

The Evolution of a Proven Giant Oil & Gas Play in Subsalt Miocene Lower Slope Sands-Reservoirs of the Federal Offshore OCS Shelf, US Gulf of Mexico

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Objectives

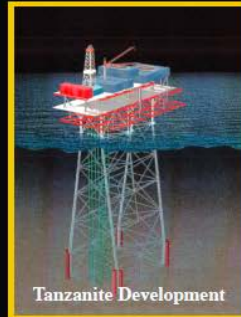
- Highlight depositional systems of reservoir sands in the Miocene-age Lower Slope section of the Offshore Central Louisiana Gulf of Mexico
- Show these Conger-Mahogany-Hickory ancestral Miocene-age Lower Slope sands, as proven highly productive reservoirs with further potential in surrounding undrilled mini-basins of the play
- Demonstrate that the Miocene-age Lower Slope is NOT a “bypass” zone, but is a broad, widespread area of sand-filled confined mini-basins with sand-filled lowstand levels of amalgamated and channelized fans.

Re-Emerging Shelf Miocene Sub-Salt Oil Sand Play

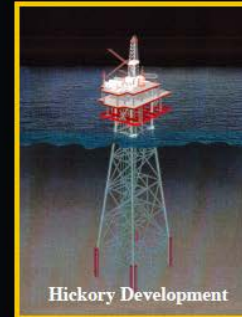
PIONEERING SUBSALT SHELF DISCOVERIES



Tarantula Development



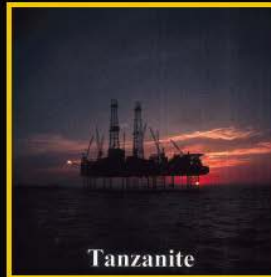
Tanzanite Development



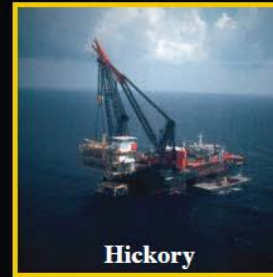
Hickory Development



Tanzanite Development



Tanzanite



Hickory



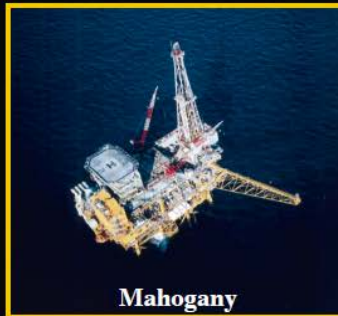
Hickory Development



Gorilla Jack-Up



Mahogany Development



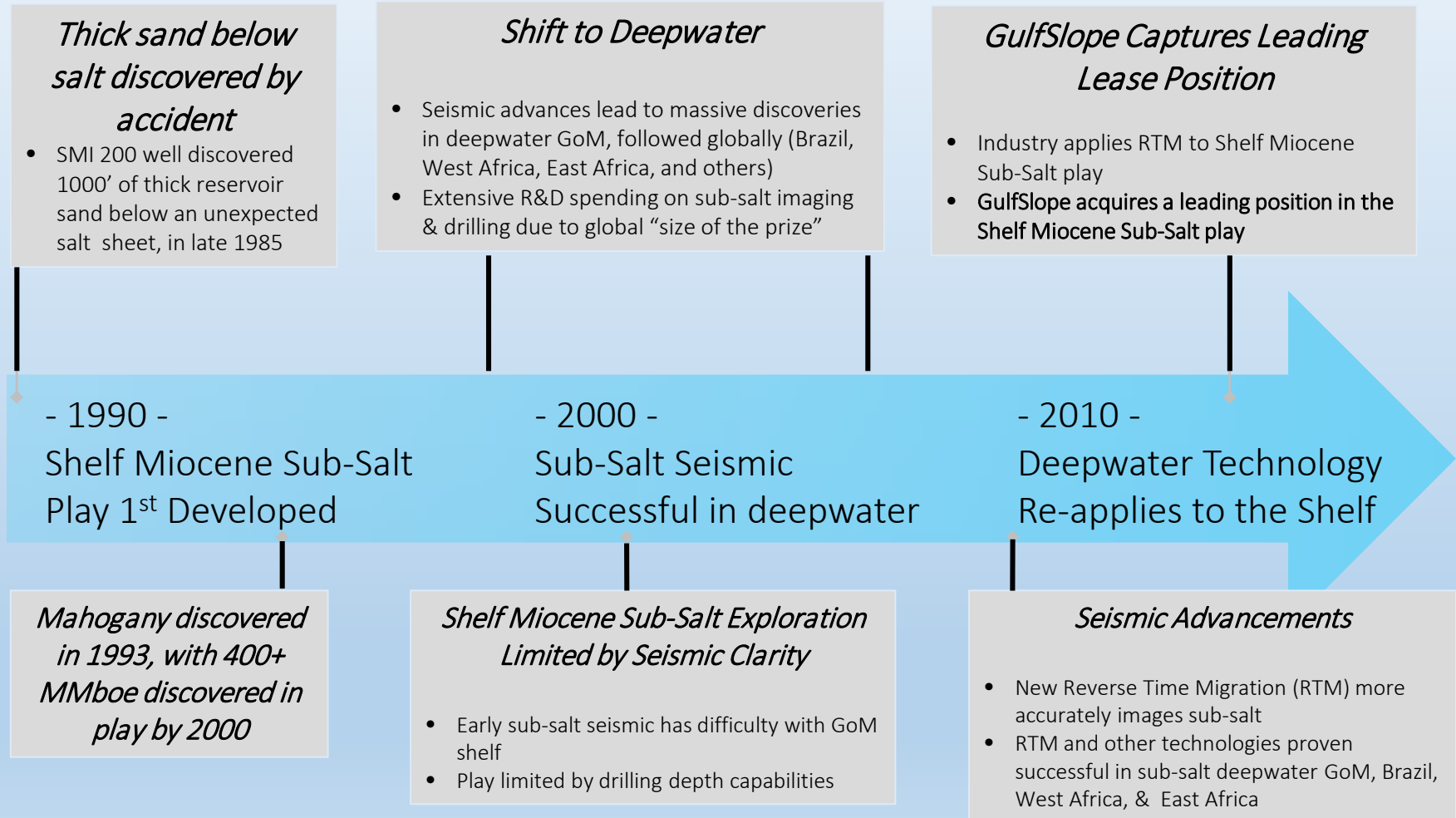
Mahogany



Mahogany Semi - Sub

Evolution of the Shelf Miocene Sub-Salt Play

The play was 1st produced in the 1990's but older technology left potential giant fields behind



Subsalt Miocene Slope Sand Production

EUR 400+ MMboe were discovered in the 1990s

Conger >250 MMBoe
 Discovered 1st Prod
 1998 2000

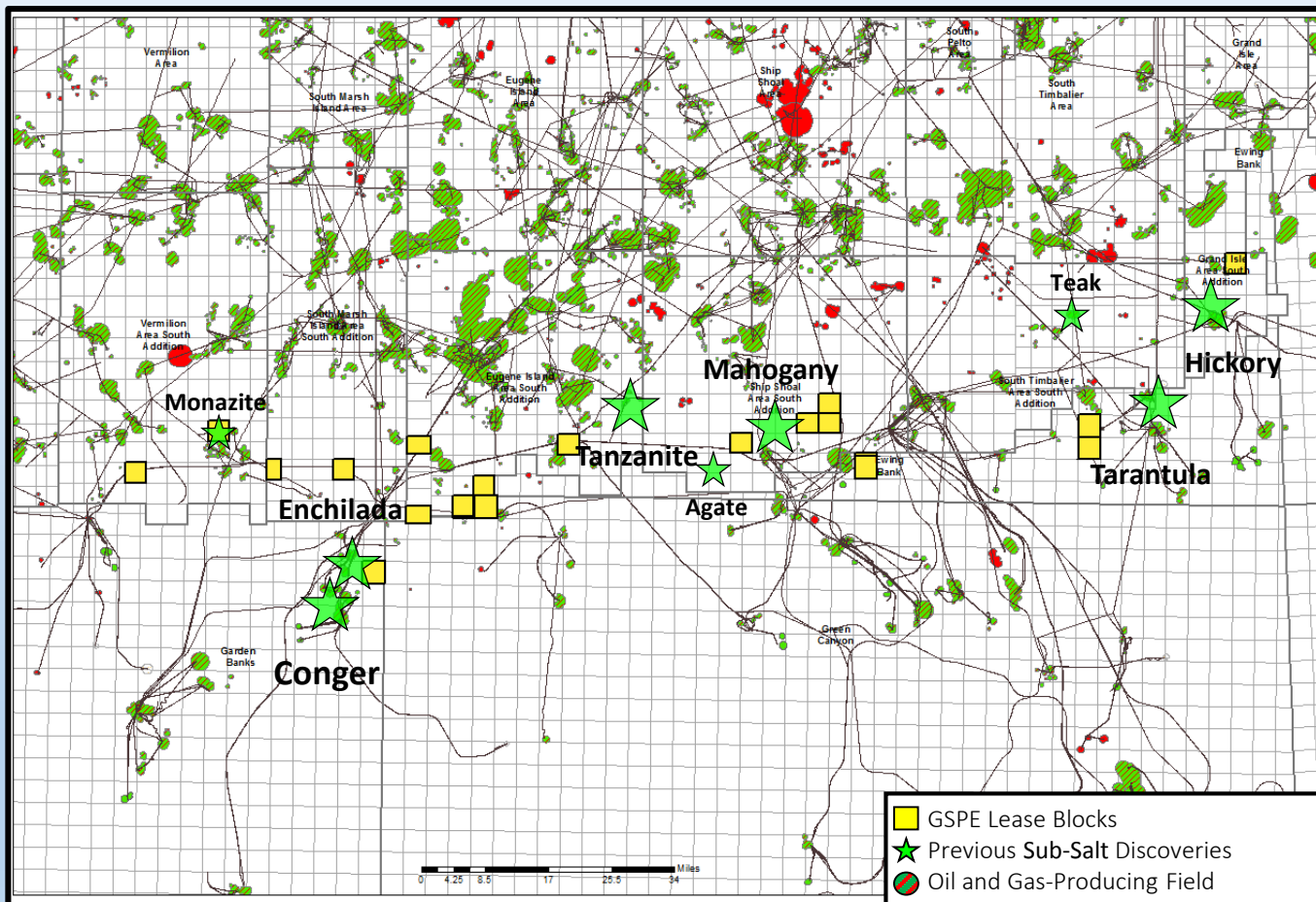
Hickory >55+ MMBoe
 Discovered 1st Prod
 1998 2000

