The Crystal Coast: A Unique Geological Phenomenon

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ABSTRACT

By only its appearance, one can tell that the North Carolina coast is unique in many ways. It houses a variety and a multitude of barrier islands that fringe the coast and contain inlets between them. The composition of the beach is also rare with its brown shells, fossilized rocks, and fascinating characteristics. Estuaries make up a large part of the North Carolina coast with more than 2.2 million acres (Schoenbaum, 1982). With such amazing characteristics, the coast's geological history is very interesting and enlightening. This research paper focuses on the parts of the North Carolina coastline that make it stand out as one of the most beautiful treasures in the world.

Distinctiveness is beginning to evolve into one of the most desired characteristics in the world. People want to obtain an original reputation through individuality. Businesses want to attract customers with new advertising ideas. As time passes, the desire to stand out from the crowd remains strong. People and businesses may try even harder to be noticeable as time passes. However, there is something that will always stand out as long as it exists: the North Carolina coast. With its rugged shape, varied beach composition, and large numbers of estuaries, the Crystal Coast stands out as one of the most unique geological locations in the United States.

One characteristic that makes the coastline so unique is its multitude of barrier islands. Not every coast is blessed with these indescribable and history-rich beauties. Barrier islands are "long bodies of unconsolidated sand, separated from the mainland by a lagoon and from other islands by inlets at both ends" (Pilkey, Rice, and Neal, 2004, p. 55). Eighteen tiny islands make up the fringe on the North Carolina coast, and the fact that they are a longer distance from the coast makes them even more unique (Morris). Five main components make a barrier island distinct. The first is the island itself, made up of sand that once rested on the actual coast. The second component is the inlets that separate "adjacent islands and allow the exchange of water between ocean and lagoon" (Pilkey, Rice and Neal, 2004, p. 56). The third component is the presence of tidal deltas. These huge bodies of sand extend both in the seaward and lagoon directions. The shore face, or lower beach, is the fourth component of a barrier island, and the

upper shoreface is the fifth (Pilkey, Rice, and Neal, 2004). These two features are masses of sand that stabilize the islands.

The process by which barrier islands are created is one of great importance. When glaciers began to melt, river valleys flooded and estuaries were formed. Many years later, small areas of sand call spits formed along the headlands. Finally, the barrier island separated from the mainland (Pilkey, Rice, and Neal, 2004). The newly made barrier islands evolved in many ways. They needed to constantly stay in equilibrium with waves, tides, wind, sand supply, underlying geology, vegetation, and sea-level change (Pilkey, Rice, and Neal 2004). The location of these islands today is largely affected by the underlying geology of the islands themselves. The narrow and long shape of these islands is "typical of barrier islands shaped by the wind, wind-generated waves, and strong currents" (Morris, 2005, p. 190). Another reason the coast is so unique is that the barrier islands migrate in response to the "changing sea level and coastal evolution" (Pilkey, Rice, and Neal, 2004, 60). A key part of this long process is sand supply. As the sand is carried by the wind or other factors to a different spot, the island slowly changes location (Pilkey, Rice, and Neal, 2004). North Carolina is one of the only states to have such a variety and massive amount of barrier islands.

One characteristic that makes the presence of the barrier islands possible is the existence of the inlets that separate them. Inlets are channels of water that connect an ocean to a lagoon. Despite the fact that inlets only occupy one percent of the North Carolina coastline, they still have huge affects on barrier shorelines throughout the coast (Cleary, 1996). Inlets also have the ability to migrate over time; often, the waves of the ocean will move sand either to

the left or to the right of the original inlet opening (Pilkey, Rice, and Neal, 2004). When this occurs after many years or many decades, the entire inlet can be moved. Inlets have unique deltas that influence the barrier islands as well. The ebb tidal delta is a mass of sand that extends in the direction of the ocean, and the flood tidal delta extends toward the lagoon (Pilkey, Rice, and Neal, 2004). Inlets, even though often shadowed by the presence of barrier islands, play a special part in stabilizing the North Carolina coast.

When any beachgoer travels out to the coast, he comes in contact with features that have an important role in history. Although often overlooked, the composition of North Carolina beaches tells an interesting story. “For example, most people are surprised to learn that by far the majority of shells that they have picked up on North Carolina beaches and identified in their shell guide are, in fact, fossils” (Pilkey, Rice, and Neal, 2004, p. 107).The most abundant of these fossils is the oyster, or *Crassostrea virginica* (Pilkey, Rice, and Neal, 2004). In order to find the age of such materials, the radio-carbon dating method is used. However, amino acid dating has had to be used to date some forty-thousand year old shells near Buxton, Shackleford Banks, and Core Banks (Pilkey, Rice, and Neal, 2004). Many aspects of these common shells reveal events that occurred many years ago.

