Southeast Offshore Storage Resource Assessment (SOSRA)
Project Number: DE-FE0026086

Offshore CO_2 Storage

Jack C. Pashin, Oklahoma State University

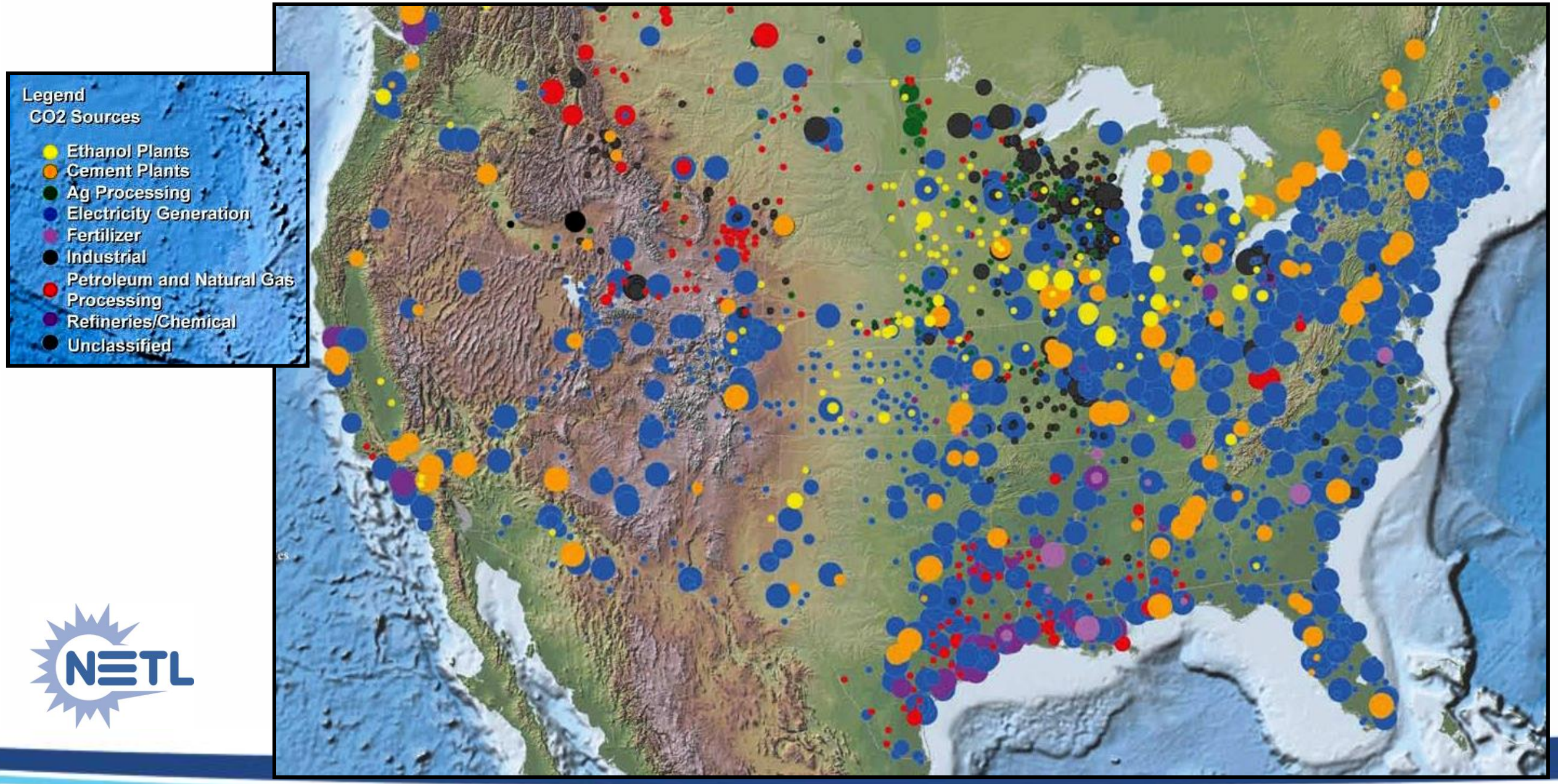
US-Taiwan International CCS Conference
NTUH International Convention Center, Taipei
April 17-21, 2017

Why Offshore Reservoirs?

- ✓ Potentially giant CO_2 capacity.
- ✓ Abundant stacked saline formations and depleted oil and gas reservoirs.
- ✓ Significant infrastructure in place.
- ✓ Proven offshore storage technology.
- ✓ Favorable ownership and access.

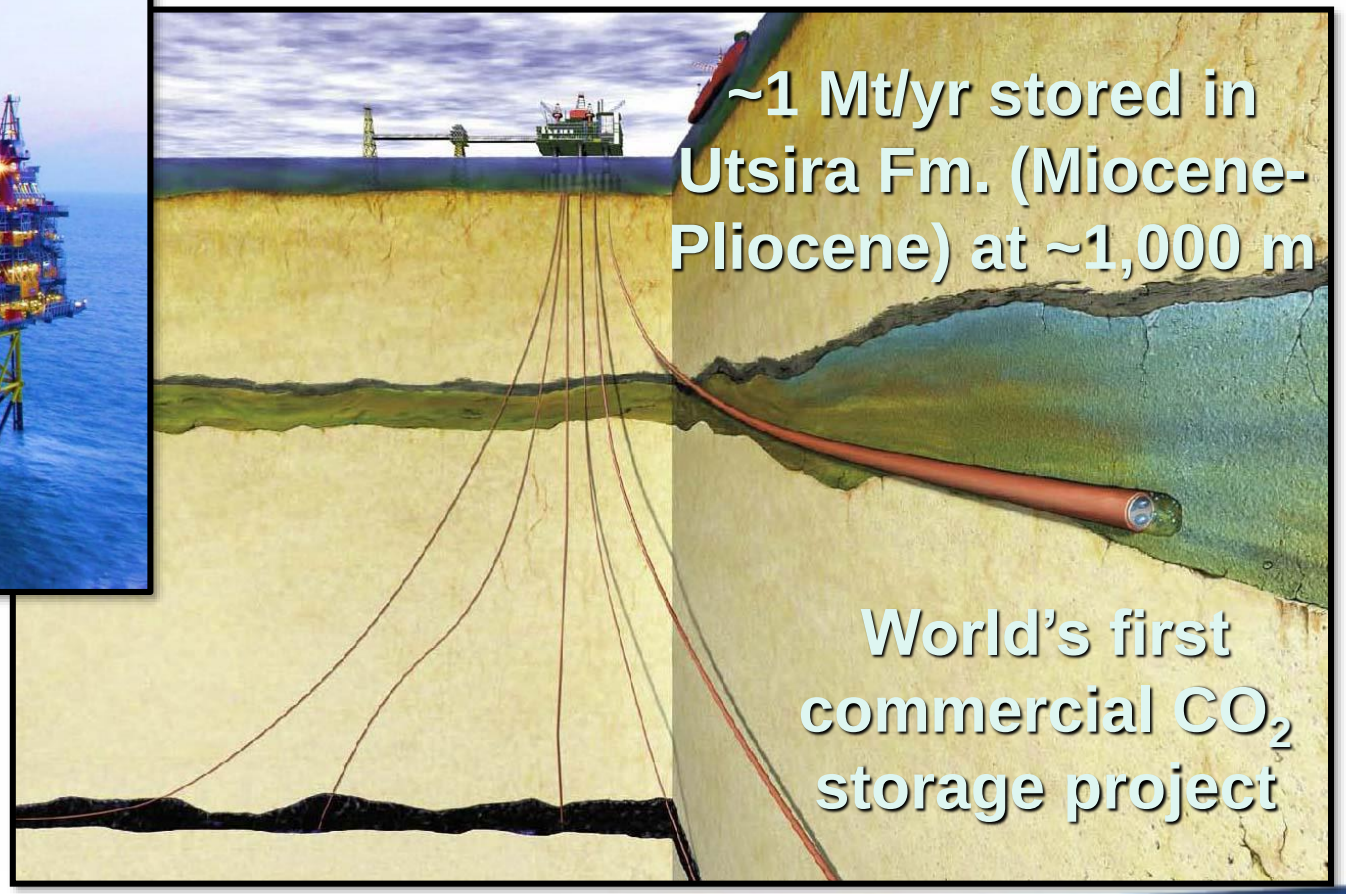
This material is based upon work supported by the U.S. Department of Energy National Energy Technology Laboratory. Cost share and research support are provided by the Project Partners and an Advisory Committee

US Stationary CO_2 Emissions



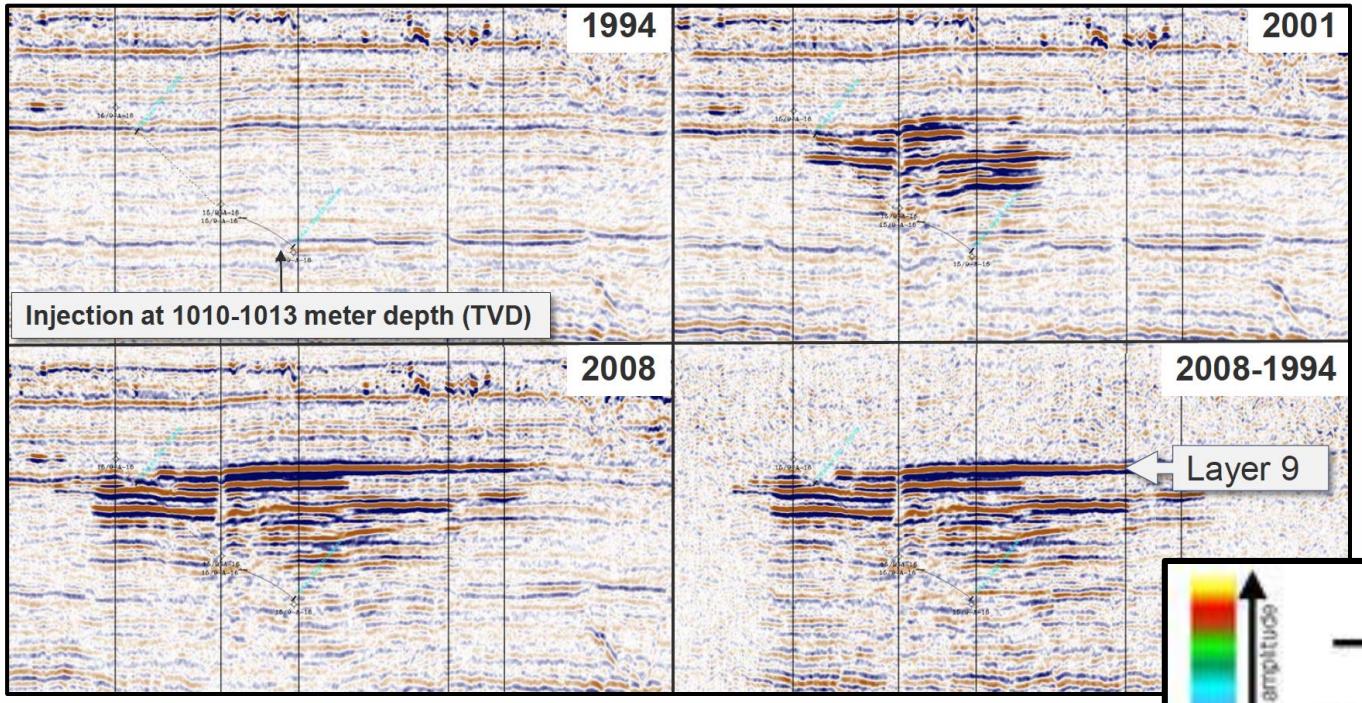
Offshore CO_2 Storage: Sleipner, North Sea

STATOIL

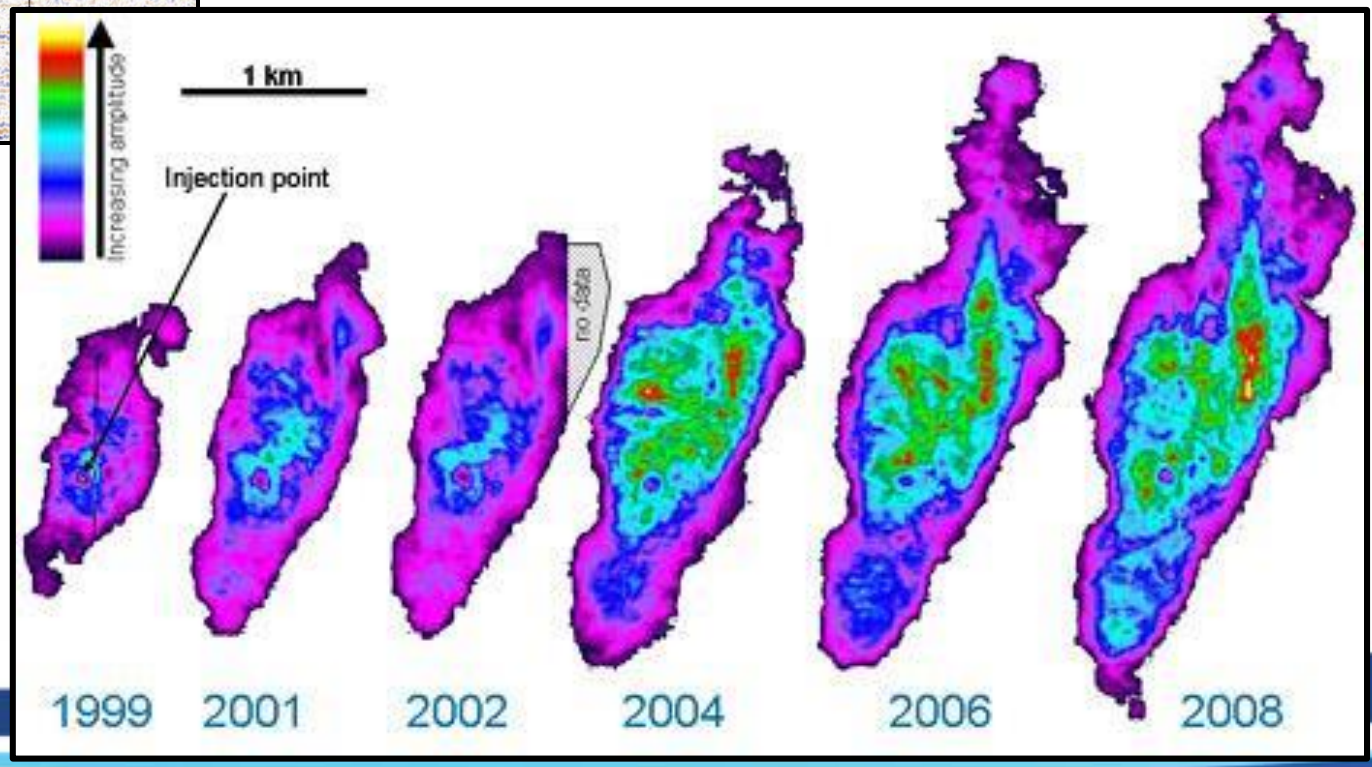


Kaarstad (2004)