Mahogany >50+ MMBoe
 Discovered 1st Prod
 1993 1997

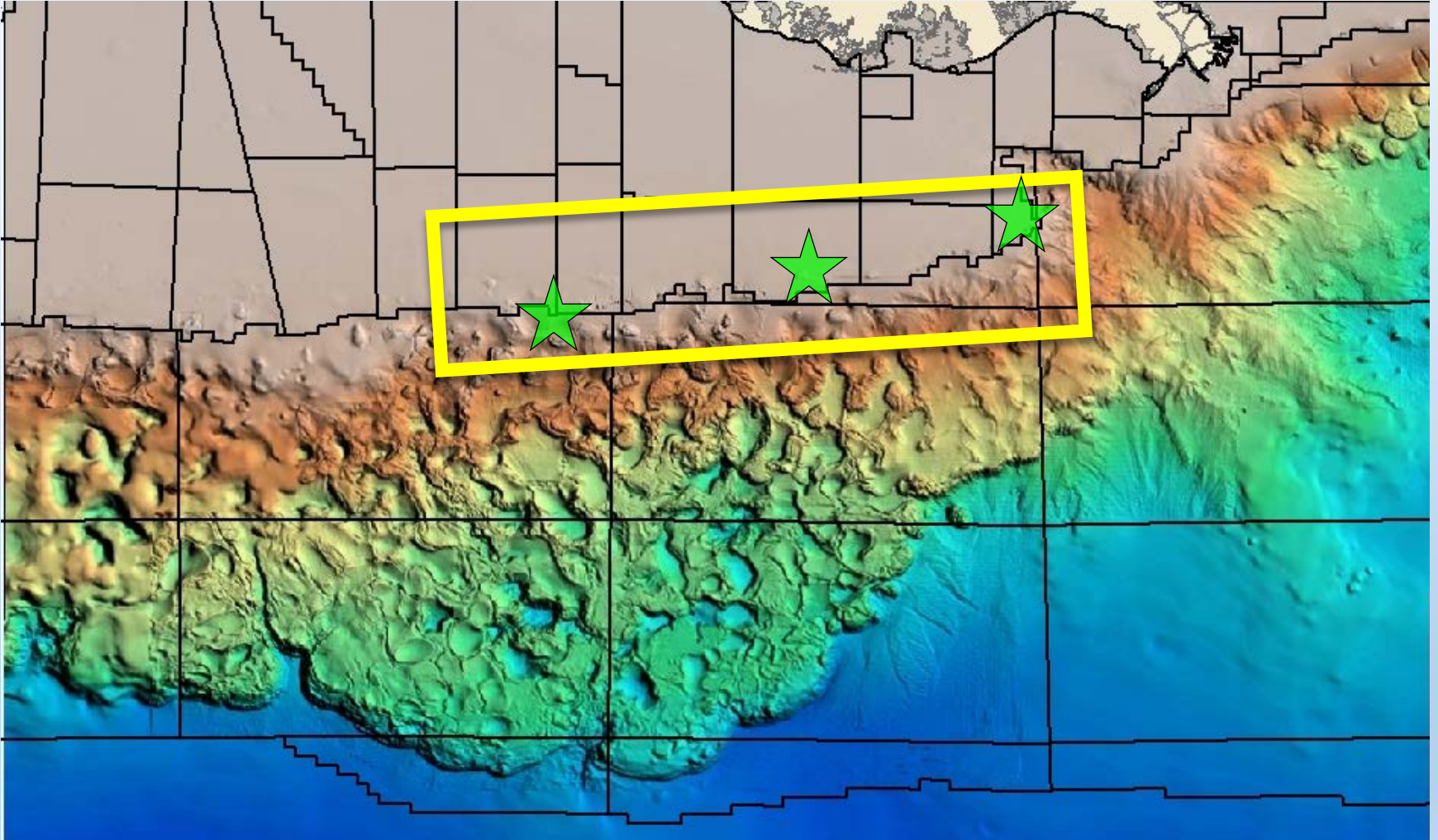
Tanzanite >20 MMBoe
 Discovered 1st Prod
 1998 1999

Enchilada >30 MMBoe
 Discovered 1st Prod
 1995 1997

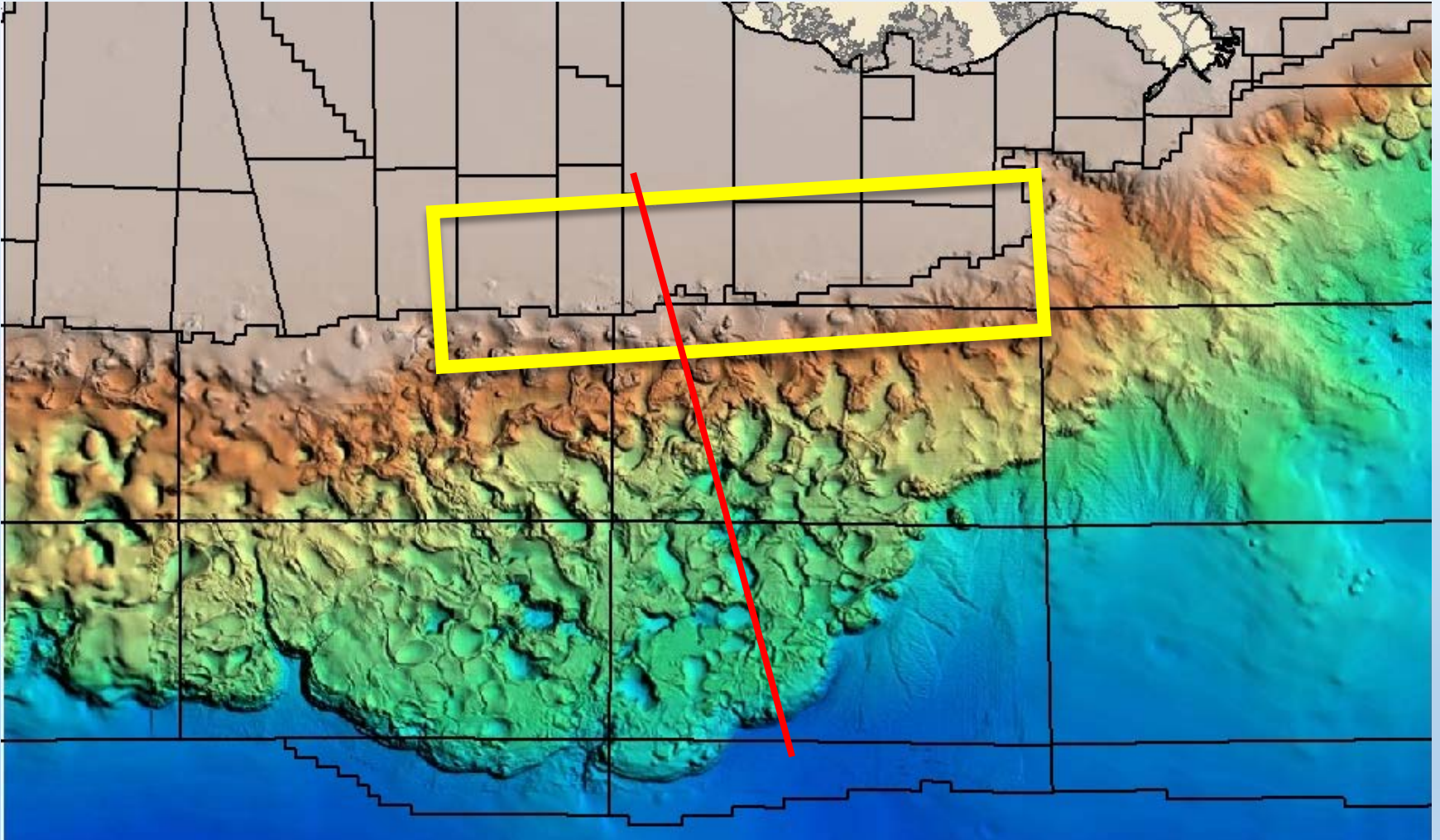
Tarantula >15 MMBoe
 Discovered 1st Prod
 2001 2004



