Attachment 2

COLA Revision 5 Highlighted Pages for Subsection 2.5.1 Figure RAIs

(Total Pages - 211)

Figure 2.5.1-201 Site Region Geologic Map (Sheet 1 of 2)

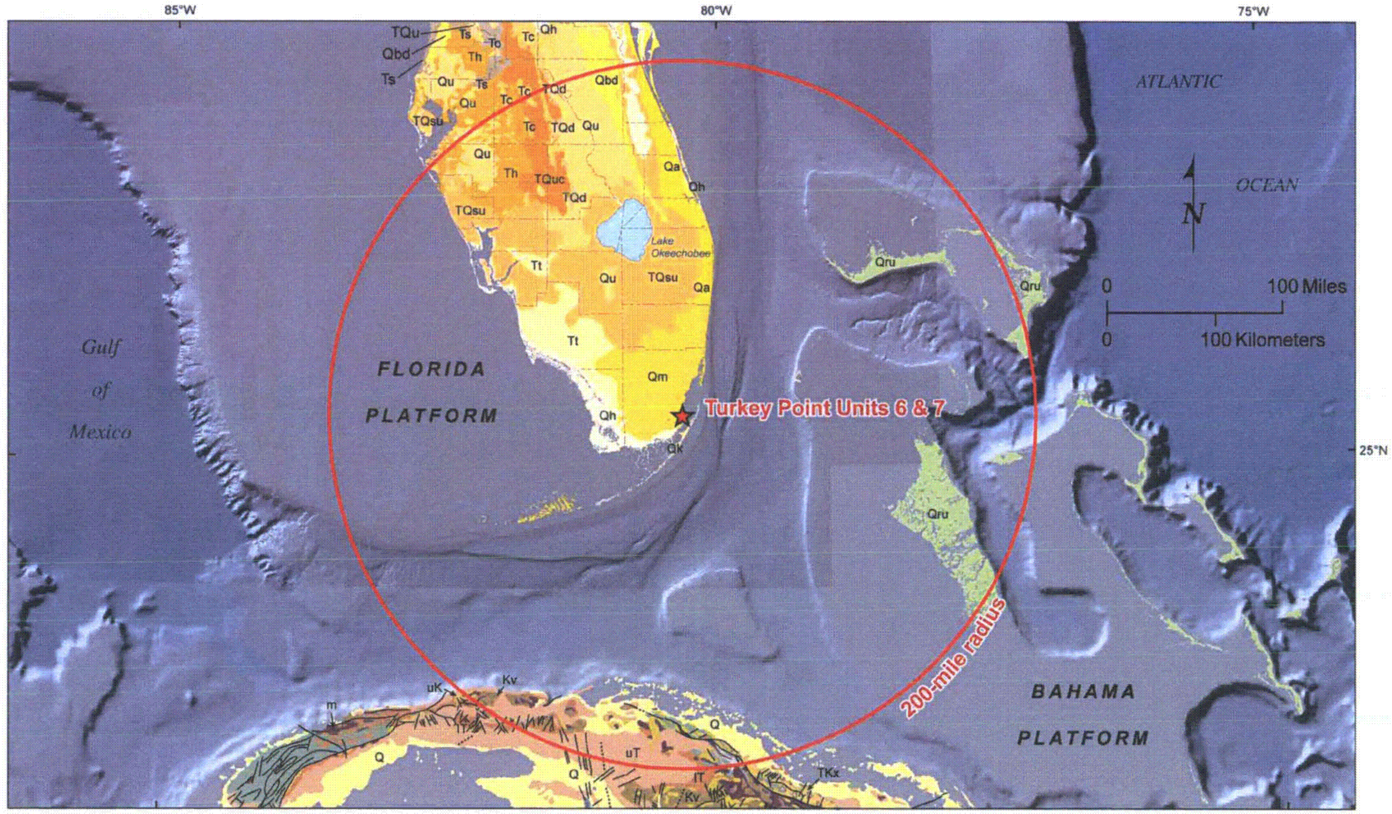


Figure 2.5.1-201 Site Region Geologic Map (Sheet 2 of 2)

Explanation

—— ······ Fault; dotted where uncertain

Florida Geologic Units

QUATERNARY

Qh	Holocene sediments
Qa	Anastasia Formation
Qk	Key Largo Limestone
Qm	Miami Limestone
Qdb	Beach Ridge and Dune deposits
Qu	Undifferentiated sediments

LATE TERTIARY/ EARLY QUATERNARY

TQsu	Shelly sediments (includes Fort Thompson, Bermont, and Caloostahatchee Formations)
TQuc	Reworked Cypresshead sediments
TQd	Dune deposits
TQu	Undifferentiated sediments

TERTIARY

Tc	Cypresshead Formation
Tt	Tamiami Formation
Th	Hawthorn Group, undivided
Ts	Suwannee Limestone
To	Ocala Limestone

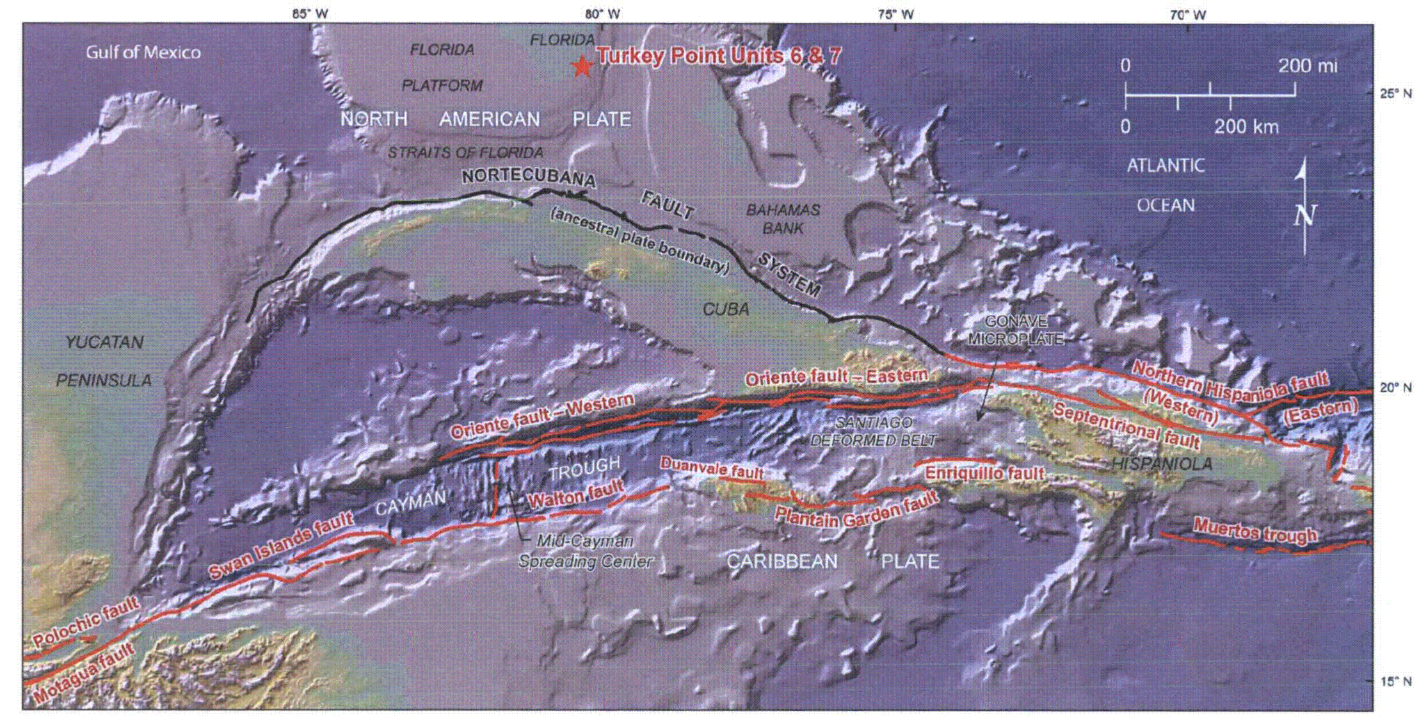
Other Geologic Units

Q	Quaternary alluvium
Qru	Quaternary reef deposits, undivided
uT	Post-Eocene marine strata
lT	Eocene and/or Paleocene marine strata
TKs	Tertiary and Cretaceous complex of deformed sedimentary rocks
uK	Upper Cretaceous marine strata
Kv	Cretaceous volcanic rocks
Ki	Cretaceous plutons, mostly intermediate to silicic
J	Jurassic marine and continental strata
Mm	Mesozoic metamorphic rocks
m	Mafic and ultramafic rocks

Note: Geologic information from References 827, 492, and 397

Figure 2.5.1-202 Tectonic Map of the Northern Caribbean-North America Plate Boundary (Sheet 1 of 2)

PTN RAI 02.05.01-3



Source: Reference 492

Figure 2.5.1-202 Tectonic Map of the Northern Caribbean-North America Plate Boundary (Sheet 2 of 2)

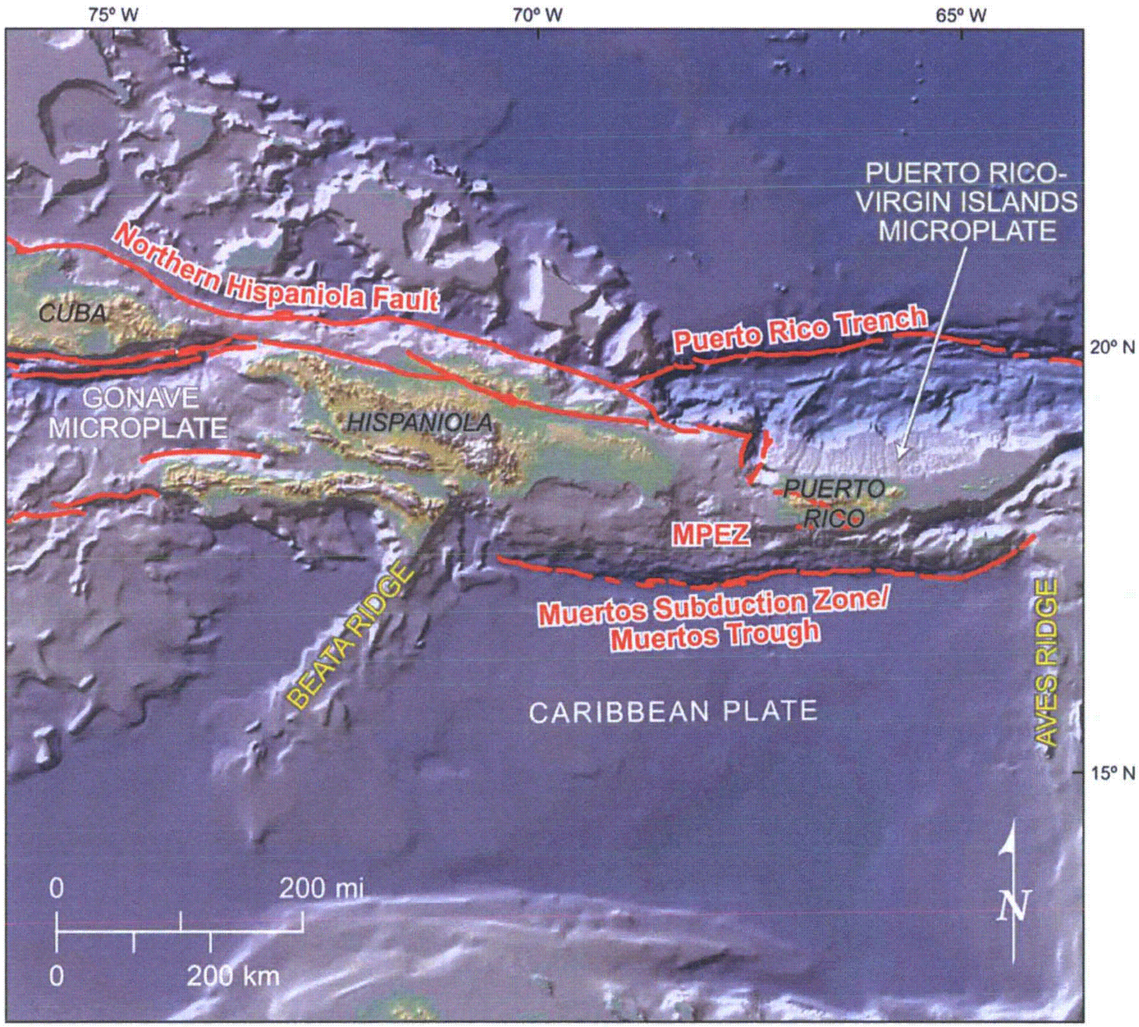
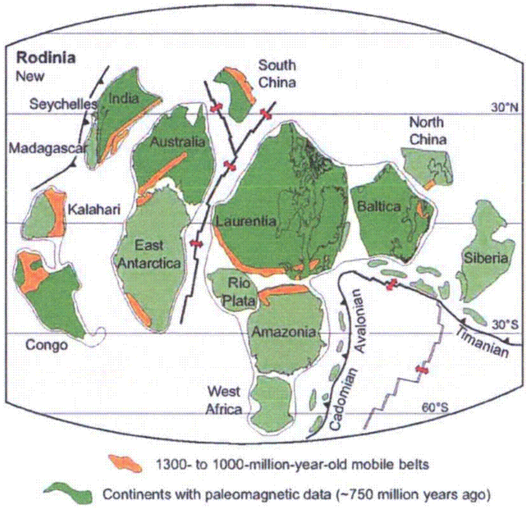
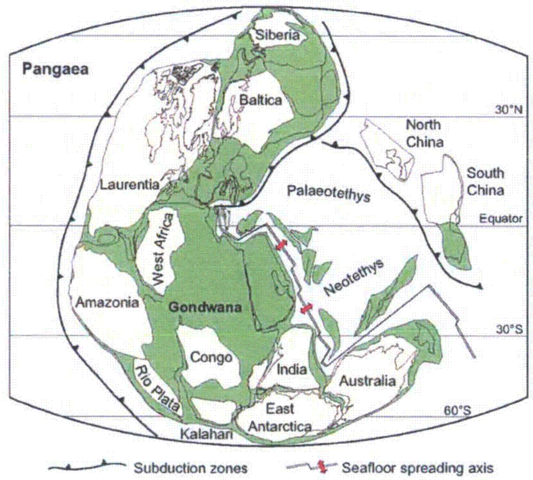


Figure 2.5.1-203 Supercontinents Rodinia and Pangea



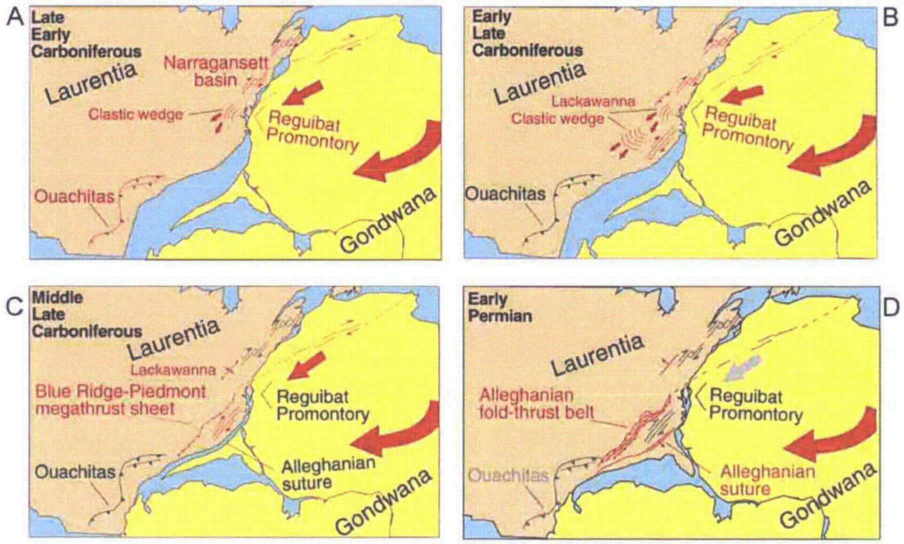
(a) The Rodinia supercontinent in the Mesoproterozoic (revised). The revised or "new" Rodinia reconstruction at 750 Ma. Compared to previous reconstructions, the positions of Australia, East Antarctica, and Congo have been revised. North China is tentatively placed north of Bakltica. Continental fragments and magmatic arcs (Avalonian, Cadomian, and Timanian) along the southwestern margin of Rodinia were welded onto West Africa, Amazonia, Baltica and Siberia in the Late Precambrian.



(b) The Pangea supercontinent in the Late Permian. At the time of its maximum extent, Pangea did not contain North and South China, and new oceanic crust was formed along the eastern margin. Precambrian terranes or continents often discussed in Rodinia reconstructions (but at different locations) are shown in yellow. Gondwana, in the Southern Hemisphere, was formed ~550 million years ago. In the Northern Hemisphere, the earlier terranes of Laurentia, Avalonia, and Baltica combined in the Early Devonian (418 to 400 million years ago) to form Laurussia. Gondwana and Laurus later collided to form Pangea.

Modified from Reference 759

Figure 2.5.1-204 Alleghanian Oblique Rotational Collision between Laurentia and Gondwana



Notes:

Red lines and symbols indicate feature is active in the time interval shown.

(A) Initial contact between Gondwana and Laurentia occurred in late Early Carboniferous (late Mississippian), producing initially sinistral faulting in New England followed immediately by dextral motion and pull-apart basins, then shedding of clastic sediments onto the continent, and Lackawanna-phase deformation.

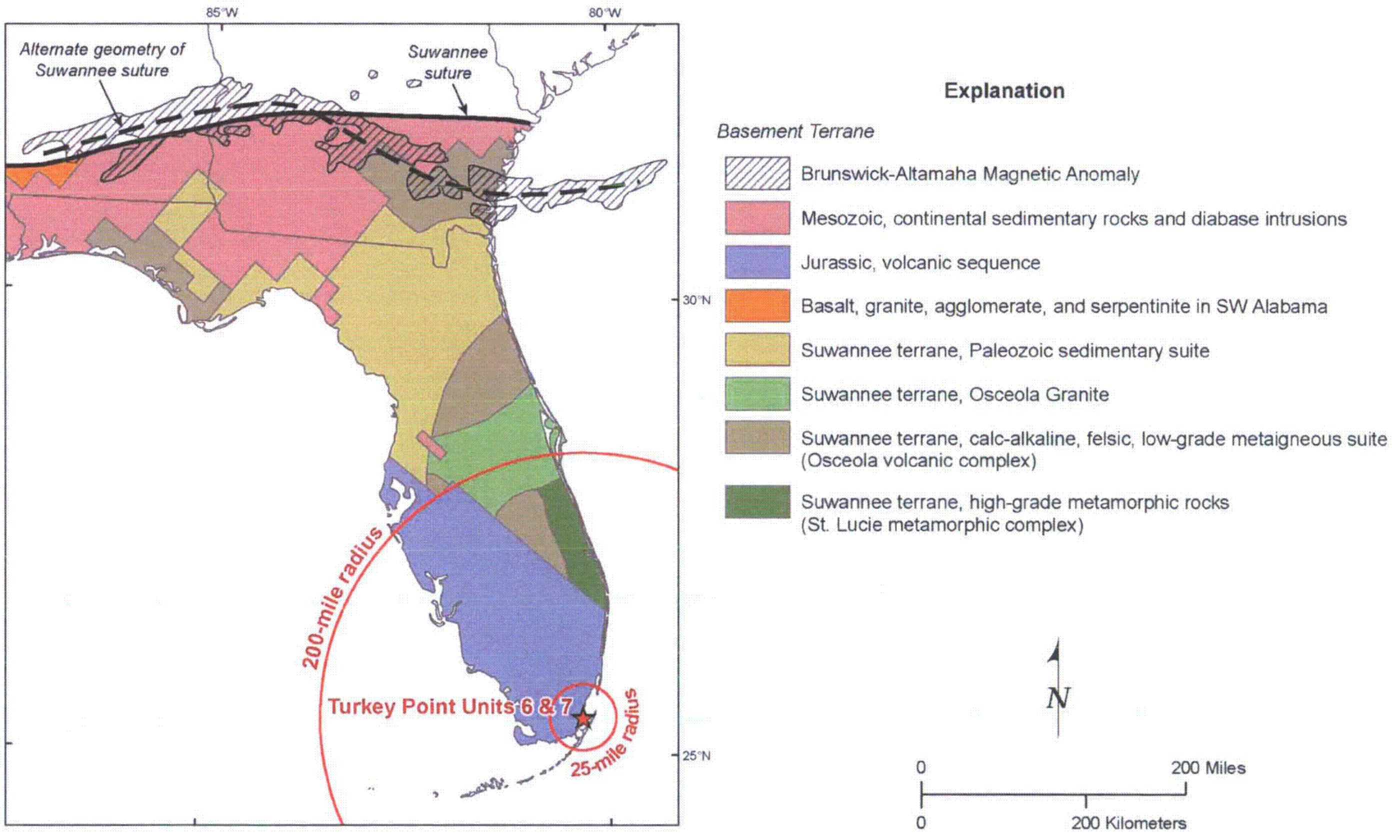
(B) Southward movement and rotation of Gondwana with respect to Laurentia in early Late Carboniferous (early Pennsylvanian) produced dextral motion throughout orogen, waning of Lackawanna phase deformation, and greater dispersal of sediments onto the Laurentian foreland.

(C) Continued clockwise rotation of Gondwana with respect to Laurentia during the Late Carboniferous closed the Theic ocean southward, bringing Gondwana into head-on collision with Laurentia, and producing the first movement on the Blue Ridge-Piedmont mega-thrust sheet.

(D) Early Permian head-on collision of Gondwana with Laurentia produced major transport on Blue Ridge-Piedmont mega-thrust sheet that drove foreland fold-thrust belt deformation (Valley and Ridge and Plateau) ahead of it.

