

Prehistory and Geology Leading to Delmarva

About 540 million years ago, **Pangaea¹ (a supercontinent) formed and** started to produce fossils such as trilobites and gastropods fossils in marine sedimentary rock layers, such as dolomite, limestone, and sandstone. These sedimentary rocks greatly facilitated fossil formation by trapping marine life in successively deposited layers that could be easily aged. By the start of the Devonian Period, some 416 million years ago, corals, sea stars, cephalopods (squid and octopuses) and bryozoans (moss animals), had already evolved, and their fossils had begun accumulating in sandstone, shales, and limestone layers.¹ Progressing to the Carboniferous Period (360 to 300 million years ago), bony fishes, lobe-finned fishes, sharks, *Limulus* (horseshoe crabs), and early land arthropods began emerging as fossils. As the Permian Period unfolded some 300 million years ago, arthropods had diversified to include cockroaches, spiders, and scorpions, as well as primitive reptiles. Then, at the outset of the Triassic Period some 250 million years ago, reptiles such as plesiosaurs, ichthyosaurs (marine, fish-like dinosaurs), and winged reptiles were flourishing.¹ The onset of the Jurassic Period some 200 million years ago saw the explosion of reptiles to such familiar great dinosaurs such as *Brontosaurus*, *Triceratops*, *Allosaurus*, and *Tyrannosaurus*. Continuing in the late in the Jurassic Period, early pterosaurs (insectivores), ichthyosaurs (fish-like dinosaurs), toothed birds, early mammals, and late pterosaurs (more winged reptiles) emerged, while arthropods had further evolved into many species of insects (including giant dragonflies, arachnids, and crustaceans)².

None of these charismatic life forms, however, were seen in Delaware sediments as the Cretaceous Period unfolded 146 million years ago, because it was at that time totally underwater. In fact, it would not be until ~130 million years ago, that the area that would become Delaware emerged from the sea. It would stay partially dry land only until the start of the Tertiary Period: some 66.5 million years ago.³ Even during this relatively brief geologic time leading to the abrupt end of the Cretaceous Period, many fossilized remains were alternately covered and exposed by water.

Natural and Biologic History

The great dinosaurs (such as *Tyrannosaurus*, *Brontosaurus*, *Triceratops*, *Allosaurus*, and many more) never existed in Delaware because Delaware was

literally still underwater until the second phase of the Cretaceous Period (about 130 million years BP), when it finally emerged from the oceans as a small, but distinct, land mass. During that period, dinosaurs such as hadrosaurs (duck-billed dinosaurs) and ornithomimids (bird-mimicking dinosaurs) became prominent. Fossilized remains of these late-coming dinosaurs were found in Delaware sedimentary rocks, including sandstone, limestone, and shale. Late in the Cretaceous Period, turtles (e.g. snapping turtles), snakes, and marine dinosaurs (mostly fierce marine predators such as mososaurs, *Globidens*, *Deinosuchus* (a 33-foot long, 10-ton crocodile-like dinosaur), and others dominated Delaware's fossilized reptilian fauna. Early shrew-like mammals were also present, which were later to evolve into many branches of mammalian life.

The Tertiary Period, 66.5 million years ago, literally started with an enormous bang because of the giant meteor collision in Mexico. Great calamities occurred on Earth, including switching of magnetic poles, shifting of the Earth's axis, rapid cooling of the Earth, and extinction of many life forms. Shockingly, the great dinosaurs, and in fact practically all dinosaurs, died off quickly after the cataclysmic collision, mainly because cold-blooded dinosaurs could not tolerate extremely cold temperatures. The extinction opened the door for the subsequent explosion of warm-blooded mammalian and avian life forms, including the mammal and bird groups we are familiar with today.

Finally, by 50 million years ago, the continents were all roughly located where they are today, though drifting apart continued across the Earth's crust to arrive at their present location. Going forward, continental drift is expected to continue for millions of years more.

