



Circum-Arctic Resource Appraisal (CARA)

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For DOC-ITA

Webinar

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Contents of this presentation

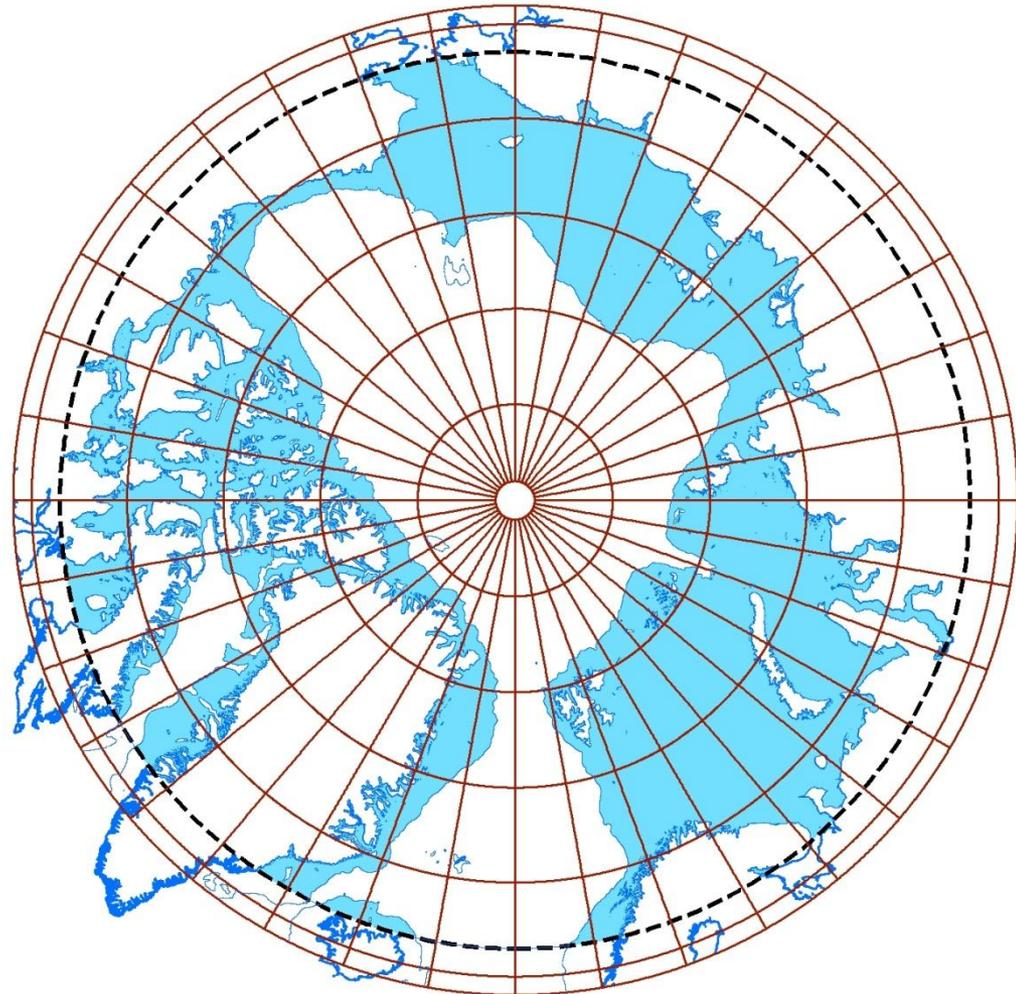
- Oil and gas in the Arctic
- Objectives of the CARA
- CARA: What's done and what's not
- CARA: What's next
- Example from northeastern Greenland

North of the Arctic Circle

- Total area >21million km²
- 6% of the Earth's surface
- Land area ~8million km²
- Shelf area (<500m) >7million km²



ARCTIC SHELF



North of the Arctic Circle:

