

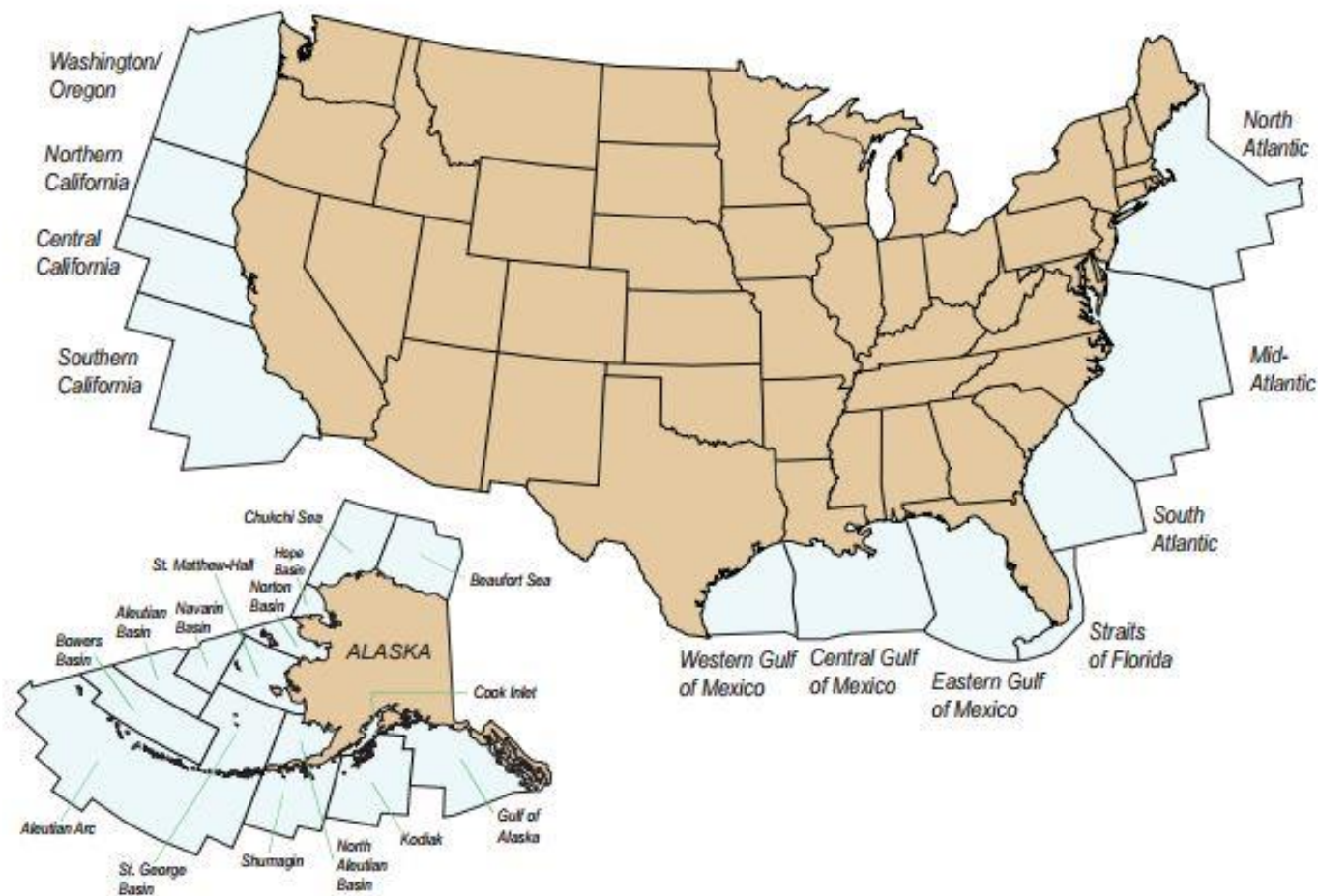


Outer Continental Shelf Committee: Future of Upstream E+P

OCS Board Workshop

January 31, 2018

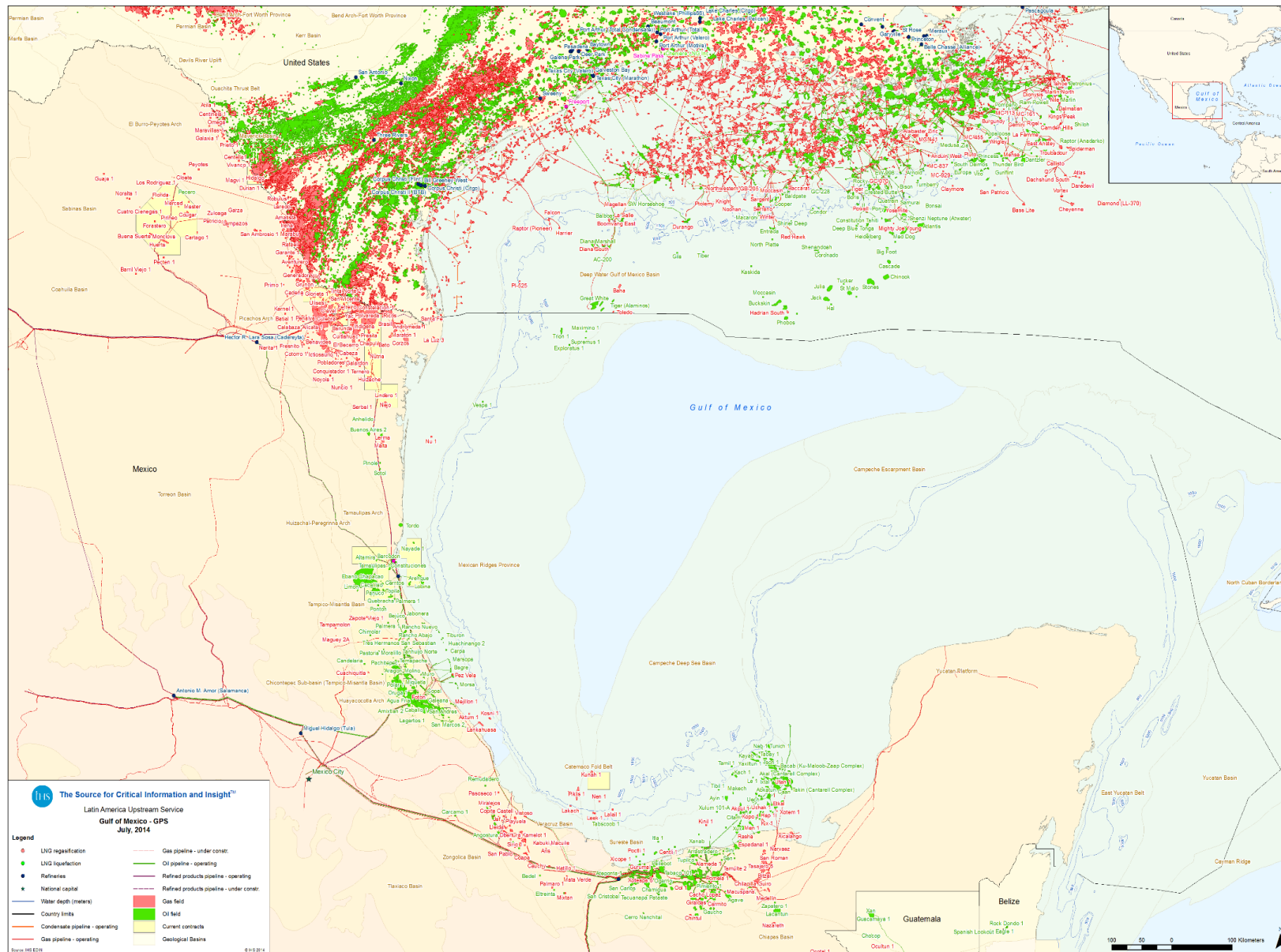
- Defined by a series of parameters but basically 200 nautical miles from the baseline
- Geologically the area is seaward of the shelf break which is approximately 600 feet water depth but the government uses 1,000 feet.
- Comprises 1.76 billion acres
- MMS estimates the OCS contains 86 BBO and 420 Tcf of gas.
- Current production is 52 MMBO/month and 87 bcfg/month.

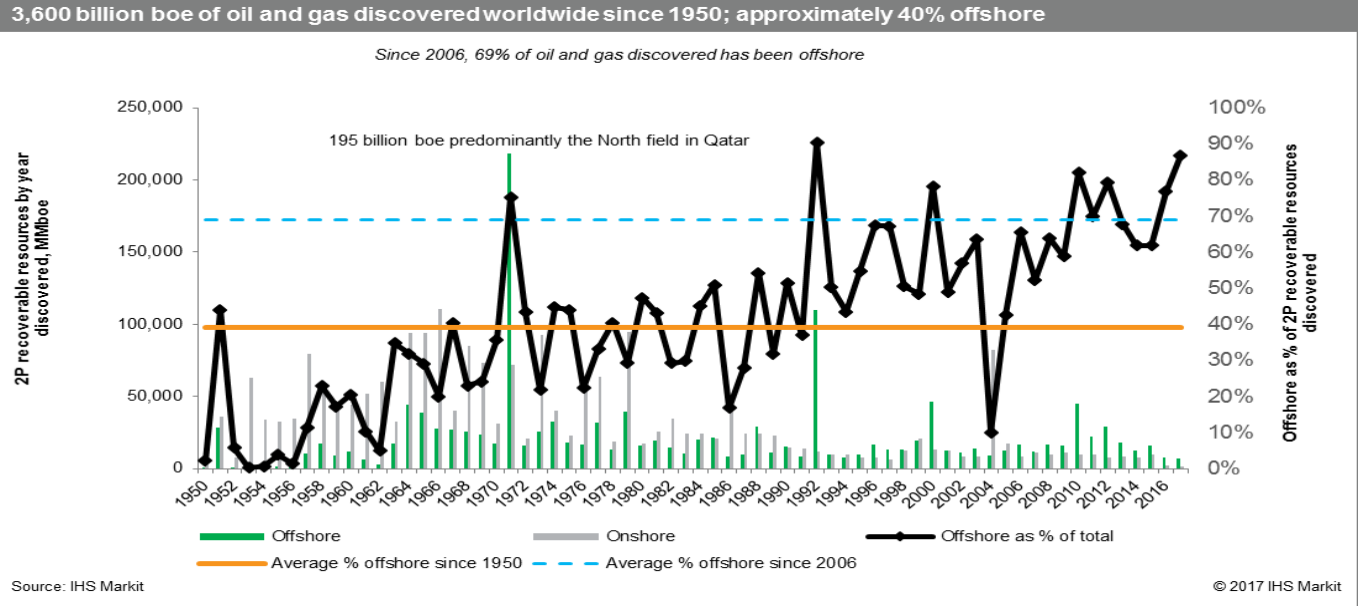


Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016 (BOEM)

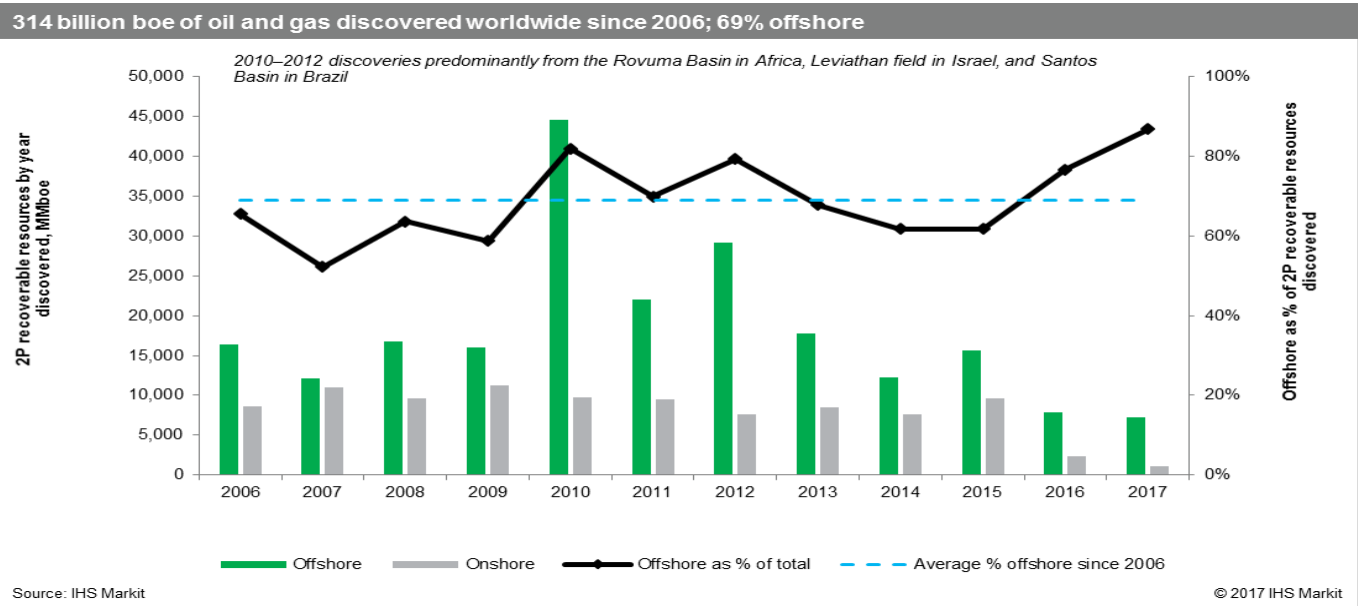
The intensity of discoveries varies considerably:

- Onshore US is dense
- Shelf fields follow trends
- Deep water US is relatively sparse, especially in the west
- Mexico offshore is barely scratched except for Sureste





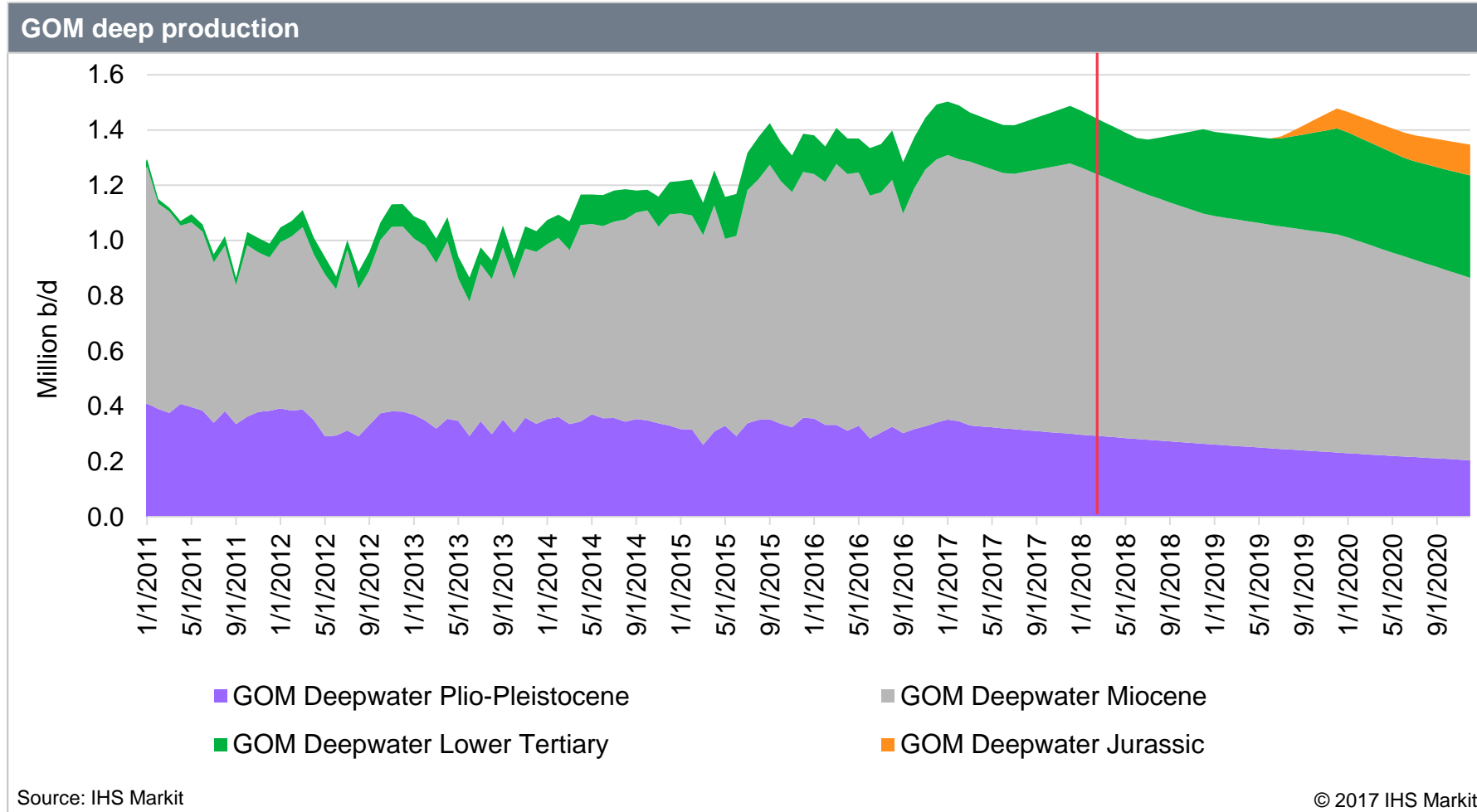
- Since 1950, offshore has found 3,600 BBO, 40% of total discoveries
- Since 2006, offshore has found 314 BBO, 69% of total discoveries
- Discovery volumes have been decreasing since 2010 and have not shown any tendency to reverse the trend



Lower 48 OCS

The GOM is reaching a peak in production.

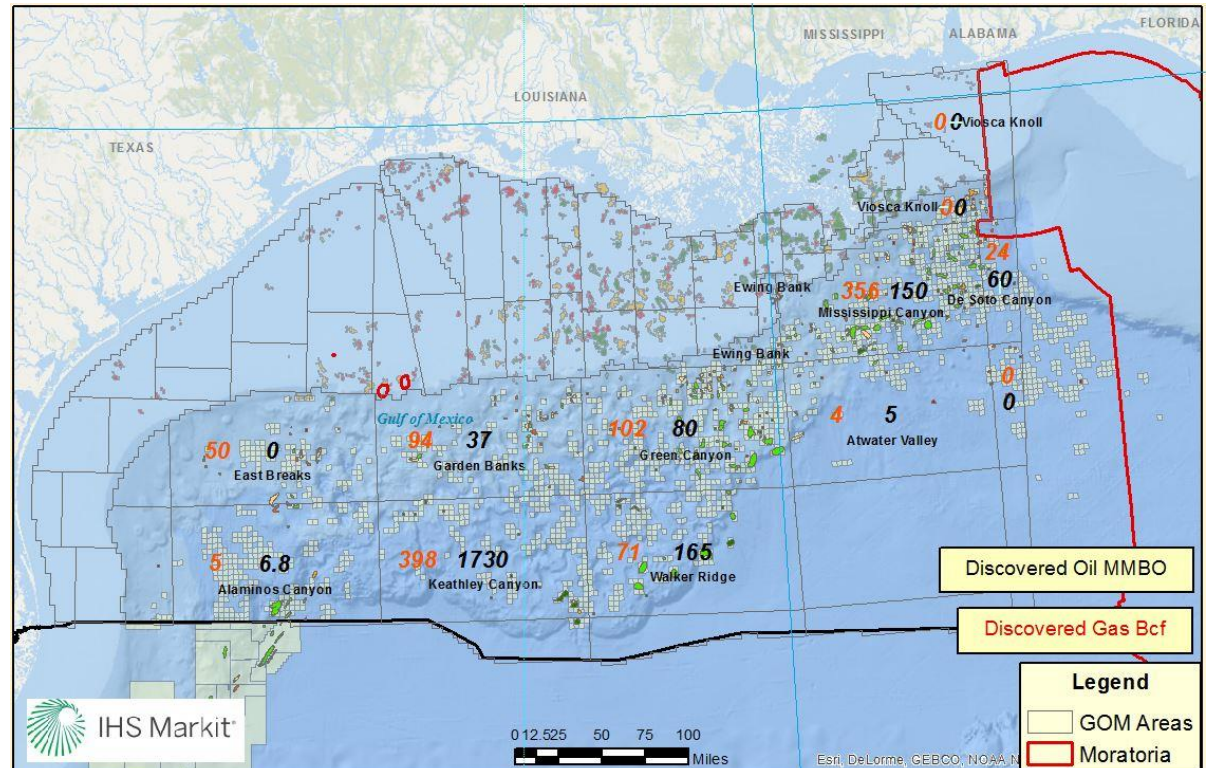
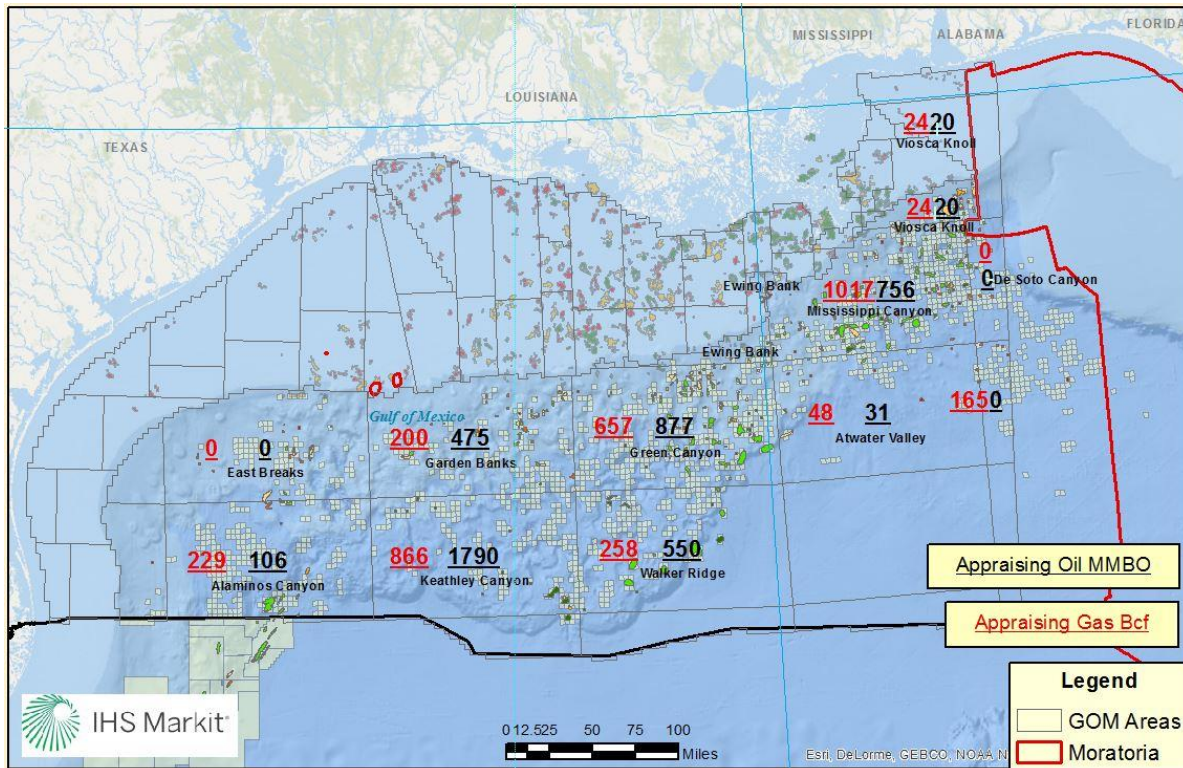
The Lower Tertiary has been able to offset declines in the Miocene and Plio-Pleistocene.