As stated earlier, except from 130 to about 66.5 million years ago, the land that was to become Delaware was largely underwater. However, skipping ahead millions of years to the start of the Quaternary Period (about 2.6 million years ago), great ice sheets and glaciers covered the polar and subpolar areas of the Earth. During that same Period, the Delaware River had its origins in what are today the Catskill Mountains of New York State. However, the actual river began its flow sometime during the early Pleistocene Epoch ~ 2.6 million years ago. From then until the start of Holocene Epoch (about 11,400 years ago), alternating periods of glaciation and warming occurred and the Delaware river appeared in

its present form, flowing some 419 miles from the Catskill Mountains of New York to the ocean³.

During these Ice Ages, sea level would rise and fall dramatically, often as much as 300 feet. By the start of the Holocene Period, the Ice Ages came to an end, and the great melting of glaciers and ice sheets ensued, resulting in huge increases in water level. Glaciers that had extended down the river to Pennsylvania and New Jersey, began melting and left behind huge rocks, stones, and glacial debris (including sand, silt, and mineral deposits), which were pushed by water flow into northern and mid-Delaware basin. As glaciers melted, the river's shorelines retreated and water levels rose all along the rivers. The shorelines retreated tremendously in what is now called the Delaware Bay. This Bay area roughly extends along an azimuth from the mouth of Simons River, DE, to the mouth of the Nantuxent River, NJ, and then southward to an azimuth connecting Cape Henlopen, DE, to Cape May, NJ.⁴ This area of the Lower Bay is as wide as 22 miles at its maximum and as deep as 150 feet in selected areas.⁵

Some of the areas in which fossils were found included the C&D Canal (especially Reedy Point), Pollack Farm (east of Smyrna), Iron Hill (near Newark) and excavated sections of what became Routes 1 and 13. Also, many fossils continued to wash down the Delaware River to the Coastal Plain of the Lower Delaware Bay. Some striking evidence of glacial activity include Delmarva Bays (seasonal undrained depressions) in Blackbird State Forest, the Big Rock at Big Stone Beach (reportedly blown apart as a target to prevent identification of a nearby fire control tower by enemy (Axis) forces in WWII). Other large stones were partially submerged at Big Stone Beach, and small stones of all types and sizes clustered at Slaughter Beach.

Extinct Wildlife from Delaware

During the Cretaceous Period, *Hadrosaurus* (duck-billed dinosaurs), ornithomimid (bird-mimicking) dinosaurs including theropods, pterosaurs (insectivorous and winged dinosaurs), monosaurs like *Globidens*, and *Deinosuchus* (a giant crocodile-like dinosaur).⁶ Fossils of these groups and species are mainly known from teeth, scales, and bone fragments. Finding these remains today is very rare today after huge destructive excavation and building occurred in the last several hundred years. By the Tertiary Period (starting 66.5 million years ago and progressing to

the end of the Miocene Epoch (5.6 million years ago), pieces of skeletons of sabre-toothed cats, hornless rhinoceroses, odd-toed ungulates (similar to cows), birds, marsupials (such as o'possums), *Eohippus*-like horses, land tortoises, and insectivorous mammals were preserved in selected areas of Delaware.

Progressing from the end of the Miocene Epoch (5.6 million years ago) through the Pleistocene Epoch of the Quaternary Period (2.6 million years ago), miniature deer, bats, peccaries, mastodons, and mammoths were thought to be in Delaware, though evidence for the latter two groups is scant.⁷

Wildlife after the Ice Ages

By the start of the Holocene Epoch (11,400 years ago), many more familiar species such as moose, caribou, white-tailed deer, bear, fox, wolves, coyotes, elk, sloths, walrus, frogs, lizards, snapping turtles, box turtles, river otters, hedgehogs, porcupines, raccoons, squirrels, skinks, snakes, rats, muskrats, deer mice, skunks, rabbits, and many species of birds occurred widely (at least in the early Holocene). However, moose, bear, caribou and elk were largely hunted out even before the time of European colonization.

References

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