

Chapter Two: Geology of the Chesapeake

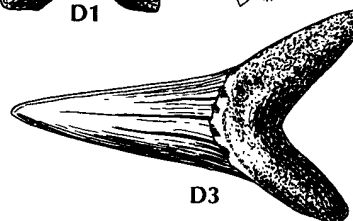
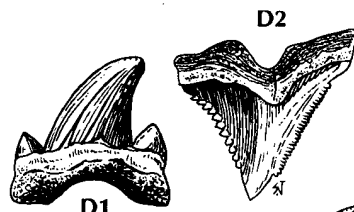
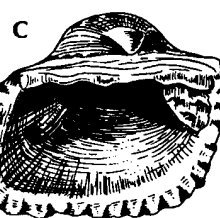
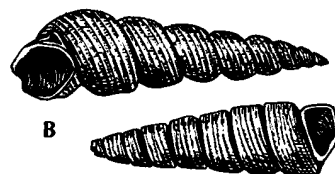
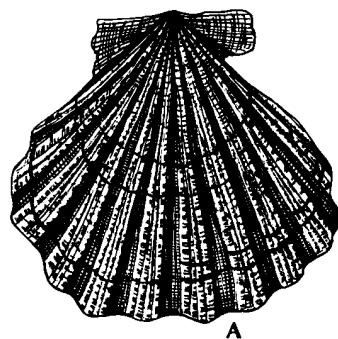
The Chesapeake Bay as we know it today is the result of thousands of years of continuous change. The Chesapeake, less than 10,000 years old, continues to change. Nature, like a dissatisfied artist, is constantly reworking the details. Some 3 modifications enhance the Bay; others harm it. All affect the ecosystem and its interdependent parts. Some changes are abrupt; while others take place over such a long time that we can only recognize them by looking back into geologic history.

Humans are becoming more involved in the reshaping process, often inadvertently initiating chains of events that reverberate through the Bay's ecosystem. Because our actions can have devastating effects on the entire system, it is essential that we develop an adequate understanding of the Bay's geological makeup and fundamental characteristics.

• Geologic History

During the latter part of the Pleistocene epoch (which began one million years ago), the region that is now the Chesapeake was alternately exposed and submerged as massive glaciers advanced and retreated up and down the North American continent. Sea levels rose and fell in concert with glacial contraction and expansion. The region still experiences small-scale changes in sea levels, easily observed over the duration of a century.

The most recent retreat of the glaciers, which began about 18,000 years ago, marked the end of the Pleistocene epoch and brought about the



FOSSILS OF CHESAPEAKE BAY

- A. Broad ribbed scallop
(*Lyropecten santamaria*)
- B. Turret snail (*Turritella plebia*)
- C. Ark (*Anadora staminea*)
- D. Shark teeth
 1. (*Otodus obliquus*)
 2. (*Hemipristis serra*)
 3. (*Oxyrhina desori*)

birth of the Chesapeake Bay. The rising waters from melting glaciers covered the continental shelf and reached the mouth of the Bay about 10,000 years ago. Sea level continued to rise, eventually submerging the Susquehanna River Valley.

The Bay assumed its present dimensions about 3,000 years ago. This complex of drowned streambeds formed the Chesapeake basin we know today.

• The Chesapeake Bay

The Bay proper is approximately 200 miles long but contains more than 4,400 miles of shoreline. The Bay ranges in width from about 4 miles near Annapolis, Maryland, to 30 miles at its widest point, near the mouth of the Potomac. The water surface area of the tidal Bay encompasses more than 2,300 square miles; include the tributaries and that figure nearly doubles.

Fifty major tributaries pour water into the Chesapeake every day. Almost 85-90 percent of the freshwater entering the Bay comes from the northern and western sides. The remaining 10 to 15 percent is contributed by the eastern shore. Nearly an equal volume of saltwater enters the Bay from the ocean.

On average, the Chesapeake holds about 18 trillion gallons of water. Although the Bay's length and width are dramatic, the average depth is only 27 feet. The Bay is shaped like a shallow tray, except for a few deep troughs believed to be remnants of the ancient Susquehanna River. The troughs form a deep channel along much of the length of the Bay. This channel allows passage of large commercial vessels. Because it is so shallow, the Chesapeake is far more sensitive to temperature fluctuations and wind than the open ocean.

To adequately define the Chesapeake ecosystem, we must go far beyond the shores of the Bay itself. Although the Bay lies totally within the Atlantic Coastal Plain, the watershed includes parts of the Piedmont Plateau and Appalachian Province. The tributaries provide a mixture of waters with a broad geochemical range to the Bay. These three different geological provinces influence the Bay. Each contributes its mixture of minerals, nutrients and sediments.

BAY FACT: More than 600 species are fossilized in the sediments of Calvert Cliffs.

