A balanced distribution of prospect types between the two licence rounds

# Data types and their coverage

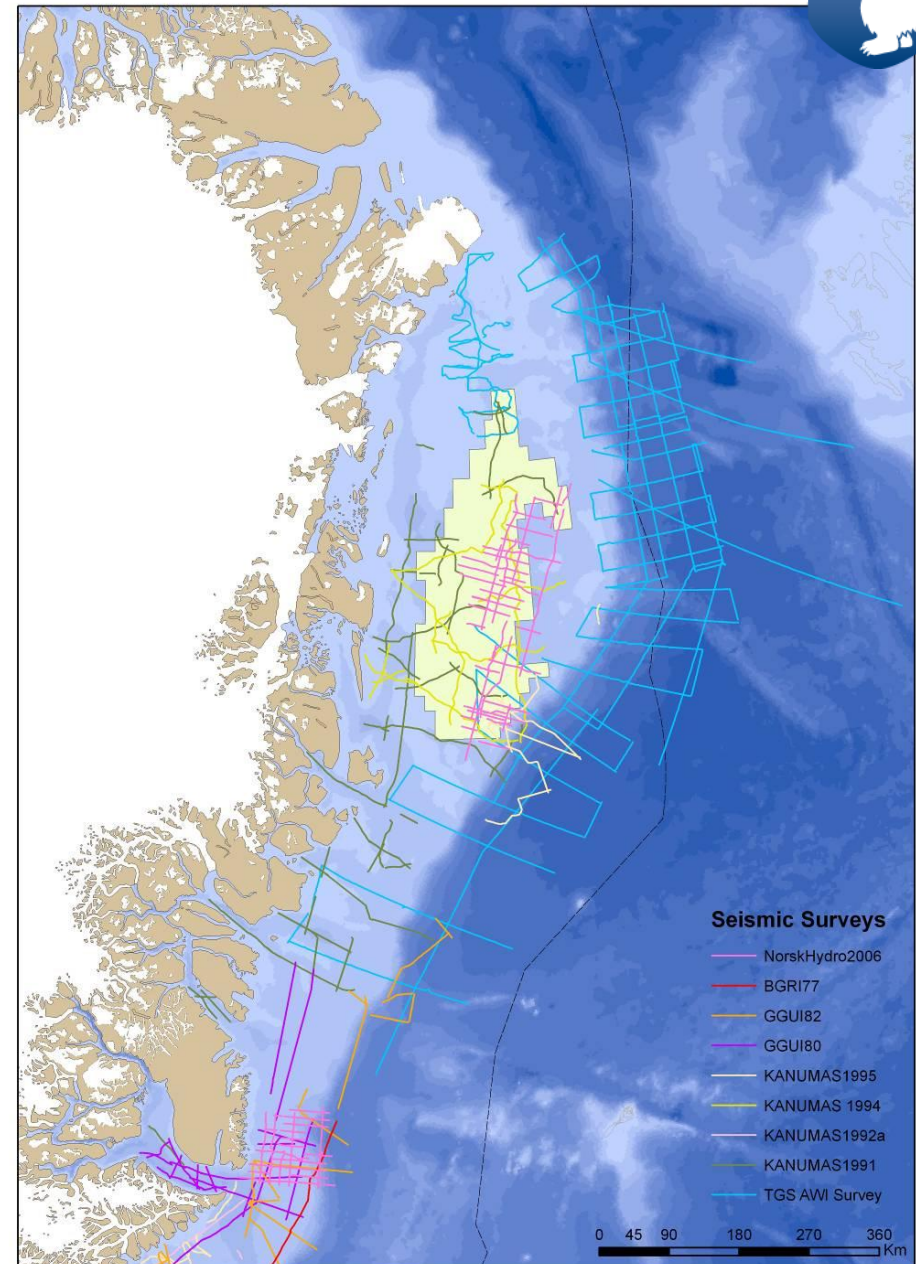


- 2D seismic data of various vintage - 1977 to 2011
- Irregular grid of 2D seismic data – less line kilometres in the northern and western blocks
- Line kilometres within blocks are between 250 – 1400 km
- Dense airborne magnetic and gravimetric data covering the E Greenland Shelf

# Seismic Data Coverage 1977-2007



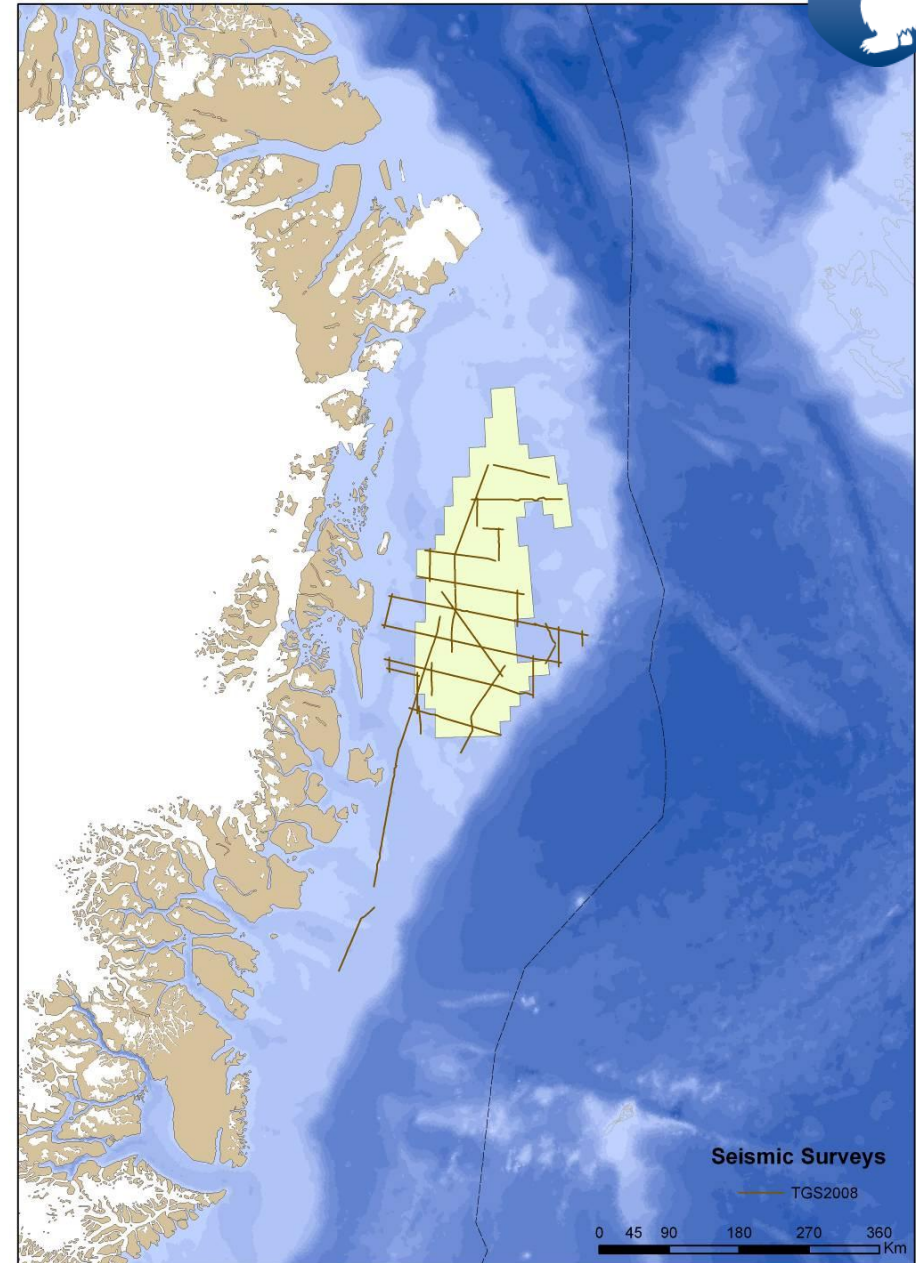
Seismic Survey	Company	Year of acquisition	Total line km
NorskHydro2006	NorskHydro	2006	3812
AWI	TGS	1999-2004	10602
Kanumas 1995	Kanumas	1995	1384
Kanumas 1994	Kanumas	1994	1636
Kanumas 1992a	Kanumas	1992	593
Kanumas 1991	Kanumas	1991	3307
GGUi82	GEUS	1982	2879
GGUi80	GEUS	1980	2622
BGRi76	BGR	1976	273
<b>Total</b>			<b>27297</b>





