Figure 1-12 is a generalized geologic map of the N.C. Coastal Plain, suggesting the major differences that occur between the northern and southern coastal regions. These differences in the underlying geologic framework reflect different and unique geological heritages that result in distinctive types of barrier islands, inlets, and estuaries. A line drawn from Raleigh through Kinston and Cape Lookout separates the coastal system into the Northern and Southern Coastal provinces. The unique topography of the North Carolina barrier islands is partly controlled by the width, bathymetry (depth of the ocean floor from the water surface), and geologic composition of the adjacent continental shelf and the drainage basin topography of the coastal plain that is being flooded. Notice in figure 1-12 that the North Carolina coast consists of a series of cuspate bays or coastal compartments, each with different spatial orientations and geologic character of the adjacent continental shelf. (Note: Cuspate refers to the points that define the bays. Think of bicuspids or tricuspids – teeth with two or three points.)

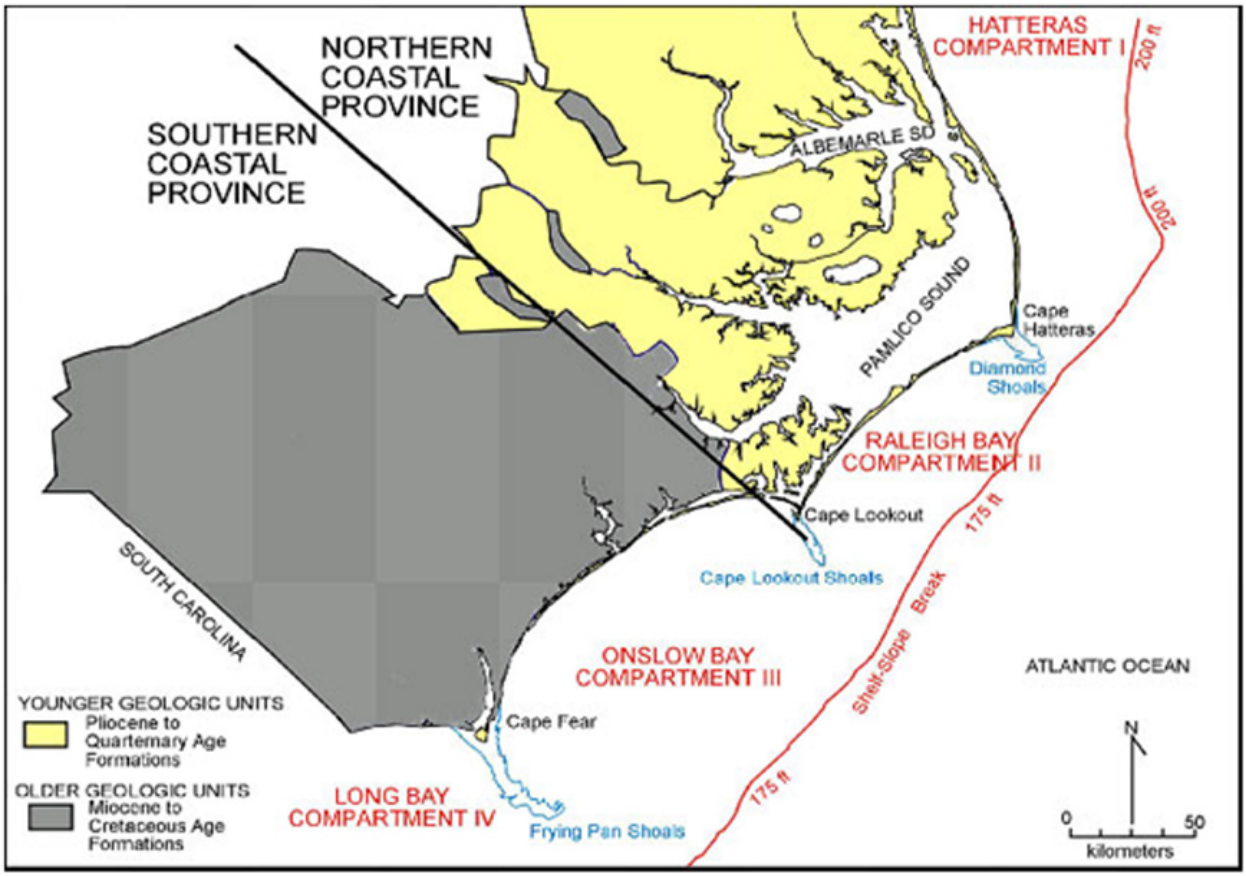

Figure 1-12. Generalized geologic map of the North Carolina Coastal Plain shows the two coastal provinces and four geomorphic compartments of the coastal system. Geologic outcrop patterns are summarized from the *Geologic Map of North Carolina* (NCGS, 1985). Figure 2-2-1, p. 21 in Riggs and Ames (2003).

The Northern Coastal province is characterized by the following:

1. Long barrier islands
2. Few inlets within the islands (today only five inlets)
3. An extensive sequence of drowned-river estuaries that form the vast Albemarle-Pamlico estuarine system

The northern barrier islands project seaward, forming the famous Cape Hatteras and associated Outer Banks – a sand damn that semi-isolates the Albemarle-Pamlico estuarine system from the ocean.

The floor of the continental shelf in the Hatteras and Raleigh Bay compartments consists primarily of younger geologic units that are Pliocene and Pleistocene in age. These units are composed of moderately soft mudstone, sandstone, fossiliferous gravel, and sandy limestone. There are local areas covered with variable thicknesses of modern unconsolidated sand. The continental shelf in the Hatteras compartment is relatively deep and becomes extremely narrow at Cape Hatteras, allowing much larger waves to interact directly with the beach, particularly at Cape Hatteras. The Raleigh Bay compartment is relatively narrow but is not as deep as the area north of the Cape. Thus, it generally tends to have intermediate size waves that interact with the beach.