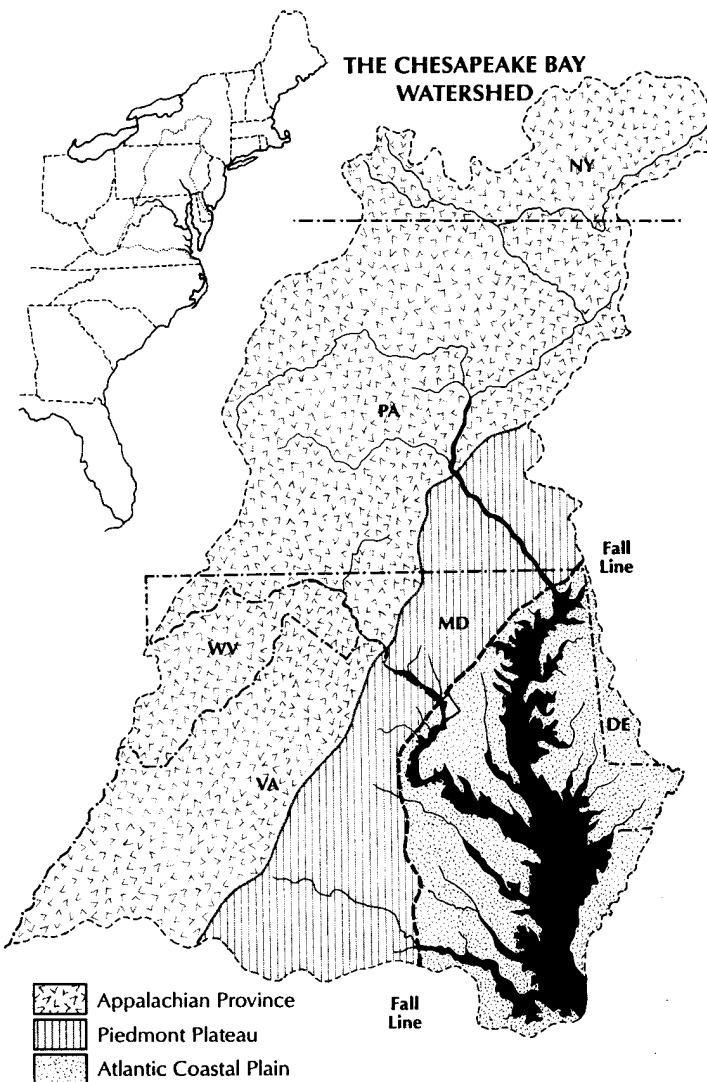
The Atlantic Coastal Plain is a flat, low land area with a maximum elevation of about 300 feet above sea level. It is supported by a bed of crystalline rock, covered with southeasterly-dipping wedge-shaped layers of relatively unconsolidated sand, clay and gravel. Water passing through this loosely compacted mixture dissolves many of the minerals. The most soluble elements are iron, calcium and magnesium.

The Atlantic Coastal Plain extends from the edge of the continental shelf, to the east, to a fall line that ranges from 15 to 90 miles west of the Bay. This fall line forms the boundary between the Piedmont Plateau and the Coastal Plain. Waterfalls and rapids clearly mark this line, which is close to Interstate 95. Here, the elevation rises to 1,100 feet. Cities such as Fredericksburg and Richmond in Virginia, Baltimore in Maryland, and Washington, D.C. developed along the fall line, taking advantage of the potential water power generated by the falls. Since colonial ships could not sail past the fall line, cargo would be transferred to canals or shipped overland. Cities along the fall line became important areas for commerce.

The Piedmont Plateau ranges from the fall line in the east to the Appalachian Mountains in the west. This area is divided into two geologically distinct regions by Parrs Ridge, which traverses Carroll, Howard and Montgomery Counties in Maryland and adjacent counties in Pennsylvania. Several types of dense crystalline rock, including slates, schists, marble and granite, compose the eastern side. This results in a very diverse topography. Rocks of the Piedmont tend to be impermeable and water from the eastern side is low in calcium and magnesium salts. This makes the water soft or easy to lather.

The western side of the Piedmont consists of sandstones, shales and siltstones, underlain by limestone. This limestone bedrock contributes calcium and magnesium to its water, making it hard. Waters from the western side of Parrs Ridge flow into the Potomac River, one of the Bay's larger tributaries.

The Appalachian Province lies in the western and northern parts of the watershed. Sandstone, siltstone, shale and limestone form the bedrock. These areas, characterized by mountains and valleys, are rich in coal and natural gas deposits. Water from this province flows to the Bay mainly via the Susquehanna River.



The waters that flow into the Chesapeake Bay have different chemical identities that depend on the geology of their place of origin. In turn, the nature of the Bay itself depends on the characteristics and relative volumes of these contributing waters.

• **Erosion and Sedimentation**

Since its formation, the Bay's shore has undergone constant modification by erosion, transport and deposition of sediments. In this process, areas of strong relief, like peninsulas and headlands, are eroded and smoothed by currents and tides, and the materials are deposited in other parts of the Bay. Sediments may be deposited in channels. Sediments, carried by the river currents, are also left at the margins of the Bay and major tributaries, resulting in broad, flat deposits of mud and silt. Colonization of these areas by hydrophytic (water-loving) vegetation may stabilize the sediments, and wetlands can develop. Recently however, wetlands along shorelines are retreating inland as sea level rises. The speed at which these modifying processes progress depends on numerous factors, including weather, currents, composition of the affected land, tides, wind and human activities.

Many of the islands that existed in the Bay during colonial times are now submerged. Poplar Island, in Talbot County, Maryland, illustrates the erosive forces continuing today. In the early 1600s, the island encompassed several hundred acres. Over the centuries, rising sea level eroded the perimeter of Poplar Island. Though still populated by the 1940s, only 200 acres remained and the island had been cut in two. Today, a chain of small islands is all that remains of the original Poplar Island. Efforts are underway to stabilize the remnant 100 acres. In addition, the island's original landmass will be rebuilt by creating marshes that will protect the island from further erosion and provide a haven for birds and other wildlife.

In contrast, sedimentation has also altered the landscape. By the mid 1700s some navigable rivers were filled in by sediment as more land was cleared for agriculture. Joppatown, Maryland, once a seaport, is now more than 2 miles from water. The forces of erosion and sedimentation continue to reshape the details of the Bay.