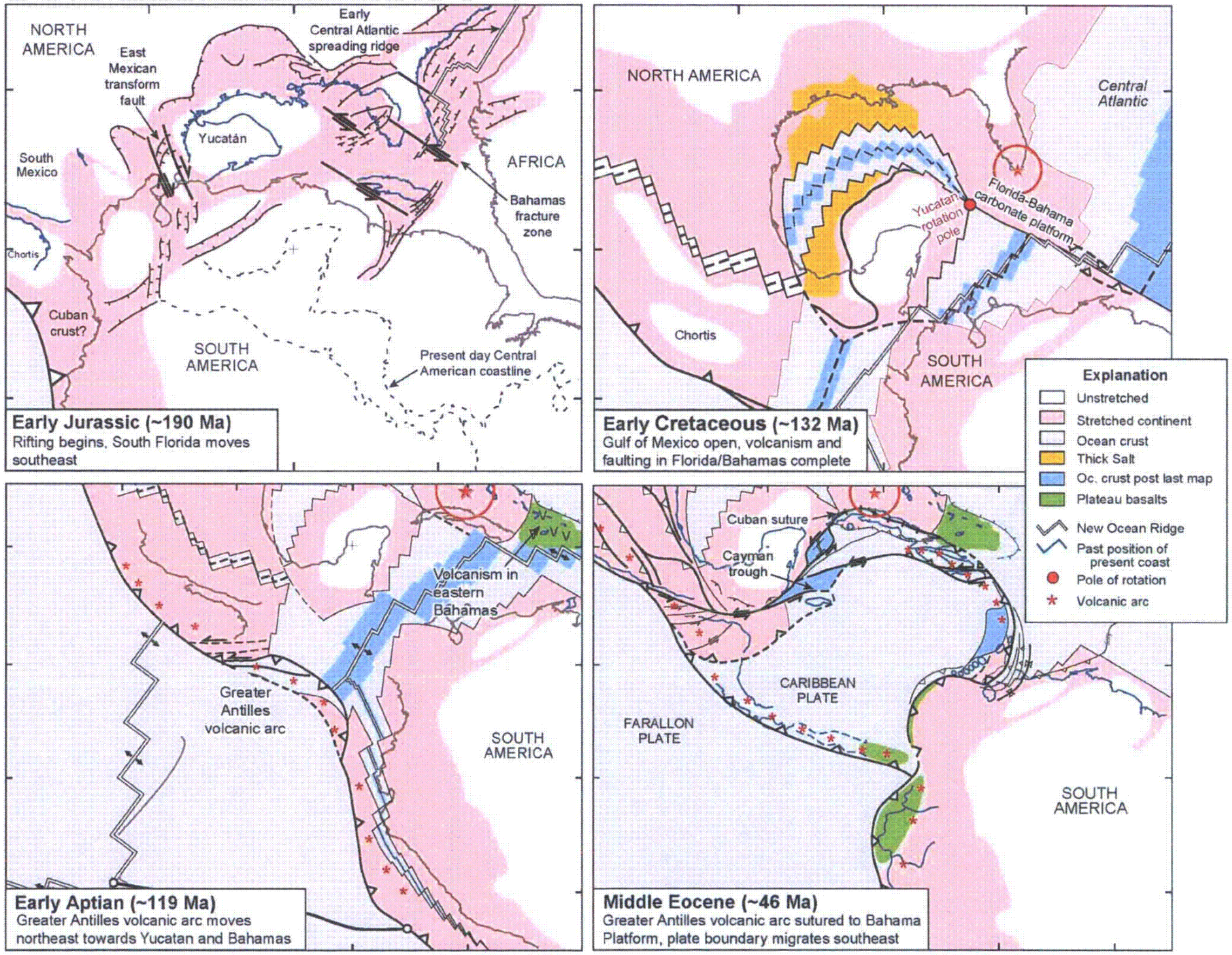
Source: Reference 795

Figure 2.5.1-205 Interpreted Basement Map of Florida



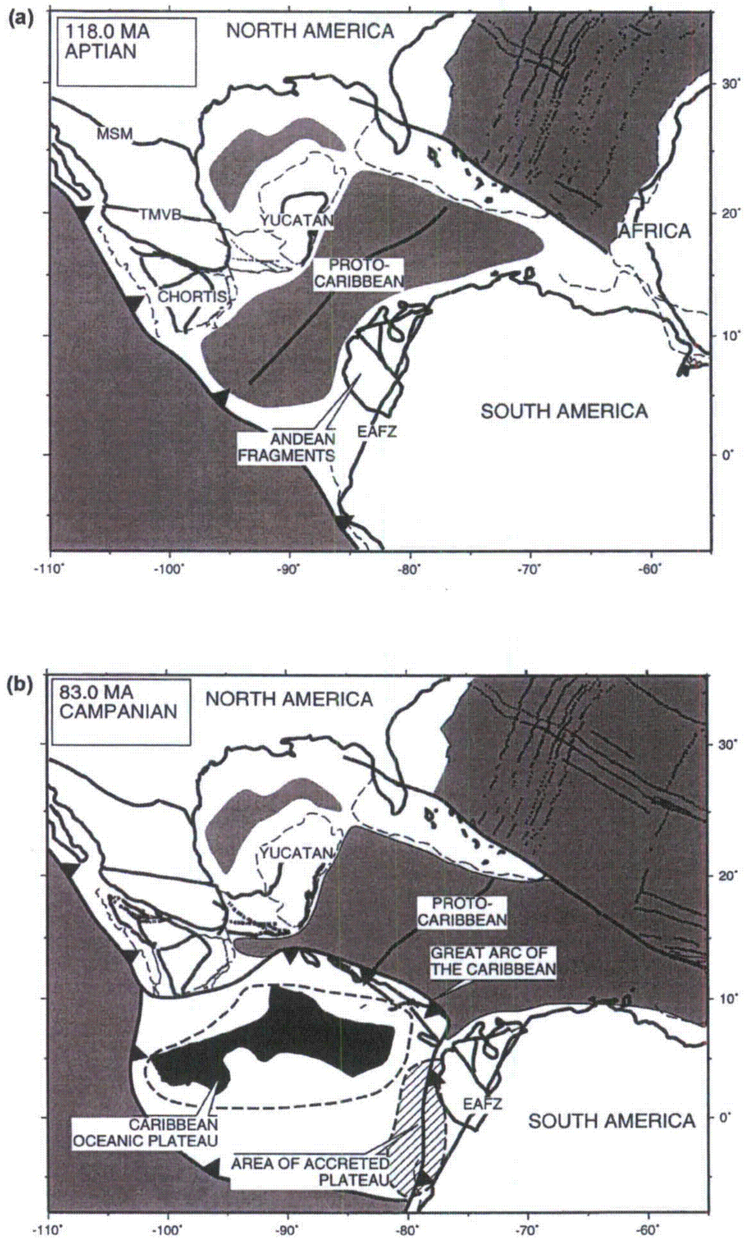
Modified from: References 206, 337, and 338.

Figure 2.5.1-206 Tectonic Plate Reconstructions of Gulf of Mexico and Caribbean Region



Note: Red circle is the approximate location of the 200-mile radius site region
Modified from Reference 696

Figure 2.5.1-207 Reconstruction of the Caribbean



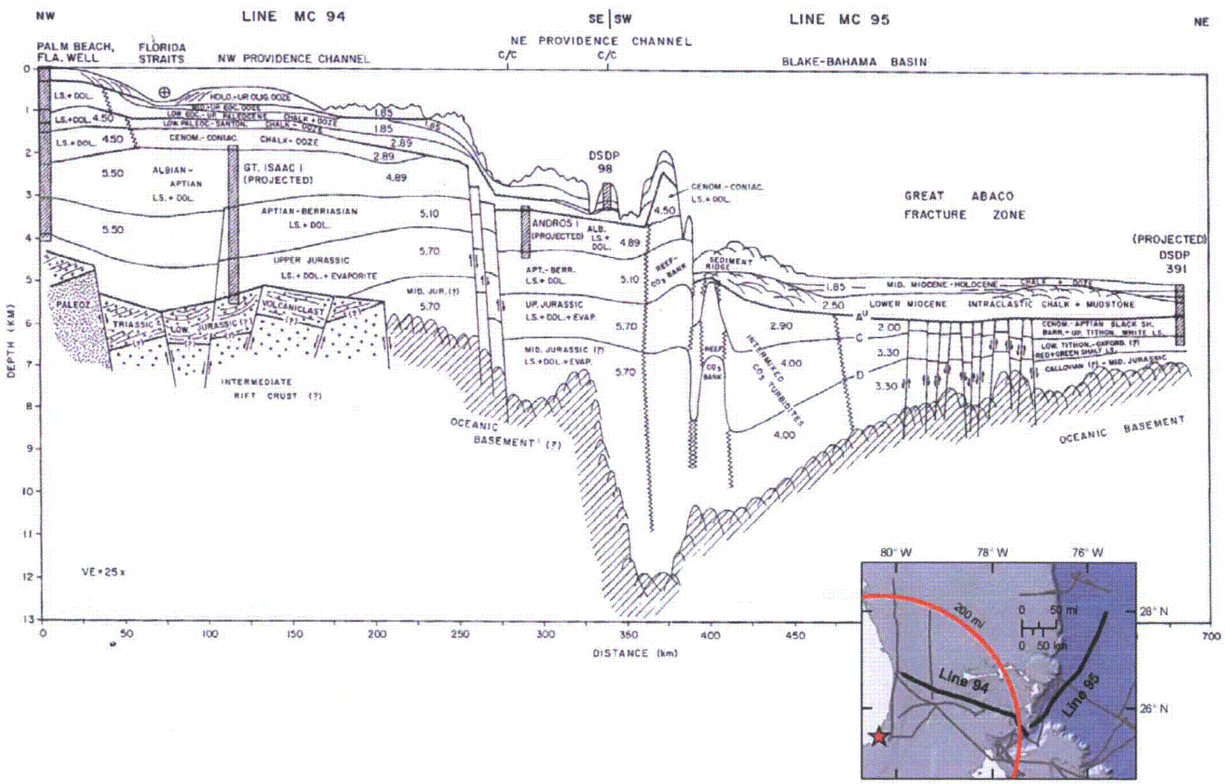
Notes:

(a) Reconstruction of the Caribbean region at 118 Ma
(b) Reconstruction of the Caribbean region at 83 Ma

MSM = Mohave-Sonora megashear, TMVB = Trans-Mexican volcanic belt, EAFZ = eastern Andean fault zone

Modified from Reference 782

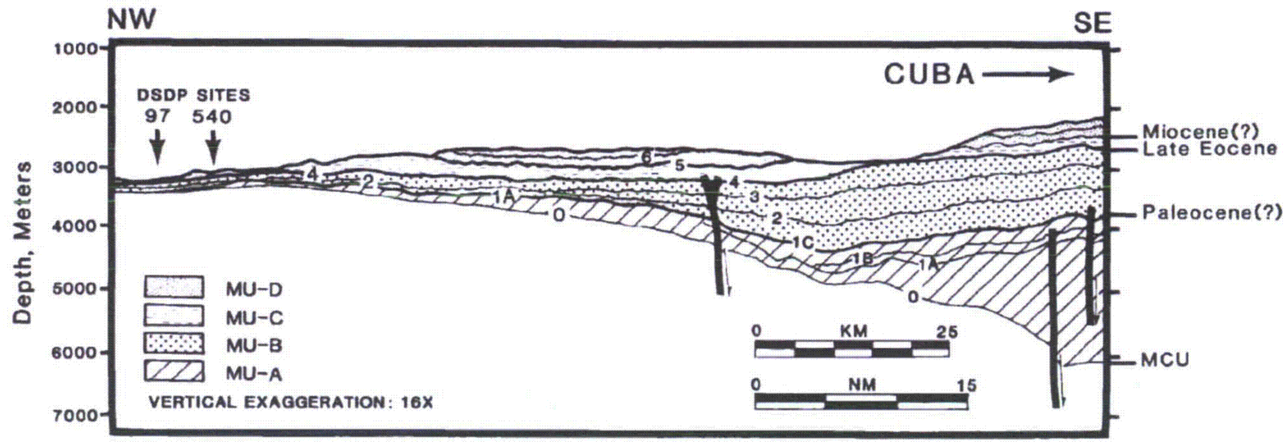
Figure 2.5.1-208 Interpretation of Seismic Line across Bahama Platform and Blake-Bahamas Basin

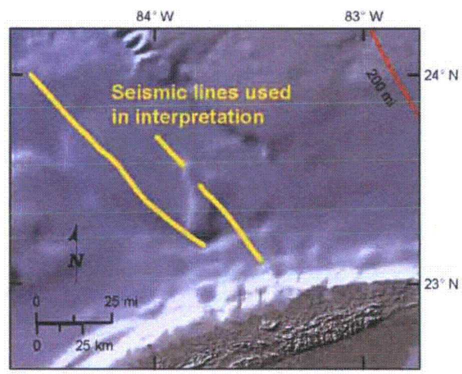


Note: See Figure 2.5.1-243 for the location and log of the Great Isaac Well 1.

Modified from: Reference 307

Figure 2.5.1-209 Seismic Line Interpretation of Cuba Foreland Basin, offshore west Cuba





Modified from: Reference 482

Figure 2.5.1-210 Physiographic Features of Northern Caribbean-North America Plate Boundary (Sheet 1 of 2)

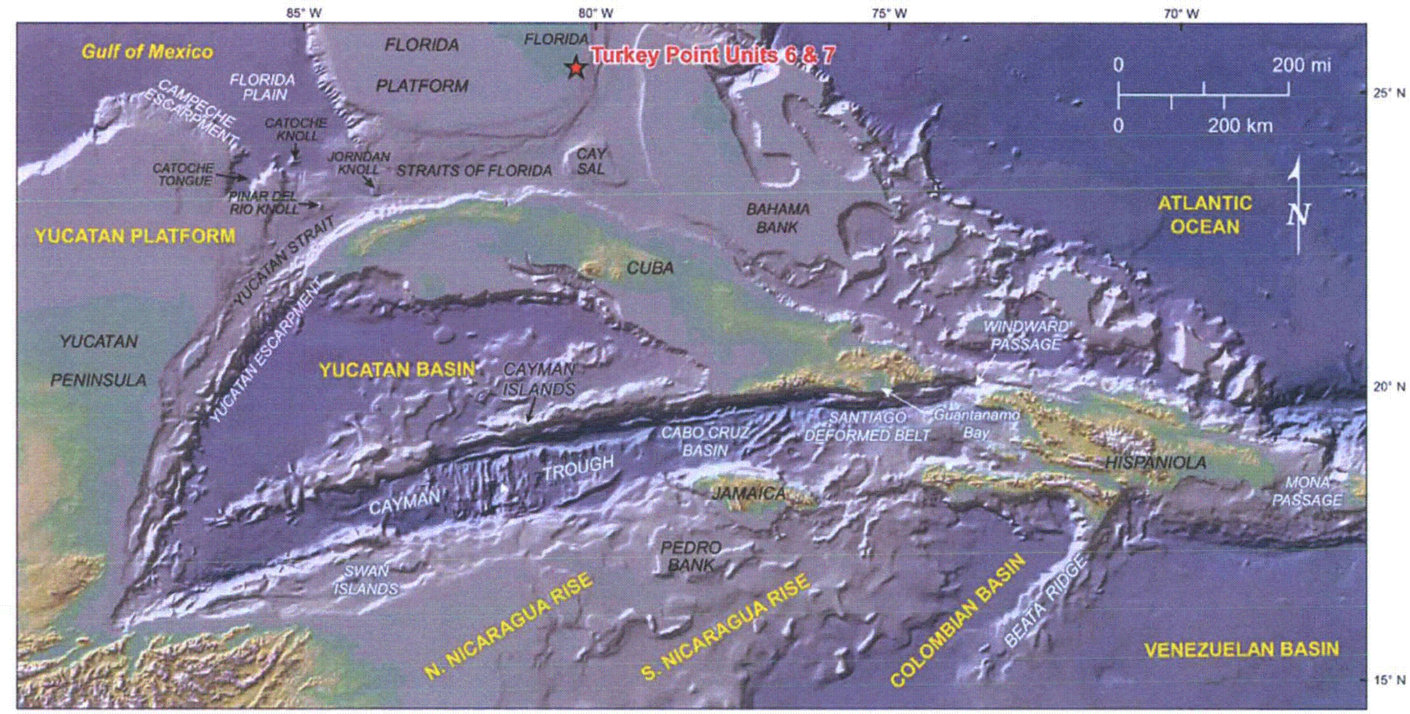


Figure 2.5.1-210 Physiographic Features of Northern Caribbean-North America Plate Boundary (Sheet 2 of 2)

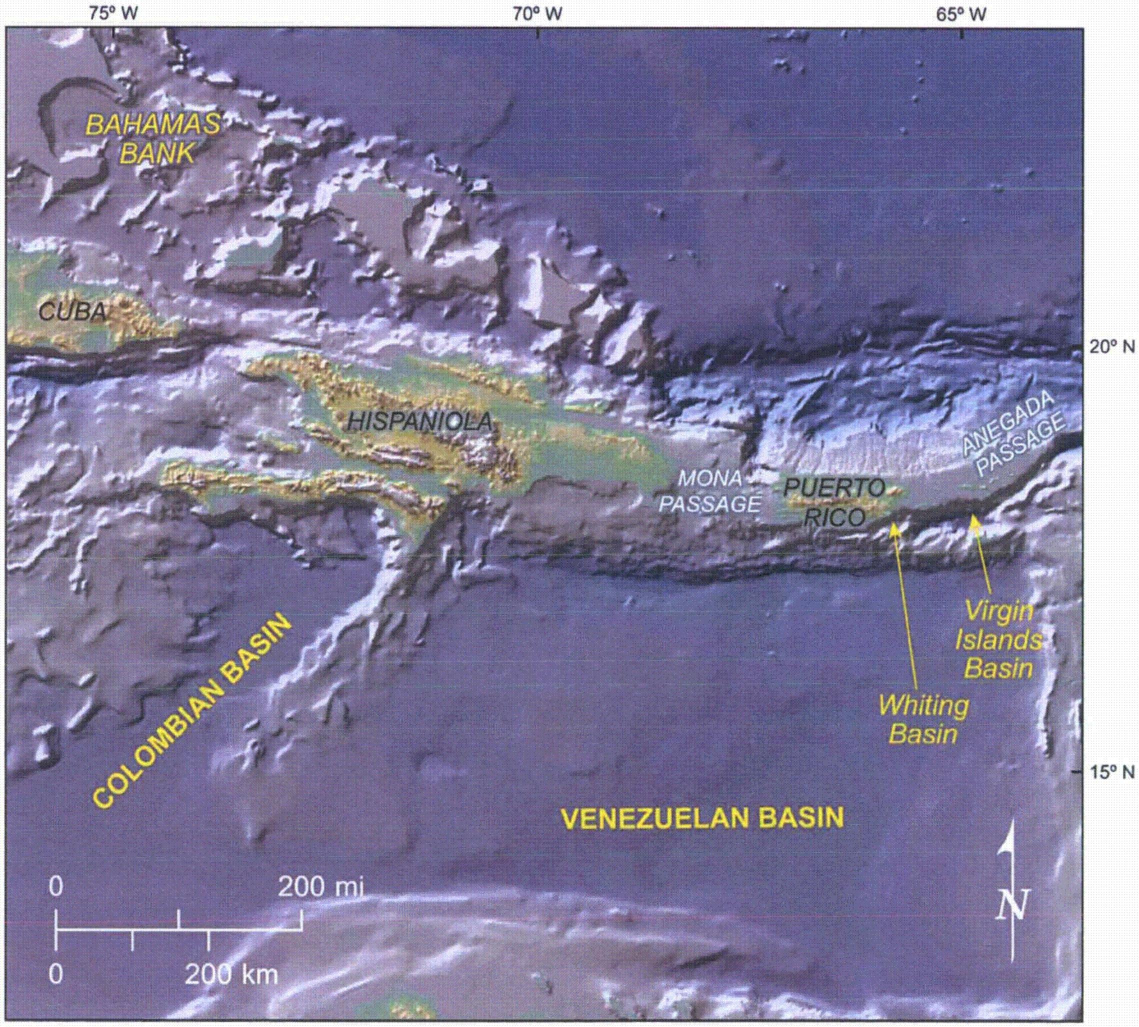
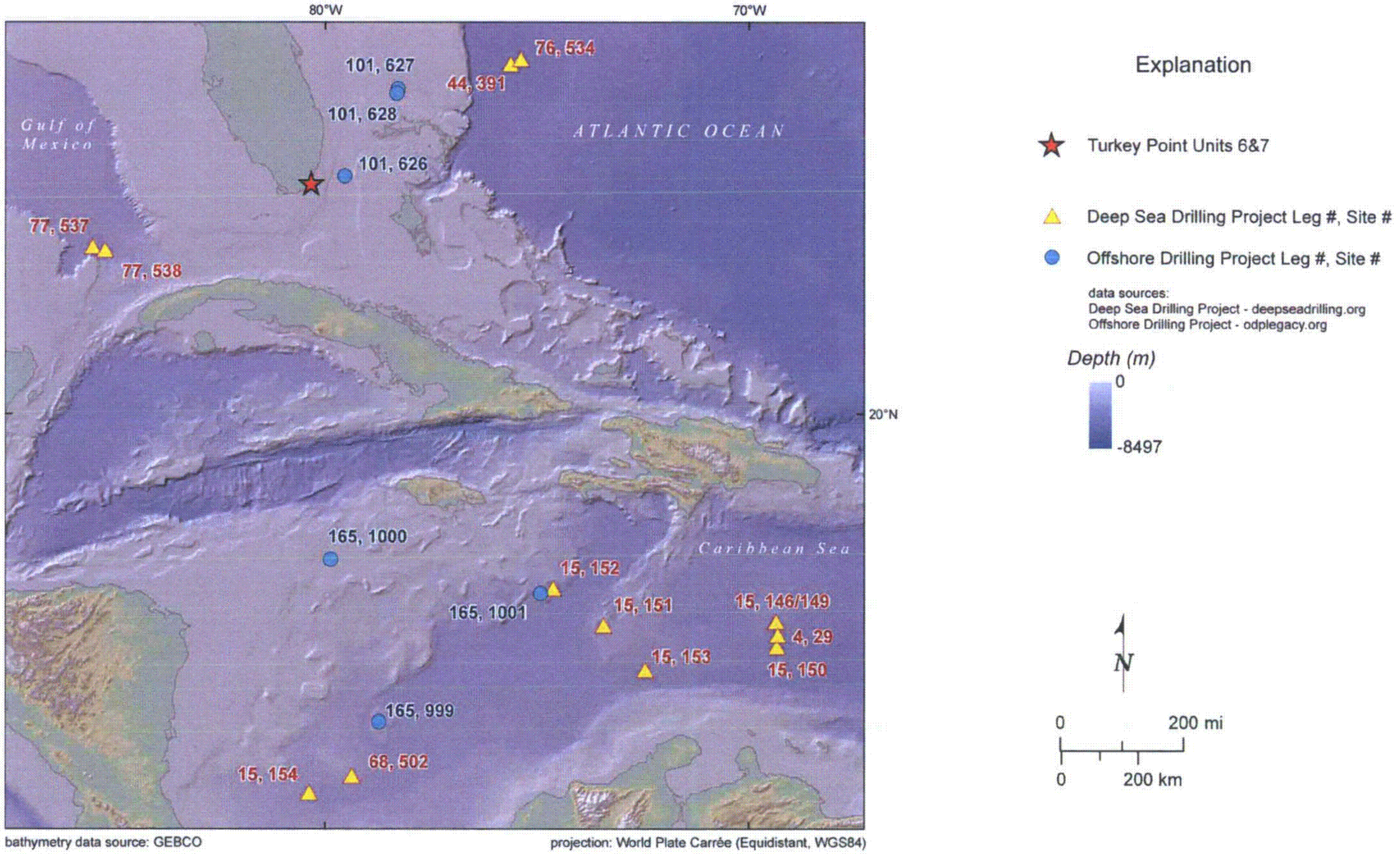
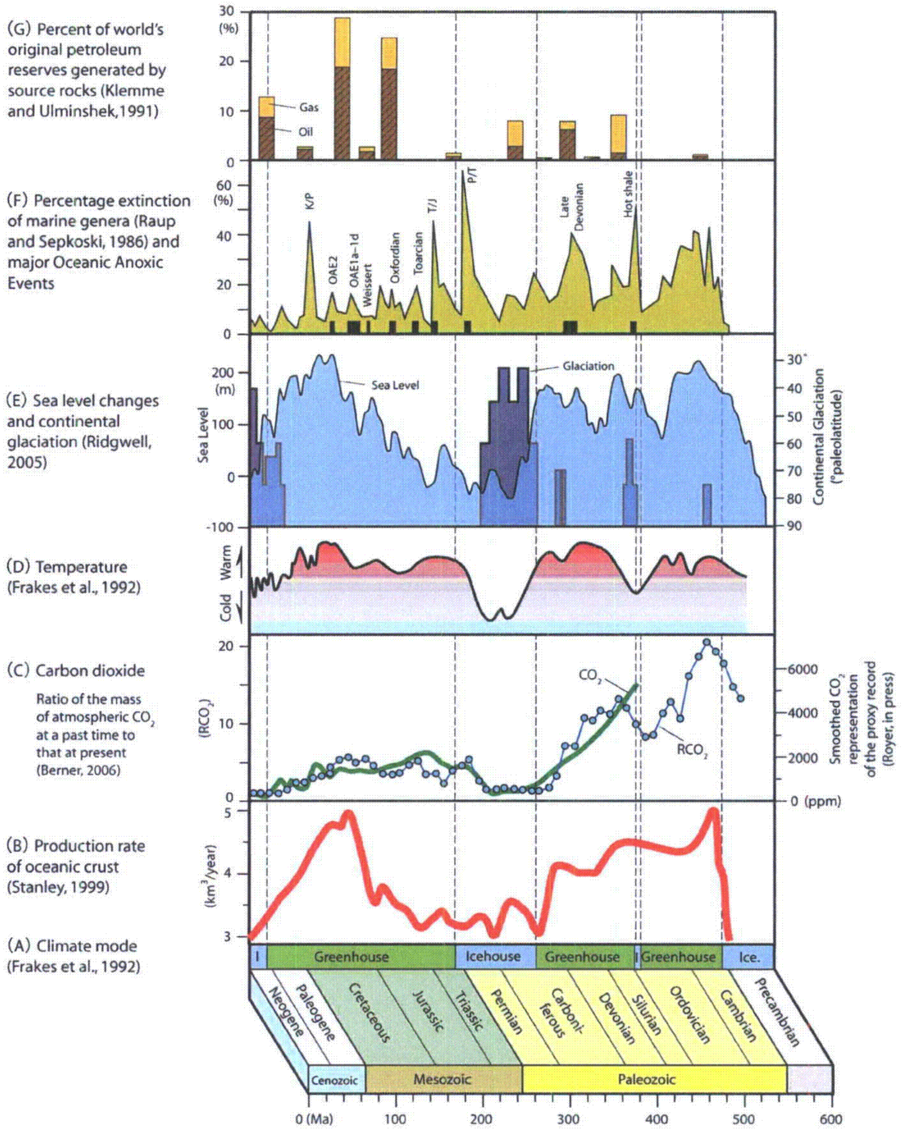