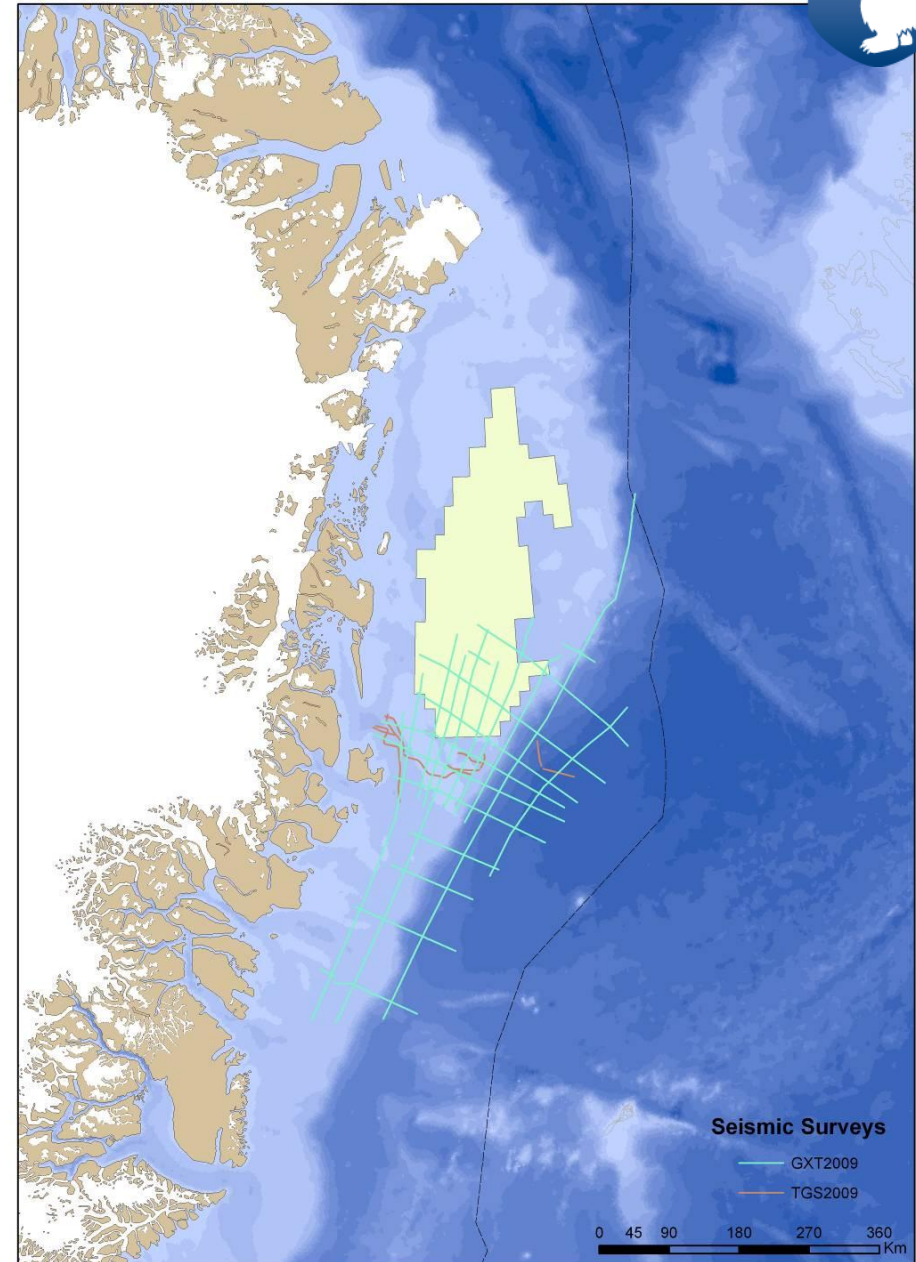
## Seismic Data Acquisition in 2008

TGS NOPEC acquired a total of 2,786 km of which 1,774 km lies within the licence area.



## Seismic Data Acquisition in 2009

TGS NOPEC and ION-GXT acquired a total of 5,283 km of which 994 km lies within the licence area.

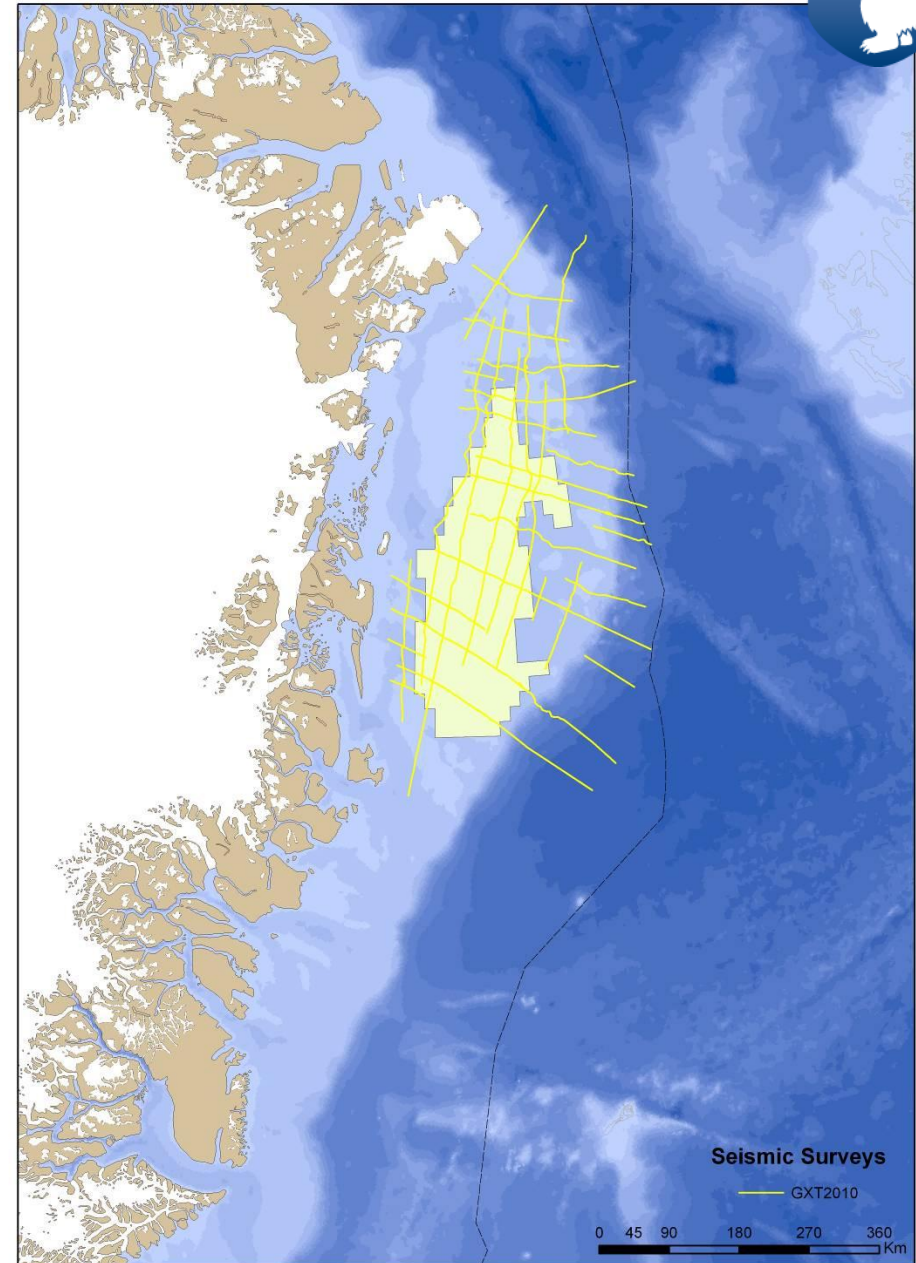


## Seismic Data Acquisition in 2010

ION-GXT acquired a total of 6,535 km of which 2,433 km lies within the licence area.

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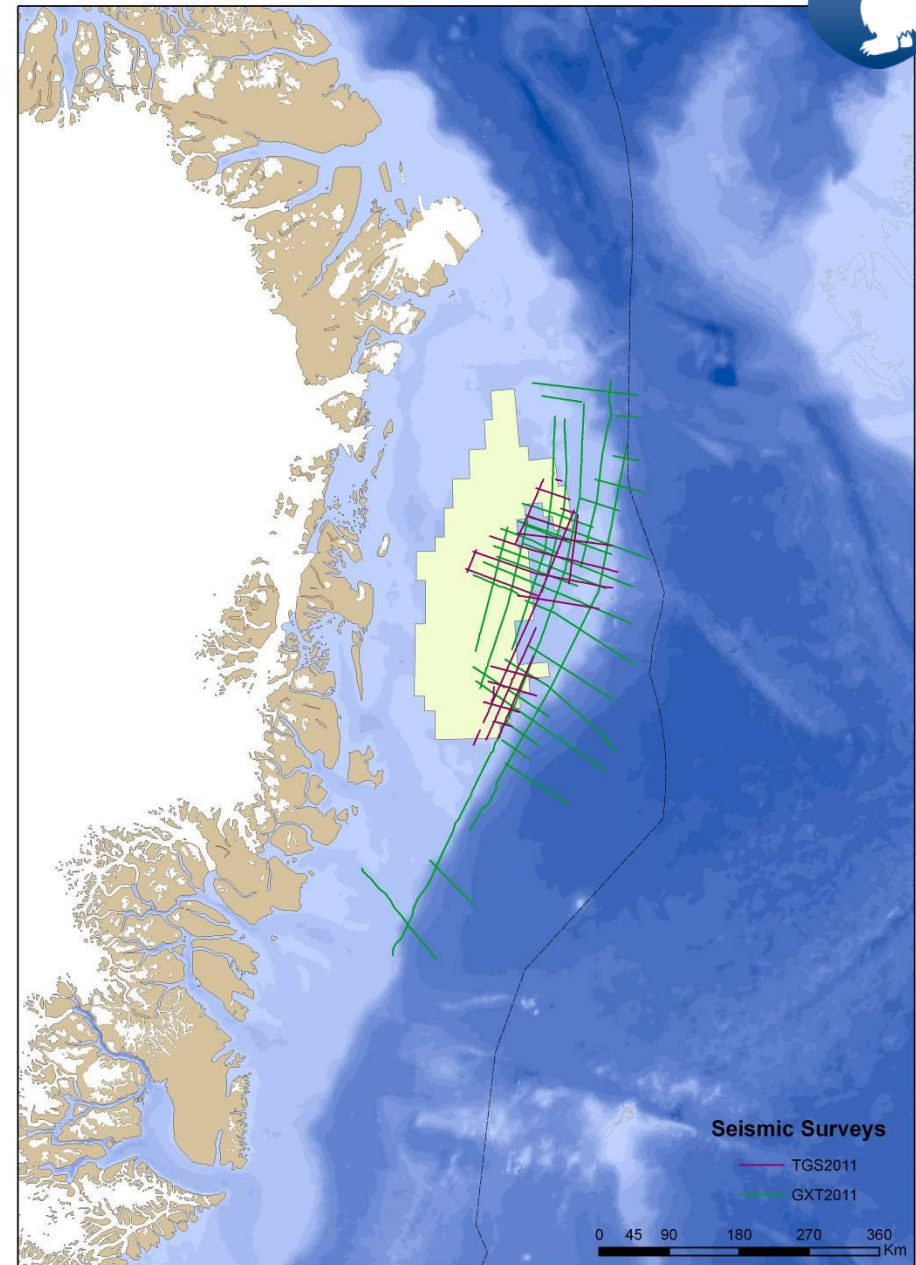
GOVERNMENT OF GREENLAND





## Seismic Data Acquisition in 2011

TGS NOPEC and ION-GXT acquired a total of 6,937 km of which 2,027 km lies within the licence area.