Sleipner Time-lapse Seismic Images



Arts et al., (2009)

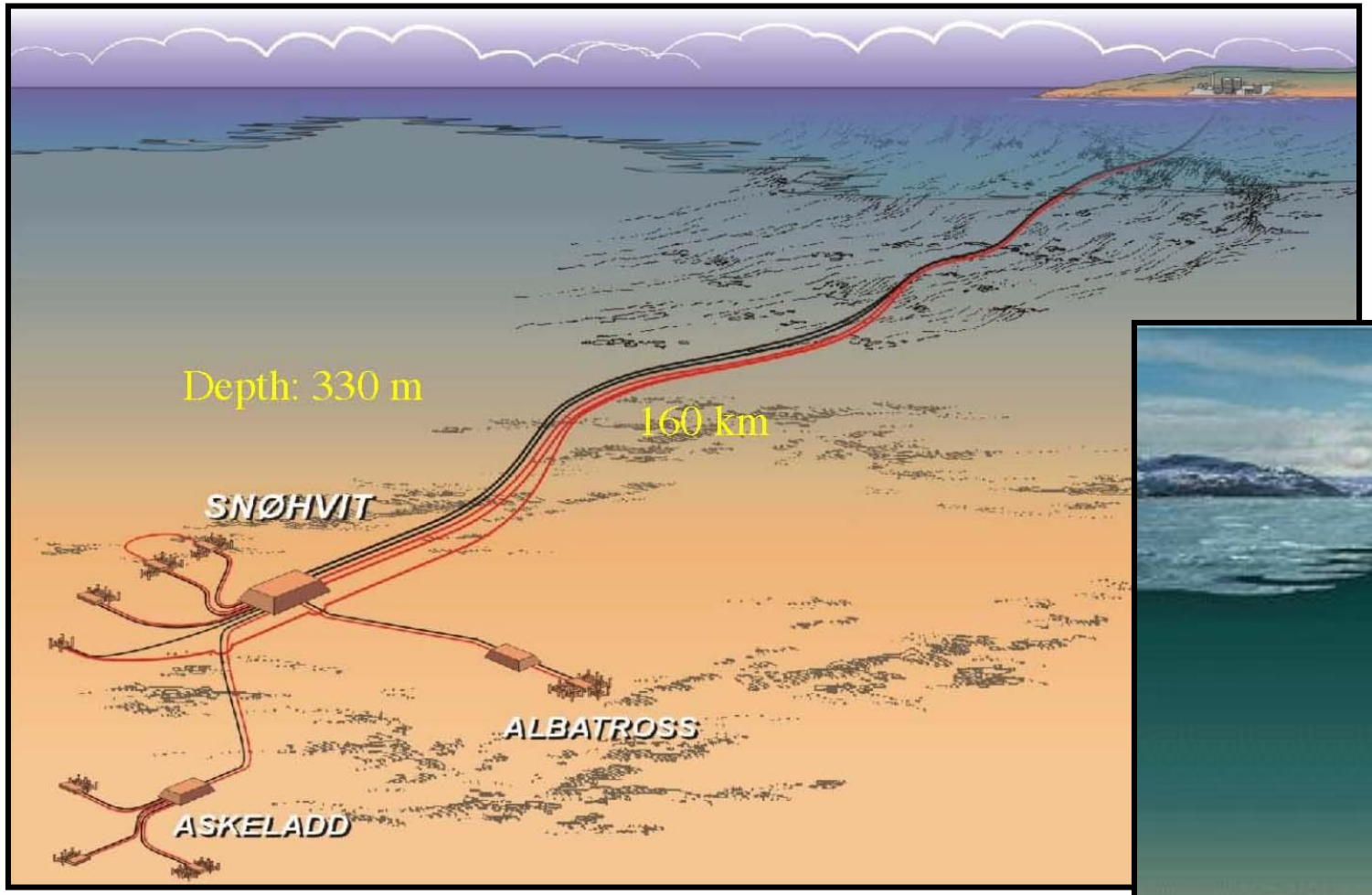


Offshore Infrastructure

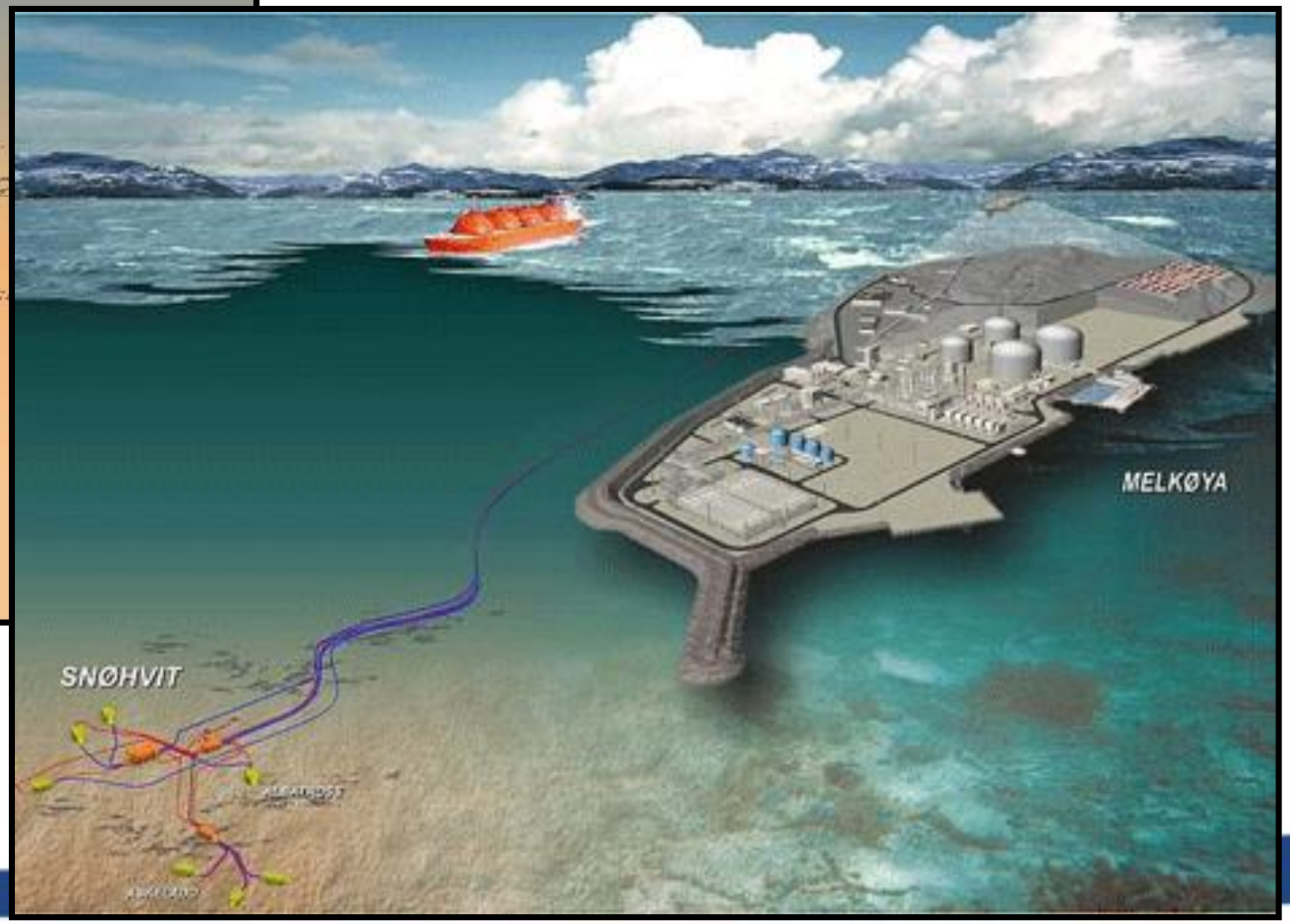
Ultradeep gas platform

Shallow gas well

Snøhvit LNG Infrastructure



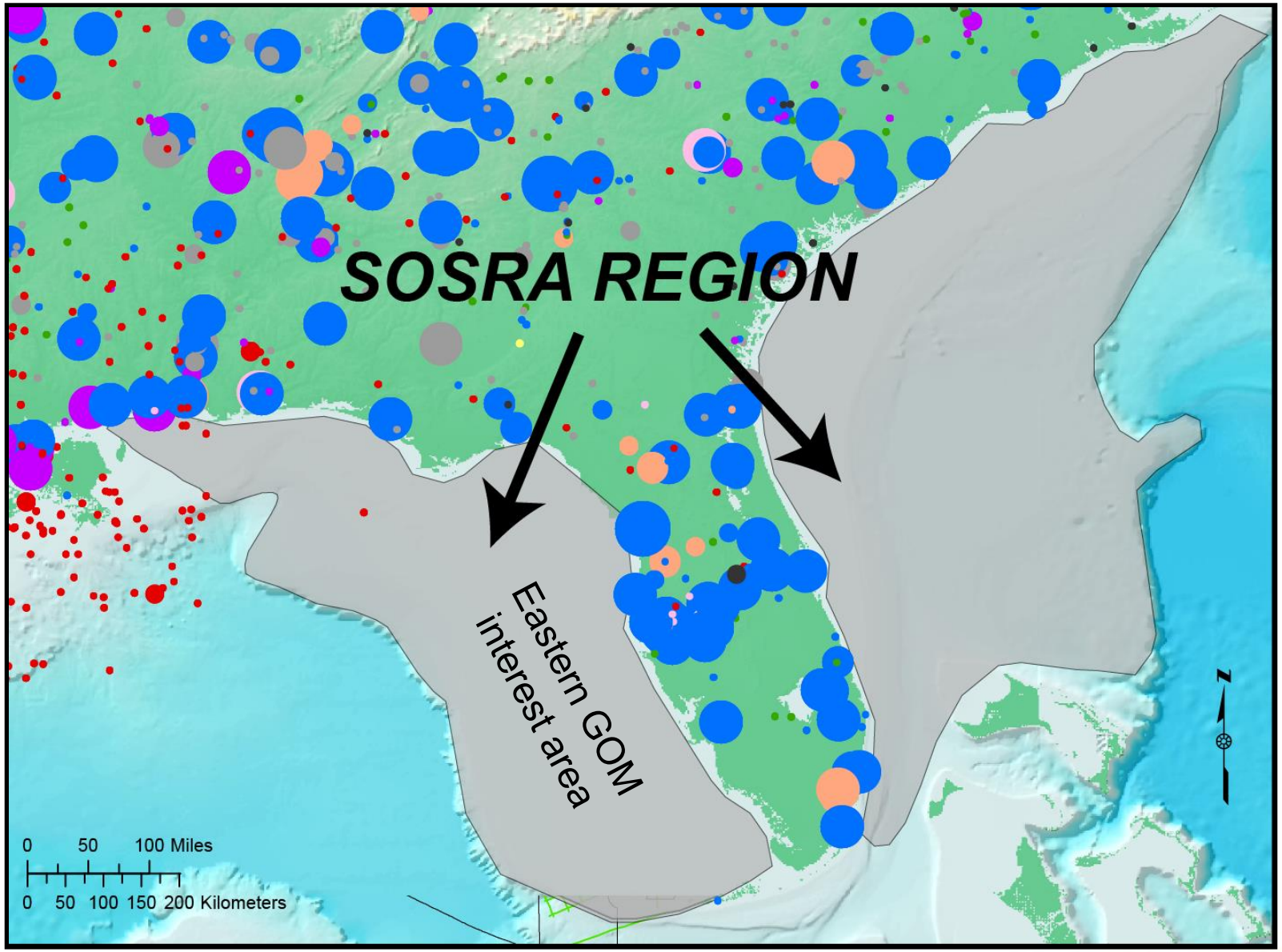
STATOIL



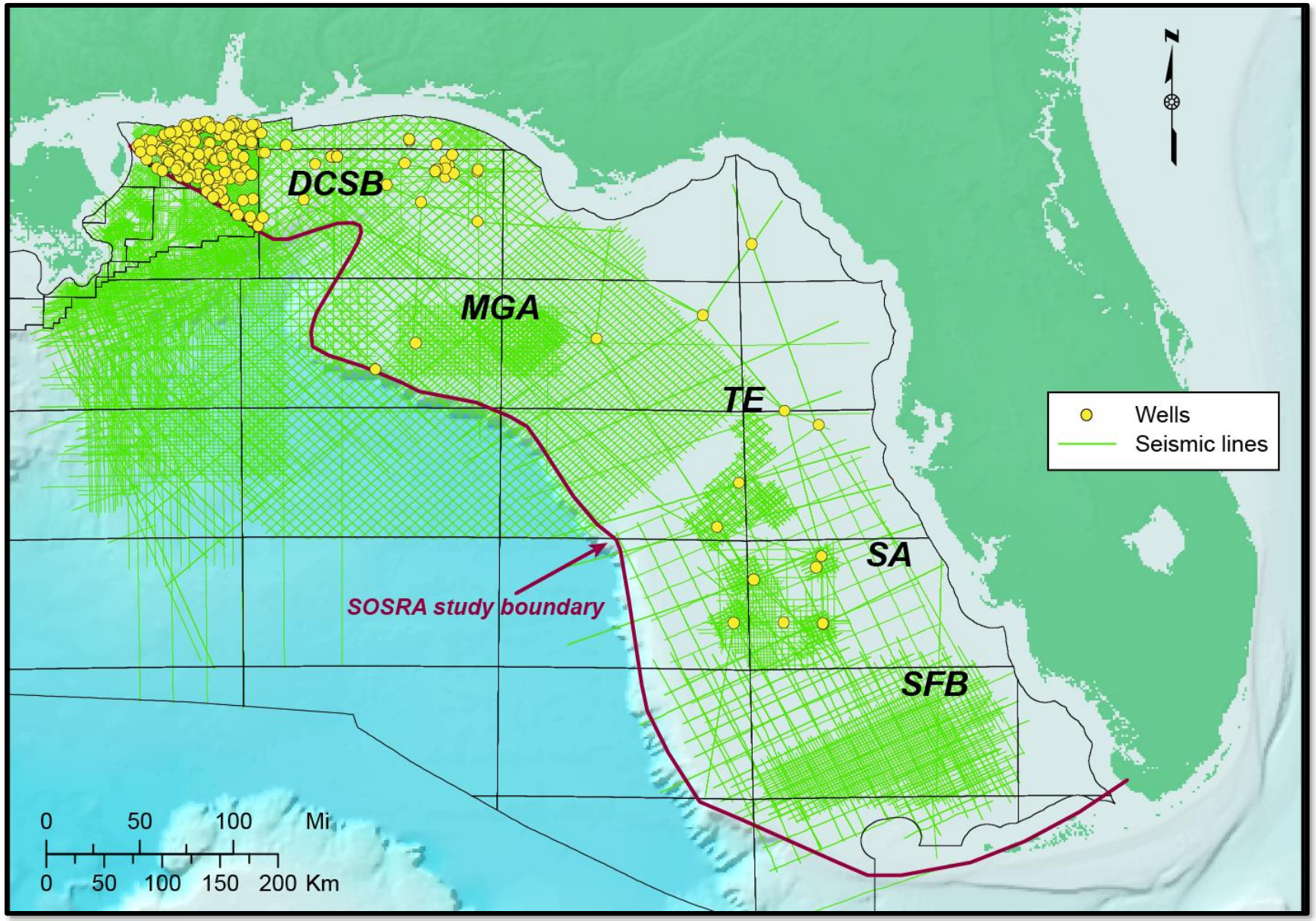