Figure 2.5.1-211 Deep Sea Drilling Locations



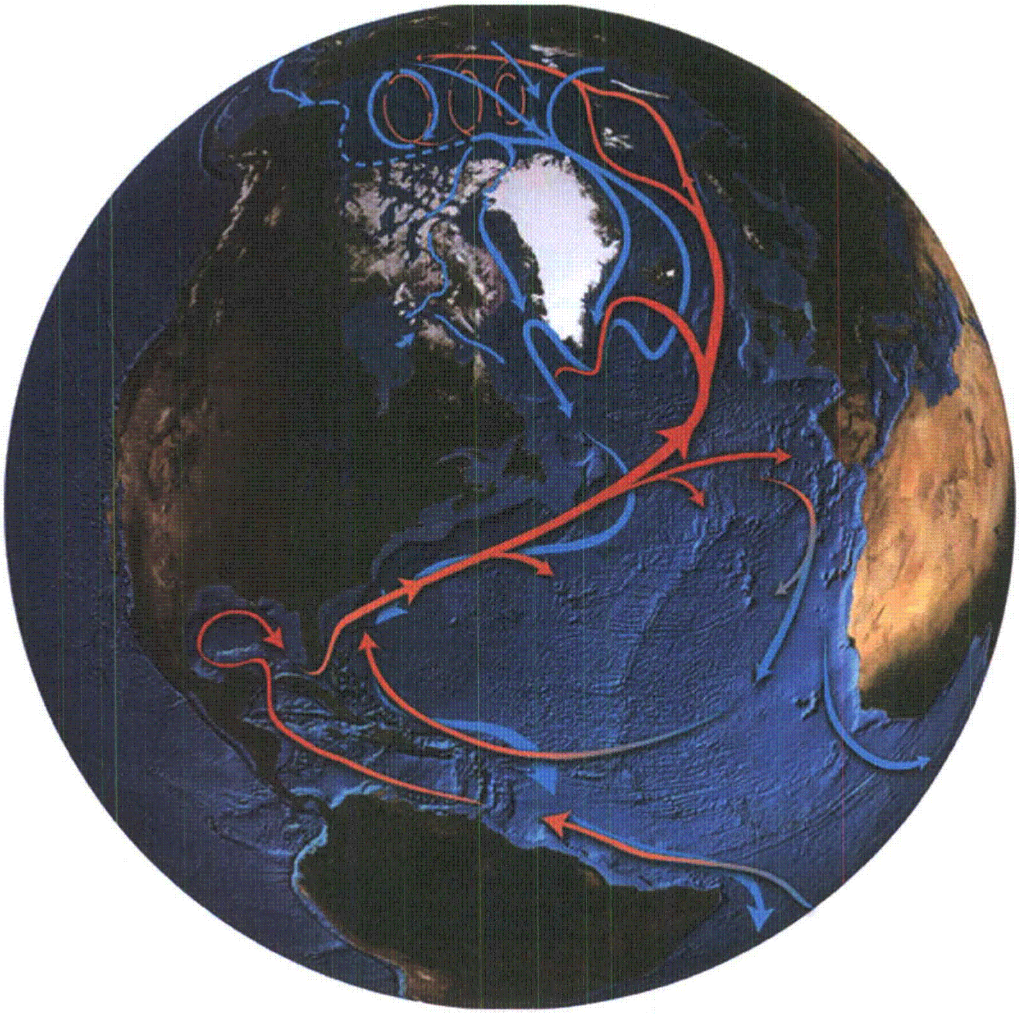
Source of DSDP location coordinates: Reference 802
Source of ODP location coordinates: Reference 803

Figure 2.5.1-212 Climate Change Parameters - Past 600 My



Modified from: Reference 761

Figure 2.5.1-213 Caribbean Currents Driven by the Great Ocean Conveyor Belt



Note: The Antilles Current flows northeast around the Bahama Bank. The Caribbean Current enters the Caribbean through a series of narrow passages and continues into the Gulf of Mexico as the Loop Current, finally exiting through the Florida Straits as the Florida Current. The Florida Current rejoins the Antilles Current and together form the Gulf Stream. The Gulf Stream then moves warm, salty water north along the U.S. East Coast and then toward Europe, before it transitions into the North Atlantic Current and heads north. As this water reaches higher latitudes, it releases heat to the atmosphere, tempering winters in the North Atlantic region and leaving behind saltier, cooler, and denser waters. These transformed waters sink to the depths and form the Deep Western Boundary Current, which flows southward along the East Coast-beneath the northward-flowing Gulf Stream-and into the South Atlantic.

Source: Reference 821

Figure 2.5.1-214 Bathymetry of the Florida Coast

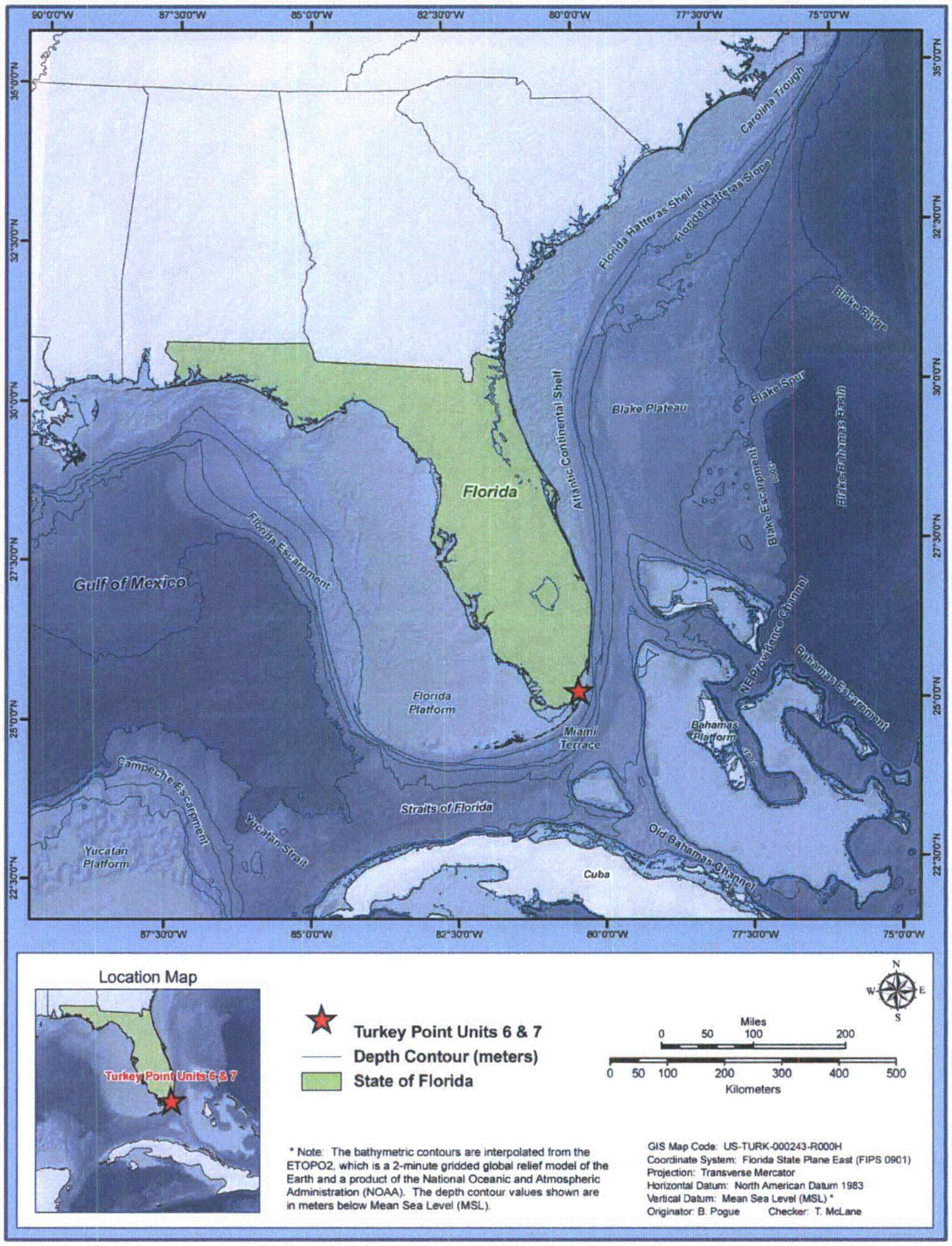
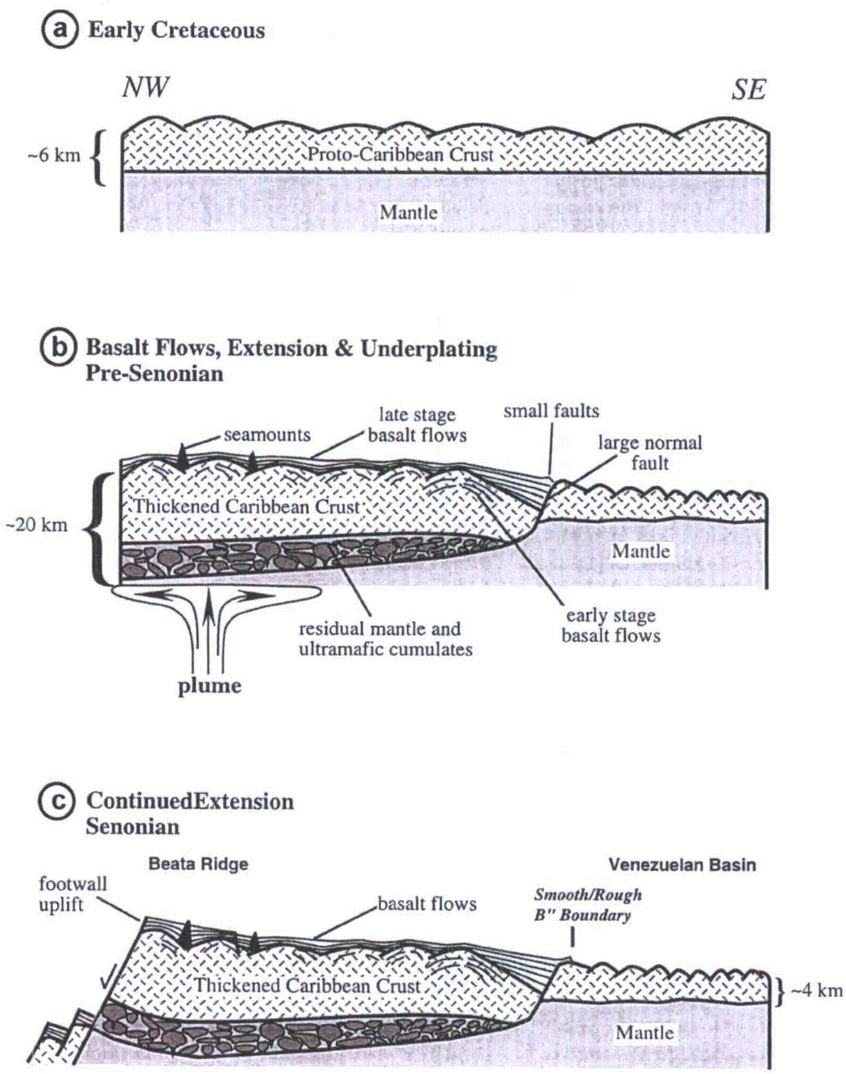


Figure 2.5.1-215 Schematic Illustrating the Geologic Development of the Caribbean Crust



Notes:

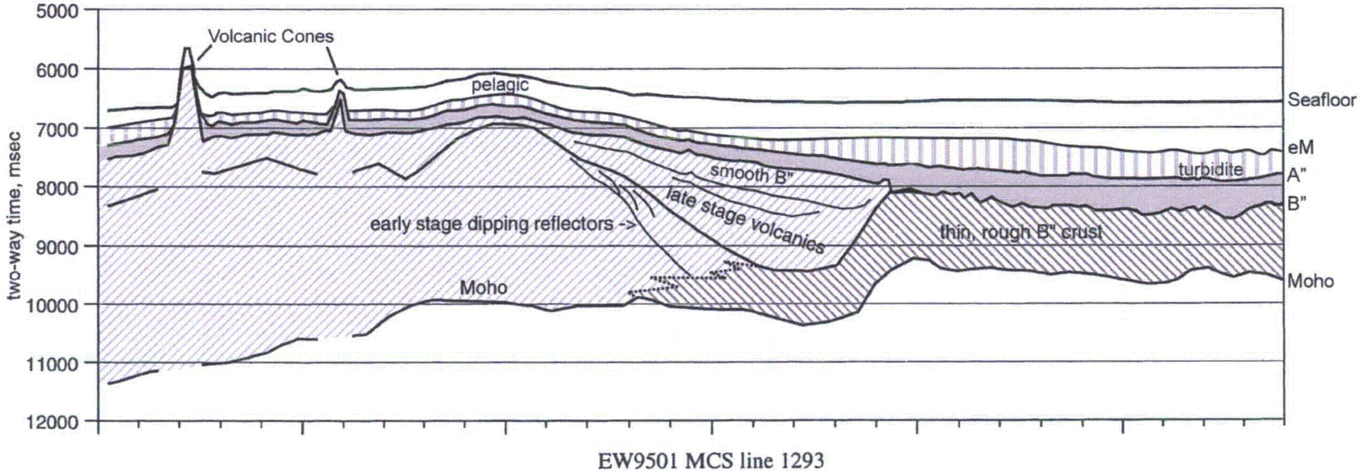
(a) Proto-Caribbean oceanic crust formed by seafloor spreading in Late Jurassic-Early Cretaceous time in the eastern Pacific.

(b) Widespread and rapid eruption of basaltic flows in concert with extension and thinning of the 'old' plate. The plate was thickened by at least two stages of basalt flows. The large divergent volcanic wedge observed along the rough-smooth B" boundary, is coincident with the abrupt shoaling of Moho, and appear to be bounded by a large northwest-dipping fault system.

(c) Minor extensional deformation across the Venezuelan Basin continued after magmatic thickening of crust as indicated by faulted and rotated basalt flows. The location of major extensional deformation migrated through time from the Venezuelan Basin to the western flank of the Beata Ridge. The extensional unloading of the footwall caused uplift and rotation of the Beata Ridge and collapse of the hanging wall (i.e., Hess Escarpment).

Modified from: Reference 253

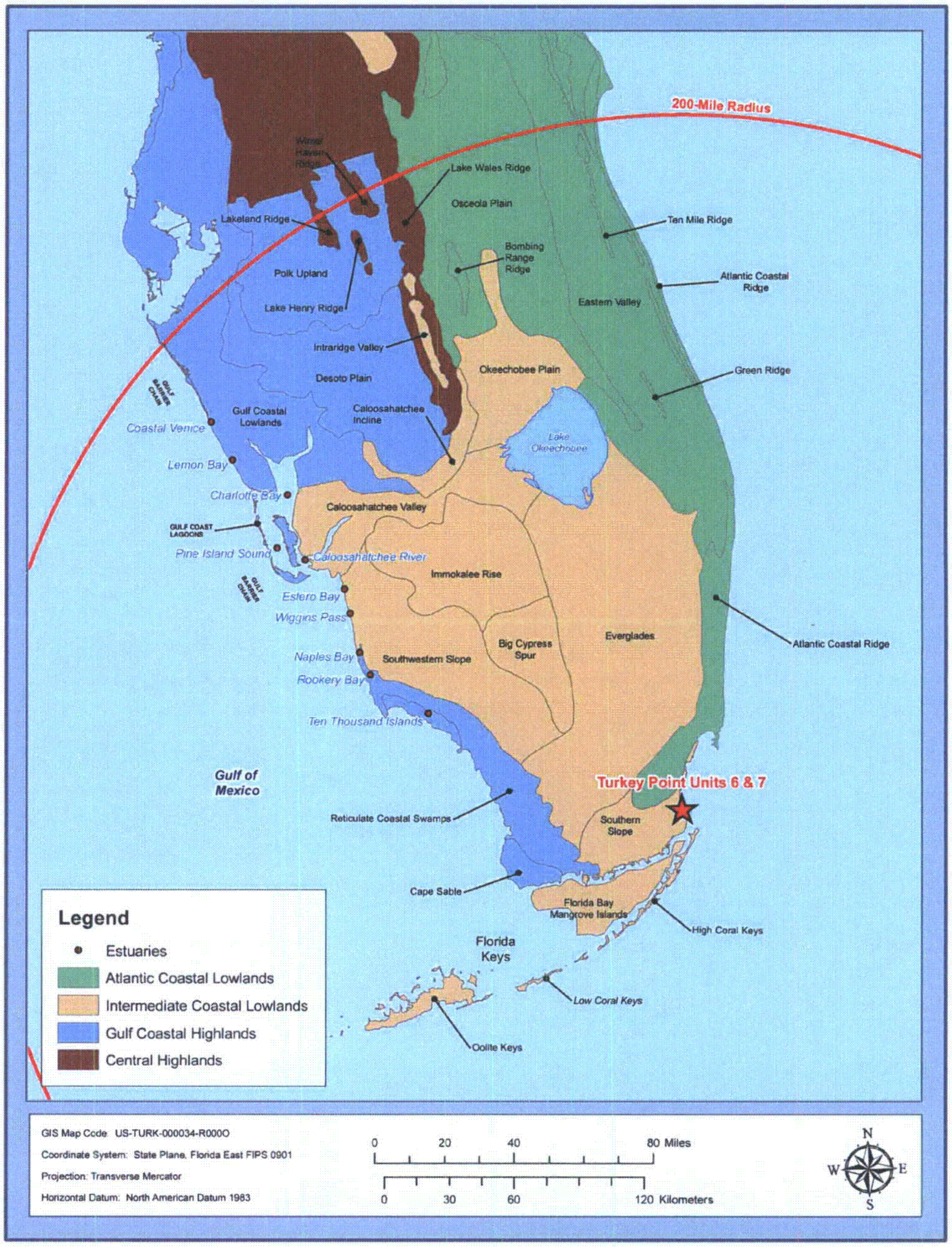
Figure 2.5.1-216 Interpreted Transition from Normal Oceanic Crust to Oceanic Plateau in the Venezuelan Basin



Note: Shows interpretation of major horizons of the Venezuelan Basin in multichannel seismic line 1293 in two-way time (top) and converted thicknesses (bottom) using averaged sonobuoy velocities.