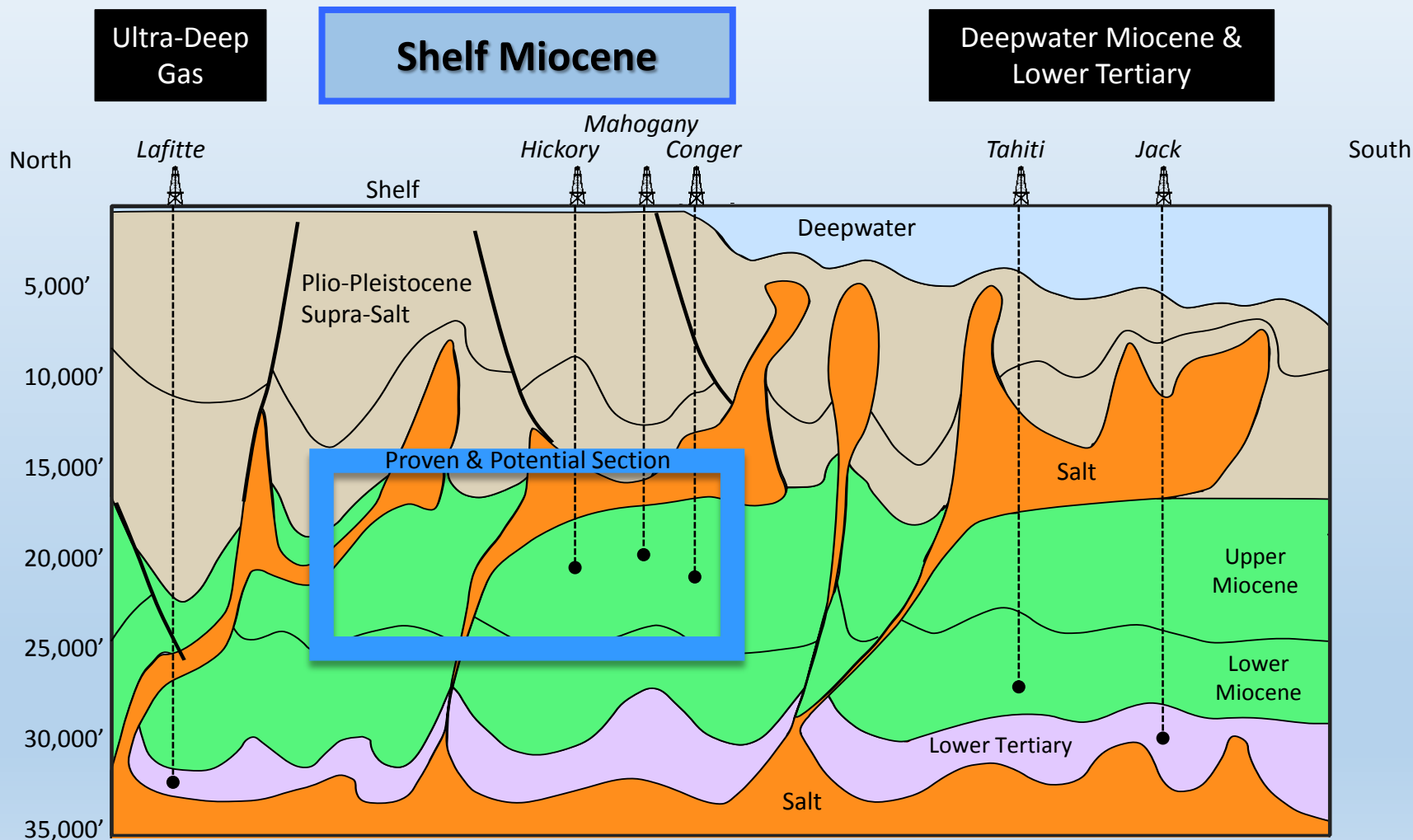
Conger-Mahogany-Hickory Field Play Area



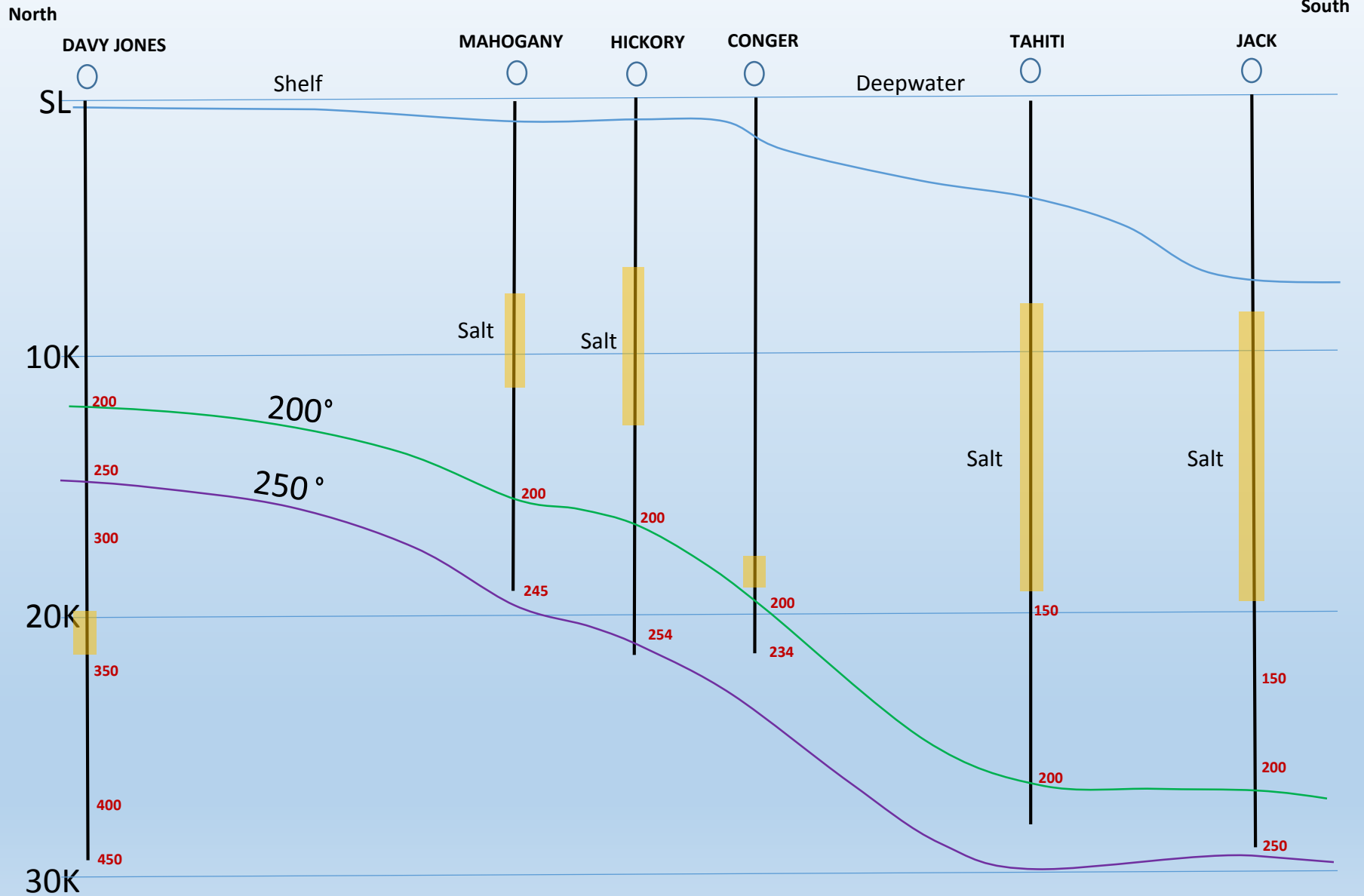
Lower Slope Miocene-Age Sand Mini-Basin Area



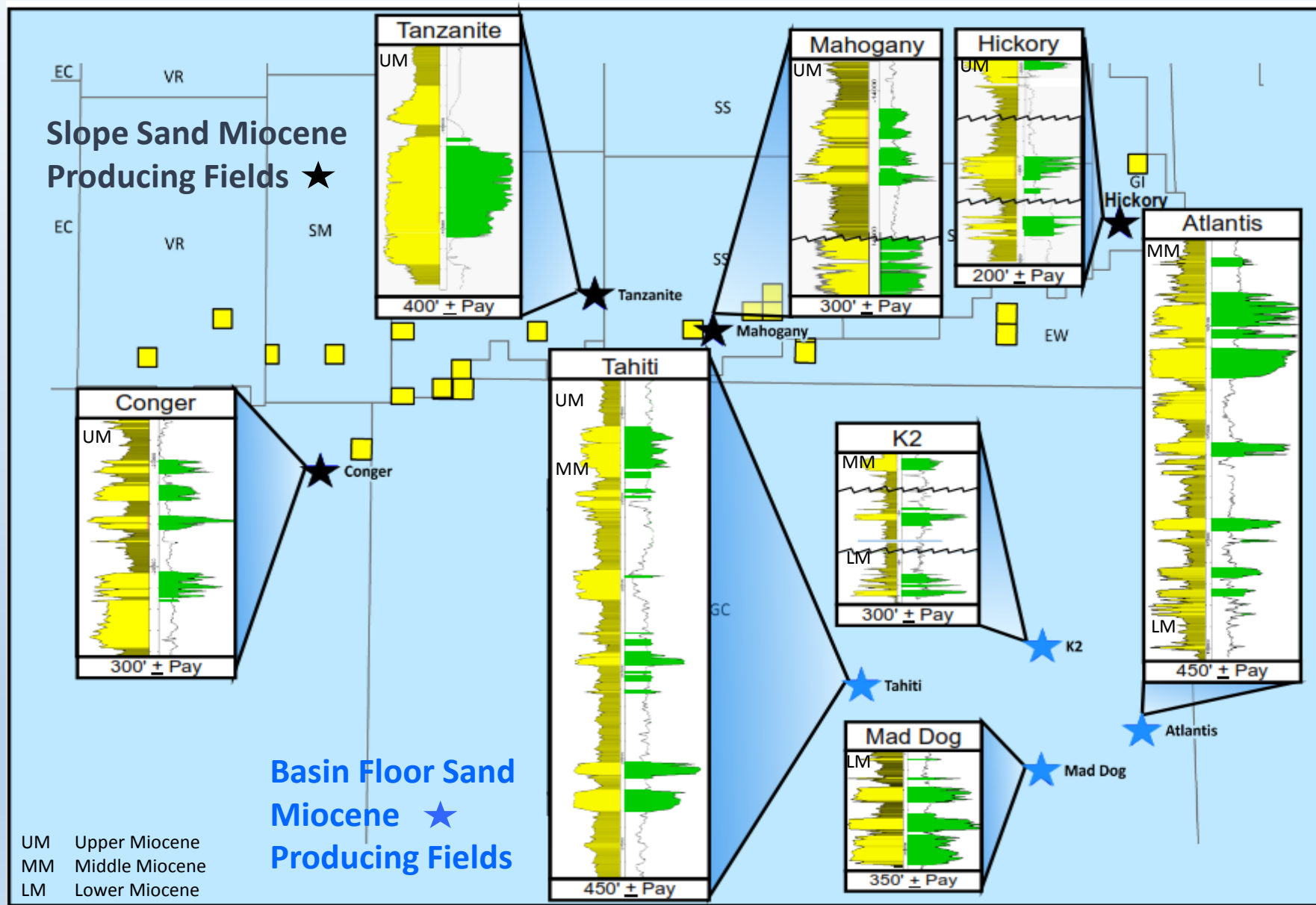
Conger-Mahogany-Hickory Play Area



5000' of Salt - Lowers Subsalt Temperature 35+ degrees (F)