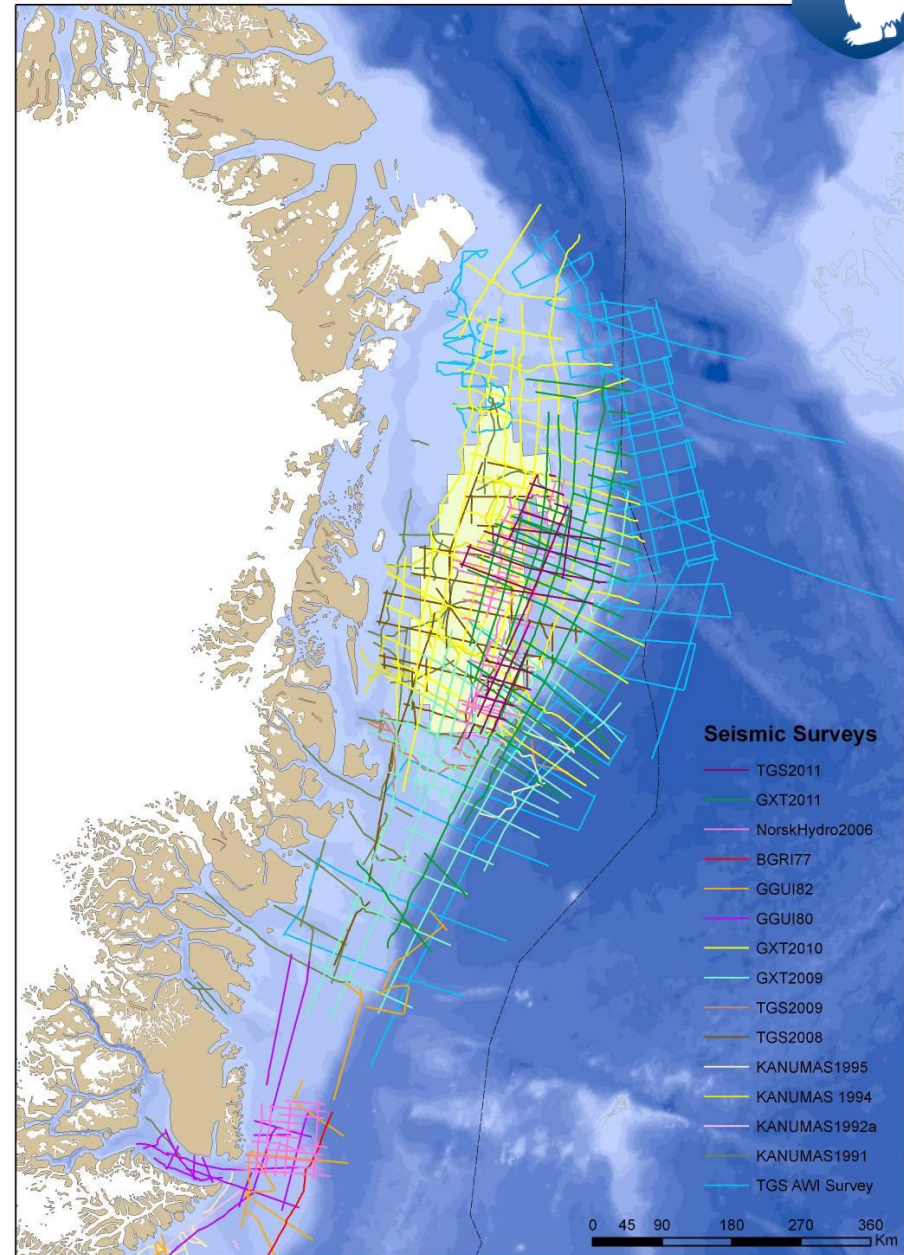




# Seismic data coverage as of 2011



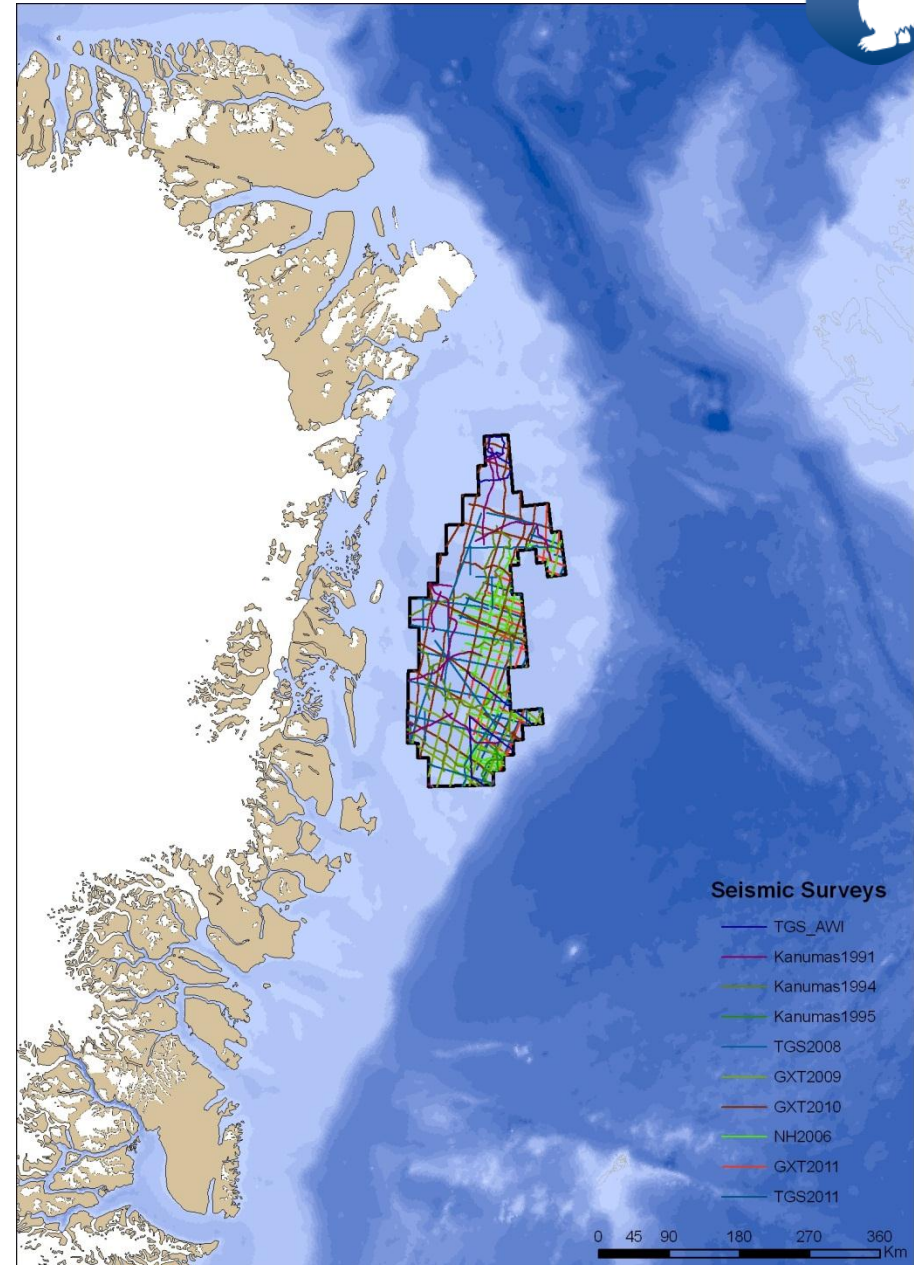
Seismic Survey	Company	Year of acquisition	Total line km
TGS2011	TGS	2011	1852
GXT2011	GXT	2011	5128
GXT2010	GXT	2010	6782
GXT2009	GXT	2009	5521
TGS2009	TGS	2009	487
TGS2008	TGS	2008	2789
NorskHydro2006	NorskHydro	2006	3812
AWI	TGS	1999-2004	10602
Kanumas 1995	Kanumas	1995	1384
Kanumas 1994	Kanumas	1994	1636
Kanumas 1992a	Kanumas	1992	593
Kanumas 1991	Kanumas	1991	3307
GGUi82	GEUS	1982	2879
GGUi80	GEUS	1980	2622
BGRi76	BGR	1976	273
<b>Total</b>			<b>49394</b>