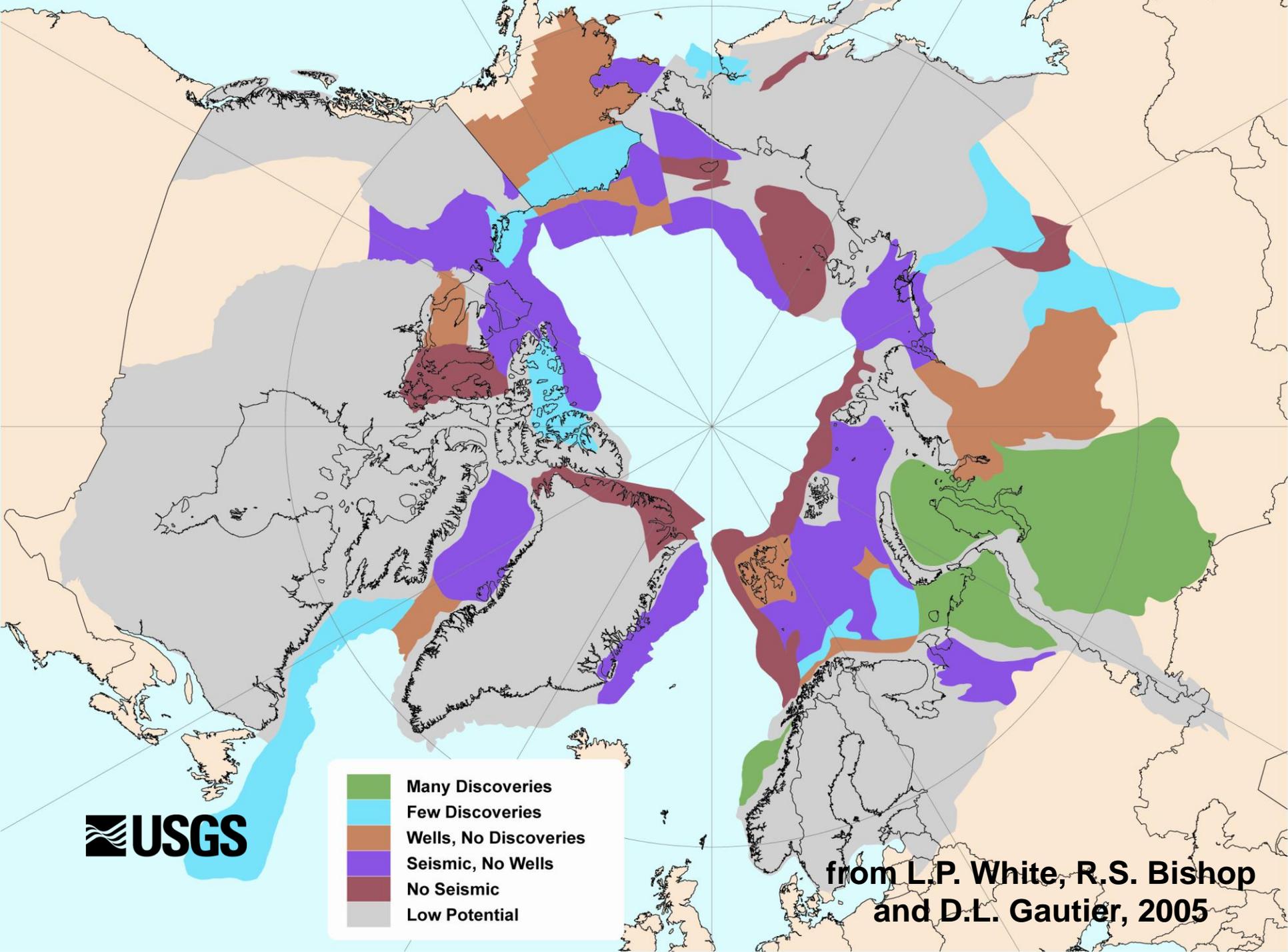
Total area	-	21,318,420 sq. km
Land area	-	7,956,313 sq. km
Shelf area (water depth less than 500 m)	-	7,066,311 sq. km

Known Oil and Gas Resources in the Arctic

- Largest field is Yamburgskoye (~38BBOE)
- Largest oil field is Prudhoe Bay (~17BBOE)
- More than 400 oil and gas fields discovered
- Known oil & gas ~240 BBOE (IHS 2007)
- ~ 10% of known world supply
- ~64% is in just ten fields
- 9/10 largest fields are Russian