Highly Productive Slope and Basin Floor Sands



Hess – Garden Banks 215 # 8

Conger Field Well Analog to Quark-Tachyon-Photon

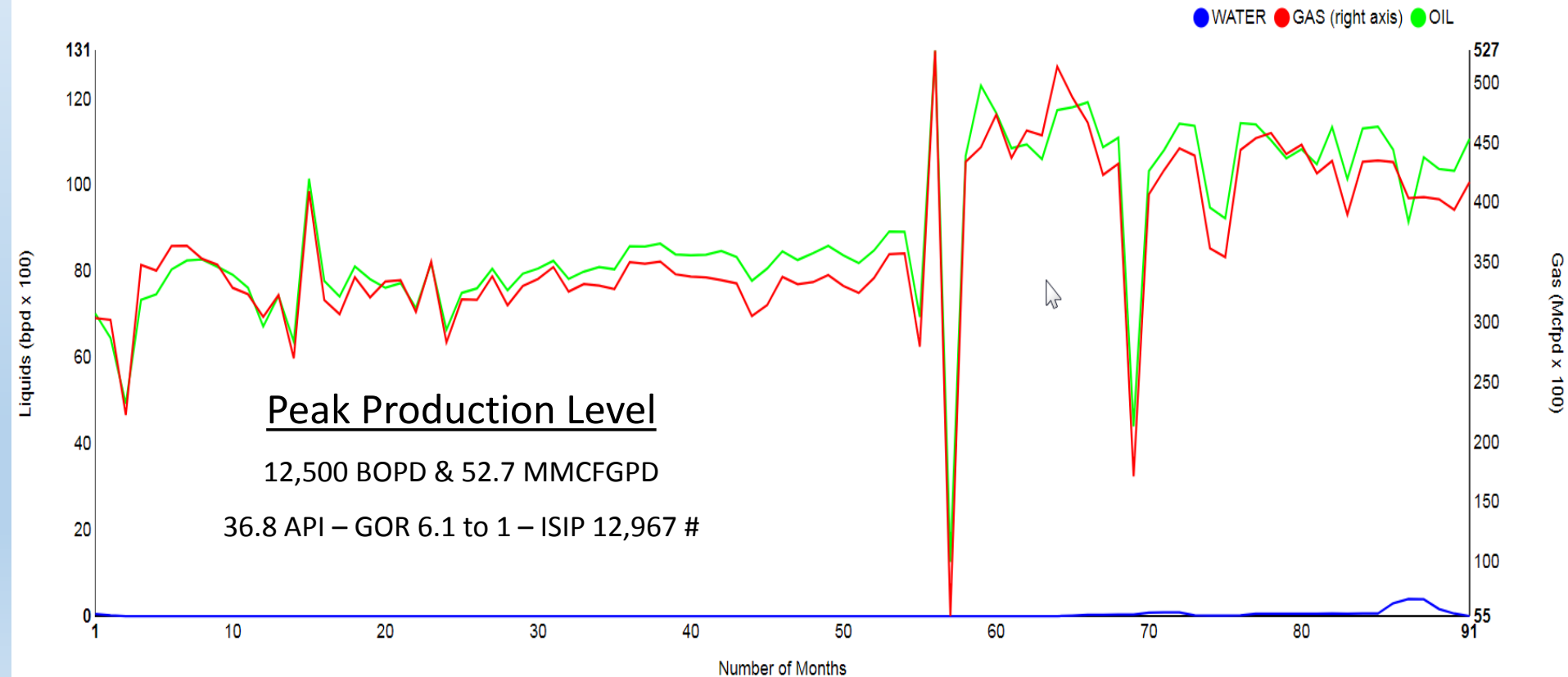


Completion Production Per Day On

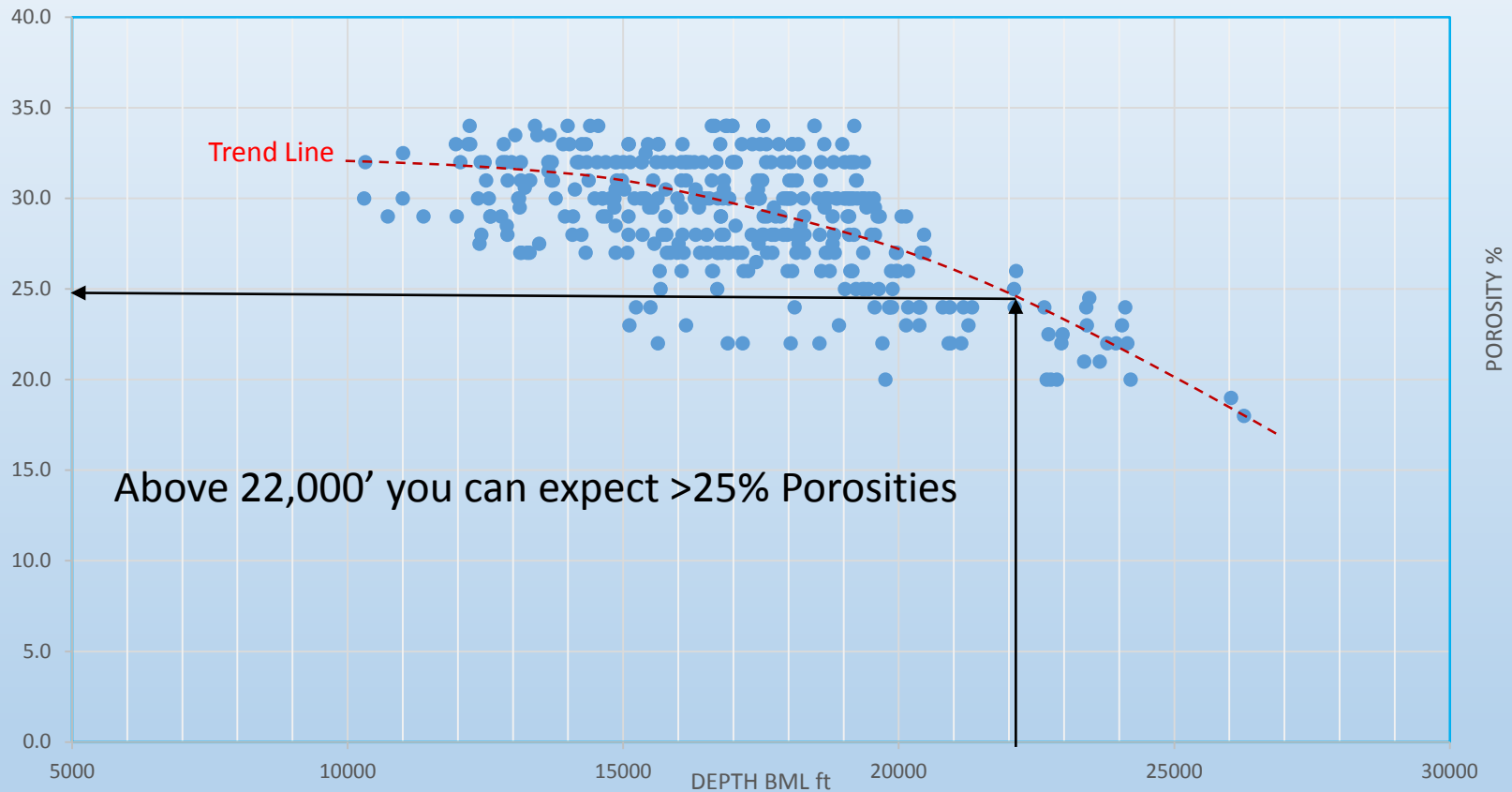
Field = GB171 ESA Comp. ID No. = 608074020101 S02 20080728 Complex ID = 90014 1

Sand = M0 , Interval = 20,035 To 20,284 (MD), TOPTVD = -19,849 , Production From Jul 2008 To Apr 2017

Cumulative Oil (Bbls) = 21,605,167 Water (Bbls) = 49,390 Gas (Mcf) = 87,941,777

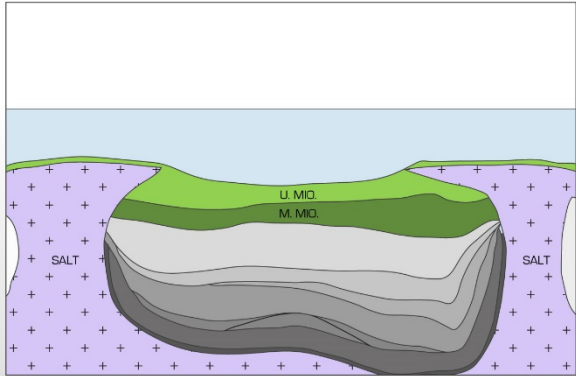


Porosity vs Depth (BML) for Miocene Slope Sands

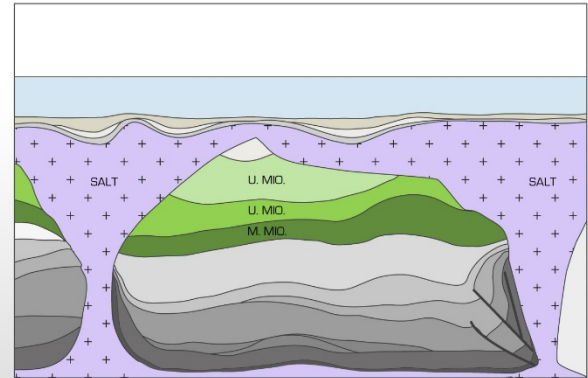


Dynamic Salt & Sediment Model

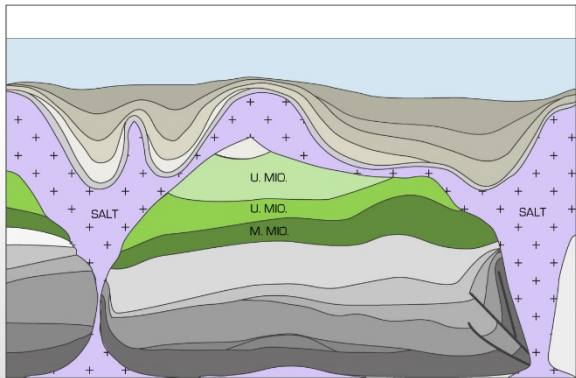
Salt Model - Upper Miocene Time



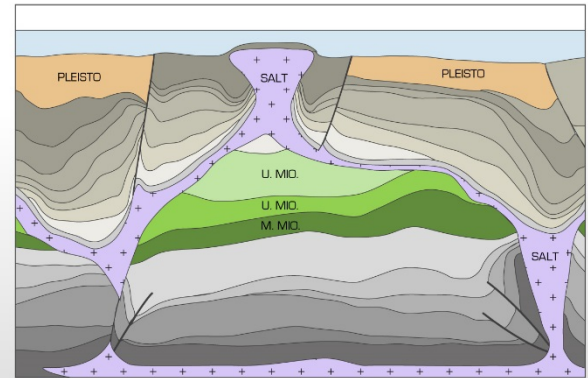
Salt Model - Thick Salt Case



Salt Model - Late Pliocene to Early Pleistocene Time

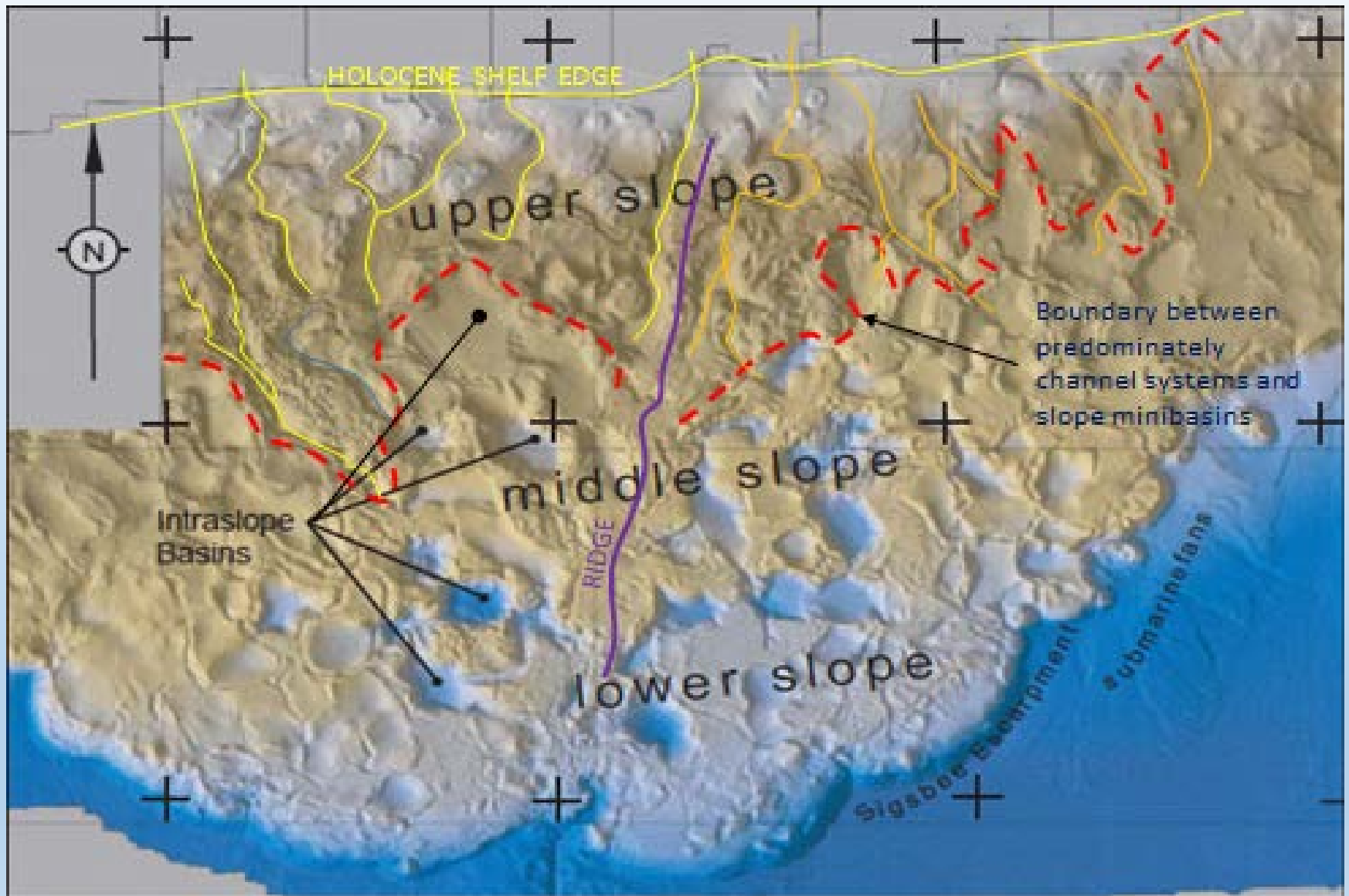


Salt Model - Pleistocene Time



Bathymetry of Modern Sea Floor *

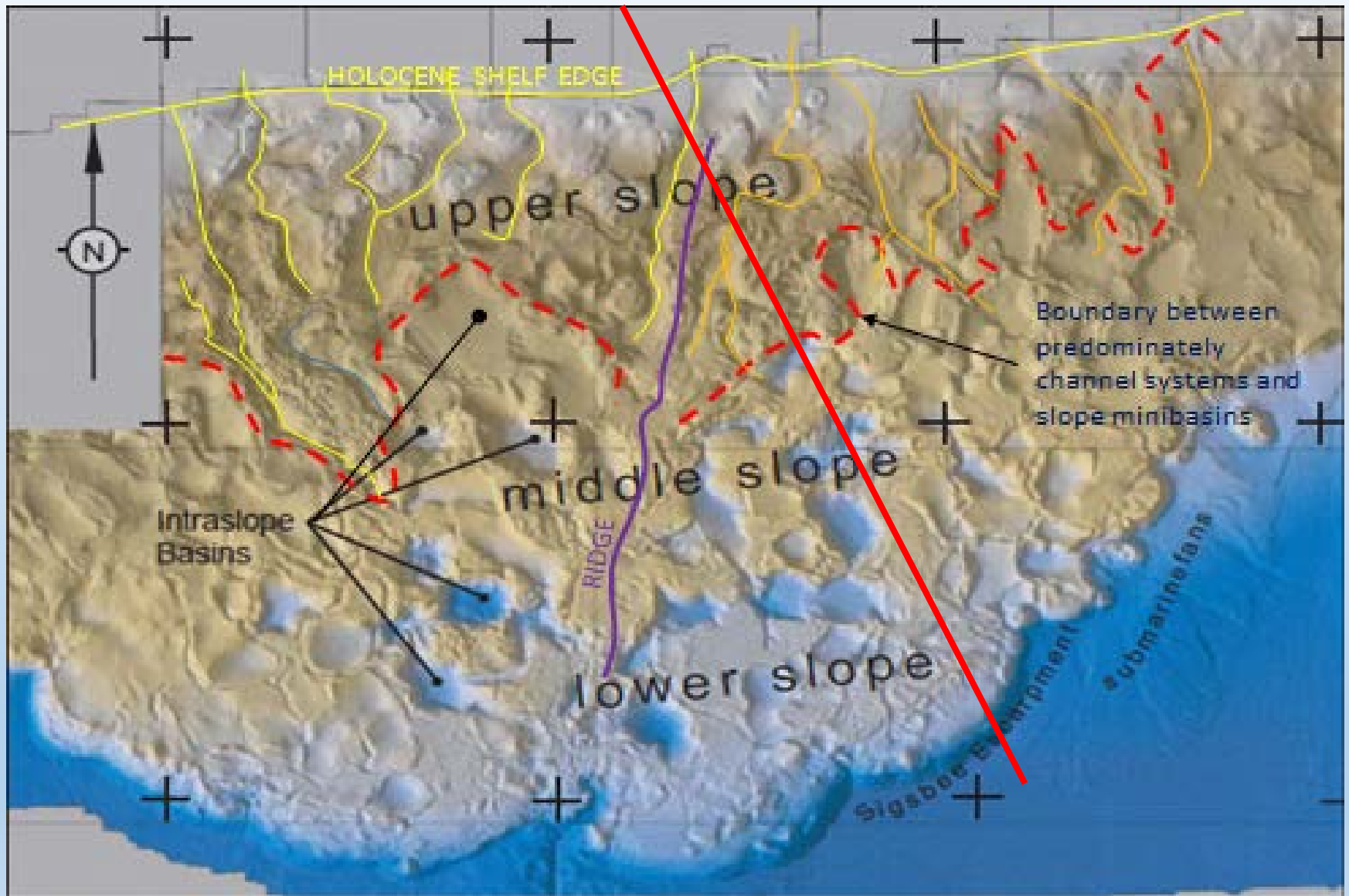
An Analog for sediment fed Intraslope Basins



