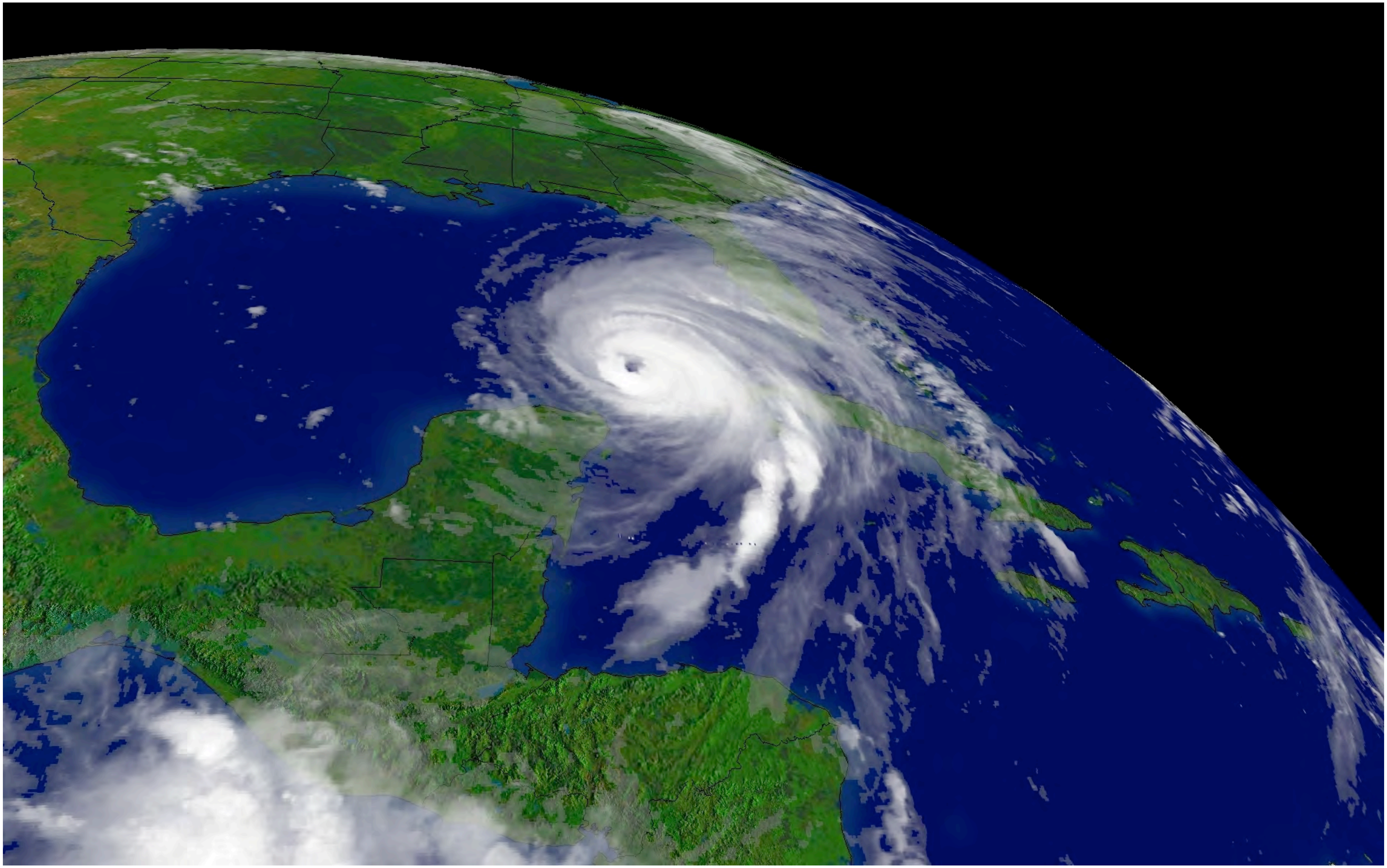
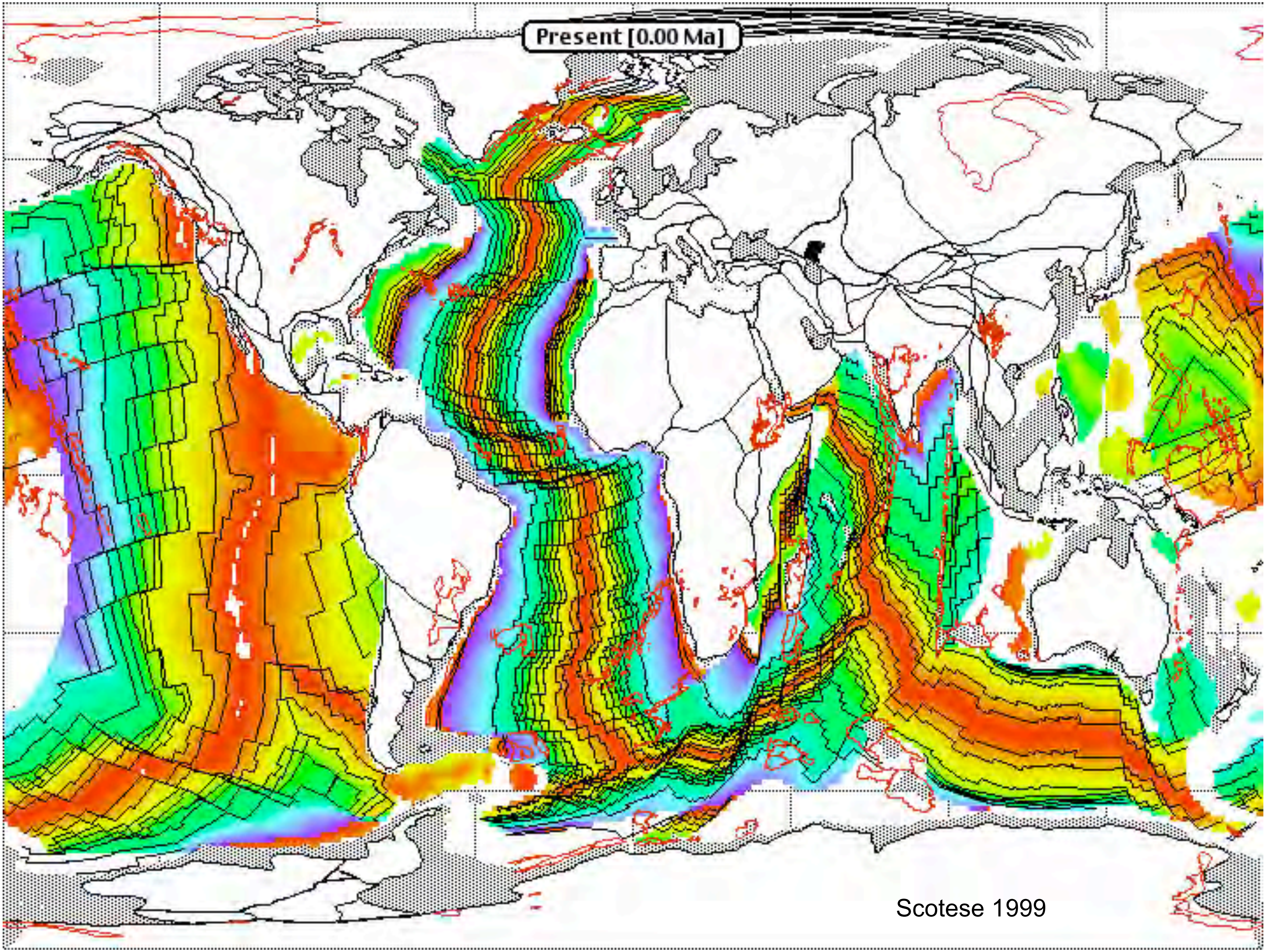


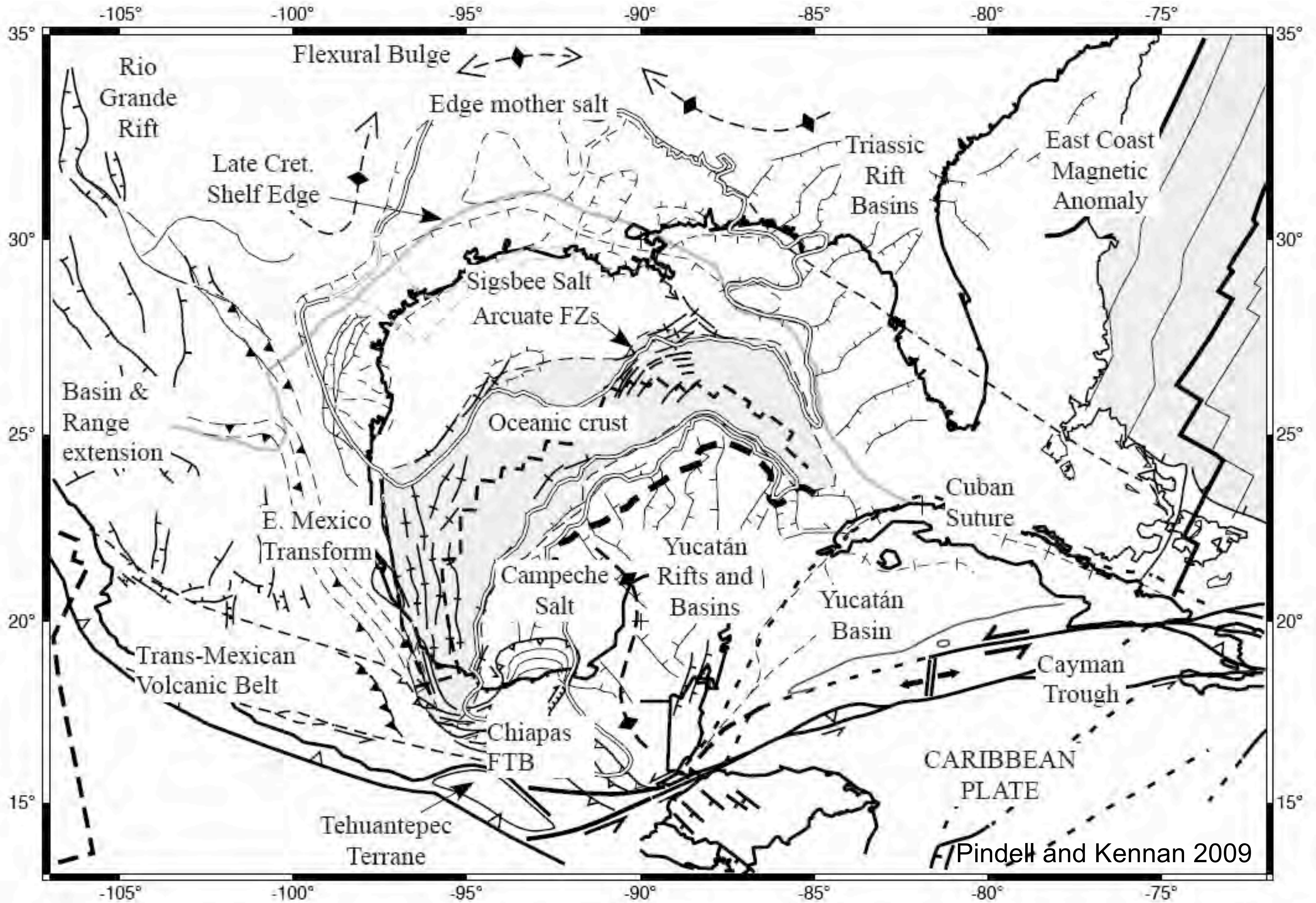
Hurricane Ivan over the Gulf of Mexico, 2004

http://www.nnvl.noaa.gov/hurseas2004/ivan1145zB-040914-4kg12.jpg



Scotese 1999

Digression: the Caribbean Plate



Pindell and Kennan 2009

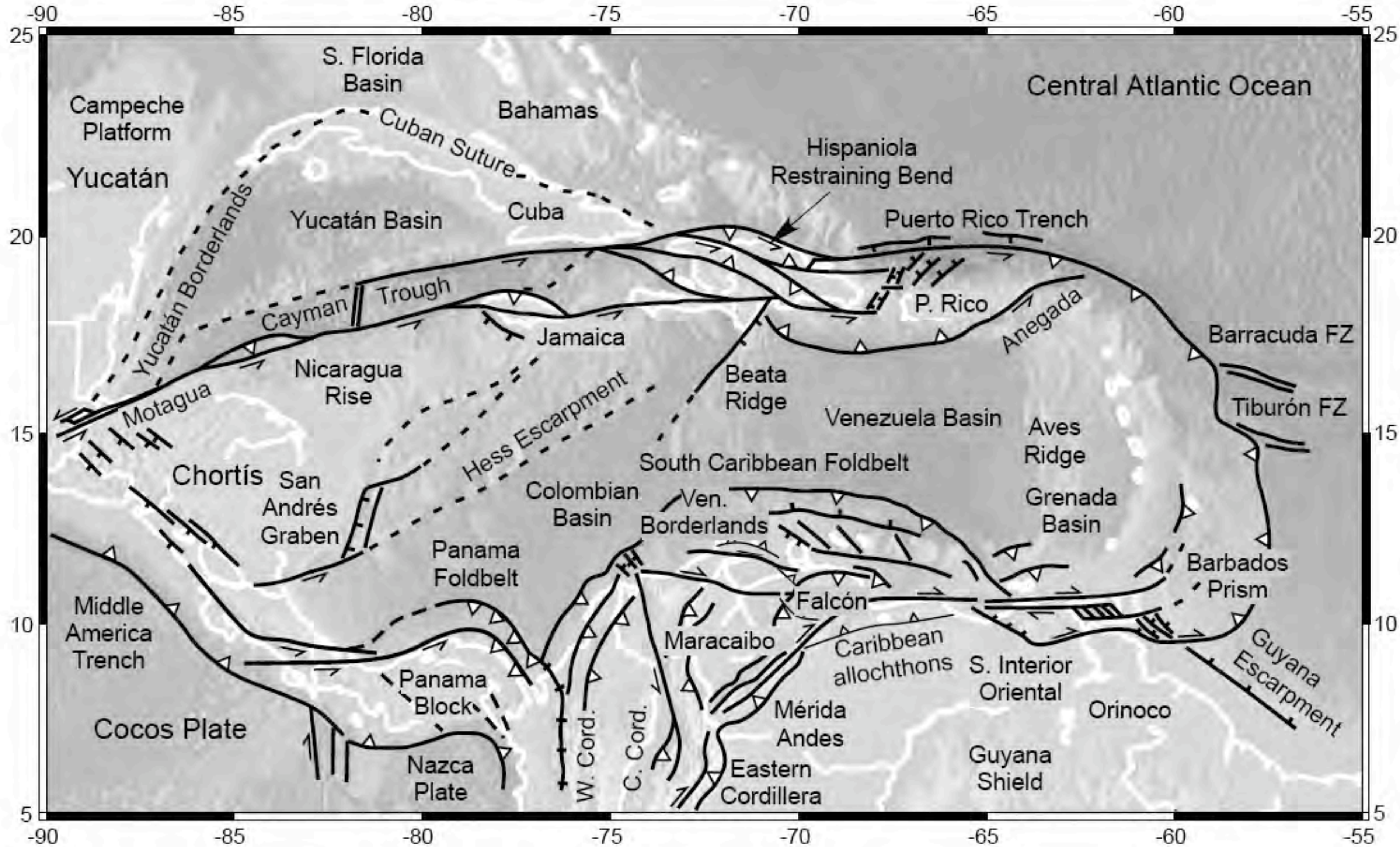
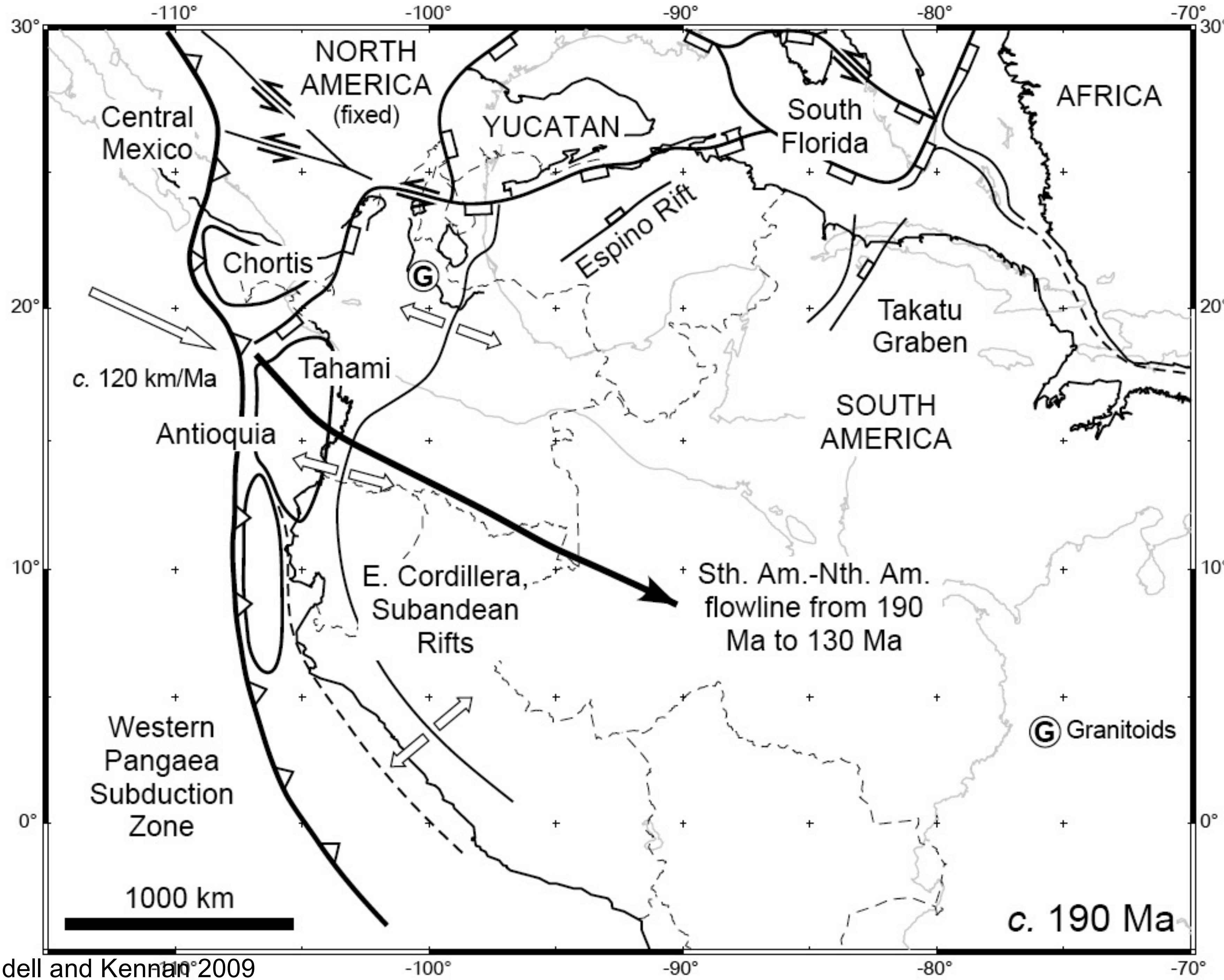
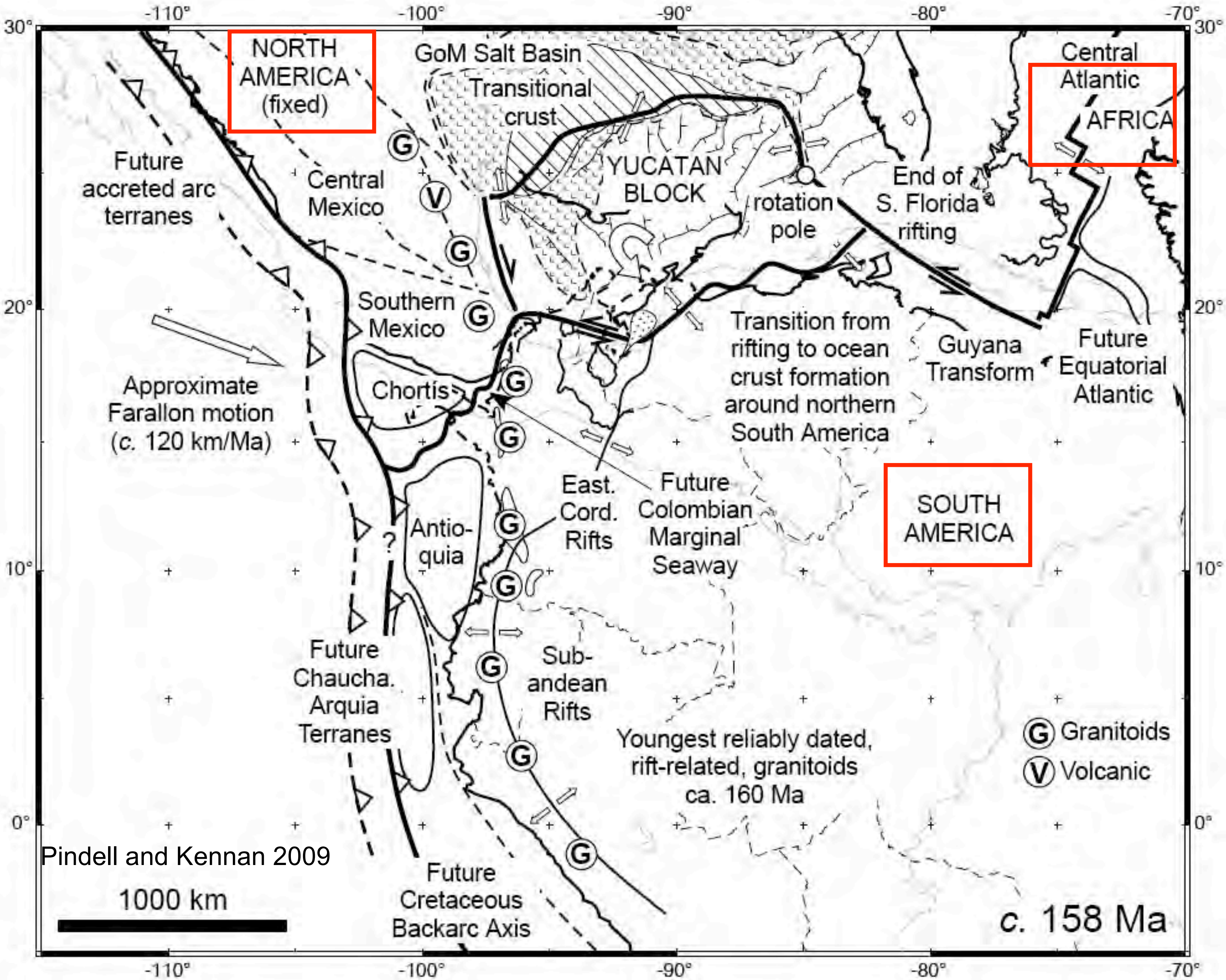


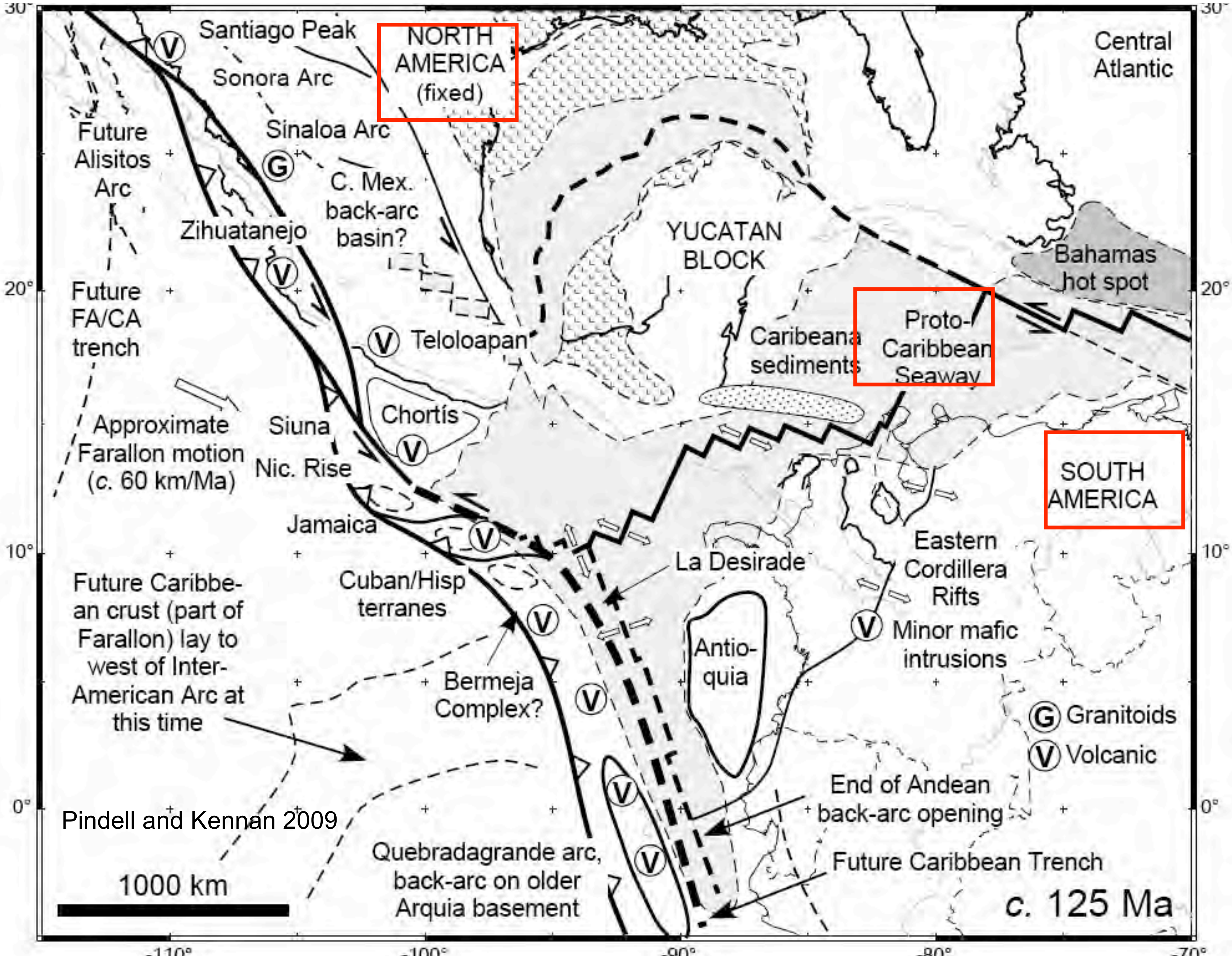
Fig. 2. Present day tectonic map of the Caribbean region.

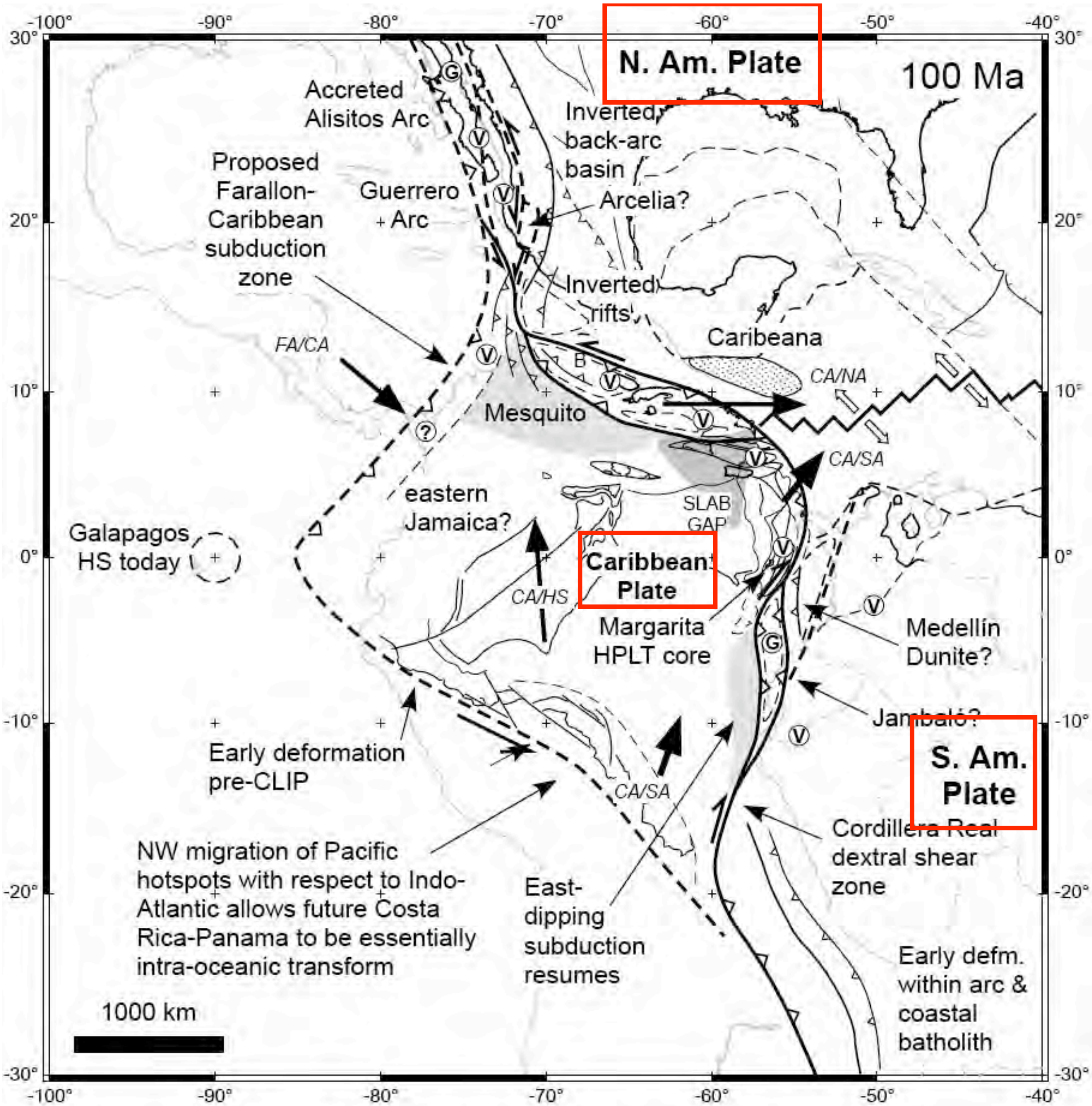
Pindell and Kennan 2009



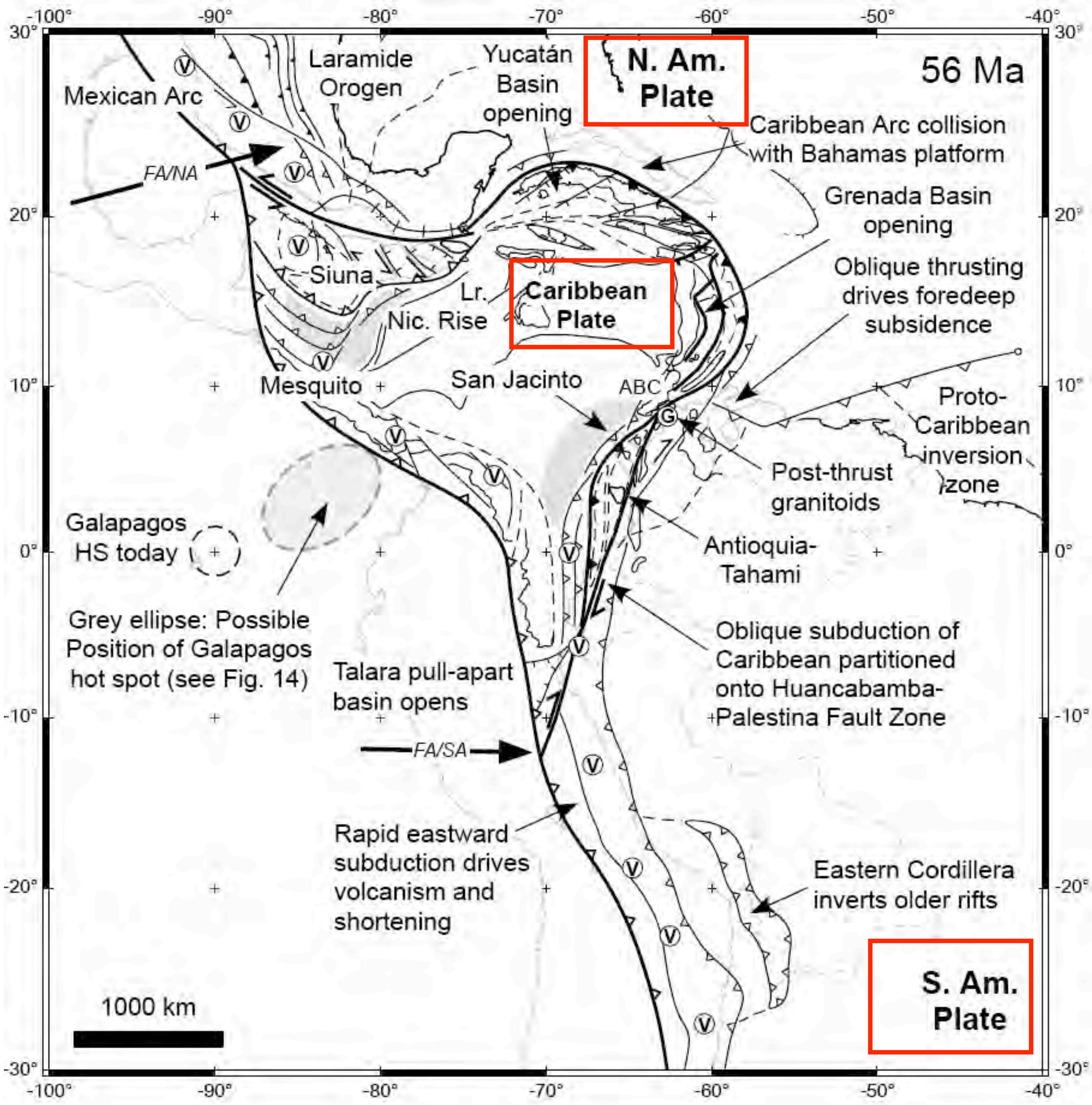
Pindell and Kennan 2009


NORTH AMERICA (fixed)
GoM Salt Basin
Transitional crust
YUCATAN BLOCK
rotation pole
End of S. Florida rifting
Central Atlantic
AFRICA
Future accreted arc terranes
Central Mexico
Southern Mexico
Approximate Farallon motion (c. 120 km/Ma)
Chortis
Transition from rifting to ocean crust formation around northern South America
Guyana Transform
Future Equatorial Atlantic
Antio-quia
East. Cord. Rifts
Future Colombian Marginal Seaway
SOUTH AMERICA
Future Chaucha. Arquia Terranes
Sub-andean Rifts
Youngest reliably dated, rift-related, granitoids ca. 160 Ma
G Granitoids
V Volcanic
Pindell and Kennan 2009
1000 km
Future Cretaceous Backarc Axis
c. 158 Ma
-110° -100° -90° -80° -70°
30° 20° 10° 0°

