grade (level of purity); however, a high-grade bituminous coal is mined from surface pits near Wilburton.

Geologic History

Geology is centered around the history of the Earth and the study of the processes that produced the geologic features seen today. Less than 200 years ago many respected scientists believed that the Earth was only a few thousand years old. James Usher, an Irish archbishop, used genealogies in the Bible as a basis for publishing in "Anneles Veteris et Novi Testamenti" that the Earth was created in 4004 B.C. The vice-chancellor of Cambridge University refined the calculations and determined that the Earth was created at 9:00 a.m. on October 26, 4004 B.C. However, Charles Darwin (1809–1882), after his observations on the voyage of the Royal Navy's H.M.S. Beagle and with the publication of *The Origin of Species*, believed that the Earth had to be much older in order to account for the changes that had taken place. Today it is believed that the age of the Earth can be measured in billions of years and that the rocks at the surface are the products of a long and complex series of events.

In the late 18th century James Hutton, a Scottish geologist, proposed the classification of rocks into strata or layers. Later, William Smith, who collected fossils in England, noted that some strata contained fossils that were different from those in the strata above and below. This led to the designation of "index fossils" to be used as a basis for dating strata. Figure 4 shows the geologic time scale and compares it to a calendar year. Geologic time has been divided into eras, which are further subdivided into periods and then epochs. The oldest era is the Precambrian, which represents about 80 percent of the total age of the Earth. The Paleozoic (600 to 220 million years ago) is the age of ancient life; the Mesozoic (220 to 70 million years ago) is the age of middle life; and the Cenozoic (70 million years ago to the present) is the age of recent life. The Paleozoic Era has been divided into seven periods of varying lengths. The rocks in Robbers Cave State Park belong to the Pennsylvanian Period, which is toward the end of the Paleozoic Era.

The Pennsylvanian Period is named after the state of Pennsylvania, where rocks of that age contain large amounts of coal. The Pennsylvanian Period began about 320 million years ago and lasted 50 million years. Although periods of geologic time may seem to be phenomenally long, they are rather brief when compared to the total age of the Earth. When the 4.5-billion-year history of the Earth is compared with a 365-day year, the Pennsylvanian Period began about 26 days ago and lasted only about 4 days (fig. 4).

During the early part of the Pennsylvanian Period the Arkoma Basin (fig. 5), an area of east-central Oklahoma that extends into west-central Arkansas, gradually began to subside. At the same time the region to the south, which is now the Ouachita Mountain Uplift, slowly began to rise.

As these slow movements of the Earth's crustal blocks continued through millions of years, weathering was causing parts of the uplifted Ouachita Mountains to decompose and disintegrate. The sediments produced were carried by streams into the sinking Arkoma Basin, where they were deposited as horizontal layers of strata. After many layers had accumulated in the basin, the sediments were lithified into the solid rocks that can be seen in northern Latimer County and the park area. These sandstones and siltstones have many features similar to present-day delta deposits, such as those in the Mississippi River delta in the New Orleans area. Therefore, using the axiom "the present is the key to the past," geologists who have studied sediments in the park interpret them as being part of an ancient delta deposit.

From time to time during the Pennsylvanian, the Arkoma Basin area was flooded by the shallow marine seas that extended throughout much of the Midcontinent area. The climate during these times was apparently warm and humid, because abundant plant remains suggest that the landscape was covered by luxuriant vegetation. During periods of submergence, marine sediments were deposited, and during periods of emergence, nonmarine sediments were deposited. Thus, interbedded marine and nonmarine sediments extend throughout the basin.

By the end of Pennsylvanian time, more than 21,000 feet of clastic sediments had been deposited in the Arkoma Basin. Geologists believe that the land remained above sea level during the Permian, Triassic, Jurassic, and Cretaceous Periods, because there is no evidence that rocks of these ages were deposited in the Arkoma Basin. Erosion continued through the Tertiary, but alluvium was deposited by streams in the stream valleys during the Quaternary. Because we are still in the Quaternary Period, we can observe that erosion continues to modify the topography, changing features that first formed near the end of the Pennsylvanian Period.