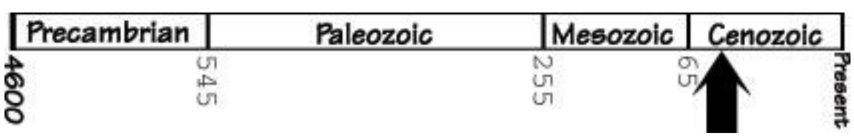
Rocks of the Coastal Plain: Region 3, con't.

Cretaceous-Tertiary (K/T Boundary)

Within the Atlantic and Gulf Coastal Plain areas, the Cretaceous-Tertiary boundary is invariably marked by a distinct physical unconformity usually distinguished by a change in lithology. For example, at Moscow Landing along the Tombigbee River in Sumter County, west-central Alabama, and along the south valley wall of Lynn Creek in Noxubee County, east-central Mississippi, Tertiary sands or sandstones and dark gray marls and clays overlie white Cretaceous chalks. Another characteristic of the K/T boundary is the presence of a thin mm-scale layer of clay containing a number of rare earth elements, including iridium. Although present along the contact in many areas of the world, this boundary layer has as yet to be documented in either the Gulf or Atlantic Coastal Plain areas. Where present, this enriched boundary layer has led many scientists to believe the Cretaceous extinctions resulted from the impact of a large comet or asteroid.

Tertiary Rocks

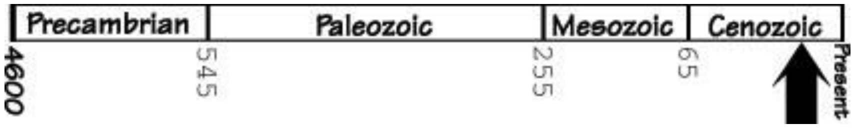


The early Tertiary sediments of the Southeast Coastal Plain, particularly Alabama, are among the thickest and most interesting sections from this time period in the world. France, England and Alabama are the global standard for early Tertiary sediments and fossils. During the early part of the Tertiary, conditions like those of the Cretaceous period prevailed throughout the Southeast. Carbonate sediment deposits (forming mainly limestone) dominated the Southeast Coastal Plain as far north as North Carolina. During the late Tertiary, non-carbonate sediment deposits dominated, and no more carbonates were deposited over most of the Coastal Plain except in southernmost Florida (Figure 2.35). Lignite is commonly found in the Tertiary-age Coastal Plain deposits because coastal marshes and swampy areas near the shoreline accumulated large amounts of plant material. Sea level fluctuations throughout the Tertiary resulted in cycles of sand, silt, clay, lignite, and carbonate sediments.

Erosion of the Appalachian Mountains continued through the Tertiary, resulting in a thick band of Tertiary-age gravel, sand, silt and clay across the Coastal Plain. Tertiary sea level fluctuations continued, causing considerable back and forth shifting of the Southeast shoreline. The middle Tertiary sediment was deposited in a variety of environments, primarily near-shore marine environments when sea level was high, and river (fluvial) environments when sea level was lower. The Gulf Trough in northern Florida was gradually filled by the large amounts of sediment eroded from the Appalachians, allowing the Florida Platform (which up to this point was predominantly an area of carbonate deposition) to be blanketed with a layer of Appalachian-derived sediment. As the sand, silt, and clay built up on the Florida Platform, the peninsula of Florida began to emerge above sea level. Deposition on the Florida platform from the middle Tertiary (~25 million years ago) to the present has consisted primarily of siliciclastic (non-carbonate) sediment (with the exception of the southern tip of the peninsula.) Sea level fluctuations affected Florida more dramatically than other parts of the Southeast because of the low relief of the area. Thus a range of environments may have existed in one place over time, from shallow lagoons and tidal flats to deep waters. In the late Tertiary, shell beds and fossiliferous sand and limestone were commonly deposited on the Florida Peninsula.

Figure 2.35: Tertiary rocks of the Coastal Plain.

Quaternary Rocks



The Quaternary period is recorded in the youngest sediment of the Coastal Plain (Figure 2.36). The period is divided into two sub-divisions (epochs): the Pleistocene and the Holocene (in which we are currently living). The ice sheet that repeatedly advanced southward over North America during the Pleistocene never made it to the Southeast region. Despite not being directly affected by the glaciers, the glaciers indirectly left their mark on the area because when the climate cooled and the ice sheet began to advance, water locked up in continental glaciers caused sea level falls. Also, the cool climate caused dramatic shifts in plant and animal communities. As glaciers to the North moved over the land like bulldozers, they scraped up the surface and pushed tons of sediment before them (and incorporated the sediment within the glacier!) When the climate warmed and ice sheets melted back (an interglacial period), sea level rose and melt water streaming off the retreating glaciers dumped gravel, sand, silt and clay into stream beds. The Ohio River valley, which forms the northern boundary of much of the Southeast region, was formed by the meltwaters of the last ice advance. Sediment from the melting ice was transported through the Ohio River in Kentucky, West Virginia and down the Mississippi River valley. The land area of the Southeast, and especially Florida, increased when sea level was low and the ice sheet was advancing. Likewise, land areas were flooded when sea level rose, and marine sediment buried terrestrial sediment. The glacial changes in living communities are recorded in the Pleistocene fossil record, and also in the presence of remnant cold-climate species (such as hemlock trees in the Dismals Canyon, Alabama) in the warm south of today.