# Seismic data coverage within the licence area



Seismic Survey	Company	Line km within licence area
TGS2011	TGS	911
GXT2011	GXT	1116
GXT2010	GXT	2433
GXT2009	GXT	994
TGS2009	TGS	
TGS2008	TGS	1774
NorskHydro2006	NorskHydro	1883
AWI	TGS	430
Kanumas 1995	Kanumas	139
Kanumas 1994	Kanumas	1069
Kanumas 1992a	Kanumas	
Kanumas 1991	Kanumas	869
GGUi82	GEUS	
GGUi80	GEUS	
BGRi76	BGR	
<b>Total</b>		<b>11618</b>

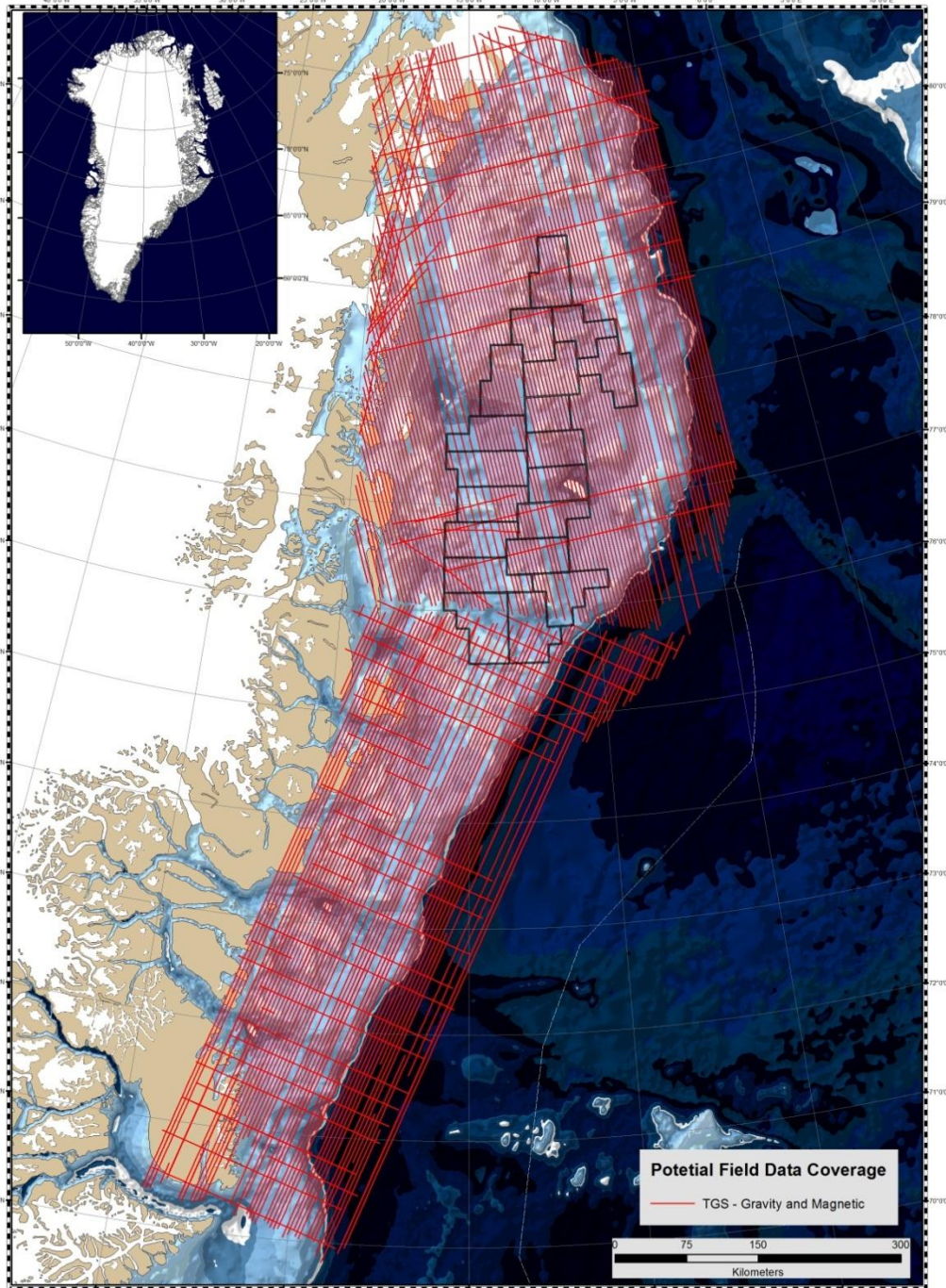


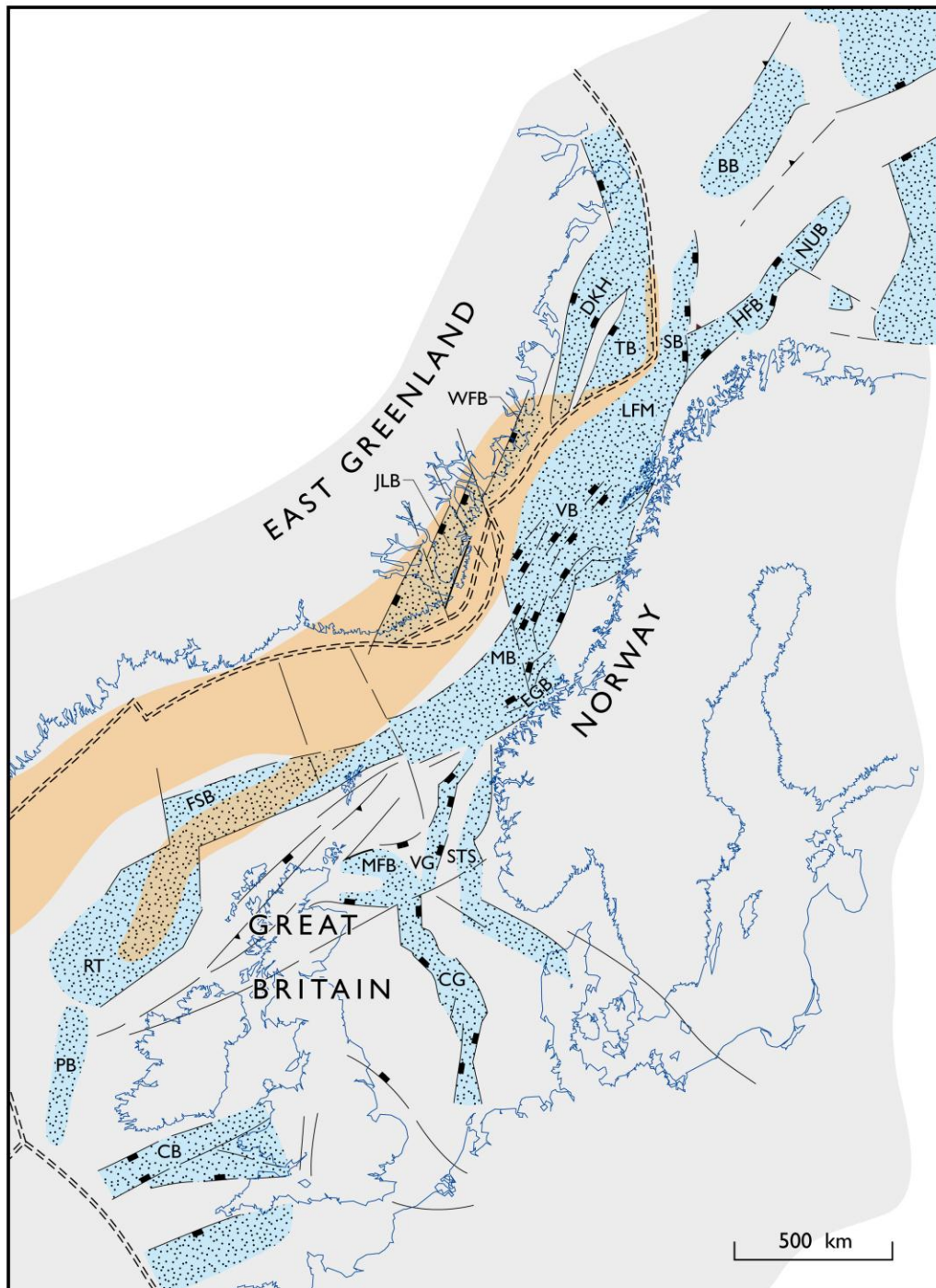




# Potential field data

Aerogravity and  
aeromagnetic data acquired  
by TGS in 2007 and 2008

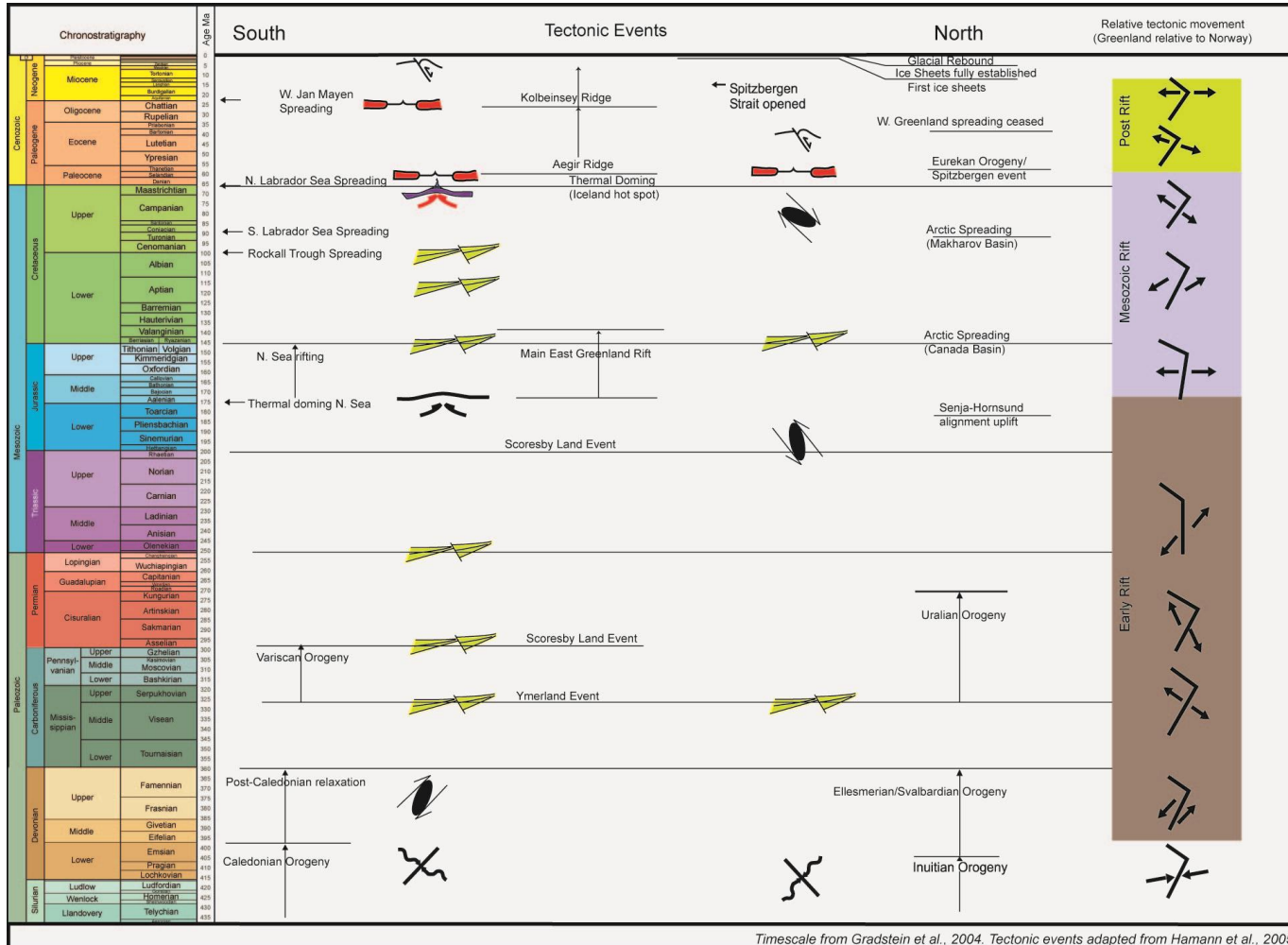




- East Greenland margin is conjugated to the Norwegian-British margin.