Another of these interesting aspects is the color of the shells. All natural North Carolina open ocean beaches have a light-brown to yellow-brown tint when viewed from afar (Pilkey, Rice, and Neal, 2004). The brown color is derived from long periods of oxygen exposure and limonite deposition in the shells; this process only takes a few months or even a year to occur. Brown staining and coloration occurs exclusively on the North Carolina coast, and these brown

beaches are an endangered species (Pilkey, Rice, and Neal, 2004). Black shells are also found in profusion on the North Carolina coast. Instead of enduring staining on the beach, black shells originated in “the backside of a barrier island” (Pilkey, Rice, and Neal, 2004, p. 115). These shells were buried deep in mud and eventually took on the black color. Although seemingly normal, shells often have a past that can be unveiled through research and time.

The sand that beachgoers walk on is made up of a variety of minerals that trace back to other parts of the state. Calcium carbonate is the most common of these (Pilkey, Rice, and Neal, 2004). Most calcium carbonate was once part of a shelled organism hundreds to thousands of years old. The primary materials found in a North Carolina beach were “brought down to the sea by ancient rivers when sea level was much lower than it is now” (Pilkey, Rice, and Neal, 2004, pp. 17-18). These materials, such as quartz, feldspar, mica, and residue of igneous and metamorphic rocks, may have evolved as far away as the Piedmont Province where Richmond, Raleigh, Greensboro, and Charlotte are located today (Pilkey, Rice, and Neal, 2004). The dark lines found near the back of a beach are important as well. These areas are made up of deposits of heavy minerals like magnetite, ilmenite, garnet, epidote, and many more. Knowing the unique history found in the composition of the North Carolina coast, beachgoers can have more motivation to conserve the beaches.

Large deposits of rock exist even on beaches. Some may be big, some may be small, and some may look like they contain shell fragments. Gravel is often found around a beach area. This gravel is most likely from “old river beds that once traversed the continental shelf when the sea level was lower during the Ice Ages” (Pilkey, Rice, and Neal, 2004, p. 34). Another type

of rock commonly found on North Carolina beaches is coquina. This unique rock is “made out of cemented fossil shells…that were deposited and buried thousands of years ago” (Pilkey, Rice, and Neal, 2004, pp. 35-36). Whether one is dealing with the smallest grains of silt or the biggest boulders, the rocks and sands of the North Carolina coast will always be treasured.

Three other rare characteristics of a North Carolina beach exist: berm, sandbars, and beach cusps. Berm is known as a long, narrow wedge of sand that has its steepest slope facing the ocean (Pilkey, Rice, and Neal, 2004). This type of feature allows sandbars to migrate closer to the beach. Sandbars, or offshore bars, are underwater mounds of sand located ten to three-hundred yards off the beach (Pilkey, Rice and Neal, 2004). These sandbars can be a variety of shapes and sizes and can even migrate over time. Finally, beach cusps are “horn-like, evenly spaced feature that consist of protruding sections of the beach that alternate with small embayments” (Pilkey, Rice, and Neal, 2004, p. 24). These features are very prevalent along the North Carolina coastline, adding more riches to the already beautiful crystal beaches.

Everyone loves to go to the beach, but on the other side of the barrier islands and the open ocean is a series of different bodies of water called lagoons, bays, sounds, or estuaries. These areas are unique in the fact that they contain a mixture of fresh and saltwater, which is known as brackish water. This allows only certain types of plants and animals to live in this highly specialized location. In North Carolina, the estuaries are often shallow and allow more plant and animal growth like fish, shrimp, crabs, clams, and oysters (Harrell and Godwin-Wyer, 2009). Many types of estuaries exist, but only three types are present along the North Carolina coast. Trunk estuaries “run perpendicular to the coast” (Harrell and Godwin-Wyer, 2009).

Tributary estuaries flow into these trunk estuaries. Finally, back barrier sounds “lie parallel to the coast, between the mainland shore and the barrier islands” (Harrell and Godwin-Wyer, 2009).

Estuaries form over long periods of time with help from various sands and sediments. The North Carolina estuaries were formed tens of thousands of years ago as sediment from the erosion of land and mountains was brought to the coastline by rivers and wind (Harrell and Godwin-Wyer). The sediment was deposited in the areas that now are occupied by estuaries. The underlying sediments of the estuaries today could be anywhere from 1.6 to 90 million years old (Harrell and Godwin-Wyer, 2009). Estuaries reveal an important part of the geological history that makes the Crystal Coast what it is today.

Although estuaries were once prevalent on coastlines around the world, the number of estuaries has dwindled because of “human development and population growth along the coast” (Harrell and Godwin-Wyer, 2009). Estuaries are extremely important parts of the environment because they have so many roles in various aquatic ecosystems. First, “estuaries help control erosion and reduce flooding of the mainland” (Harrell and Godwin-Wyer, 2009). Also, estuaries act as a filter to harmful toxins. Estuaries minimize the impact of storms and produce a large amount of the fish and shellfish that humans and animals eat today. North Carolinians are lucky to have such valuable and unique features alongside the coast and should therefore try their best to protect them.