*Modified from Diegel et al., 1995, Prather, 1998

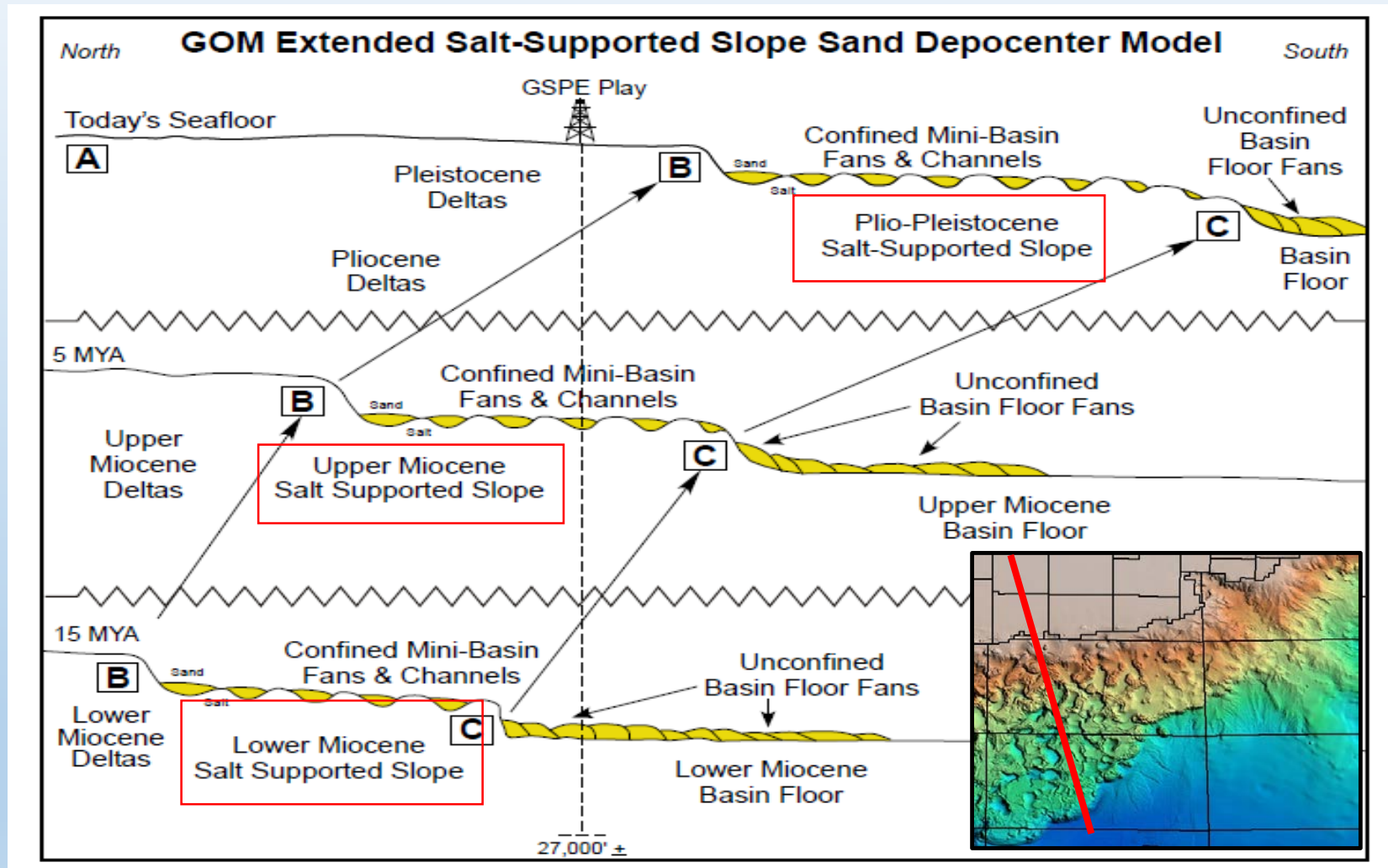
Bathymetry of Modern Sea Floor *

An Analog for sediment fed Intraslope Basins

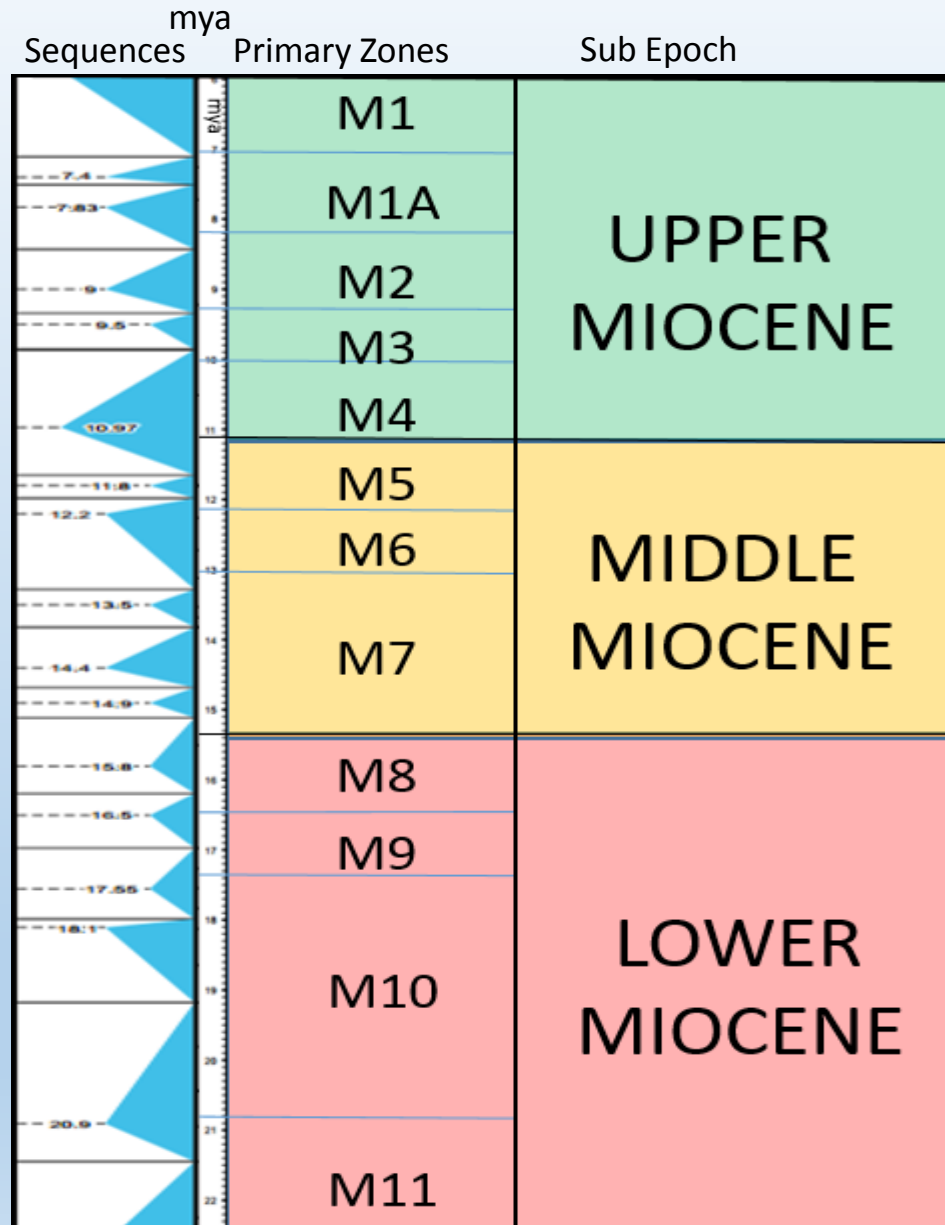


*Modified from Diegel et al., 1995, Prather, 1998

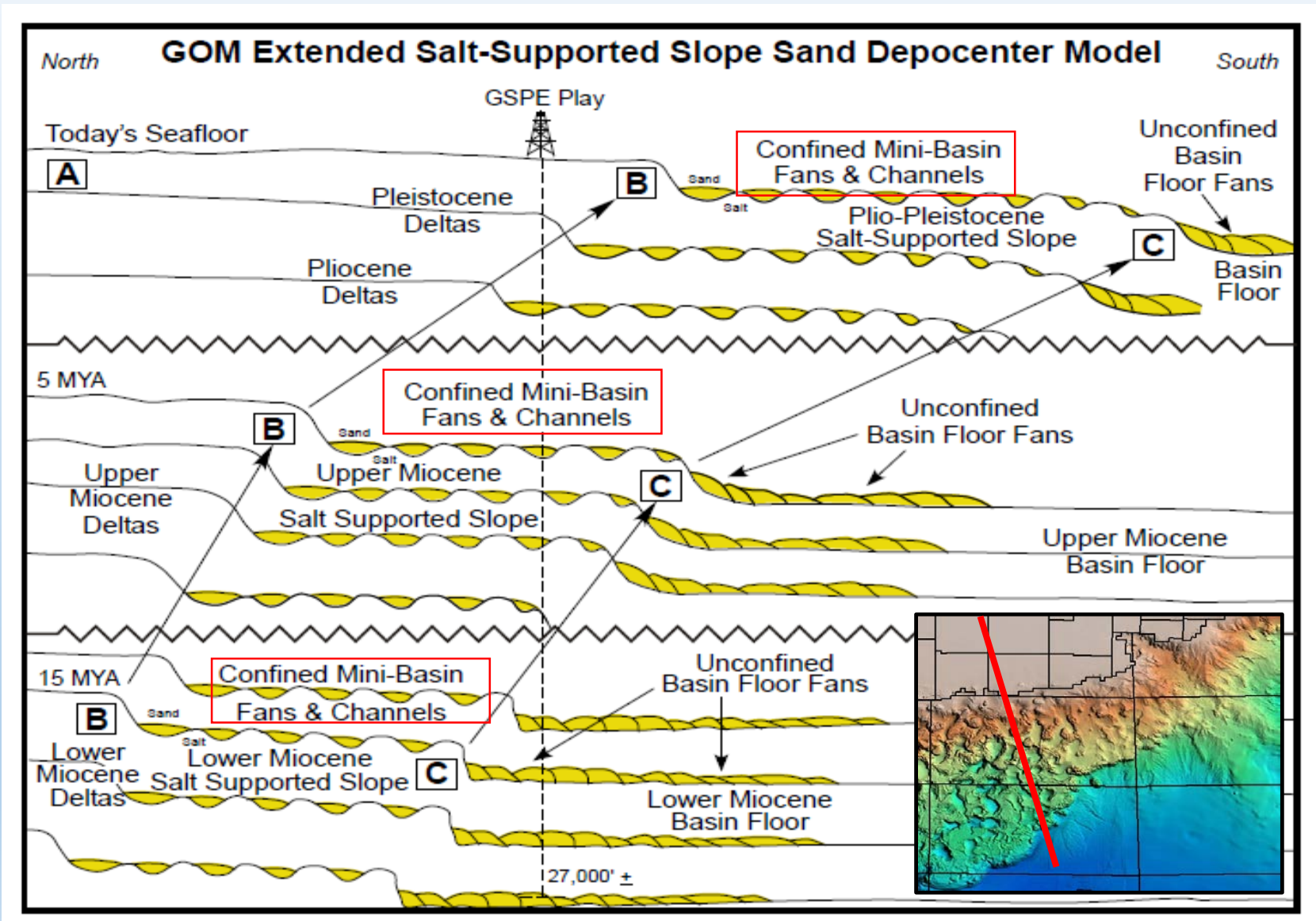
Delta, Slope, & Basin Floor Prograde Seaward