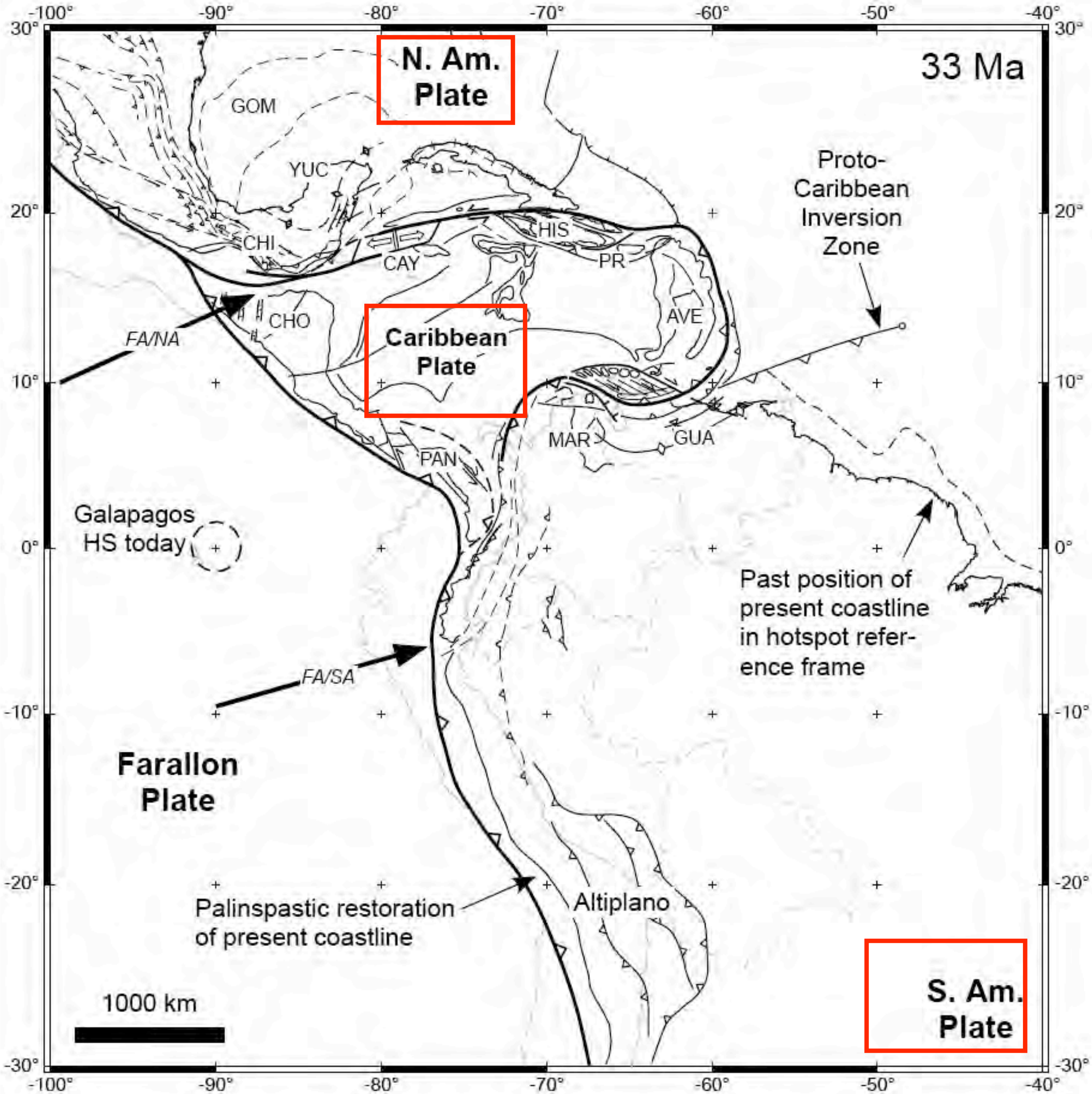

NORTH AMERICA (fixed)
Santiago Peak
Sonora Arc
Sinaloa Arc
Future Alisitos Arc
C. Mex. back-arc basin?
Zihuatanejo
YUCATAN BLOCK
Central Atlantic
Bahamas hot spot
Future FA/CA trench
Teloloapan
Caribeana sediments
Proto-Caribbean Seaway
Chortís
Siuna
Approximate Farallon motion (c. 60 km/Ma)
Nic. Rise
SOUTH AMERICA
Jamaica
La Desirade
Eastern Cordillera Rifts
Cuban/Hisp terranes
Minor mafic intrusions
Future Caribbean crust (part of Farallon) lay to west of Inter-American Arc at this time
Antioquia
Bermeja Complex?
G Granitoids
V Volcanic
End of Andean back-arc opening
Pindell and Kennan 2009
Future Caribbean Trench
1000 km
Quebradagrande arc, back-arc on older Arquia basement
c. 125 Ma
30°
20°
10°
0°
-110°
-100°
-90°
-80°
-70°



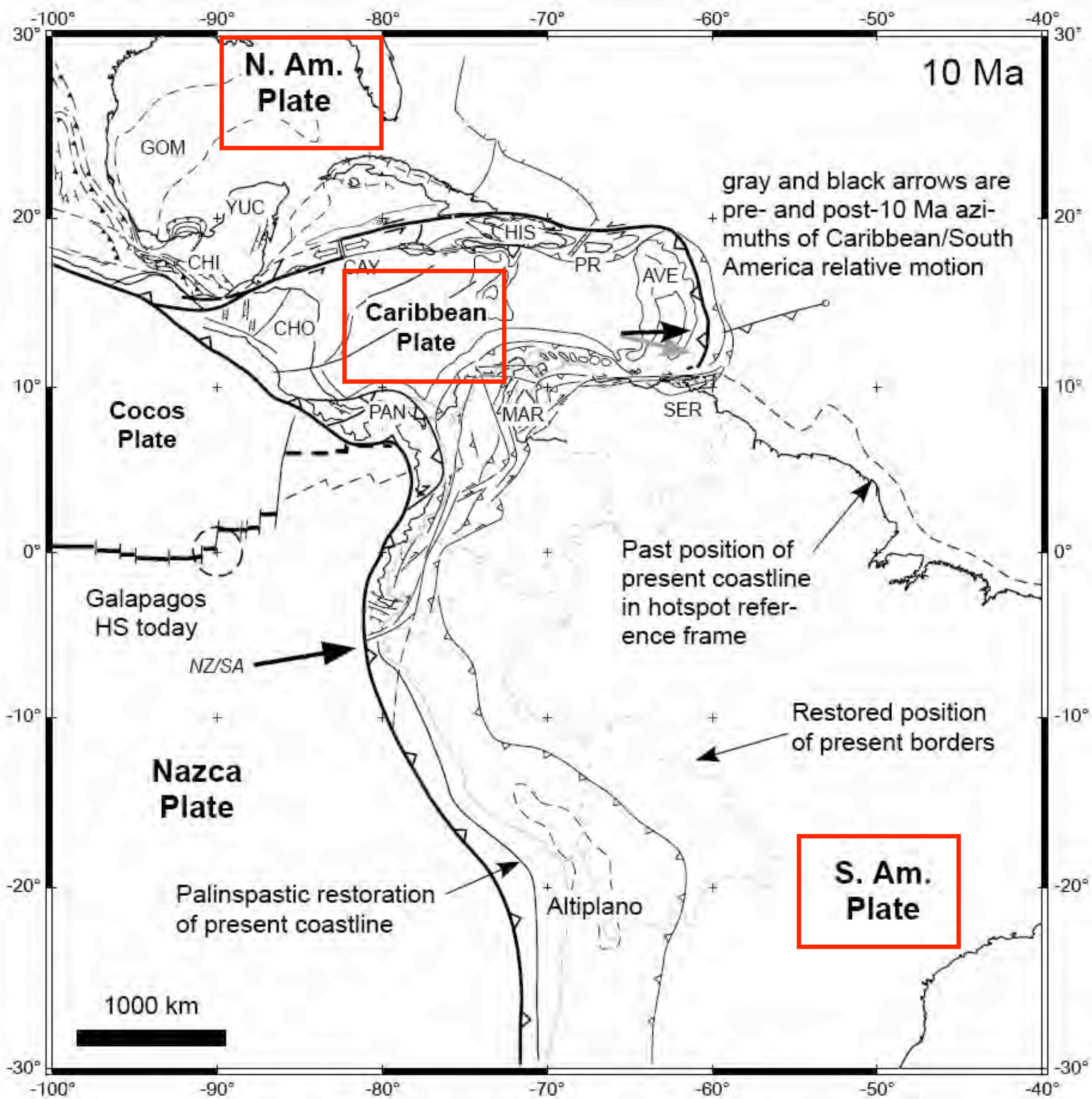
Pindell and Kennan 2009



Pindell and Kennan 2009



Pindell and Kennan 2009



Pindell and Kennan 2009

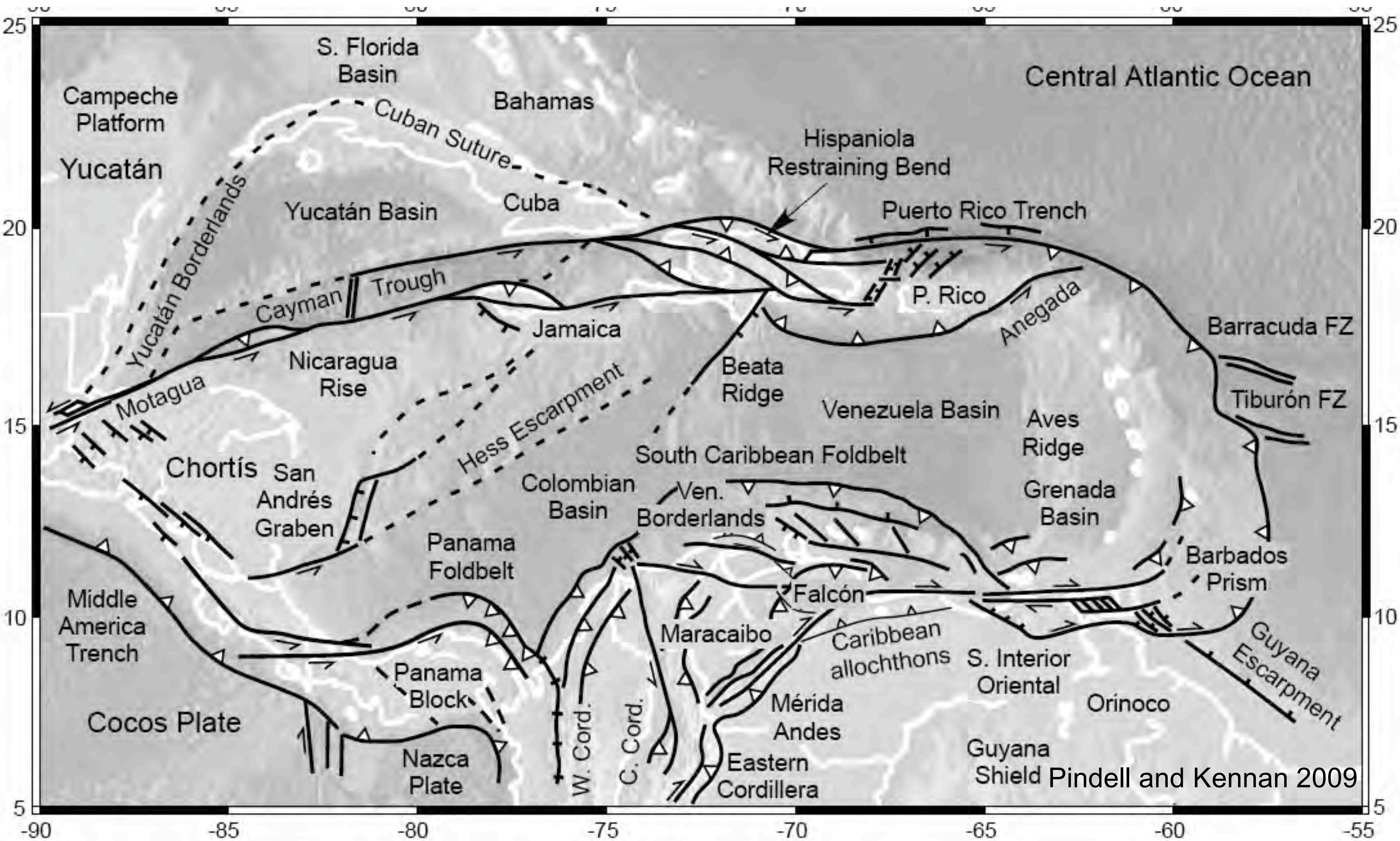


Fig. 2. Present day tectonic map of the Caribbean region.

. . .End Digression

Jurassic: Rifting, Sea Floor Spreading, and Salt Deposition

a)

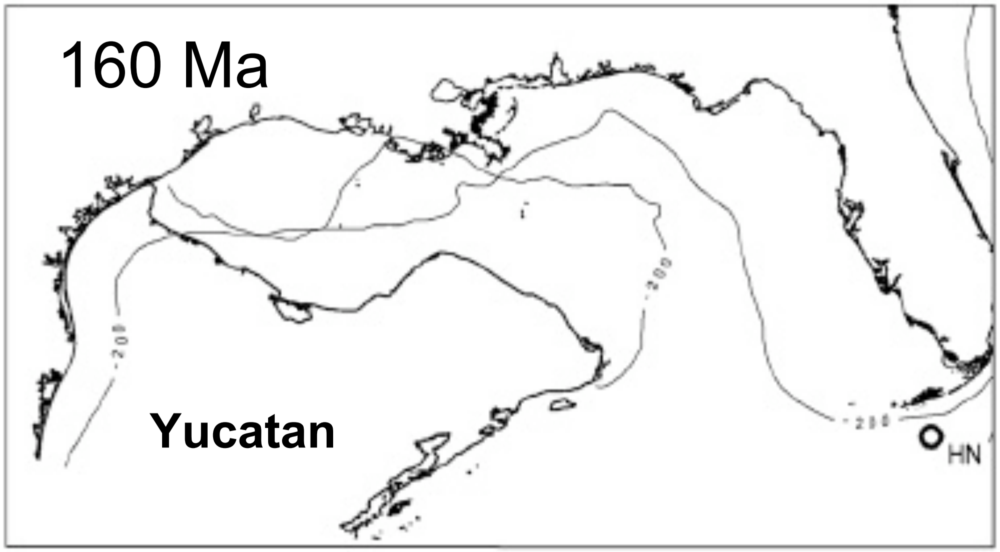
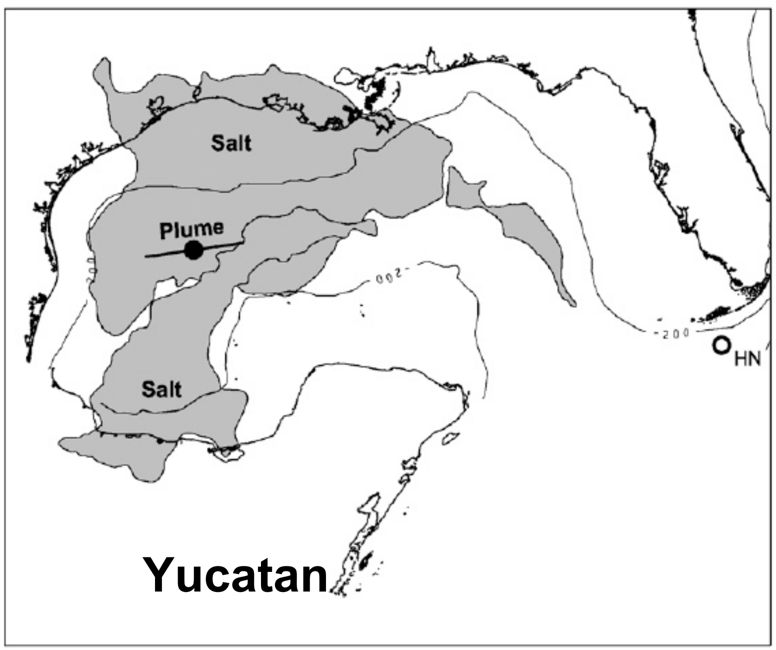


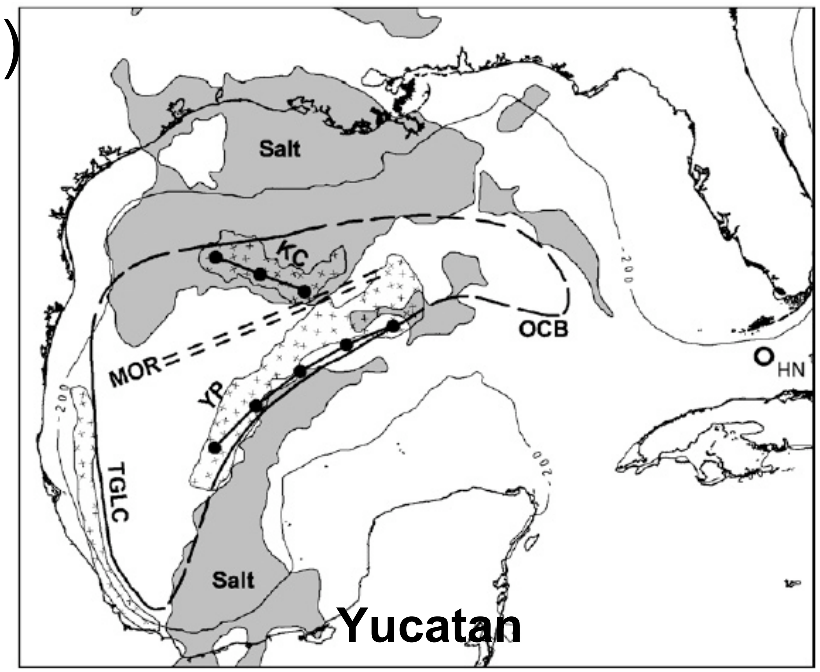
Figure 7. Reconstruction of Gulf of Mexico, 20-m.y. evolution of Yucatan motion. Pole used by Hall and Najmuddin (1994) = HN. (a) Initial position: about 160 Ma (exact age unknown). Yucatan occupies what is the Gulf of Mexico Basin now. Because the Yucatan was probably longer at that time, no gap was present between the peninsula and western Florida (Burke, 1988). (b) 10–12 m.y. coinciding with 22° of rotation and continental crust extension (about 150–152 Ma). Sea-floor spreading began at the end of this time when the plume became active. (c) 20 m.y. and 42° total rotation (adding 20° by rotation of sea-floor spreading), present position achieved (about 140 Ma).

b)



152-150 Ma

c)



~140 Ma

Bird et al 2005

An alternative view from Stern and Dickinson 2010

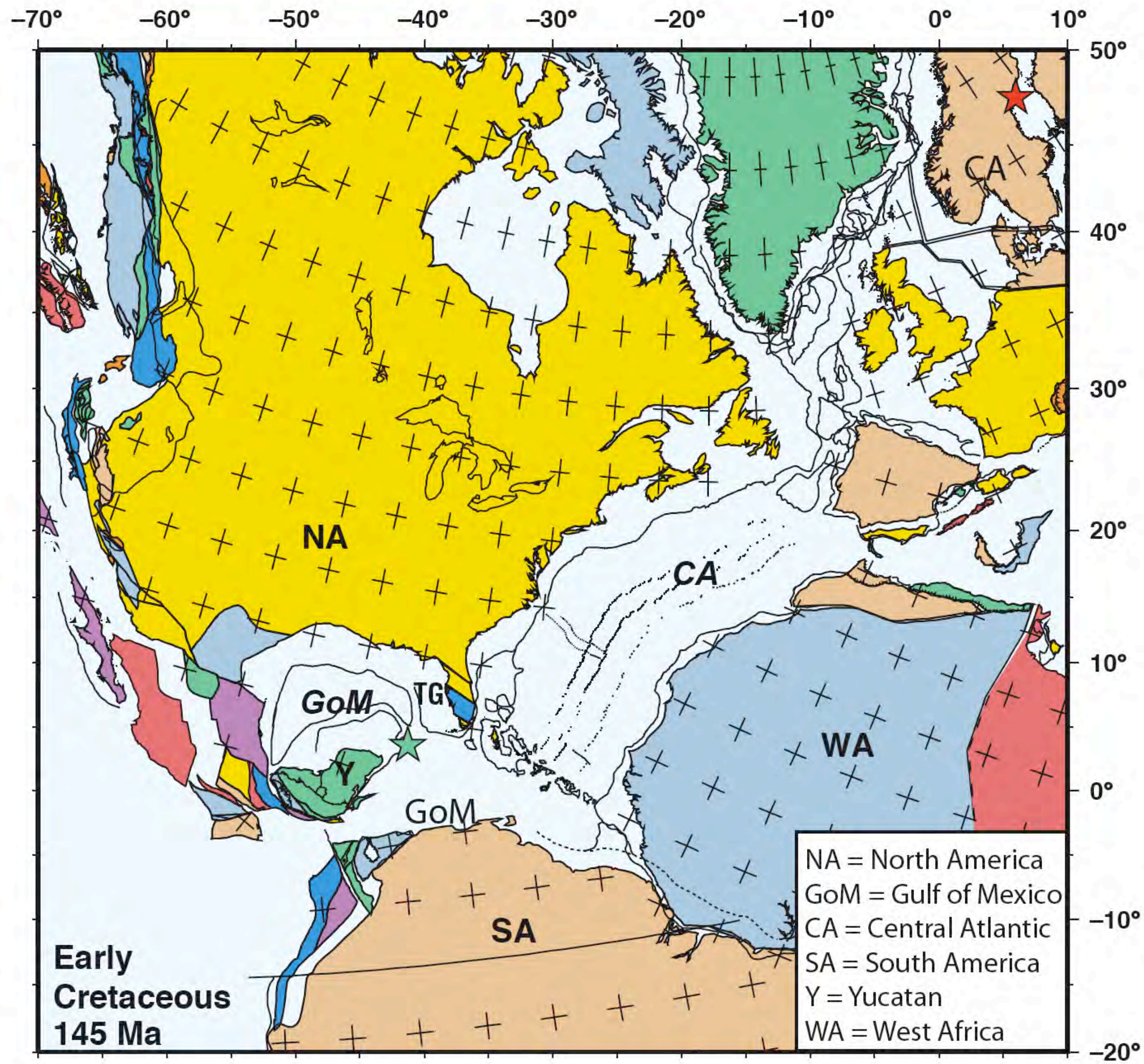
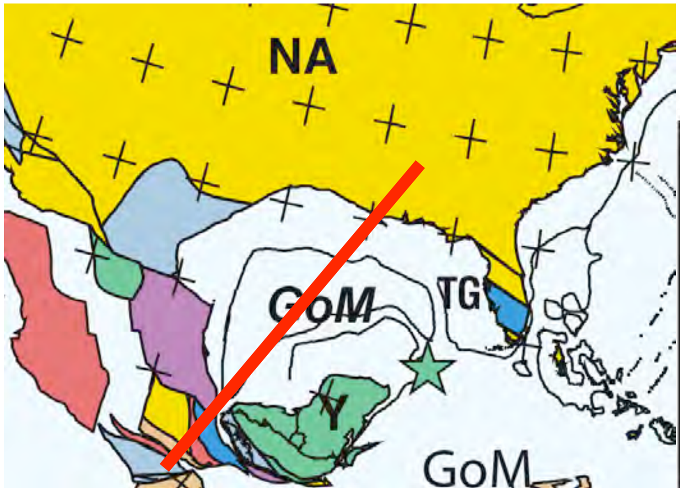


Figure 1. Configuration of continents and ocean basins around the central Atlantic and Gulf of Mexico ca. 145 Ma (Late Jurassic, courtesy Lisa Gahagan, University of Texas Institute for Geophysics PLATES project: http://www.paleogis.com/dotnetnuke/PlateModels/ThePLATESProjectatUTIG/tabid/84/Default.aspx). Note the very different positions of Euler poles for the Gulf of Mexico (Yucatan–North America, 23.0°N, 85.2°W; green star) and central Atlantic (West Africa–North America, 66.2°N, 18.3°W, red star).



Stern and Dickinson 2010

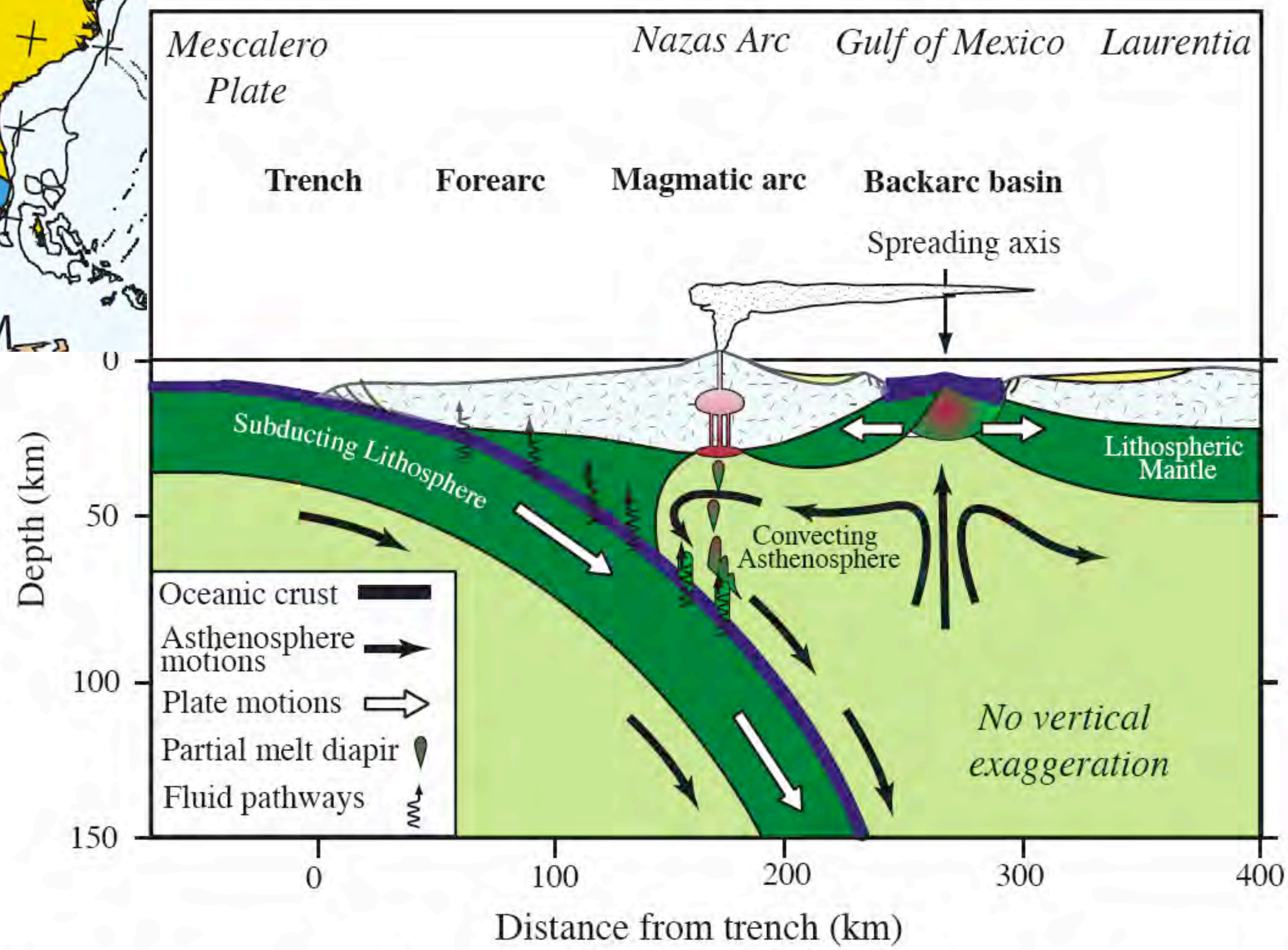


Figure 9. Schematic section through the upper 150 km of a subduction zone, showing the principal crustal and upper mantle components and their interactions; modified from Stern (2002) to show a section through Mexico to the Gulf of Mexico. Note that the location of the mantle wedge (unlabeled) is that part of the mantle beneath the overriding plate and between the trench and the most distal part of the arc where subduction-related igneous or fluid activity is found. Not all convergent plate margins have backarc basins.