NETL

OKLAHOMA STATE UNIVERSITY

SOSRA Region



Eastern Gulf of Mexico Interest Area



DCSB DeSoto Canyon Salt Basin

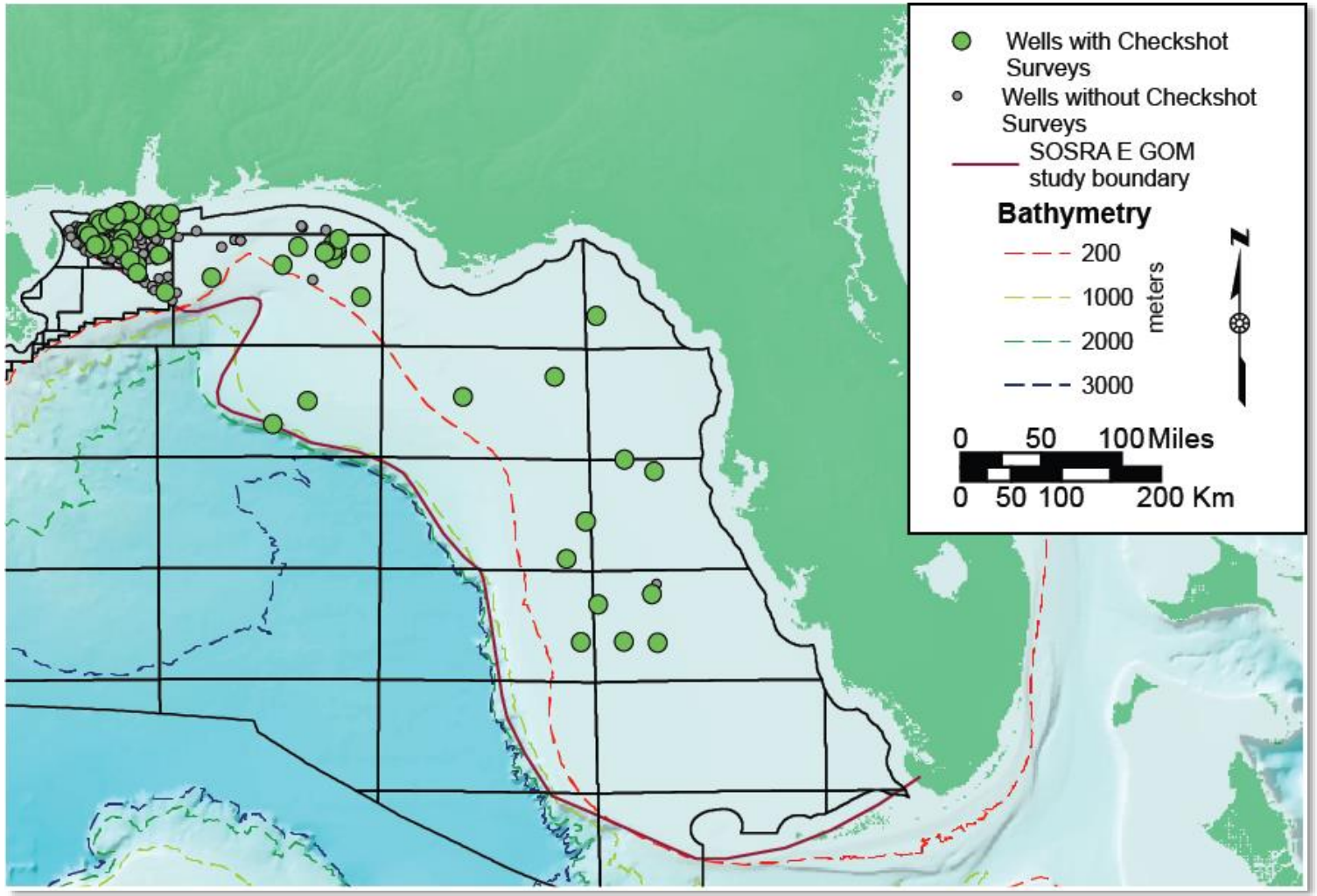
MGA Middle Ground Arch

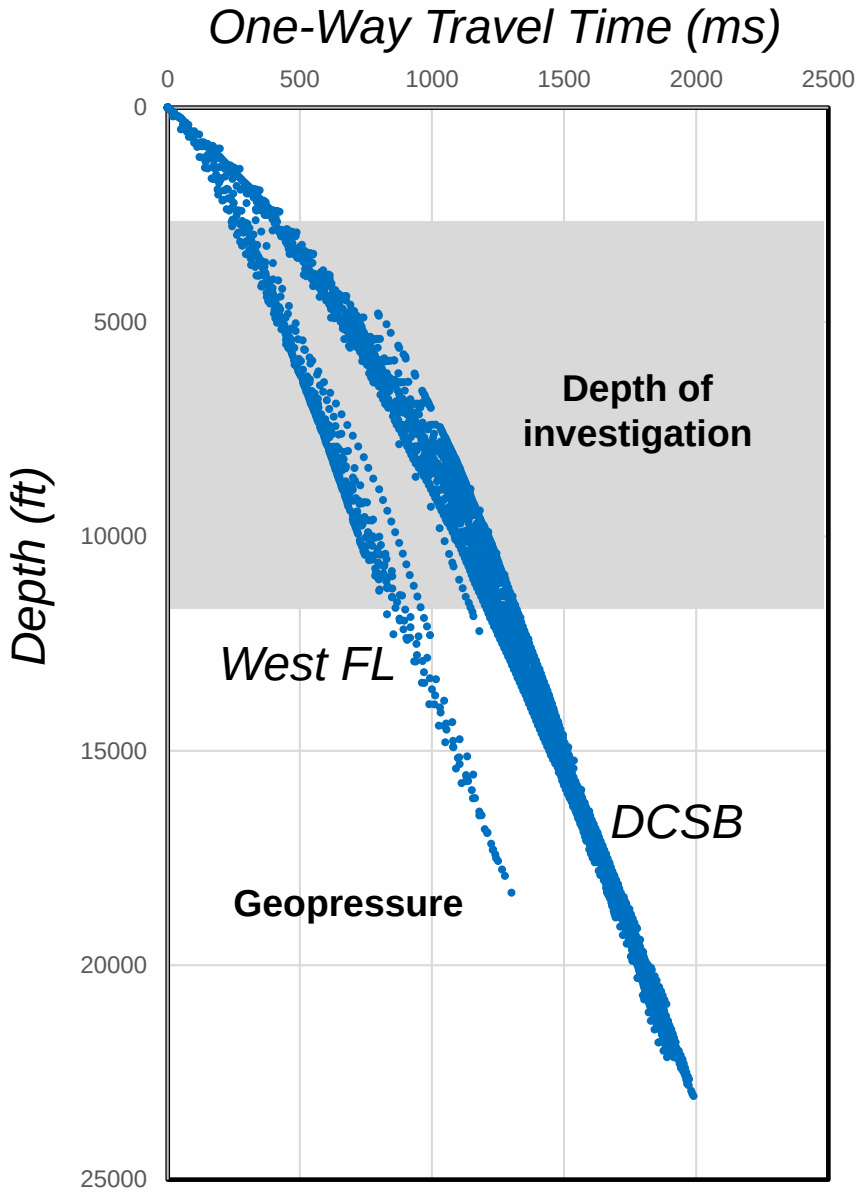
TE Tampa Embayment

SA Sarasota Arch

SFB South Florida Basin

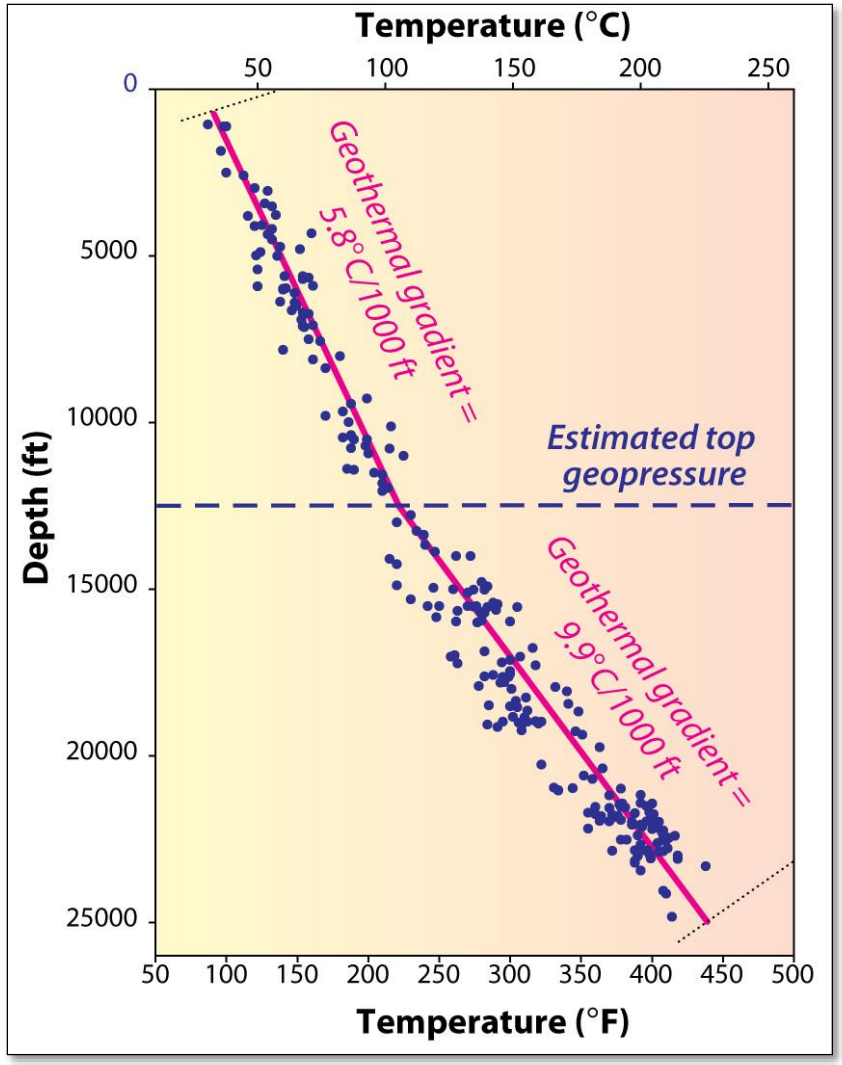