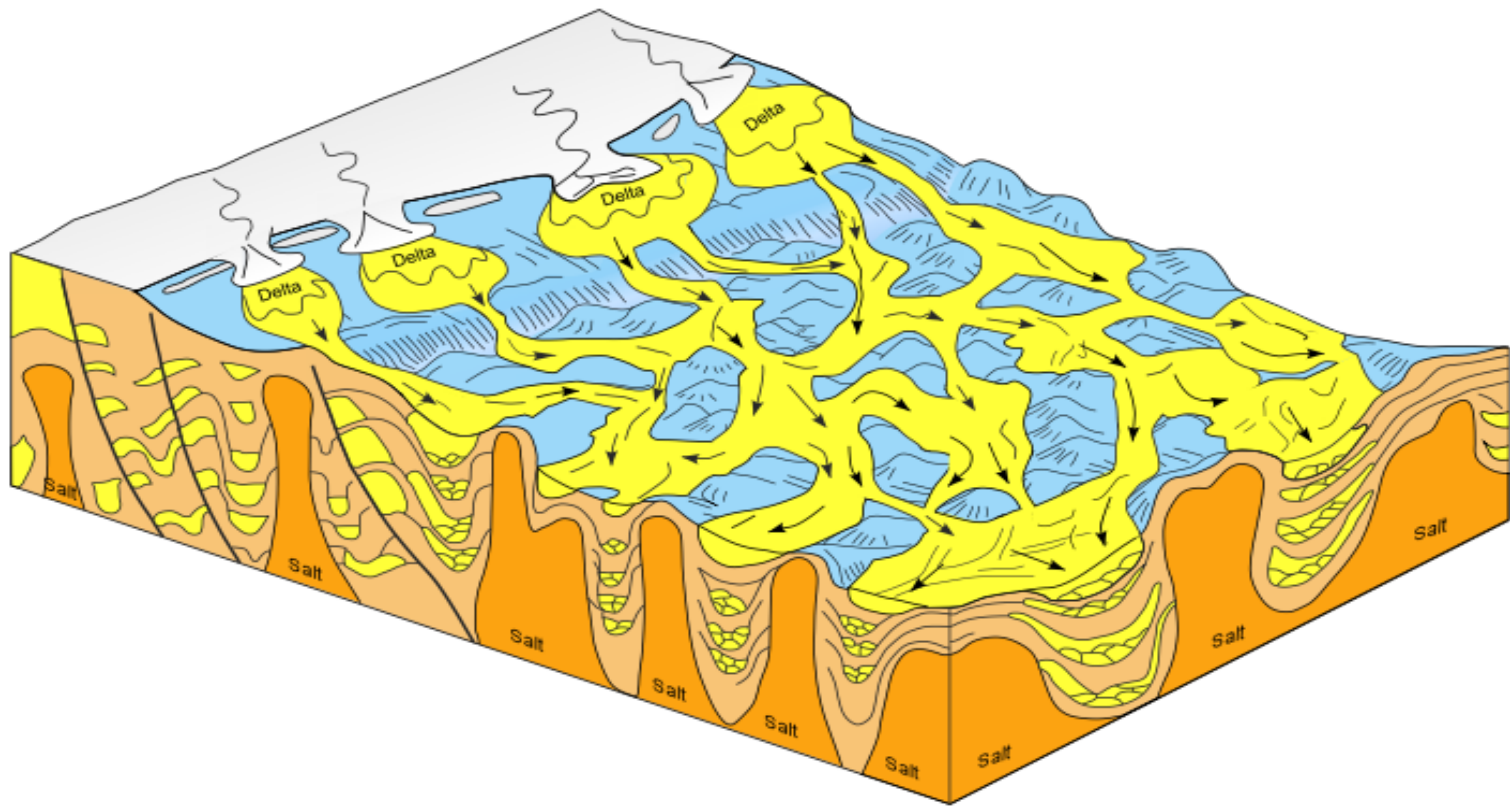
15+ Sequences - Lowstand Sand Potential



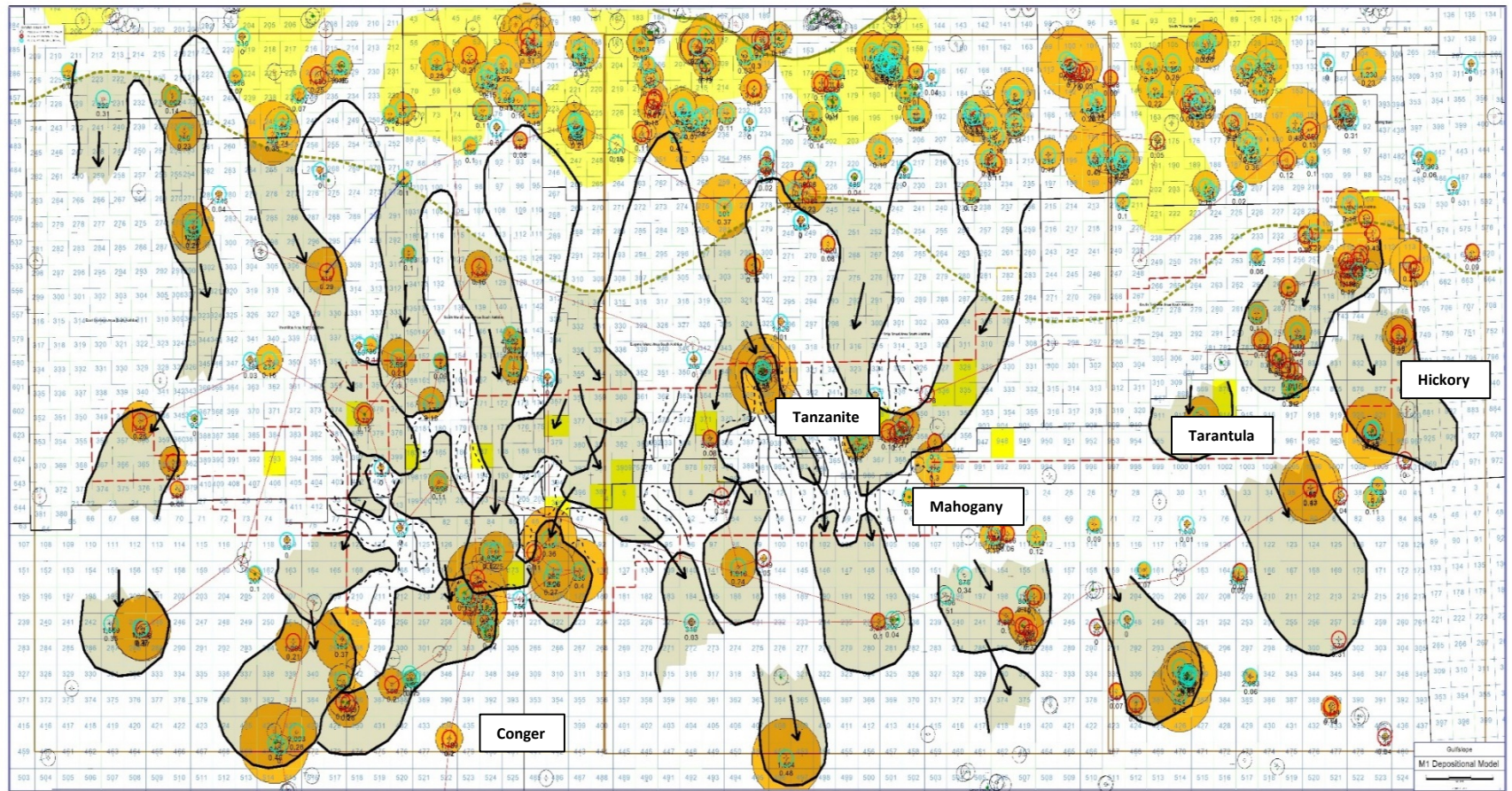
15+ Successive Lowstand Cycles in Miocene



Lowstand Deltas Feed the Salt-Supported Extended-Slope Creating Confined Mini-Basins with Amalgamated & Channelized Fans

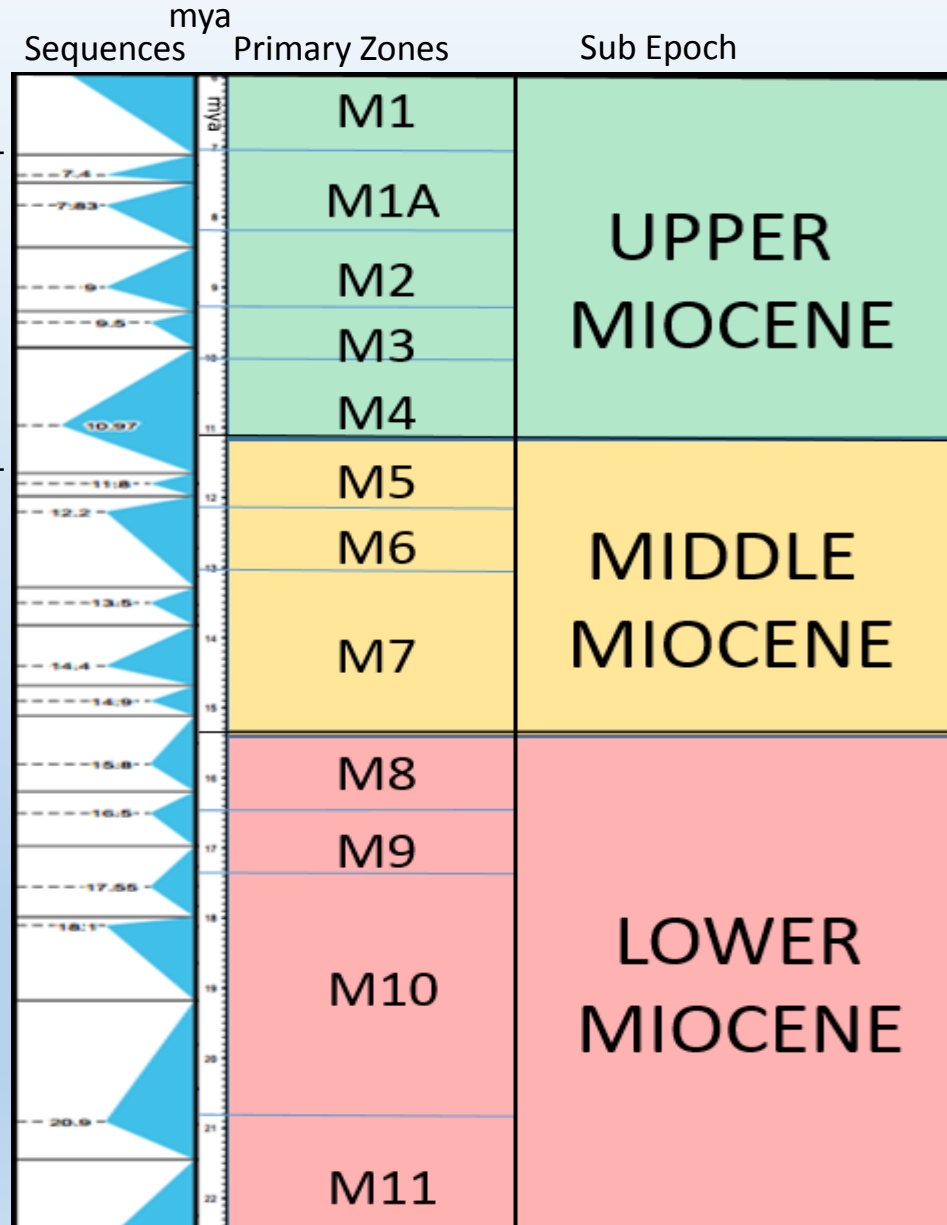


Upper Miocene “Messinian” Fairways – Mini-basin fill downslope from Shelf-edge Deltas