Four Continental Backarc Basin Systems at the same scale

Stern and Dickinson 2010

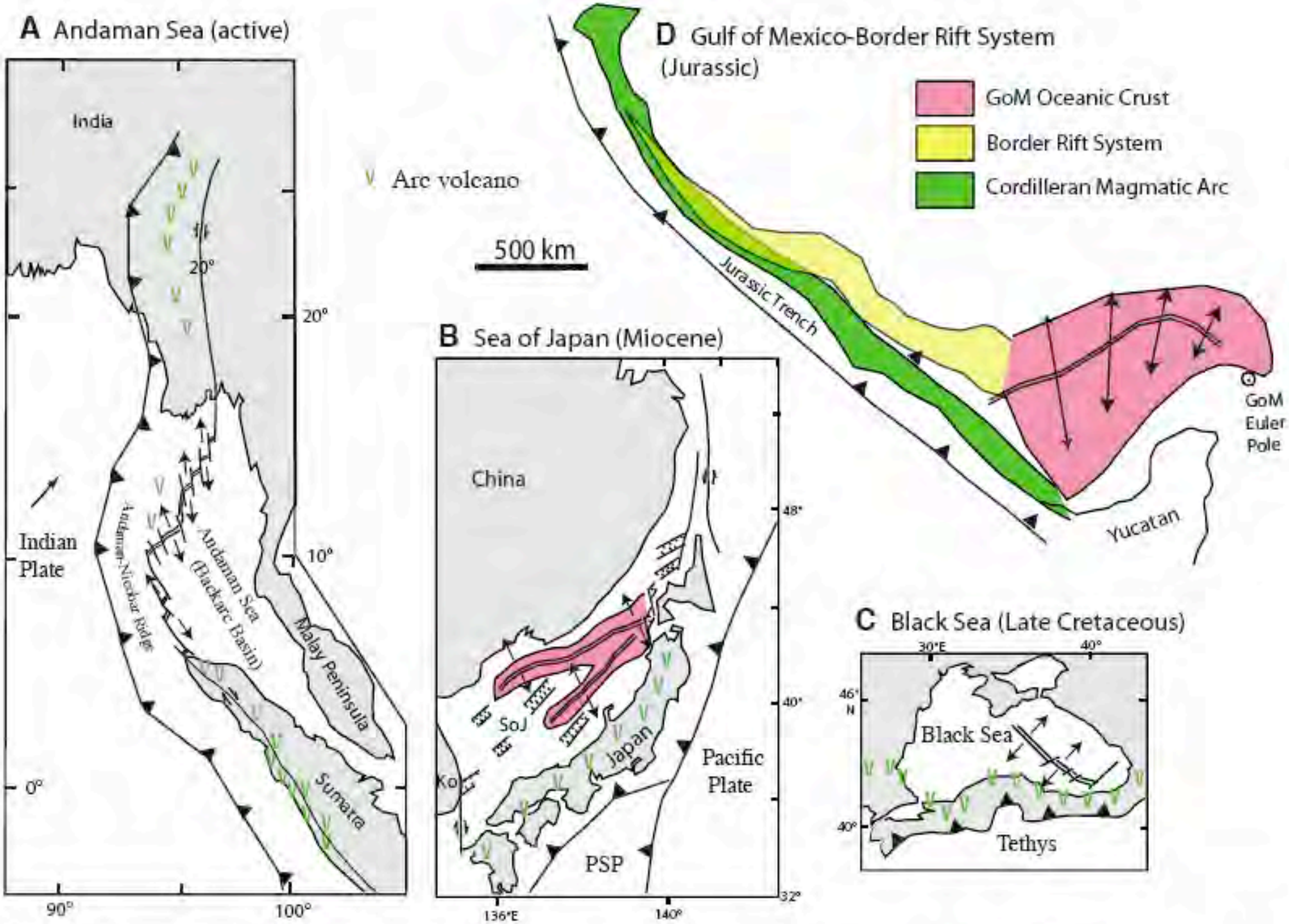
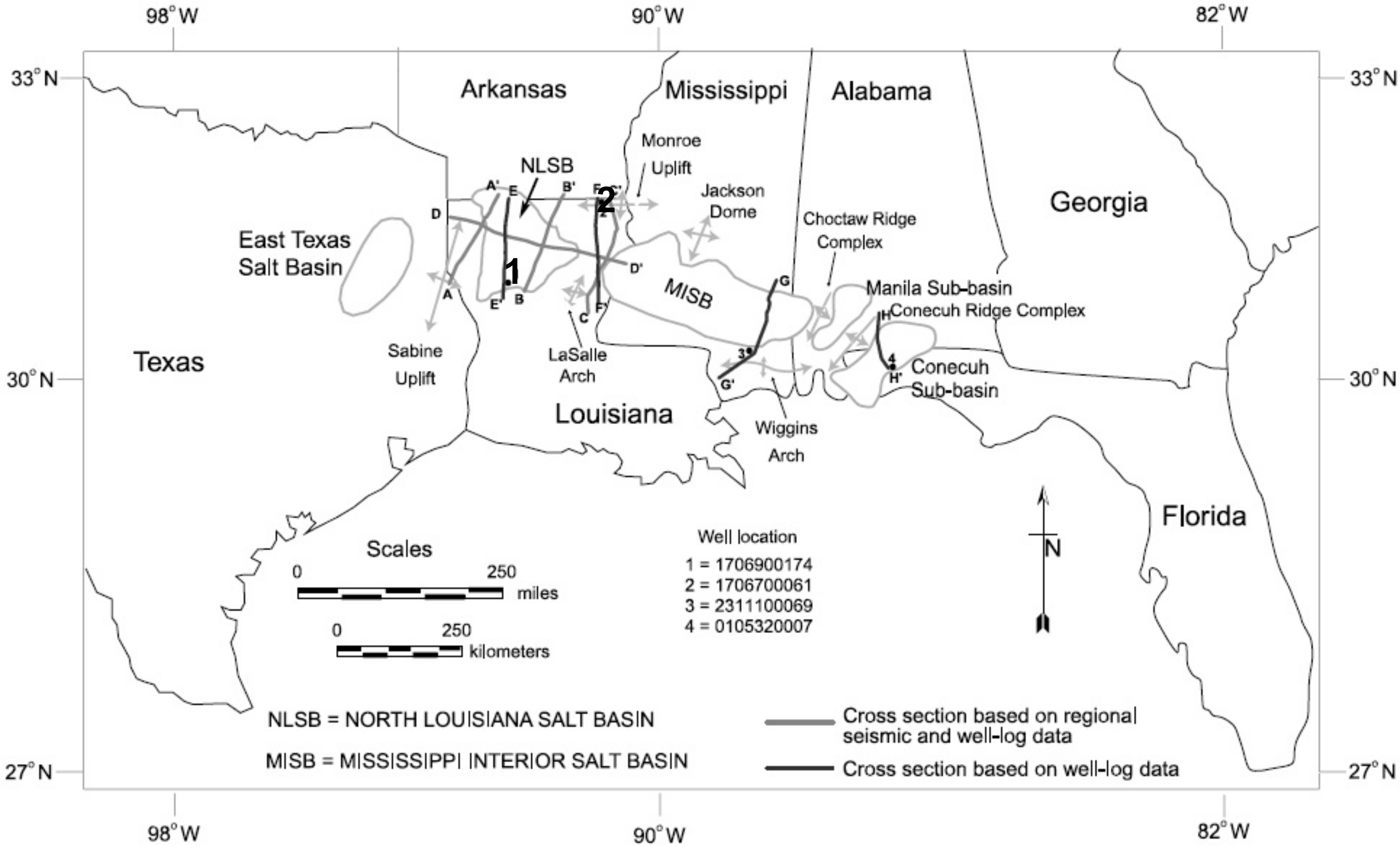


Figure 10. Comparison of the Gulf of Mexico (GoM) backarc basin (BAB) system (A) with two other examples of transtensional BABs, Andaman Sea (B) and Middle Miocene (ca. 20–15 Ma) Sea of Japan (C). Andaman Sea BAB system is simplified after Curray (2005) and Pal et al. (2007). Sea of Japan BAB system is modified after Jolivet et al. (1994). PSP—Philippine Sea Plate; Ko—Korea; SoJ—Sea of Japan.

Cretaceous: Shelf and Basin Sedimentation



Mancini et al 2008

System	Series	Stage	Group	Stratigraphic Units[1] Louisiana	Stratigraphic Units[1] Mississippi	T-R Sequences
Cretaceous	Upper Cretaceous	Maastrichtian	Navarro	**Arkadelphia Formation**[2]	**Prairie Bluff Chalk**[3]	R / T Sequence 11
				Nacatoch Formation	Ripley Formation[4]	
				Saratoga Formation		R Sequence 10
		Campanian	Taylor	Marlbrook Formation	Demopolis Chalk	
				Annona Formation		T
				Ozan Formation		
		Santonian	Austin	Brownstown Formation	Mooreville Chalk	R Sequence 9
		Coniacian		Tokio Formation	Eutaw Formation	T
		Turonian	Eagle Ford	**Eagle Ford units**	Upper Tuscaloosa Fm.	R Sequence 8
		Cenomanian	Tuscaloosa	Tuscaloosa units	**Middle Tuscaloosa Fm.**	T
					Lower Tuscaloosa Fm.	
			Washita	upper Washita units	upper Washita units	R / T Sequence 7
	Lower Cretaceous	Albian		lower Washita units	Dantzler Formation	R Sequence 6
			Fredericksburg	Goodland Formation	Andrew Formation	T
				Paluxy Formation	Paluxy Formation	R Sequence 5
			Trinity	Rusk Formation/ Mooringsport Member	Mooringsport Formation	
				Ferry Lake Anhydrite	**Ferry Lake Anhydrite**	T
		Aptian		Rodessa Formation	Rodessa Formation	
				Bexar Formation	**Bexar Formation**	
				James Limestone	James Limestone	R Sequence 4
				Pine Island Shale	**Pine Island Shale**	
		Barremian		Sligo Formation	Sligo Formation	T
		Hauterivian Valanginian		Hosston Formation	Hosston Formation	
		Berriasian	Cotton Valley	Knowles Ls. / Dorcheat Mbr.	Schuler Formation / Dorcheat Mbr.	R / T Sequence 3
Jurassic	Upper Jurassic	Tithonian		Schuler Fm. **Bossier Fm.**[5] / Shongaloo Mbr.	Shongaloo Mbr.	
		Kimmeridgian		Haynesville Formation	Haynesville Formation	R / T Sequence 2
				Gilmer Limestone Member / **Buckner Anhydrite Member**	**Buckner Anhydrite Member**	
		Oxfordian		Smackover Formation	Smackover Formation	R / T[7] Sequence 1
				Norphlet Formation	Norphlet Formation[6]	

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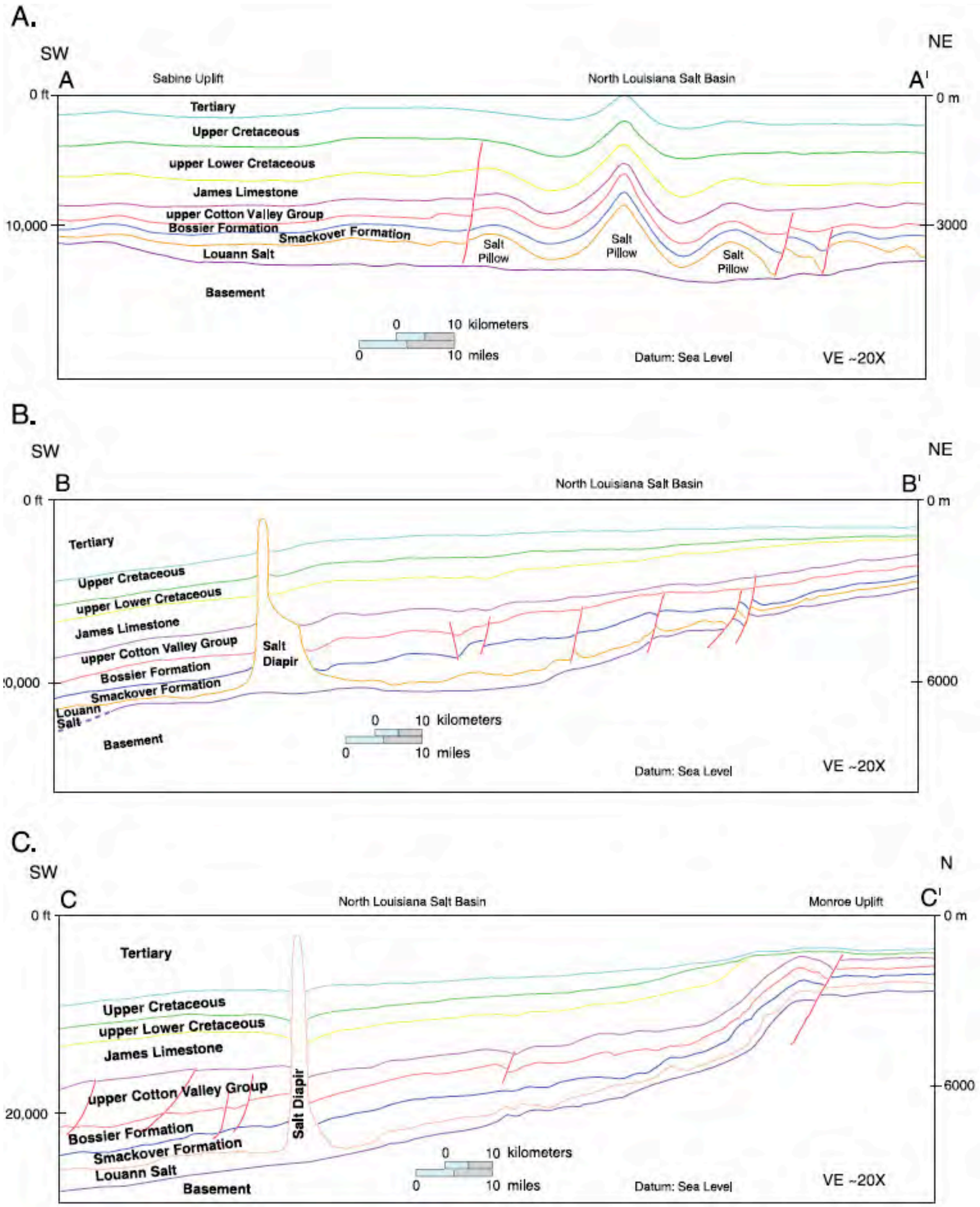
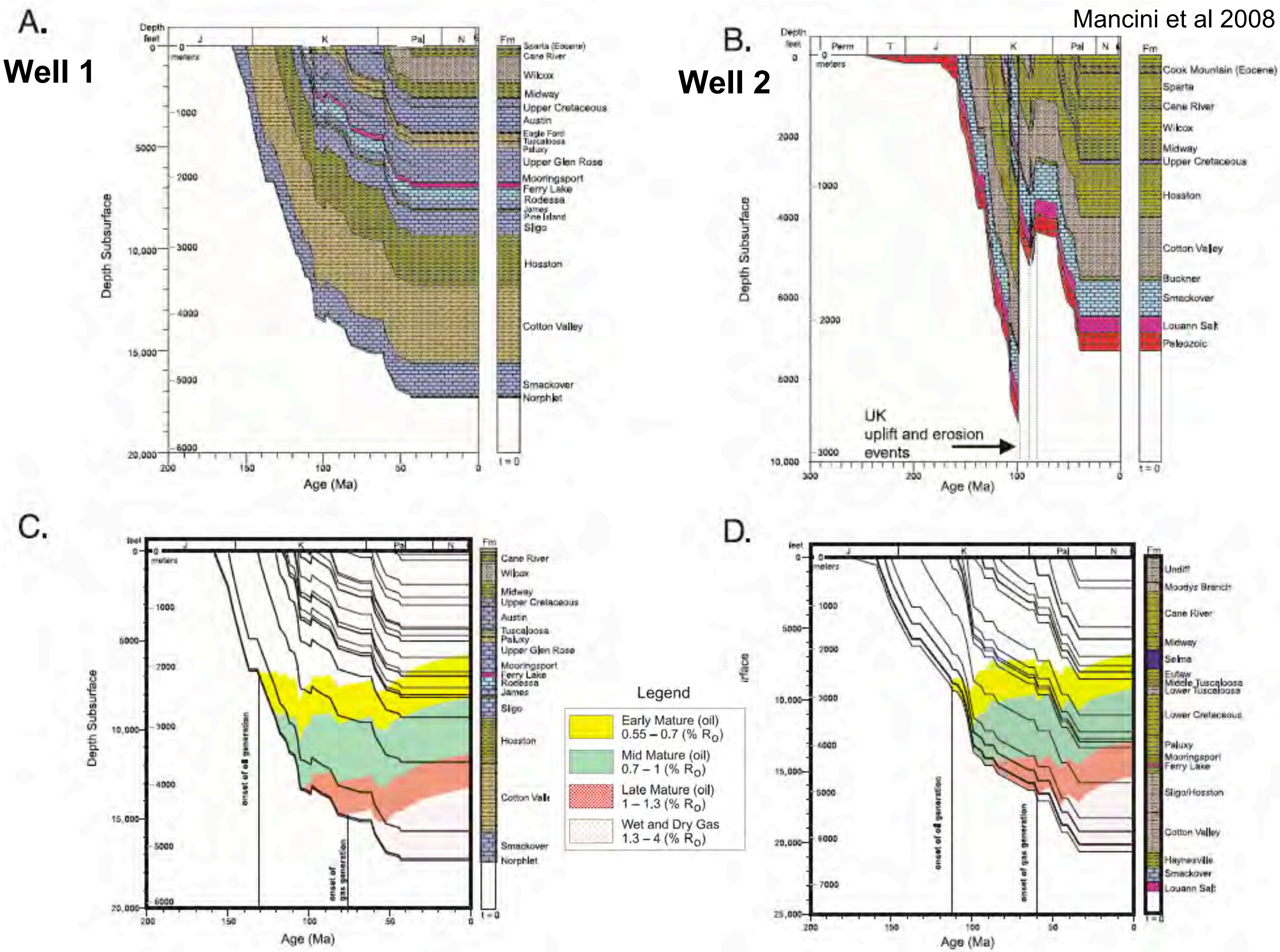


Mancini et al 2008



Mancini et al 2008
A.
Well 1
B.
Well 2
C.
D.
Depth Subsurface
Age (Ma)
Sparta (Eocene)
Cane River
Wilcox
Midway
Upper Cretaceous
Austin
Eagle Ford
Tuscaloosa
Paluxy
Upper Glen Rose
Mooringsport
Ferry Lake
Rodessa
James
Pine Island
Sligo
Hosston
Cotton Valley
Smackover
Norphlet
Cook Mountain (Eocene)
Sparta
Buckner
Louann Salt
Paleozoic
UK
uplift and erosion
events
onset of oil generation
onset of gas generation
Legend
Early Mature (oil) 0.55 – 0.7 (% Ro)
Mid Mature (oil) 0.7 – 1 (% Ro)
Late Mature (oil) 1 – 1.3 (% Ro)
Wet and Dry Gas 1.3 – 4 (% Ro)
Undiff
Moodys Branch
Selma
Eutaw
Middle Tuscaloosa
Lower Tuscaloosa
Lower Cretaceous
Sligo/Hosston
Haynesville

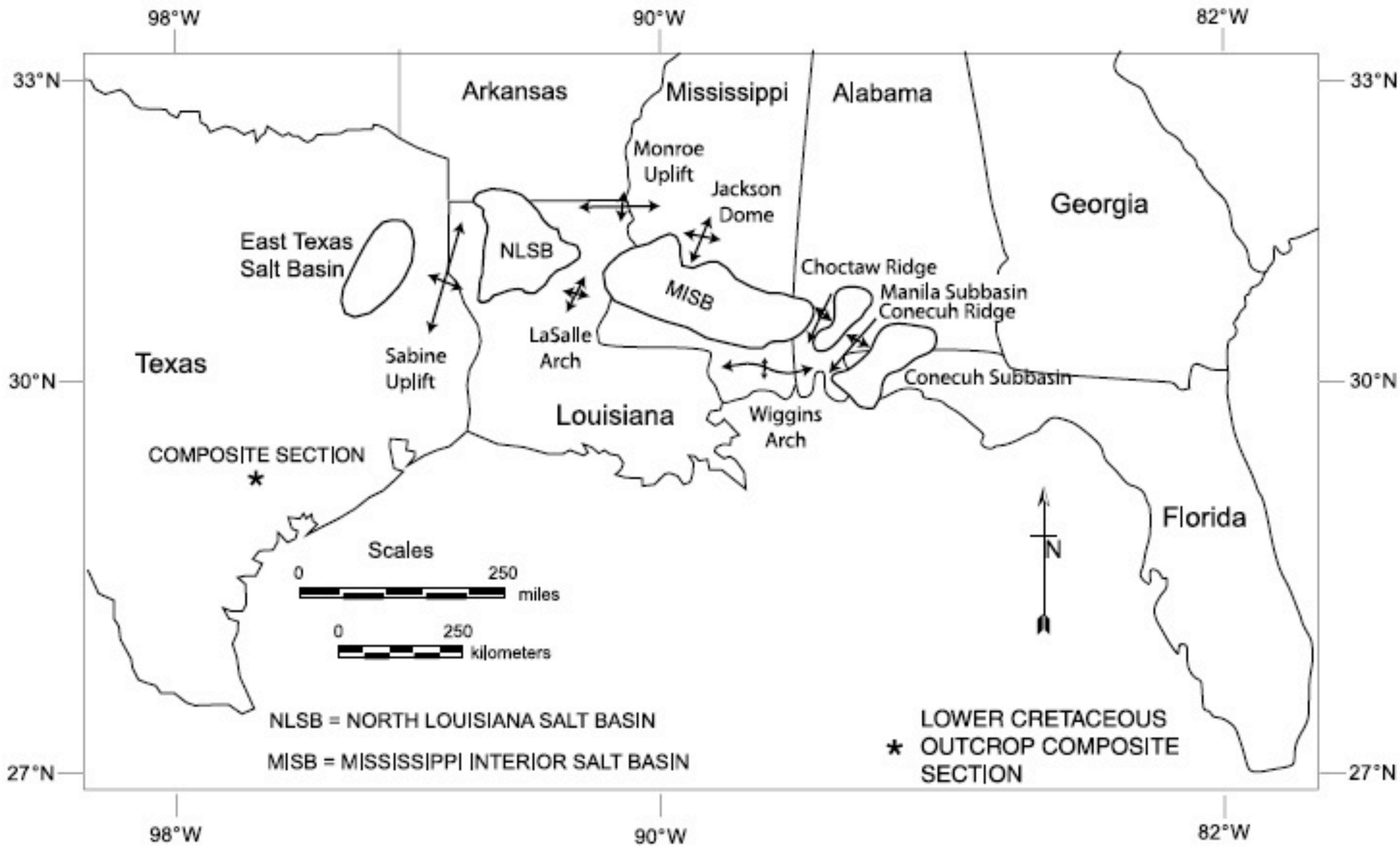


Figure 1. Interior Salt basins and subbasins and structural highs in the Gulf coastal plain and location of the Lower Cretaceous outcrop composite section in south-central Texas studied (modified from Mancini et al., 2008b).

Mancini, Obid et al 2008

Cretaceous Sections Louisana-Alabama

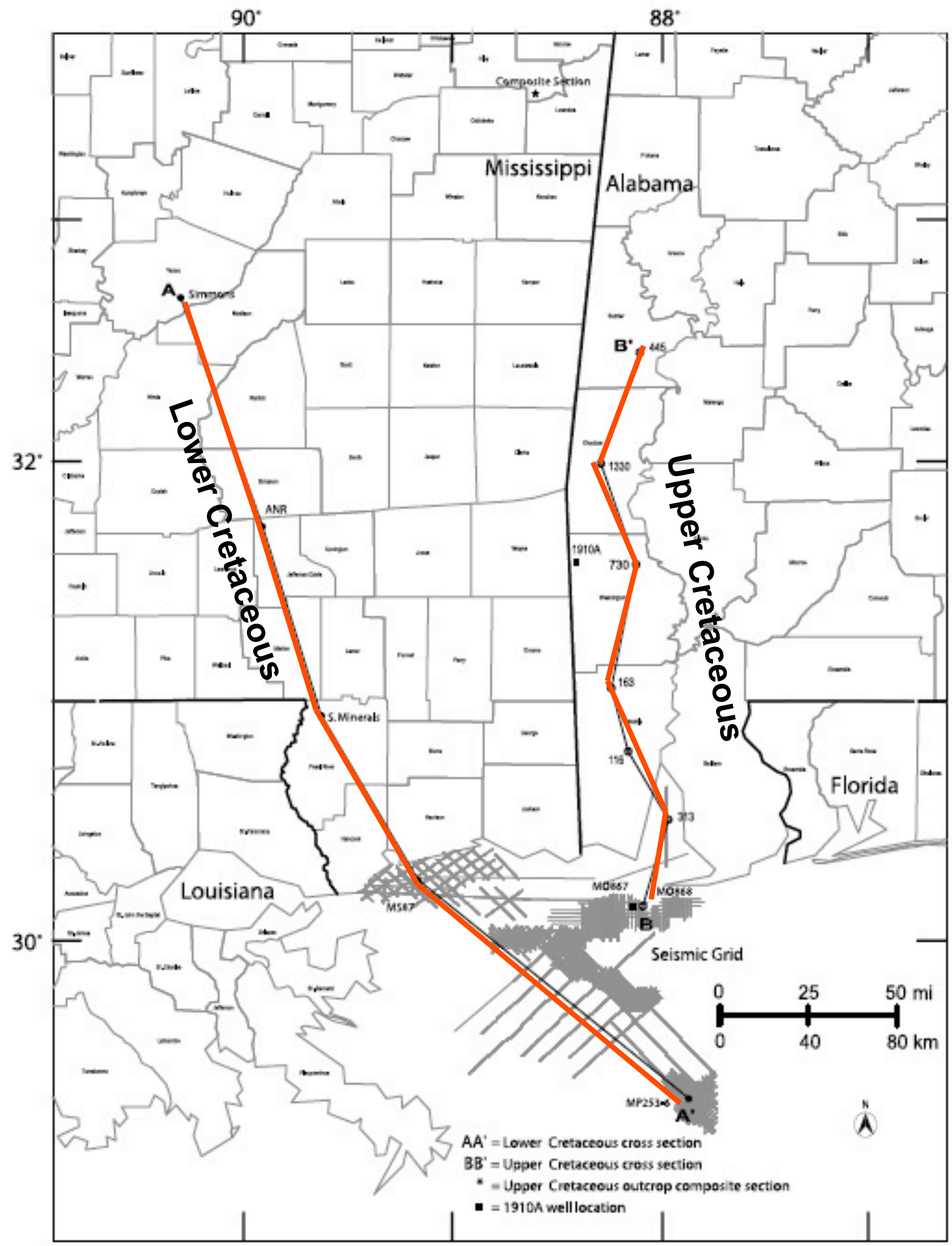
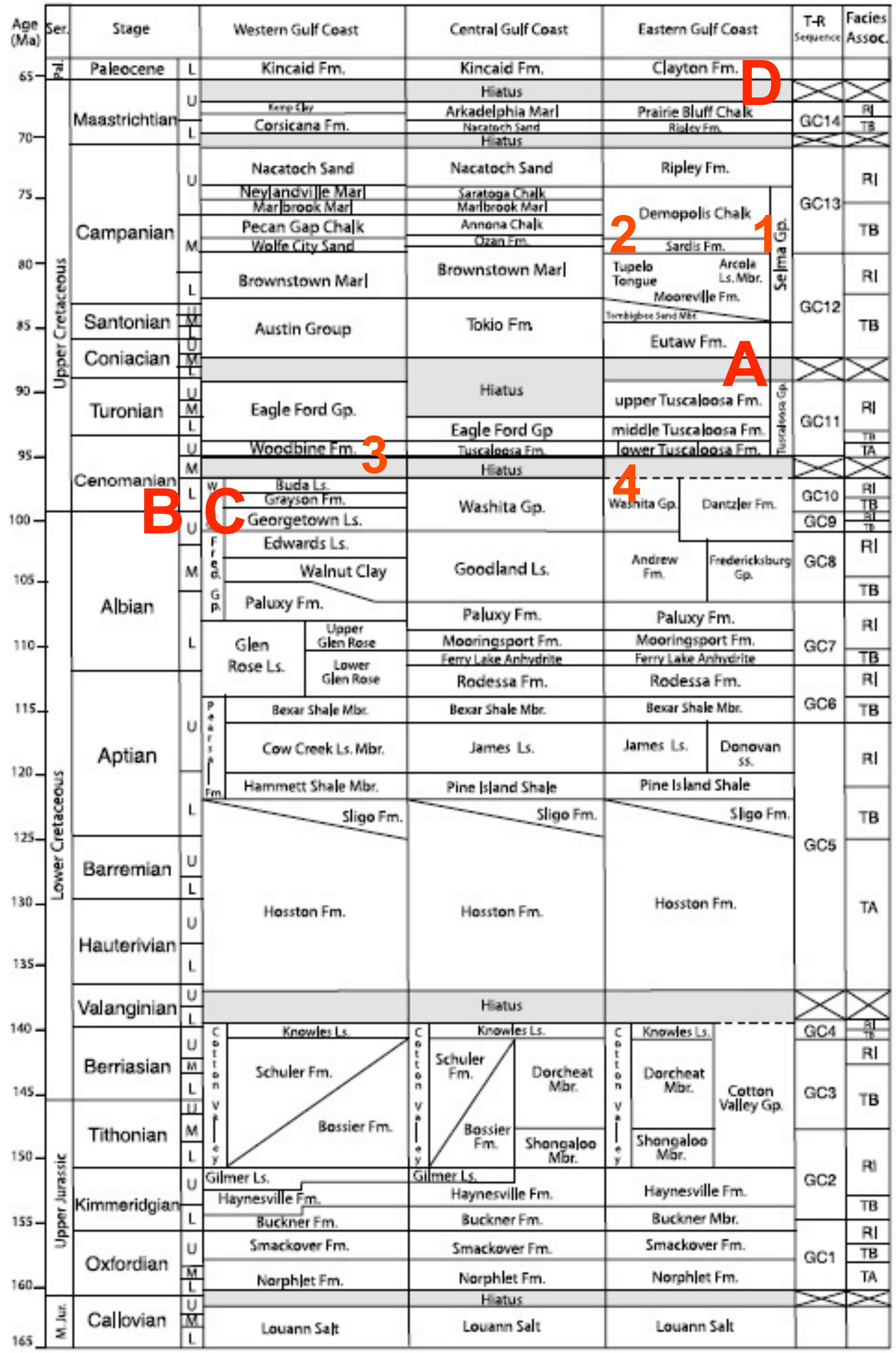
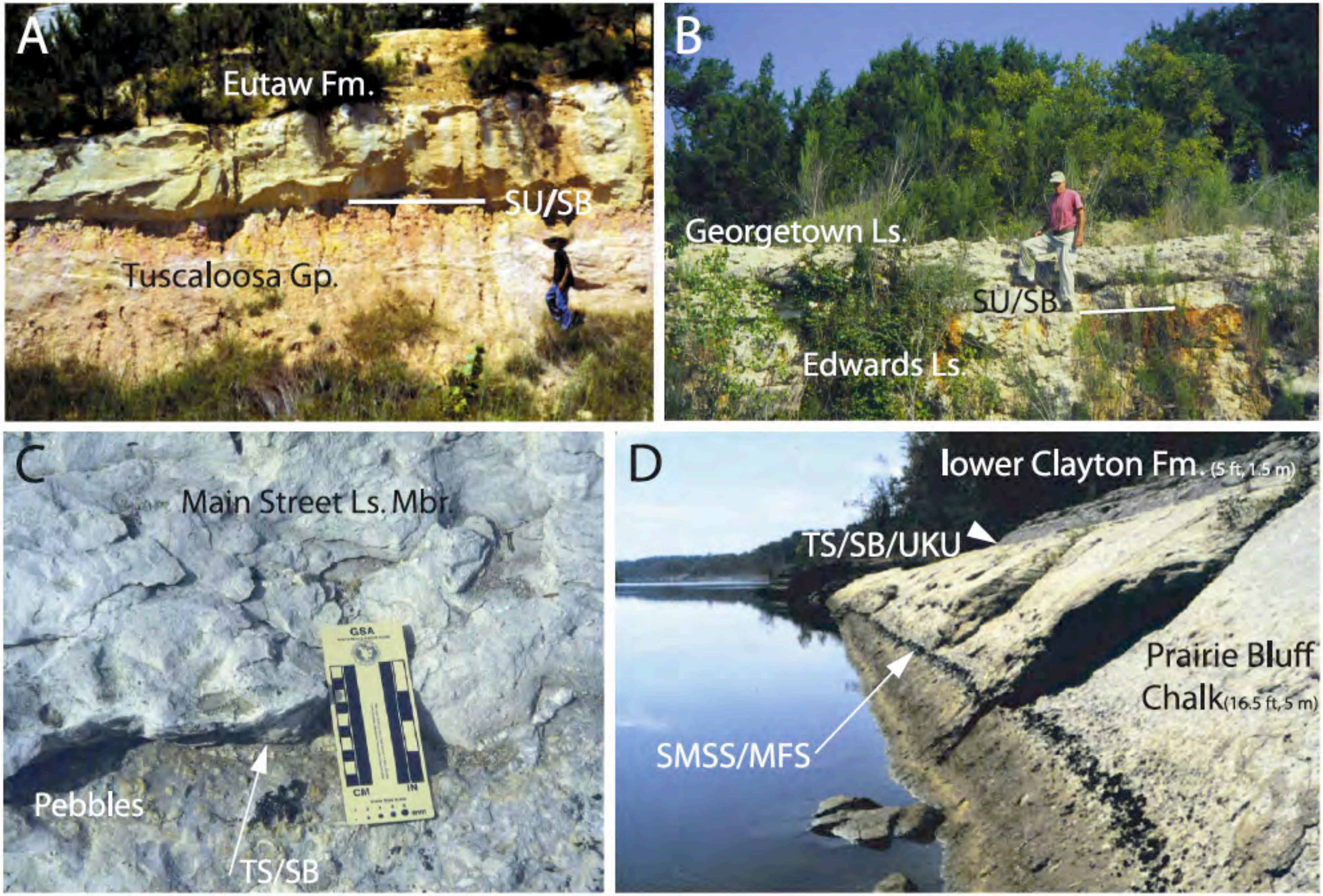


Figure 2. Map showing the location of the Upper Cretaceous outcrop composite section, wells, grid of seismic sections studied, and lines of prepared cross sections.

