Rocks of the Coastal Plain: Region 3

The Southeast Coastal Plain region exposes Cretaceous, Tertiary and Quaternary rocks of the Atlantic and Gulf Coastal Plains, which sweep in a wide arc through Virginia, around the point of Florida, and up through the Mississippi Embayment and across Texas. The Atlantic Coastal Plain continues northward through New England, and the Gulf Coastal Plain wraps west around the Gulf of Mexico. Overlying the ancient bedrock of the Blue Ridge & Piedmont region, Coastal Plain sediment forms a wedge of gently dipping layers of sediment and sedimentary rock that thickens towards the Atlantic Ocean and Gulf of Mexico (Figure 2.32). At its innermost edge (bordering the Piedmont), the wedge of sediments is very thin. Under the continental shelf out in the Atlantic Ocean, the wedge of sediment is as much as 4000 meters thick. On the Gulf Coast, the sediment is up to 12 kilometers thick.

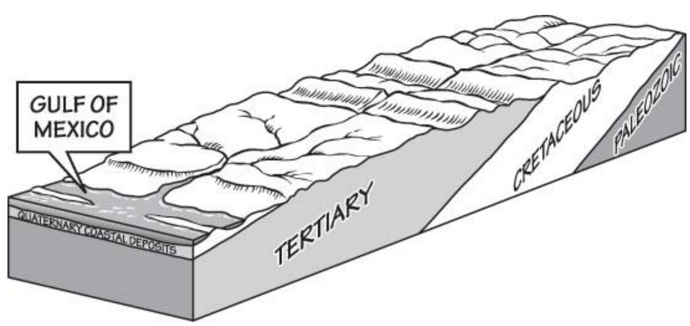
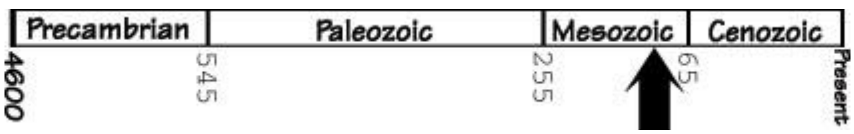


Figure 2.32: The weight of millions of years of sediment accumulation in the basins caused the coastal areas to subside, creating a gentle slope eastward toward the Atlantic and southward toward the Gulf of Mexico. This tilting, though slight, exposes the older Cretaceous units that would otherwise be buried by younger sediment.

Tilted Rocks

Why are the Coastal Plain sediments exposed at the surface younger and younger as you move out toward the Atlantic Ocean or the Gulf of Mexico? As the Atlantic Ocean and Gulf of Mexico basins widened following the breakup of Pangea, new sediment was deposited in the basins. The weight of millions of years of sediment accumulation in the basins caused the coastal areas to subside, creating a gentle slope eastward toward the Atlantic and southward toward the Gulf of Mexico. The Mississippi River Valley also was subsiding during the Mesozoic and Cenozoic, causing a similar tilting of Coastal Plain sediment toward the Mississippi Embayment. This tilting, though slight, exposes the older Cretaceous units that would otherwise be buried by younger sediment. (Figure 2.32)

Cretaceous Rocks



The sediment and rock of the Coastal Plain is geologically very young, ranging in age from Cretaceous (at the end of the "Dinosaur Age") to Quaternary. The sediment and rock include gravel, sand, silt, clay, marl, limestone, and uncommon layers of concentrated shell material called coquina. Much of the Coastal Plain "rock" is unconsolidated sediment that has not had time to be lithified, cemented or compacted enough to become hard. It may be tens or hundreds of millions of years before the unconsolidated layers of sediment are turned to rock, depending on the rates of cementation and compaction. Not all of the Coastal Plain rocks, however, are unconsolidated sediment. Some formations are more compacted or cemented than others, particuthe Quaternary Ice Age, also greatly contributed to coastal deposition and erosion. During the middle Mesozoic, when the Atlantic Ocean formed, a shallow sea connecting the Gulf of Mexico and the Atlantic Ocean covered the area that is now Florida. During the Cenozoic and Quaternary falling sea level exposed the Florida Peninsula. It was also during this time that the Mississippi Embayment was filled with sediment.