Figure 2.36: Quaternary rocks of the Coastal Plain.

Quaternary deposits make up much of the sediment you see immediately adjacent to modern estuaries, streams, floodplains and creek beds throughout the Southeast. The Chickasaw Bluffs, adjacent to the Mississippi River, formed from glacial sediment (including rock flour) that had filled up the Mississippi River Valley when the last ice sheet was melting back nearly 10,000 years ago. When the rock flour dried, it was easily picked up by the wind and storms, creating thick layers of loess on the banks of the Mississippi River. Loess is common elsewhere in the Southeast and not all of it is Quaternary in age. The erosion resistant loess layers form the bluffs at Vicksburg, Mississippi. The bluffs, up to 80 feet thick in places, made Vicksburg easily defended against capture by the Union gunboats that bombarded them from below. The extended siege at Vicksburg, the last Confederate stronghold along the lower Mississippi River, resulted from the strategic advantage of high ground overlooking the river.

Erratics

It is common in some of the Southeastern states to find boulders, cobbles, pebbles, gravel and sand that are not of the same composition as the local rock or sediment. For example, boulders of igneous and metamorphic rocks have been found in northern Kentucky and elsewhere, despite the fact that no igneous and metamorphic rocks outcrop in the vicinity. What accounts for the presence of these out-of-place "erratic" rocks? In many cases, glacial melt water brought these erratics much farther south than their origin.

Most of the surface sediment of the Florida Peninsula formed during the Pleistocene as sea level dramatically rose and fell. Over much of the peninsula, siliciclastic sediment dominates the surface sediment. In southern Florida, however, carbonate sediment makes up most Pleistocene and recent deposits. In particular, the Miami Limestone underlies much of the southern peninsula.

At the southern rim of the Florida Platform's escarpment lies a fringe of living and dead coral reefs (Figure 2.37). The Florida Keys consist of fossil reefs and associated sediment. The living reefs are seaward of the Keys. During the ice age, colonies of coral flourished along the edge of the Florida platform. When sea level rose, the reefs grew upward, and when sea level dropped, parts of the reef were exposed and died. The dead reefs became foundations for new coral growth, forming the very thick (75-200 ft) Key Largo Limestone. The last sea level fall of the Pleistocene Epoch exposed the Key Largo Limestone, which is seen at the surface of the Florida Keys today. A bank of oolitic shoals formed the Lower Keys. Small, egg-shaped ooids are formed by a tiny fragment of shell or sand grain that is covered gradually by concentric rings of calcium carbonate. The shoals became exposed above sea level and eventually cemented together to form the surface of the Lower Keys.

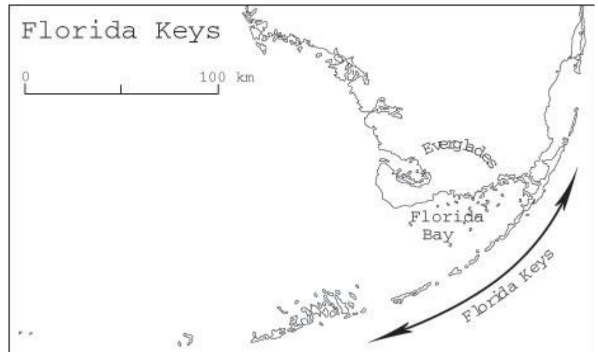


Figure 2.37: The Florida Keys.

Look Closely at the Sand!

If you travel around the Coastal Plain of the Southeast and closely examine the sand at different beaches, you will notice incredible differences! Parts of the Southeast are known for their pure white sand, such as the Gulf coast of Florida, Georgia, Alabama, and Mississippi. If you examine the white sand, you will see that it is made almost entirely of quartz grains. Other beaches may be pink (indicating a high concentration of the mineral feldspar) or have black specks (heavy minerals) or they may be white sands entirely made of calcium carbonate shell material! A surprising number of organisms can sometimes be identified by closely studying the tiny shell pieces. Look closely for parts of corals, bryozoans, echinoderms, shark teeth, clams, and snails, to name just a few.

Some of the differences will be noticeable only with a microscope. For example, grains of dune sand have been constantly moved around by the wind often have a polished, frosted surface. West Tennessee has “glass sand.” Determining the types of organisms represented by the grains in carbonate sands is also easier with a microscope.

Why are there such differences in the types of sand? The answer lies in the origins of the sand. What rock was eroded to make up the sand? How long has the sand been eroded and weathered? How much of the sand is shell material that grew on or near the beach? Sand eroded from granite highlands may still have grains of granite left in it. If the sand is heavily weathered, the granite pieces will have broken down into their individual mineral components. Further erosion will entirely breakdown certain minerals such as feldspar into clays that are winnowed away leaving only the quartz and other resistant minerals that are comparatively rare.

Source: http://geology.teacherfriendlyguide.org/index.php/rocks-se/region-3-coastal-plain

Picconi, J. E. 2003. The Teacher-Friendly Guide to the Geology of the Southeastern U.S. Paleontological Research Institution, Ithaca, NY.