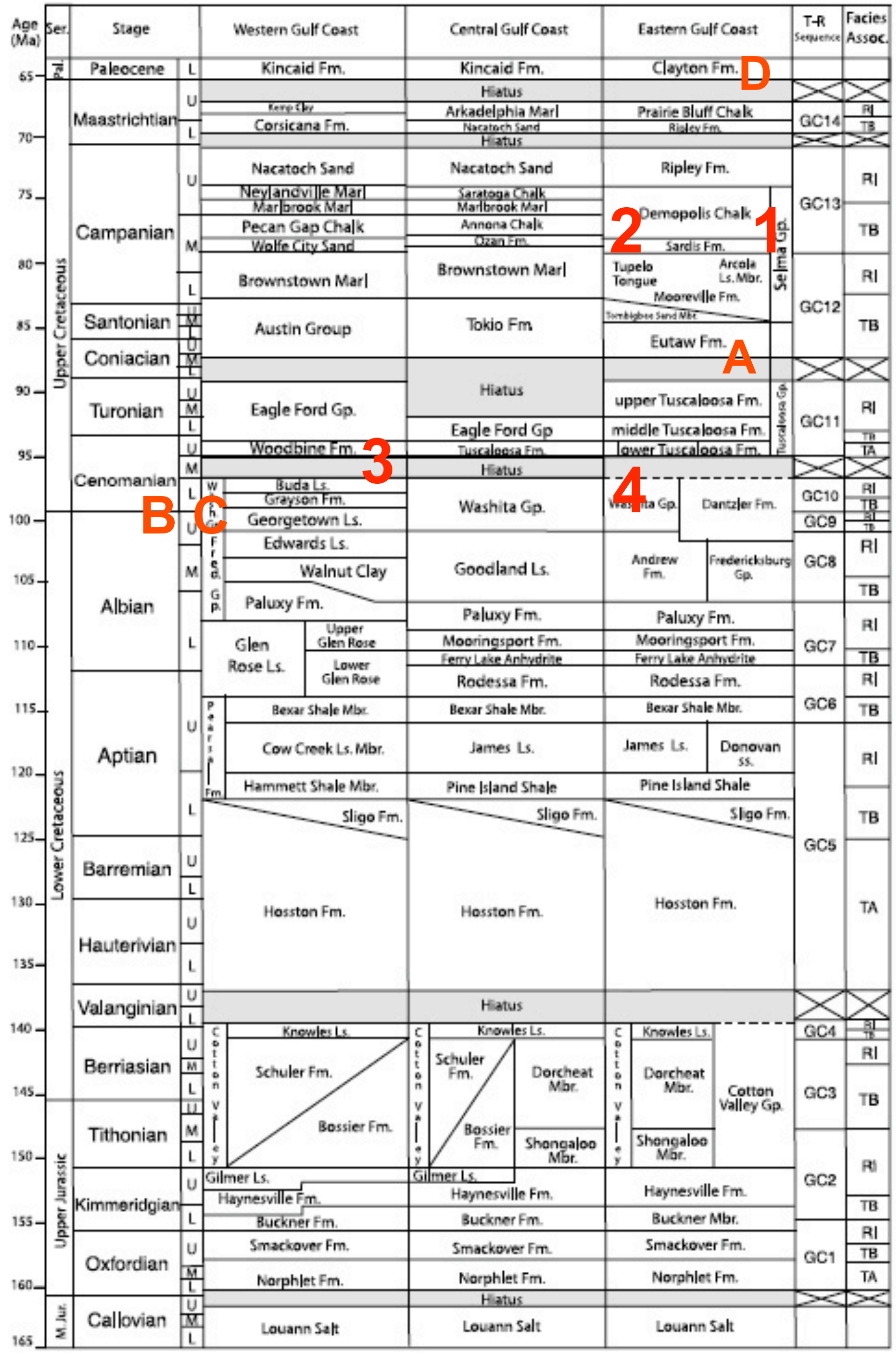
Mancini, Obid et al 2008



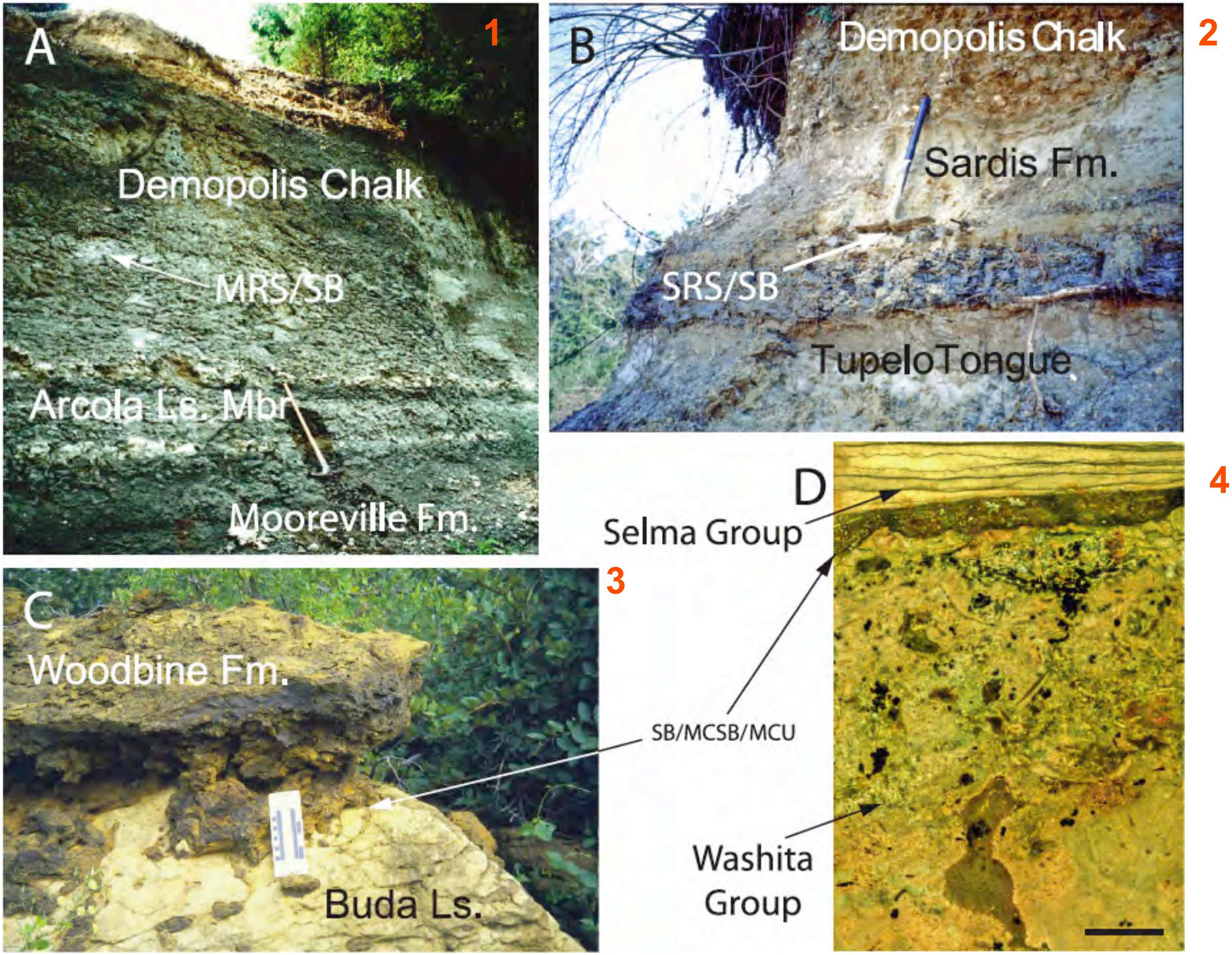
Mancini, Obid et al 2008



Mancini, Obid et al 2008



Mancini, Obid et al 2008



Mancini, Obid et al 2008

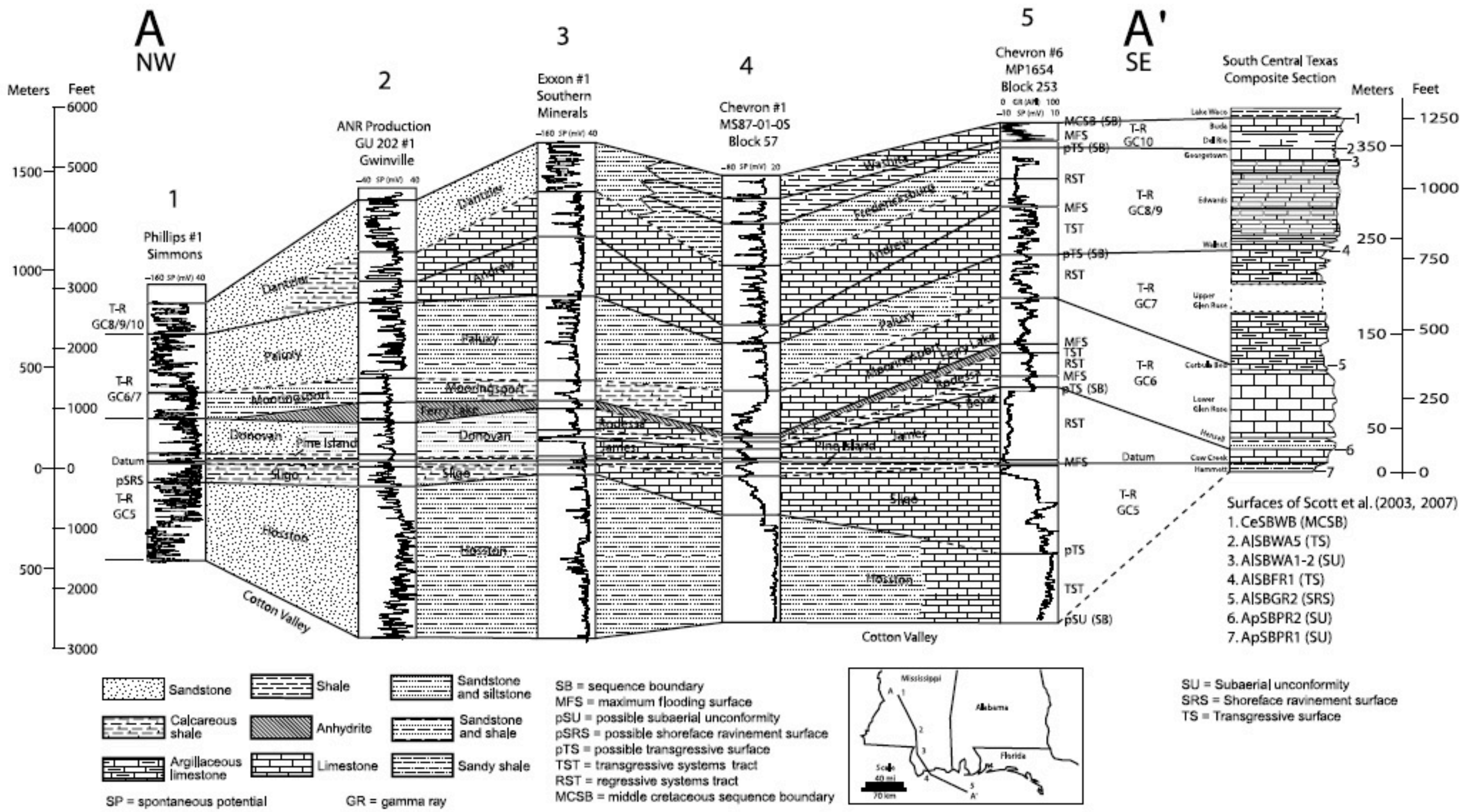


Figure 13. Northwest to southeast cross section AA′ showing the correlation of Lower Cretaceous strata from an inner shelf setting to an outer shelf setting and the correlation to Lower Cretaceous strata in outcrop along the Guadalupe and Blanco Rivers, Comal and Hayes counties, south-central Texas, western Gulf coastal plain. The Lake Waco Formation is part of the Eagle Ford Group. The Del Rio Clay is equivalent to the Grayson Formation, and the Hensell Sand Member is equivalent to the Bexar Shale Member (Figure 3). See Figure 1 for the site of the Lower Cretaceous composite measured section, and Figure 2 for the location of wells and line of cross section. T-R = transgressive-regressive; GC = Gulf Coast.

Lower Cretaceous Section

Mancini, Obid et al 2008

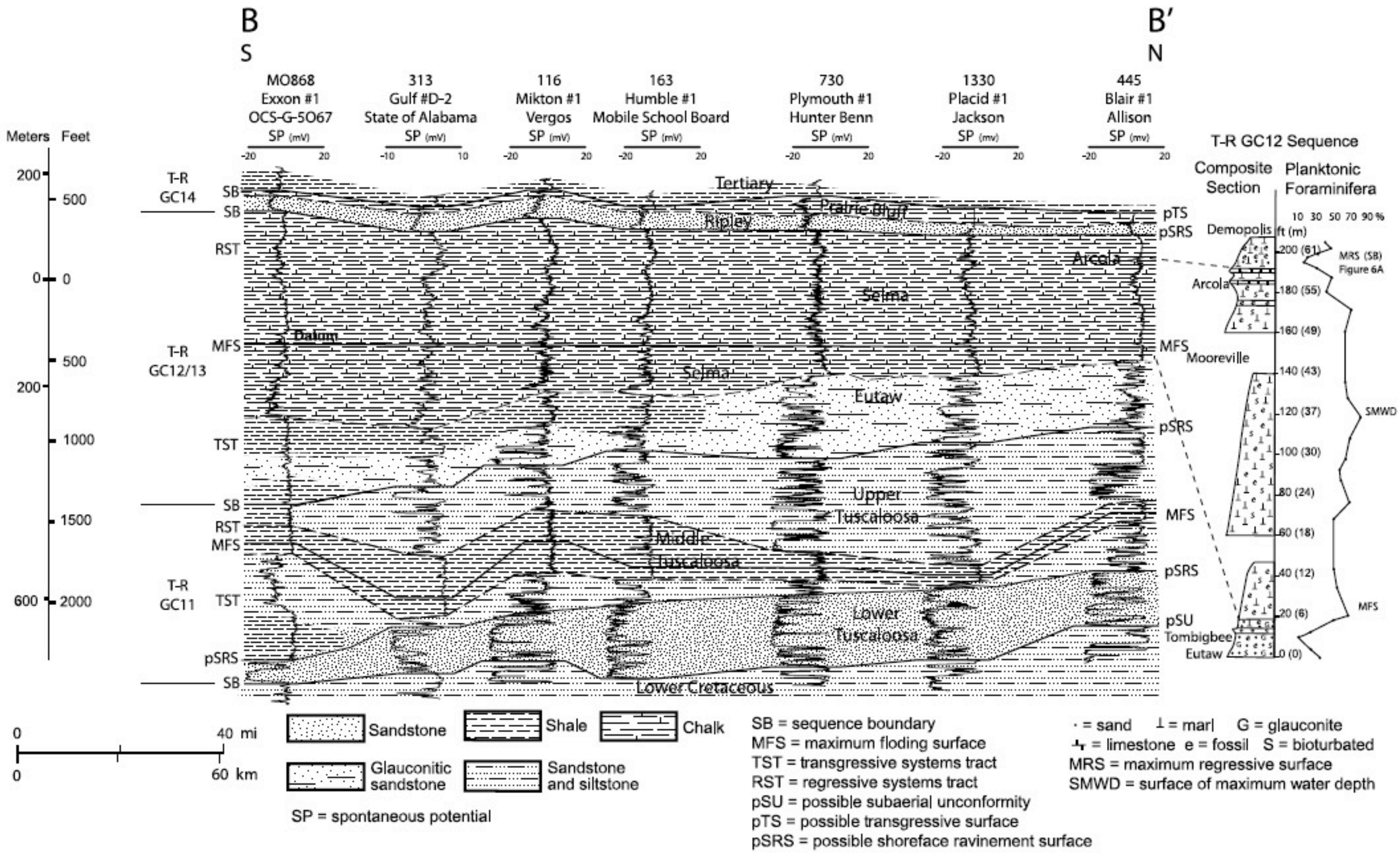
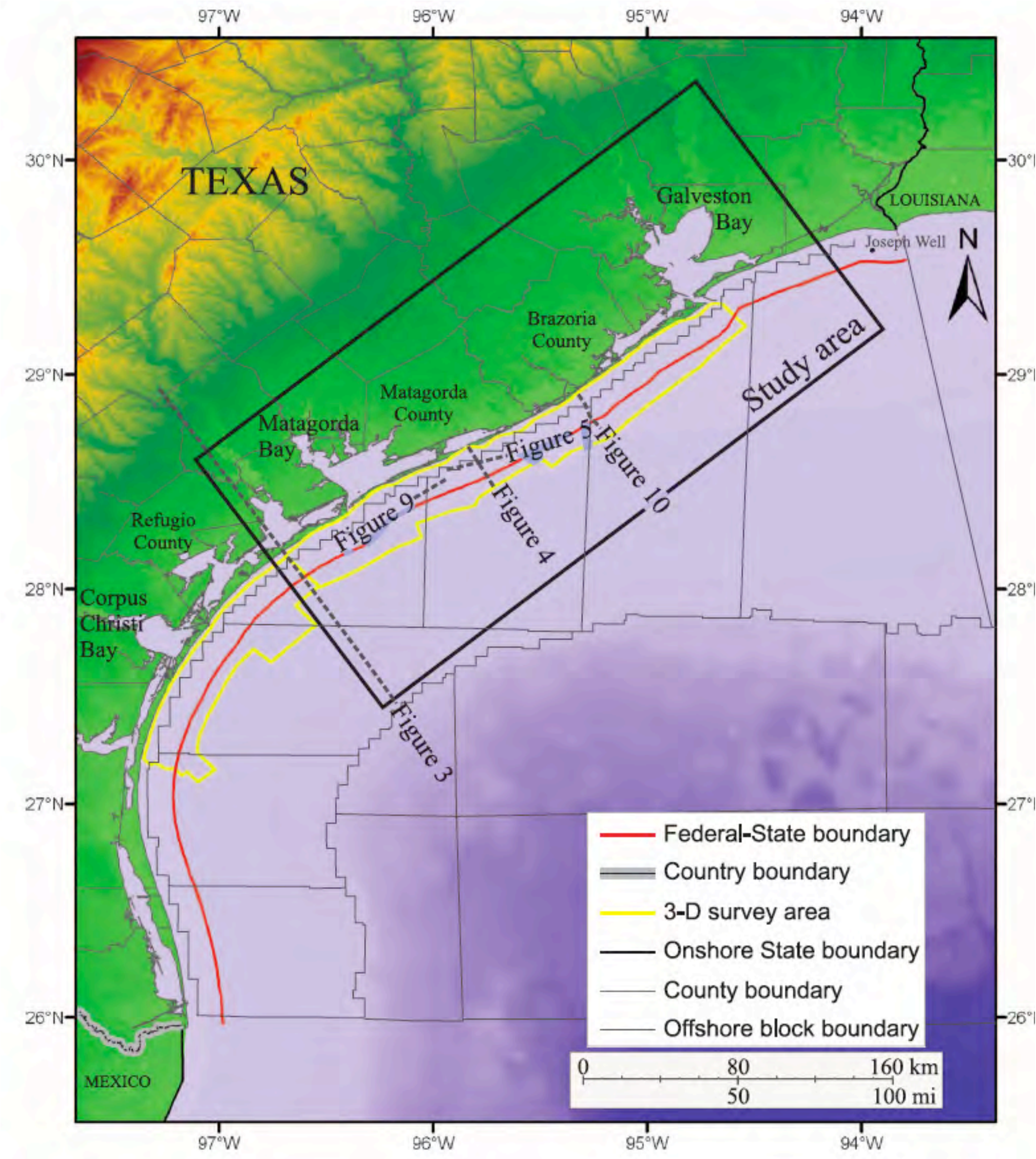


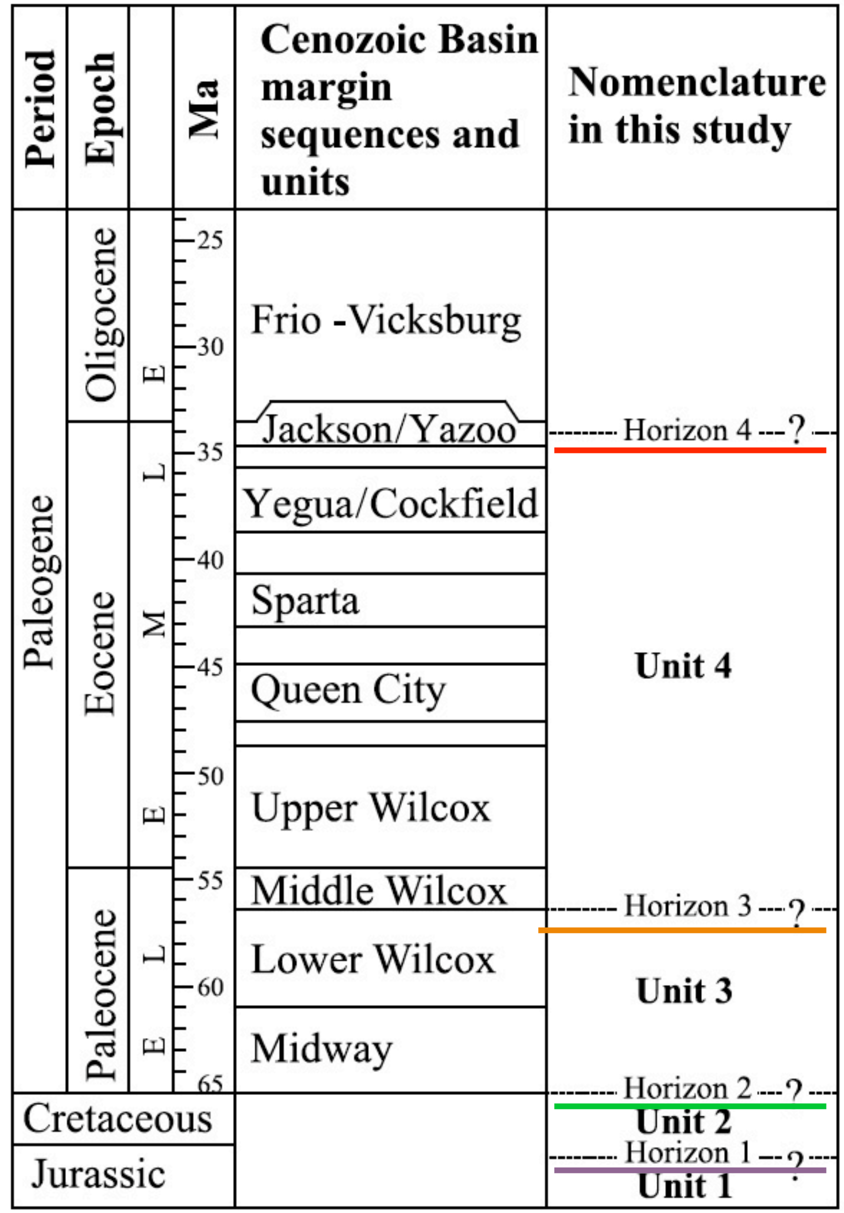
Figure 14. South to north cross section BB′ showing the correlation of Upper Cretaceous strata from an inner shelf setting to a middle shelf setting and the correlation of strata in outcrop along Tibbee Creek in eastern Mississippi to strata in the subsurface in the offshore northeastern Gulf of Mexico. See Figure 2 for the location of wells, site of the Upper Cretaceous composite measured section, and line of cross section. T-R = transgressive-regressive; GC = Gulf Coast.