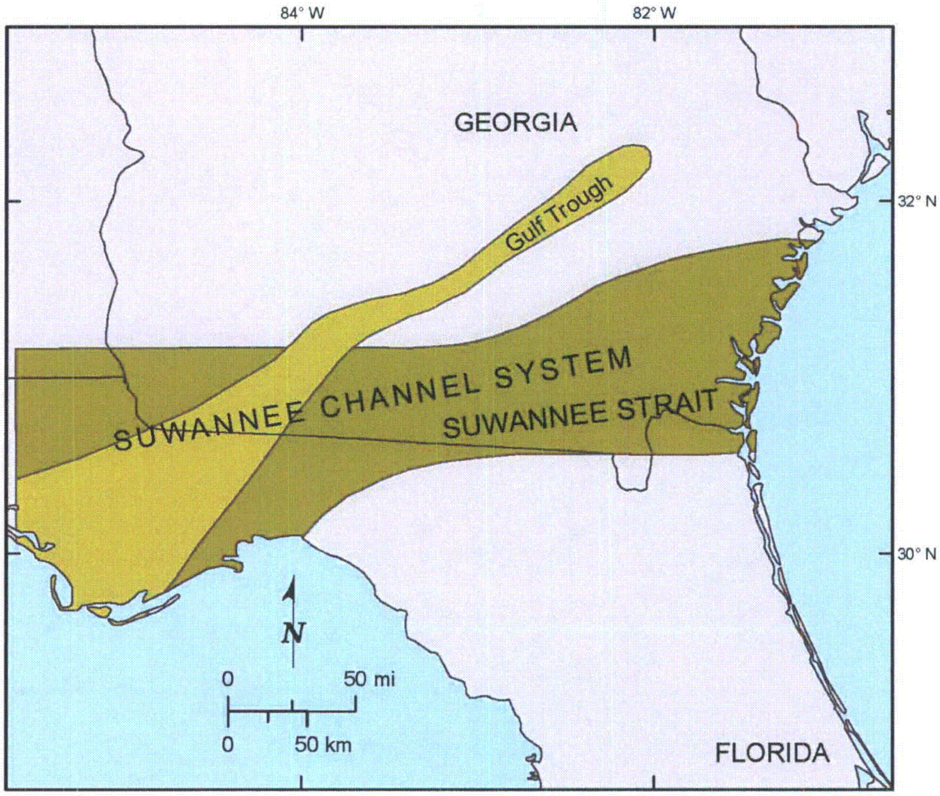
Modified from: Reference 255

Figure 2.5.1-217 Physiography of Florida



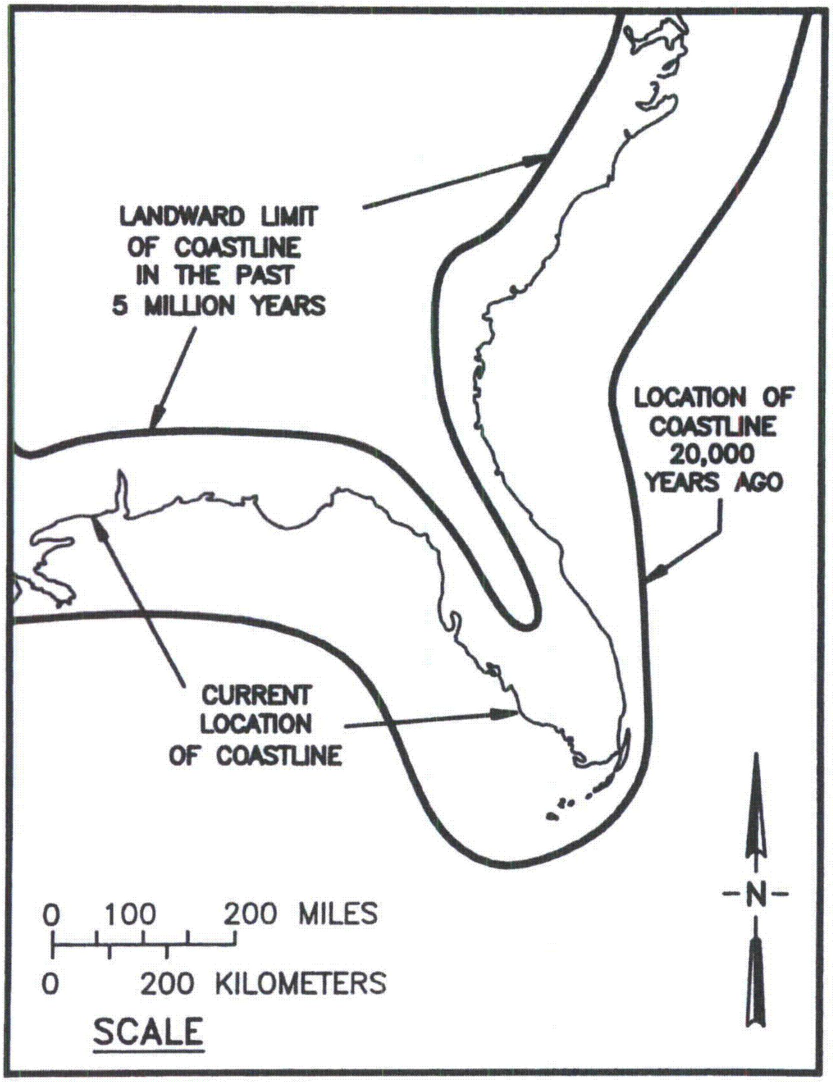
Modified from References 265 and 266

Figure 2.5.1-218 Suwannee Channel System



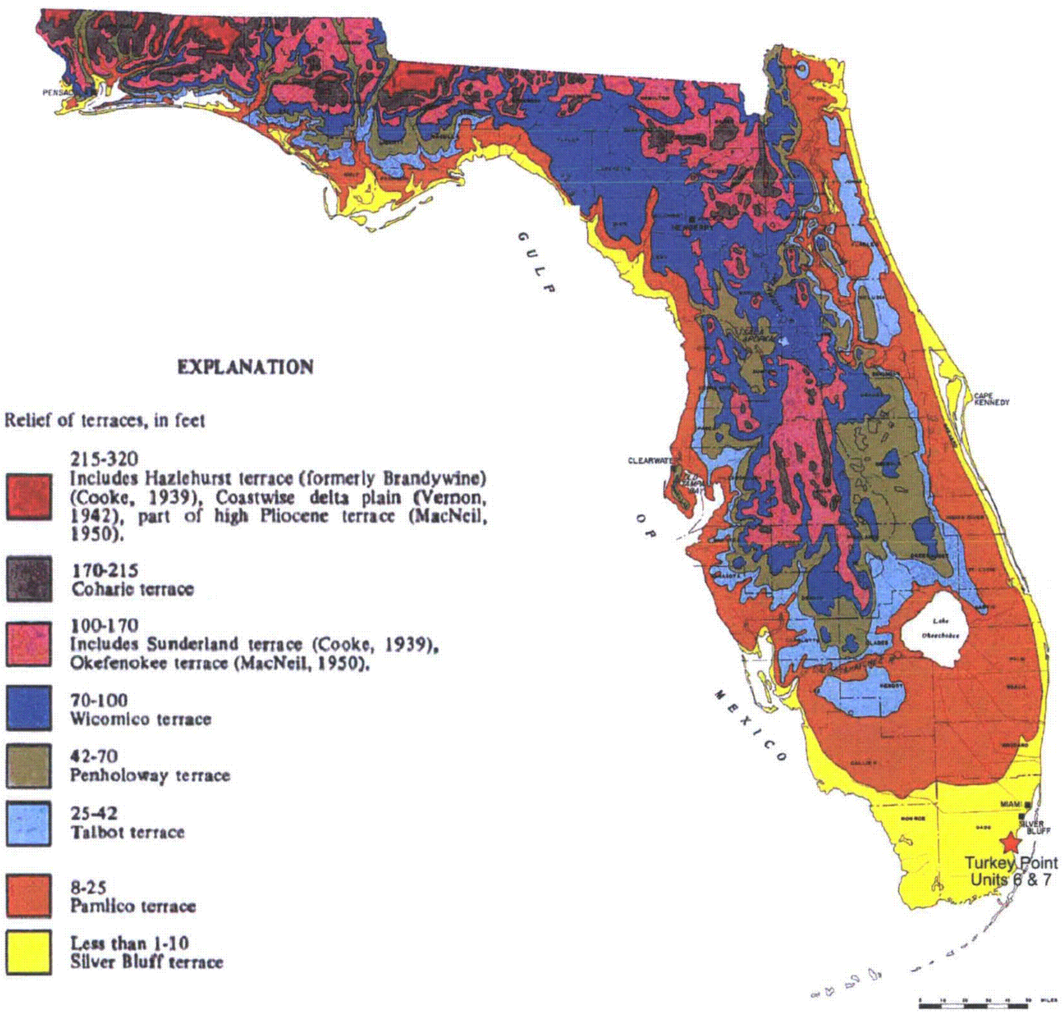
Modified from: Reference 388

Figure 2.5.1-219 Ancient Florida Coastlines



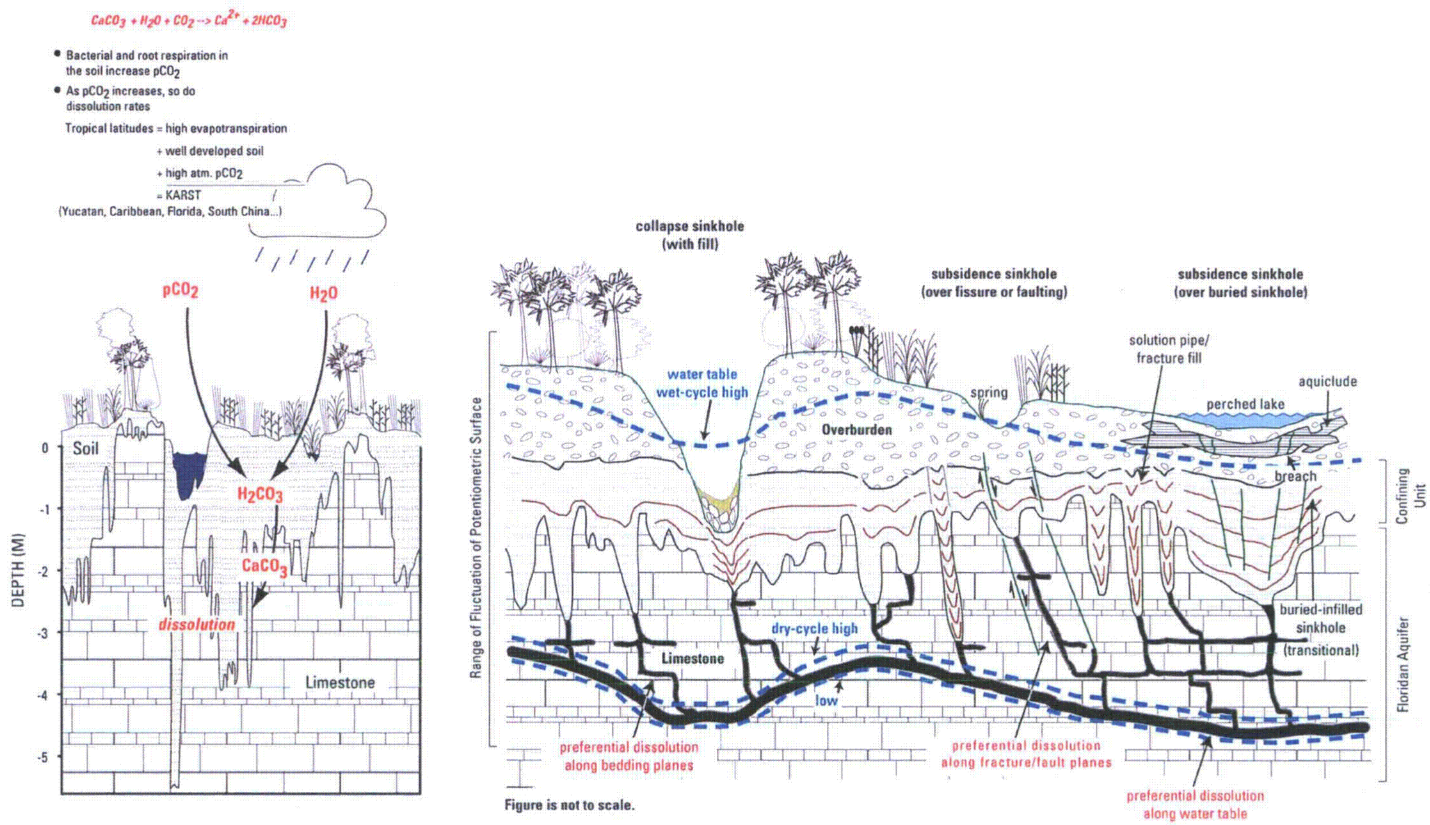
Source: Reference 266

Figure 2.5.1-220 Terraces and Shorelines of Florida



Modified from: Reference 261

Figure 2.5.1-221 Karstification Process

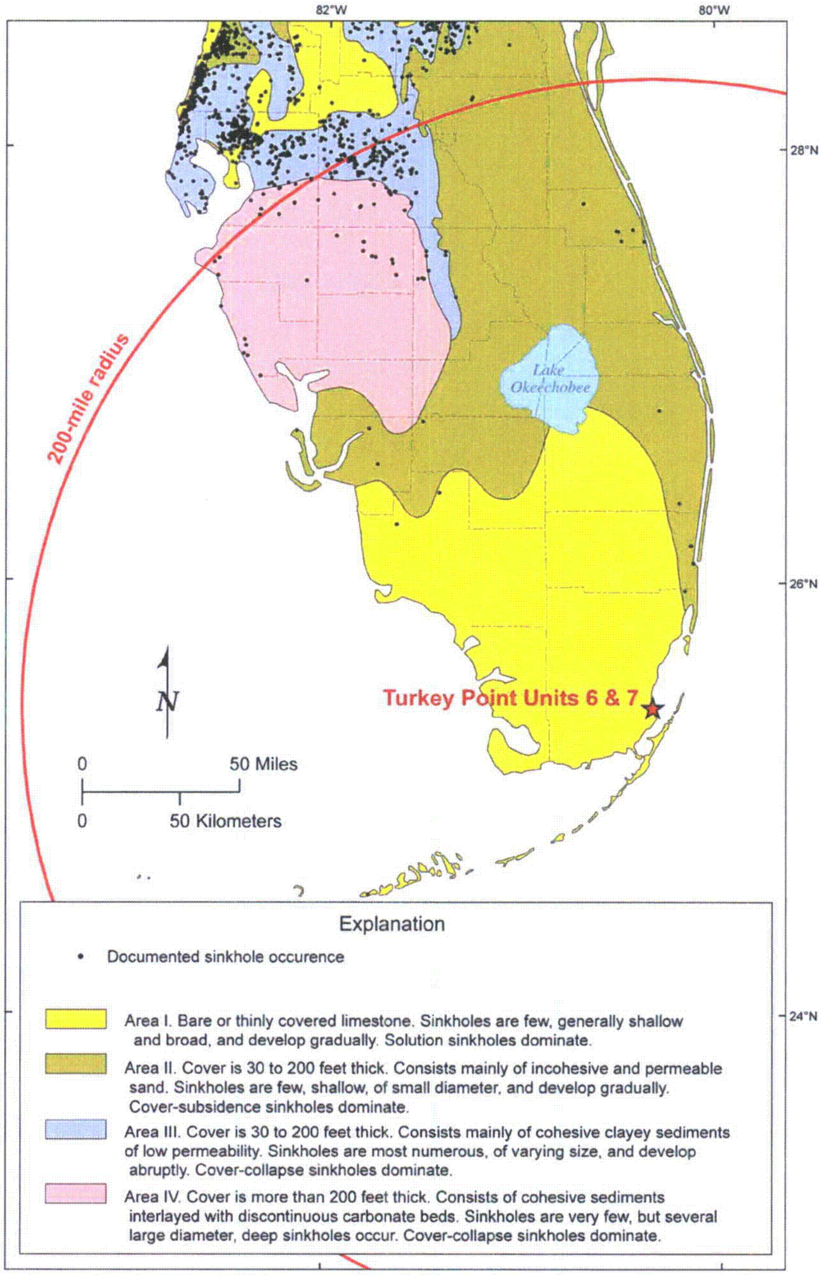


(a) Carbonate dissolution process and karst formation

(b) Solution and collapse features of karst and karren topography

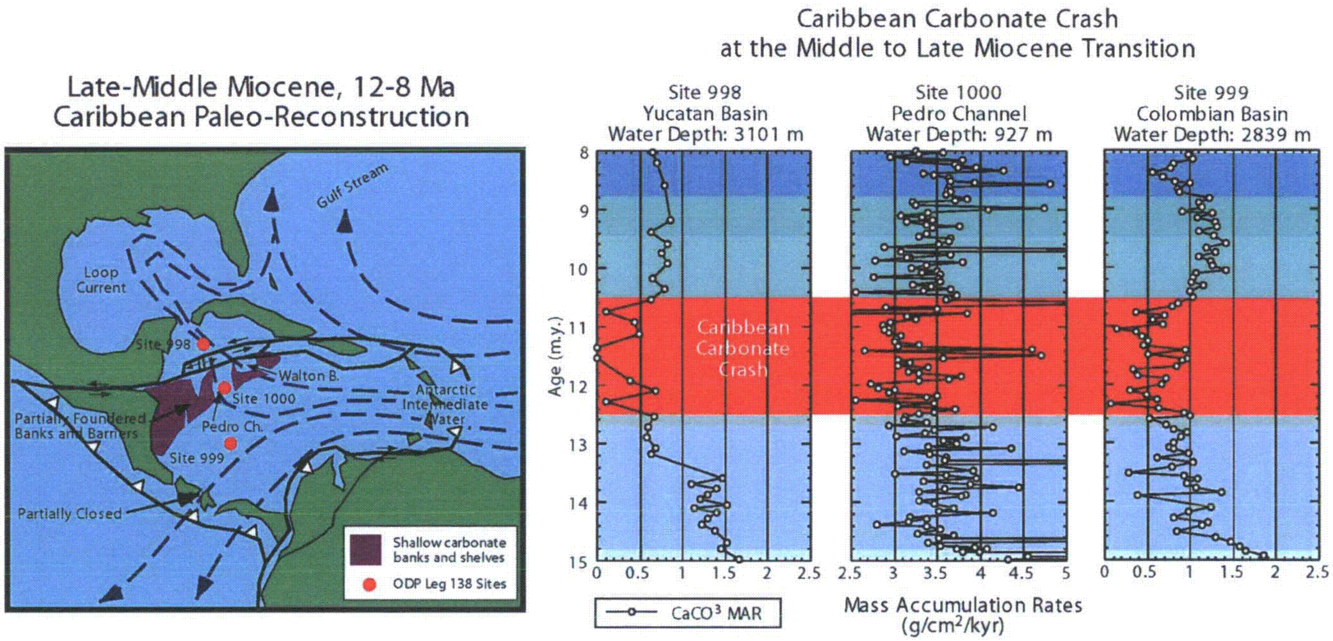
Modified from: Reference 760

Figure 2.5.1-222 Sinkhole Type, Development, and Distribution



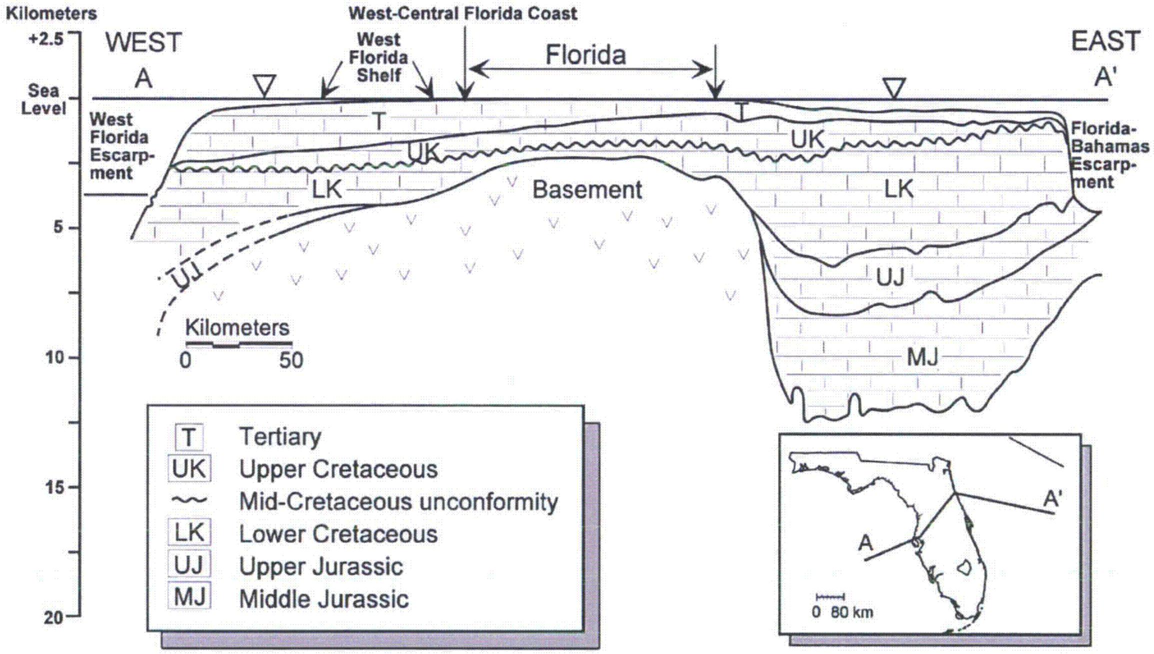
Data source: Reference 264

Figure 2.5.1-223 The Caribbean Carbonate Crash and Initiation of the Modern Global Thermohaline Ocean Circulation



Modified from: Reference 879

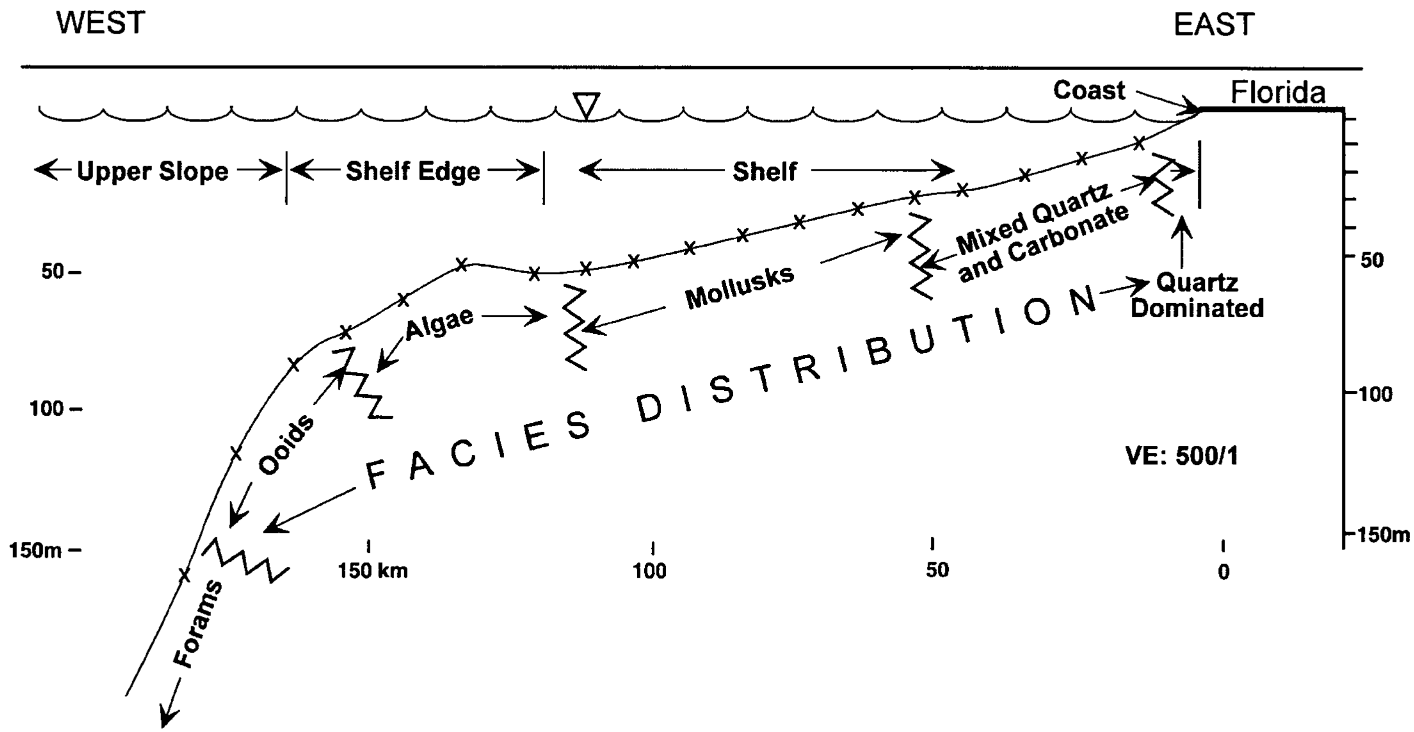
Figure 2.5.1-224 Cross Section of the Florida/Bahama Platform Showing Range of Thickness of Carbonate Rocks Covering Basement Rocks



Note: Peninsular Arch forms the backbone of peninsular Florida. About 4 kilometers (2.5 miles) of shallow water carbonates underlie portions of the site area. This figure shows that the west Florida shelf is a low-gradient carbonate ramp.

Source: Reference 764

Figure 2.5.1-225 Facies Distribution across the West-Central Florida Inner Shelf

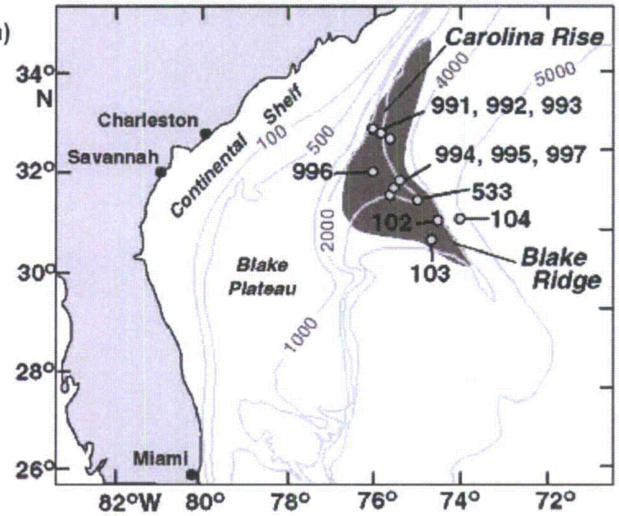


Note: Deposits along the coast are predominantly comprise quartz-rich sediments but contain a skeletal carbonate component. Just offshore, the skeletal components increase so that the inner shelf lies within the mixed quartz and carbonate zone. Further to the west out onto the shelf and upper slope, the carbonate content increases and belts of different carbonate constituents, including mollusks, algae, ooids and foraminifera, appear with broad transitions between the belts.

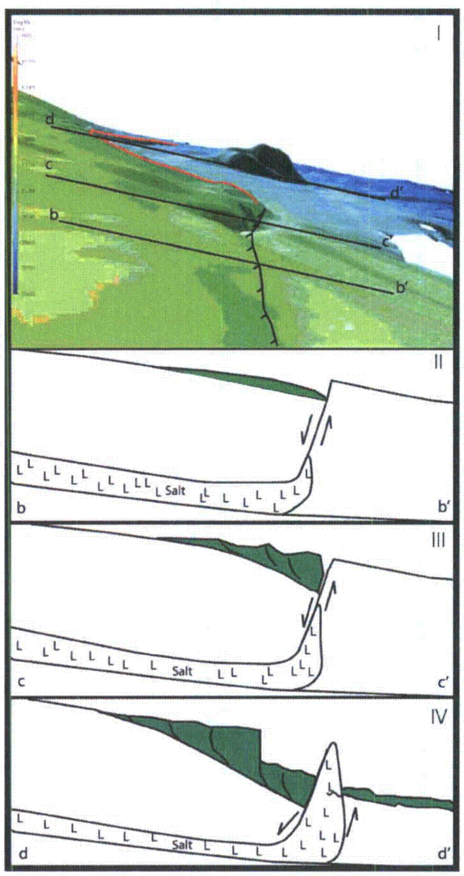
Source: Reference 764

Figure 2.5.1-226 Cape Fear Landslide and the Blake Ridge Salt Diapir Structure and Gas Hydrate Deposit

(a)



(b)



(I) Three-dimensional view of the Cape Fear Slide from the south,assuming a vantage point near the Blake Ridge Diapir and looking along the strike of the normal fault (black line with tick marks). The solid black lines show the locations of interpreted cross sections bb', cc' , and dd' (Figures II, III, and IV, respectively). Although Figures II through IV correspond to different parts of the fault, they also serve as a proxy for the impact of salt migration along the normal fault over time: The northernmost profile (dd') captures the most advanced stage of salt intrusion, and the southernmost profile captures the least (bb').
(II) Cross section coincident with Cape Fear Slide line 59, where the normal fault is observed. This likely represents the configuration of slumps (green), salt (hatched), and the normal fault at the Cape Fear Slide before sliding initiated.
(III) As normal faulting progressed, salt began to evacuate the subsurface, resulting in slope steepening along the downdropped portion of the fault and some sliding.
(IV) Continued salt extrusion resulted in even further steepening, perpetuating mass wasting at the site and eventually leading to breaching of the salt structure.