Seismic Velocity Surveys



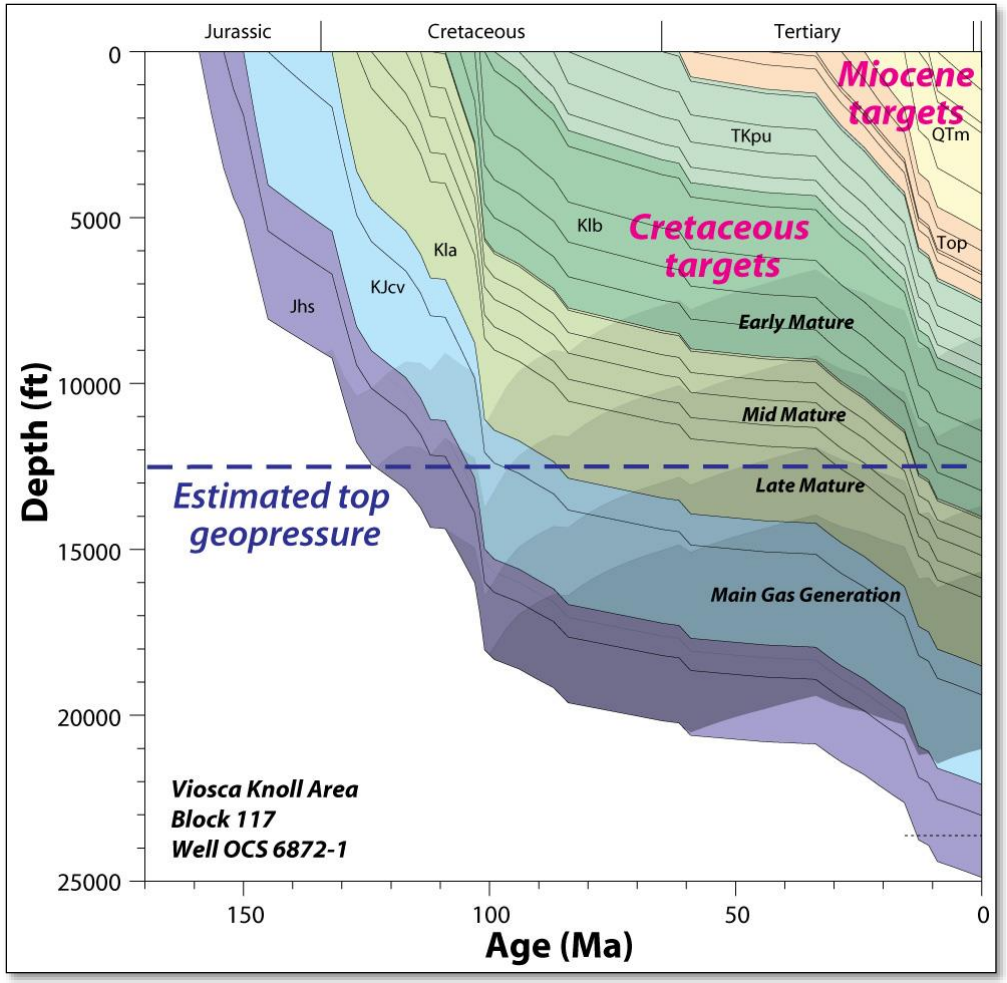


Geothermal and Burial Data

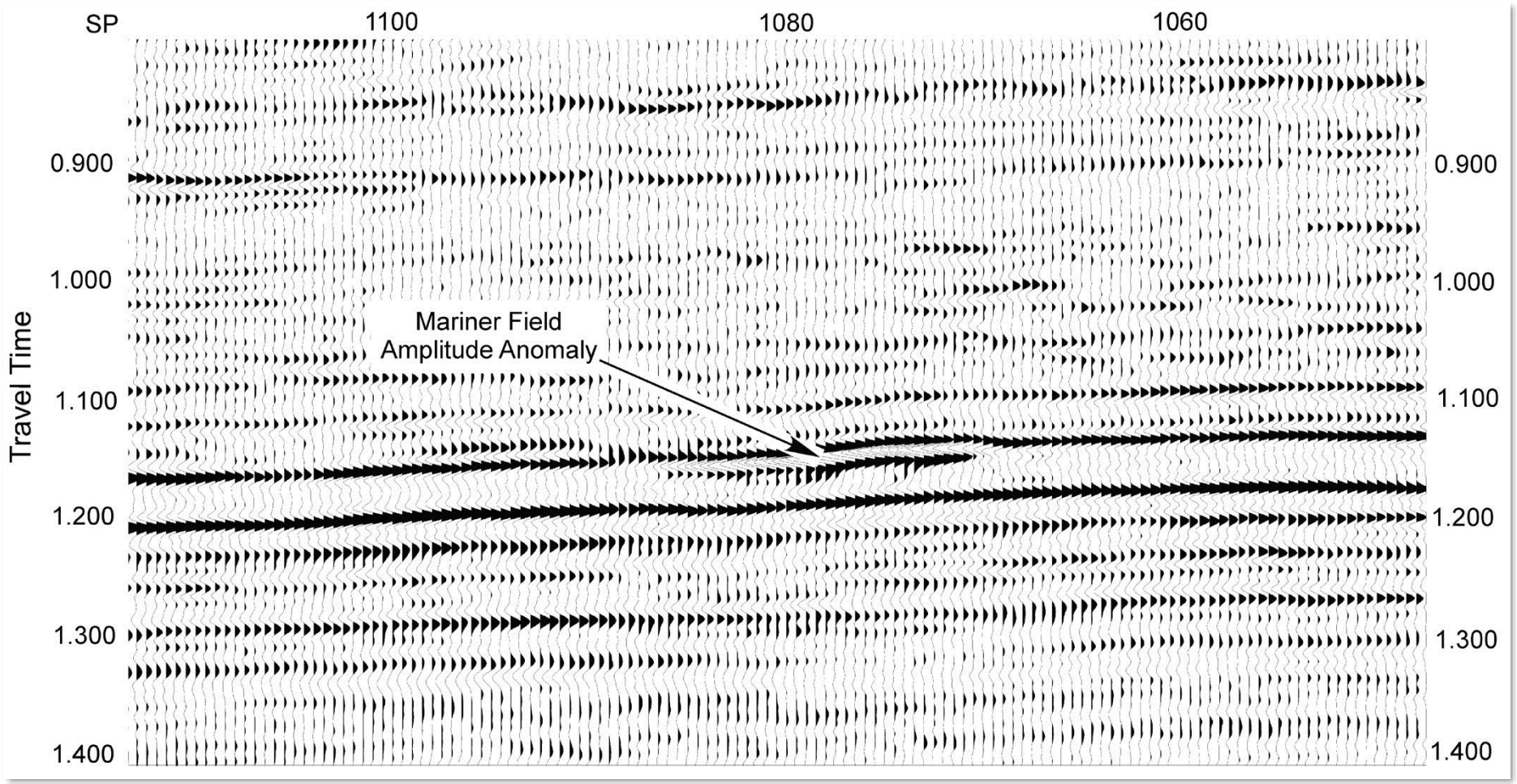
Temperature-depth profile



Burial history curve

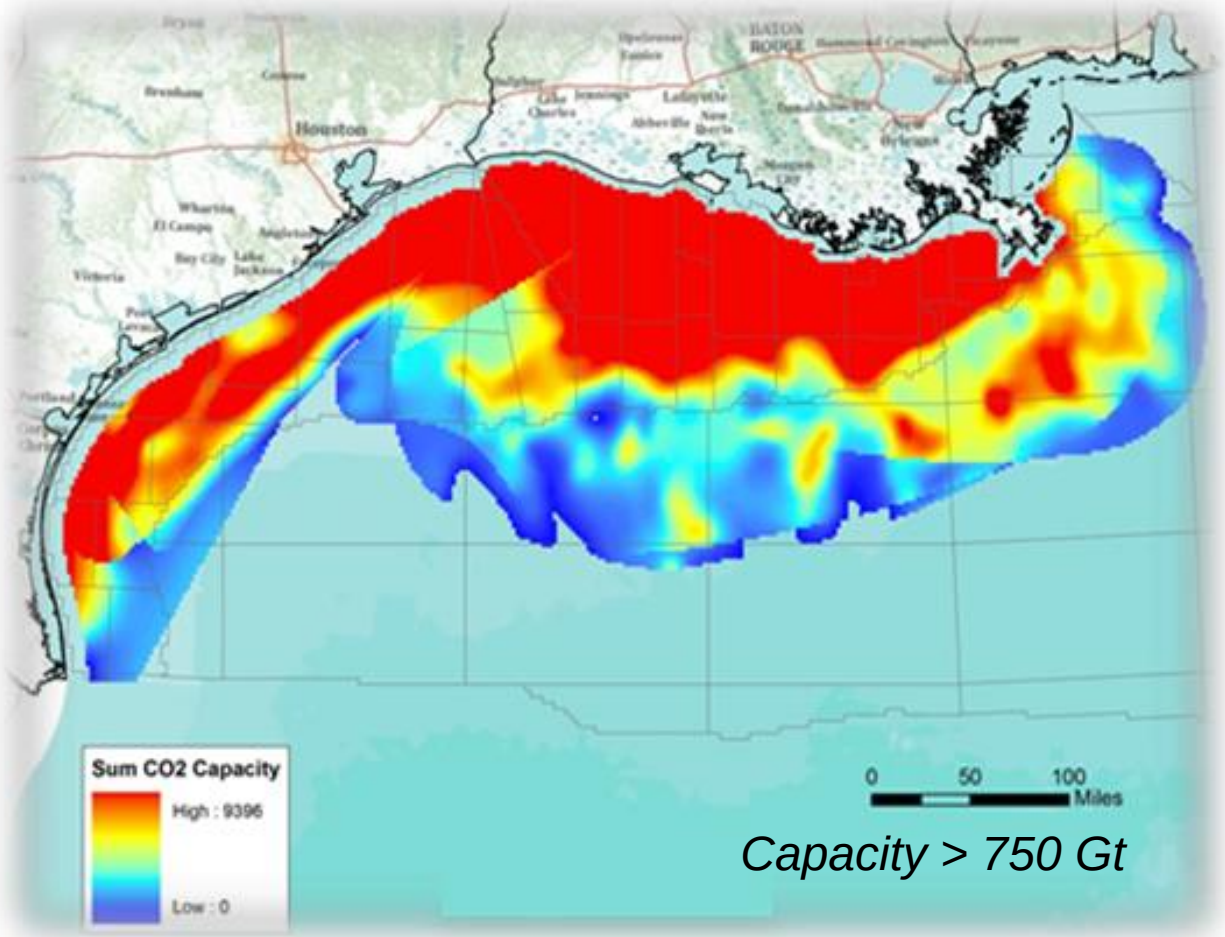


Miocene Gas Sands

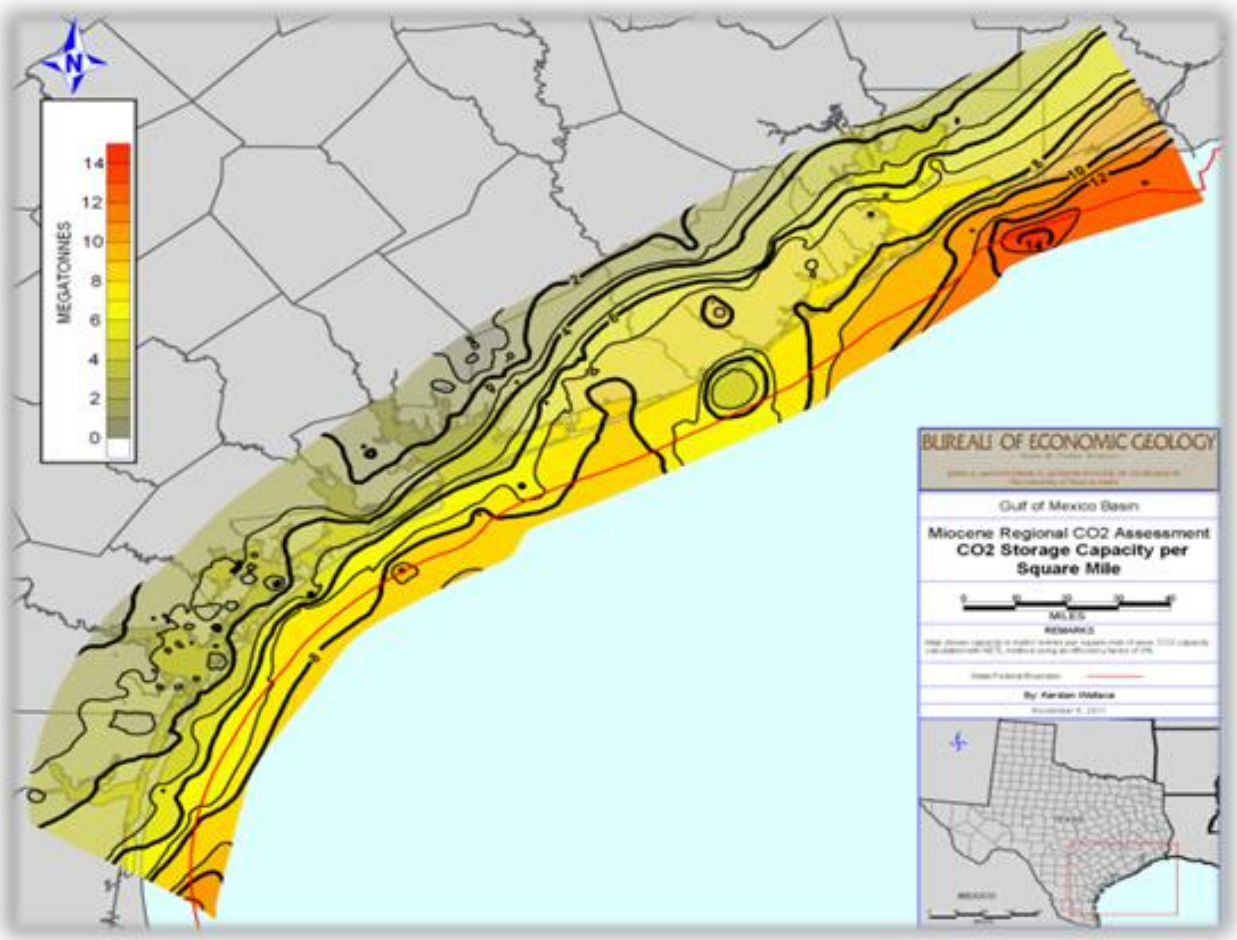


Handford and Baria (2003)