The Arctic is Largely Unexplored-- Resources are Poorly Understood

- Extreme geological uncertainty
- Extreme technical uncertainty
- Political stability (more or less)
- Great environmental sensitivity
- Information is expanding exponentially
- Future surprises certain (good & bad)
- Pervasive high costs will persist



from L.P. White, R.S. Bishop
and D.L. Gautier, 2005

Assessment Techniques are Limited in Unexplored Basins



■ Discovery History Analysis



■ Prospect counting



■ Reservoir modeling



■ Geologic synthesis



■ Analog modeling

Near-term objectives of the Circum-Arctic Resource Appraisal

- Probabilistic estimates of potential additions to oil and gas reserves
- Include all areas north of the Arctic Circle
- Conventional (ex-ice) oil and gas only
- Geologic assessment complete August 2008
- Release: WPC, Madrid and IGC, Oslo
- Resource/cost curves to be released late 2008

What's done:

Methodology for assessment

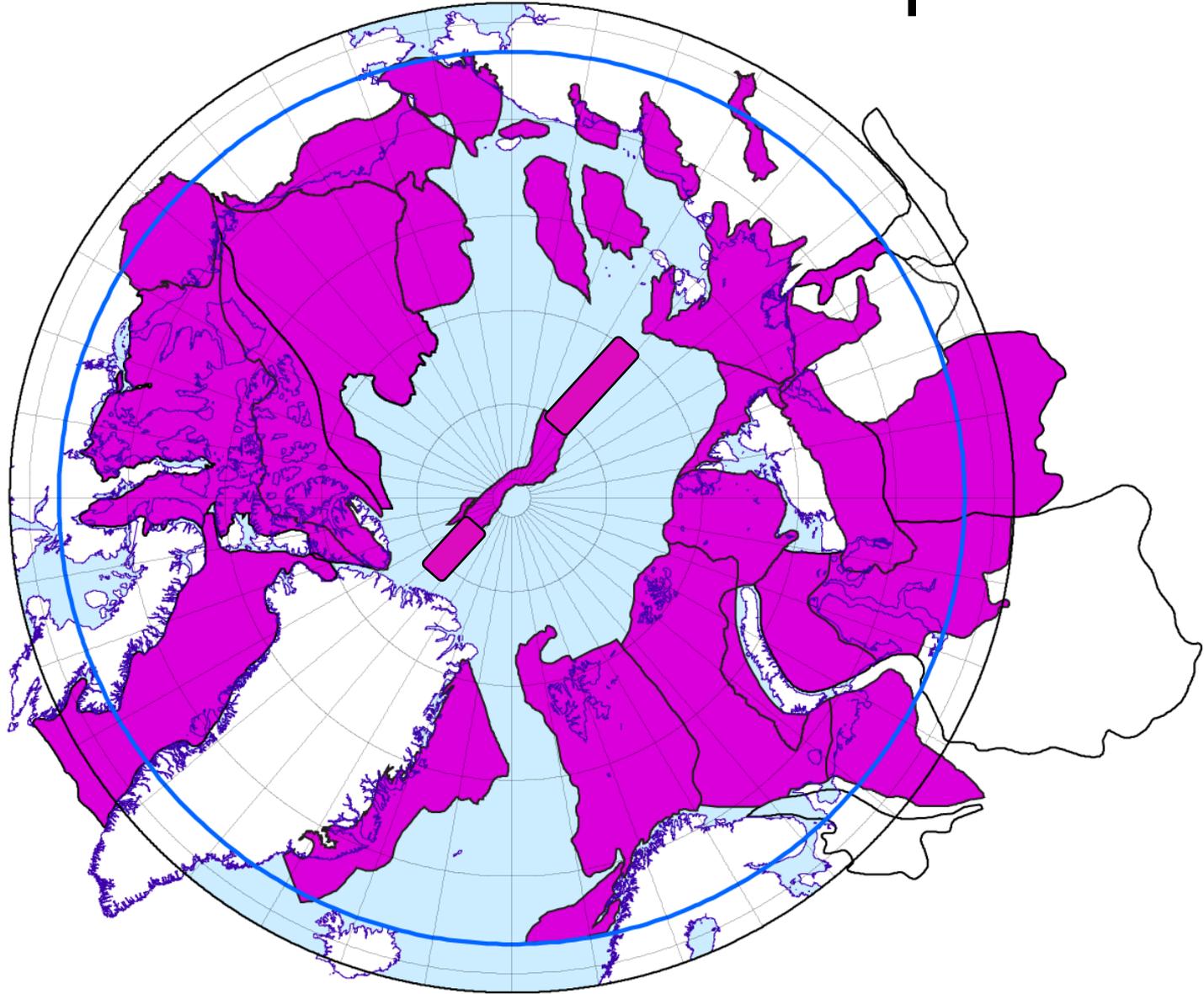
Analog data model and database

Map of Arctic sedimentary basins

Assessment of 56 provinces, 145 AUs

Develop prototype of a full-cycle model

Provinces Assessed as of April 2008



Things to watch for:

Geologic risk of at least one field of minimum size

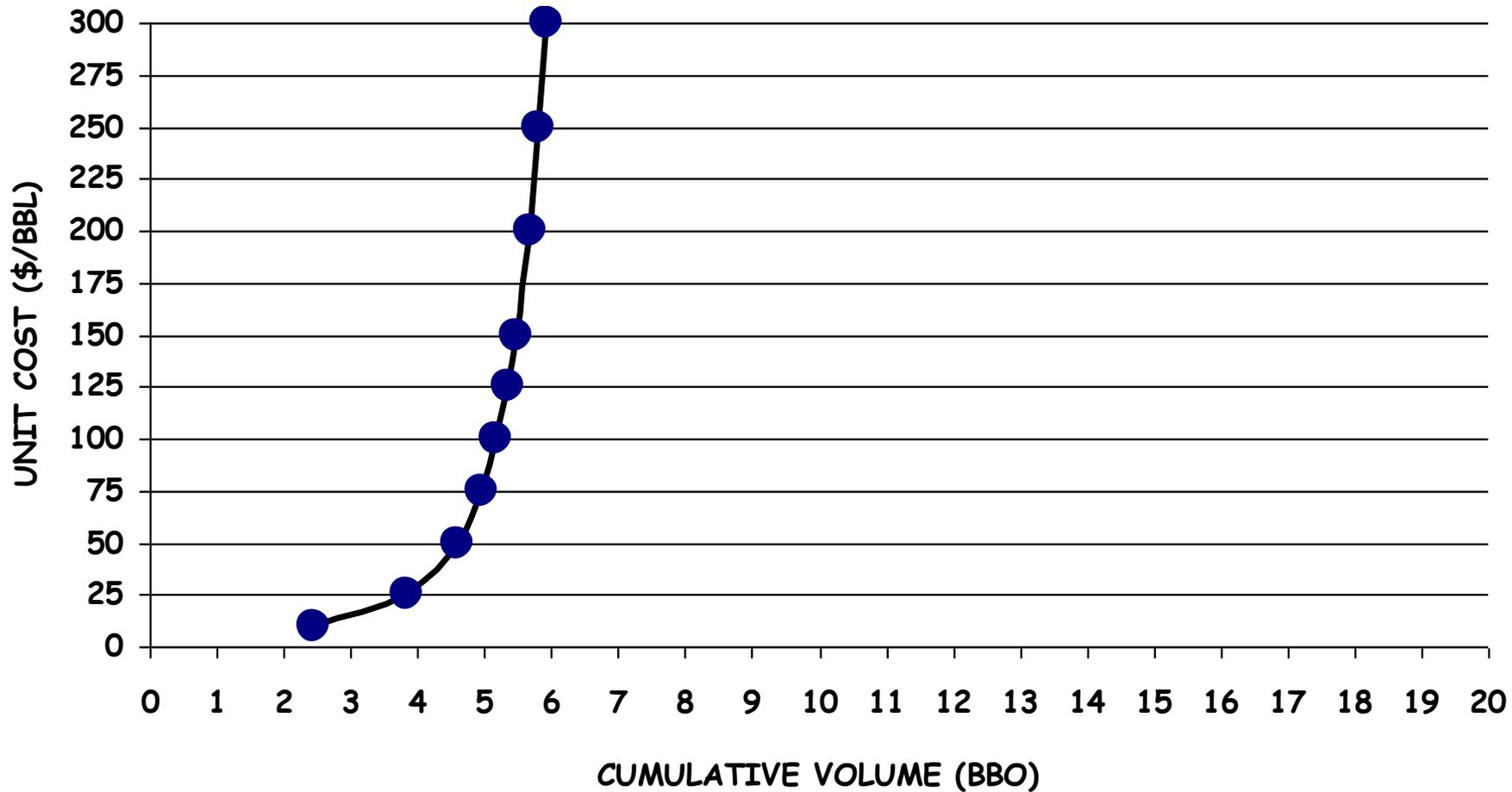
Probability distribution of the maximum field size

Numbers of estimated accumulations

Area of assessment (km²)