Notes:
(a) Source: Reference 302
(b) Modified from: Reference 323

Figure 2.5.1-227 Physiography of Cuba

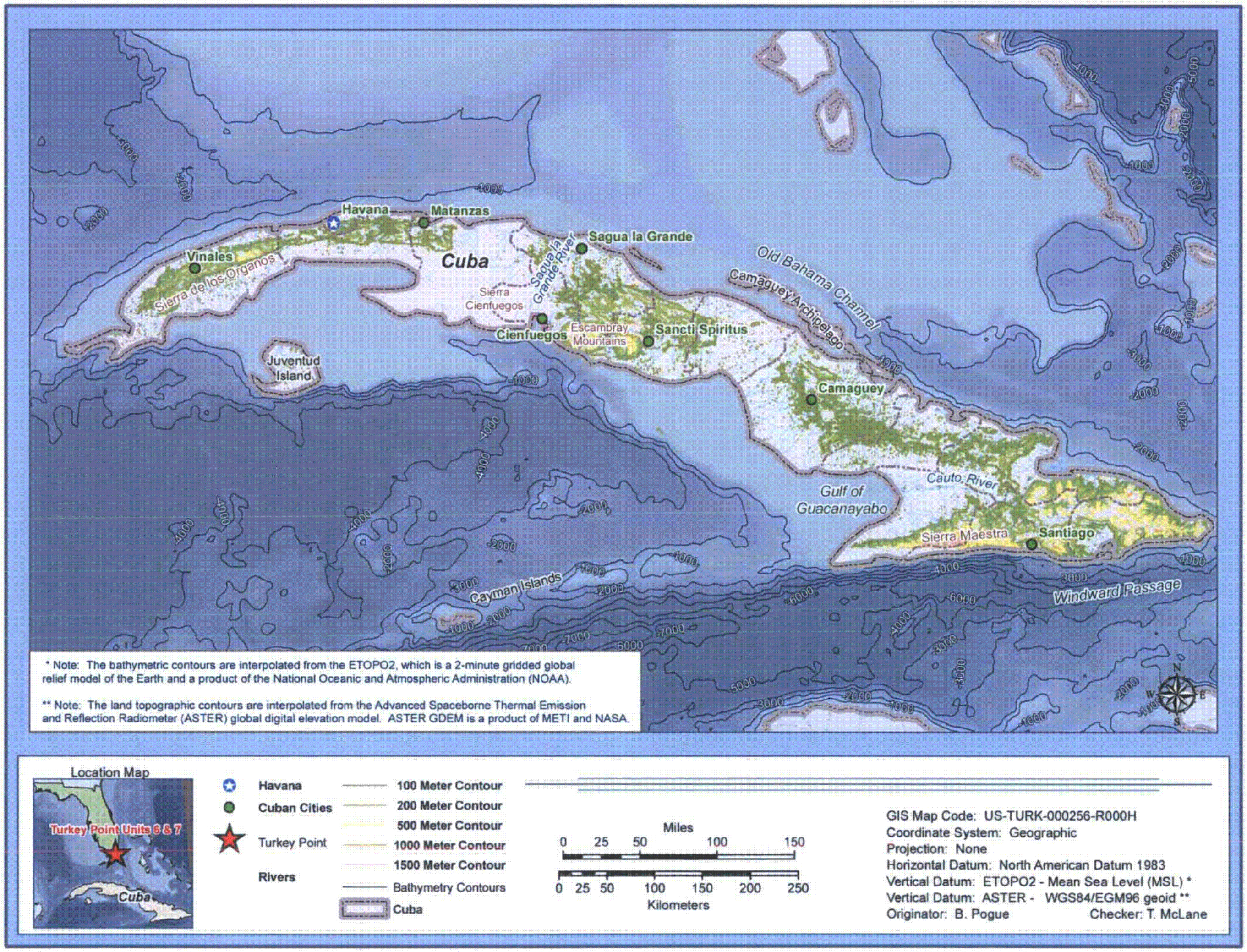


Figure 2.5.1-228 Paleozoic to Mesozoic Stratigraphy of Florida

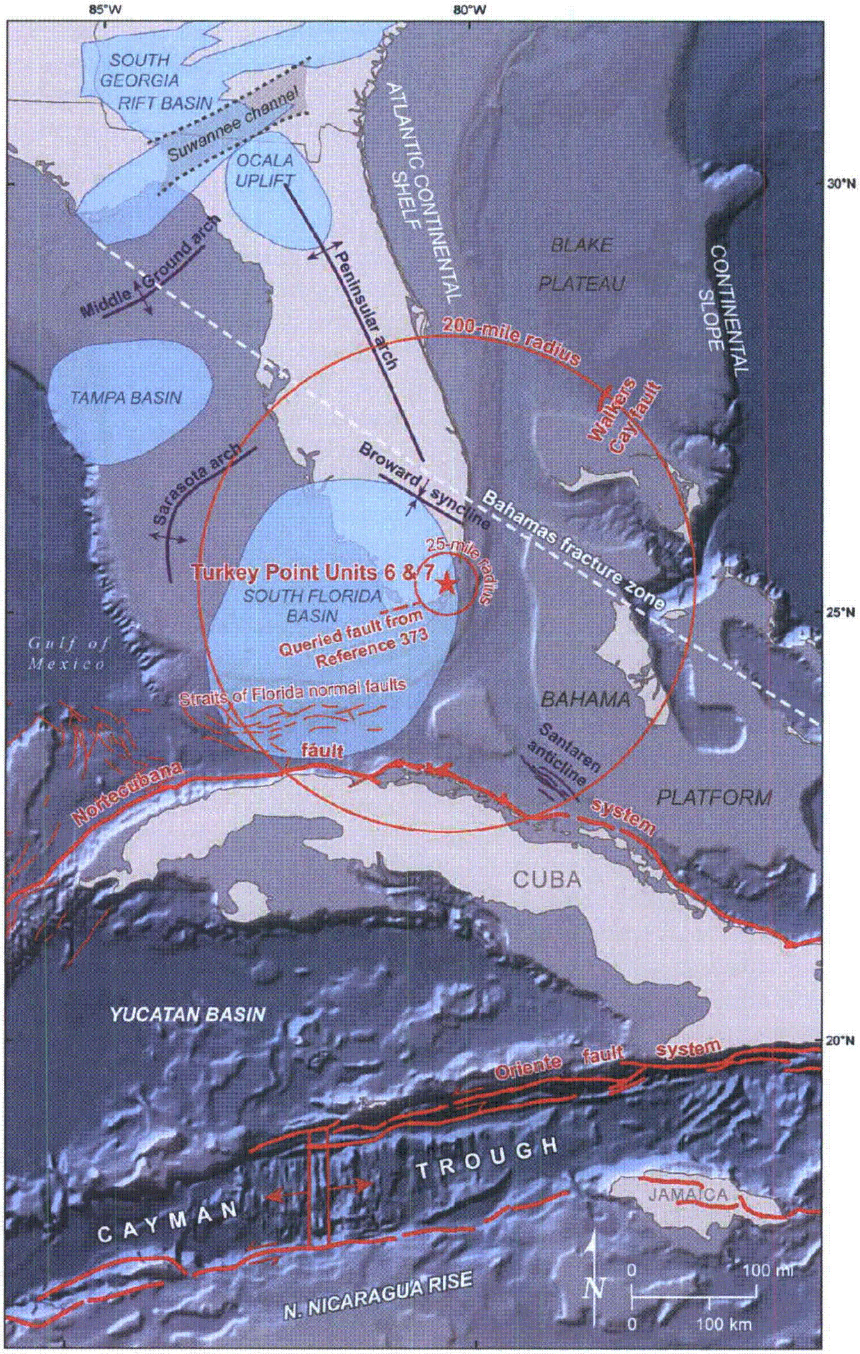
ERA	SYSTEM	SERIES	STRATIGRAPHIC UNIT		LITHOLOGY	APPROXIMATE THICKNESS (ft)
MESOZOIC	CRETACEOUS	UPPER	Pine Key Formation		chalk, ls, dol	3000
		LOWER	Naples Bay Group	Corkscrew Swamp Fm	ls with anhyd & dol	450
				Rookery Bay Fm		500
				Panther Camp Fm		350
			Big Cypress Group	Dollar Bay Fm	ls w. dol & anhyd	450-620
				Gordon Pass Fm	anhyd w. ls & dol	475
				Marco Junction Fm	ls w. dol & anhyd	350
			Ocean Reef Group	Rattlesnake Hammock Fm	anhyd w. ls & dol	600
				Lake Trafford Fm	ls with anhyd, dol	150
				Sunniland Fm	ls with dol & anhyd	200-300
			Glades Group	Punta Gorda Anhydrite	salt with anhyd & dol	800
				Lehigh Acres Formation	anhyd, ls, dol	210
					ls, dol, brown dol zone	300
					sh	200
			Pumpkin Bay Formation		anhyd with ls	1200
			Bone Island Formation		ls with anhyd & dol	1300-2000
	JURASSIC	UPPER	Wood River Formation		dol, anhyd, salt, ss	1700-2100
		MIDDLE	basement volcanic province		felsic rocks: rhyolite porphyry	
		LOWER			mafic volcanics: basalt & diabase	
PALEOZOIC			Suwannee Terrane	Paleozoic sedimentary Suite	quartzitic sandstone & black shale	
				St. Lucie Metamorphic Complex	pan-African metamorphics	
				Osceola Granite	granite	
				Osceola volcanic complex	felsic meta-igneous	
TOTAL THICKNESS						12,750-14,300

Abbreviations:
ls = limestone ss = sandstone sh = shale
dol = dolomite anhyd = anhydrite Fm = formation

Sources: References 352, 339, 338, 354, 366, 467, and 470

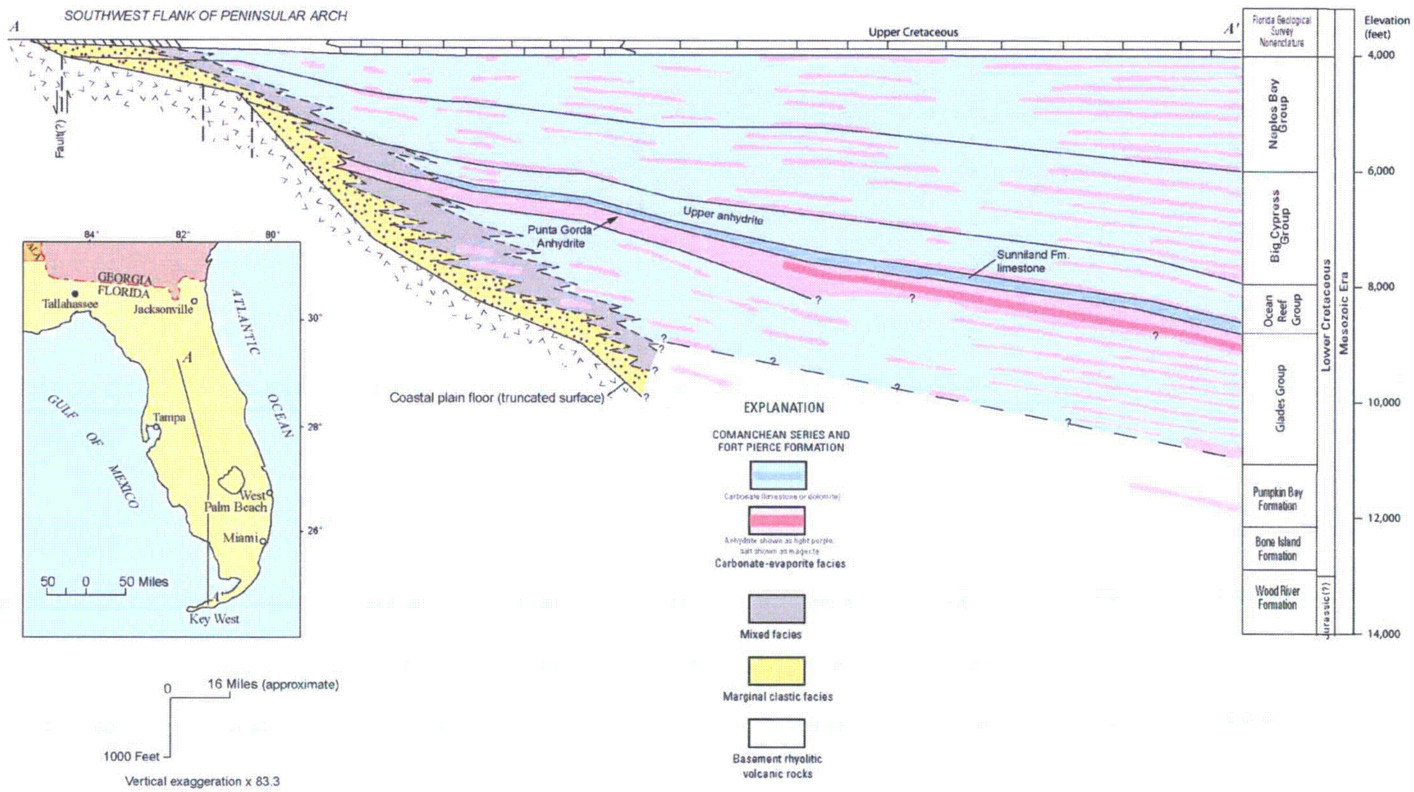
PTN RAI 02.05.01-11
PTN RAI 02.05.01-12

Figure 2.5.1-229 Regional Tectonic Features



Sources: References 822, 482, 823, 457, 212, and 421

Figure 2.5.1-230 Simplified North-South Profile of Mesozoic-Age Rocks in Florida



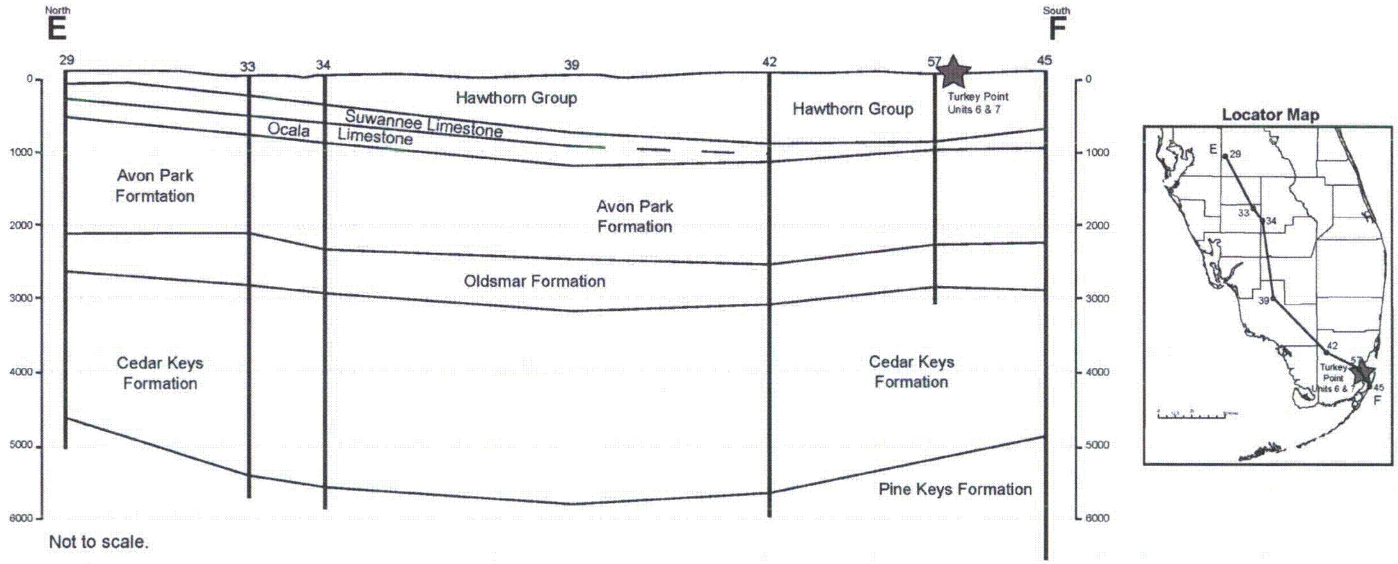
Modified from: Reference 366

Figure 2.5.1-231 Cenozoic Stratigraphy of Southern Florida

ERA	SYSTEM		SERIES	STRATIGRAPHIC UNIT		LITHOLOGY	APPROXIMATE THICKNESS (ft)
CENOZOIC	QUATERNARY		PLEISTOCENE	Miami Limestone / Key Largo Limestone/ Anastasia Formation		sandy, oolitic, coralline, shelly limestone	10-180
CENOZOIC	QUATERNARY		PLEISTOCENE	Caloosahatchee Formation/ Fort Thompson Formation		poor/well indurated sandy, fossiliferous limestone	50-100
CENOZOIC	TERTIARY	NEOGENE	PLIOCENE	Tamiami Formation/ Cypresshead Formation (Long Key Formation)		fossiliferous sand & silt with limestone	25-220
CENOZOIC	TERTIARY	NEOGENE	MIOCENE	Hawthorn Group	Peace River Formation	sands, clays, & phosphatic carbonates	100-650
CENOZOIC	TERTIARY	NEOGENE	MIOCENE	Hawthorn Group	Arcadia Formation	fine crystalline limestone with sand/clay, phosphatic fossiliferous limestone, & dolomite	100-700
CENOZOIC	TERTIARY	PALEOGENE	OLIGOCENE	Suwannee Limestone		poor/well indurated fossiliferous vuggy to moldic limestone	200-600
CENOZOIC	TERTIARY	PALEOGENE	EOCENE	Ocala Limestone		poor/well indurated fossiliferous limestone	200-400
CENOZOIC	TERTIARY	PALEOGENE	EOCENE	Avon Park Formation		poor/well indurated fossiliferous limestone & vuggy dolostone	400-1200
CENOZOIC	TERTIARY	PALEOGENE	EOCENE	Oldsmar Formation		vuggy limestone & dolomite	500-1500
CENOZOIC	TERTIARY	PALEOGENE	PALEOCENE	Cedar Keys Formation		dolomite, gypsum, & anhydrite	500-2000
TOTAL THICKNESS							**5000-6000**

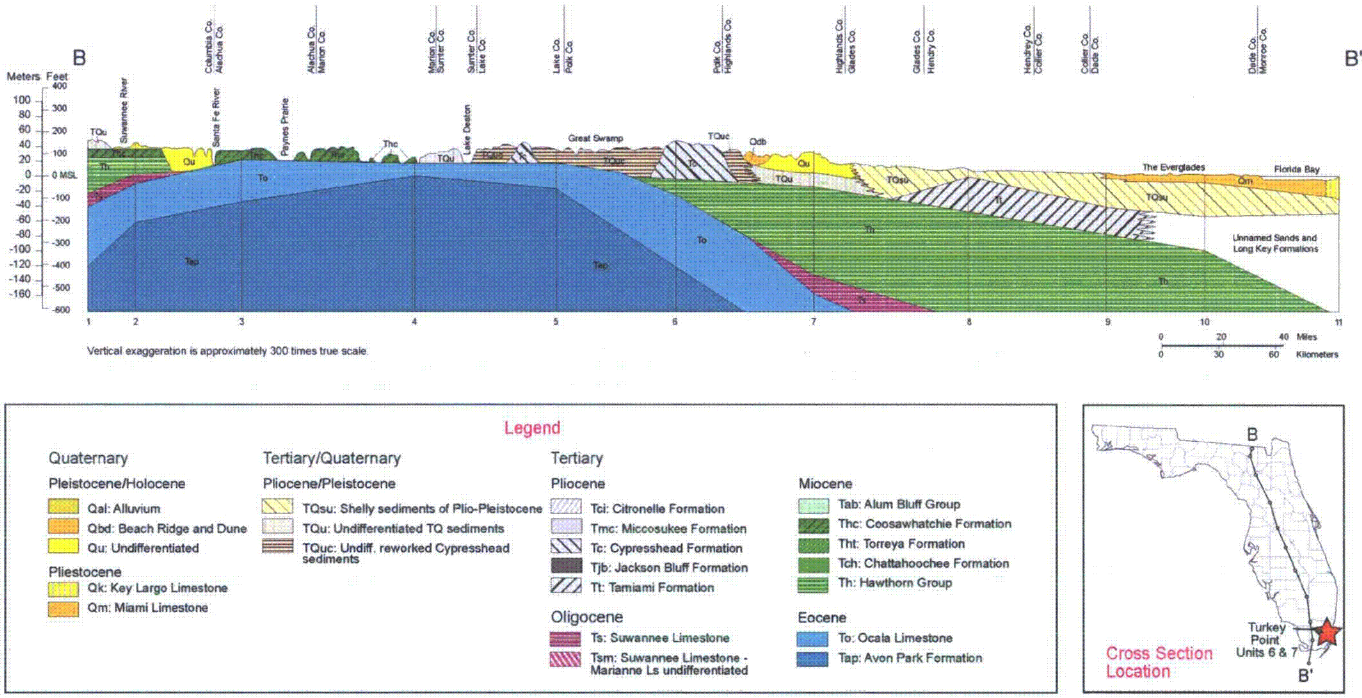
Sources: References 357, 373, 375, 376, 394, 397, 398, 399, 403, and 406

Figure 2.5.1-232 North-South Geologic Cross Section of Upper Mesozoic and Lower Cenozoic Rocks in Southern Florida



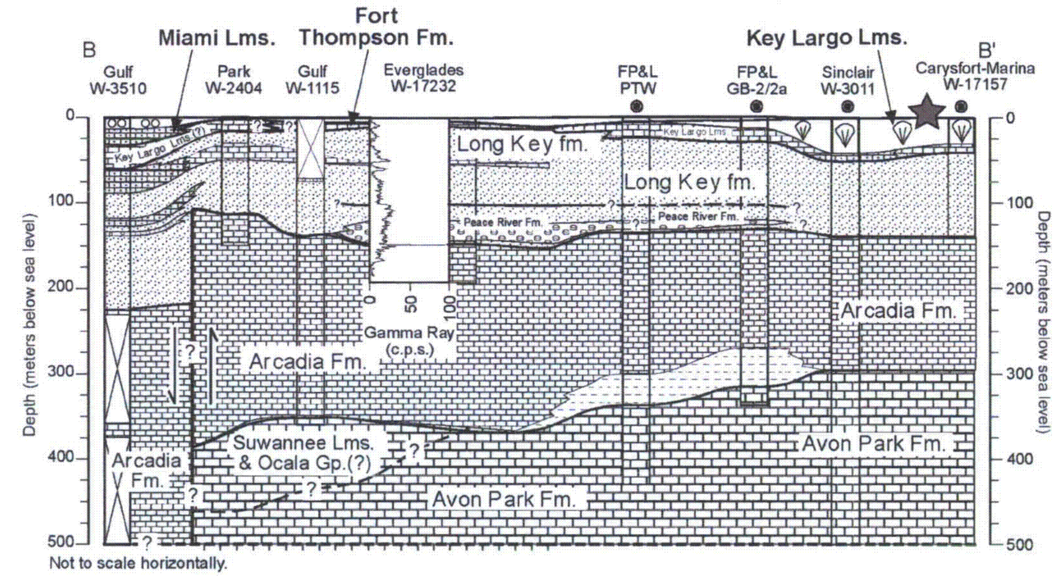
Modified from: Reference 397

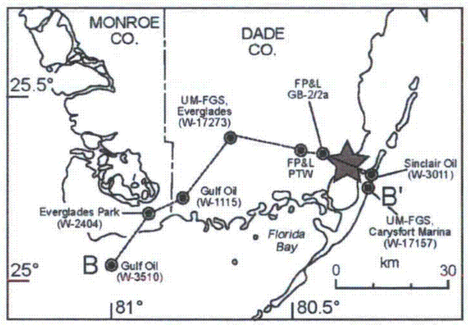
Figure 2.5.1-233 Cenozoic North-South Cross Section of Florida



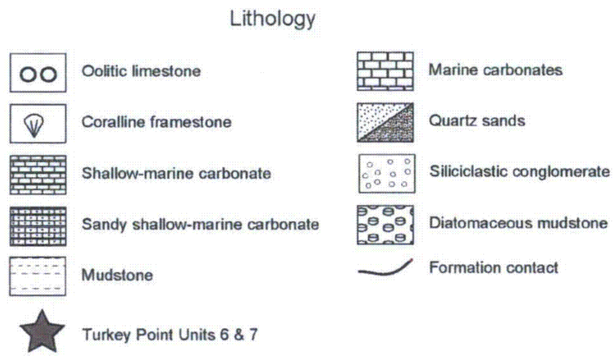
Modified from: Reference 377

Figure 2.5.1-234 East-West Geologic Cross Section of Upper Cenozoic Age Rocks in Southern Florida



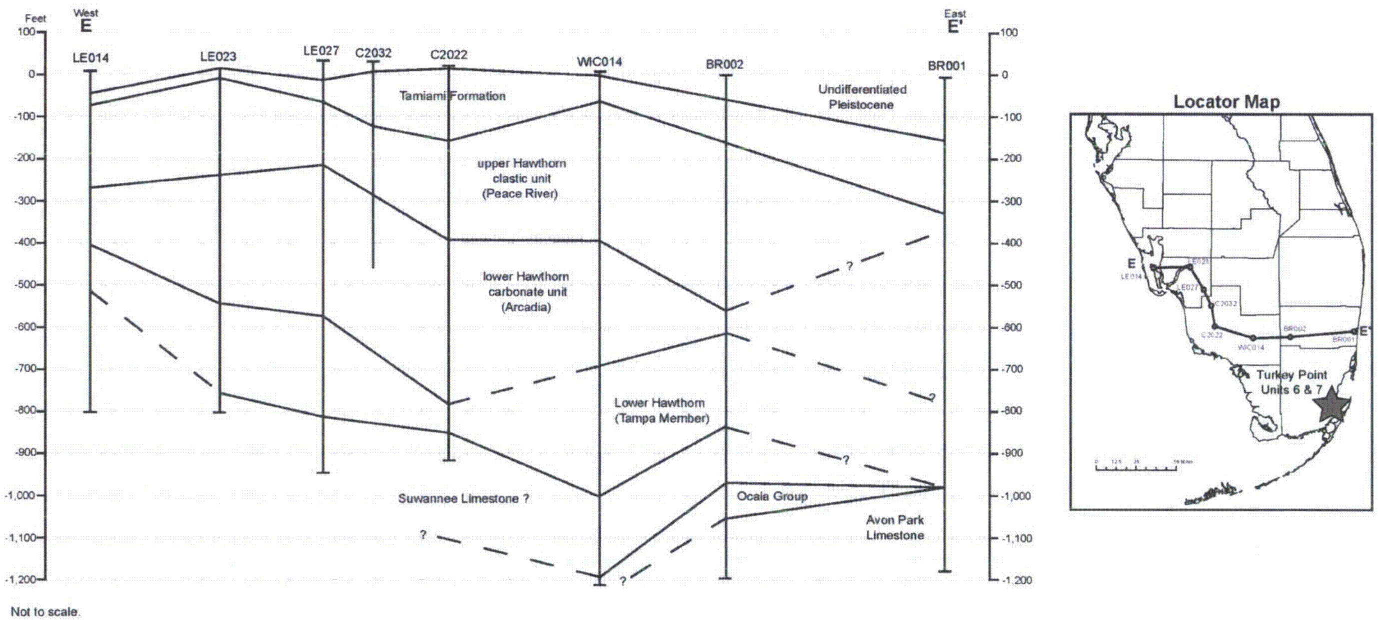


Location of cross section (B-B') in southern Florida.