Upper Cretaceous Section

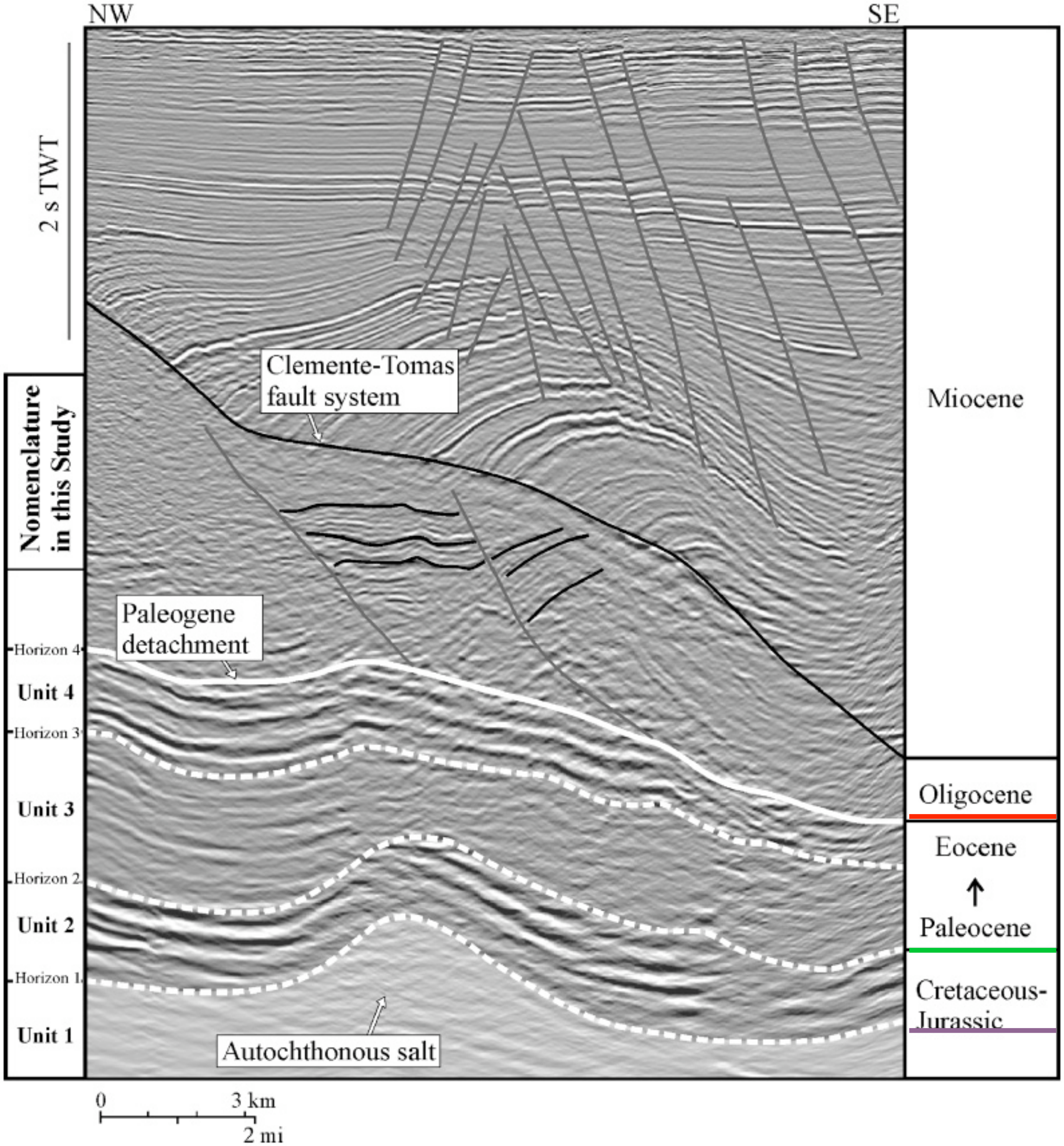
Mancini, Obid et al 2008

Cenozoic: Continued Shelf and Basin Sedimentation and Salt Dome Growth

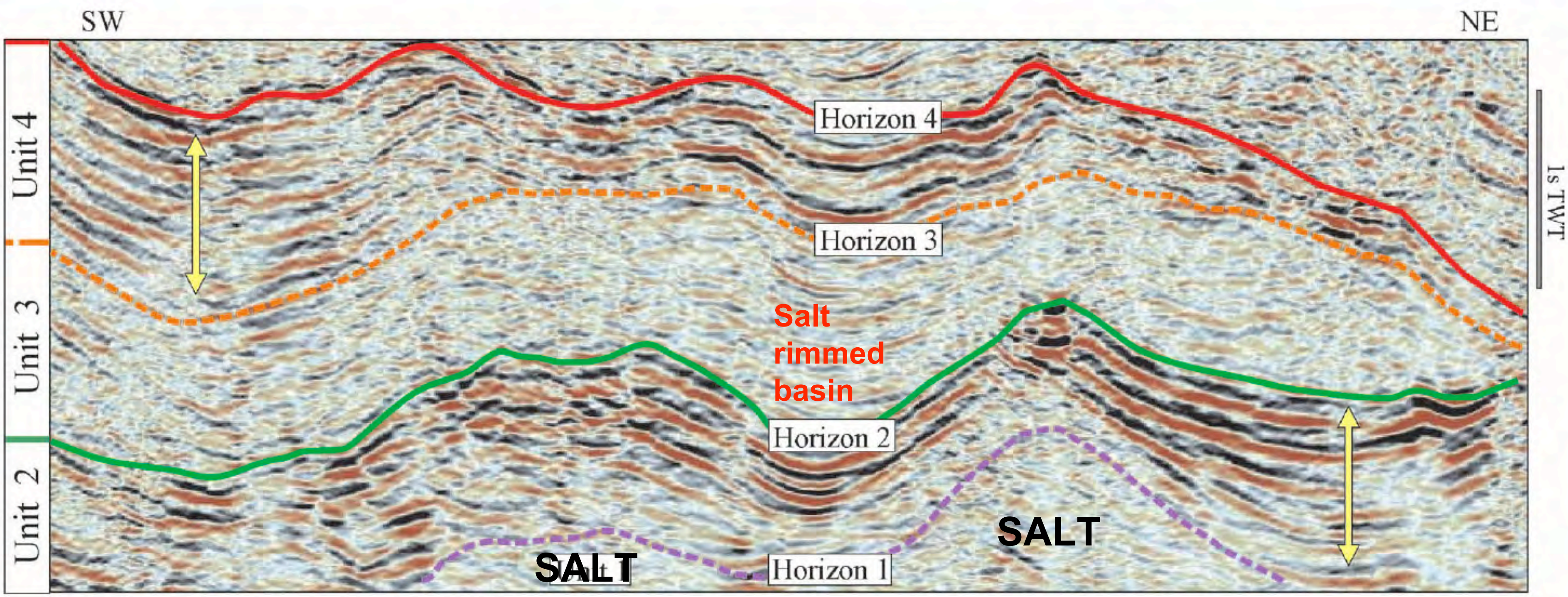


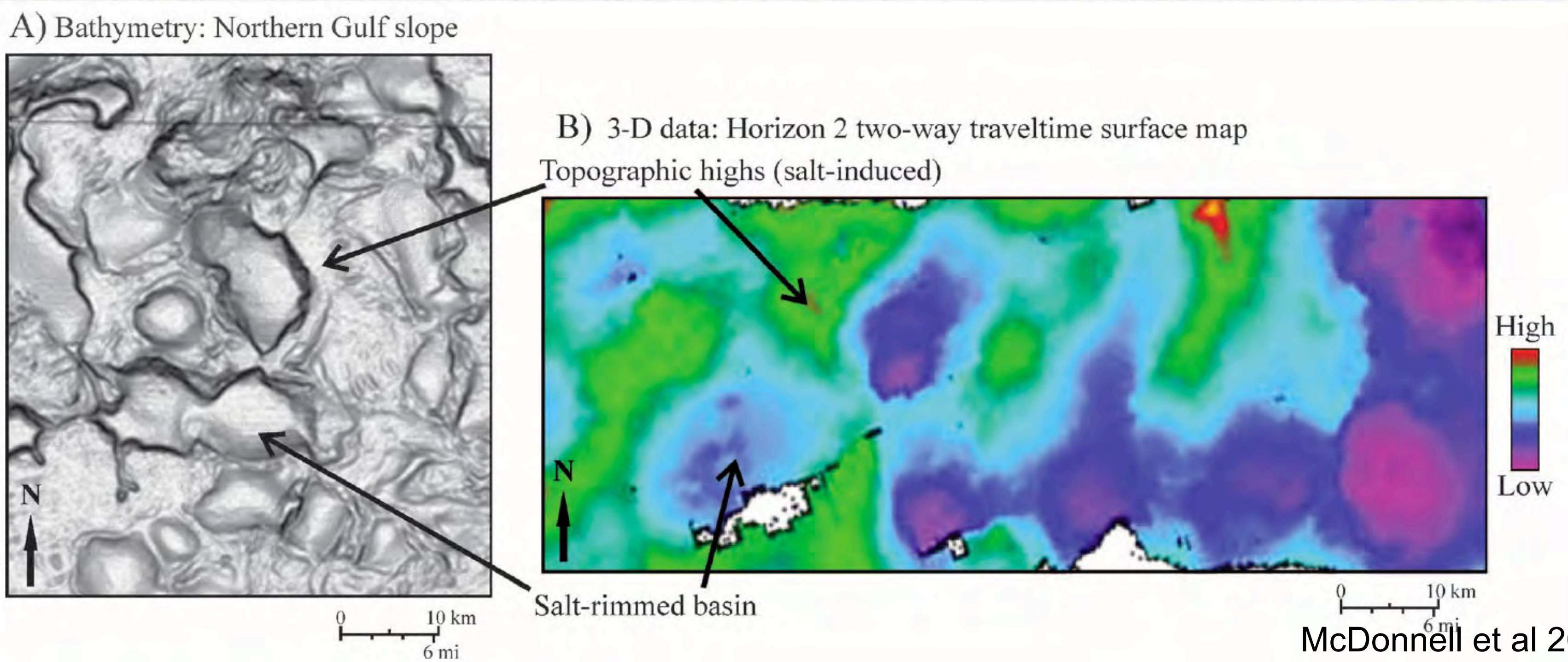


McDonnell et al 2008

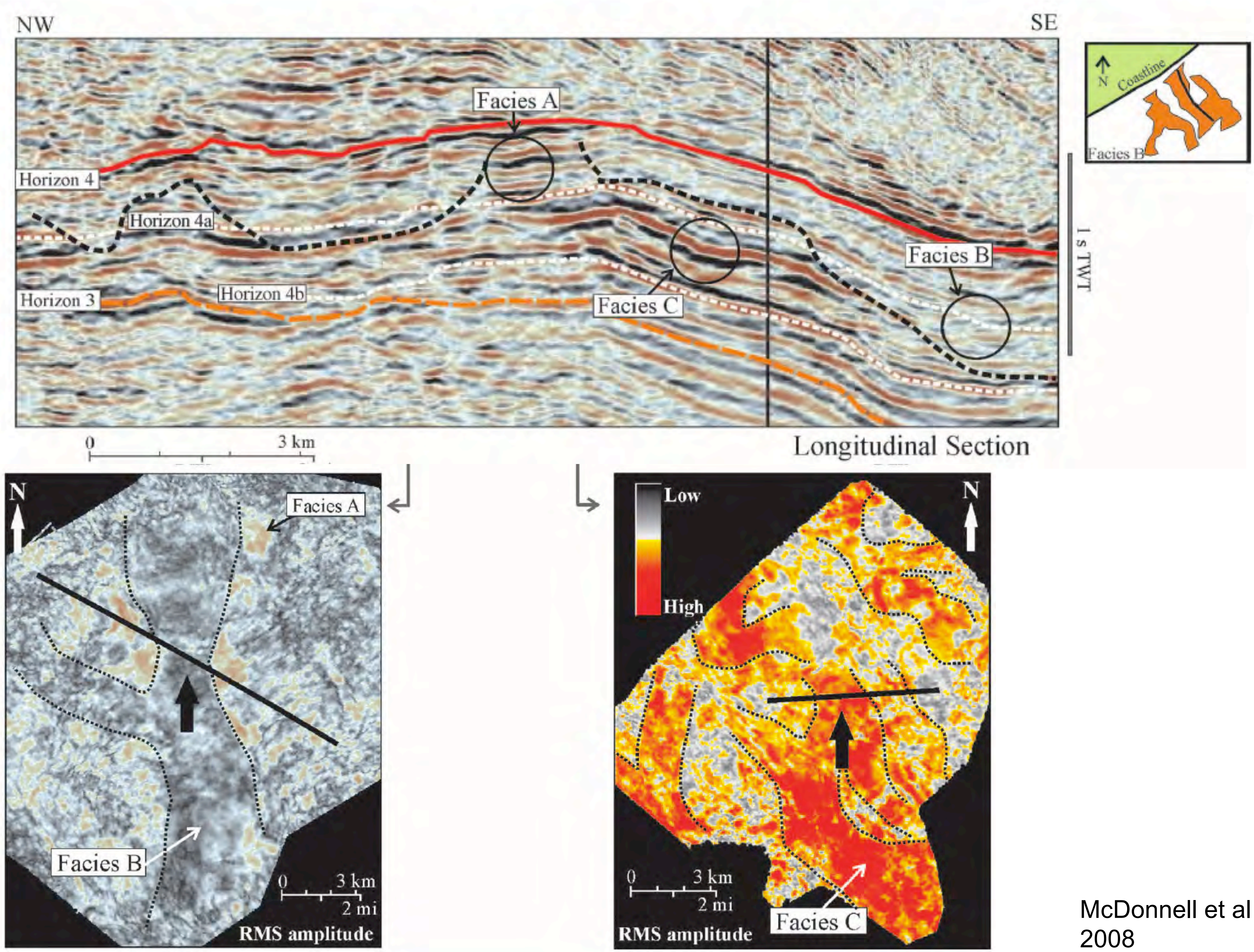


McDonnell et al 2008





McDonnell et al 2008



McDonnell et al 2008

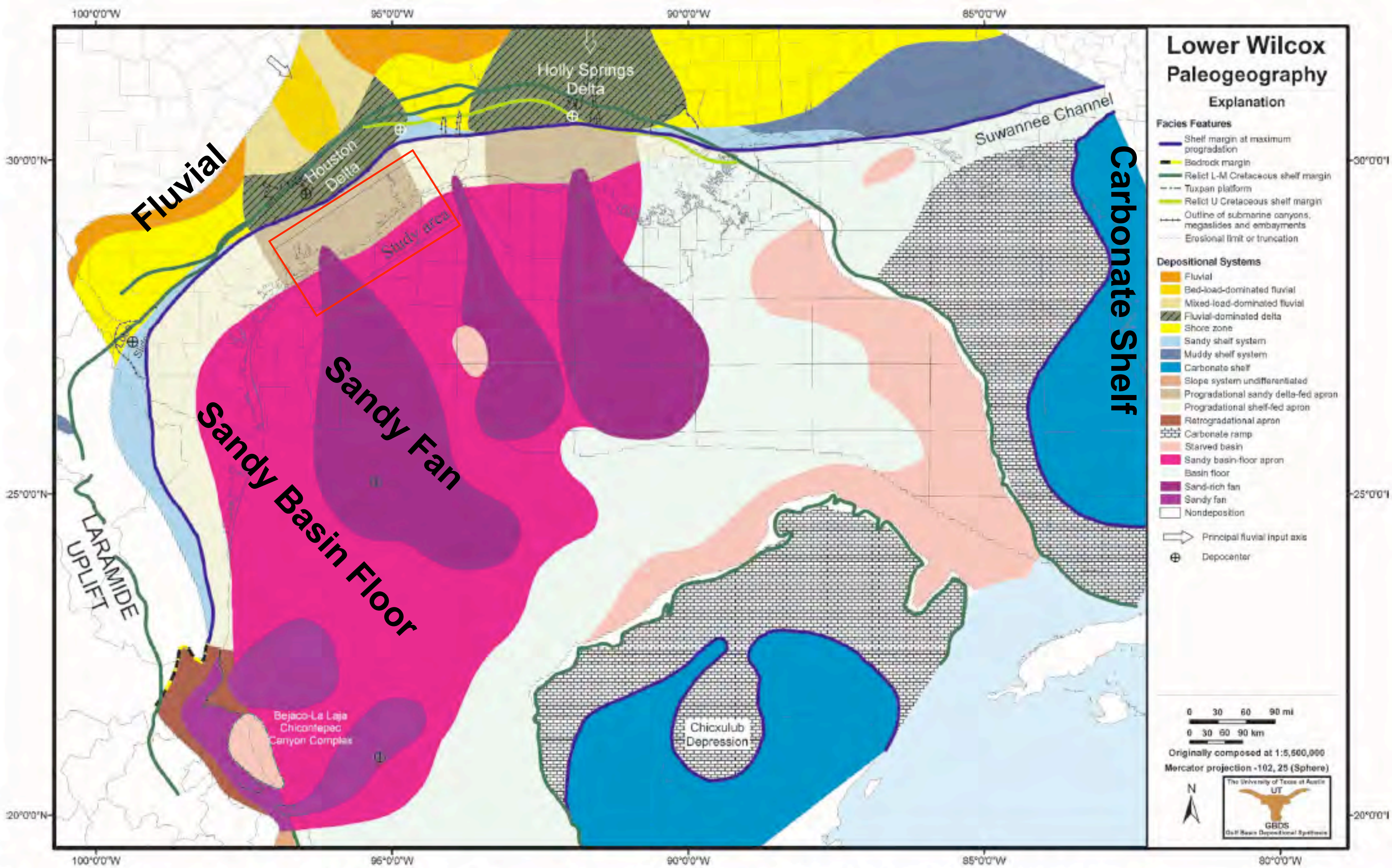
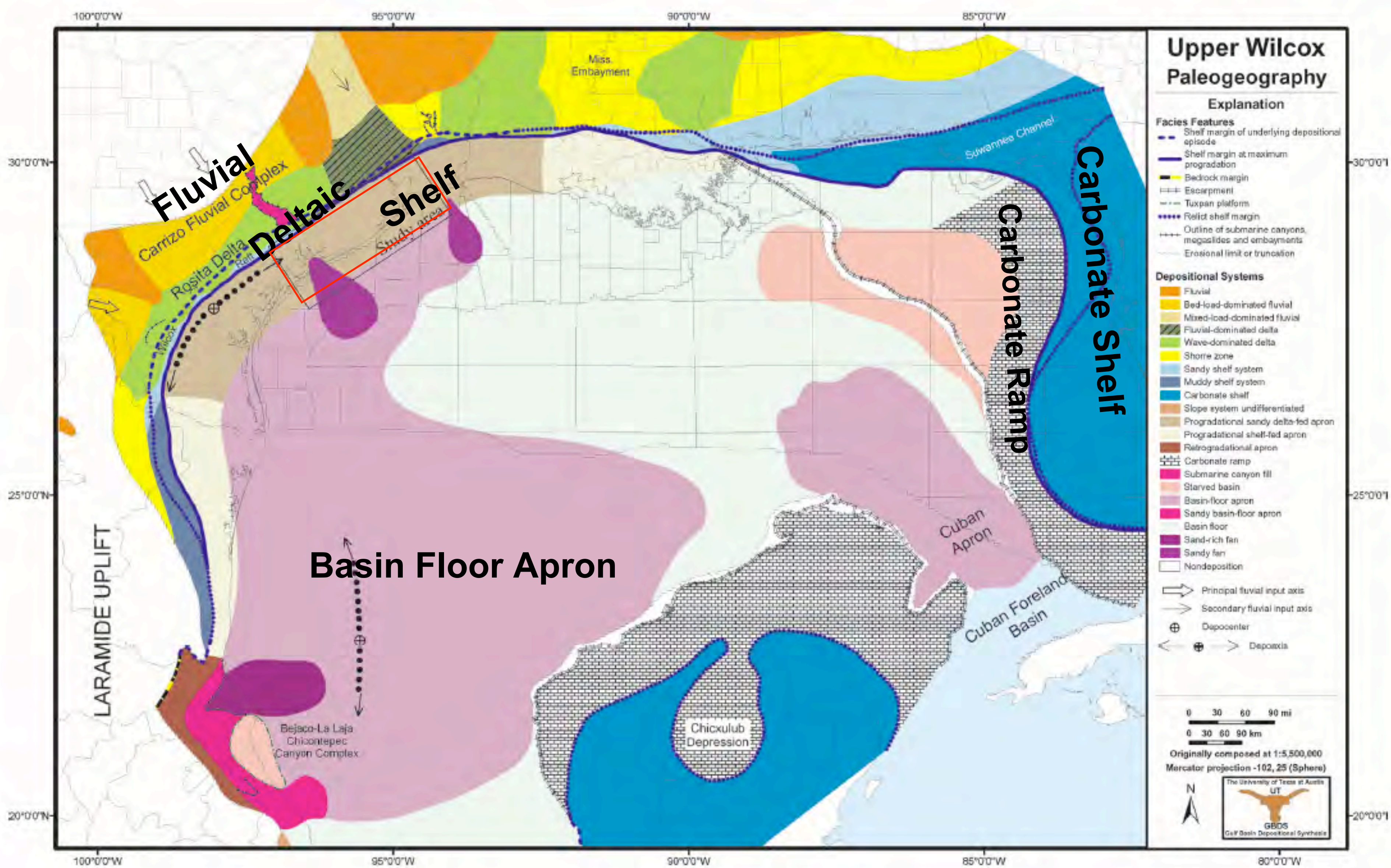


Figure 15. (A) Paleogeographic map for the lower Wilcox. (B) Paleogeographic map for the upper Wilcox Group. Modified from Galloway et al. (2000).

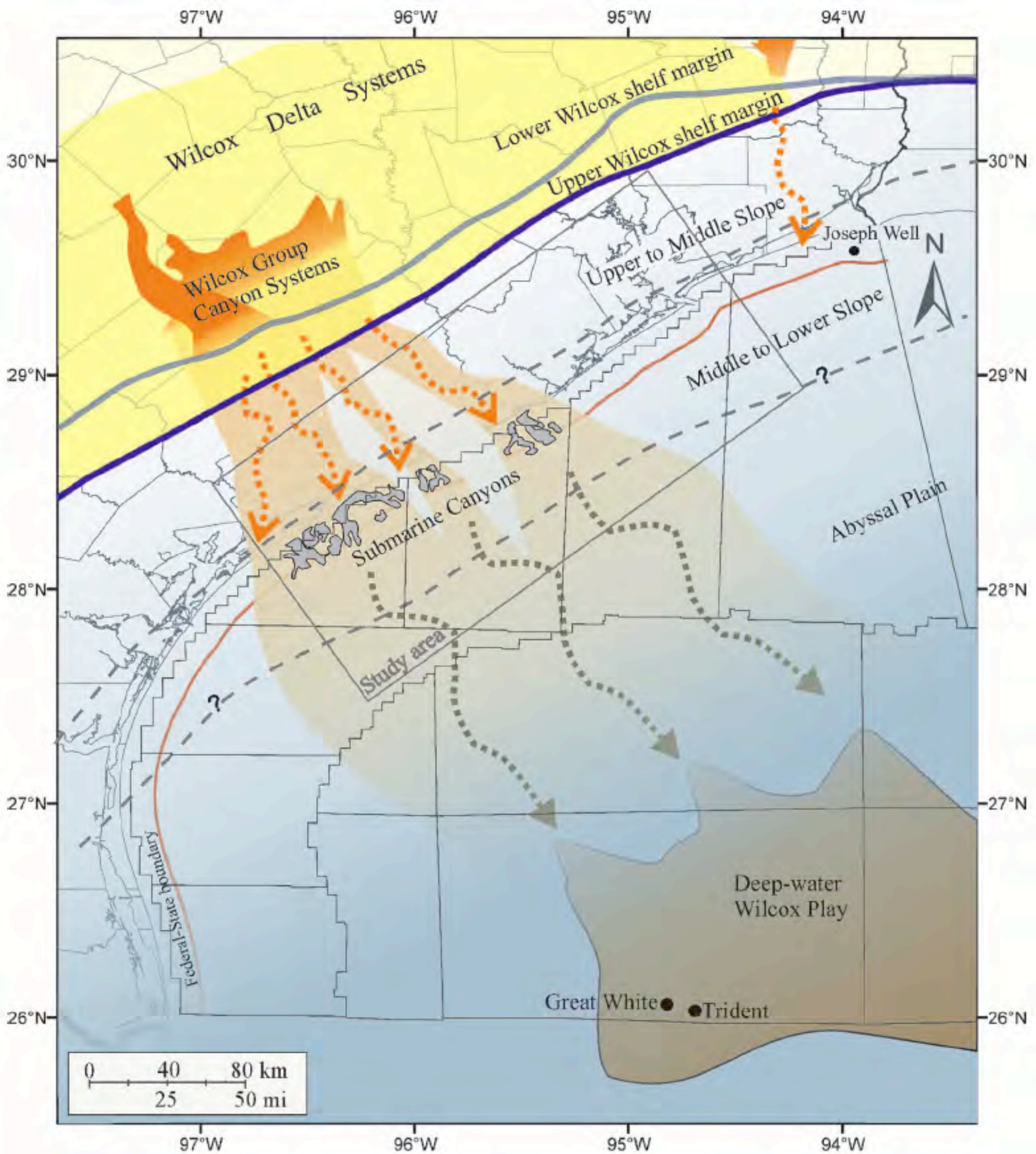
Paleocene Paleogeography

McDonnell et al 2008



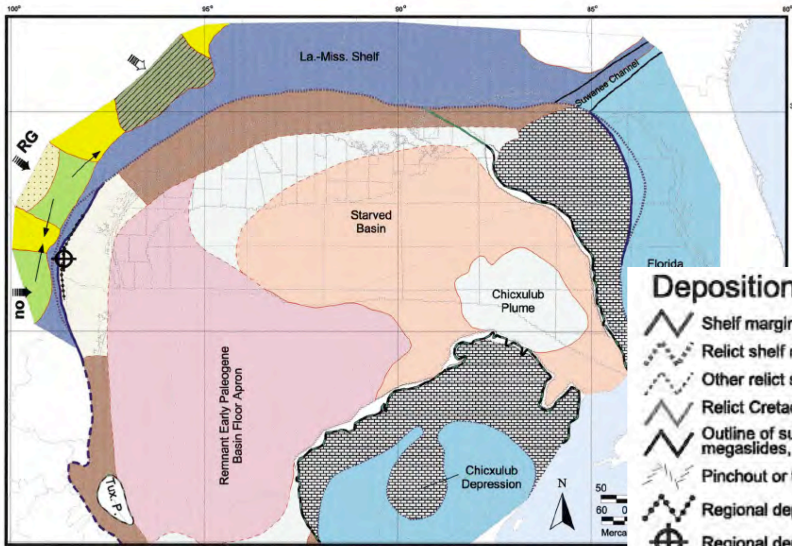
Early Eocene Paleogeography

McDonnell et al 2008



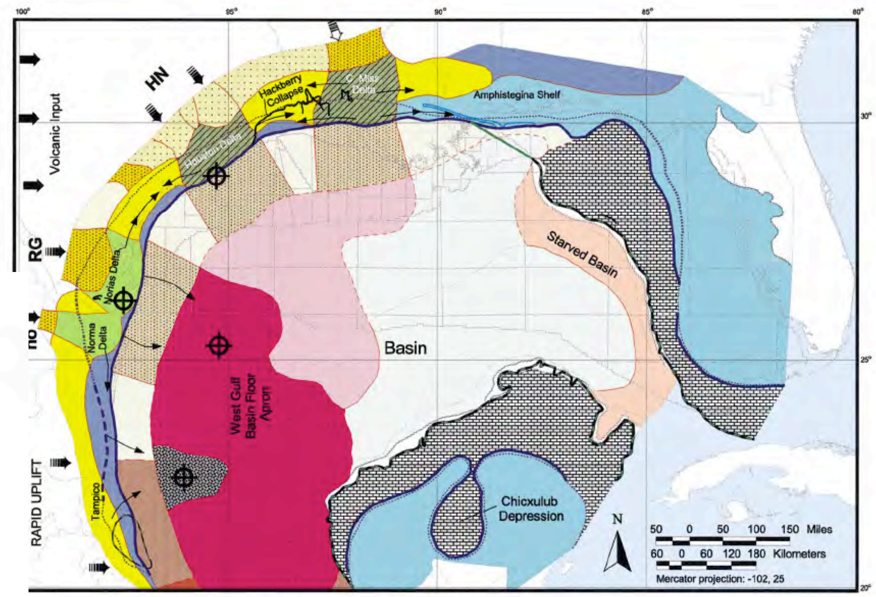
General Conclusion: growing salt domes control locations of submarine channels that carry sediment to the basin floor.

McDonnell et al 2008



e 7. Paleogeography of the Queen City (QC-C, 47.5–44.5 Ma) depisode. See Figures 3 and 4

47.5-44.5 Ma

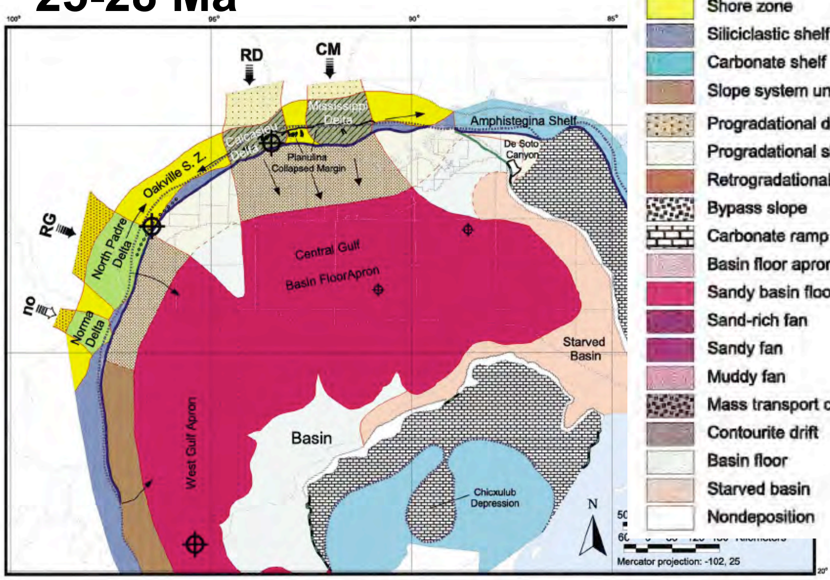


Paleogeography of the early Frio/Vicksburg (OF-E, 32.6–28 Ma) depisode. See Figures 3 and 4 for explanations of

32.6-28 Ma

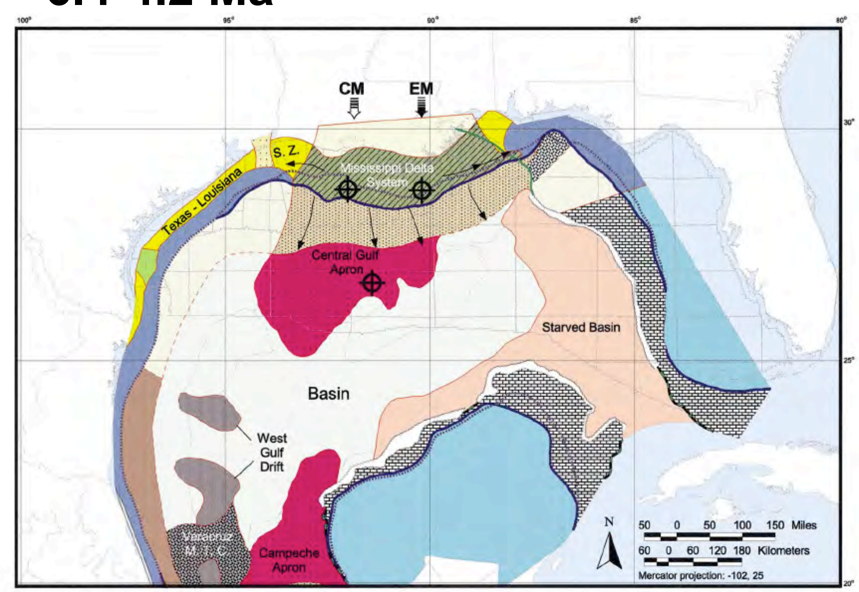
Galloway et al 2008

25-28 Ma

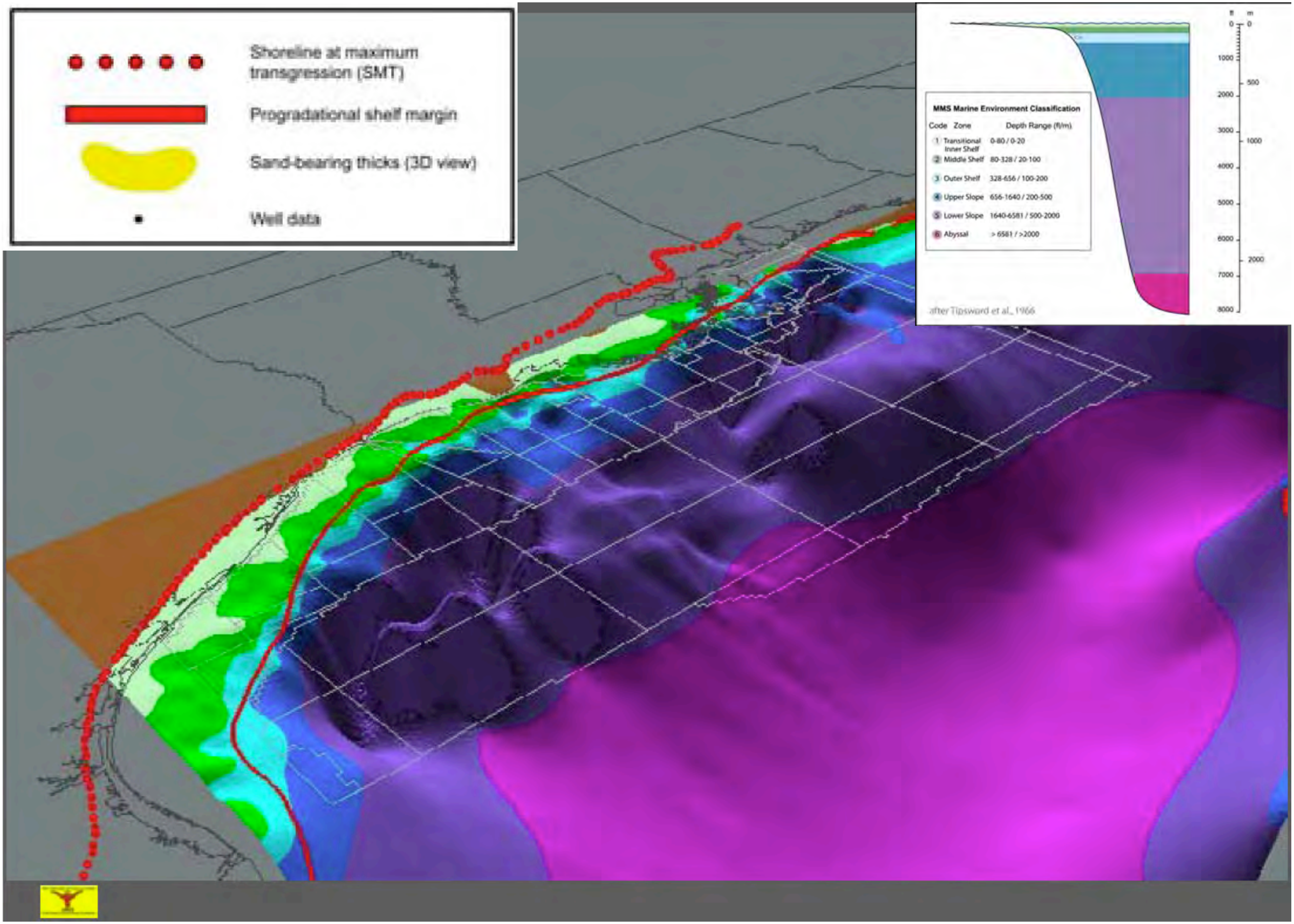


e 11. Paleogeography of the first early Miocene (LM1-G, 25–18 Ma) depisode. See Figures 3 and 4 for explanations of