Distribution of oil and gas in undiscovered fields

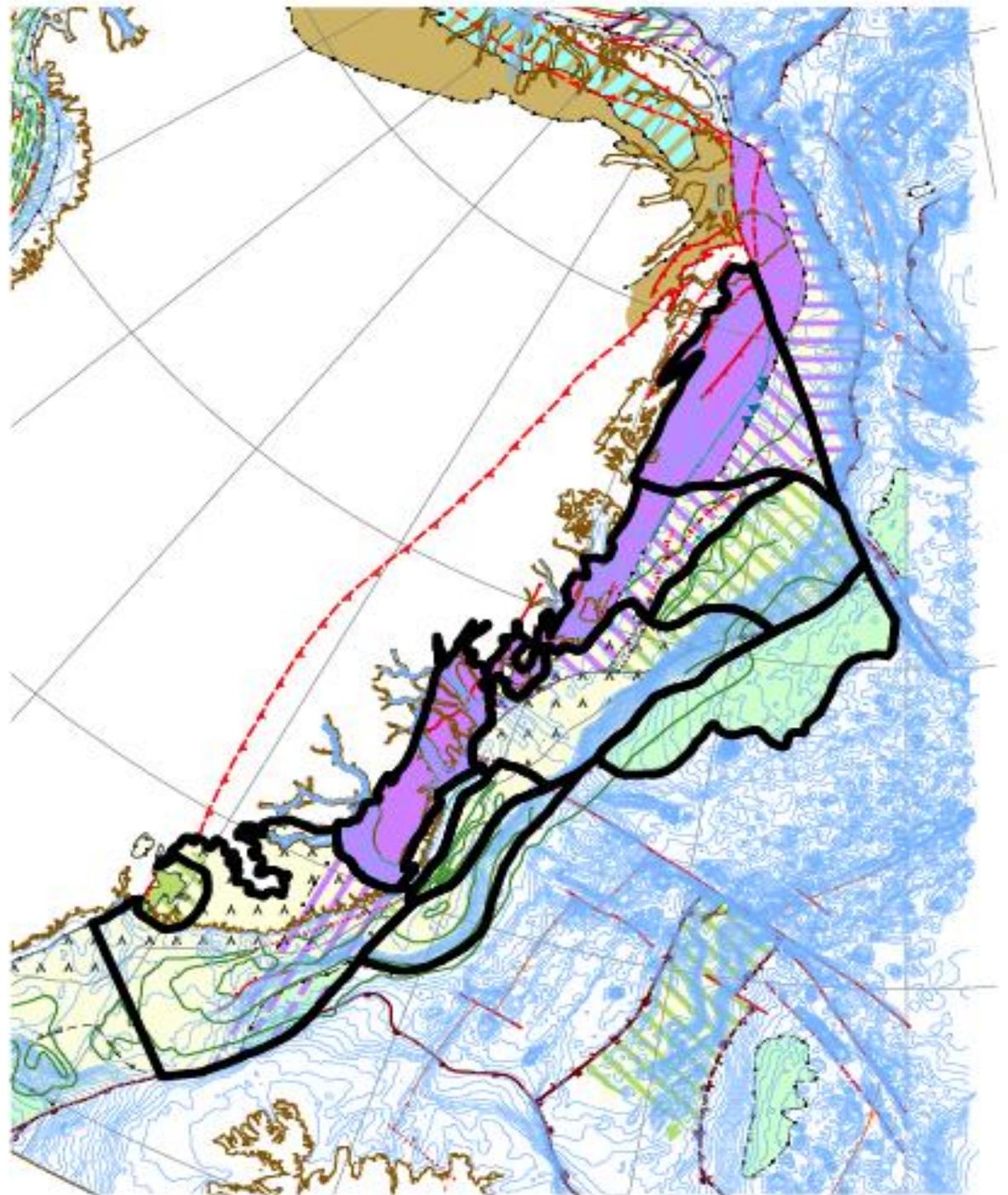
AU2 RESOURCE COST CURVE (SUCCESS CASE): OIL