- Thus, prior to break up NE Greenland rift basins were directly linked with the prolific Norwegian Atlantic basins.
- The Geology of onshore NE Greenland resembles that of the Norwegian-British margin.
- It is conceivable that the pre-break up geology offshore NE Greenland also resembles that of the Norwegian-British margin.



# Regional geological setting

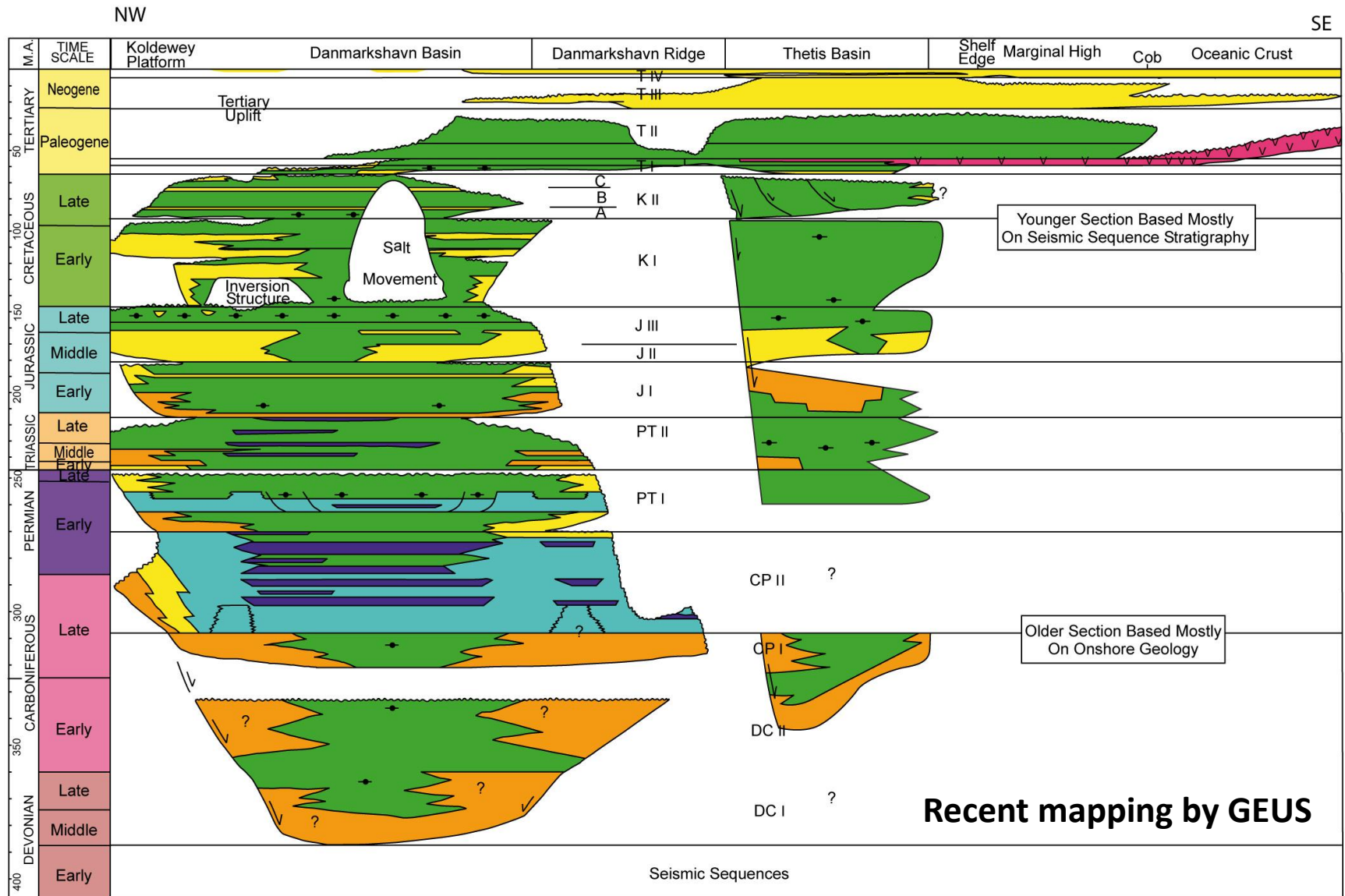


Timescale from Gradstein et al., 2004. Tectonic events adapted from Hamann et al., 2005

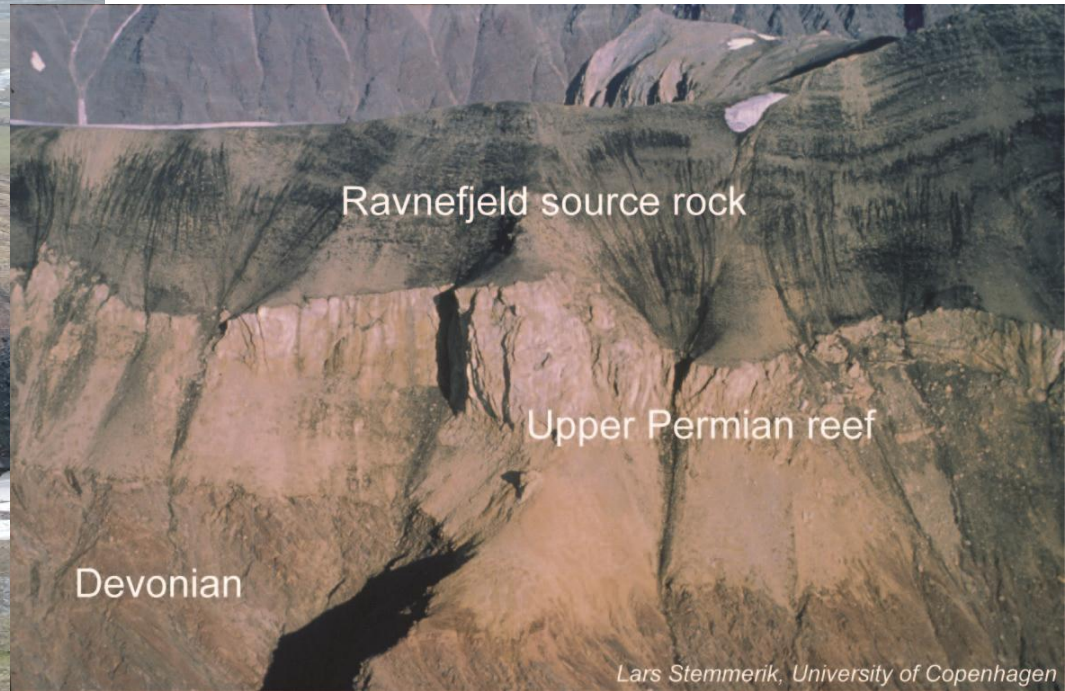
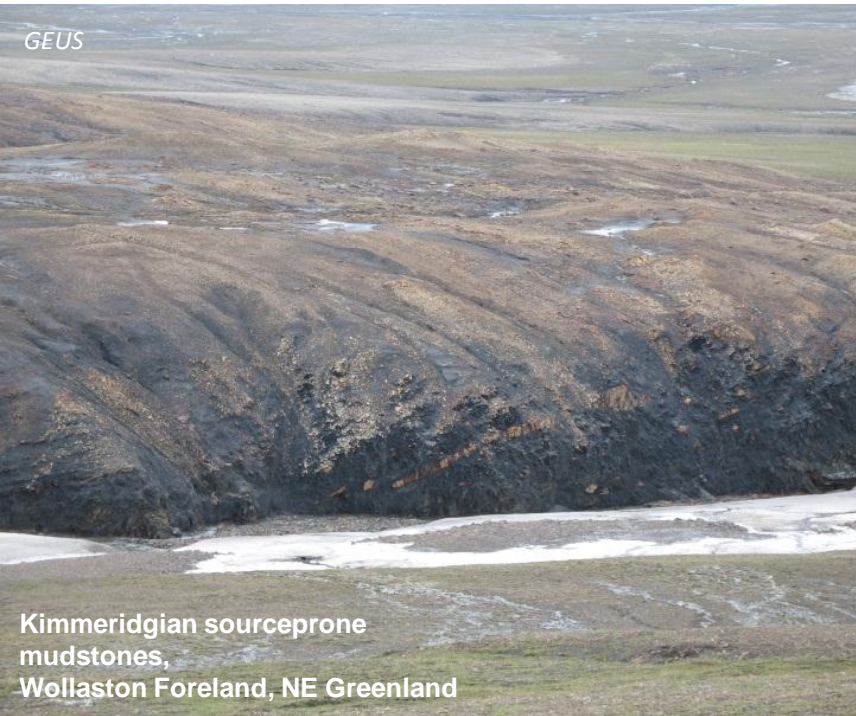
- Main rift events during the Carboniferous and the Cretaceous
- Tertiary oceanic break-up
- Paleocene-Eocene magmatism