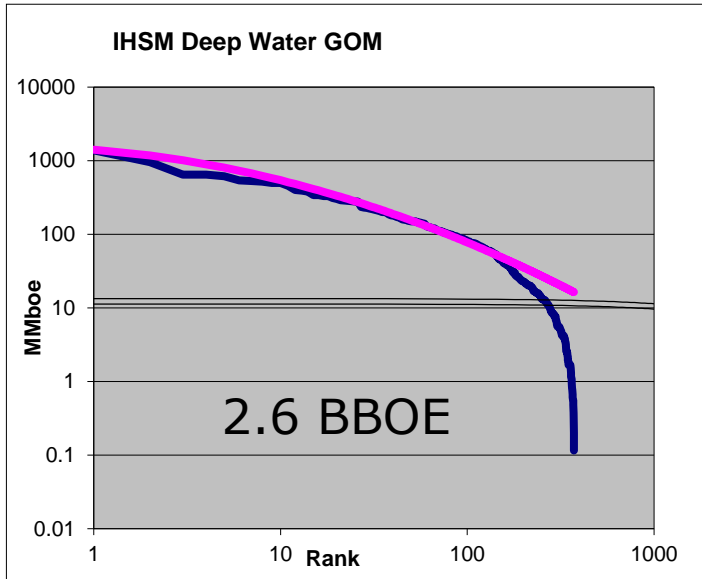


21 BBO and 29 Tcf have been found in the deep water Gulf of Mexico
 12 BBO and 21 Tcf have been developed
 9 BBO and 8 Tcf are being developed, appraised or are discoveries

Appraising

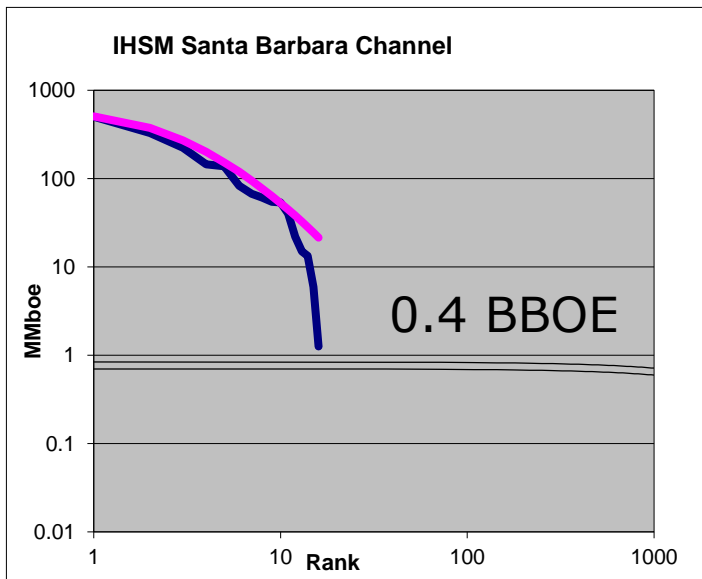
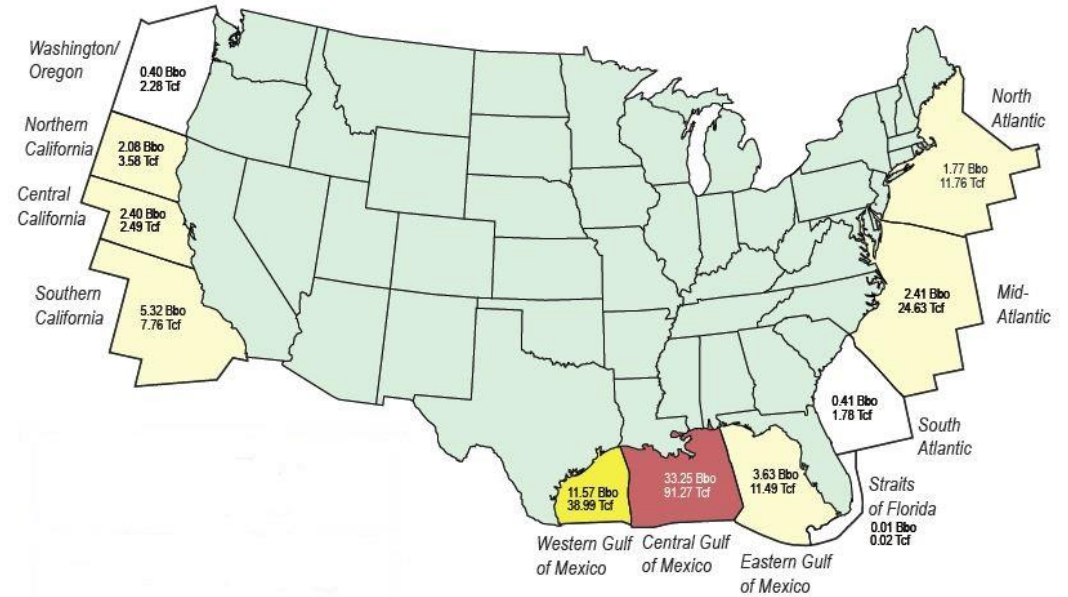
Discovered and not being appraised





IHSM Reserve Size Categories (MMboe)	Reserves to Date		Estimated Total Recoverable		Yet-to-Find	
	MMboe	Number of Fields	MMboe	Number of Fields	MMboe	Number of Fields
>=50 and <100	4,553	62	4,958	71	405	9
>=100 and <250	8,334	55	7,747	50	0	0
>=250 and <500	5,784	17	5,917	17	0	0
>=500 and <1000	4,955	8	5,359	8	0	0
>=1000 and <2500	1,390	1	3,601	3	2,211	2

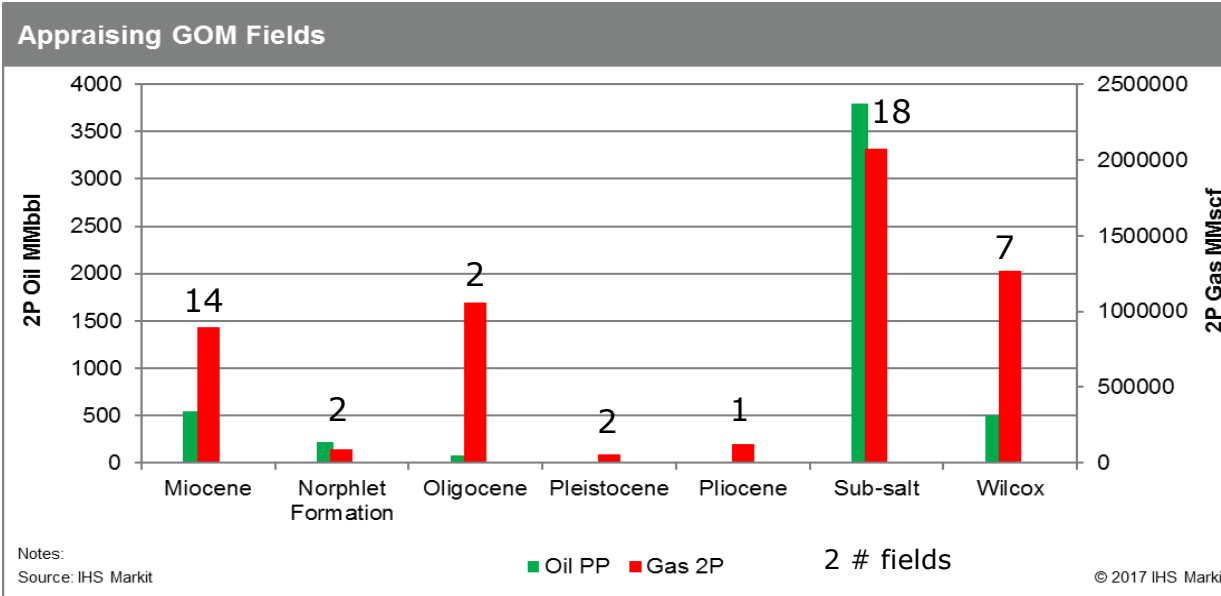
Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016



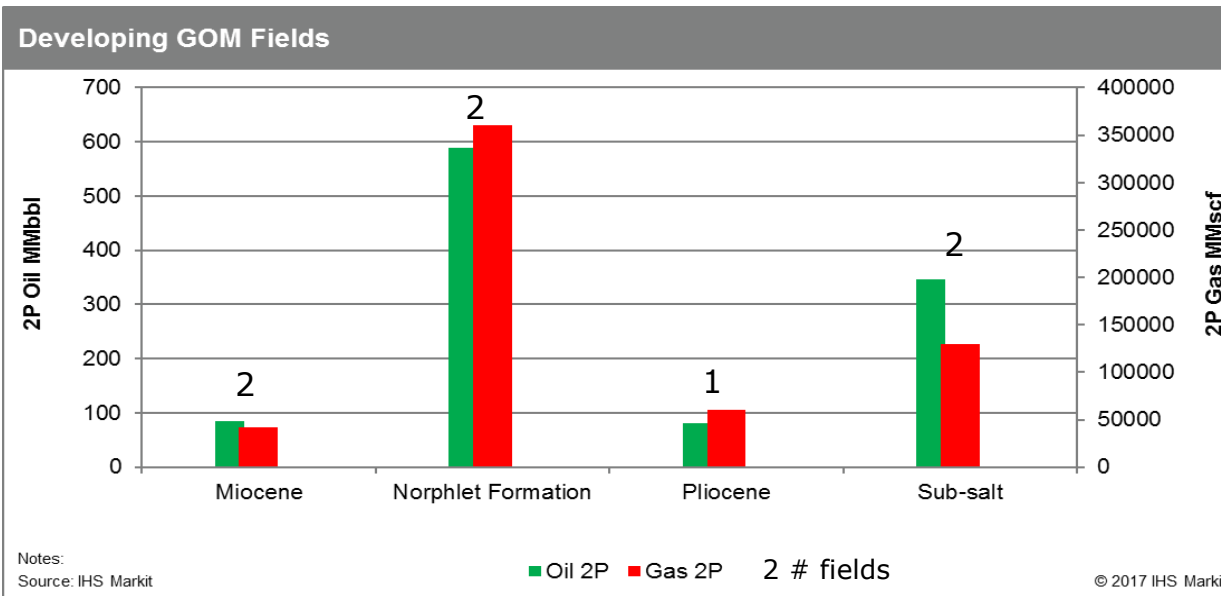
IHSM Reserve Size Categories (MMboe)	Reserves to Date		Estimated Total Recoverable		Yet-to-Find	
	MMboe	Number of Fields	MMboe	Number of Fields	MMboe	Number of Fields
>=25 and <50	40	1	144	4	104	3
>=50 and <100	320	5	289	4	0	0
>=100 and <250	508	3	473	3	0	0
>=250 and <500	328	1	645	2	317	1

Regional Totals:		
Alaska OCS	26.56 Bbo	131.38 Tcf
Atlantic OCS	4.59 Bbo	3.43 Tcf
Gulf of Mexico OCS	48.46 Bbo	141.76 Tcf
Pacific OCS	10.20 Bbo	16.10 Tcf
Total U.S. OCS	89.82 Bbo	327.42 Tcf