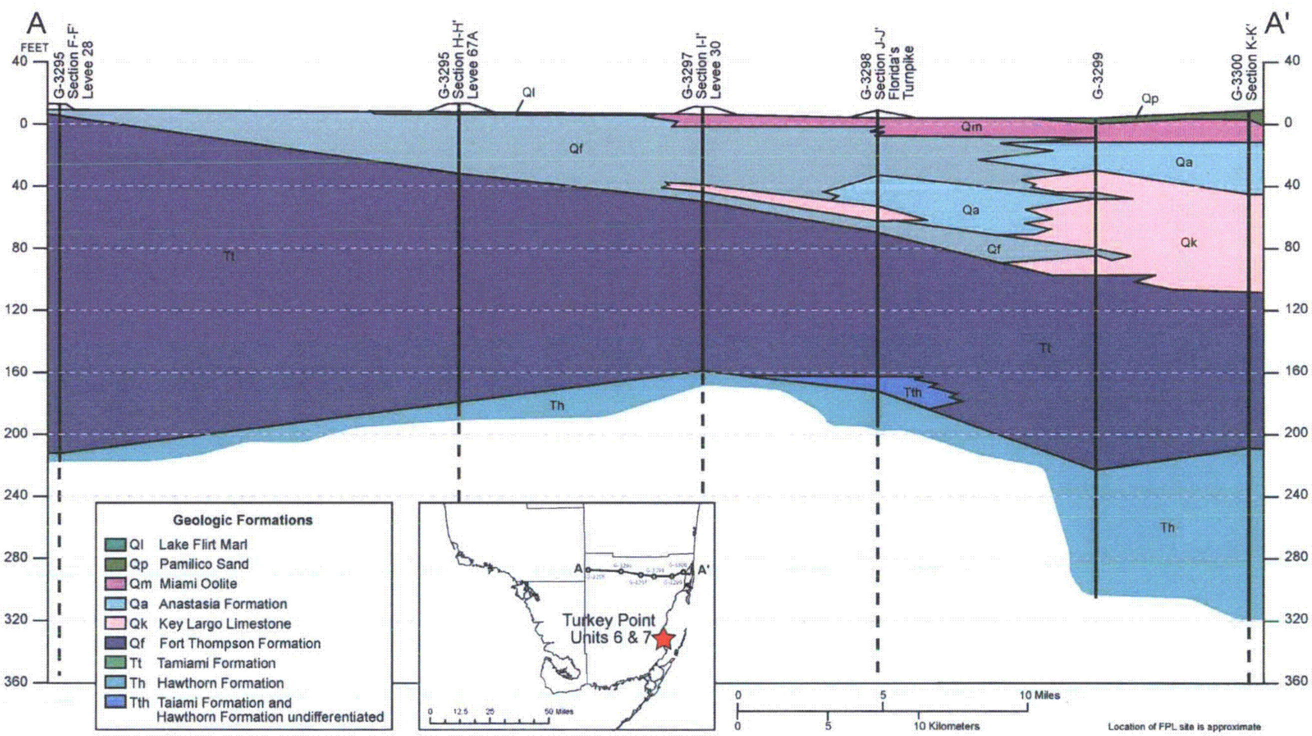
Modified from: Reference 373
Note: Primary siliclastic source - Appalachians

Figure 2.5.1-235 East-West Geologic Cross Section of Eocene through Pliocene-age Rocks in Southern Florida



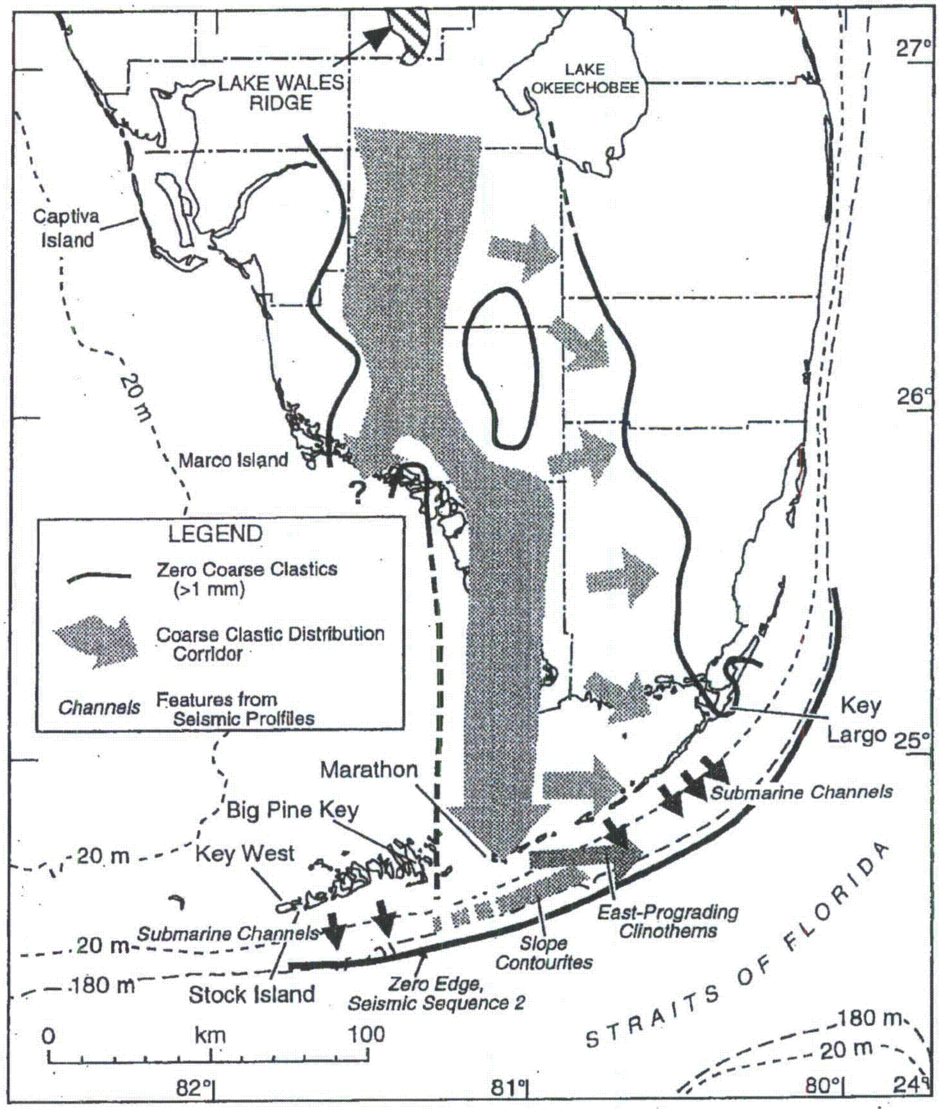
Modified from: Reference 378

Figure 2.5.1-236 East-West Geologic Cross Section of Miocene through Pleistocene-age Rocks in Dade County, Florida



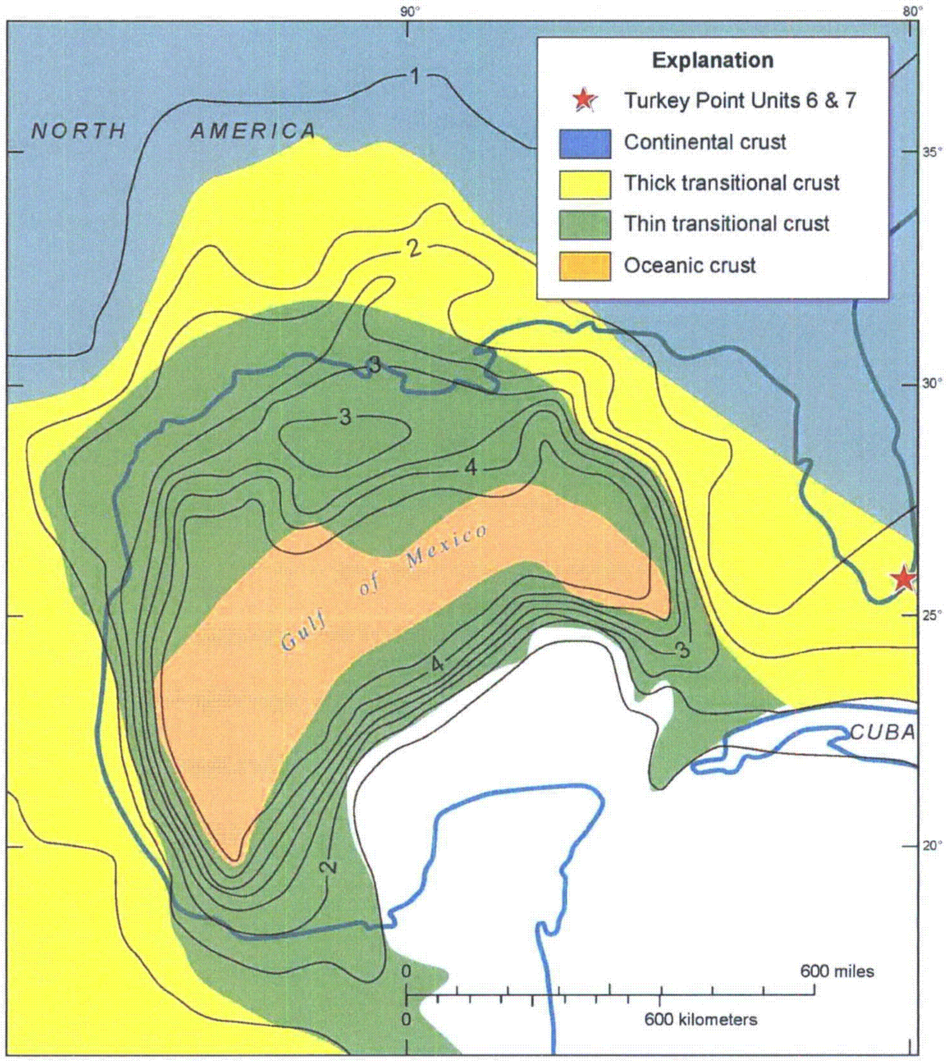
Modified from: Reference 374

Figure 2.5.1-237 Miocene-Pliocene Siliciclastic Transport Pathways in Southern Florida



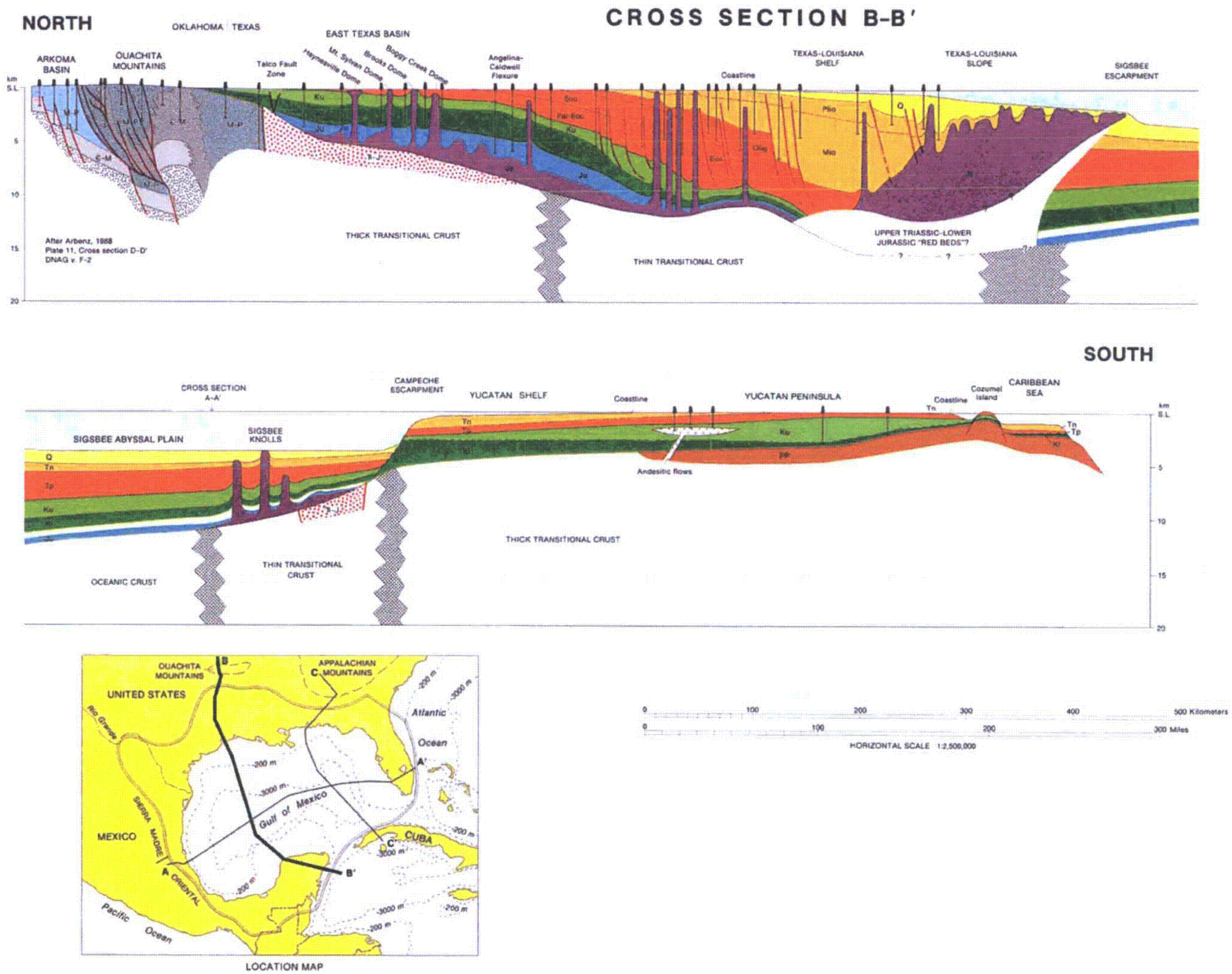
Source: Reference 393
Note: primary siliciclastics source – Appalachians

Figure 2.5.1-238 Map of Crust Types in Gulf of Mexico Region



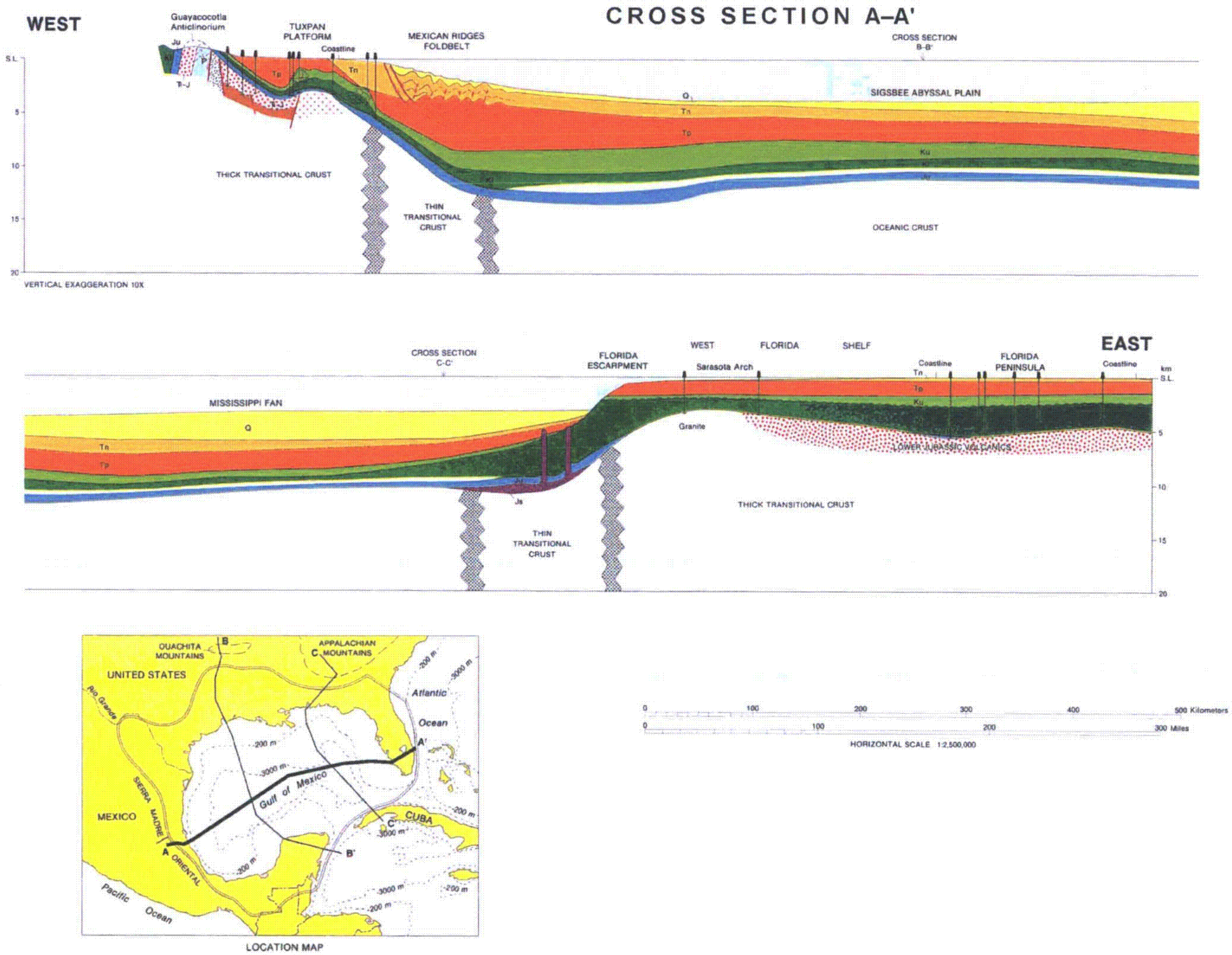
Modified from: Reference 410

Figure 2.5.1-239 Gulf of Mexico Cross Section B–B'



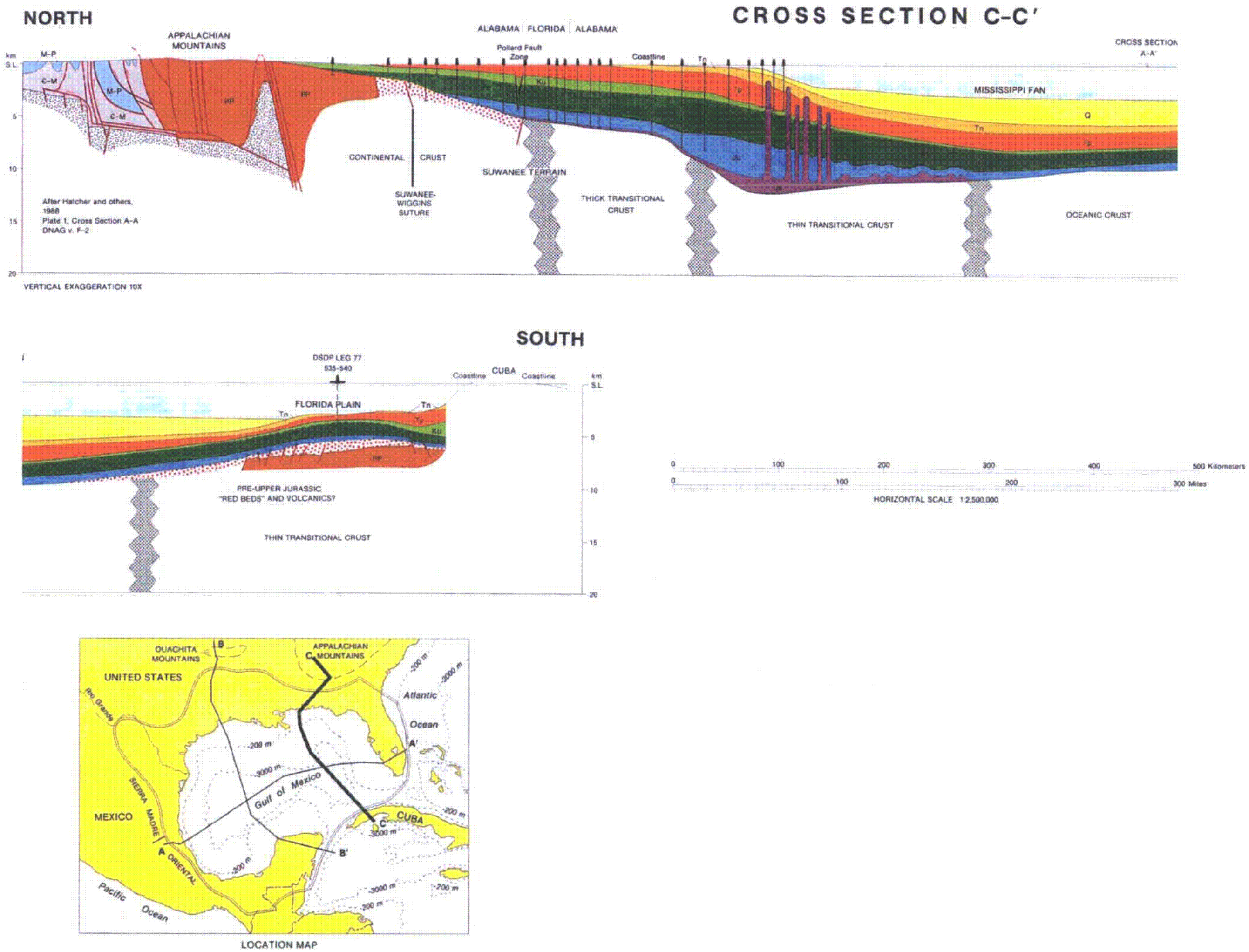
Note: Explanation in Figure 2.5.1-242
Source: Reference 839

Figure 2.5.1-240 Gulf of Mexico Cross Section A–A'



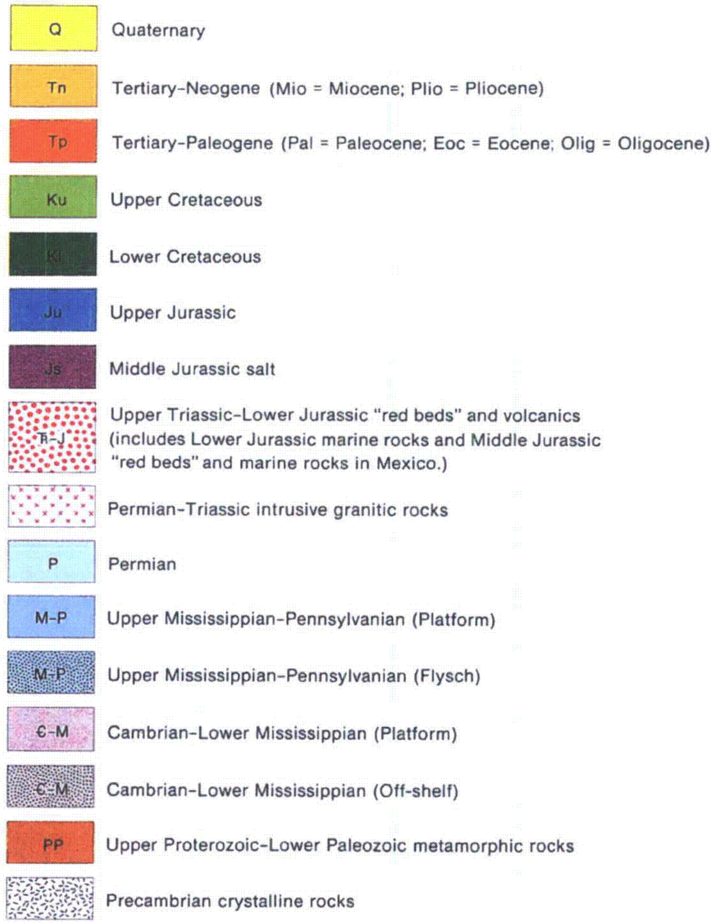
Note: Explanation in Figure 2.5.1-242
Source: Reference 839