Miocene Capacity, Gulf of Mexico

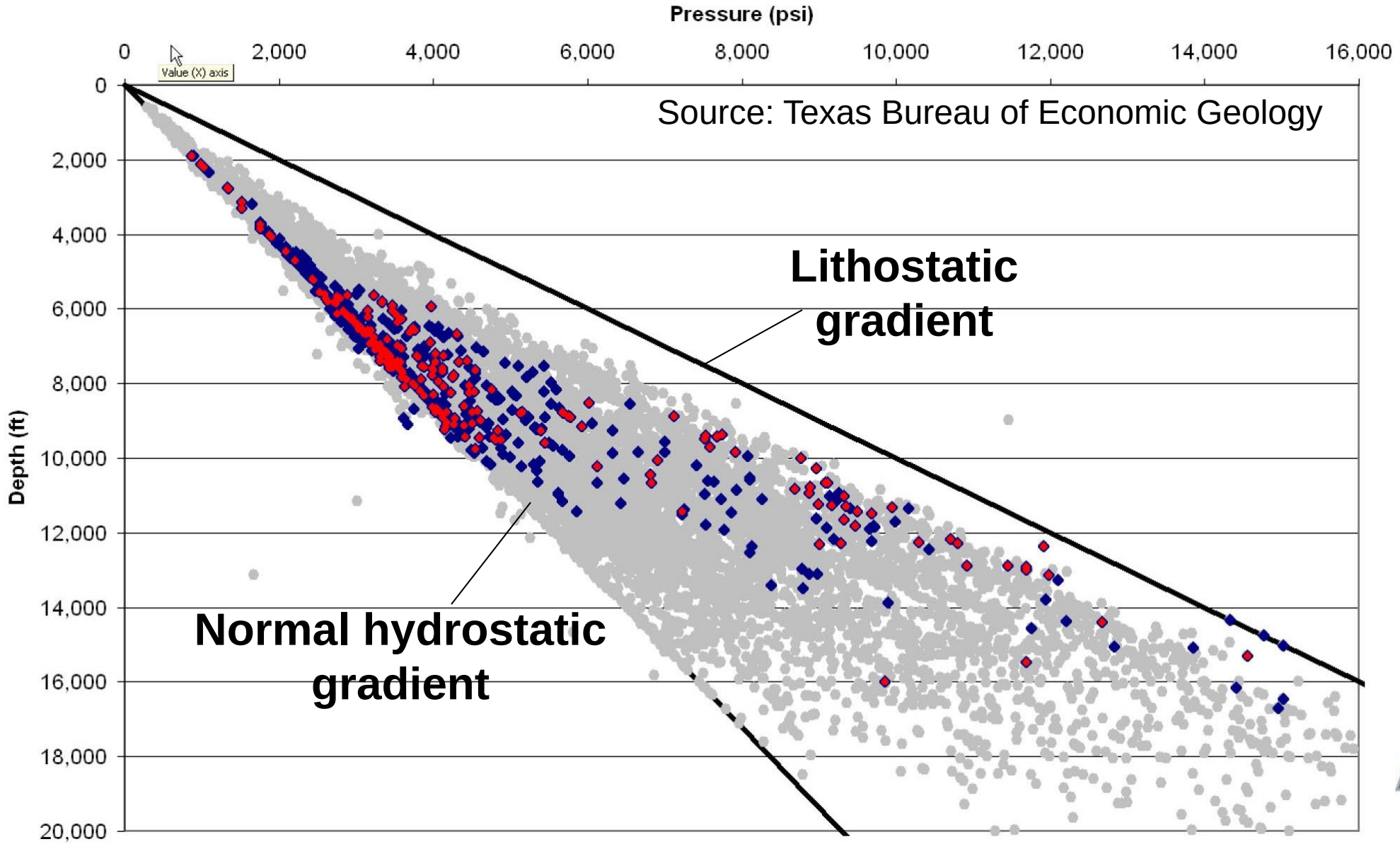


Capacity > 750 Gt



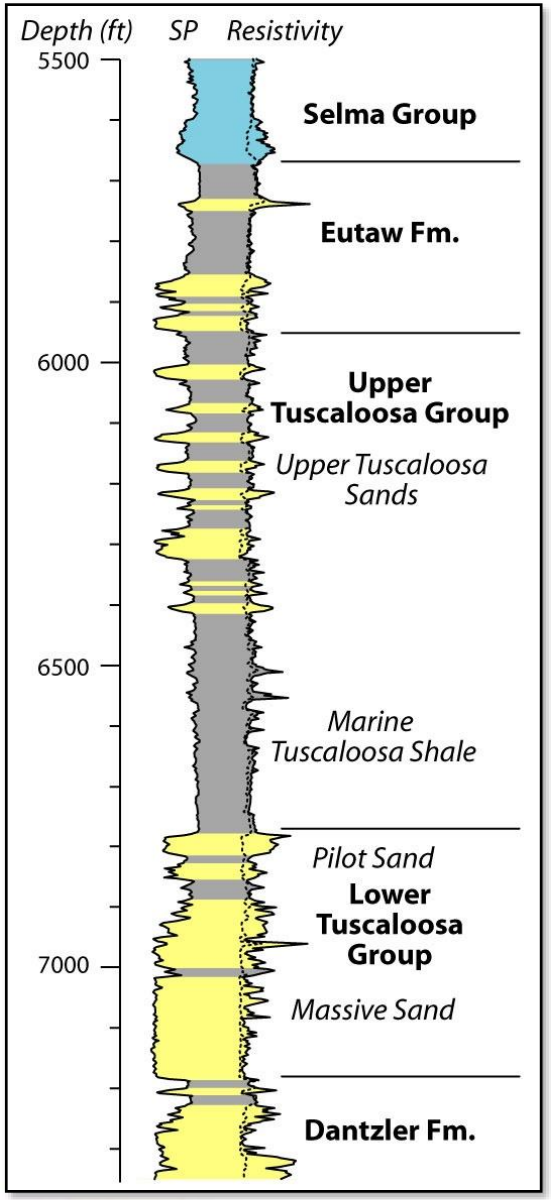
Source: Texas Bureau of Economic Geology