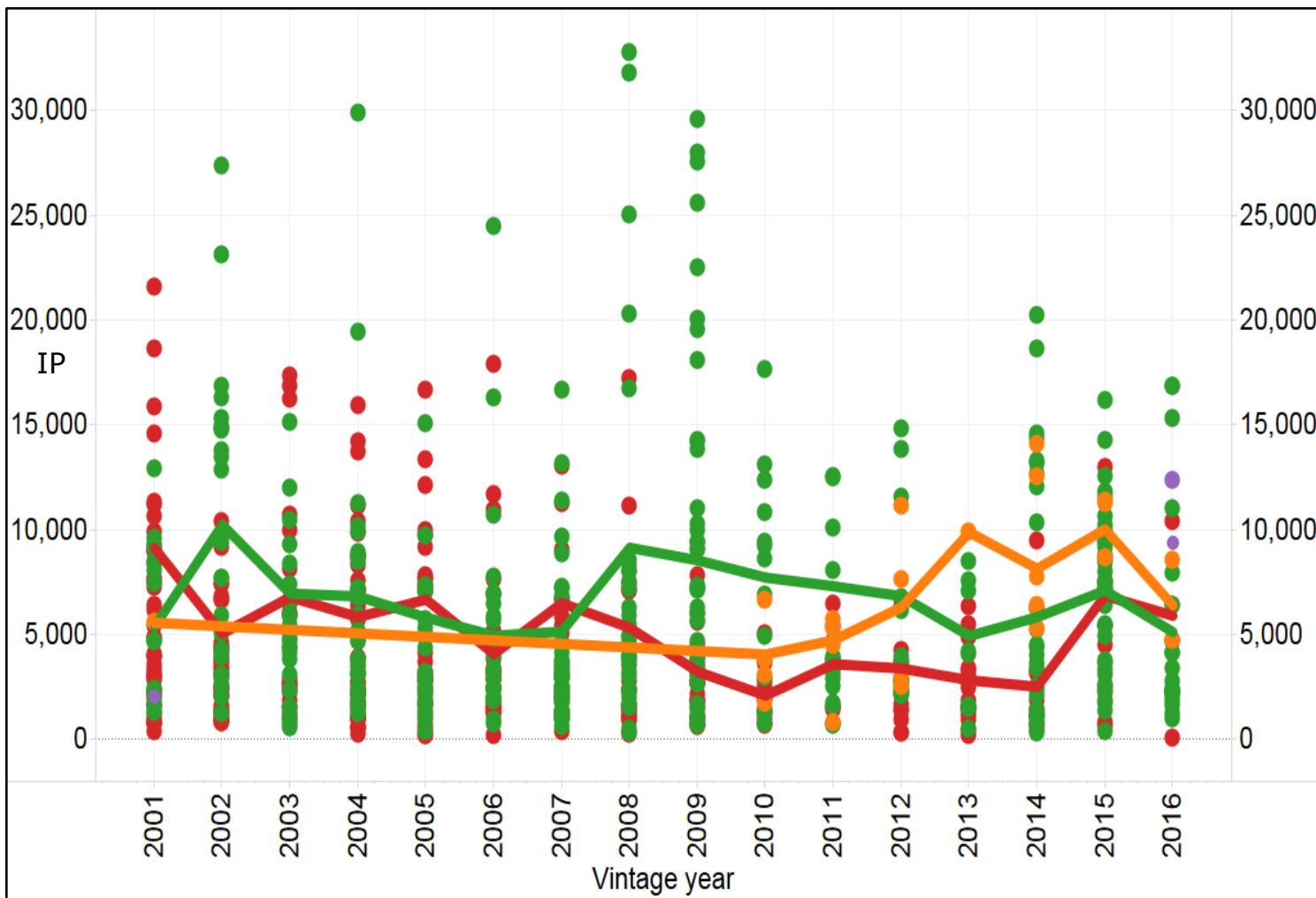
Over 3.5BBO is being appraised in the sub salt



600MMBO and 300+MMBO are being developed in the Norphlet and sub salt respectively



The recent average peak 6 month boe (20:1) is highest for the Lower Tertiary



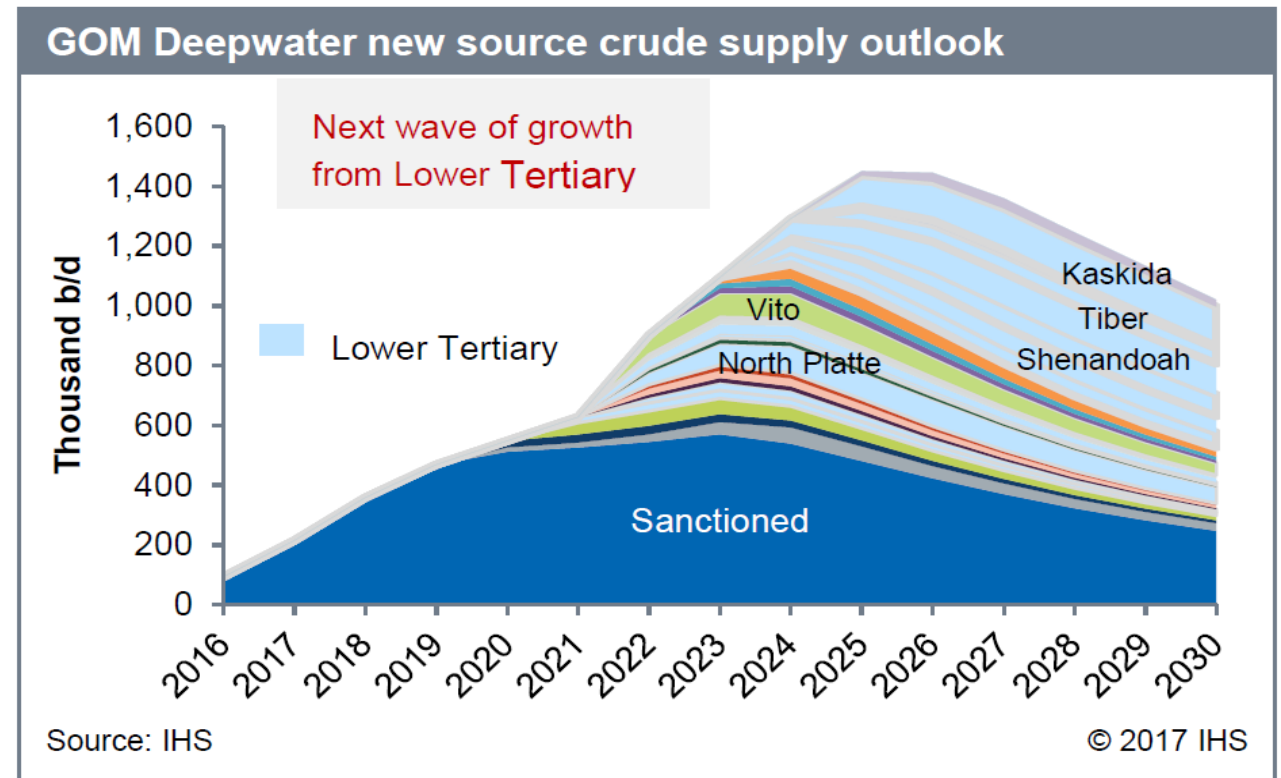
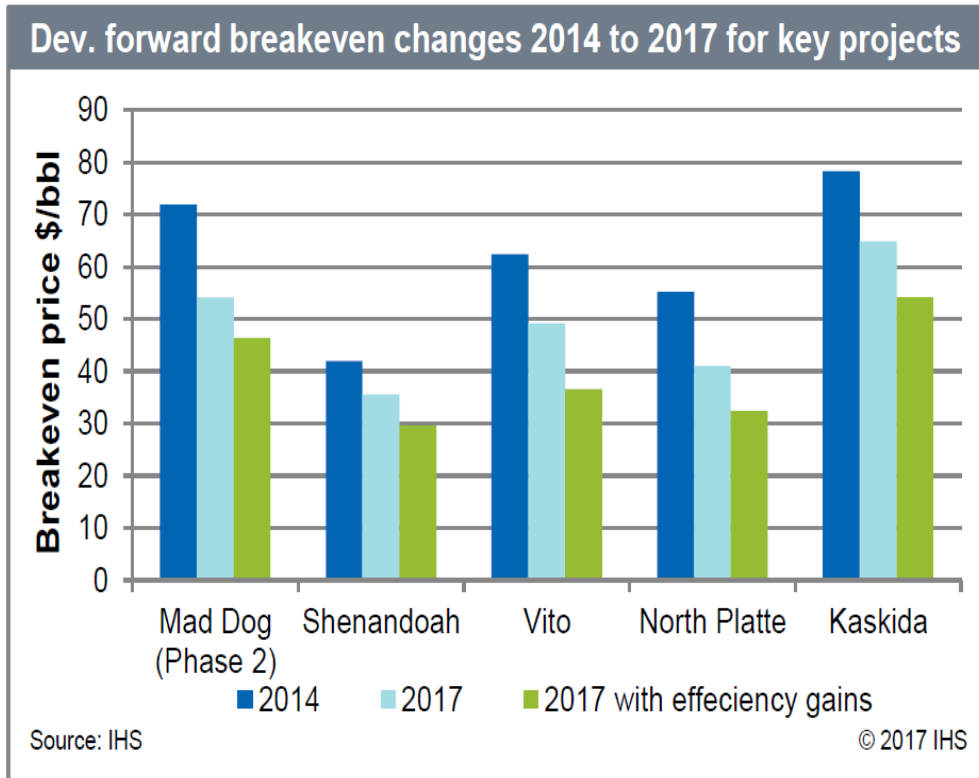
- Lower Tertiary wells have been consistent, with few poor or high performers.
- Miocene wells have the potential to have the highest rates.
- Lower Tertiary wells have had the highest average rates since 2012.

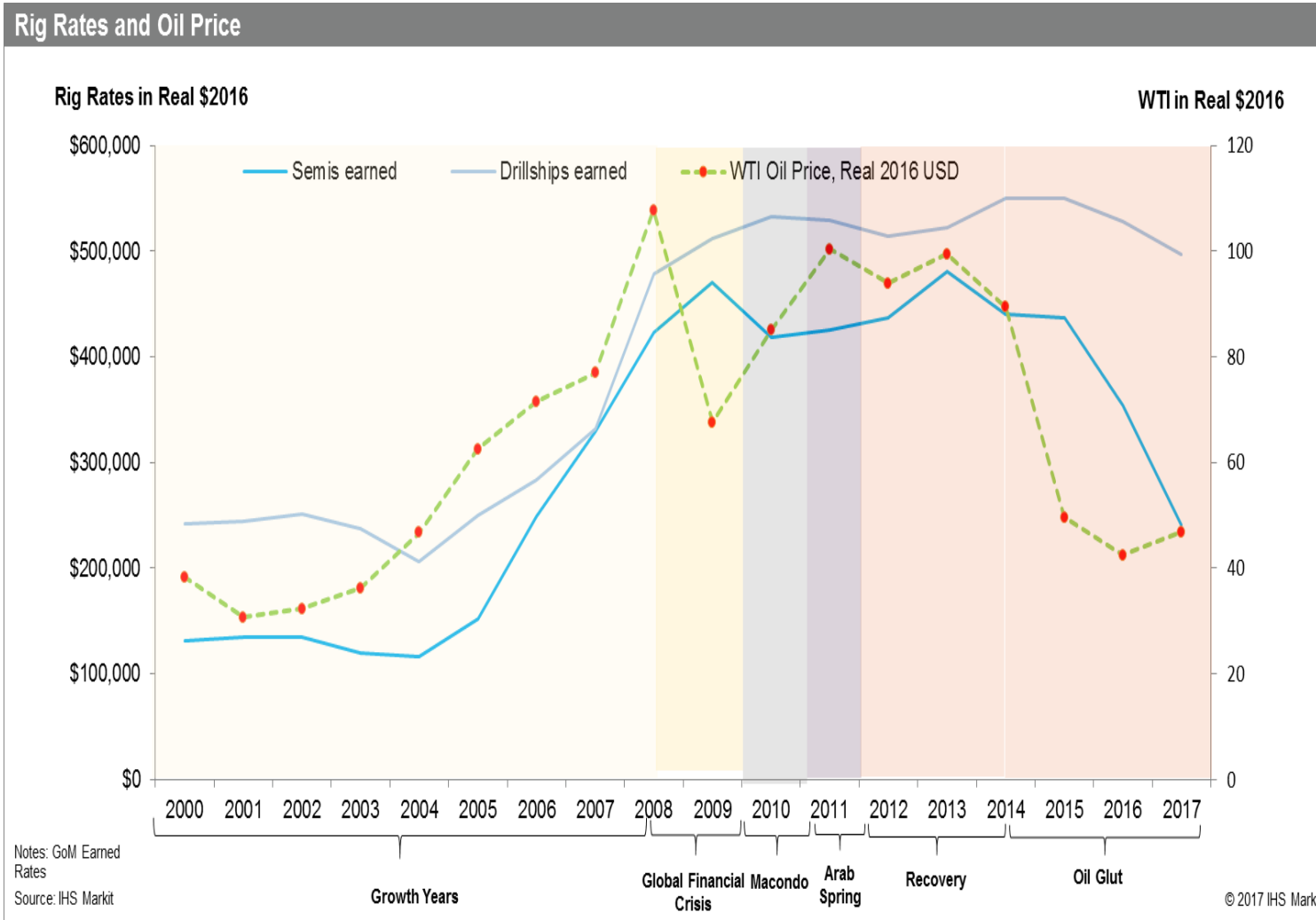
Age	Porosity Avg Pct	Perm Avg md	Water Saturation Percent	Break Evens
Average Plio Pleis	30	1010	23	
Average Miocene	29	720	25	\$36.33
Average Lower Tertiary	21	242	29	\$46.08
Average Jurassic	21	196	33	\$44.96

Red Pliocene
 Green Miocene
 Orange Lower Tertiary

Lower service costs, better design and more efficiency are decreasing project costs.

Multiple projects are expected to increase production over time.