Figure 2.5.1-241 Gulf of Mexico Cross Section C–C'



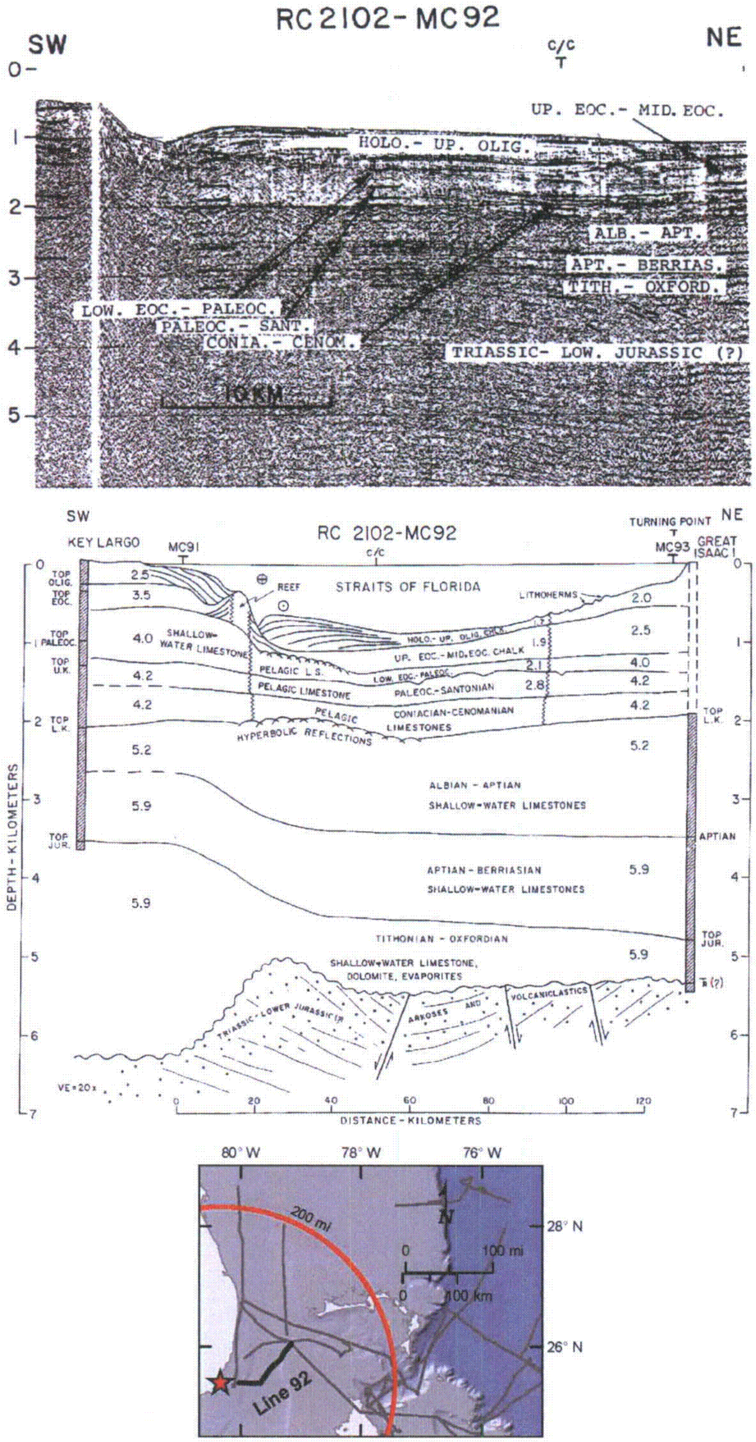
Note: Explanation in Figure 2.5.1-242
Source: Reference 839

Figure 2.5.1-242 Explanation for Gulf of Mexico Cross Sections A–A', B–B', and C–C'



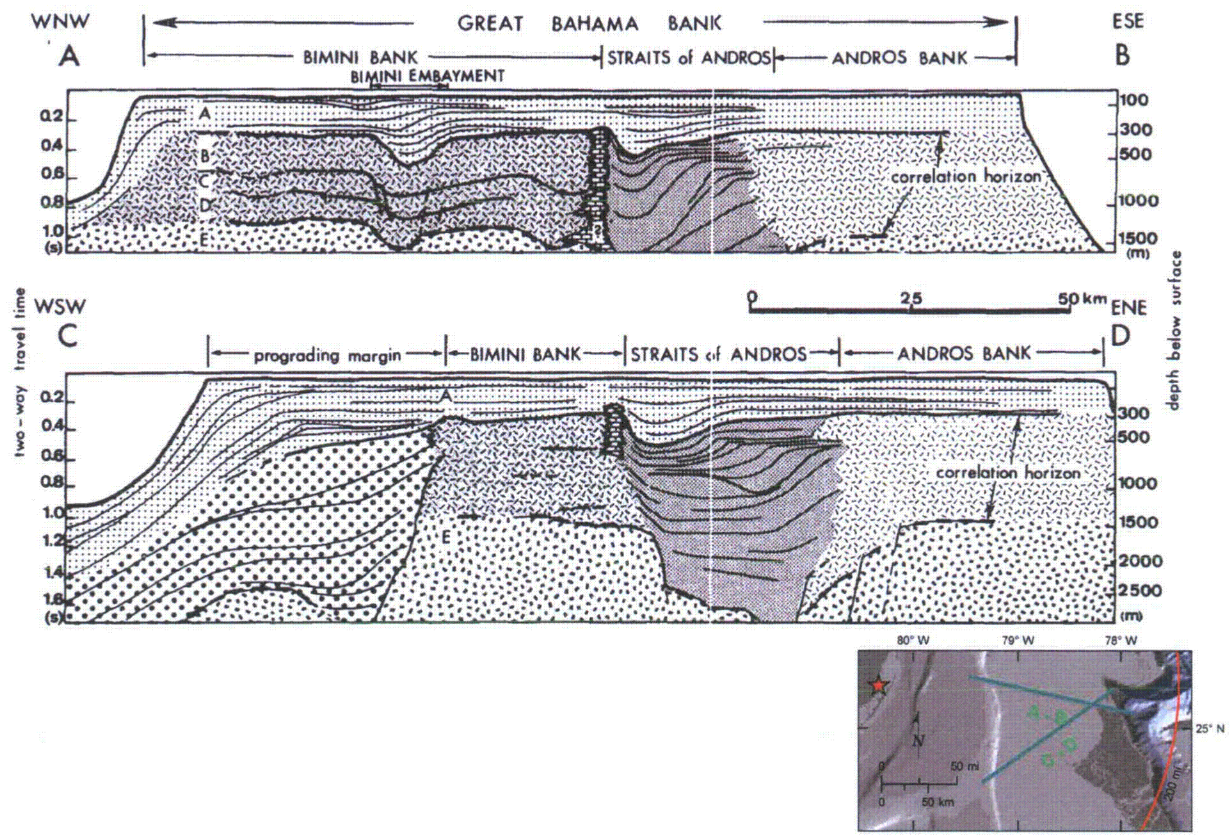
Source: Reference 839

Figure 2.5.1-243 Seismic Line and Well Correlation, Florida, and Bahama Platform



Modified from: Reference 307

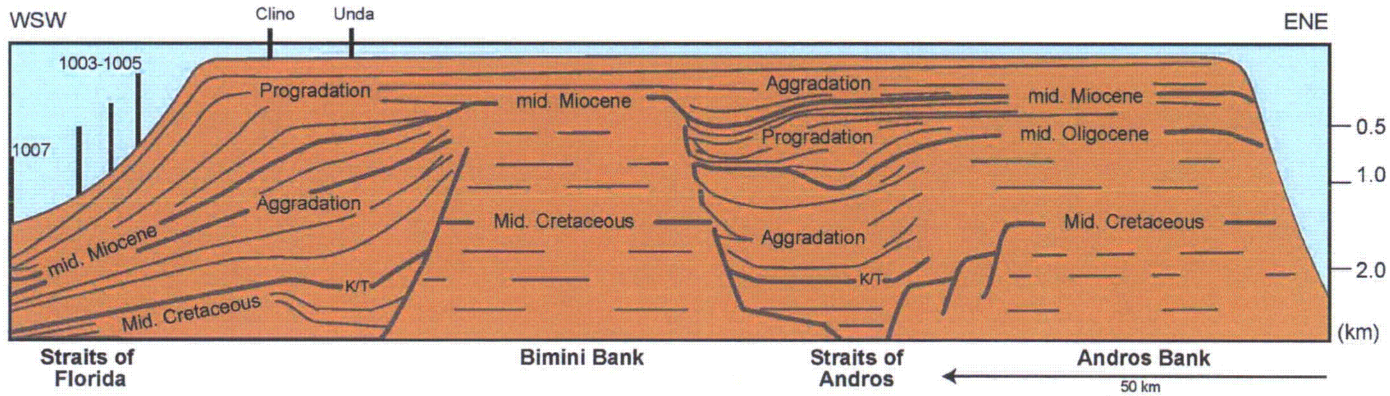
Figure 2.5.1-244 Seismic Line Interpretation across Bahama Plateau



Notes:
Top: Cross section displaying two buried banks (Andros, Bimini) and two completely infilled troughs (Straits of Andros, Bimini embayment). A-E = depositional megasequences. Correlation is given by two horizons (E, B). Note difference in size and age of two troughs.
Bottom: Cross section along WESTERN documenting lateral progradation of Bimini western margin and complex filling of Straits of Andros. Compare volume of prograded part with oroducina platform.

Modified from: Reference 475

Figure 2.5.1-245 Great Bahama Bank Geologic Environment



Modified from: Reference 768

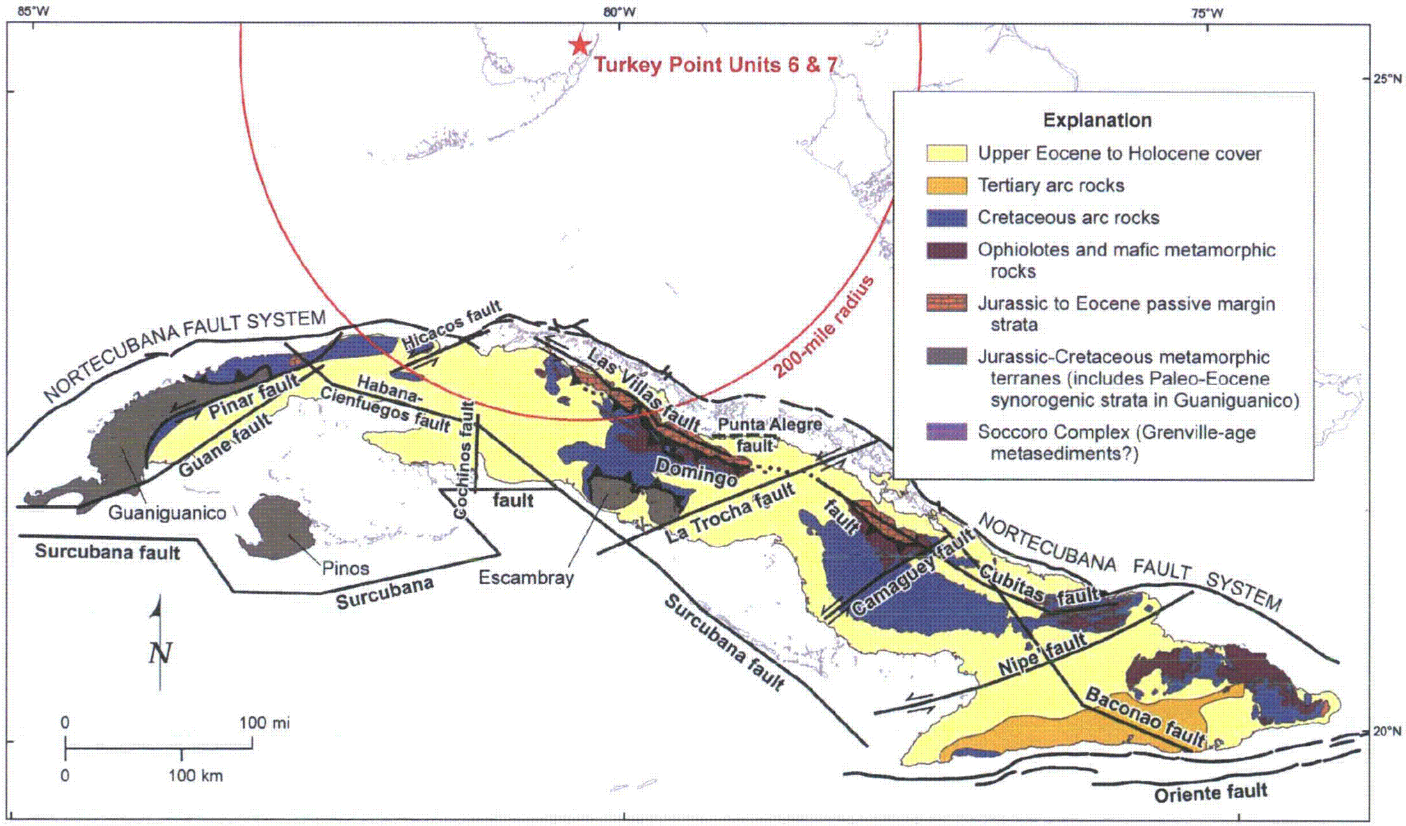
Figure 2.5.1-246 Lithostratigraphic Column for the Bahama Islands

<table>
<tr><th>ERA</th><th>SYSTEM</th><th>SERIES</th><th colspan="2">FORMATION</th></tr>
<tr><td rowspan="5">CENOZOIC</td><td rowspan="5">QUATERNARY</td><td rowspan="2">HOLOCENE</td><td rowspan="2">Rice Bay Formation</td><td>Hana Bay Member</td></tr>
<tr><td>North Point Member</td></tr>
<tr><td rowspan="3">PLEISTOCENE</td><td rowspan="2">Grotto Beach Formation</td><td>Cockburn Town Member</td></tr>
<tr><td>French Bay Member</td></tr>
<tr><td colspan="2">Owl's Hole Formation</td></tr>
</table>

Not drawn to scale
Modified from: Reference 438

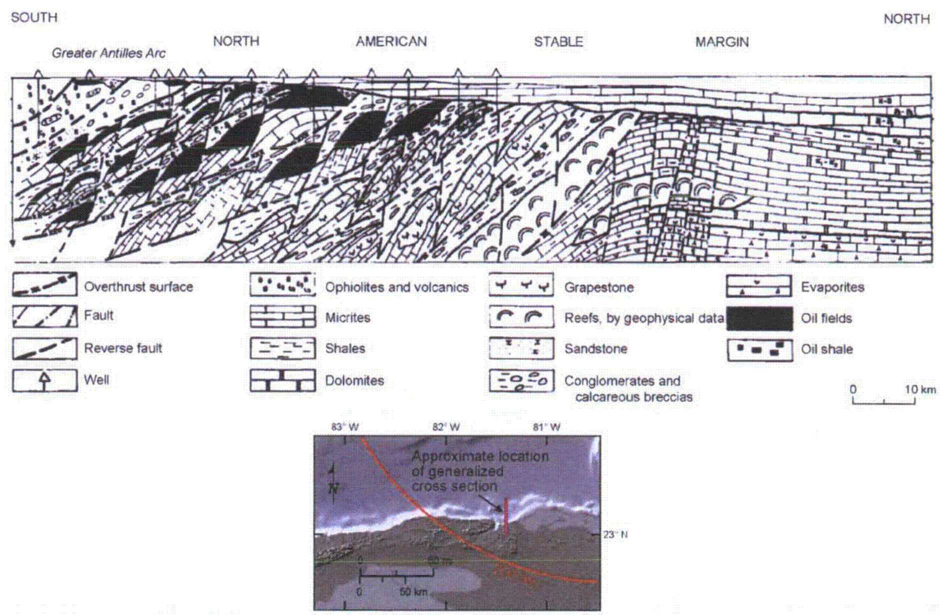
PTN RAI 02.05.01-21

Figure 2.5.1-247 Tectonic Map of Cuba



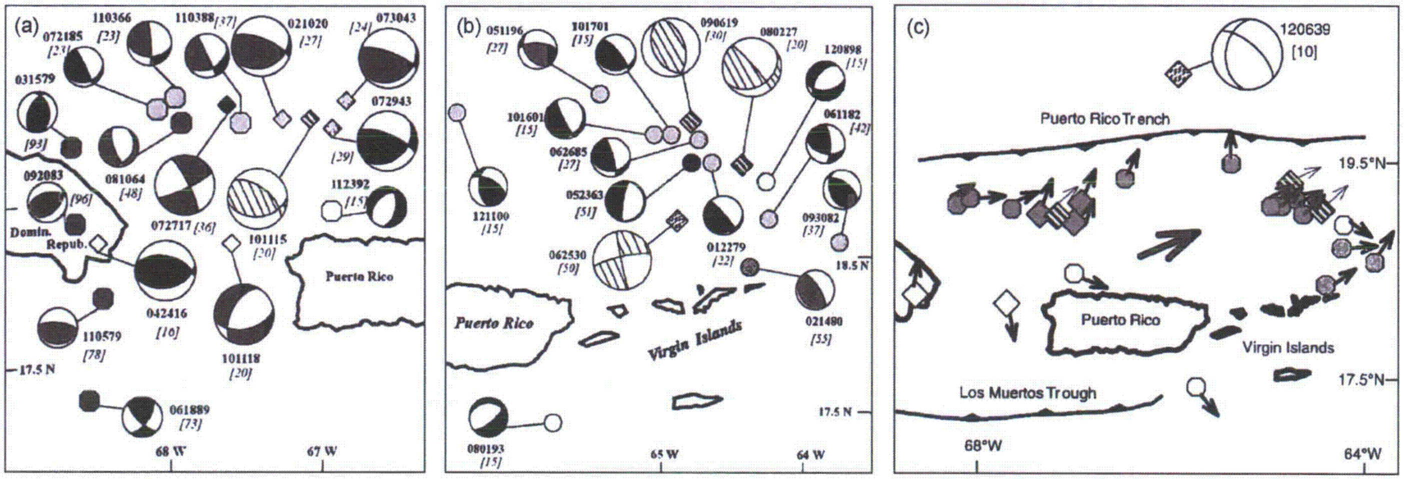
Multiple sources were used to compile this map, including References 443, 448, 439, 770, 492, and 494

Figure 2.5.1-248 Generalized Cross Section of Northern Cuba



Source: Reference 497

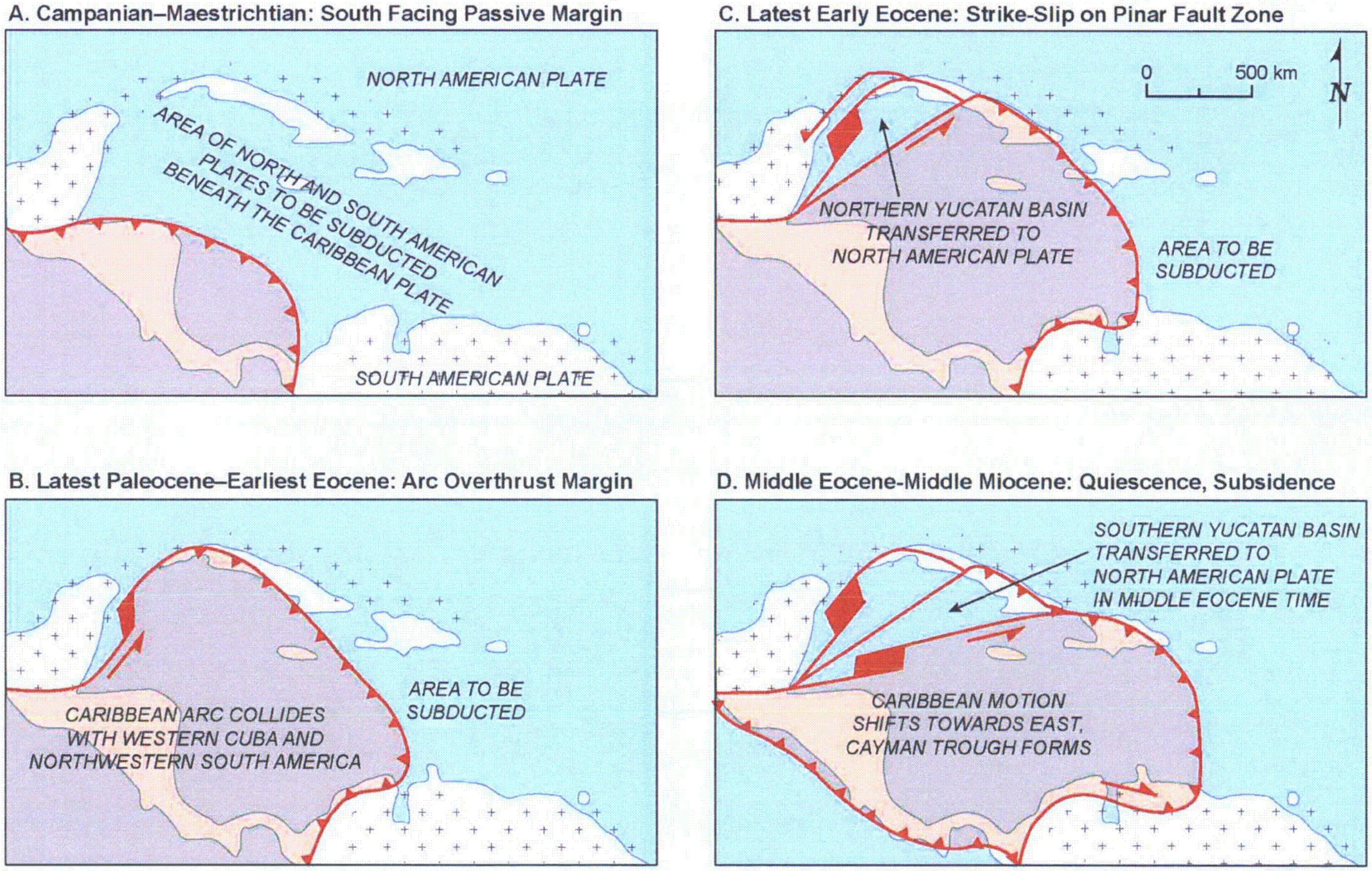
Figure 2.5.1-249 Focal Mechanisms and Slip Vectors of Northeast Caribbean Earthquakes



(a) Focal mechanisms of northwestern offshore Puerto Rico earthquakes. Dates are in mm/dd/yy format. Striped mechanisms are from forward modeling, and are less well constrained.
(b) Historic and recent earthquakes of the Virgin Islands Region
(c) Slip vectors of earthquakes occurring in Greater Antilles crust (open symbols) and along plate interface (closed symbols). Focal mechanism for 1939 normal faulting outer rise event shown at top."