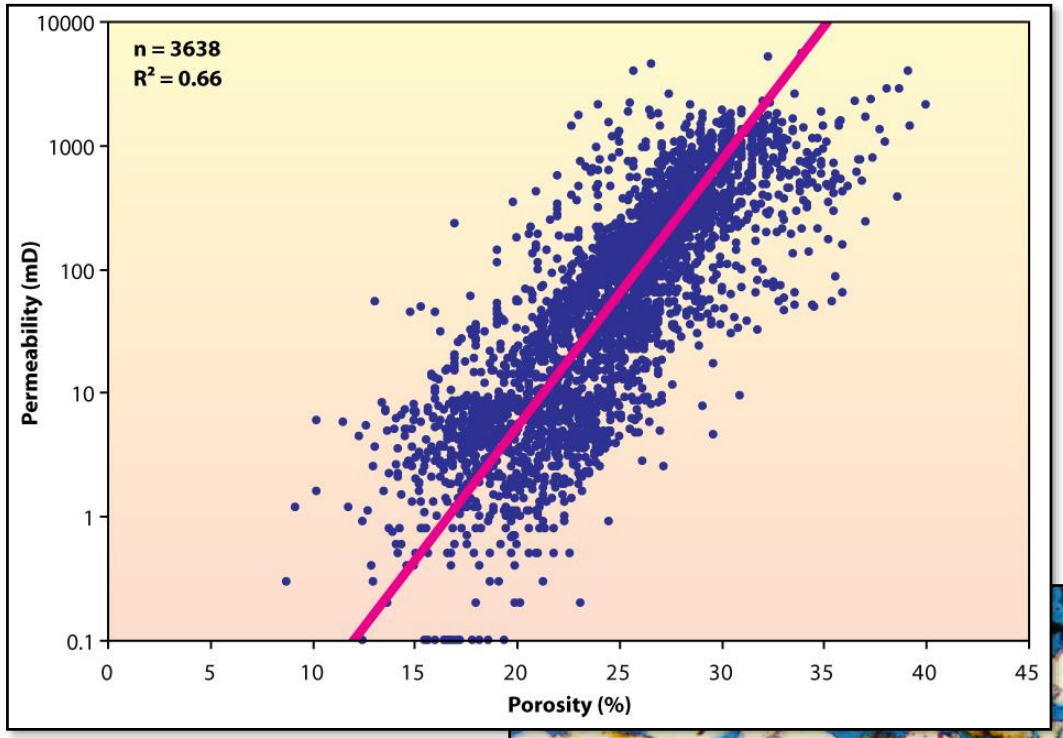
Miocene Pressure-Depth Profile

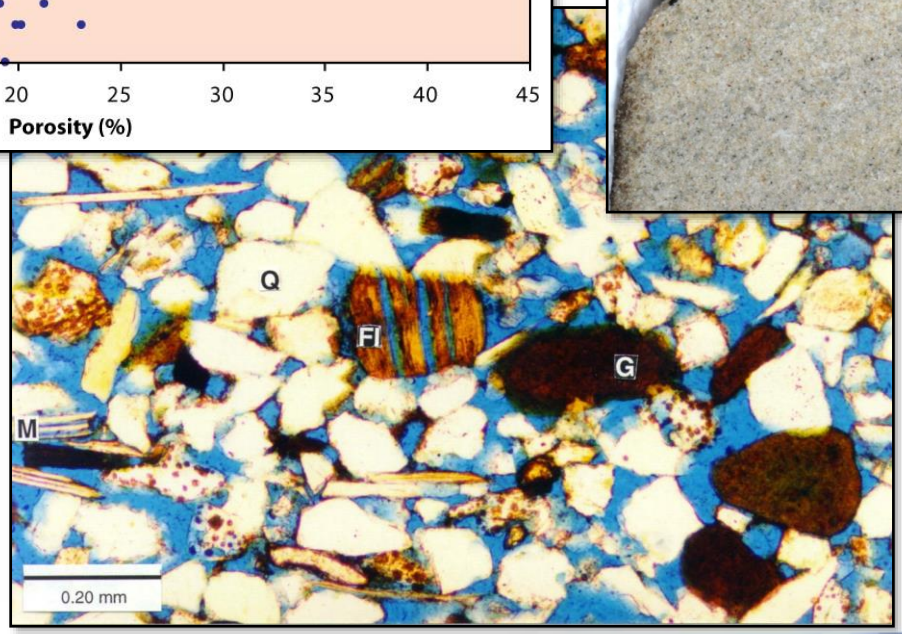


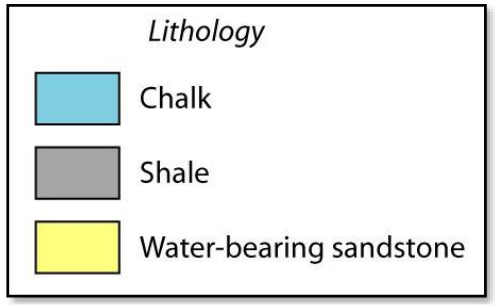
Meckel (2010), Offshore Texas Miocene

Cretaceous Sandstone





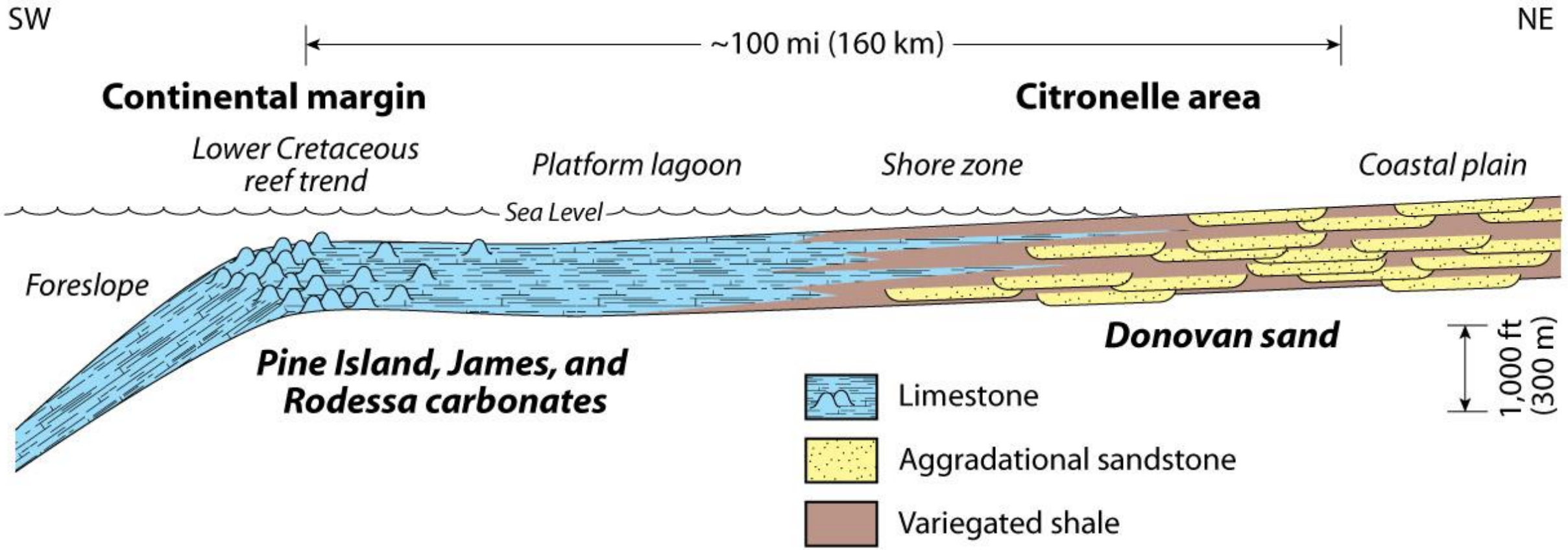




Cretaceous Facies

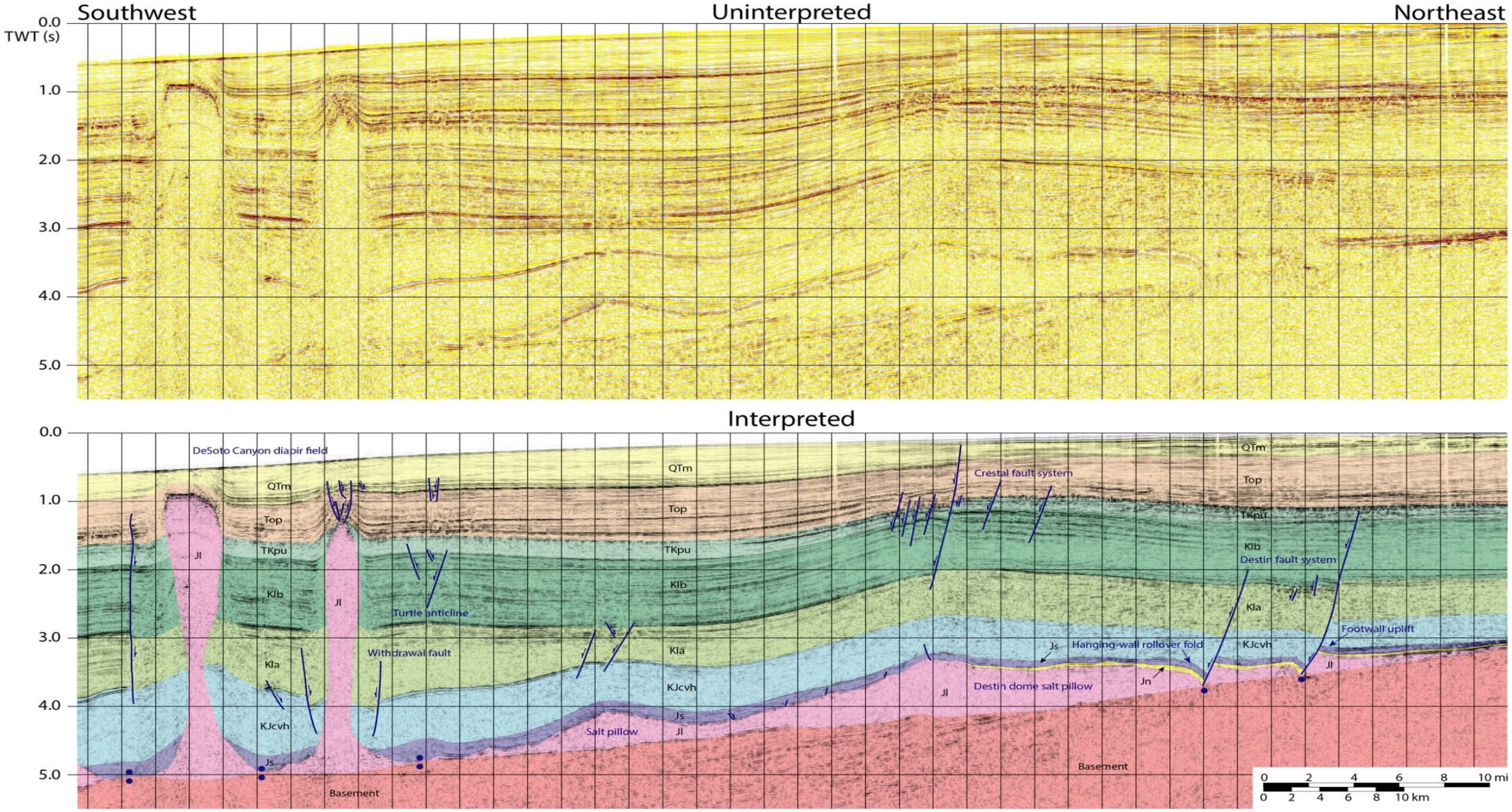
SOSRA REGION

NETL EOR TEST
SECARB ANTHROPOGENIC TEST

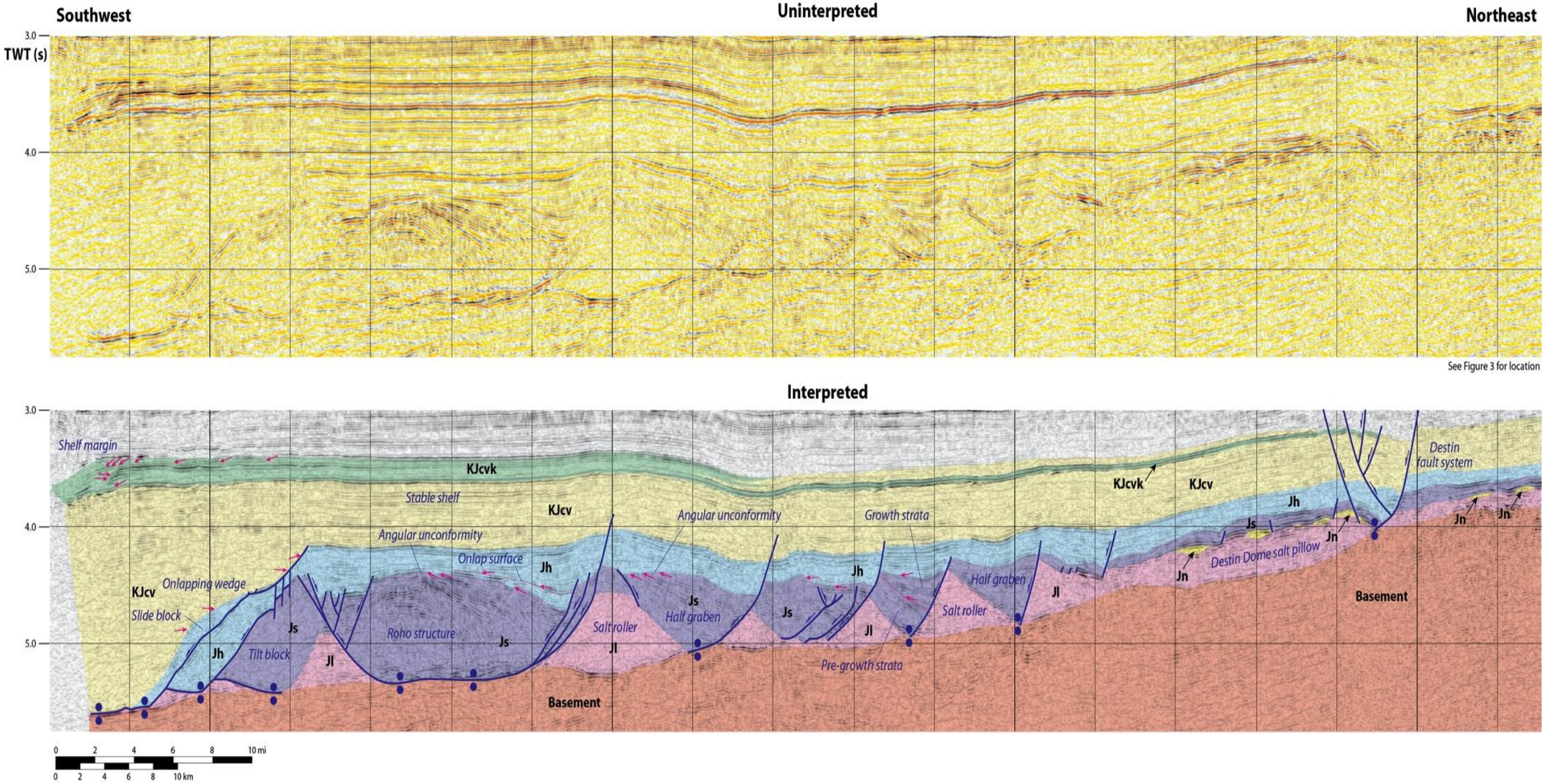


Pashin et al. (2014)