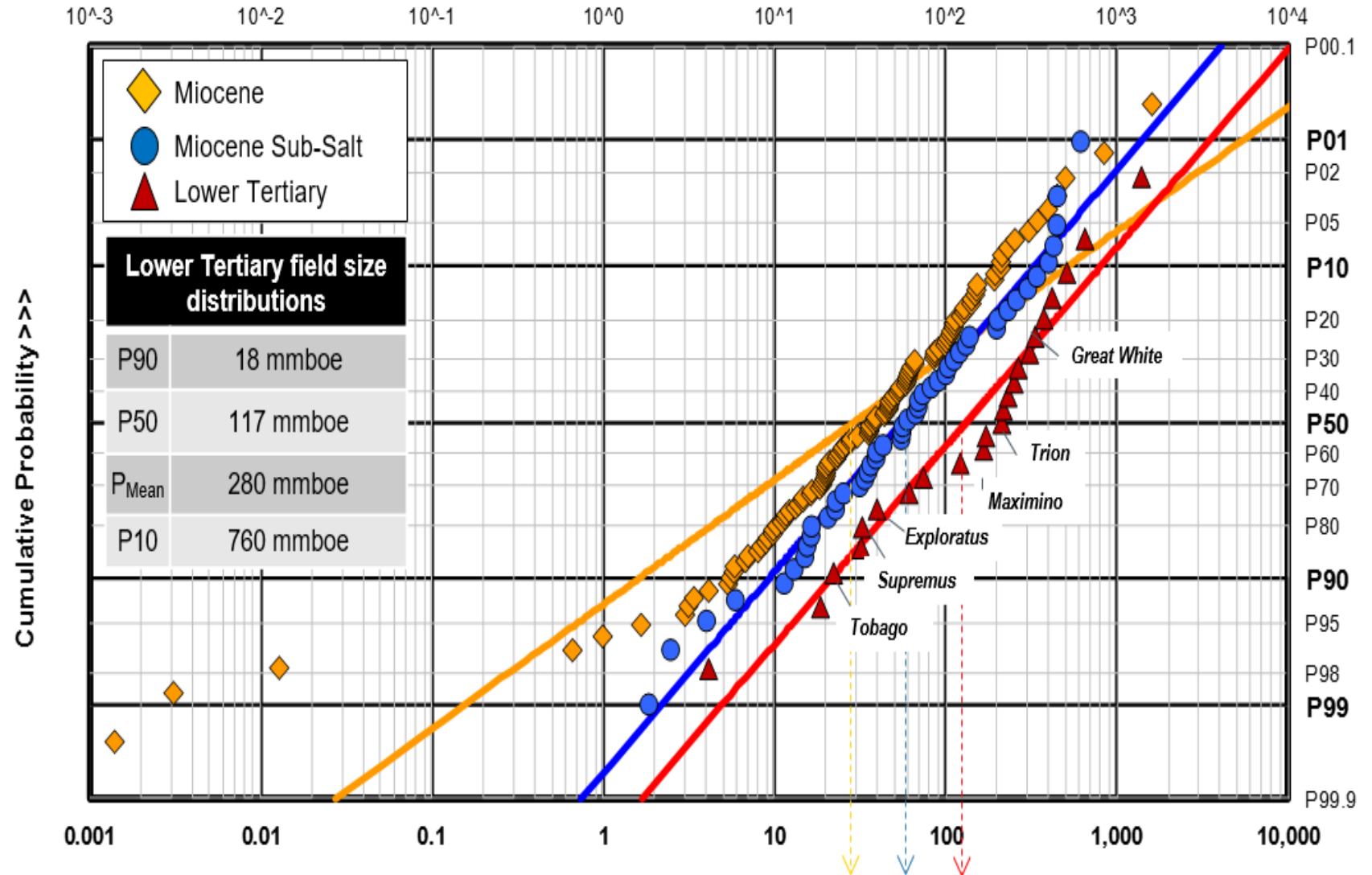
Rig rates correlate to oil price

Only semi's have declined recently

Lower Tertiary project costs

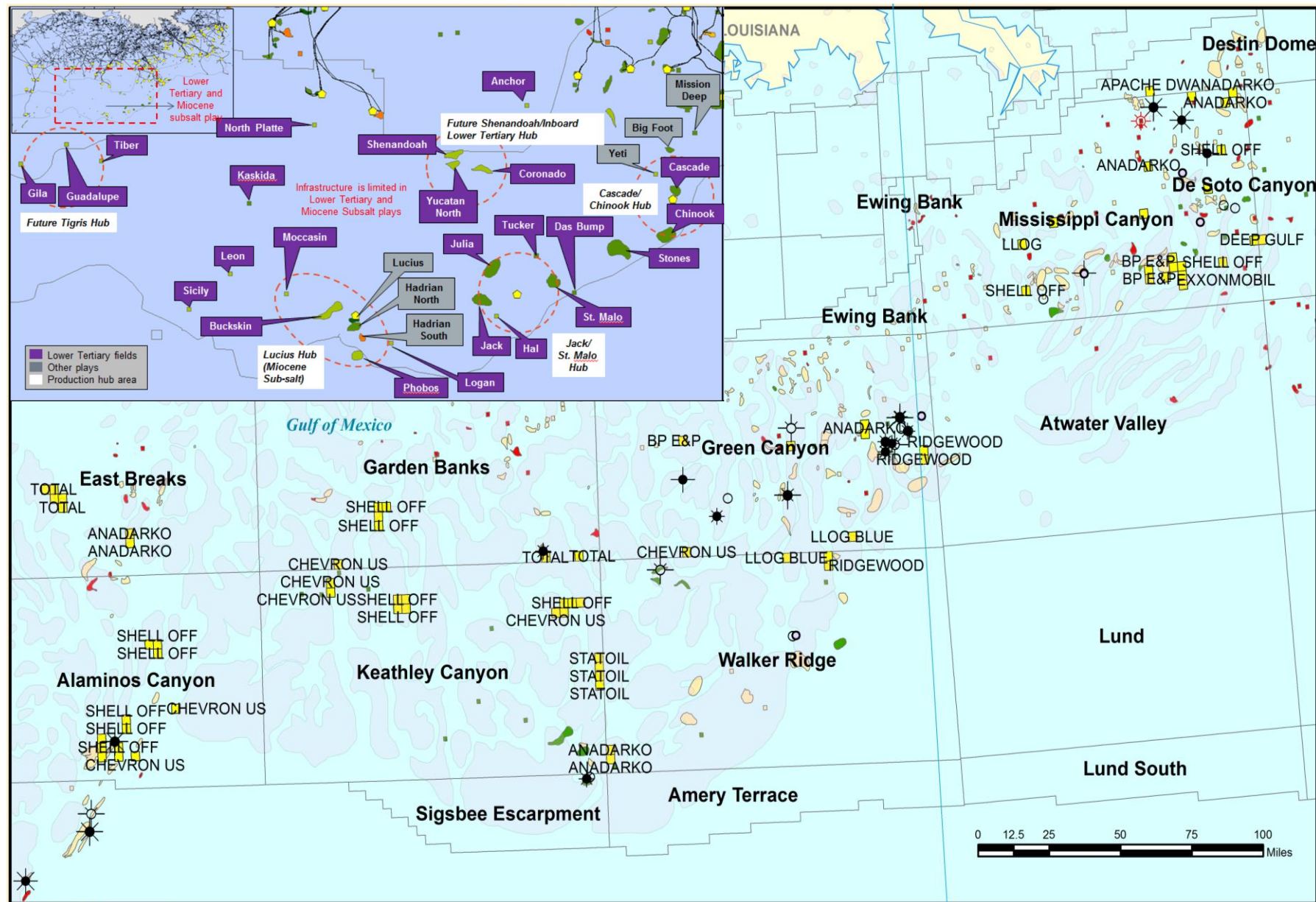
Region	Cost Reduction from 2014 to 2017			
	Design Change	Deflation	Efficiency	Total
Gulf of Mexico	-5.4%	-17.2%	-14.3%	-36.9%

- Lower Tertiary fields are the largest with Mean reserves of 280 MMBO
- There are fewer Lower Tertiary fields than Miocene sub salt or Miocene
- Lower Tertiary P50's are ~ 120 MMBO
- Sub salt Miocene P50's are ~ 70MMBO
- Miocene P50's are ~ 28 MMBO



Leasing Activity in Round 249

- Round 249 had participation in the Lower Tertiary, Miocene Sub Salt and Perdido plays.
- Total, Shell, Chevron, Statoil, LLOG, Anadarko, Ridgewood, BP and Apache were awarded blocks.
- While the major plays were represented, the companies stayed close to existing licenses.