15+ Sequences - Lowstand Sand Potential

The 6+ LSTs of the
Tortonian Stage
7.0 – 11.6 MYA



TORTONIAN PALEOENVIRONMENTS*
Locations for Cross Sections A-A' and B-B'

OUTER SHELF
SHELF MARGIN DELTAS
SHELF EDGE

UPPER BATHYAL
MIDDLE BATHYAL
LOWER BATHYAL

TORTONIAN (SIGSBEE-STYLE) ESCARPMENT
ABYSSAL PLAIN

GARDEN BANKS AREA
GREEN CANYON AREA

LOCATIONS FOR CROSS SECTIONS A-A' AND B-B'
A, B, A', B', TANZANITE, MAHOGANY, E1385, CONGER FIELD, TIGER, CRESTED BUTTE, ASPEN, HICKORY, TARANTULA, KNOTTY HD, DBL MTN, TAHITI, TONGA

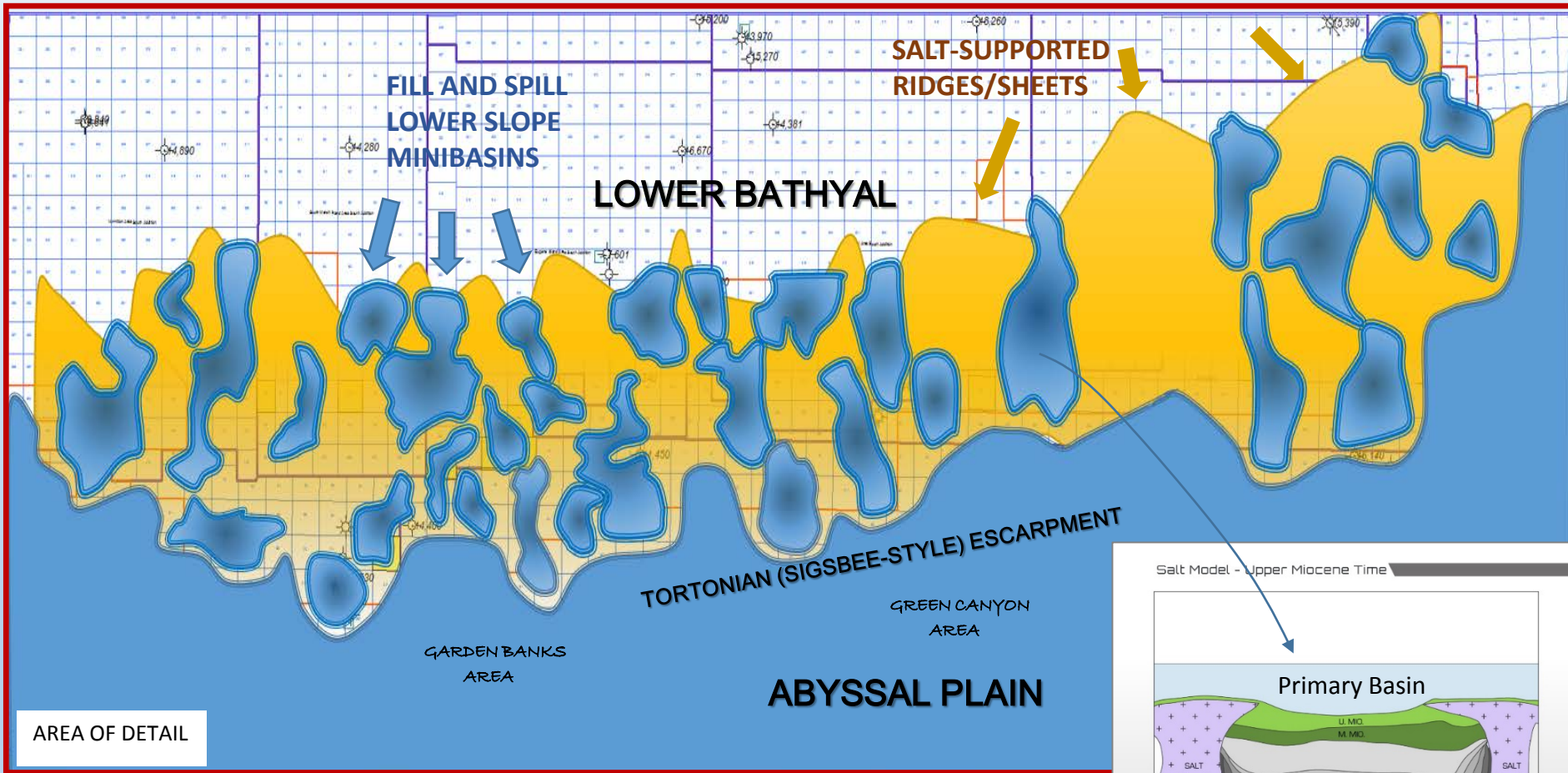
Tortonian Paleo Ecozones
0
1 Inner Neritic
2 Middle Neritic
3 Outer Neritic
4 Upper Bathyal
5 Middle Bathyal
6 Lower Bathyal
7 Abyssal
Well Location

Scale: 0 4.5 9 18 27 36 Miles

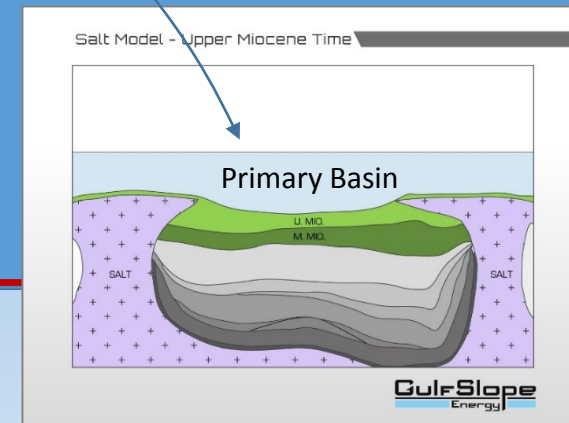
*** Interpretation based upon BOEM Public Data**

Bathymetry of Upper Miocene "Tortonian"

Showing Lower Slope Mini Basins as "Primary Basins"*



*Interpretation based upon 3D Seismic Isopach mapping



NORTH-SOUTH STRUCTURAL SECTION

A

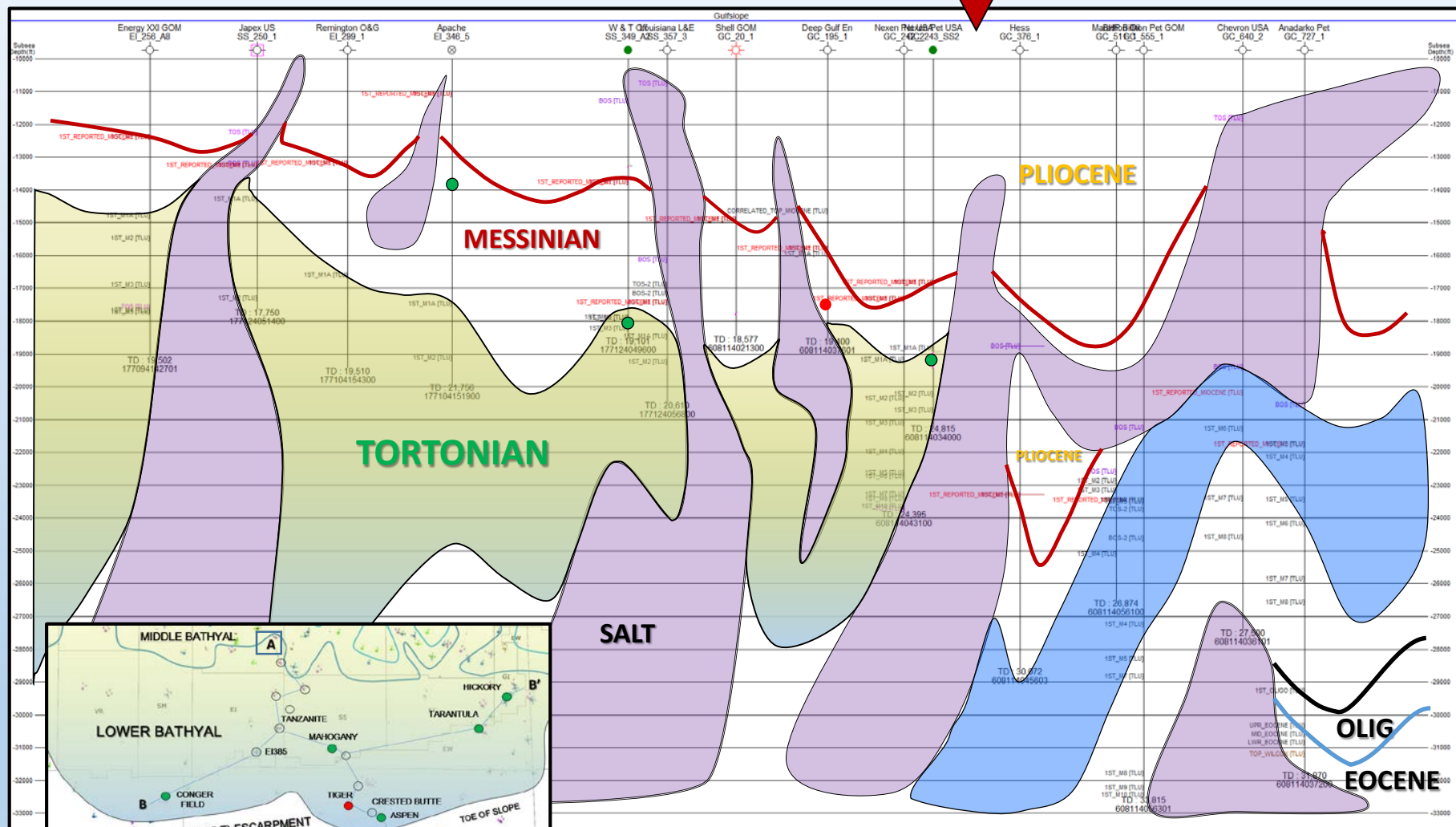
A'