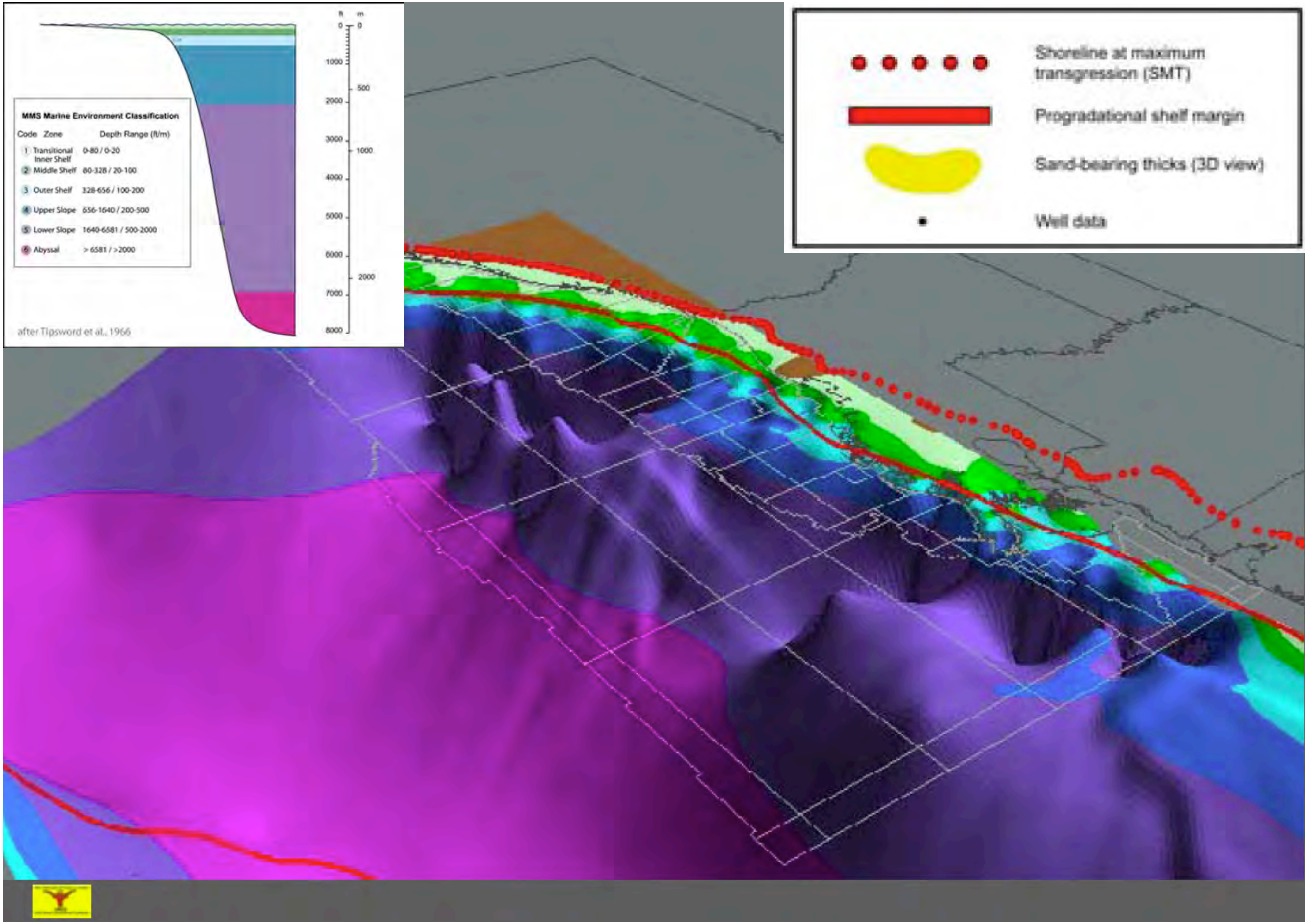
6.4-4.2 Ma



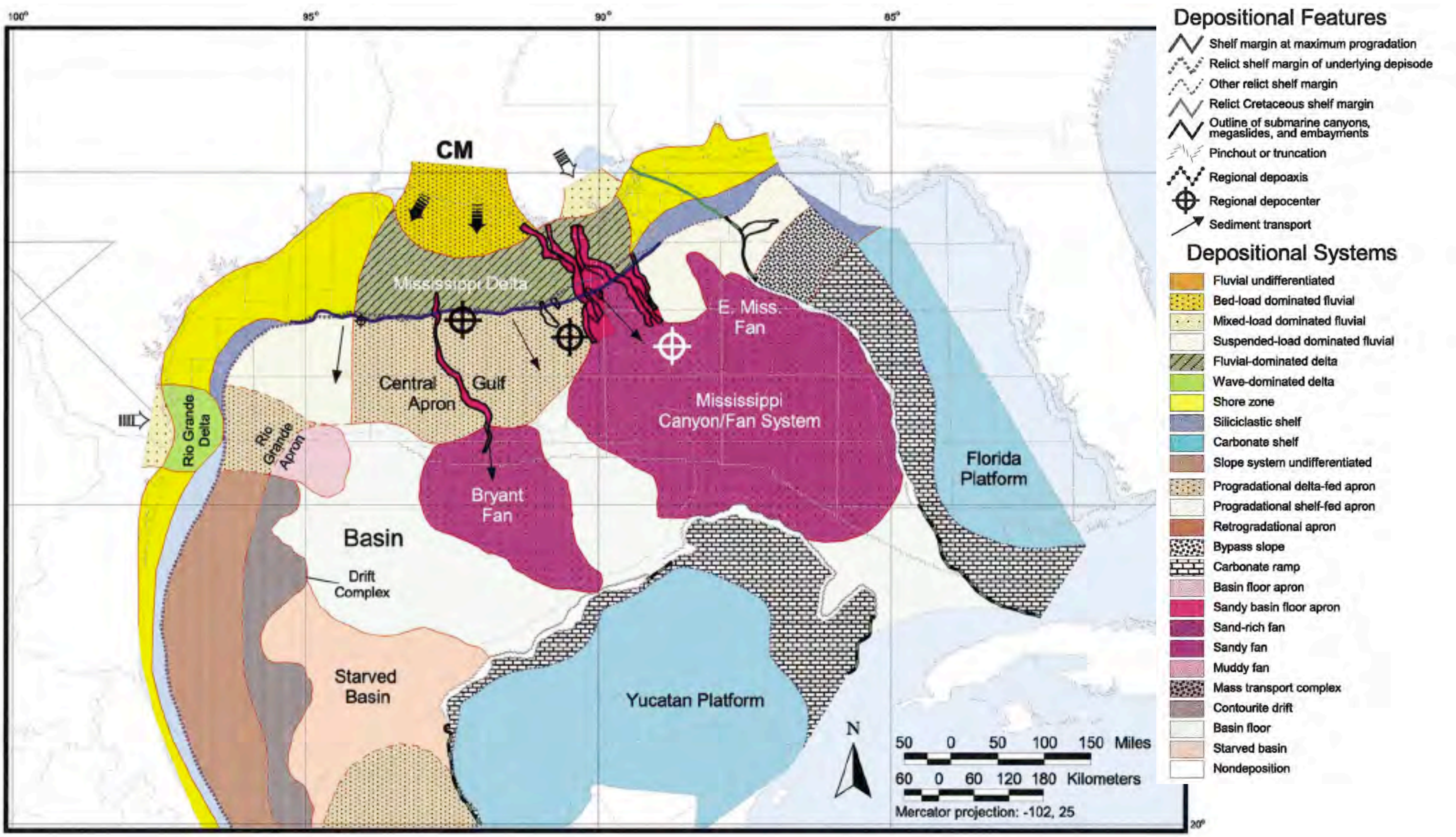
e 14. Paleogeography of the *Buliminella* 1 (PB1-L, 6.4–4.2 Ma) depisode. See Figures 3 and 4 for explanations of



Middle Miocene Oblique View to NE (Galloway et al 2003 AAPG Annual Meeting)



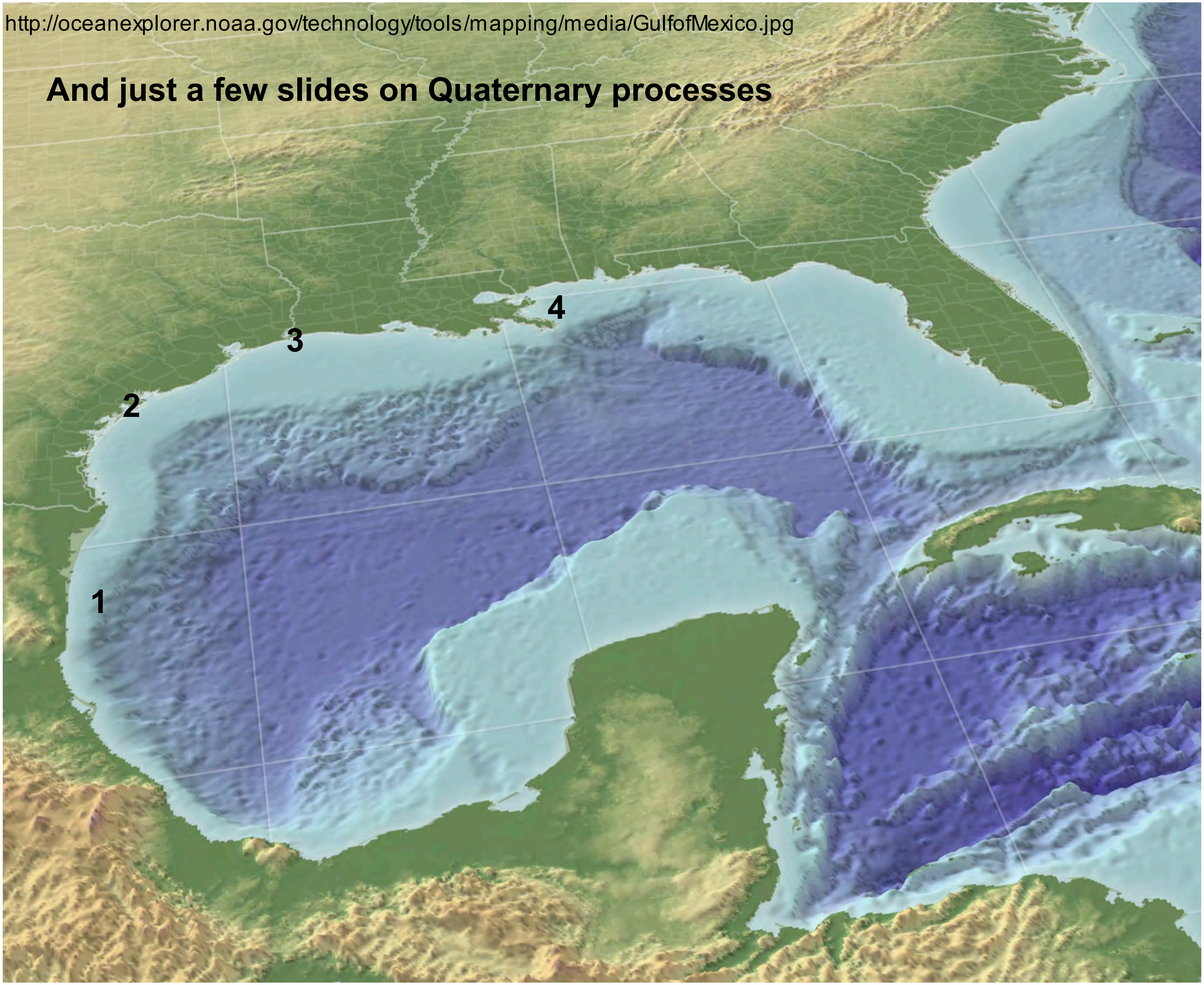
Middle Miocene Oblique View to NW (Galloway et al 2003 AAPG Annual Meeting)



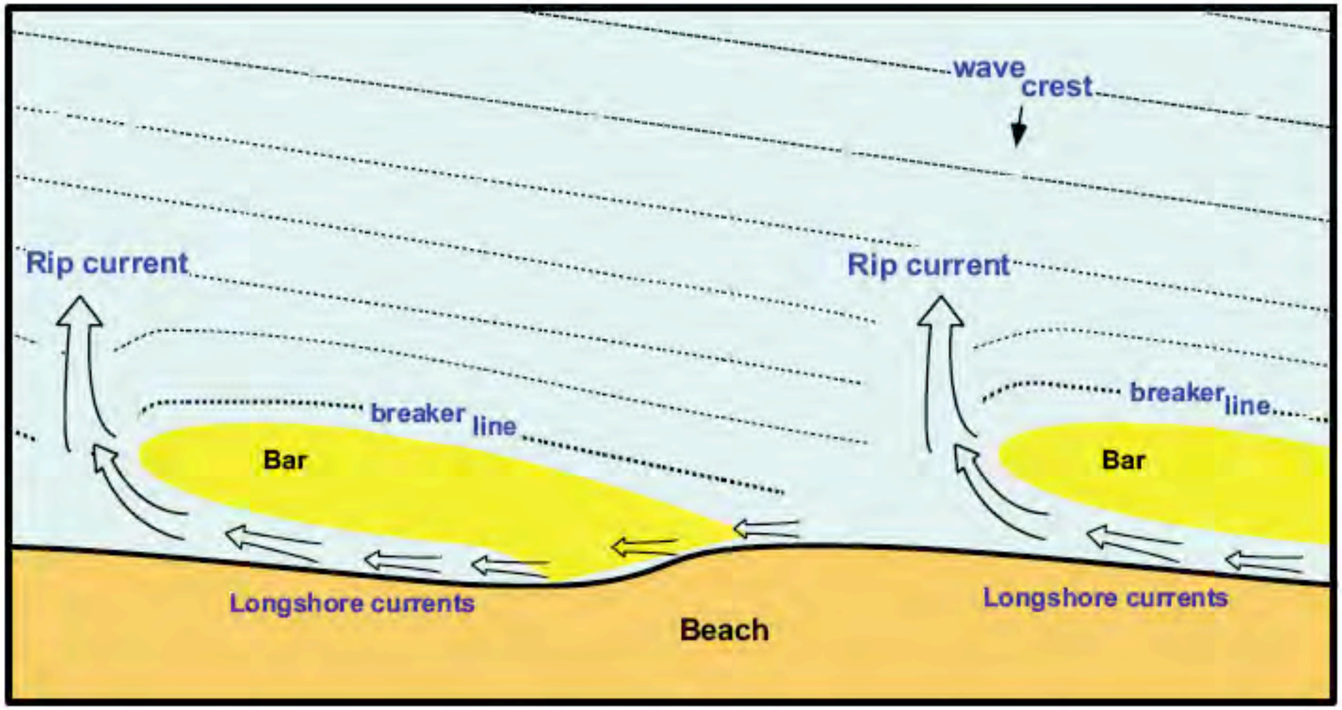
e **18.** Paleogeography of the Sangamon (PS-R, 0.6–0.1 Ma) depisode. See Figures 3 and 4 for explanations of syml

0.6-0.1 Ma

McDonnell et al 2008


http://oceanexplorer.noaa.gov/technology/tools/mapping/media/GulfofMexico.jpg
And just a few slides on Quaternary processes
4
3
2
1

Matagorda Island
Corpus Christi
Kleberg Dome
N
31.1 mi
© 2010 INEGI
© 2010 Google
© 2010 Europa Technologies
©2006 Google™
Pointer 27°10'29.51" N 96°55'56.36" W
Streaming |||||||||| 100%
Eye alt 96.89 mi



35.—Nearshore circulation cells where wave incidence is oblique to coast. Longshore currents tend to flow in one direction only. uch cells promote the development of attached oblique bars (shown in yellow).

Clifton 2006

ISS017E018804

Port Isabel, South Padre Island and Laguna Madre, Texas

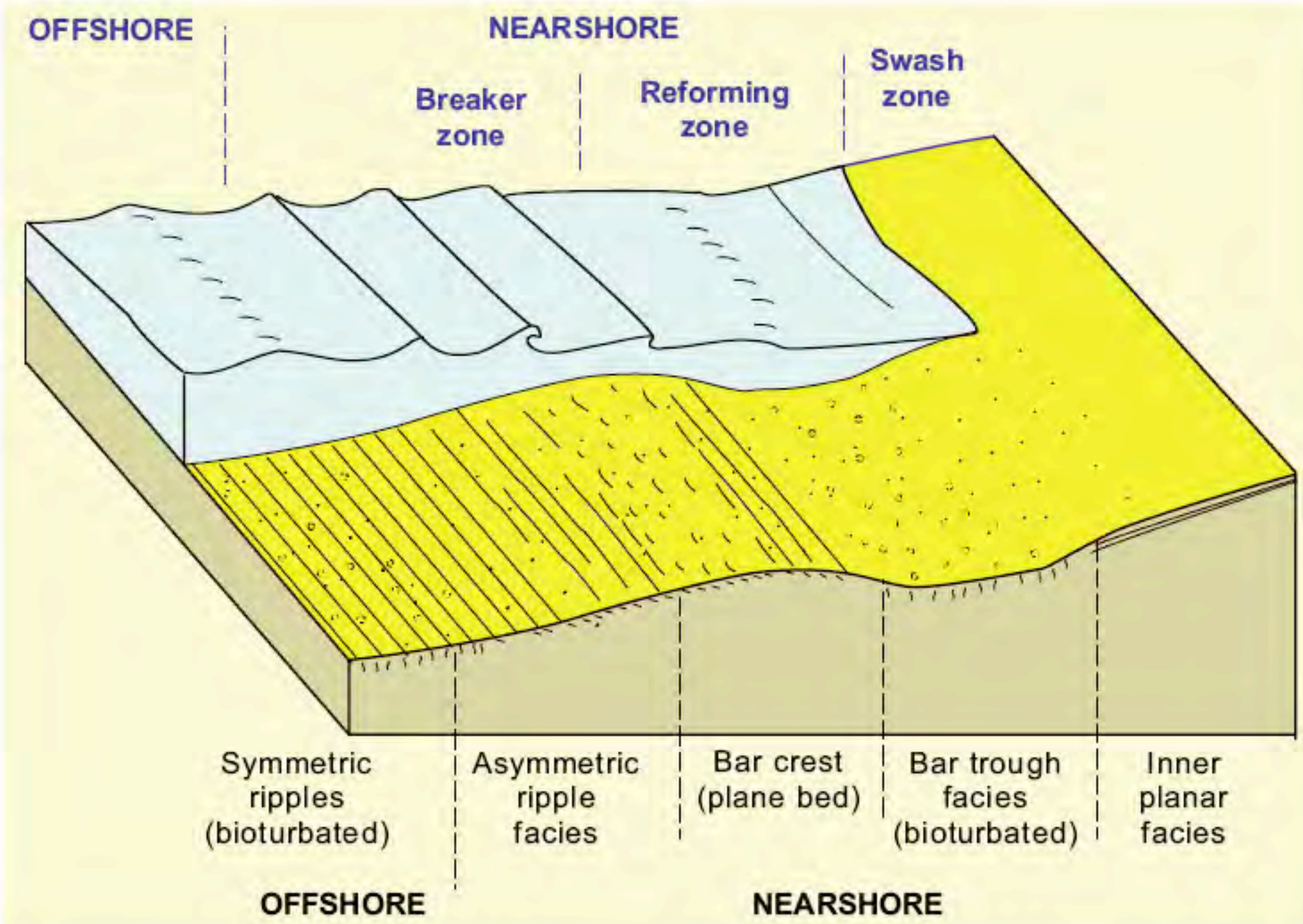
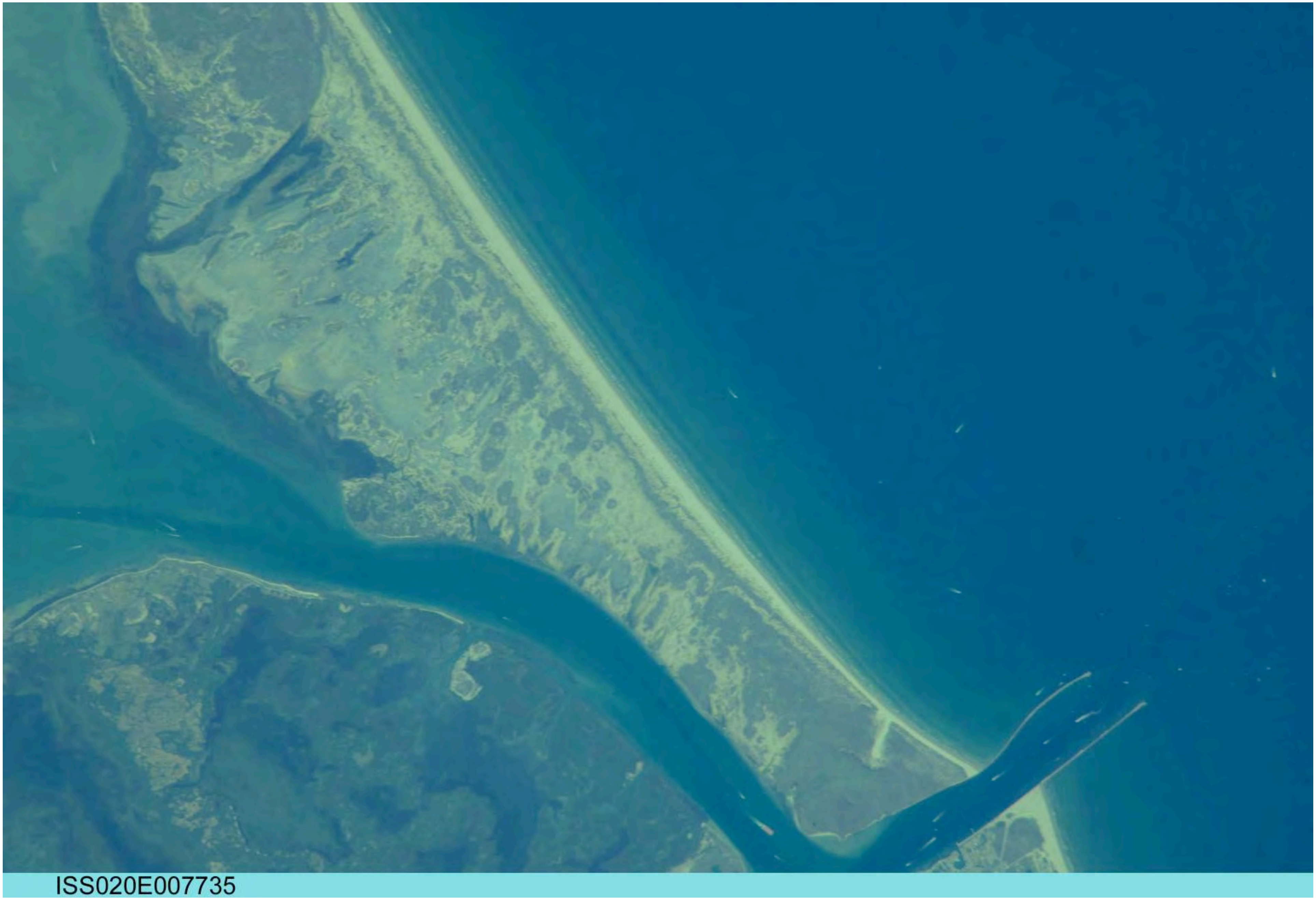


FIG. 49.—Sedimentary structural facies in a barred low-energy fine-grained nearshore under fair-weather conditions (example, Padre Island, Texas, U.S.A., after Hill and Hunter, 1976). Sediment in the longshore trough and seaward from the bar is intensely bioturbated.

Clifton 2006



Port Aransas and San Jose Island, Gulf of Mexico, Texas

ISS017E018815

Matagorda Island, Gulf of Mexico, Texas

ISS017E018819

Galveston, Texas

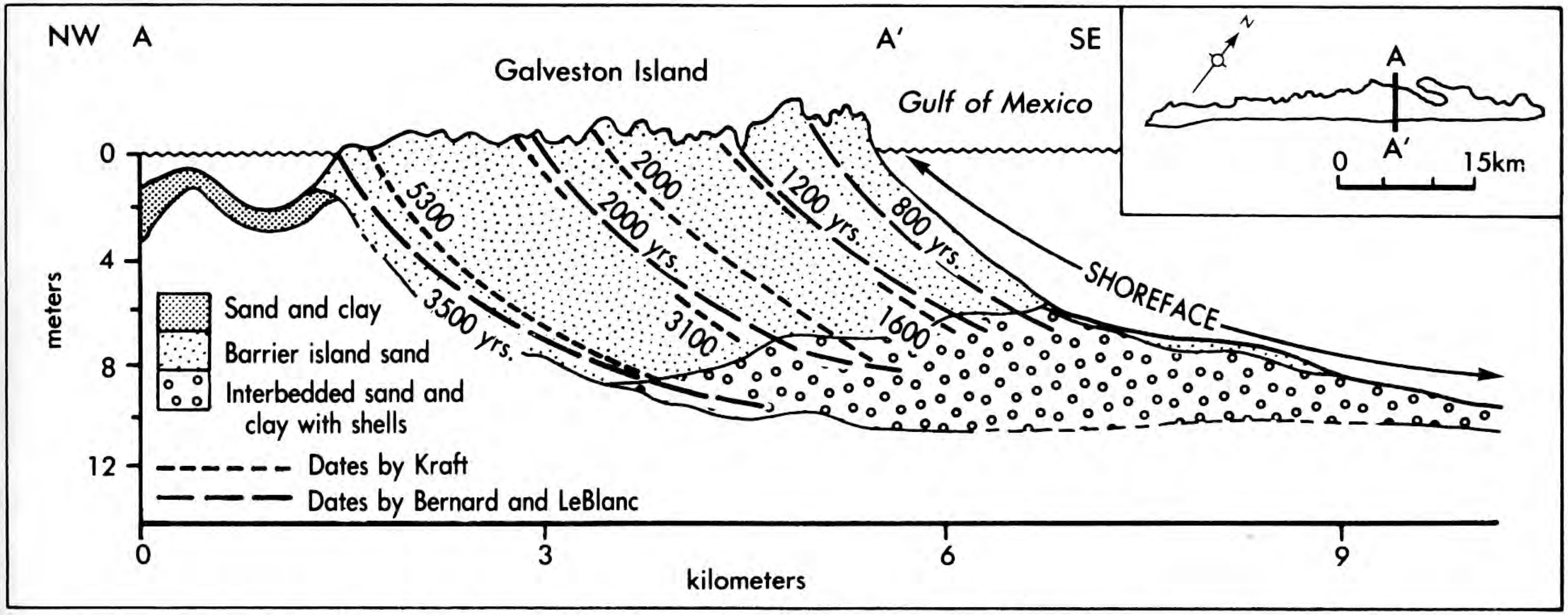
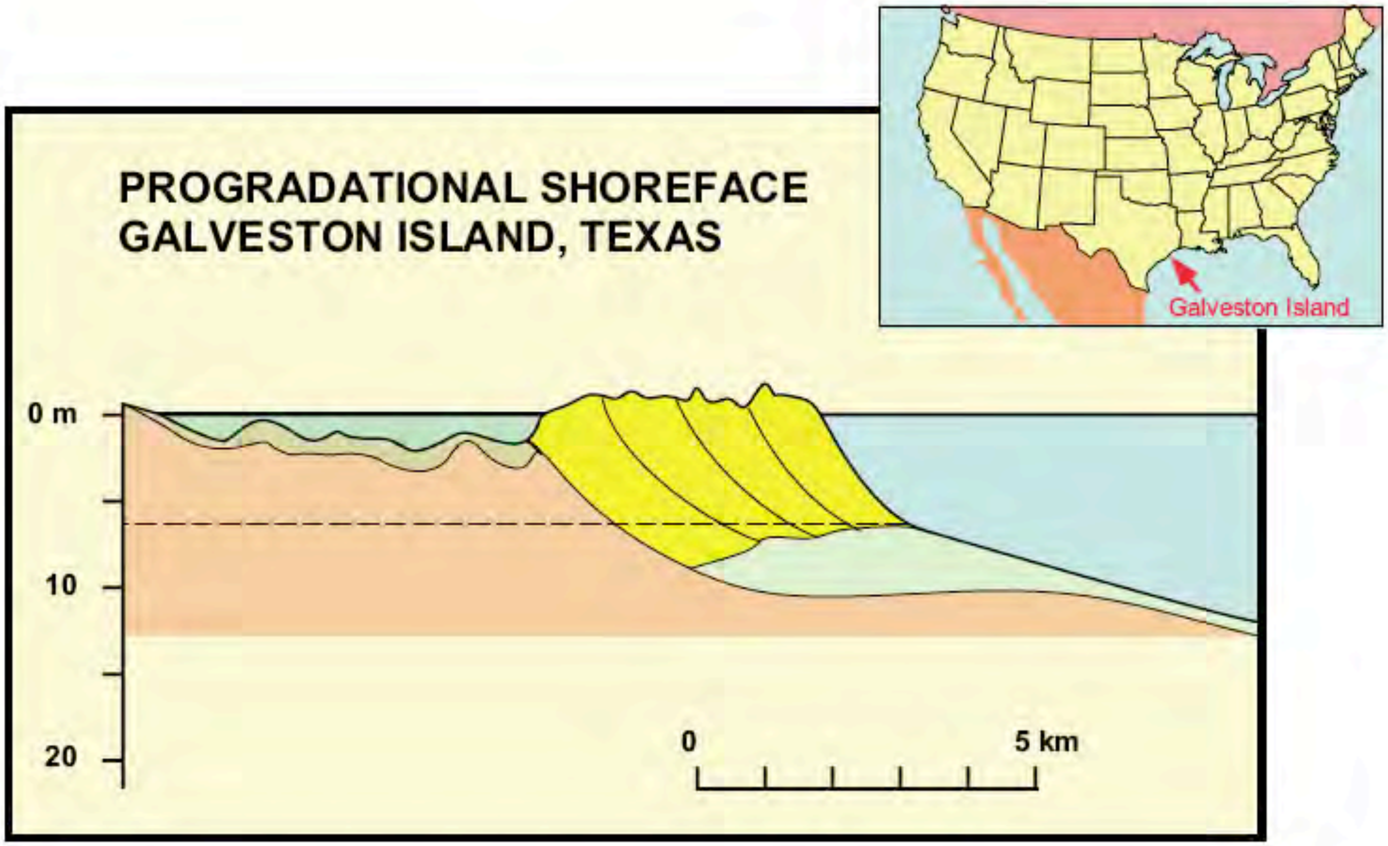


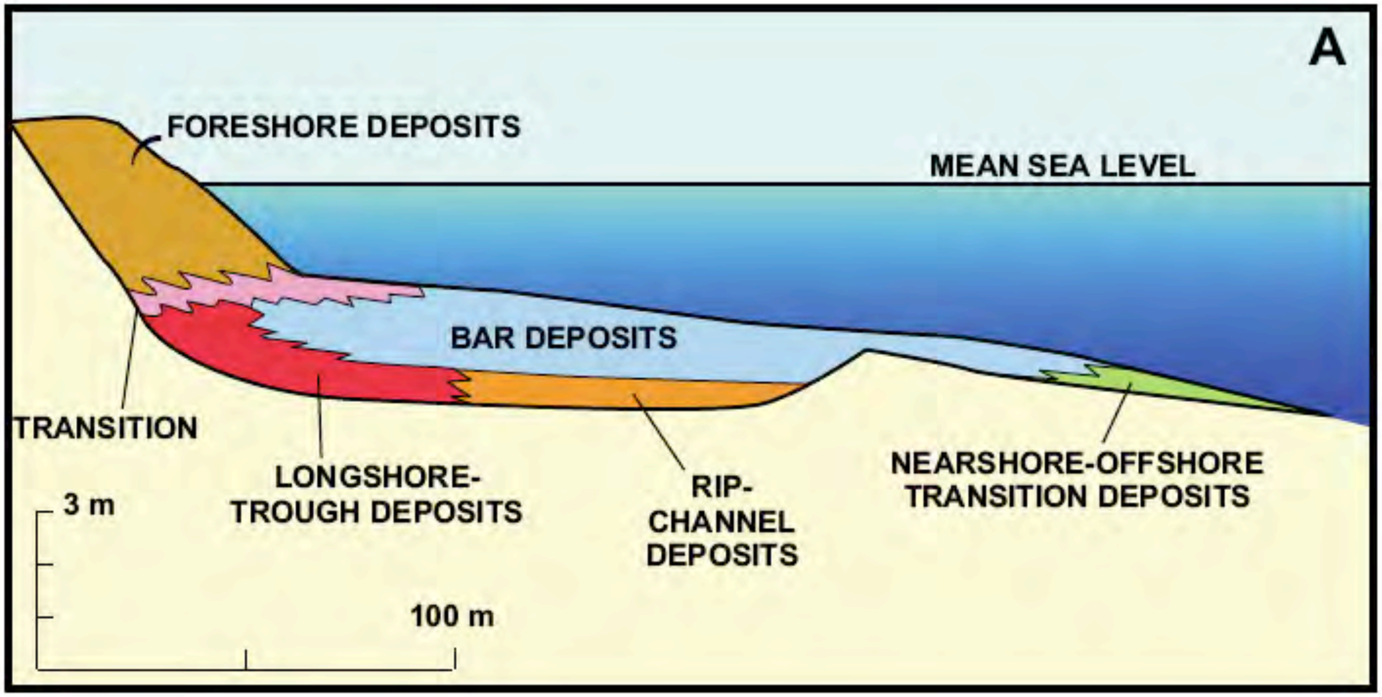
Figure 4. Cross section of a regressive barrier island, Galveston Island, Texas. The form lines with age dates indicate the seaward buildout of the barrier island during the latter part of the Holocene. The ages are based on radiocarbon dates. From Bernard and others (1962).