# Deep stratigraphy in the Thetis Basin



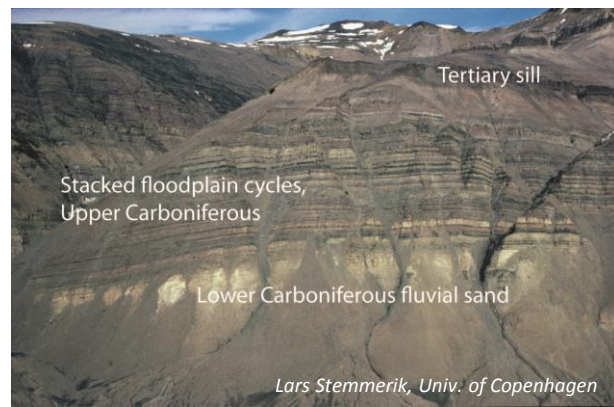
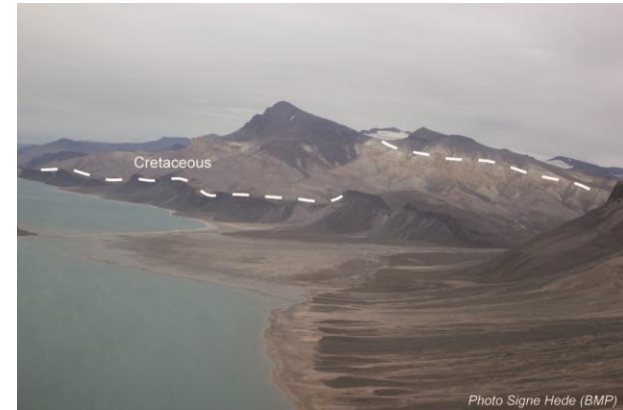
# Source Rock intervals - onshore



# Reservoir intervals - onshore



Onshore Reservoir Sections - Northeast Greenland		
Age	Formation/Unit Name	Depositional Environment
Upper Paleocene		Fluvial conglomerates and sandstone
Upper Cretaceous	Vega Sund Fm and Østersletten Mbr	Slope channel and basin floor sandstones
Lower Cretaceous		Deltaic and shallow marine coarse-grained wedges
Upper Jurassic	Hareelv Fm	Turbidite sandstone
Middle - Upper Jurassic	Olympen Fm	Shallow marine and deltaic sandstones
Middle Jurassic	Pelion Fm	Shallow marine syn-rift; 10 - 600 m thickening northwards
Lower Jurassic	Neill Klintner Grp	Shallow marine sandstones
Lower Jurassic	Kap Stewart Grp	Lacustrine sandstones
Upper Permian	Foldvik Creek Grp	Carbonates and deep marine sandstone turbidites
Upper Carboniferous		Fluvial and lacustrine sandstones

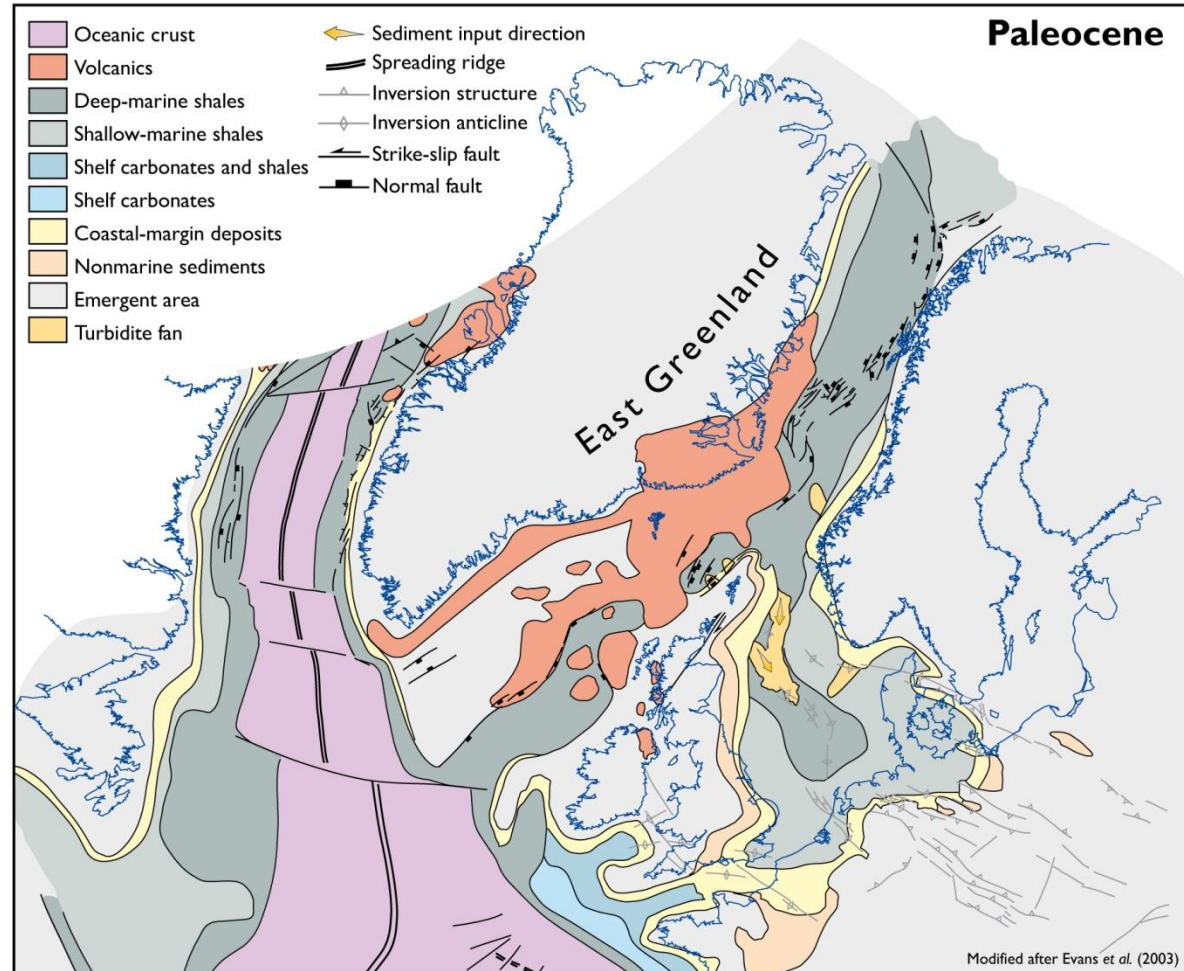
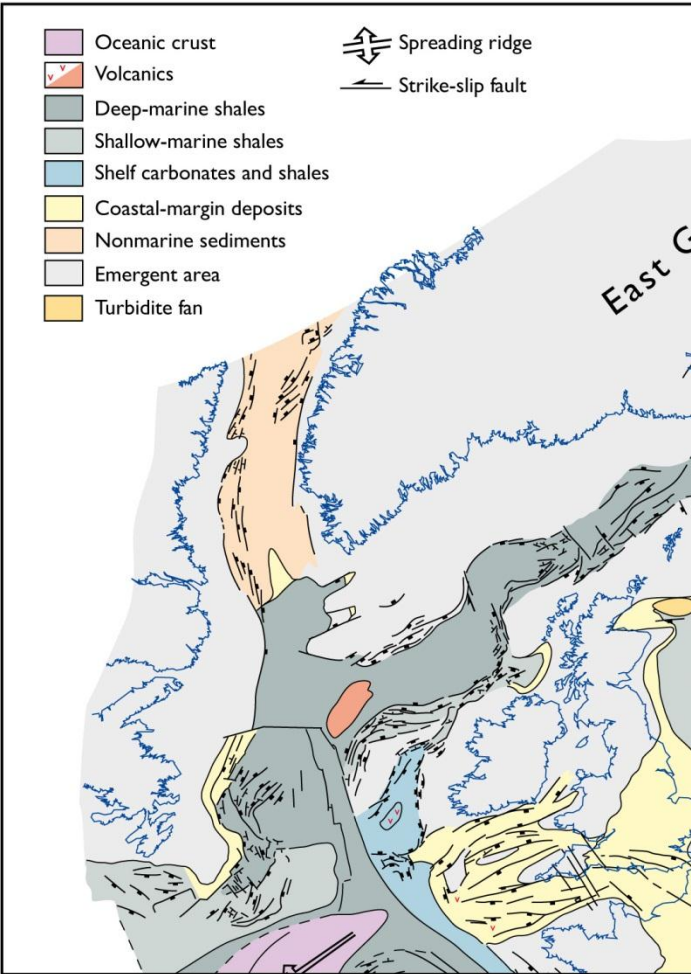