MIDDLE BATHYAL

LOWER BATHYAL

TOE
OF SLOPE

ABYSSAL PLAIN

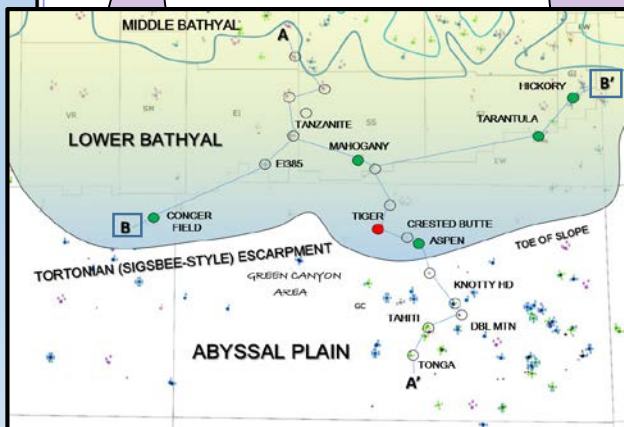
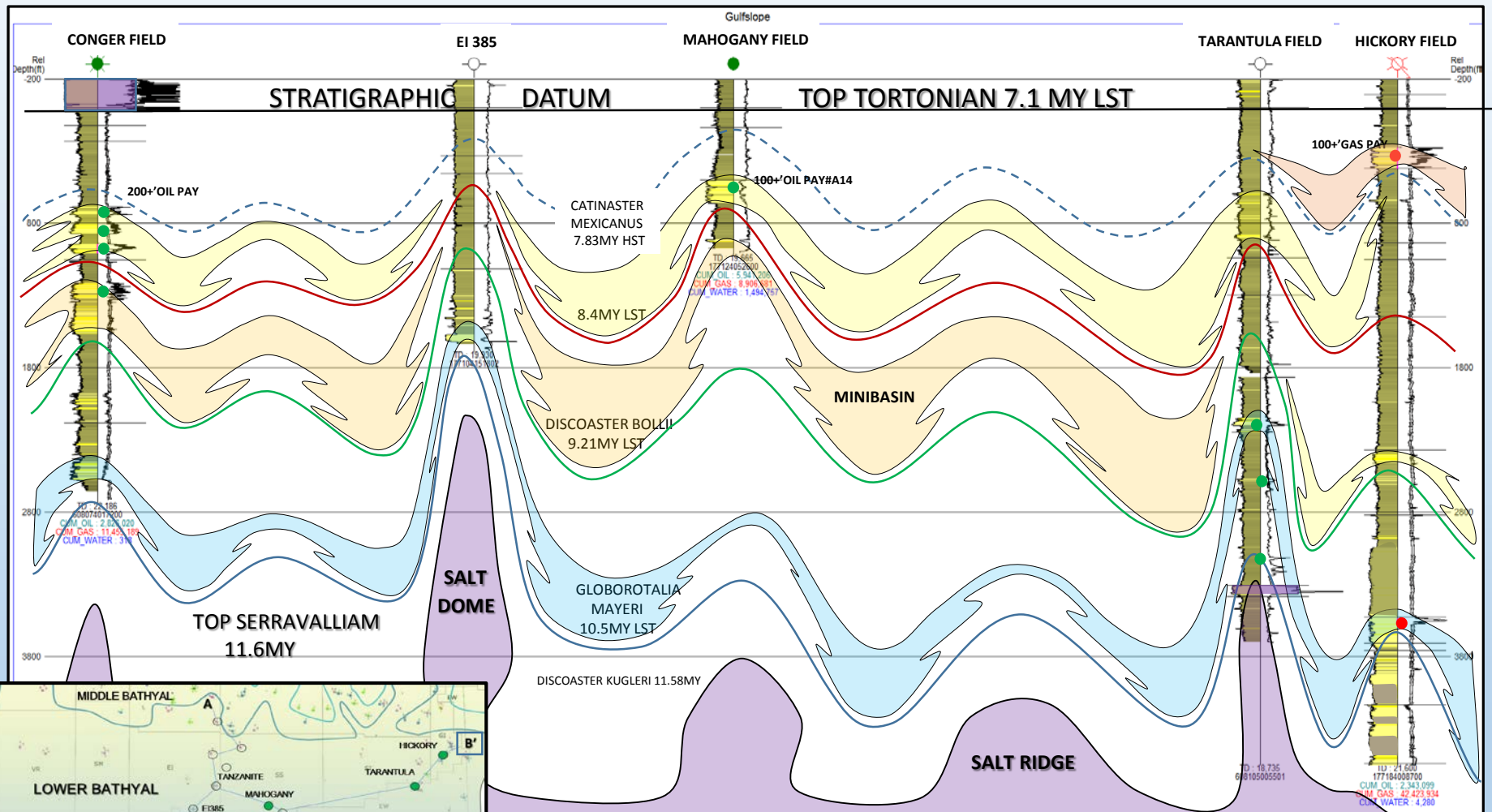


WEST-EAST STRATIGRAPHIC SECTION

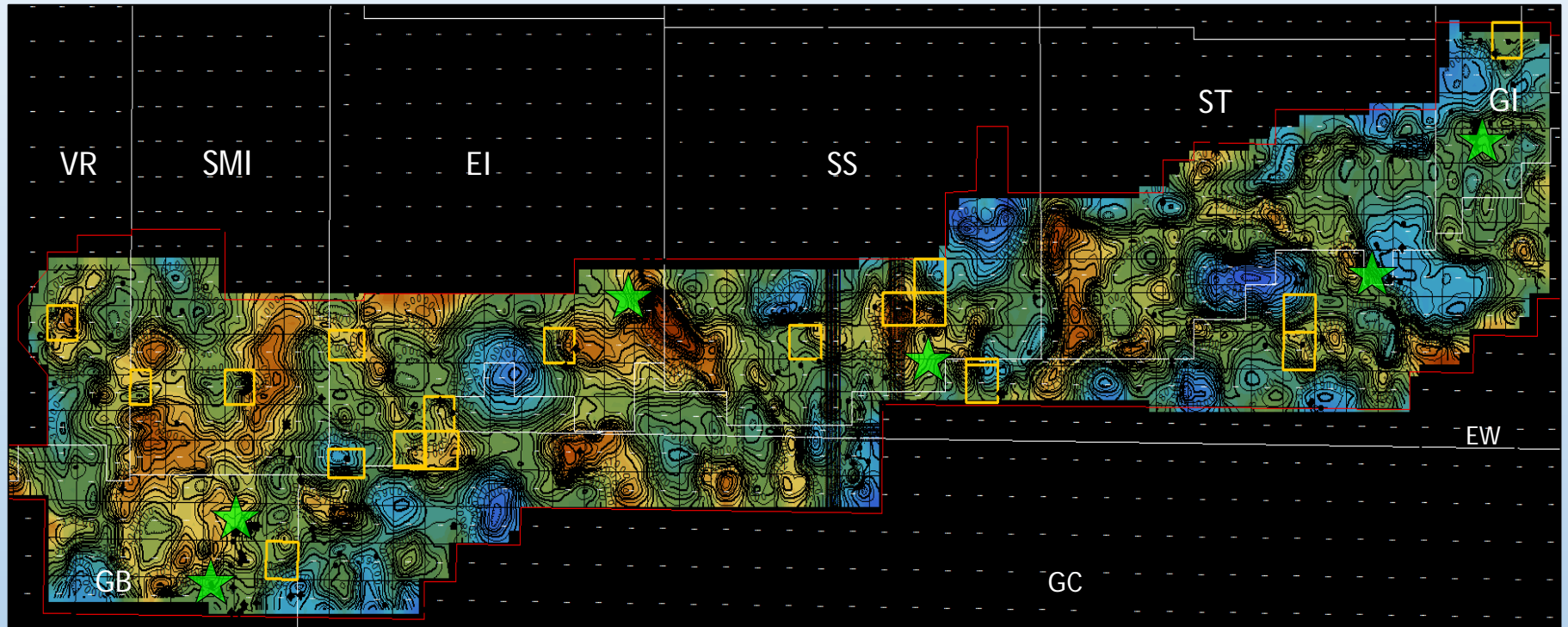
Showing 3 Major Tortonian Lowstand Episodes

B

B'

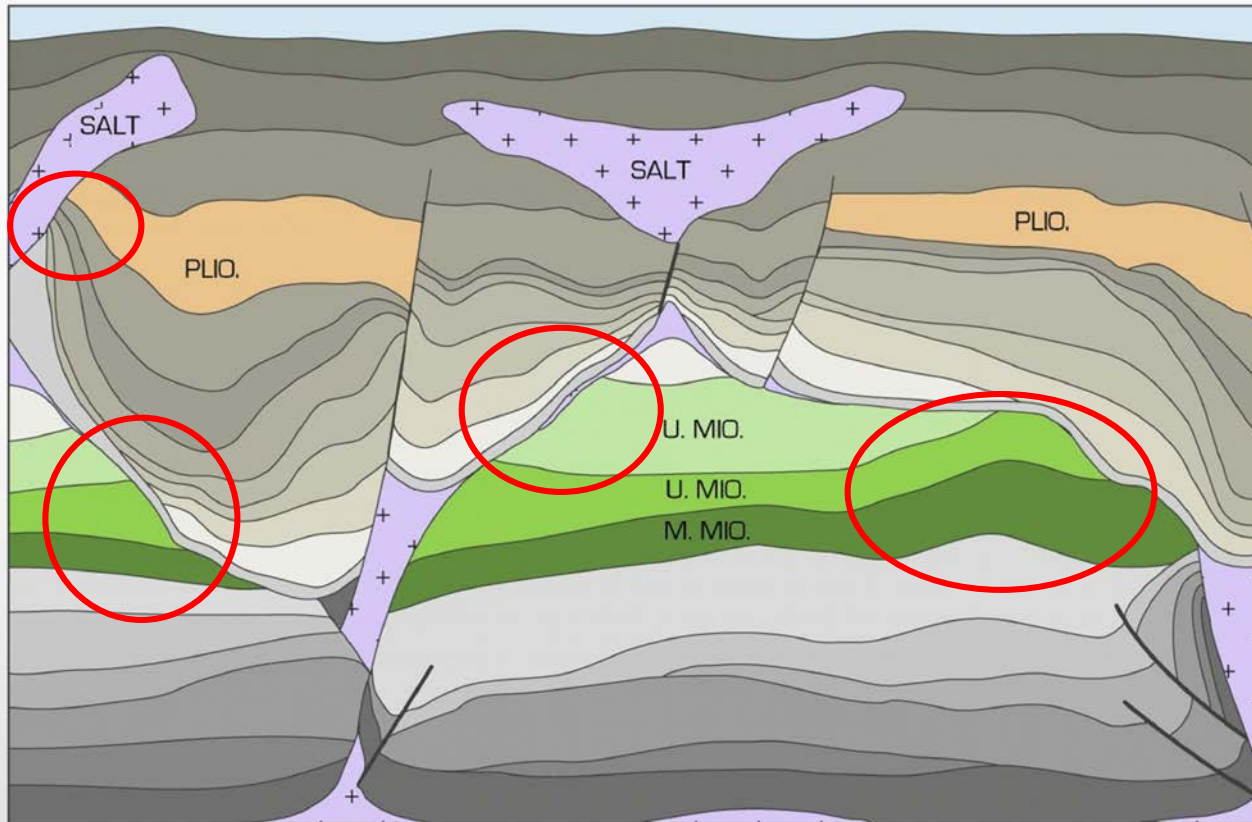


Base of Miocene Structure



Trap Styles result from Salt & Sand Dynamics

Salt Model - Recent Time



GulfSlope
Energy

Geological & Geophysical Advantages

- Confined Mini-basin Fan Sands - Continuous Reservoirs
- Excellent Porosities (25-30+%) & Permeabilities (800-1200+ md)
- Key Fields - Conger, Mahogany, Hickory, Tarantula, Enchilada
- Proven Petroleum System - Excellent Reservoirs, Traps, Seals, Source
- Advanced Seismic Processing (RTM+) Clarifies Sub-Salt Images

Economic Advantages

- Water Depths: 300-450' - Super Gorilla Jackups for 365/24/7
- Modern Drilling Technology below Salt - Synthetic Mud & MPD
- Mostly Jack-up Rig Access - \$70-95K/day - \$20-45MM per wildcat
- Mostly Conventional Platforms - \$40-50 MM per platform
- Extensive Existing Platform-Pipeline Infrastructure across area

Conclusions

- Lower Slope sands are extensively deposited across the Miocene ancestral slope, and are most commonly found as amalgamated and channelized fans in intraslope confined mini-basins
- Miocene-age Lower Slope sands have produced well in Conger-Mahogany-Tanzanite-Hickory reservoirs to date (350+ MMBOE produced – 400+ MMBOE EUR)
- The GOM Miocene-age Lower Slope is NOT a “bypass” zone, but consists of widespread sand-filled confined mini-basins with sizeable untested field potential across a 400+ block – 2+ million acre area of the present day Louisiana outer shelf

Acknowledgements

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