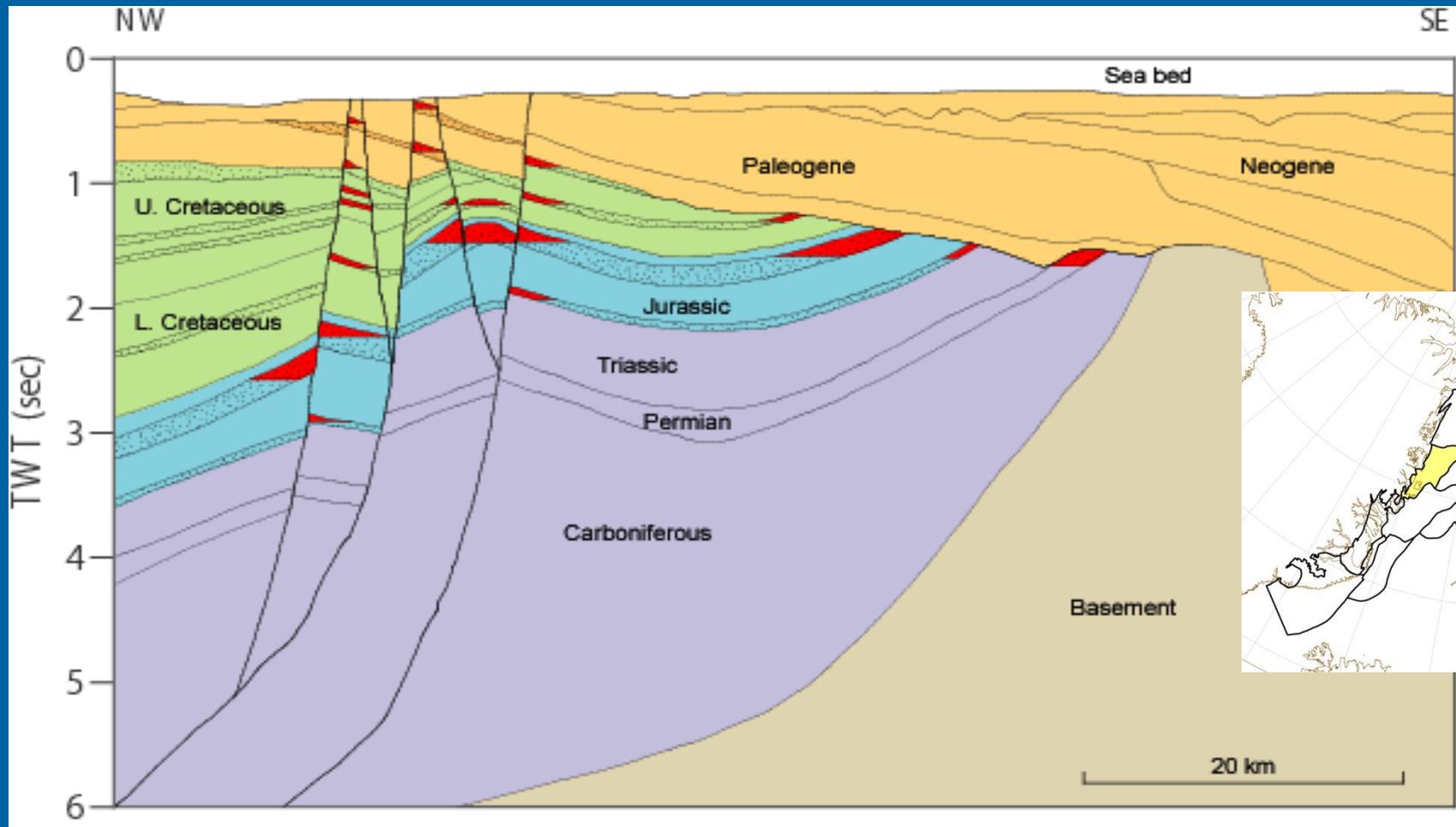
What's not, what's next:

Assessments of Lincoln Sea, Lena Delta
Aggregations
Release of results: factsheets, WPC, IGC
Publish documentation
Apply full-cycle model to the CARA