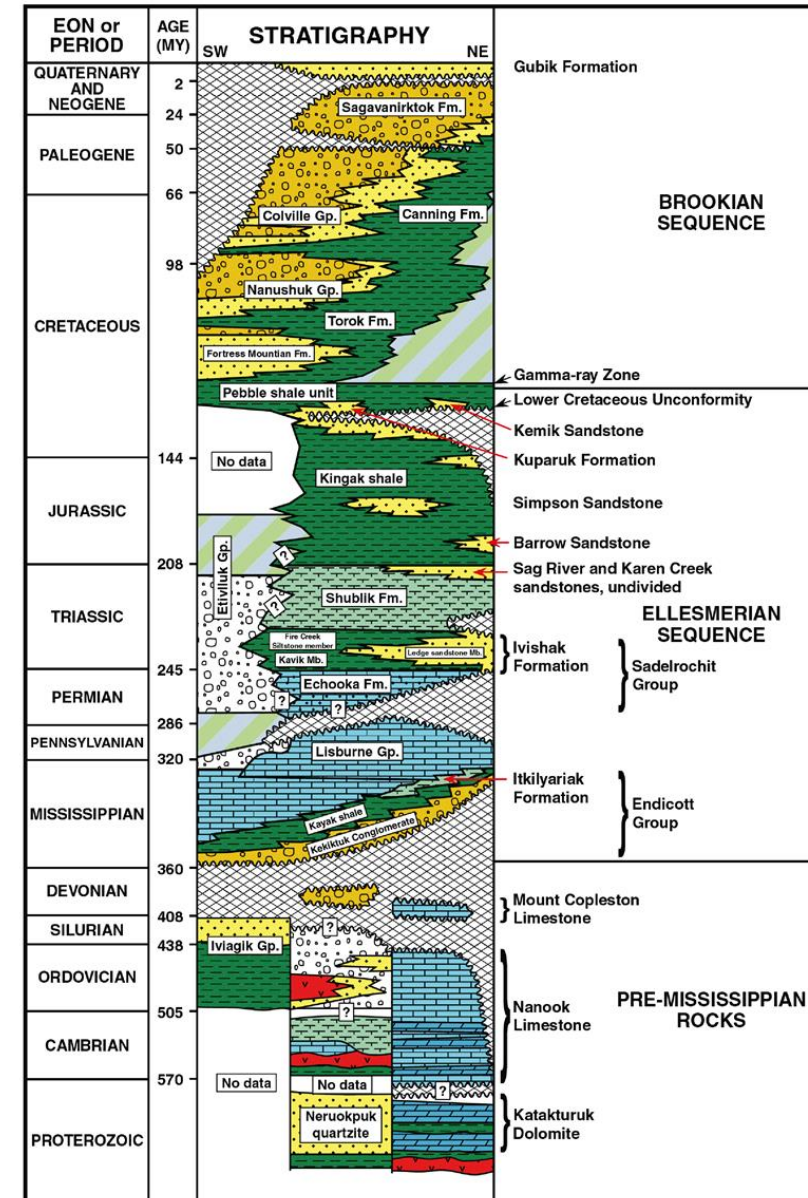


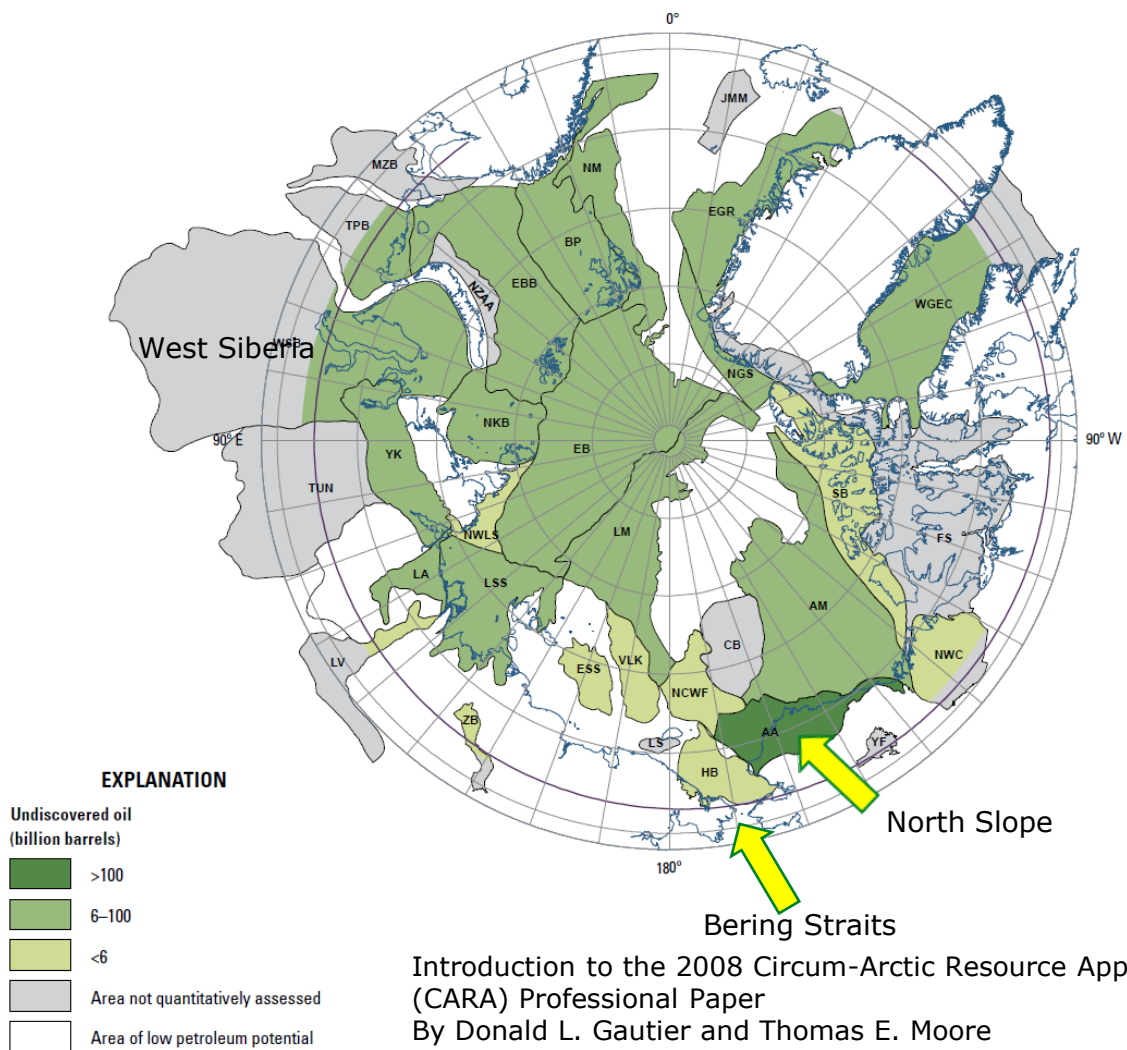
Alaska OCS and Artic

CARA Principle Findings

- The area is highly under explored making any resource assessment highly uncertain.
- The Chukchi Sea, Beaufort Sea, MacKenzie Delta, northeast Greenland, North Kara Sea and West Siberia are the most geologically likely areas for undiscovered resources.
- The oil resources are not large by world standards but the gas resources are large.
- CARA estimated 44-157 BBO and 770-2,990 Tcf of gas

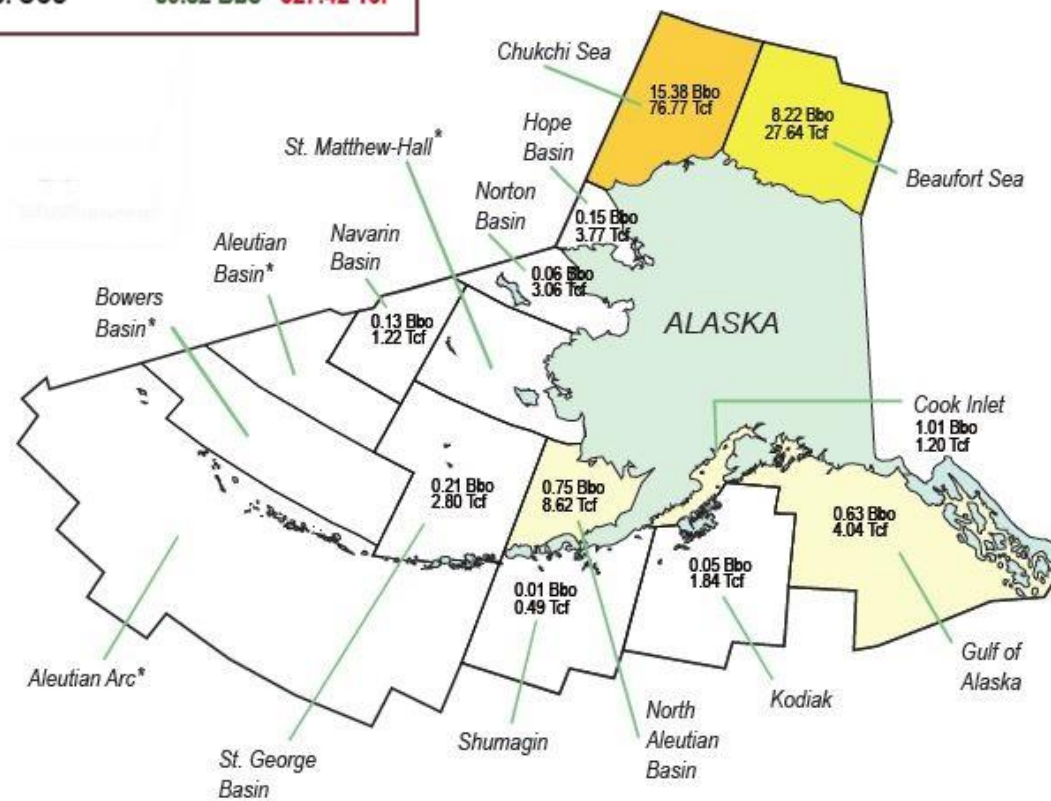
Introduction to the 2008 Circum-Arctic Resource Appraisal (CARA) Professional Paper
 By Donald L. Gautier and Thomas E. Moore
 Chapter A of The 2008 Circum-Arctic Resource Appraisal
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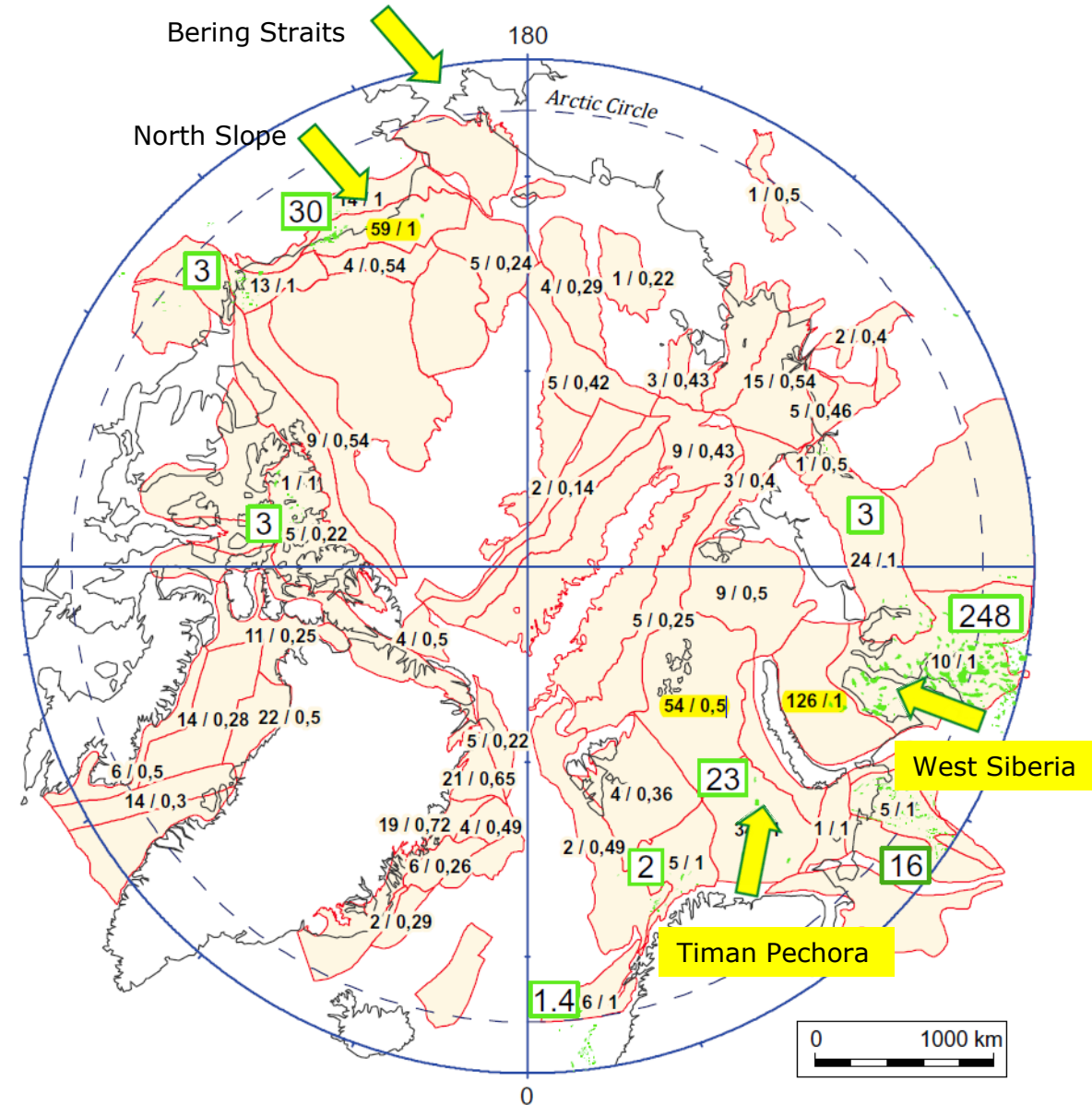
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Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016 (BOEM)

- West Siberia has the highest discovered reserves of 248BBOE and highest undiscovered resources of 126 BBOE.
- The North Slope and Chukchi have 30 BBOE discovered and 59 BBOE resources.
- Timan Pechora has 23 BBOE discovered and 54 BBOE resources.