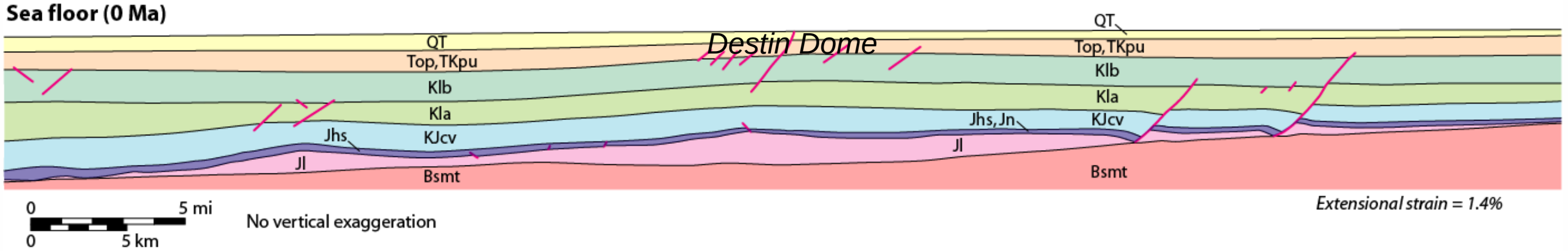
DCSB Destin Dome

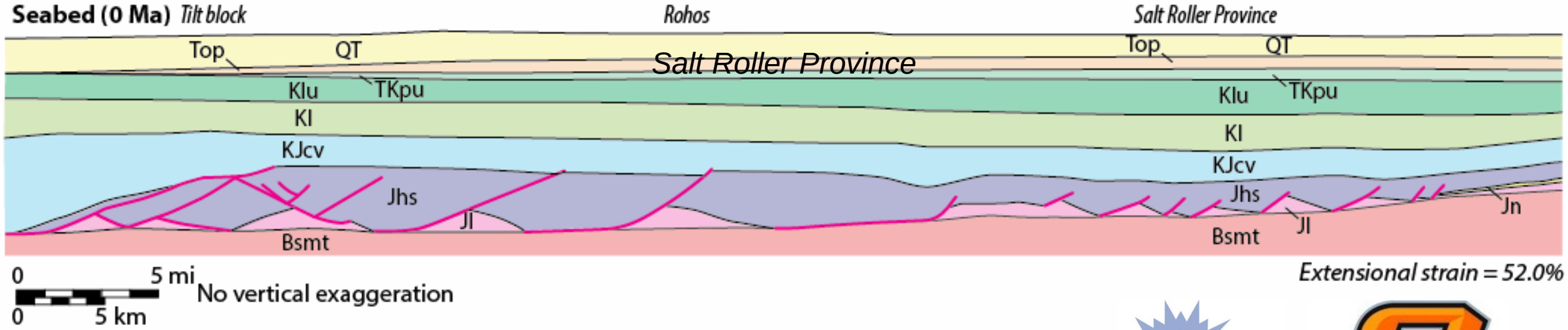


DCSB Salt Roller Belt

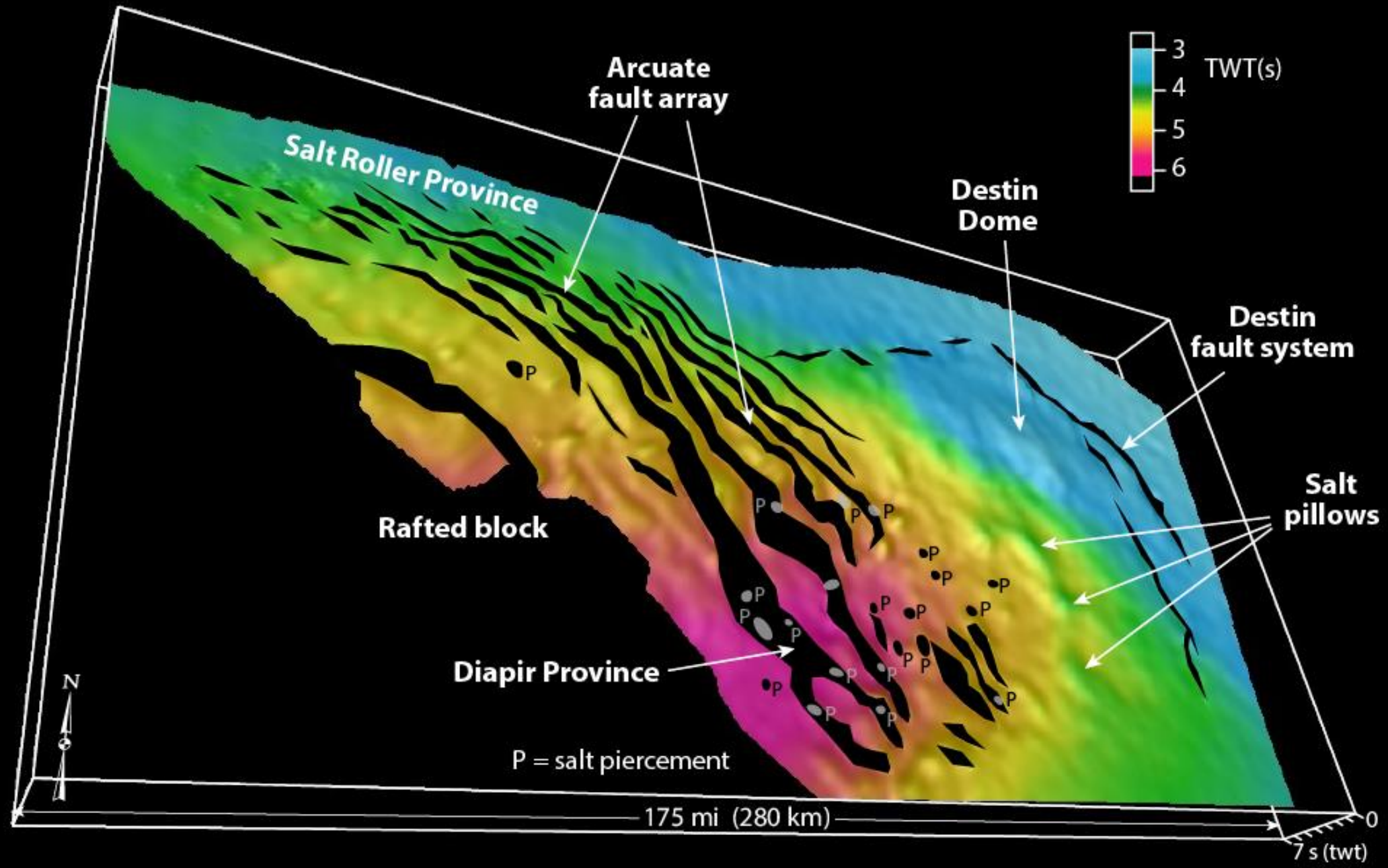


Depth-Converted Structural Cross Sections

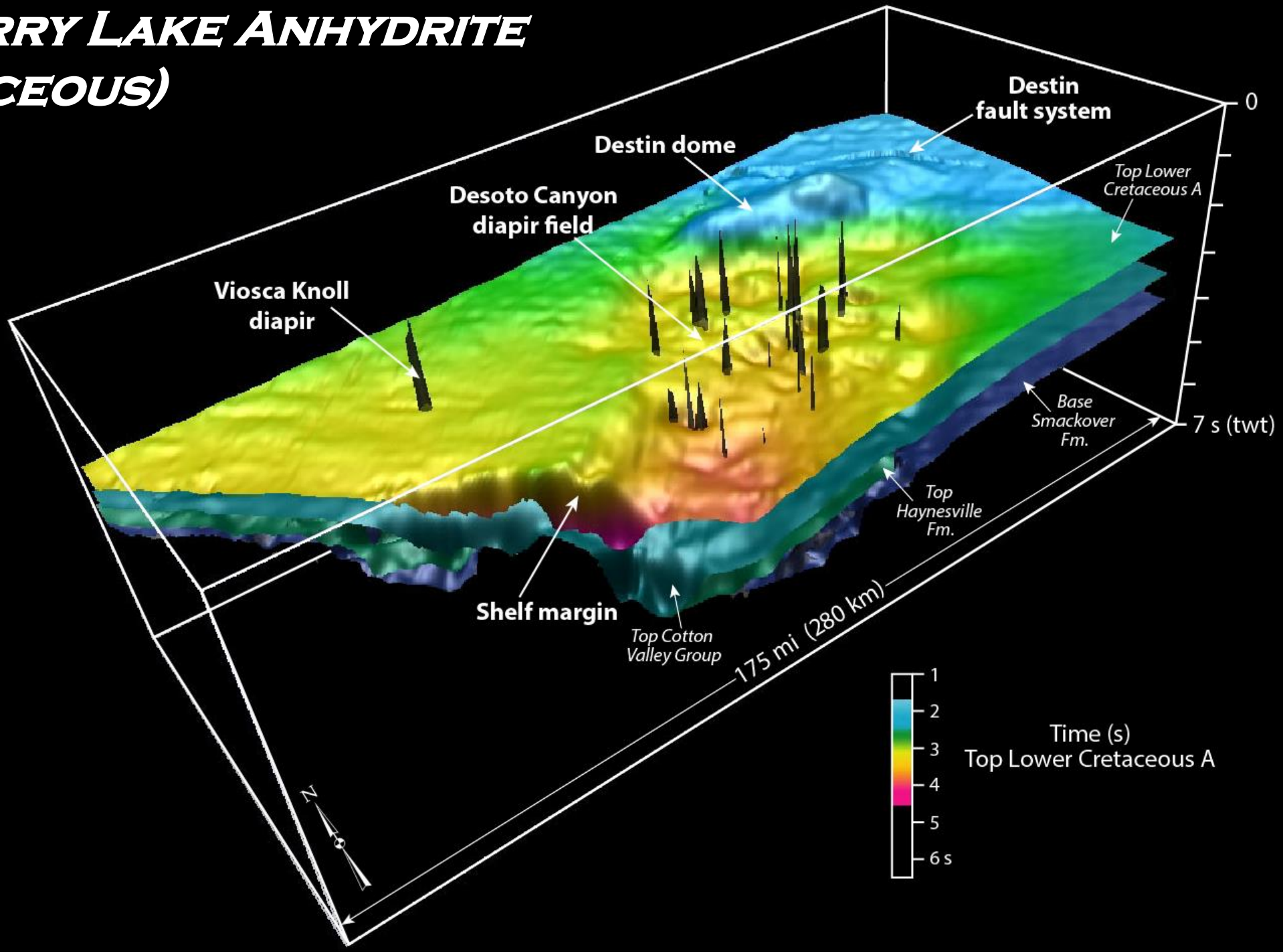




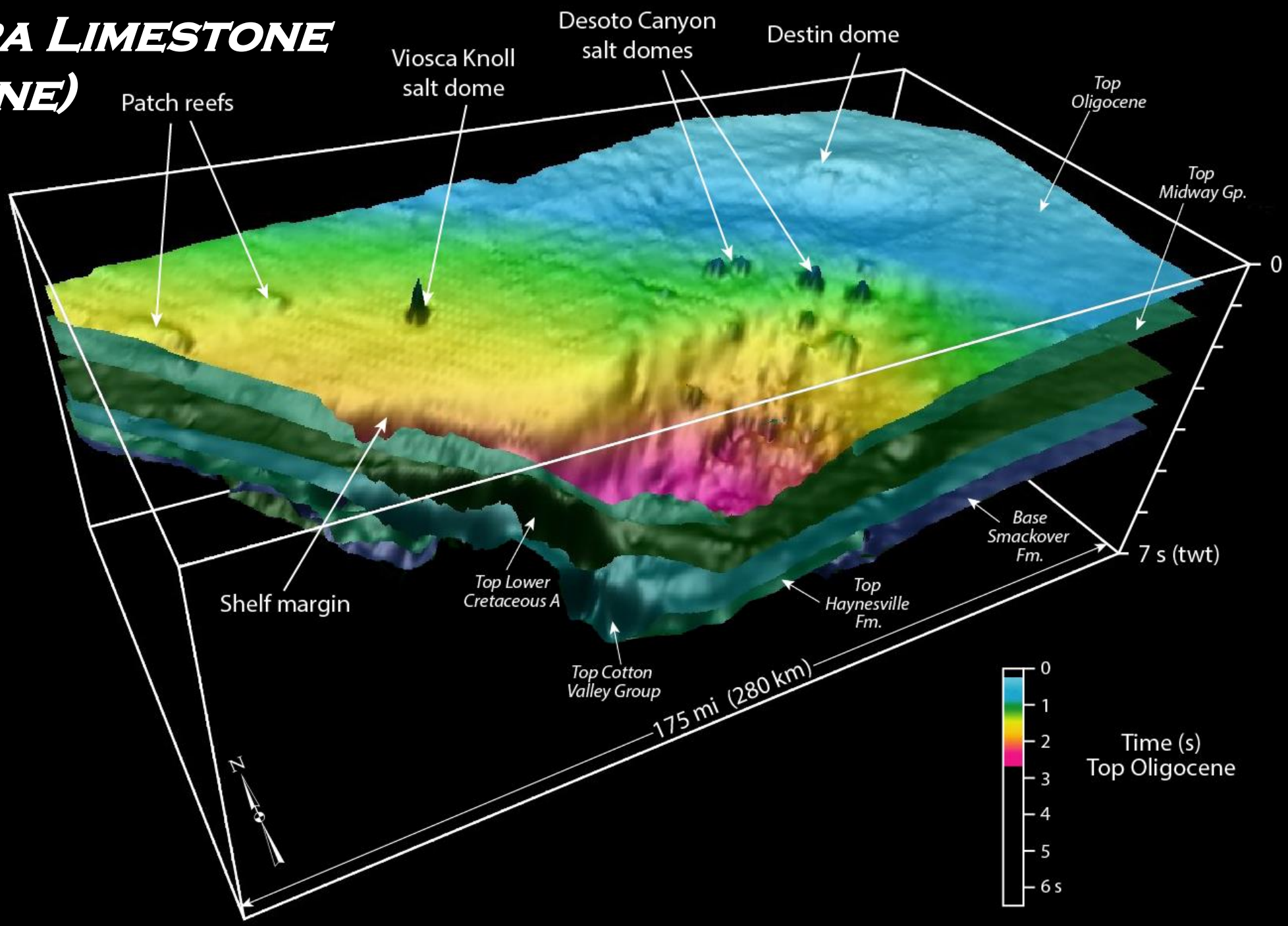
Top Smackover Limestone (Jurassic)



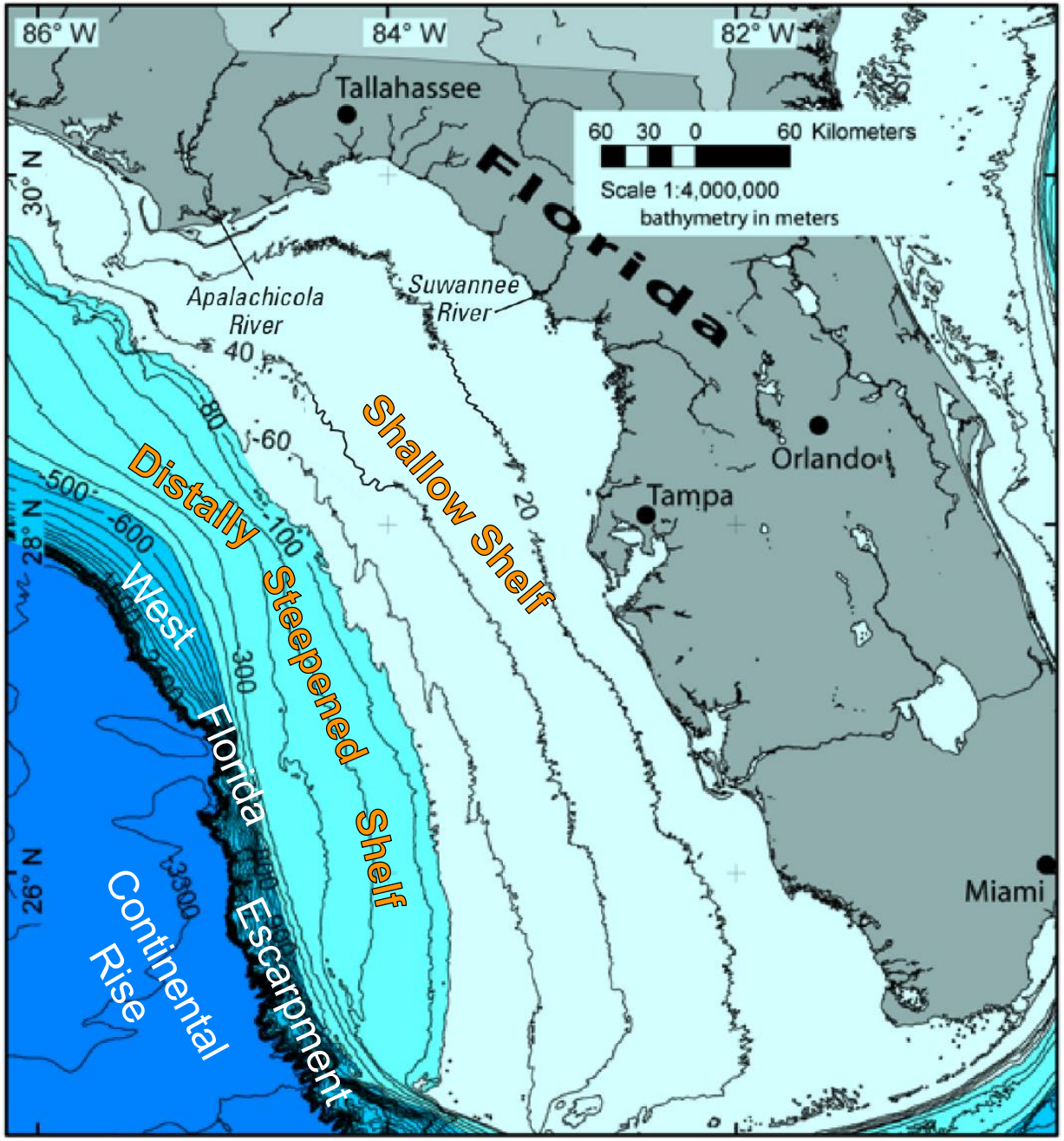
Top Ferry Lake Anhydrite (Cretaceous)



Top Tampa Limestone (Oligocene)

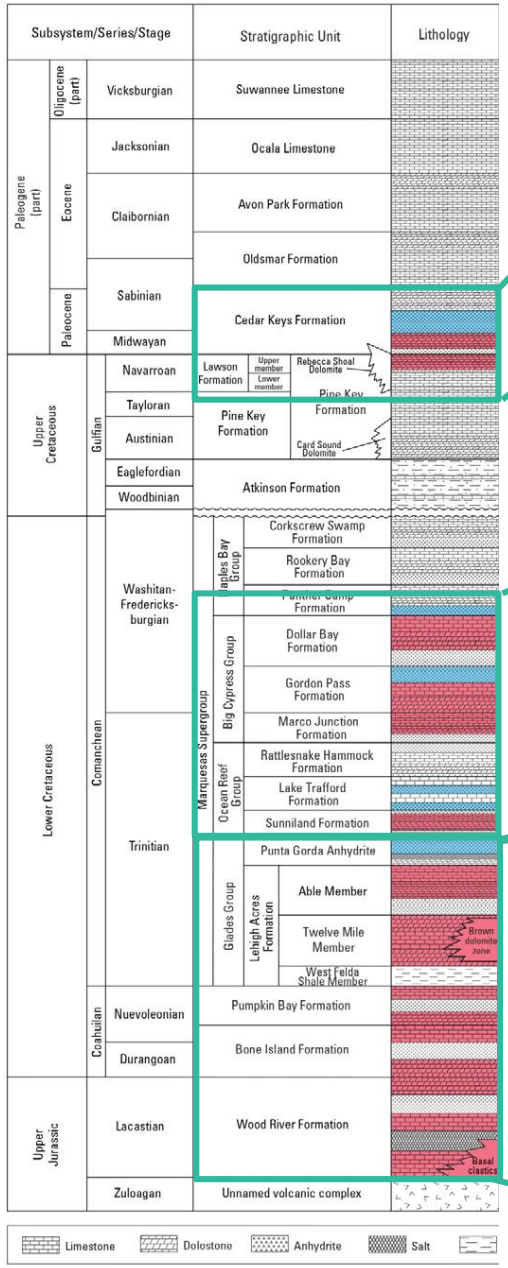


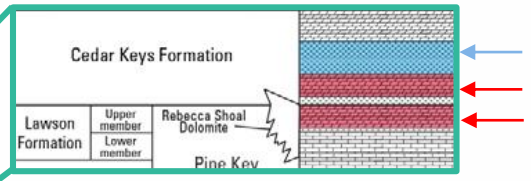
West Florida Bathymetry

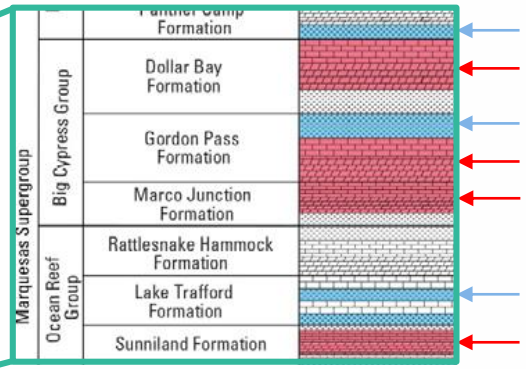


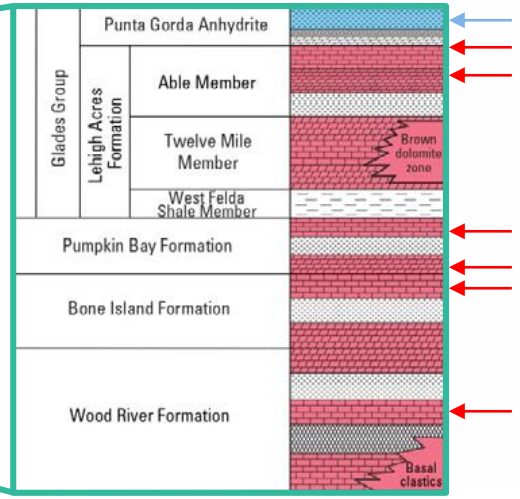
- Broad, shallow, region near shore (NE of 80 m contour).
- Distally steepening outer shelf leading to West Florida Escarpment.