Cretaceous deposits are the oldest sediment deposits exposed at the surface in the Coastal Plain and are found along the inner edge of the region (Figure 2.33). The Cretaceous units record the erosion of the Appalachian Mountains and transportation of sediment by rivers to the coast, building up successive layers of gravel, sand, silt and clay that fanned out onto the continental shelf. A variety of clays are found in the Cretaceous rocks of the Southeast, including montmorillonite, which has been interpreted as a weathered volcanic ash that was perhaps coming from central Mississippi or the Rocky Mountains. Another kind of clay found in Alabama, Georgia and Florida is kaolinite, a valuable economic resource that is mined in certain areas of the Southeast. Triassic and Jurassic rocks, exposed at the surface, exist in the subsurface of the Coastal Plain and are studied using drill cores.

Why would there be volcanic ash in the Coastal Plain region? Two thousand nine hundred feet beneath Jackson, Mississippi, a set of igneous rocks and ash deposits attests to the volcanic past of the Southeast. During the Cretaceous, the Gulf of Mexico was widening as South America separated from North America. The divergence of plates caused significant volcanic activity in the area and volcanoes were located along the rim of the modern Gulf Coast. The volcanoes spewed ash that settled in layers at the surface. Far below the surface was magma that formed the cores of the volcanoes. The magma eventually cooled to form igneous rock. Though the igneous rocks are not seen at the surface, they are evidence of a now long-extinct volcano. Jackson, Mississippi is unique: no other US State capital or large city is situated on top of an extinct volcano! Also at this time in geologic history, the Rocky Mountains were being uplifted with much volcanic activity and ash that could have spread as far as the Southeast.

Figure 2.33: Cretaceous rocks of the Coastal Plain.

Toward the end of the Cretaceous period, sea level was very high worldwide, allowing the deposition of marine sediment across much of the Coastal Plain. "Greensand" was deposited in these marine settings during the Cretaceous and Tertiary. The greensand gets its color from the green mineral, glauconite. Since the mineral glauconite is associated with modern marine environments, its presence is a clue to geologists that sediment was deposited in a marine environment. Other clues to the marine origin of the late Cretaceous Southeast sediment include thick deposits of chalk. A soft variety of limestone, chalk forms from the build up of microscopic plates from one-celled algae. The plates, small as grains of clay, are called coccoliths. Chalk deposits are common in Cretaceous deposits worldwide and represent deeper ocean waters in which the shells of tiny organisms settled to the bottom upon death and accumulated as layers of calcium carbonate. When clay particles are also settling to the bottom and are mixed with the layers of calcium carbonate, marl forms. While chalk deposits are white, marl deposits are gray to green because clay mud is mixed with the calcium carbonate mud. In the Southeast, thick chalk and marl layers are found in Alabama and Mississippi in a region known as the Black Belt.

Although there are no Cretaceous rocks exposed at the surface in Florida, the carbonate sediment deposited during this period created the foundation of the modern Florida Platform. Following the breakup of Pangea in the Jurassic, a basin formed in the region of Florida where the continents separated and new ocean crust was forming. The basin was very gradually sinking, allowing reef communities to flourish and build on top of each other as sea level slowly rose (as the basin sank!). Sediment eroded from the Appalachian Mountains did not reach the carbonate platform because of the Gulf Trough in northern Florida. Currents moving through the trough swept away sediment coming from the north, thus protecting the corals and other organisms on the carbonate platform (Figure 2.34). The skeletons of reef communities were composed of calcium carbonate, which formed the modern carbonate platform. Carbonate sediment continues to build up on parts of the Florida platform (such as the seaward side of the Florida Keys) because similar conditions prevail today: warm, sub-tropical climate, and clear, shallow water that allow organisms with calcium carbonate skeletons to thrive and grow.

Figure 2.34: The presence of the Gulf Trough contributed to the Cretaceous carbonate deposits in Florida.

Depositional Environments

Sedimentary rock and sediment hold clues that lead geologists to recognize the environments that existed when the Earth materials formed. Geologists can recognize river or marine environments in deposits of gravel, sand and silt using evidence such as fossils, sedimentary structures, sediment size and other tools. For example, in some Cretaceous units paleosols are found. Paleosols are ancient soils. We can tell they are soils because they contain preserved mud cracks, root traces, and iron and manganese oxides, which indicate sediment exposed to the air and oxidized. The type of soil structures formed depends on climate and the amount of time the sediments were exposed. Paleosols can be compared to modern soils to determine ancient climates. In some areas, such as central Alabama and Northeast Mississippi, the paleosols have been heavily eroded and the colorful oxide layers look similar to the Badlands of South Dakota. Paleosols can also be found in older rocks of the Appalachian Plateau, and Valley and Ridge, and even in rock cores cut far below the surface in oil or gas wells.

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

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