Region	Area (MMkm2)	Wildcat Wells	Discoveries	Discovered Oil BBOE	Discovered Gas BBOE	YTF Guatier BBOE	YTF Kontorovich BBOE
Arctic Alaska	0.5	317	61	23.1	6.8	59	
Mackenzie Delta	0.1	196	59	1.4	1.8	13	
Timan Pechora	0.2	646	142	12.4	3.6	54	15
W Sib + S Kara	0.7	426	92	22.0	226.3	126	100
Norwegian Sea	0.1	38	12	0.7	0.7	6	
West Greenland	0.7	12				67	
East Greenland	0.5					52	

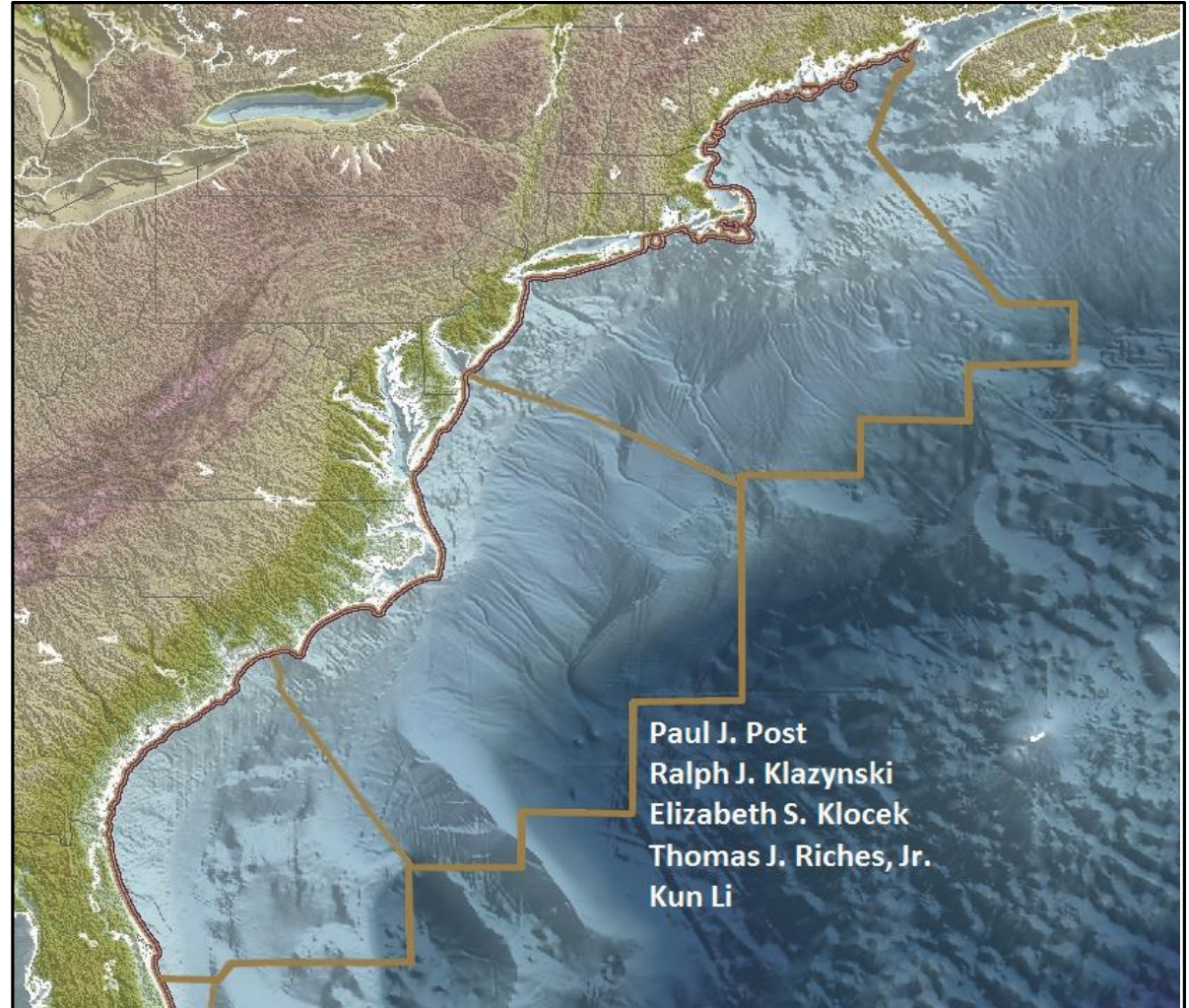


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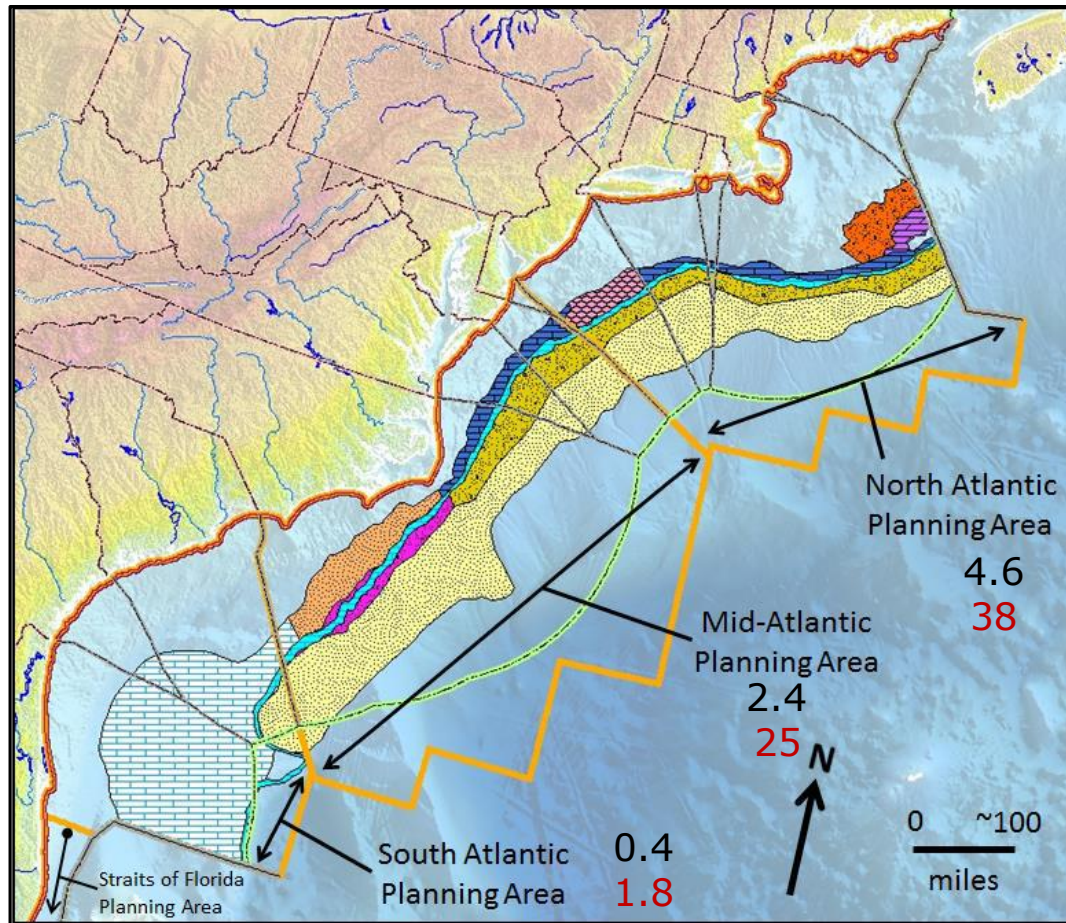
Atlantic Margin OCS

Inventory of Technically and Economically Recoverable Hydrocarbon Resources of the Atlantic Outer Continental Shelf as of January 1, 2014

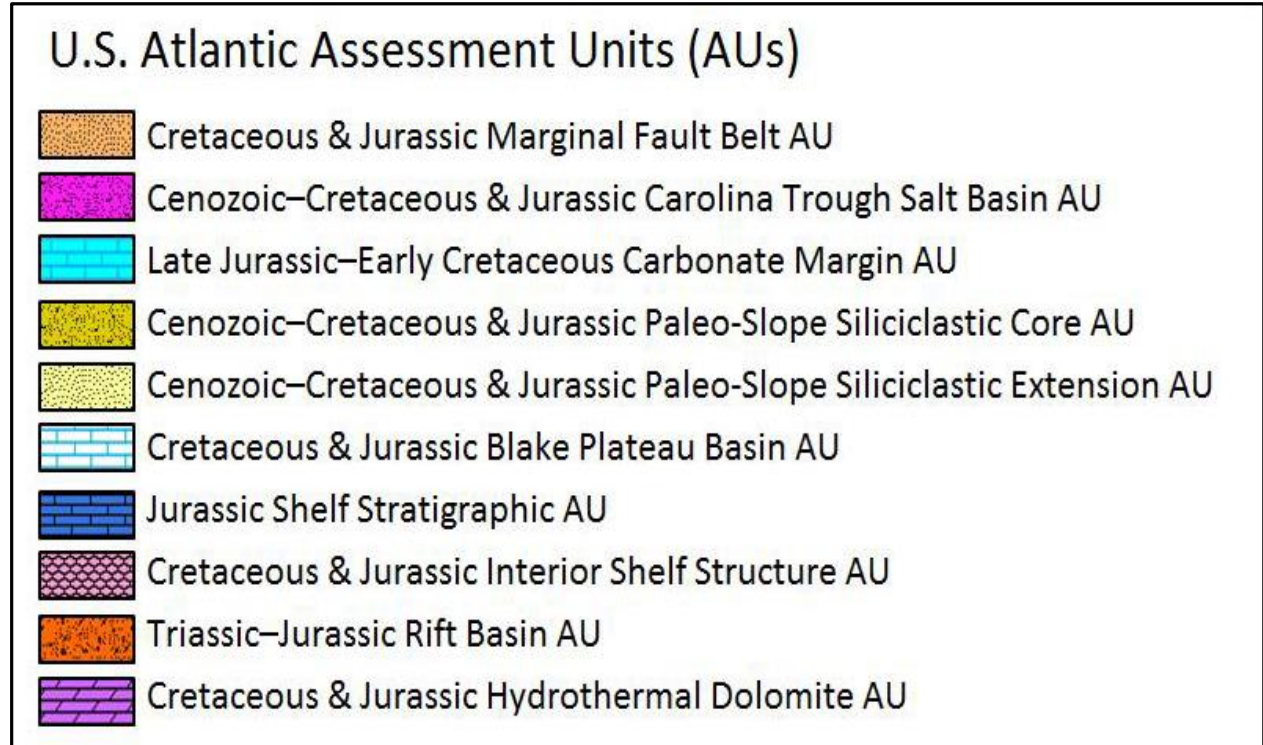
- No commercial discoveries to date
- 239,000 miles of seismic data, 51 wells
- Nine lease sales, 410 leases, 2,334,198 acres
- North, Mid and South protraction areas occupy 408,584 square miles
- The Baltimore Canyon Trough is the only well with 'discoveries' Eight wells had 'wet' natural gas shows indicating a mature oil and gas source rock.