The continental shelf off of the Onslow and Long Bay compartments consists primarily of older geologic units that range from Cretaceous to Pliocene in age. These units are composed of relatively hard mudstone, sandstone, and limestone with very little modern unconsolidated sand. Because of the harder rock composition, the continental shelves in both compartments are very wide and shallow, causing the general wave patterns to be much smaller than the northern two compartments.

In summary, the Northern Coastal province generally has significantly higher wave energy than the Southern Coastal province. Here is the connection:

1. In the Northern Coastal province, the continental shelf is generally narrower and deeper than that of the Southern Coastal province, resulting in higher wave energy at the Cape Hatteras shore. This is the reason surfers flock to this site. Wave energy is greater at Hatteras because there is deeper water all the way to the shoreface and less distance over which the open ocean waves lose energy by dragging along the deeper bottom.
2. Conversely, wave energy in the Southern Coastal province is generally less because of the greater distance from the shelf’s edge and the much shallower character of the shelf. This causes an increased loss of energy as waves drag along the shallow bottom over longer distances.

The shoals associated with each of the capes in Figure 1-12 consist of extensive sand deposits that are perpendicular to the shore and extend seaward for the following approximate distances:

10 miles (Diamond Shoals off Cape Hatteras)
15 miles (Lookout Shoals off Cape Lookout)
30 miles (Frying Pan Shoals off Cape Fear)

These vast, shallow-water shoal systems often have water depths less than ten feet over large areas and are extremely treacherous for ships. These shallow shoals have caused the demise of many mariners and have given the North Carolina coast the dubious honor of being called “the Graveyard of the Atlantic.”

Three types of storms frequently affect the barrier islands:

1. The winter storms or nor’easters have strong Northeast winds.
2. The summer storms or sou’westers have strong Southwest winds.
3. Tropical storms and hurricanes originate in the warm ocean waters near the equator and often approach North Carolina from the South to Southeast, primarily during the summer and fall.