The coast is full of unanswered questions and unknown treasures. The North Carolina coastline is a unique place because it combines barrier islands, inlets, shells, sand,

rocks, and estuaries to create one of the most diverse places in the world. Conservation on beaches is vital for the continuation of the North Carolina coast. Beachgoers need to preserve the resources and riches of the coast because they tell a story and reveal a puzzle piece of the history of our world. The Crystal Coast will always have the presence and the majesty of something inimitable because it is truly one of a kind.

References

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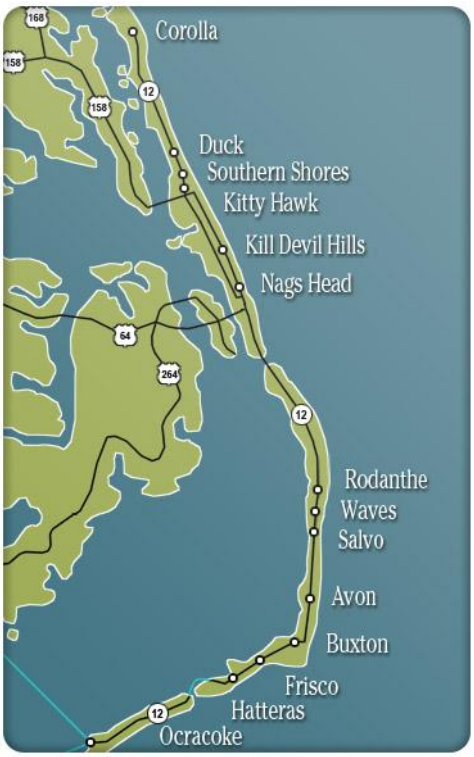
Appendix



This drawing represents the barrier islands of North Carolina and major cities located on these islands. The drawing accentuates the long, thin shape of the barrier islands and their distance from the coast of North Carolina,

http://www.lesliesvacationrentals.com/images/map.jpg

This drawing shows the inlets located along the North Carolina Coast. Inlets separate the barrier islands and are therefore important.

http://www.ncwaterman.com/nautical_charts.asp

This is a photograph of Mason's Inlet. Mason's Inlet has experience migration and relocation in the past few decades.

http://www.wrightsville.com/Masons_Inlet_from_Shell_Island_Resort1.jpg

This is a photograph of a piece of coquina rock. Fragments and whole shells are visible.

http://www.dep.state.fl.us/geology/geologictopics/rocks/anastasia.jpg

This is a photograph of berm located on the backside of the beach. It has a unique and sloping shape.

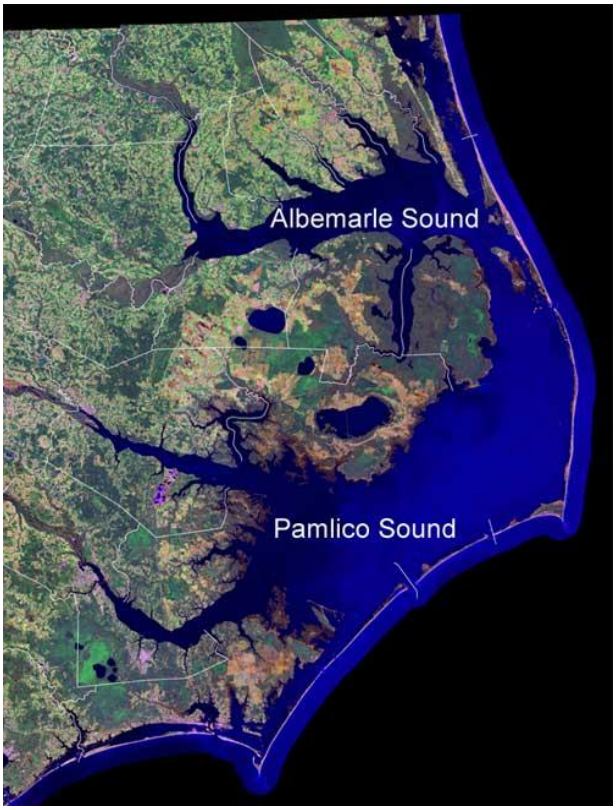
http://lh6.ggpht.com/_EY4gKhwQrTY/Szl-9p_KHPI/AAAAAAAAOyg/iI4rN-JmEIM/s288/IMG_0898.jpg

This is a photograph of a sandbar located off of the coast. The sandbar is the mass of sand that is tan or white colored.

http://media-cdn.tripadvisor.com/media/photo-s/01/79/c6/af/boat-tour-sand-bar.jpg

This is a photograph of beach cusps that occur because of waves. The marsh grass shows the distinct lines.

http://www.grad.ucl.ac.uk/comp/2005-2006/research/gallery/entries/153.jpg



This is an aerial photograph of two of North Carolina's largest sounds or estuaries.

http://dcm2.enr.state.nc.us/Wetlands/Coastal_Explorers/images/estuary/alebmarle_pamlico_lg.jpg