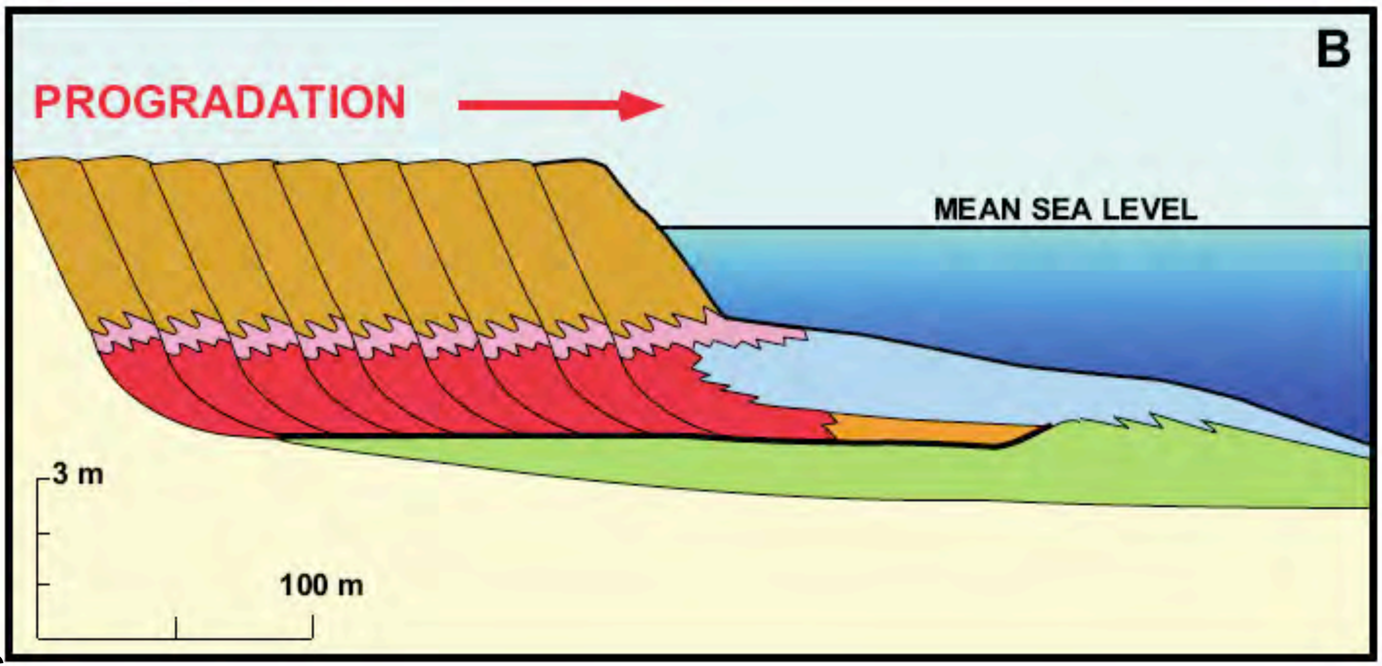
Coleman et al 1991



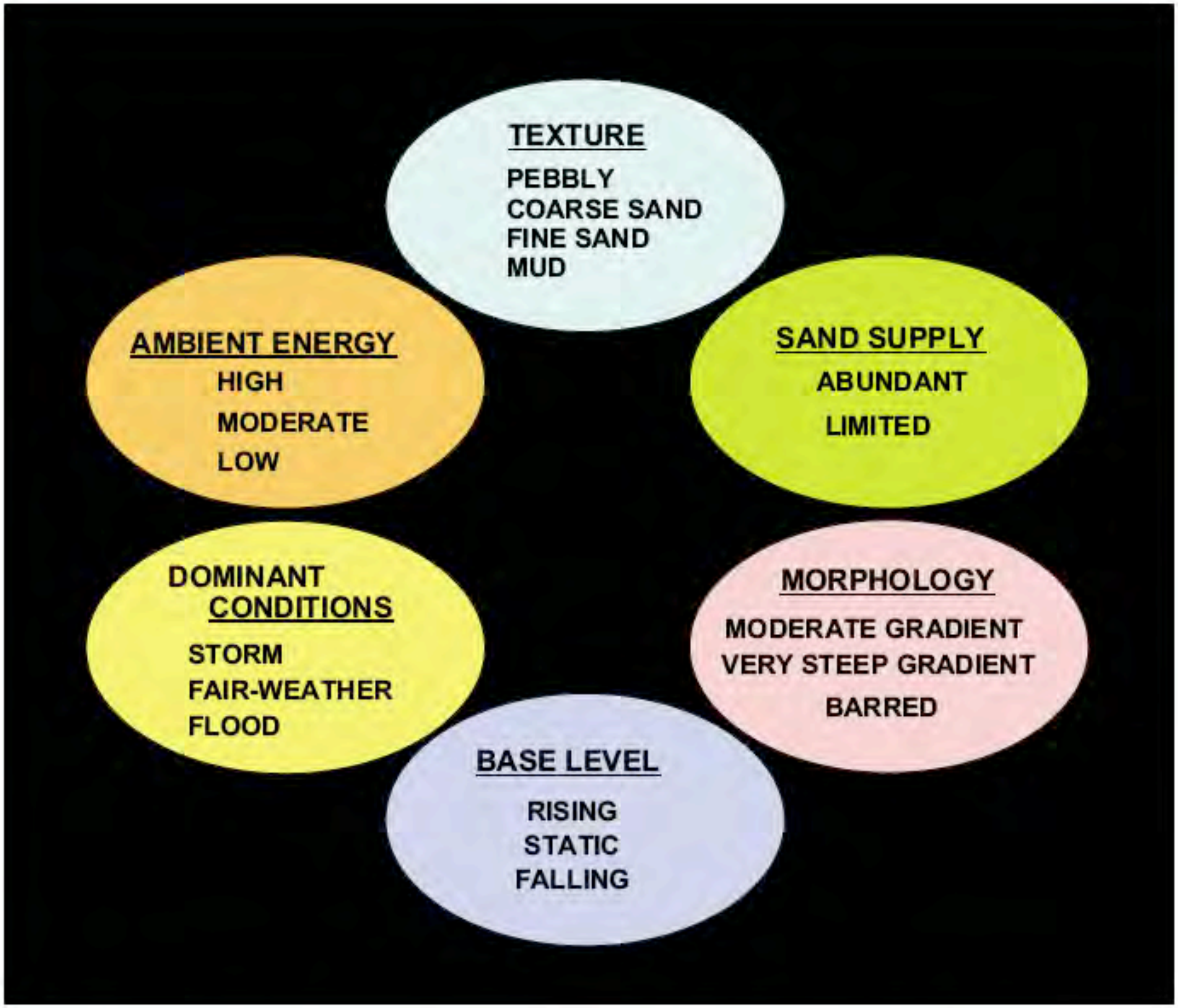
:. 28.—Profile across Galveston Island, Texas, U.S.A. Break in slope that defines shoreface–shelf boundary lies in about 6–7 m of water. After Morton (1994).

Clifton 2006



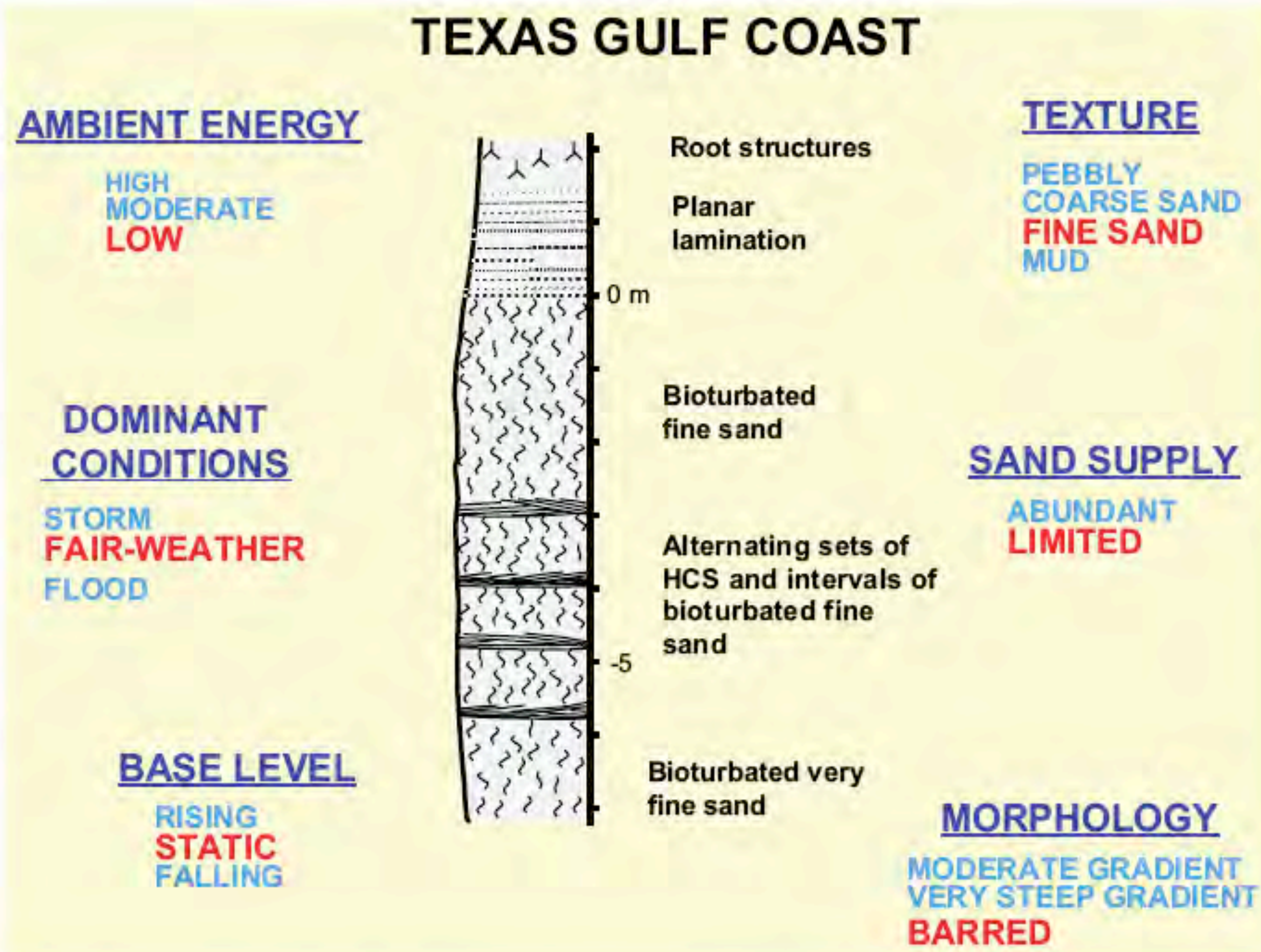


Clifton 2006



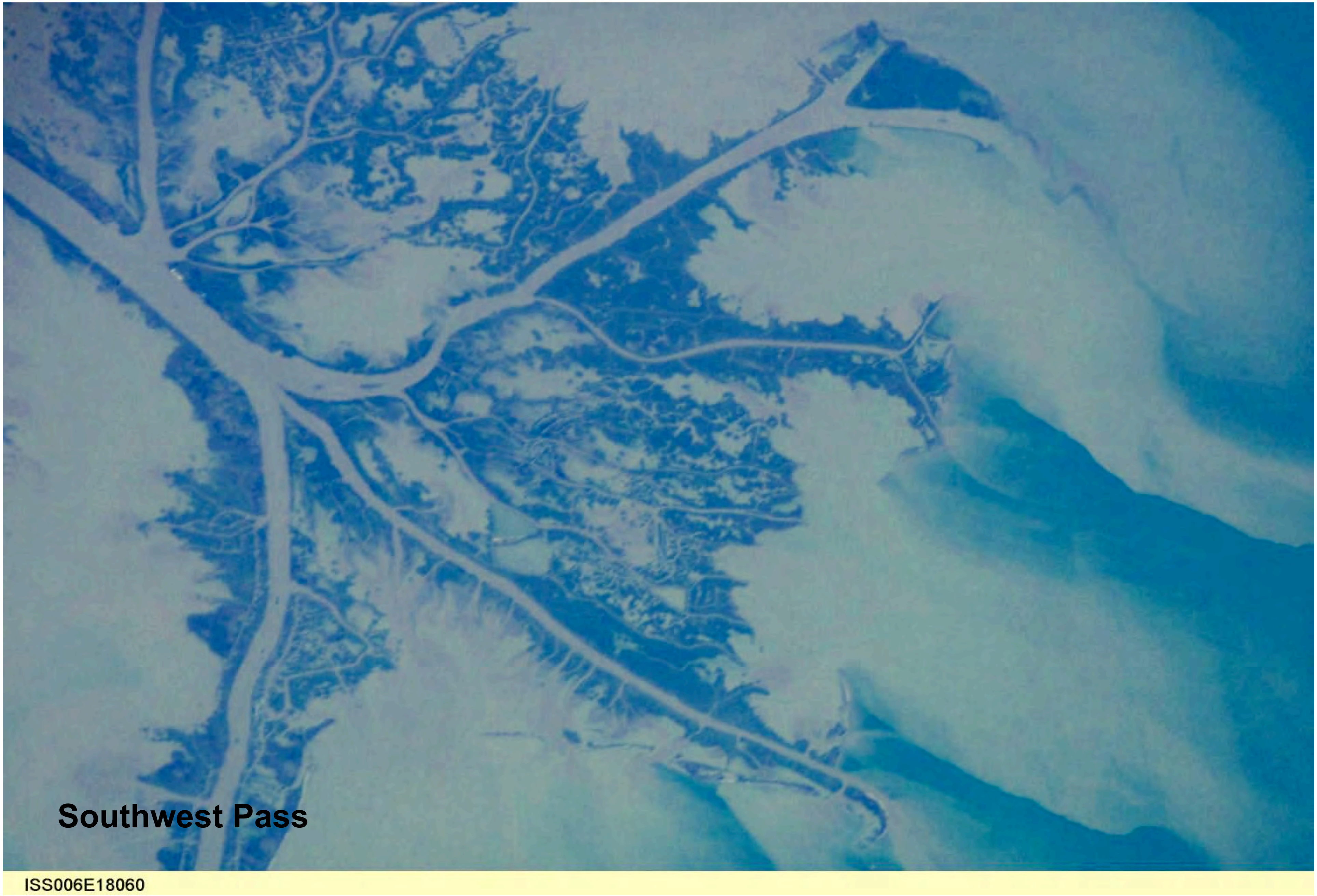
:. 58.—Parameters of open-coast settings that can influence the lithologies and stratigraphic succession of the deposit.

Clifton 2006



gure 62. Prograding shoreline typical of that found on the Texas Gulf coast. Specific to a low-energy, barred setting with an limited supply of fine to very fine sand under conditions of static base level. Abundance of bioturbation indicates a dominance of fair-weather conditions, although storm deposits exist in the lower part of the succession.

Clifton 2006

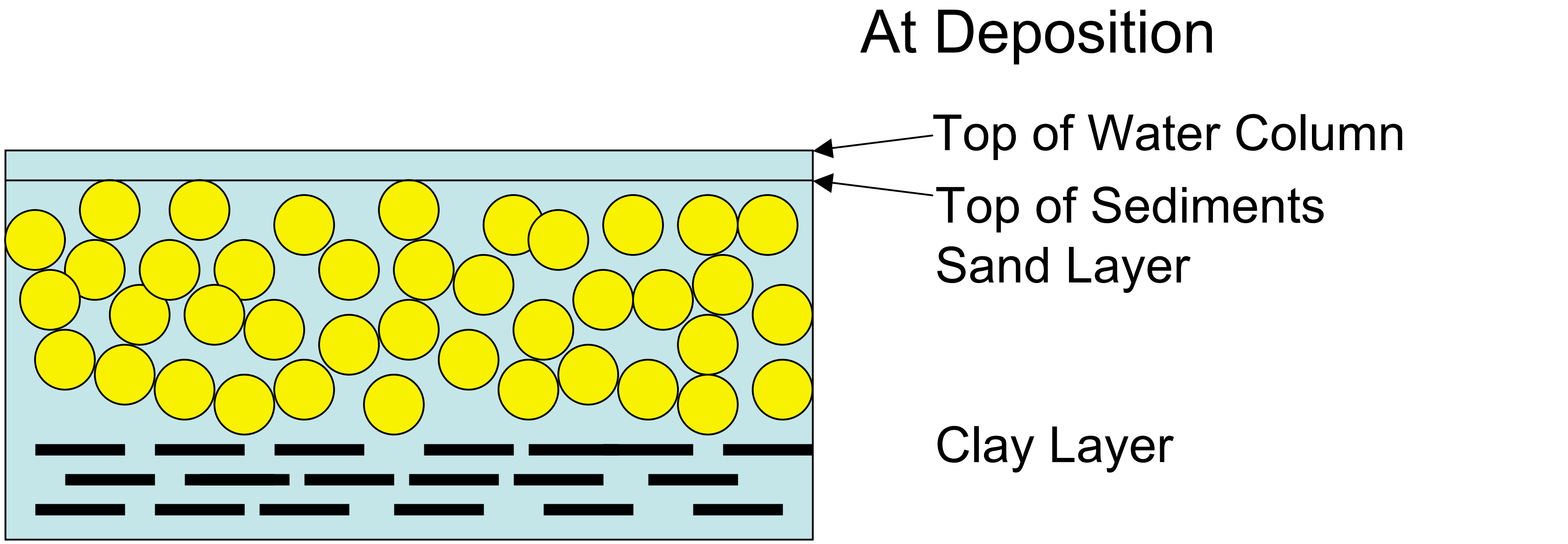


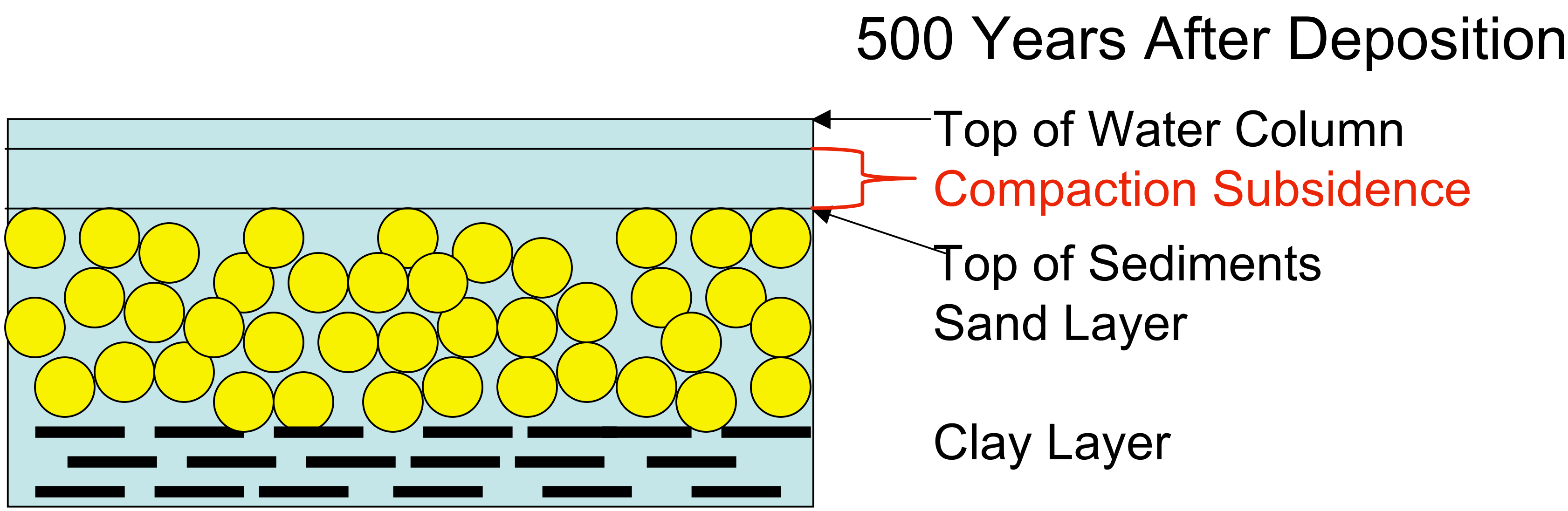
Balize Delta, Mississippi River, Louisana

ISS006E26597

Southwest Pass, Balize Delta, Mississippi River, Louisana

Compaction Subsidence: hundreds of years





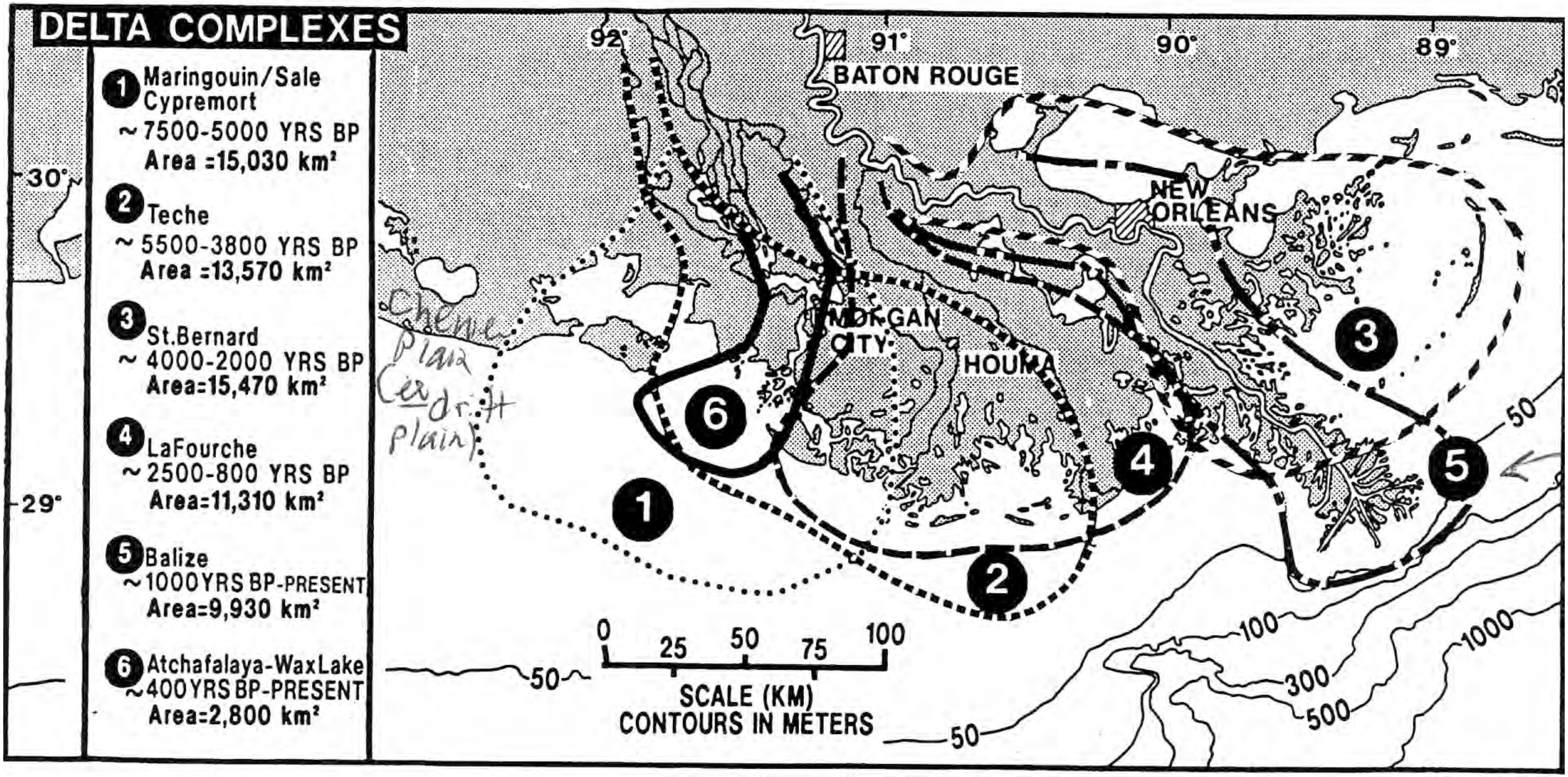
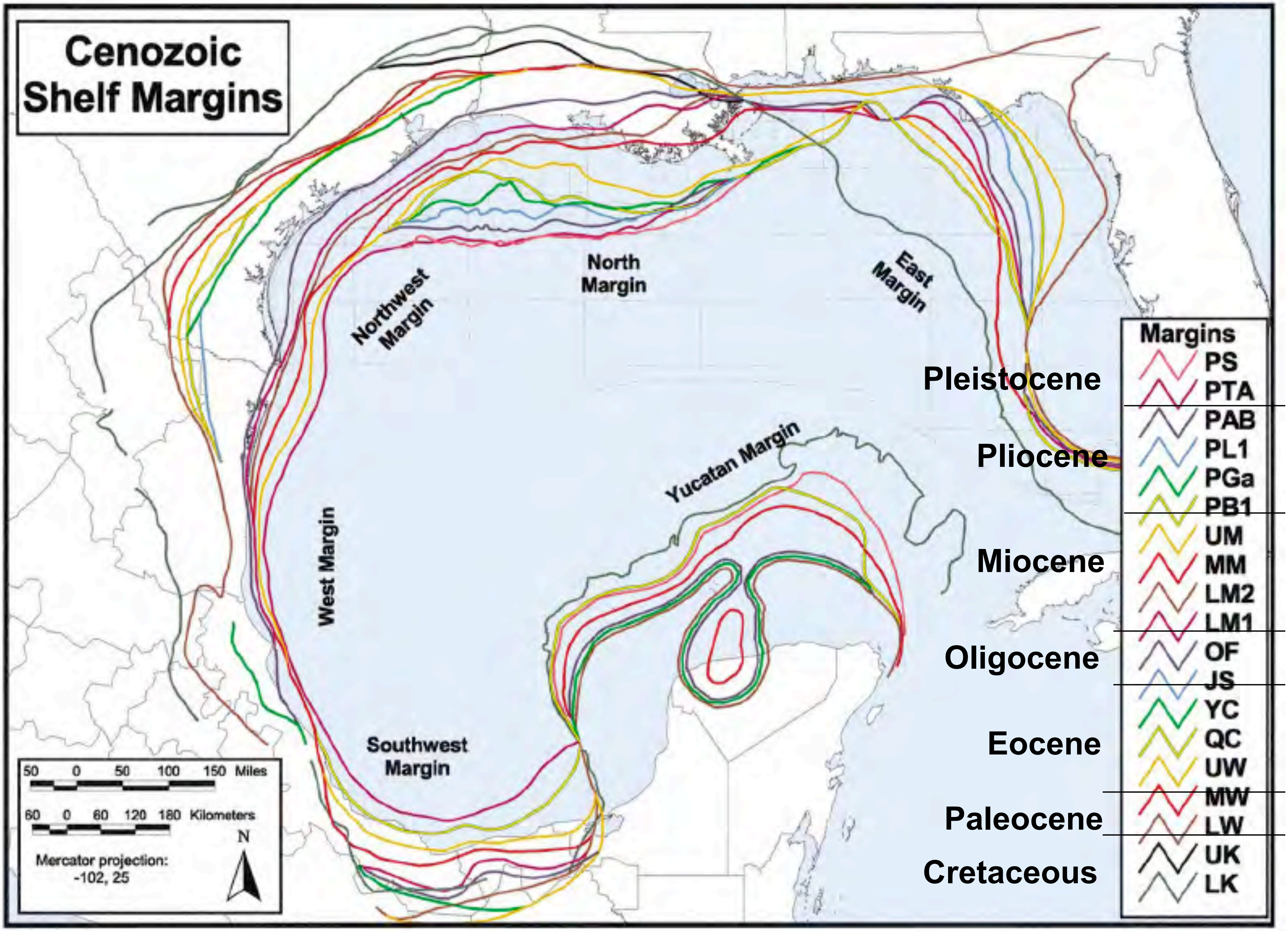
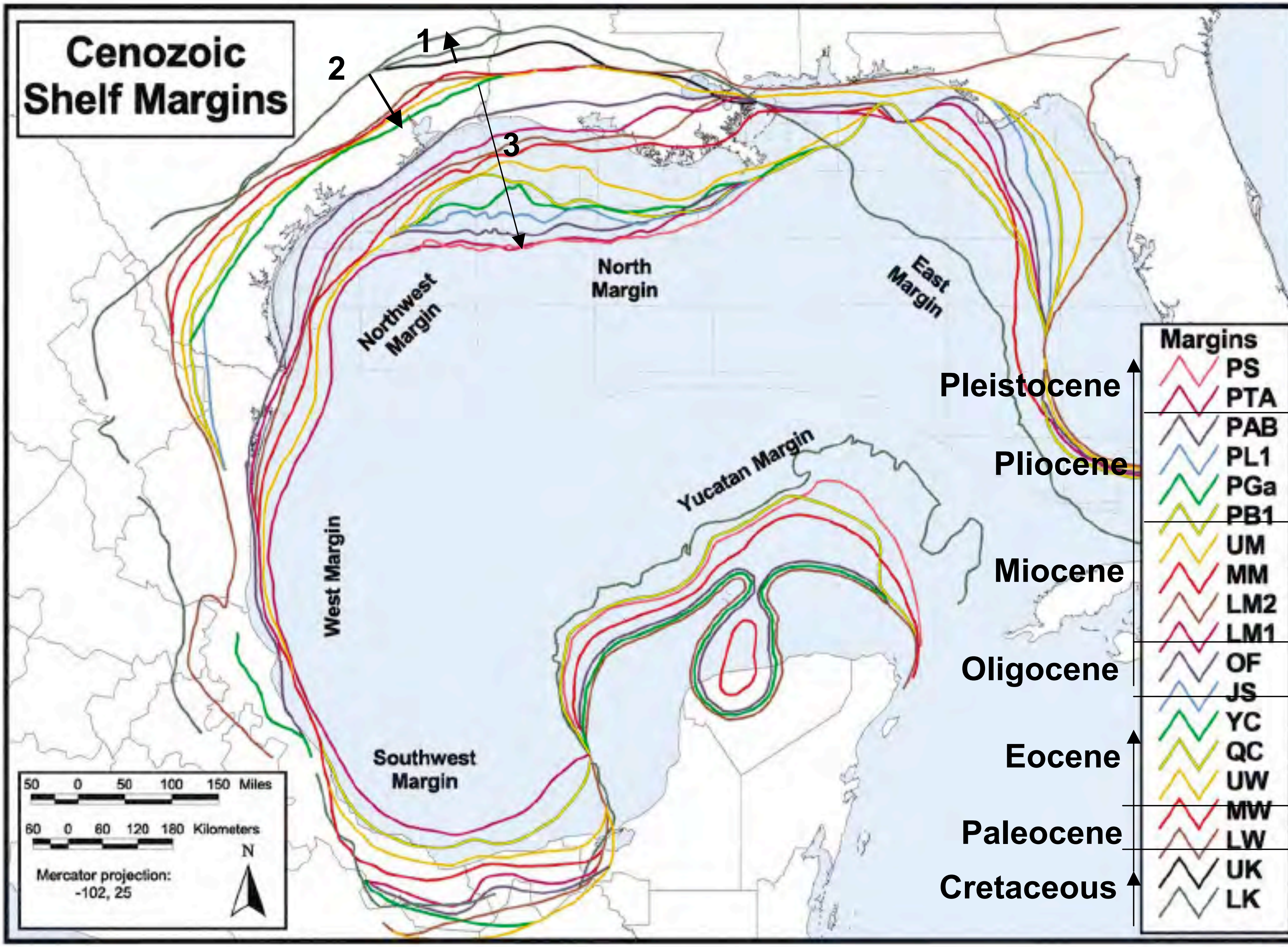


Figure 2. Holocene deltas of the modern Mississippi River. After Roberts, 1997.