# Regional development in short

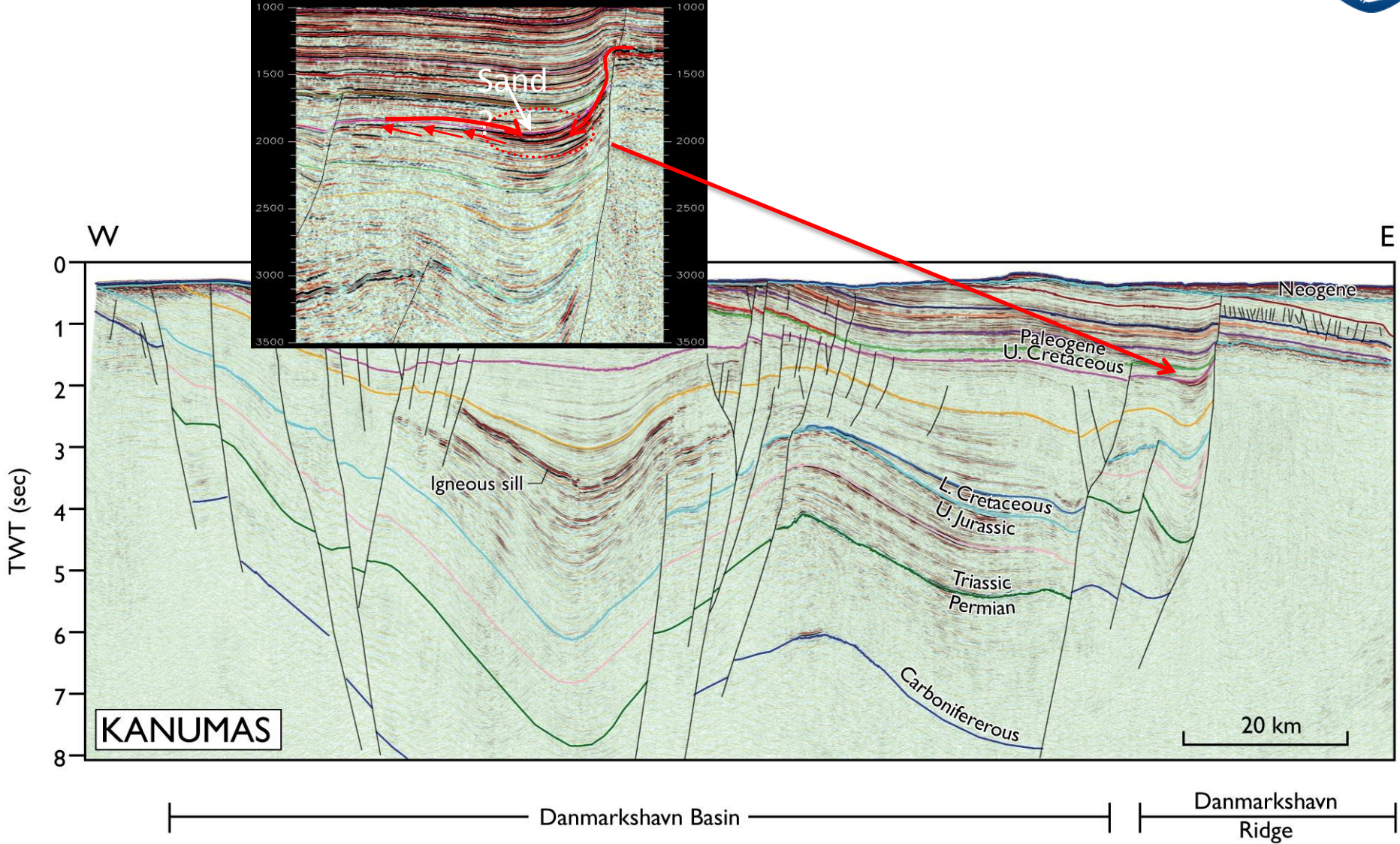


Late Carboniferous - Early Permian: Marine influence and carbonates: Turbidite fan  
 Early Permian - Early Cretaceous: North Atlantic Volcanism and continental break-up  
 Early Cretaceous - Paleocene: North Atlantic Volcanism and continental break-up  
 Paleocene - Present: North Atlantic Volcanism and continental break-up  
 Devonian and Carboniferous: Deposition



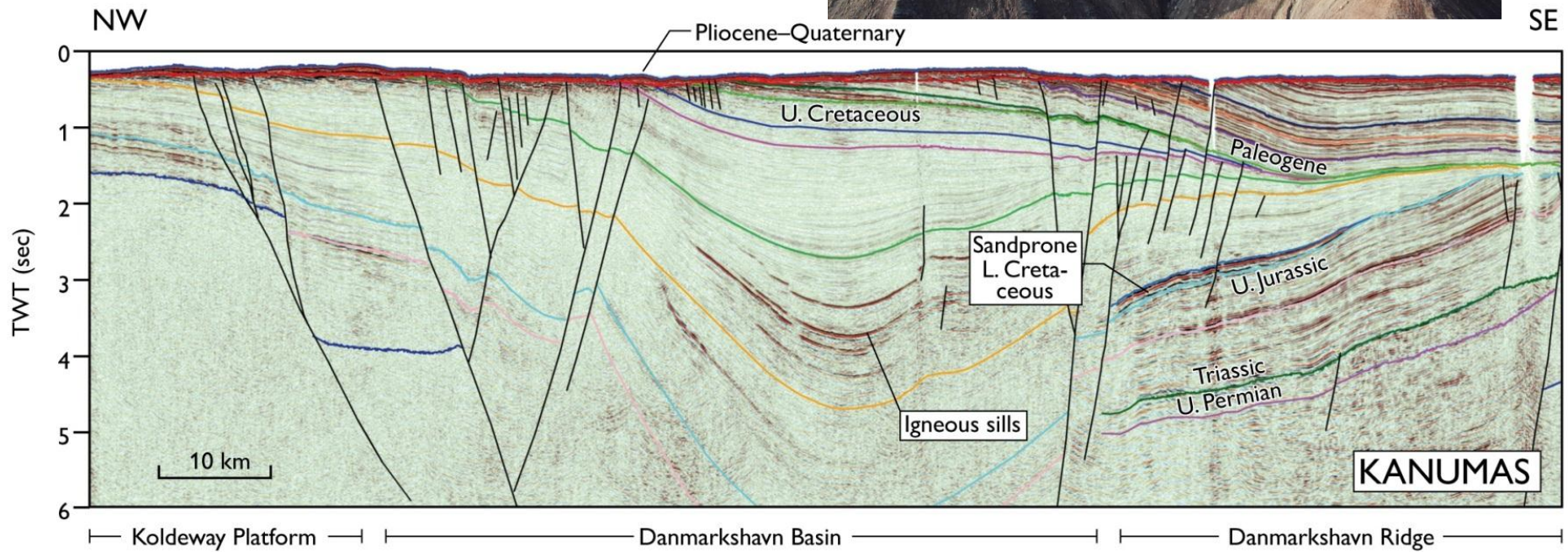
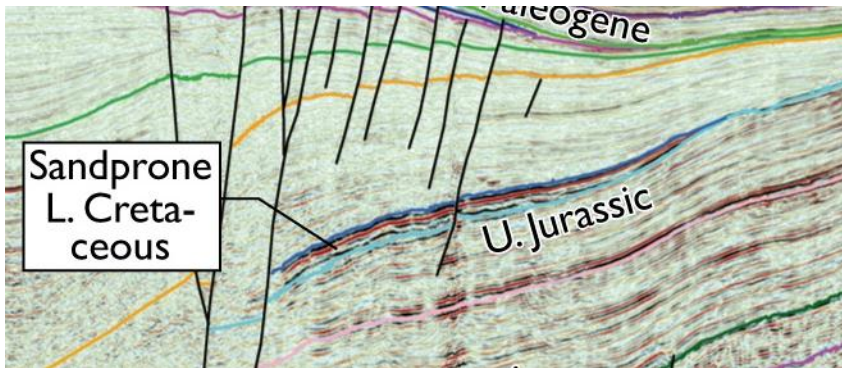