Florida Stratigraphy





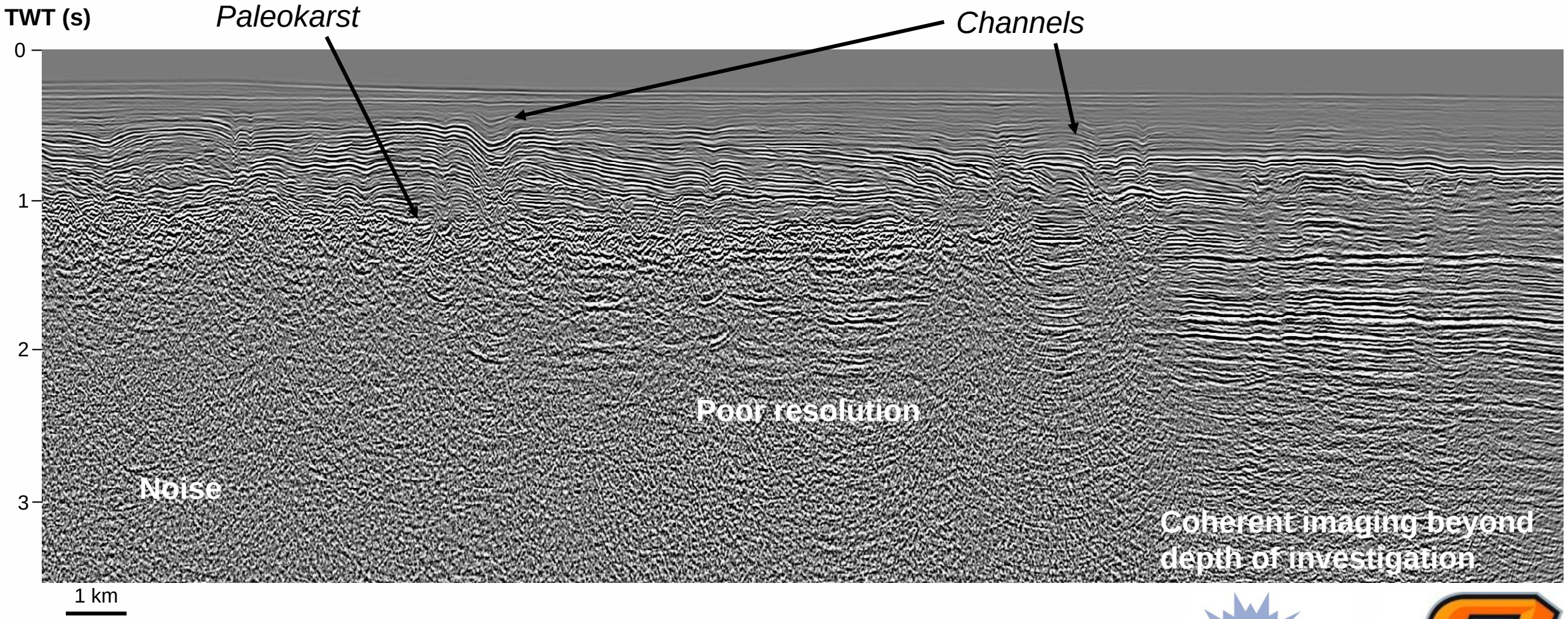




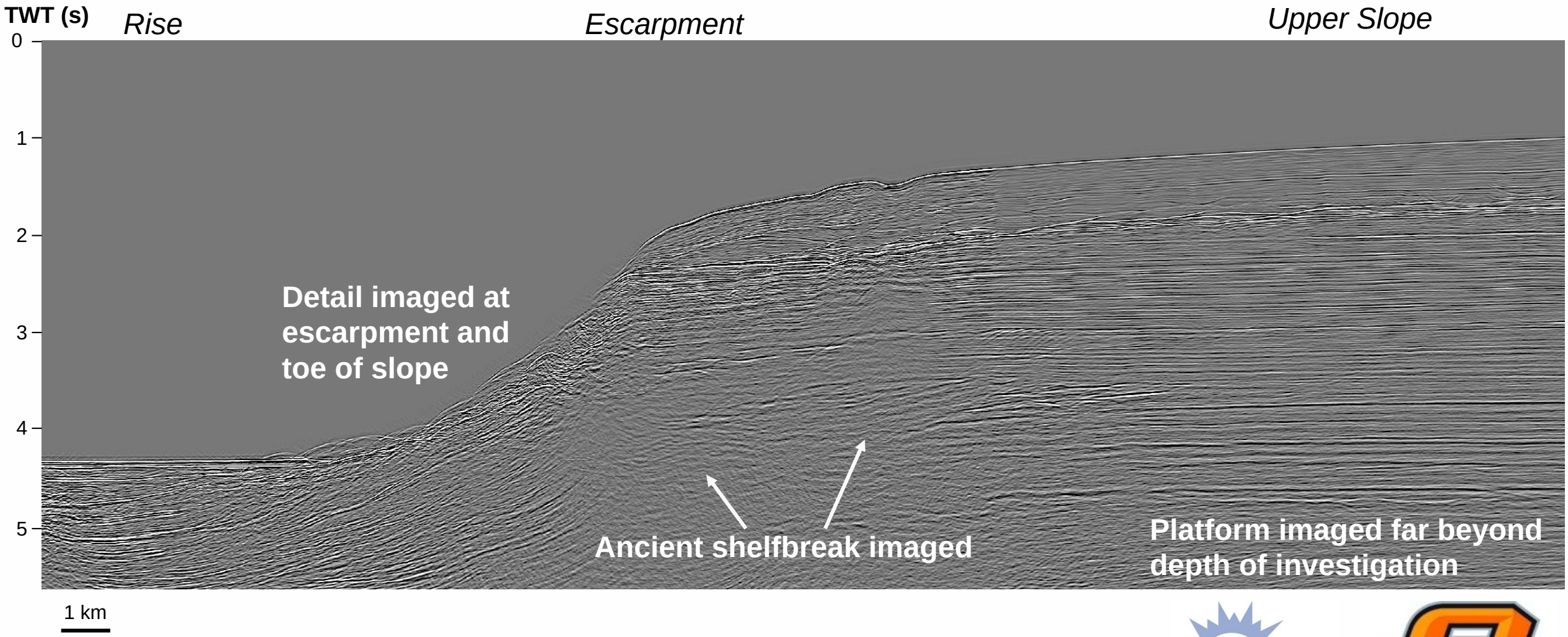
Seal
Sink

Roberts-Ashby et al. (2015)

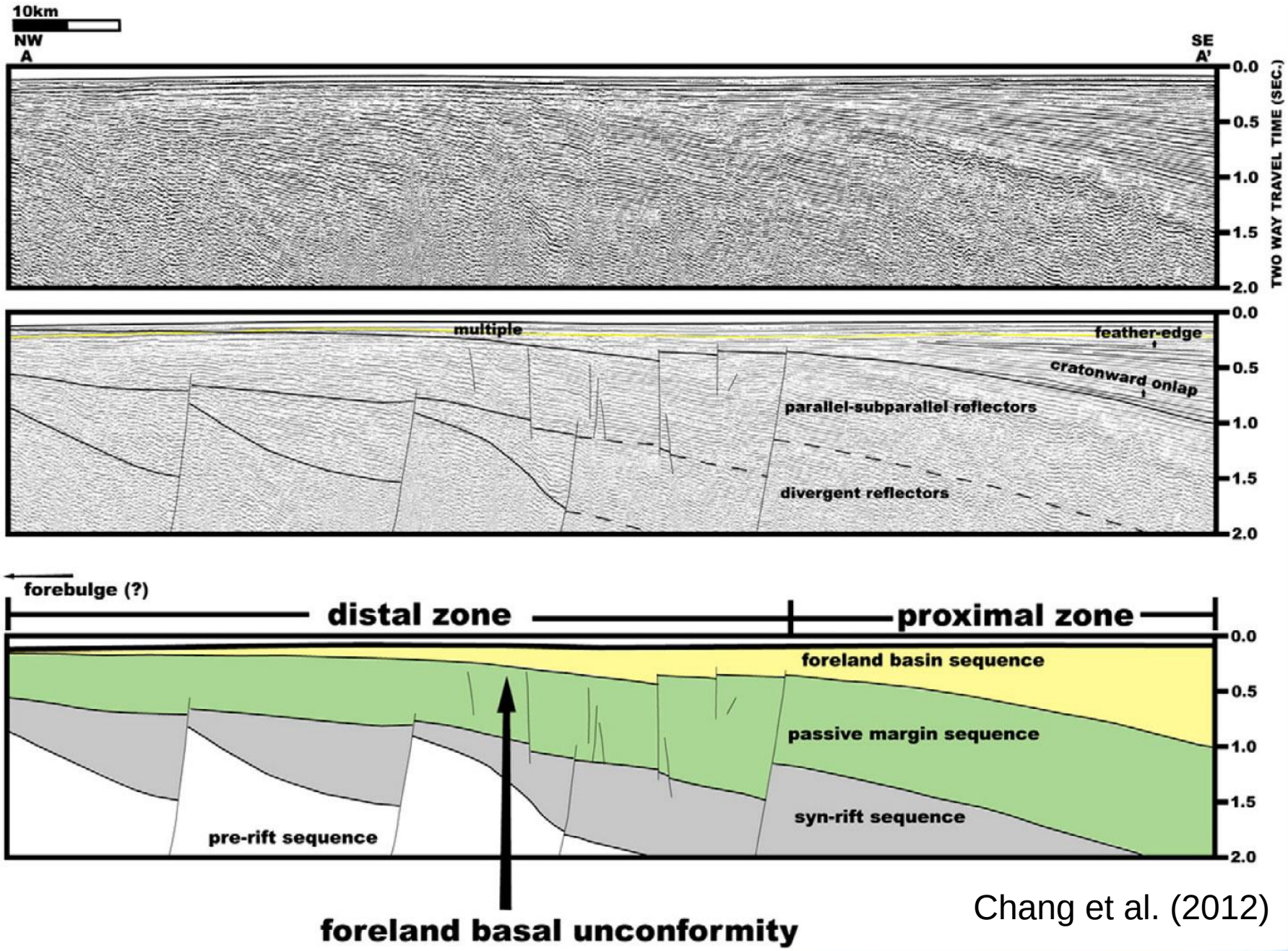
Data Quality – West Florida



Data Quality – West Florida



Taiwan Foreland Basin



Chang et al. (2012)

Legal, Regulatory Considerations

- ✓ Ownership
- ✓ Leasing
- ✓ Well design, drilling, injection control
- ✓ Enhanced oil recovery
- ✓ Facilities (platforms, compression, pipelines, etc.)
- ✓ Navigation fairways
- ✓ Existing and pending guidance, regulations, and treaties

Project Risks

-25 to -20	BLACK	NON-OPERABLE:	Evacuate the zone and or area/country
-16 to -10	RED	INTOLERABLE:	Do not take this risk
-9 to -5	YELLOW	UNDESIRABLE:	Demonstrate ALARP before proceeding
-4 to -2	GREEN	ACCEPTABLE:	Proceed carefully, with continuous improvement
-1	BLUE	NEGLIGIBLE:	Safe to proceed

MITIGATION / Control Measures / PREVENTION	Improbable 1	Unlikely 2	Possible 3	Likely 4	Probable 5
	LIKELIHOOD				
Light -1	-1 1L	-2 2L	-3 3L	-4 4L	-5 5L
Serious -2	-2 1S	-4 1S	-6 3S	-8 4S	-10 5S
Major -3	-3 1M	-6 2M	-9 3M	-12 4M	-15 5M
Catastrophic -4	-4 1C	-8 2C	-12 3C	-16 4C	-20 5C
Multi-Catastrophic -5	-5 1MC	-10 2MC	-15 3MC	-20 4MC	-25 5MC

SEVERITY

- ✓ Reservoir integrity
- ✓ Operational risk
- ✓ Shallow hazards
- ✓ Long-term responsibility
- ✓ Public perception

Source: Schlumberger Carbon Services

Concluding Thoughts

- ✓ Experience from offshore development indicates extensive capacity, technical feasibility.
- ✓ Robust portfolio of target sinks and reservoir seals.
- ✓ Numerous technologies available, offshore injection experience advancing rapidly.
- ✓ Legal, regulatory structure evolving.
- ✓ Risks similar to those routinely encountered by oil and gas industry; they are manageable.

This material is based upon work supported by the U.S. Department of Energy National Energy Technology Laboratory.
Cost share and research support are provided by the Project Partners and an Advisory Committee