Atlantic Protraction Areas and Plays

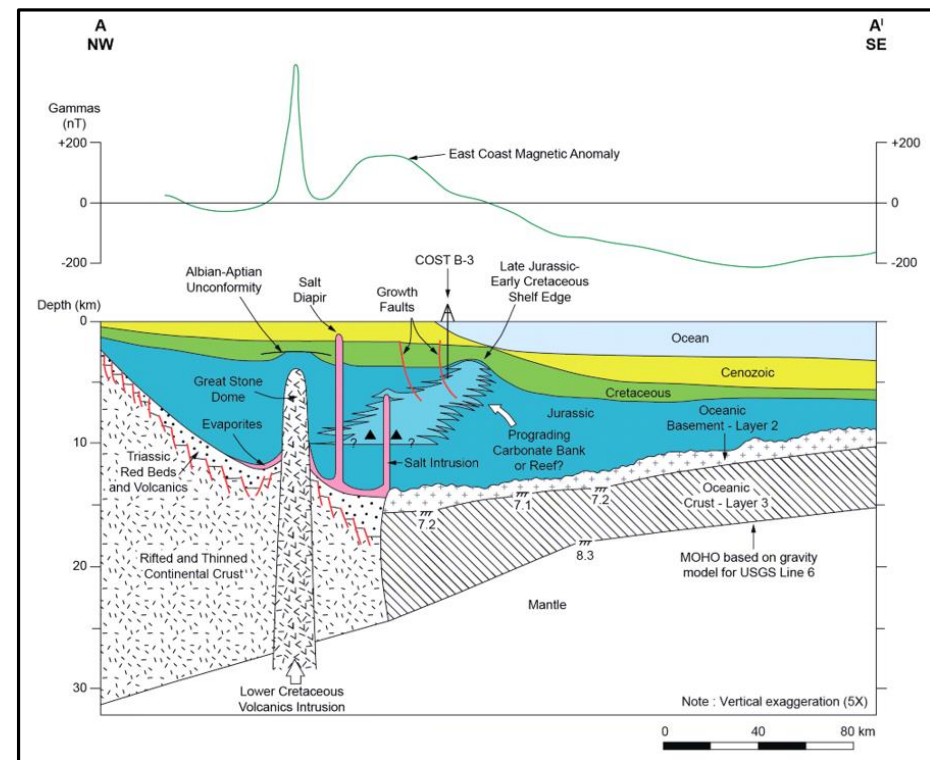
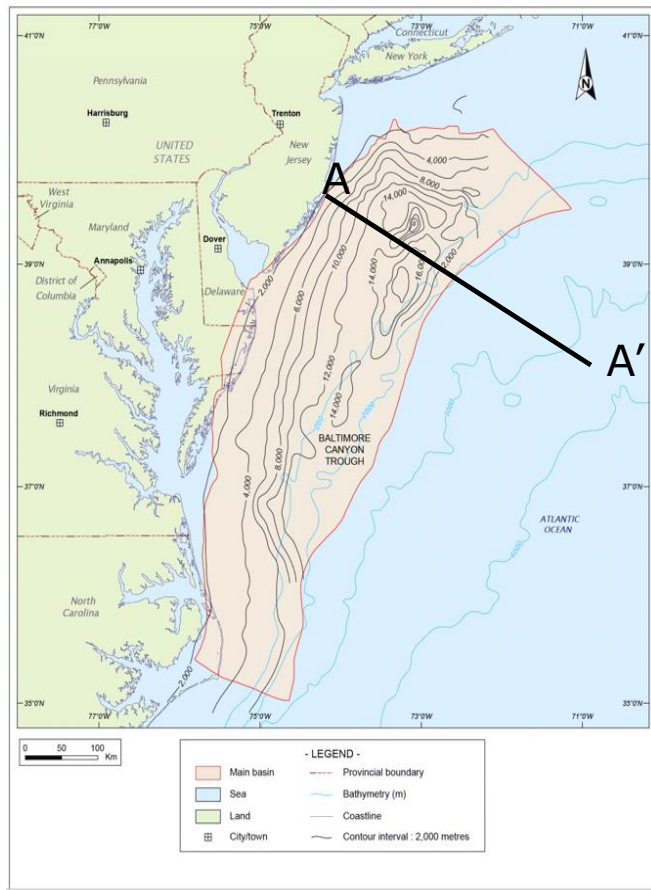
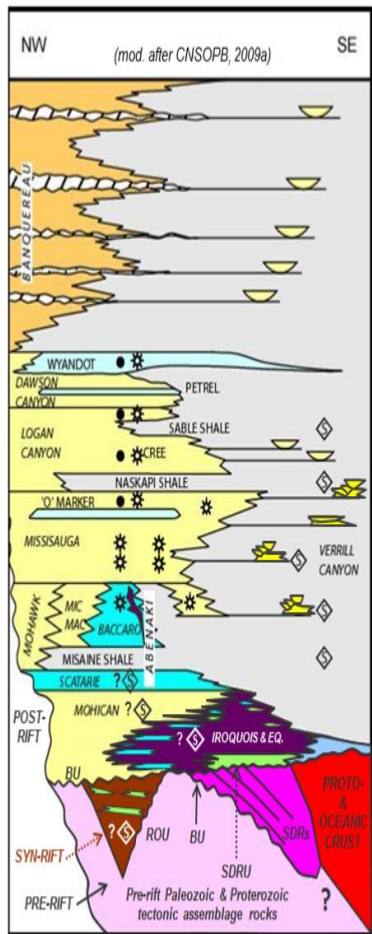
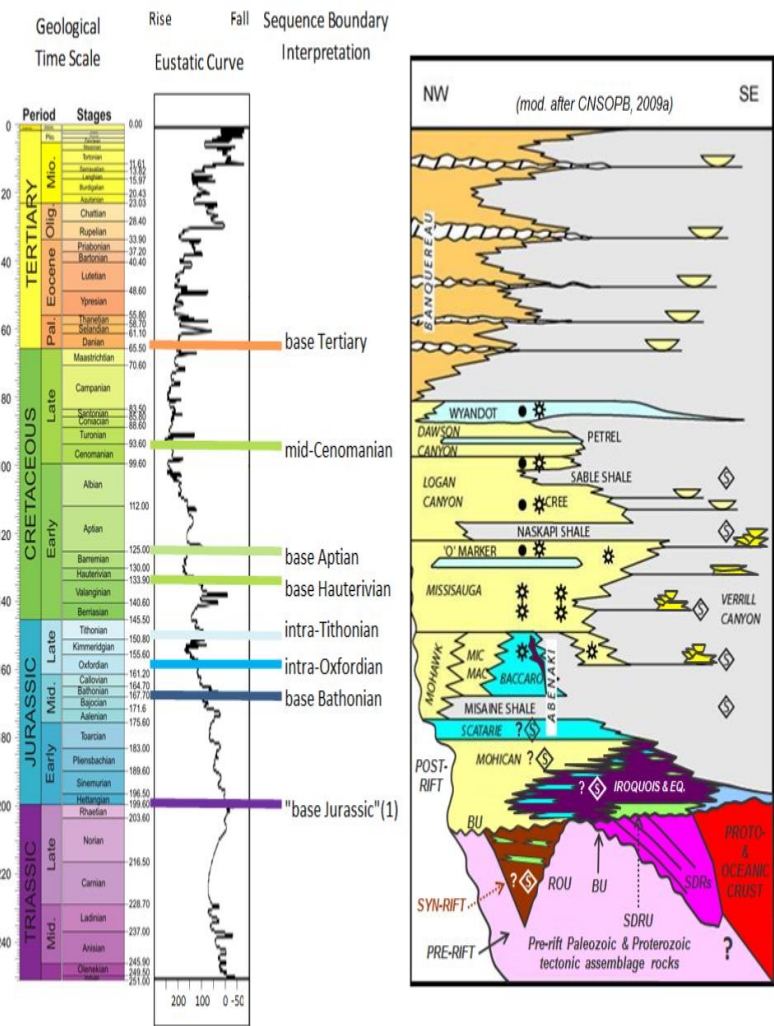


The entire area has only been lightly explored. Deep water Cretaceous and Tertiary sands are unexplored.



4.6 BOEM Technically recoverable oil BBO
 38 BOEM Technically recoverable gas Tcf

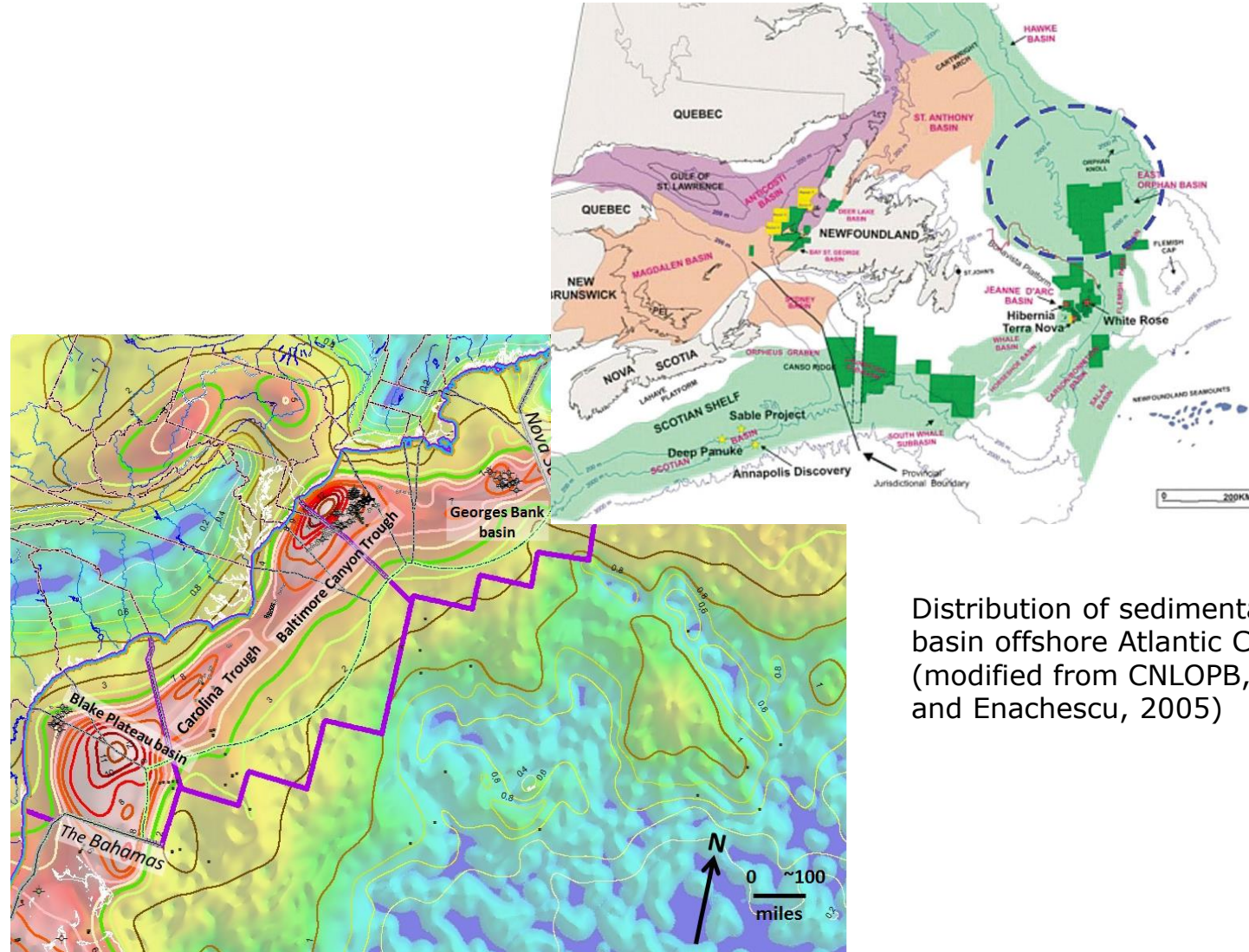
Sea level lowstands allowed sand to cross the shelf and be redeposited as deep marine fans similar to the fans seen in West Africa.



Time Scale from Ogg, Ogg, and Gradstein (2008)

Eustatic curve mod. from Haq et al., 1987 (as digitized by Miller et al., 2005)

- Canada is actively exploring and producing from their Atlantic Margin (Lake Erie as well)
- Hibernia (early Cretaceous deltaic sands), White Rose (Cretaceous shallow marine) and Terra Nova (Late Jurassic fluvial) produce from the Jeanne de Arc Basin
- Sable (Jurassic deltaic) gas produces from the Scotian shelf
- Shell has abandoned two wells off Nova Scotia, the Monterey Jack and Cheshire.
- BP have plans to drill in 2018



Distribution of sedimentary basin offshore Atlantic Canada (modified from CNLOPB, GSC and Enachescu, 2005)

Executive order seeks to expand offshore drilling on Outer Continental Shelf:

- President Donald Trump last week signed the America First Offshore Energy Executive Order, which aims to expand offshore oil and gas exploration and production in the Outer Continental Shelf through a review of the five-year leasing program and reconsideration of certain regulations pertaining to offshore energy potential.
- The order also directs the Secretary of the Interior to implement a streamlined permitting approach for privately funded seismic data collection to determine offshore energy resource potential.
- The executive order directs the Secretary of Interior and Secretary of Commerce to take action on OCS restrictions. The Secretary of the Interior will review areas closed off by the current five-year plan for sale of oil and gas leases in the OCS, without disrupting scheduled lease sales.
- These planning areas include, but are not limited to: the Western and Central Gulf of Mexico, the Chukchi Sea, the Beaufort Sea, the Cook Inlet, and areas of the Mid and South Atlantic.
- Secretarial Order 3550 directs BOEM to immediately develop a new “Five Year Outer Continental Shelf Leasing Program” with full consideration given to leasing the OCS offshore Alaska, mid- and south-Atlantic, and the Gulf of Mexico.
- Under the (old) current five-year plan (2017-2022)—which was finalized in January, 2017 by the Obama administration—94% of the OCS is off limits for oil and gas development. As of March 1, 2017, only 16 million acres on the OCS (out of a total 1.7 billion acres) are under lease for oil and gas development.

- The Gulf of Mexico has ample discovered reserves. Some of these are being appraised and some are fallow.
- GOM costs have come down, oil price is better and there is exploration opportunity. However, the environment is marginal with economic challenges and political uncertainty.
- Offshore west coast has exploration potential but is unlikely to overcome local political opposition.
- Offshore east coast has not met with past exploration success.
- The bold may ultimately try exploring the deep water past the reefs where Cretaceous turbiditic sands are prospective.
- The Artic has potential in the Chukchi and Beaufort Seas but the difficult operating environment and high costs are going to hamper commercial production.
- We wait to see what the new five year leasing plan is going to be?
 - Update 1: January 4, 2018 – Zinke Unleashes OCS
 - Update 2: January 10, 2018 – Florida removed from offshore drilling list