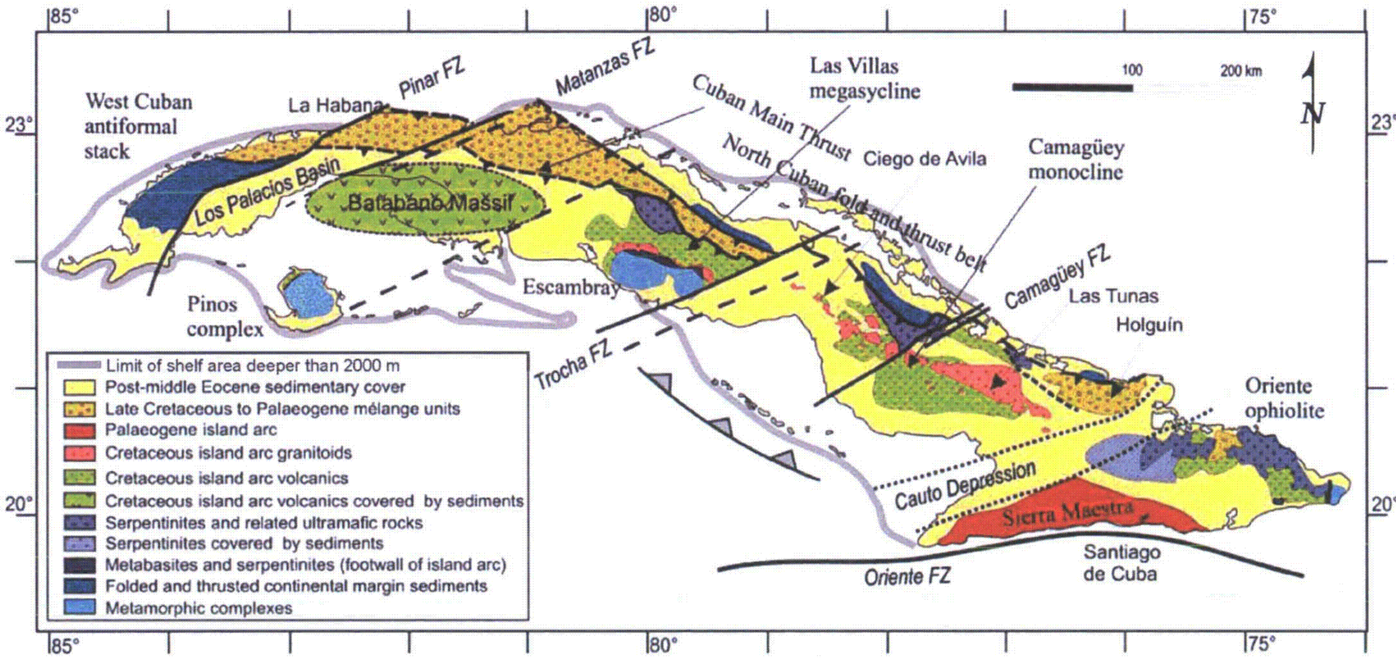
Modified from: Reference 681

Figure 2.5.1-250 Tectonic Evolution of the Greater Antilles Arc Collision



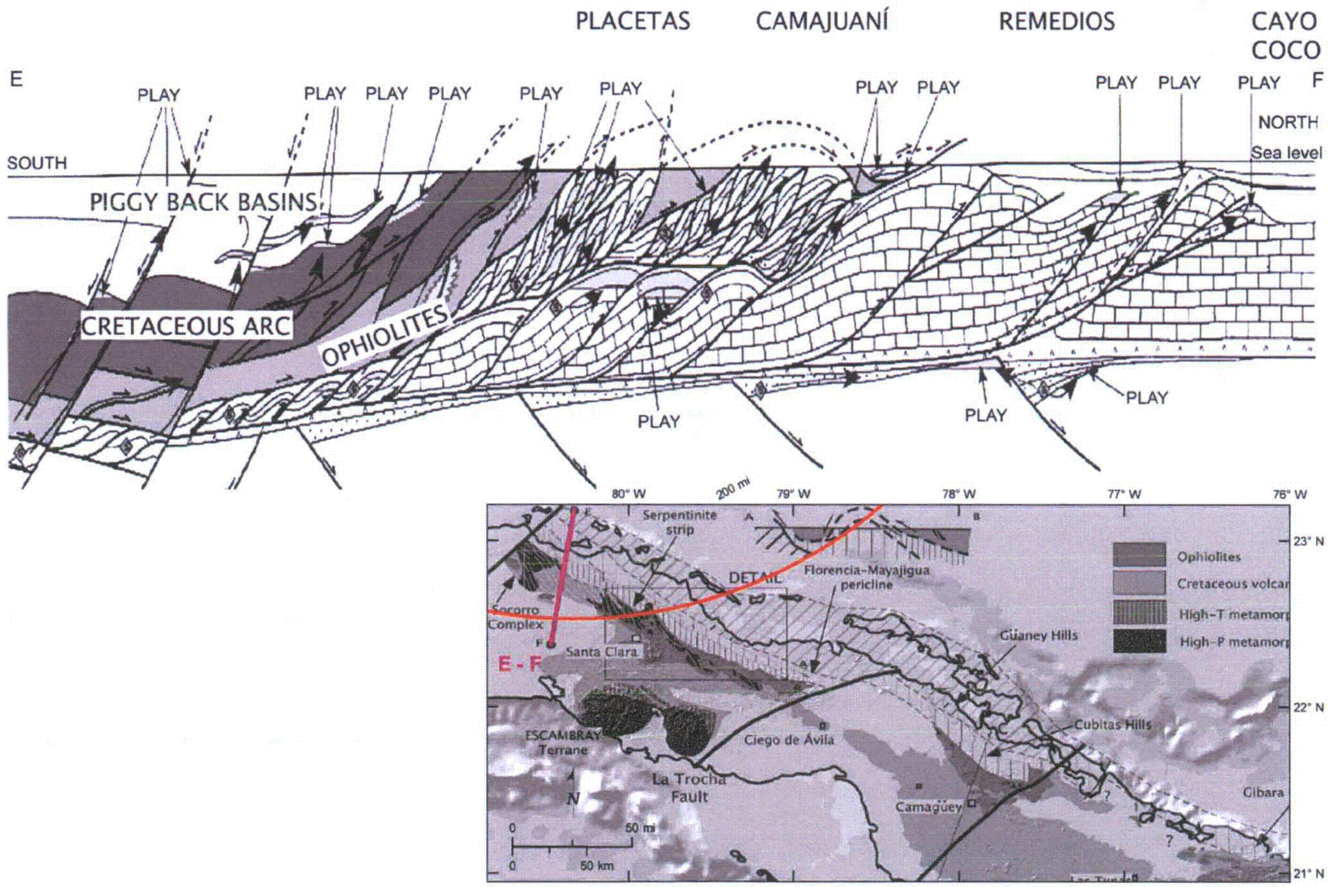
Modified from: Reference 697

Figure 2.5.1-251 Lithostratigraphic Map of Cuba



The Matanzas fault shown here is the same structure as the Hicacos fault shown on Figure 2.5.1-247.
Modified from: Reference 769

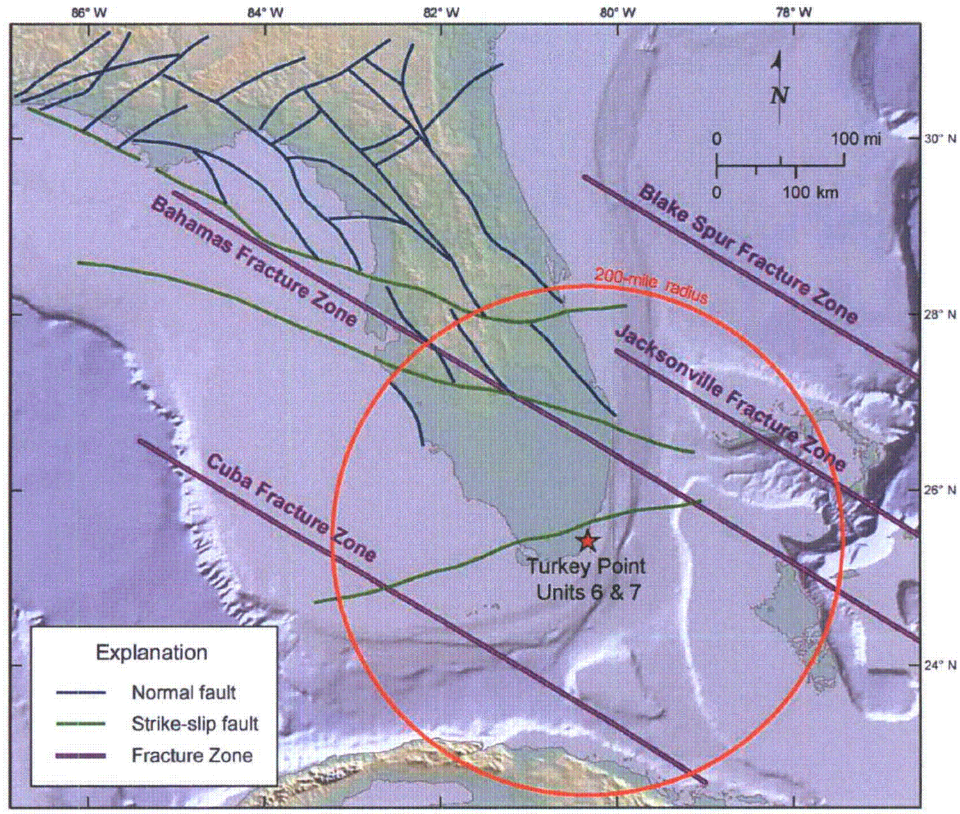
Figure 2.5.1-252 Structural Cross Section across Central Cuba, Line E–F



Note: Structural cross section of the Cuban fold-and-thrust belt. This cross section illustrates the deep detachment surface and the amalgamated thrust nappes between the Bahamas platform and the allochthonous Caribbean plate (serpentinite mélange, ophiolites, and Cretaceous volcanic arc suites). The foredeep basin deposits crown the Mesozoic stratigraphic sections, and represent the seal of the petroleum systems.

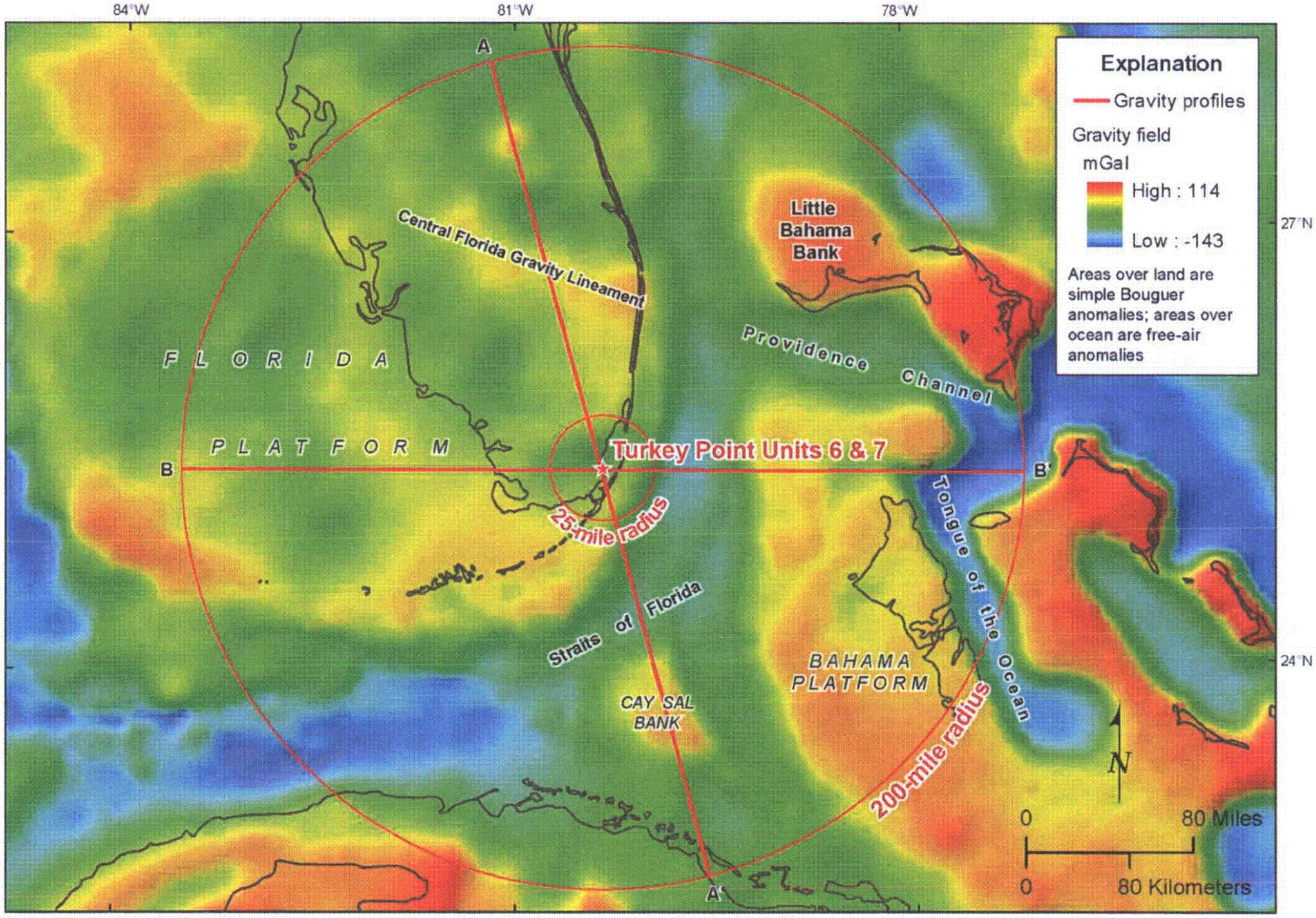
Modified from: Reference 786

Figure 2.5.1-253 Basement Faults of Florida Platform



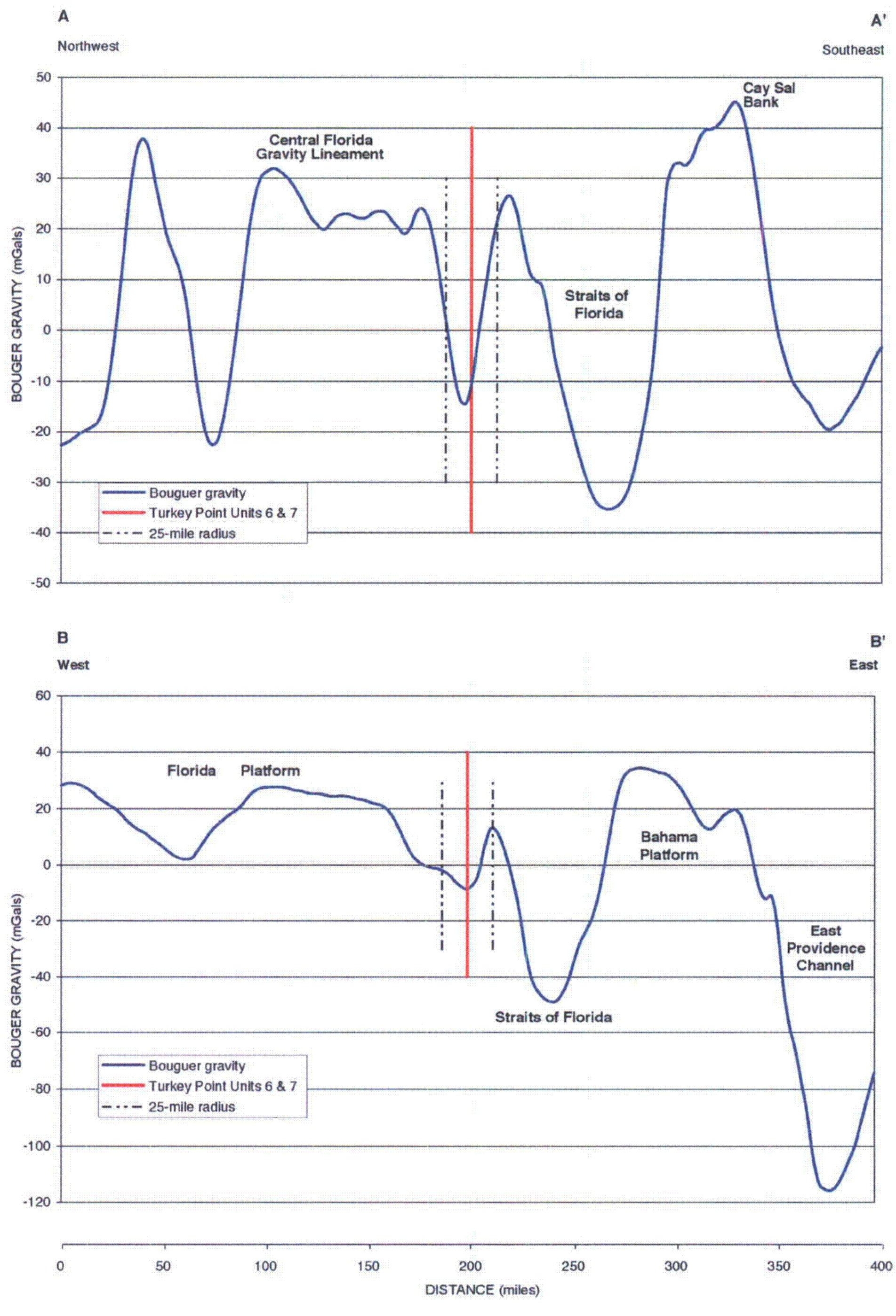
Modified from: References 212 and 458

Figure 2.5.1-254 Gravity Field for the Site Region



Note: Gravity includes Bouguer over land and free-air over water.
Source of Bouguer gravity information: References 452 and 453
Source of physiographic features: Reference 409

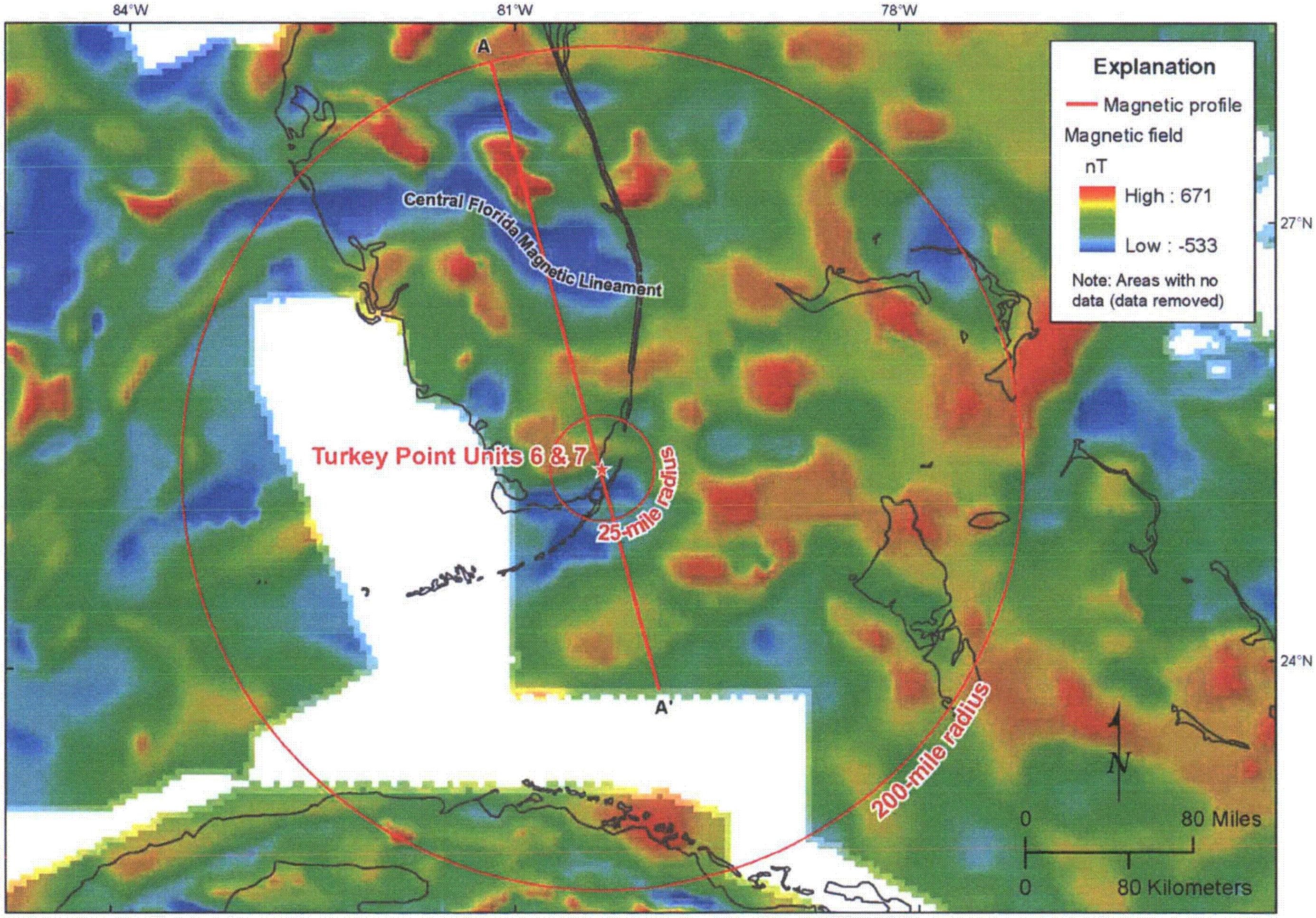
Figure 2.5.1-255 Gravity Profile A–A' and B–B'



Notes:

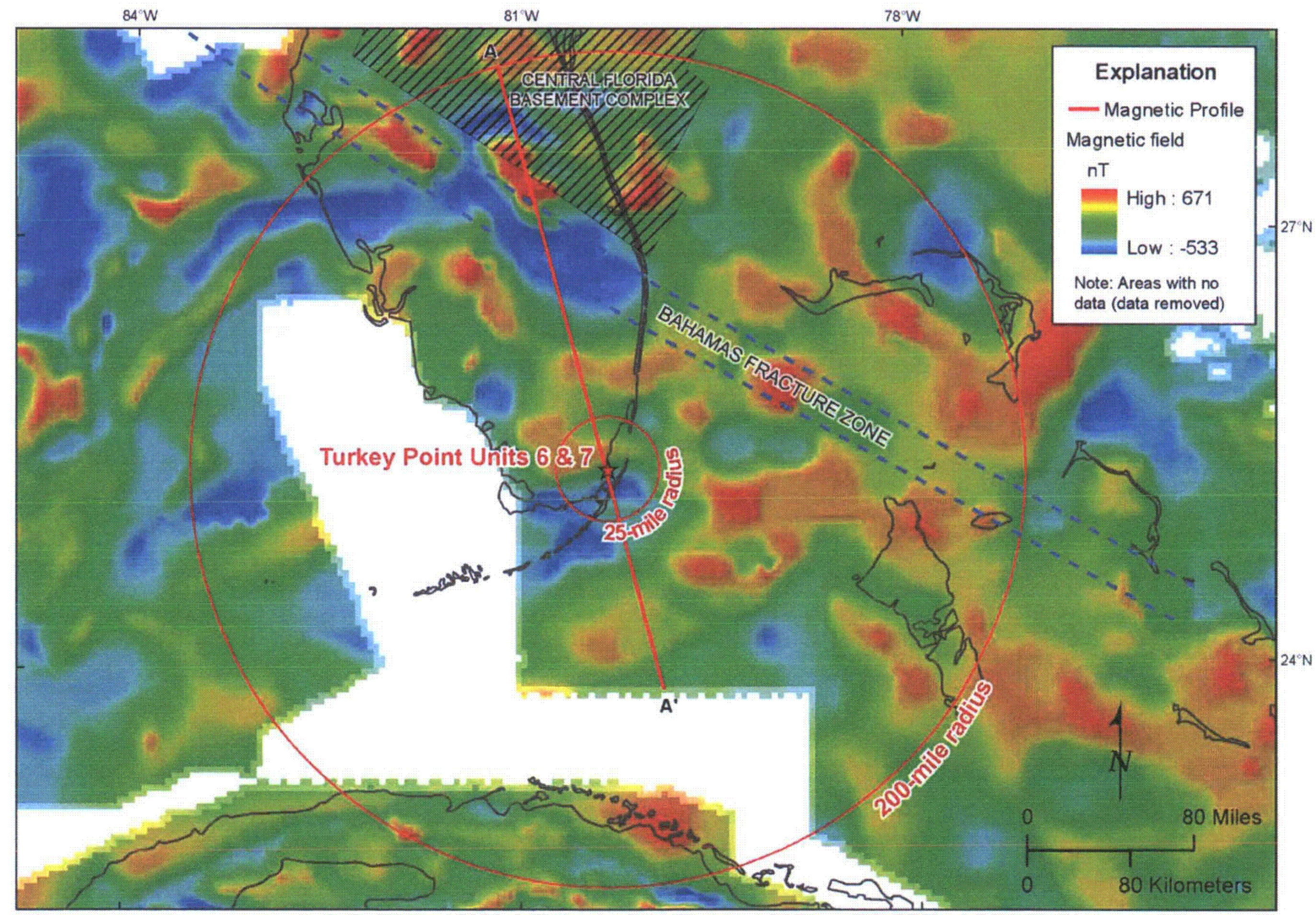
- Gravity includes Bouguer over land and free-air over water
- Physiographic features adapted from Reference 307

Figure 2.5.1-256 Magnetic Field for the Site Region



Source of basement complex and Bahama faults: Reference 212

Figure 2.5.1-257 Regional Magnetic Field Annotated with Locations of the Central Florida Basement Complex and Bahama Fracture Zone



Source of magnetic information: References 452 and 453
Source of basement complex and Bahama faults: Reference 212