Compaction subsidence of older deltas leads to switching of delta lobes through time



Galloway et al 2008



Galloway et al 2008

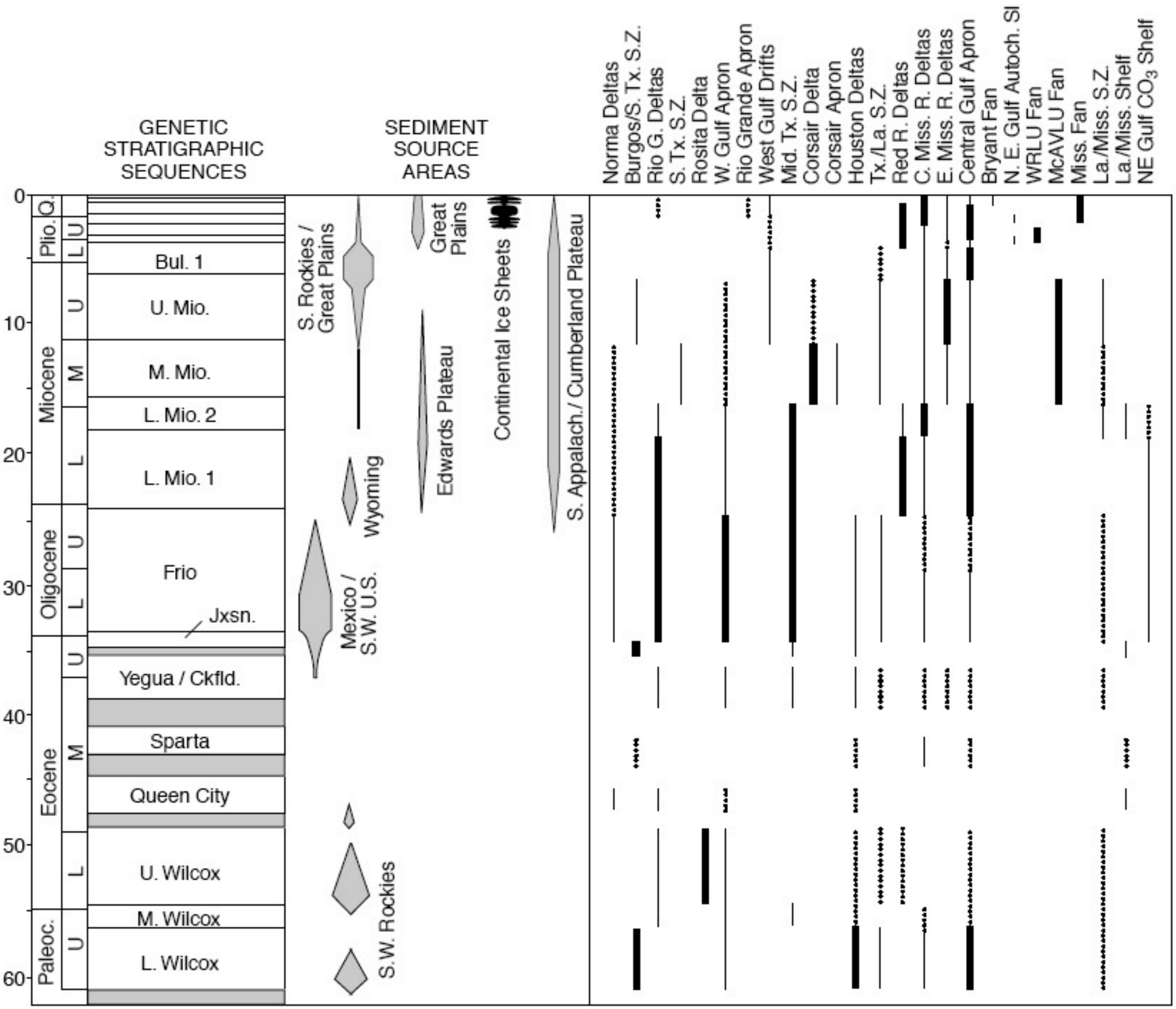
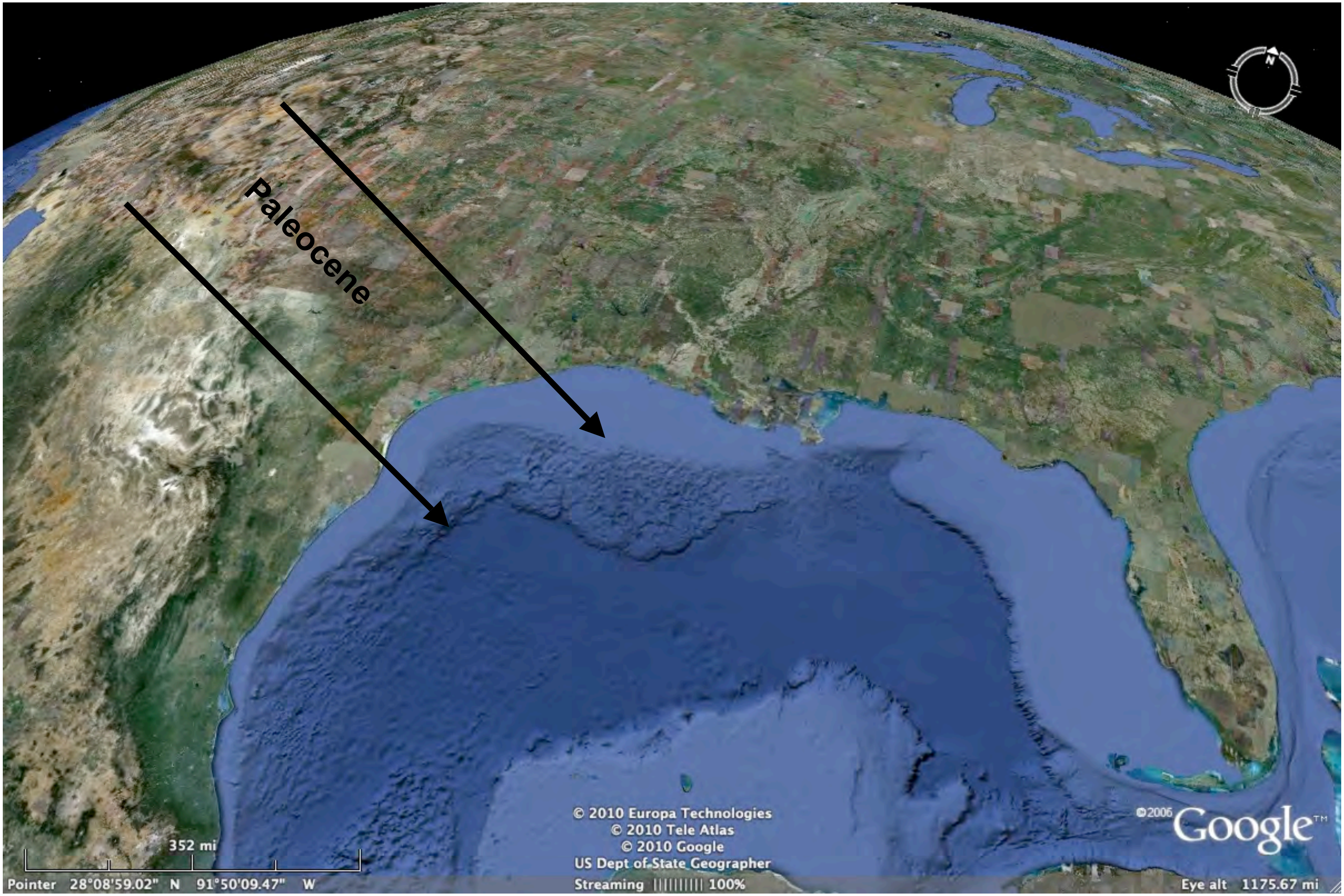
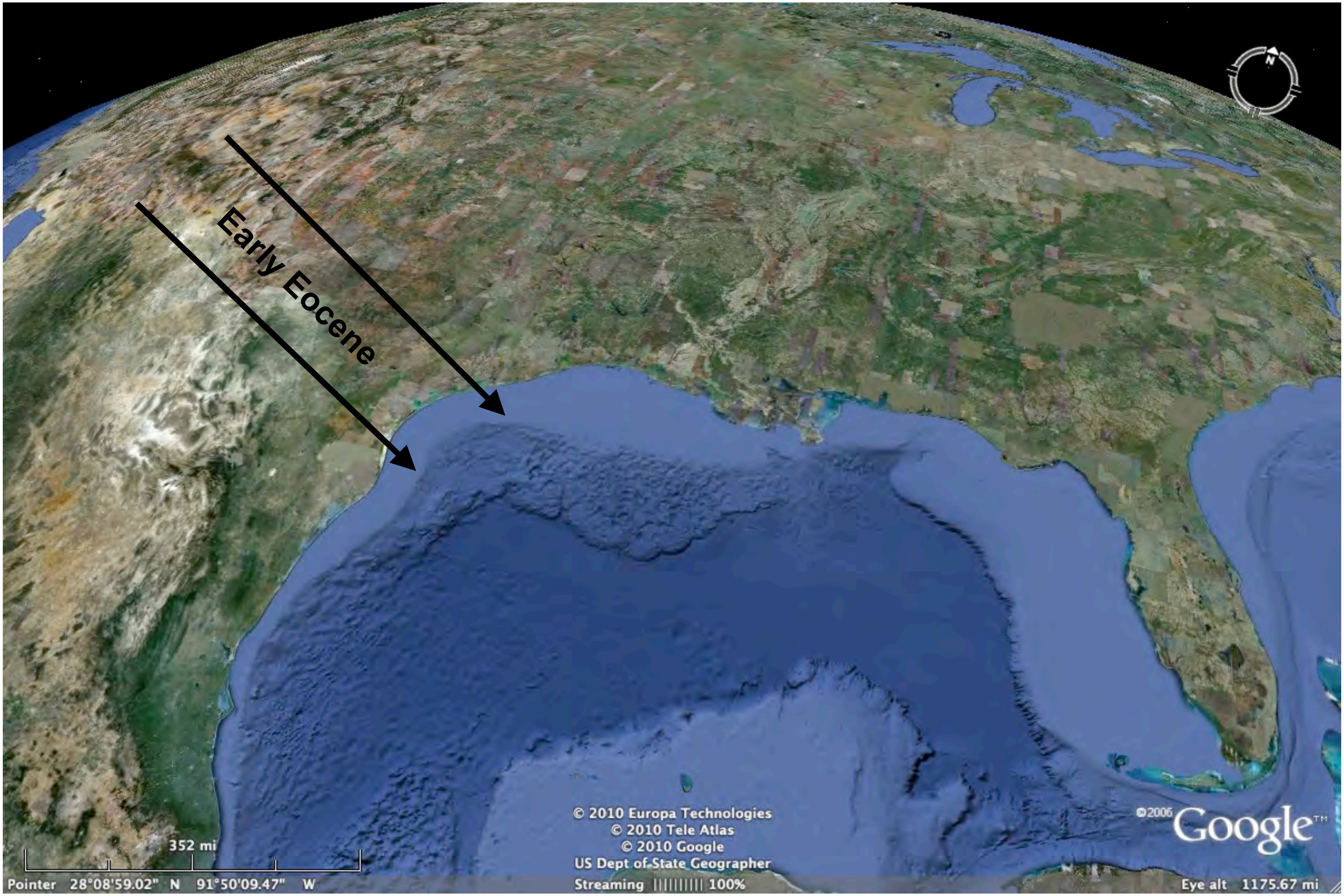


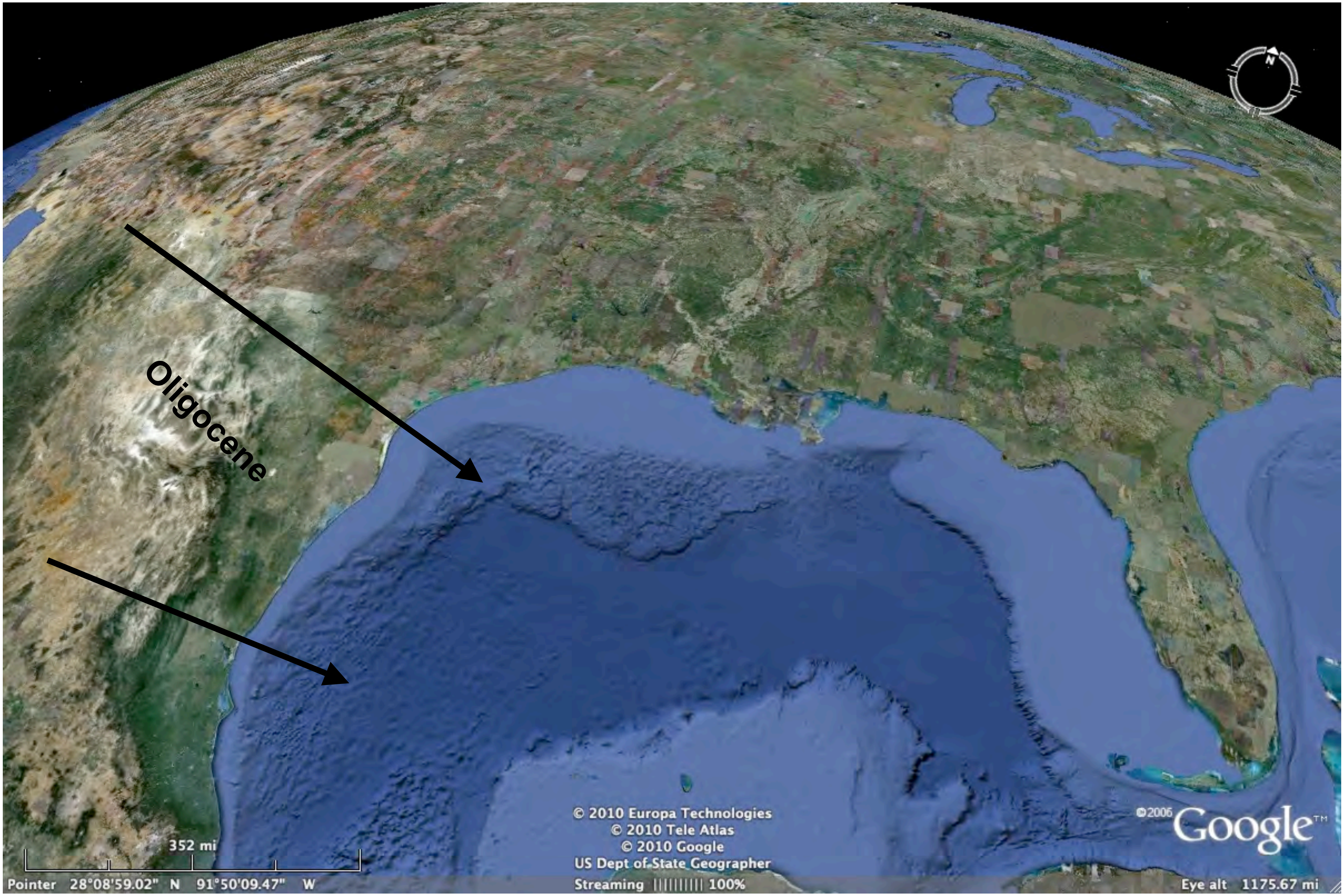
Figure 19. Temporal distribution of volumetrically important Cenozoic depositional systems of the northern Gulf basin and major tectonic phases affecting North American and adjacent Mexican sediment source areas. Bars indicate duration and relative importance of each source area uplift. Continental glaciation also affected late Neogene sediment supply. Length of the bar beneath each system shows the period(s) of active sediment accumulation within that system. Width of bar reflects the relative volumetric importance of the depositional system. Systems are arranged by geographic location from west to east; updip systems within a major dispersal axis are to the left.



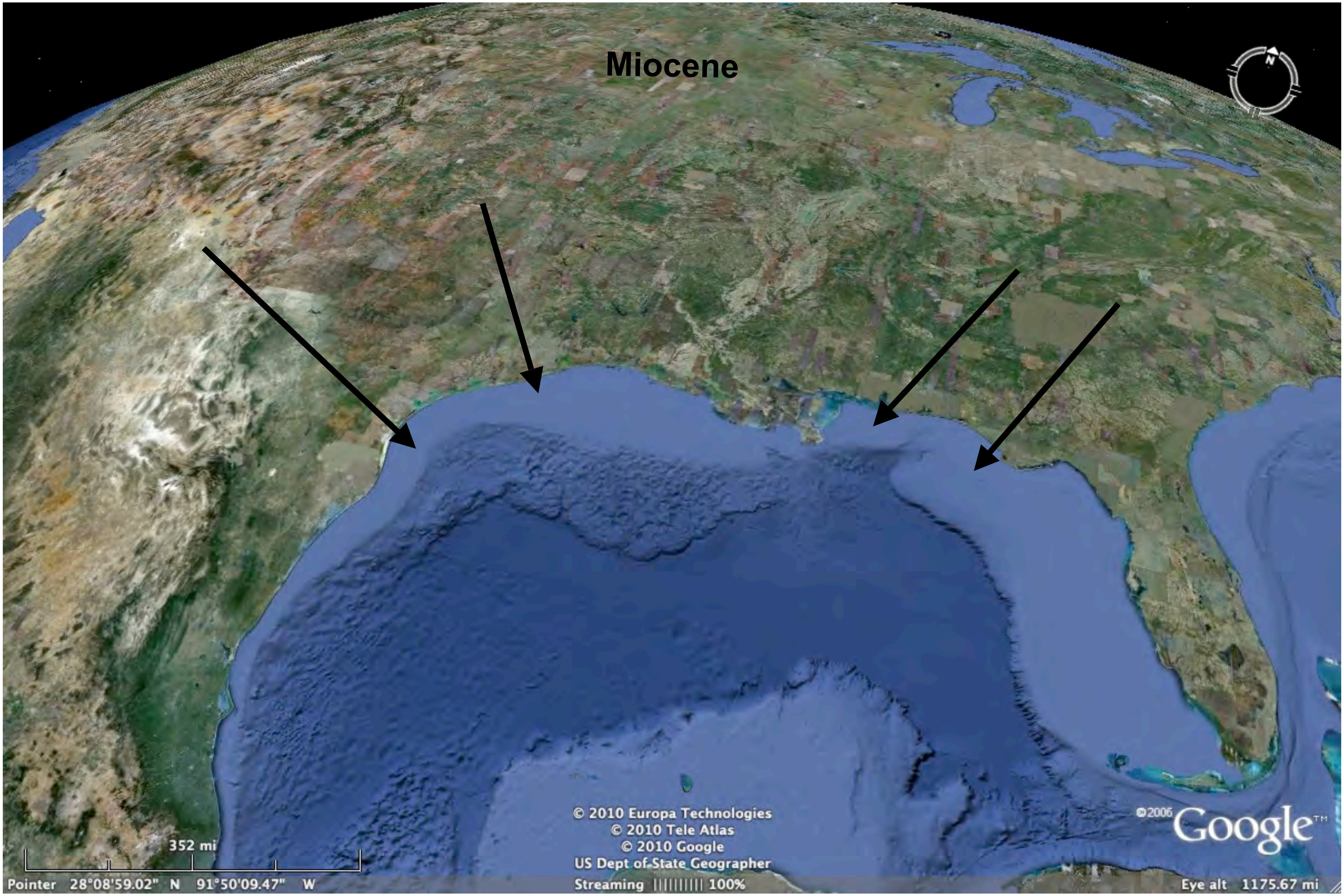
Sediment sources in the Gulf of Mexico through time



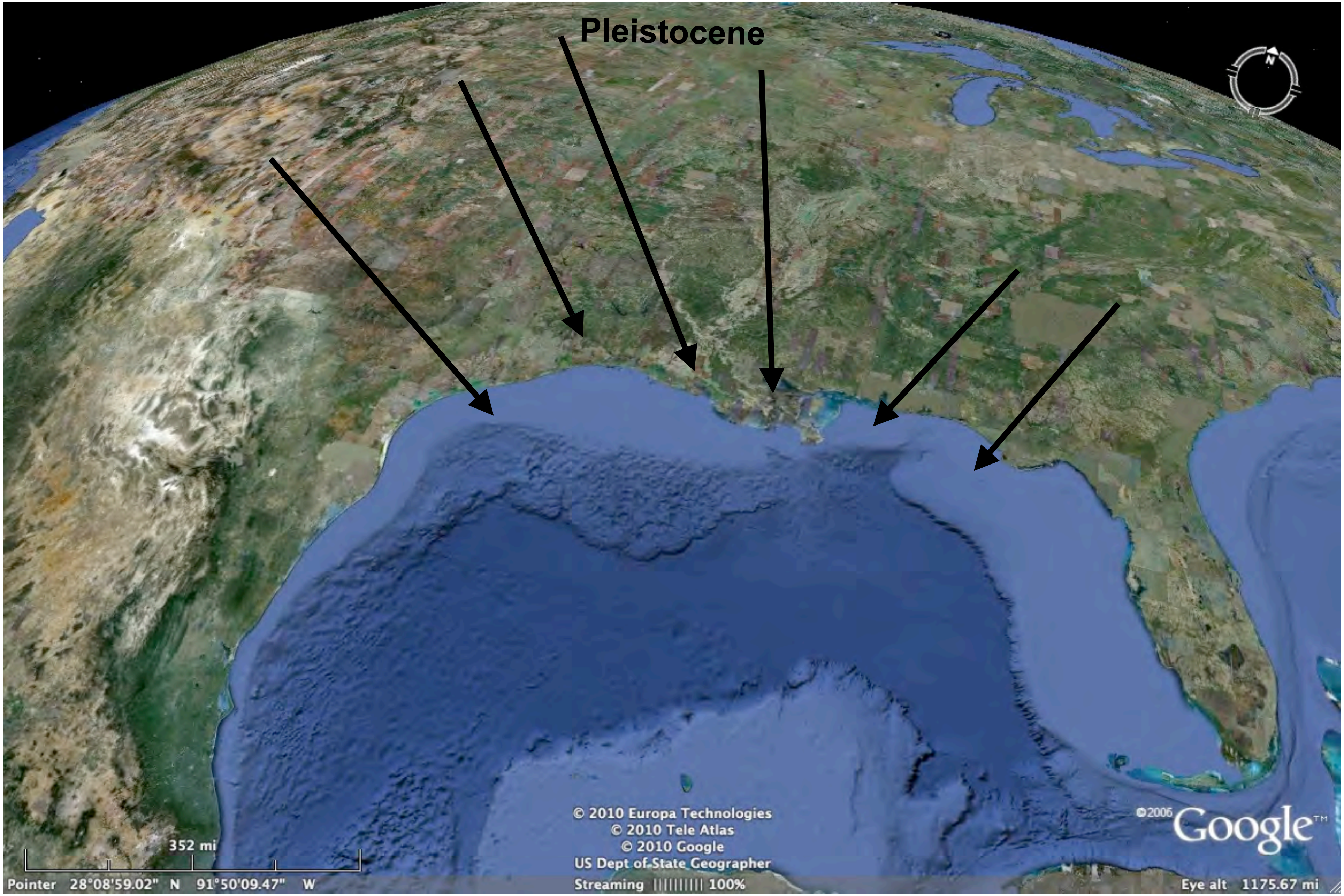
Sediment sources in the Gulf of Mexico through time



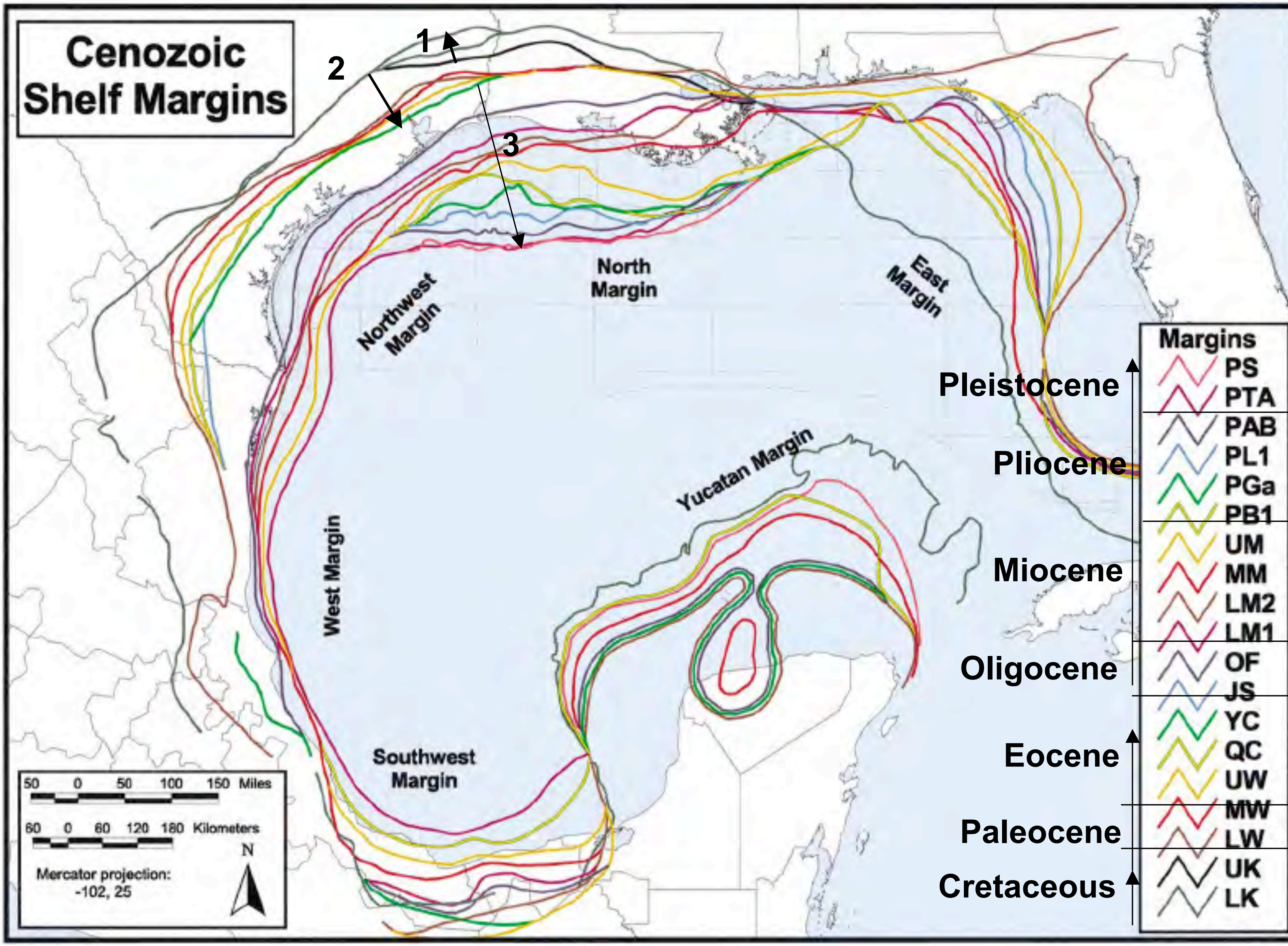
Sediment sources in the Gulf of Mexico through time



Sediment sources in the Gulf of Mexico through time



Sediment sources in the Gulf of Mexico through time



Galloway et al 2008

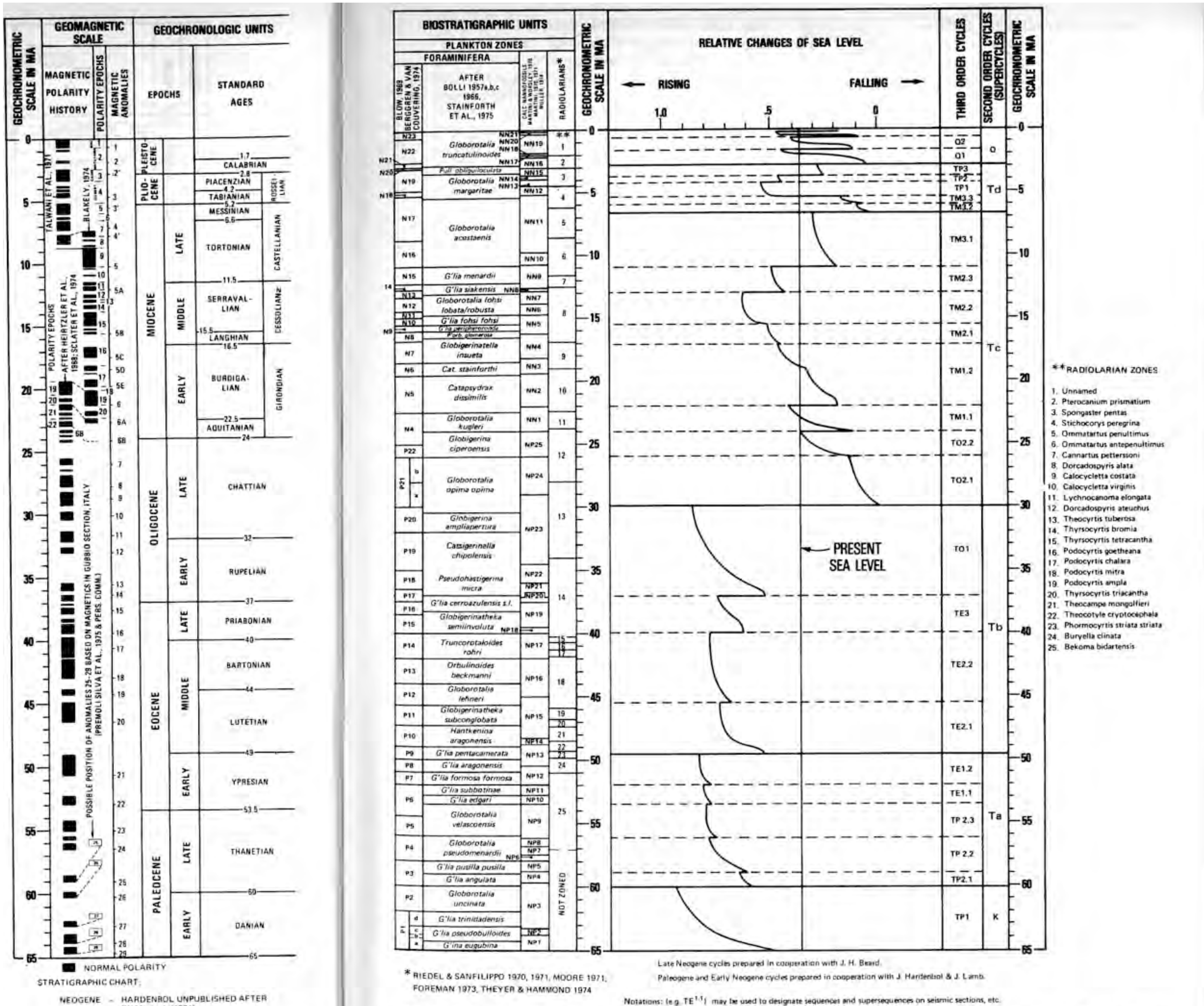


FIG. 3—Global cycles of relative change of sea level during Cenozoic time. Basic references for the stratigraphic part of the chart are Hardenbol (unpublished after Ryan et al, 1974) and Hardenbol and Berggren (1977).

Vail et al 1977


Canal St.
RIVERFRONT