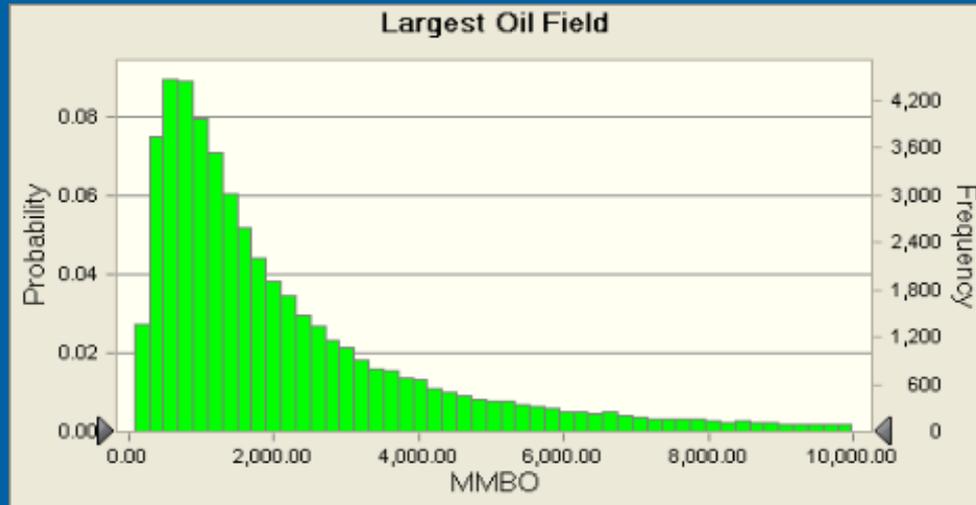
Part of Grantz Map with USGS AUs



South Danmarkshavn Basin



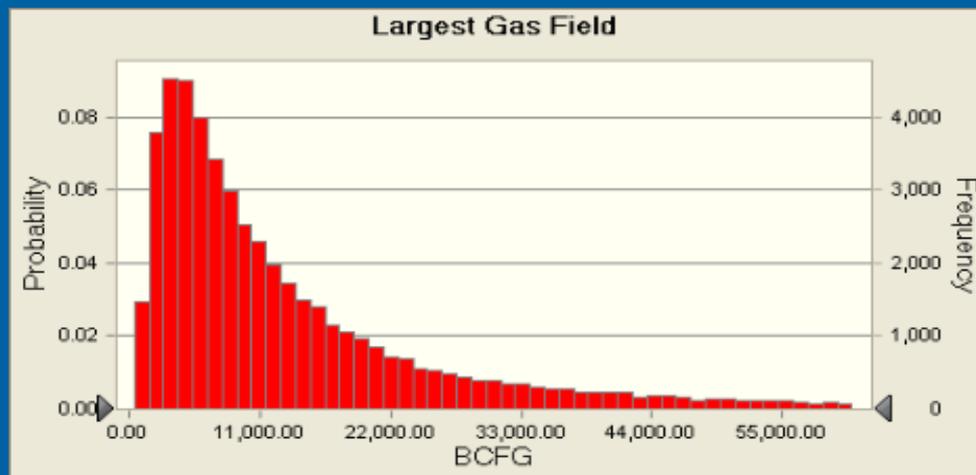
South Danmarkshavn Basin Largest Undiscovered Field



Mean = 2.5 BB

S.D. = 2.7 BB

F05 = 8.1 BB



Mean = 14.9 TCF

S.D. = 16.4 TCF

F05 = 49.2 TCF

South Danmarkshavn Basin Resource Estimates

- Probability of one field >50MMBOE: 72%
- Largest oil field (50% chance): 1.5BB
- Largest oil field (5% chance): 8.1BB

- Volume of oil (mean estimate): 4.4BB
- Volume of oil (5% chance): 14.0BB

- Volume of resources (mean estimate) 13.7BBOE

Total Conventional Resources in NE Greenland (Sum of AUs) Assuming Perfect Correlation

Commodity	F95	F50	F5	Mean
Liquids, BB	0	10	60	17
Gas, TCF	0	53	299	86
Total, BBOE	0	19	110	31

World Ranking of Fully Risked Undiscovered Petroleum in NEG

- World province rank* (known BOE): #19 of ~500 (Ghawar is # 3; North Sea is # 8; N. Alaska is # 24)
- Largest oil field rank** (2.5+ BBO): #72 of 876 (Prudhoe is # 10; Ekofisk is #52; Forties is # 93)
- Largest gas field rank** (18+ TCF): #48 of 876 (Shtokman is # 14; Troll is #42; Hugoton is # 46)