# Intra-Cretaceous unconformities – Sources of Cretaceous sand





# Lower Cretaceous Stratigraphy

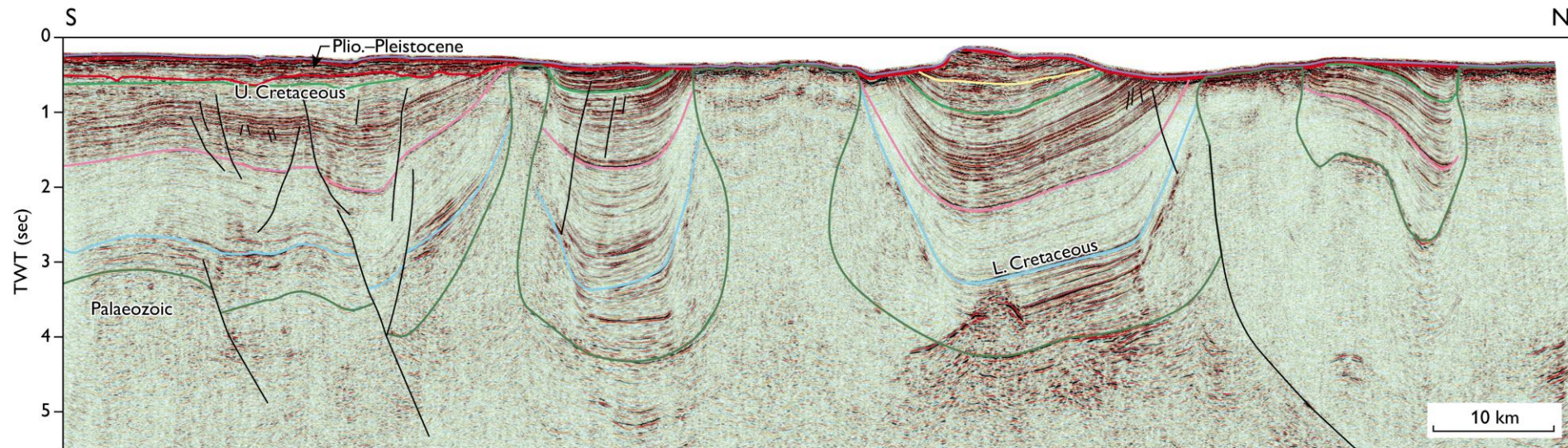
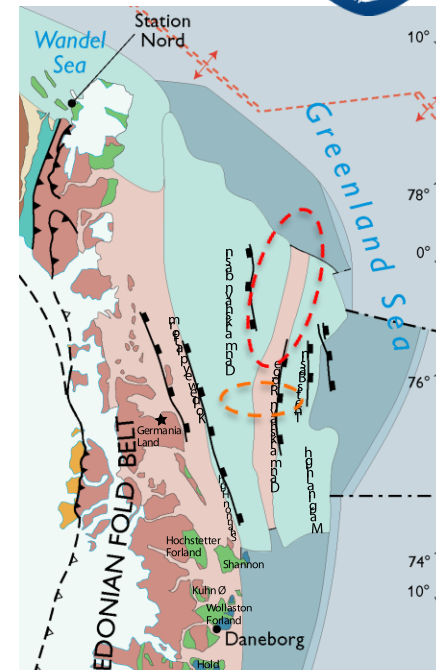




# Cretaceous Salt kinetics



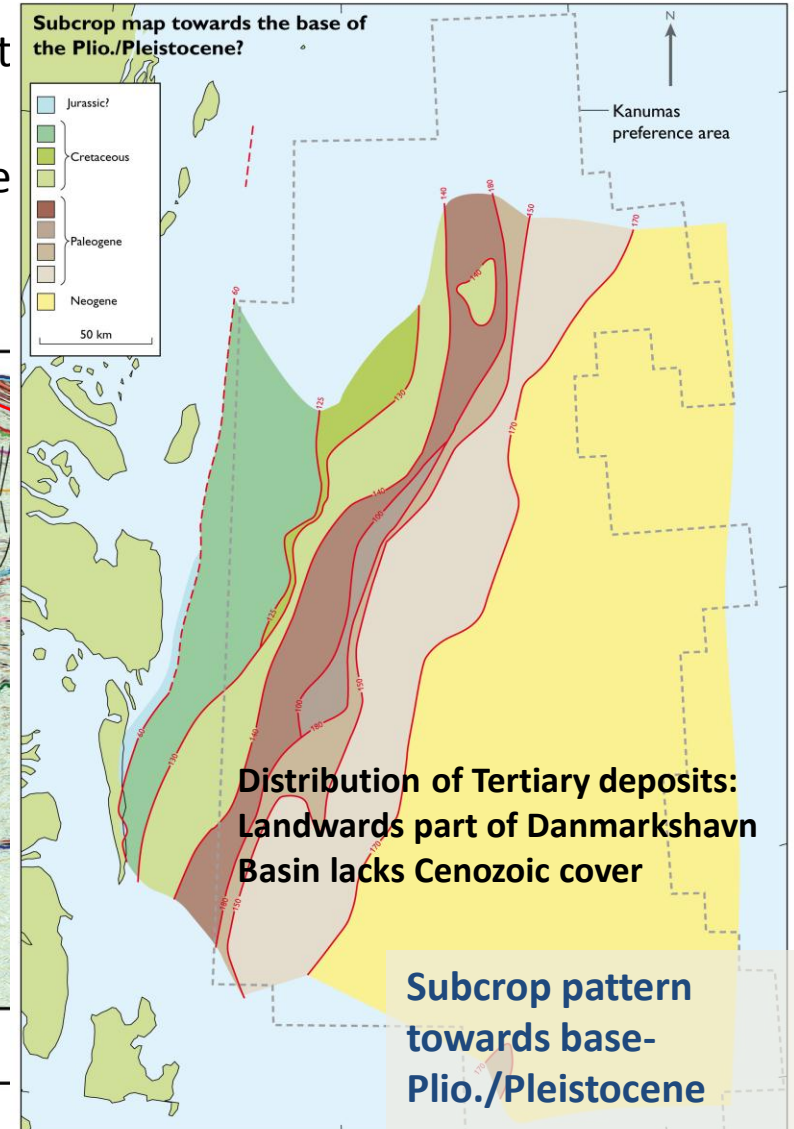
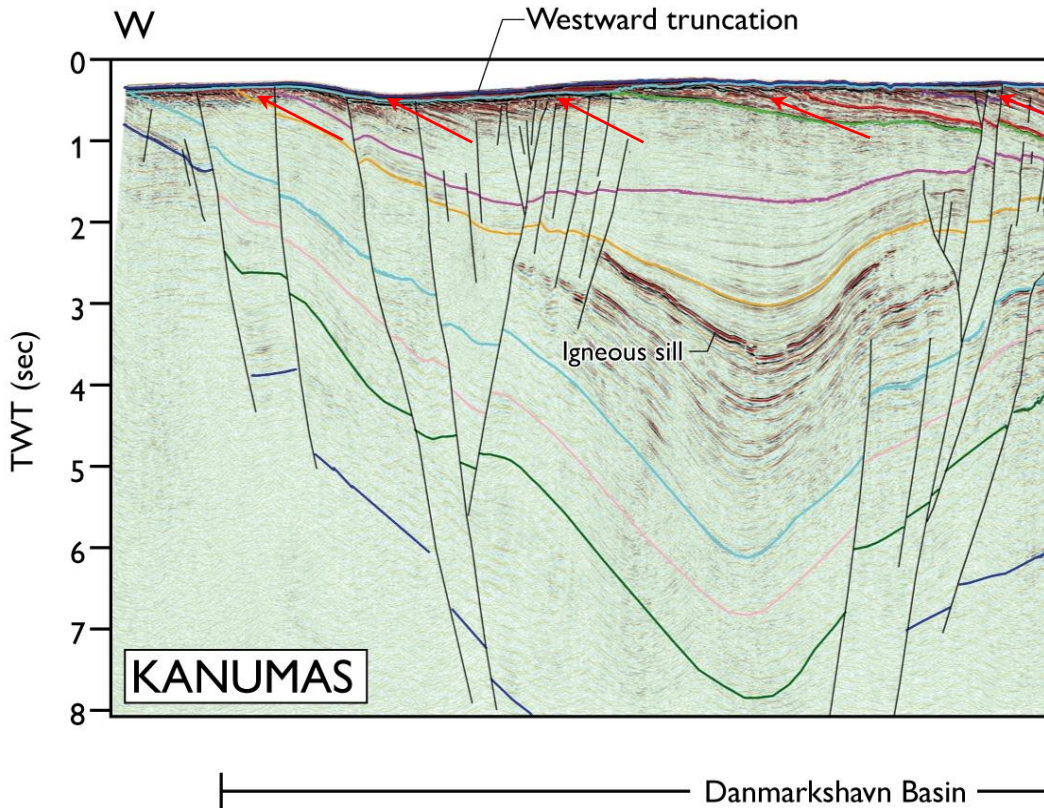
- Response to burial.
- Starting during the E. Cretaceous and likely continuing to the onset of Tertiary uplift, but difficult to assess.



# E. Tertiary extension



- Paleocene - Eocene (pre- to syn volcanism) ext to 1+ km throw across faults)
- Eocene – Oligocene distributed moderate ext throw across single faults)





# Conclusion - Geology



- The immediate geologic **history** of the 2012 – 2013 license areas spans ca. **400 Ma**.
- More or less continuous **deposition** since at least the **Carboniferous**.
- Main **rift** events during the **Carboniferous** and the **Cretaceous**.
- Tertiary oceanic **break up**.
- Paleocene-Eocene **magmatism**.
- Pulsed Tertiary **uplift** and **erosion** and associated Eocene – Recent overall **progradation**.

# Conclusion – HC potential



- High chances of significant **source rock** intervals of which the Mesozoic are considered the most important.
- Most Mesozoic SR intervals likely **matured** during Late Cretaceous – Tertiary burial.
- Mesozoic clastics are considered the most likely **reservoirs**, but Palaeozoic and Tertiary rocks may also contain local reservoir potential.
- Important **structures** (potential traps) formed during Cretaceous rifting, C-T salt tectonics & oceanic break-up.
- Structures were in place during Late Cretaceous – M. Tertiary HC-generation leaving adequate **timing** for HC trapping.



# Thank you for your attention!!

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for more information