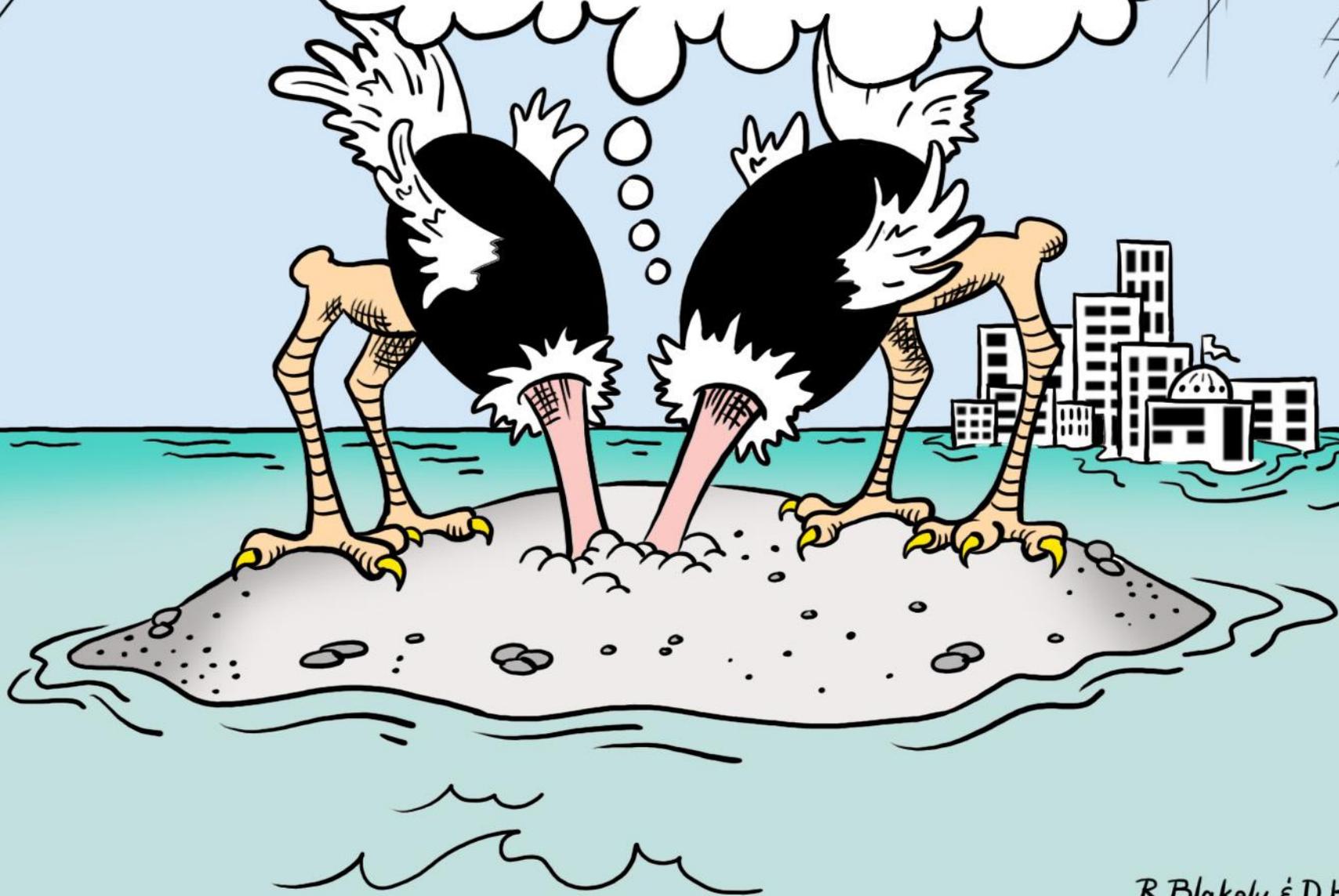
*source: USGS DDS-60

**source: AAPG Memoir 78

Northeast Greenland Mean Estimates Compared to other Provinces

	North Sea	Mara-caibo Basin	Alberta Basin	NEG	Anglo-Dutch Basin
Oil, BB	57	57	16	17	<1
Gas, TCF	198	44	91	86	86
Total (BOE)	98	66	34	31	15

THE **AAPG** SAYS, "WE NEED TO COLLECT AND EXAMINE MORE DATA, STUDY, INTEGRATE, AND DISCUSS" BEFORE KNOWING THE "ANTHROPOGENIC EFFECT ON CLIMATE CHANGE." **OH, REALLY?!**



U.S. Geological Survey Circum-Arctic Resource Appraisal

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Photo: Stefan Piasecki



GEUS