

Chapter 40

Appalachian Planation Surfaces

The Appalachian region not only includes the mountains, but also the surrounding provinces. During the erosion episode (see Chapter 8 and Appendix 4), rocks of the Appalachians were sometimes planed into a flat or nearly flat planation surface, especially on the provinces east and west of the Blue Ridge Mountains (Figure 40.1). But planation surfaces are also found in the Appalachian Mountains, mainly on the mountaintops.

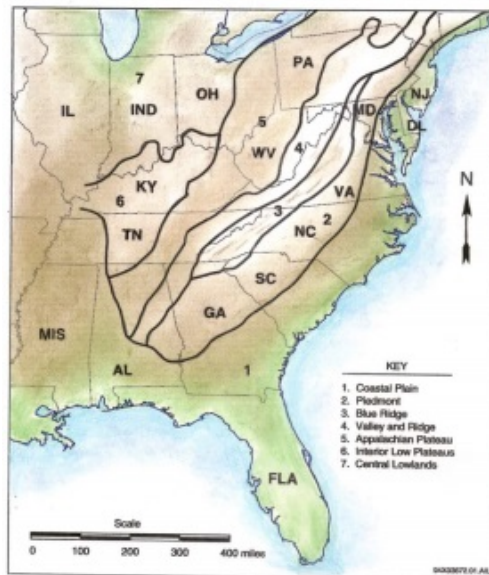


Figure 40.1. Map of the Appalachian provinces and the two provinces to the west (from Aadland et al., 1992).

Due to their rolling and dissected morphology, the Appalachian provinces are rarely called planation surfaces, but they would mostly be erosion surfaces. I will continue to use the more descriptive term, planation surface, with the understanding that many of these are erosion surfaces. The Appalachian provinces exhibit three possible planation surfaces, from east to west, they include: (1) the Piedmont Province, (2) the accordant mountaintops of the Valley and Ridge Province (part of the Appalachian Mountains), and (3) the Appalachian Plateau which is divided into the Allegheny Plateau in the north and the Cumberland Plateau in the south. I also will include the Interior Low Plateaus Province to the west of the Appalachian Plateau.

Many articles have been published about the Appalachian planation surface. Their origin is controversial among secular geologists, but they can readily be explained by the runoff of the global Genesis Flood.



Figure 40.2. Lake on the Piedmont near Parkersville, South Carolina, showing general flatness of the terrain.

The Piedmont Planation Surface

The Piedmont Province begins just east of the Blue Ridge Mountains from the Hudson River in the north to Alabama in the south. It is 125 miles (200 km) at its widest point near the Virginia-North Carolina border. The Piedmont is bordered on the east by the Atlantic Coastal Plain Province, the boundary being the Fall Line, and its elevation gradually rises westward toward the Blue Ridge Mountains. It is relatively flat (Figure 40.2) with many erosional remnants called monadnocks (Figure 40.3). Stone Mountain, Georgia, is probably the best known monadnock (Figure 40.4).¹ It rises about 800 feet (240 m) above the surrounding terrain.

The highly-deformed rocks of the Piedmont are predominantly igneous and metamorphic. They have several distinct tectonic zones and lithologic belts parallel to the Blue Ridge Escarpment, the Brevard Fault zone, the Charlotte Belt, and the Carolina Slate Belt. Granitic bodies locally intrude the Piedmont. The type of rock varies widely; in spots there are even some mantle rocks.²

Nevertheless, the Piedmont has been *planed fairly smooth* across its entire area. Because of the considerable variations in rock type, erosion by modern processes over millions of years would have worn soft rocks the most and hard rocks the least. The harder rocks should be

¹ Froede Jr., C.R., 1995. Stone Mountain Georgia: a creation geologist's perspective. *Creation Research Society Quarterly* 31:214–224.

² Farrar, S.S., 1985. Tectonic evolution of the easternmost Piedmont, North Carolina. *GSA Bulletin* 96:362–380.

mountains and the softer rocks, deep valleys. But both the hard and the soft rocks have been planed generally the same. Geomorphologist Nevin Fenneman stated the Blue Ridge Mountains and the Piedmont used to be called the “Older Appalachians,” but the eastern part was planed:

At a much later time the older belt became two physiographic provinces by the reduction of its seaward side of a relatively late peneplain (Piedmont province), while the higher belt on its western side (Blue Ridge province) was not destroyed.³



Figure 40.3. Monadnock on the Inner Piedmont close to Caesar's Head State Park, South Carolina.

Are the Ridges in the Valley and Ridge Province a Planation Surface?

The Valley and Ridge Province, on the opposite side of the Blue Ridge Mountains from the Piedmont, extends a distance of about 1,200 miles (1,900 km) from the St Lawrence Lowland to Alabama.^{4,5} Its width varies from about 14 miles (22 km) along the New York-New Jersey state line to 80 miles (125 km) between Harrisburg and Williamsport, Pennsylvania. The province is thought to have formed by folding and thrusting toward the northwest of mostly early Paleozoic strata followed by millions of years of erosion. The ridges and valleys run parallel to each other going northeast to southwest (Figure 40.5). The Great Valley is usually considered the first

³ Fenneman, N.M., 1938. *Physiography of Eastern United States*. McGraw-Hill Book Company, Inc, New York, NY, p. 122.

⁴ Fenneman, Ref. 3, pp. 1–714.

⁵ Thornbury, W.D., 1965. *Regional Geomorphology of the United States*, John Wiley & Sons, New York, NY.

valley along the southeast edge as it borders the Blue Ridge Mountains to the east (arrow in Figure 40.5).

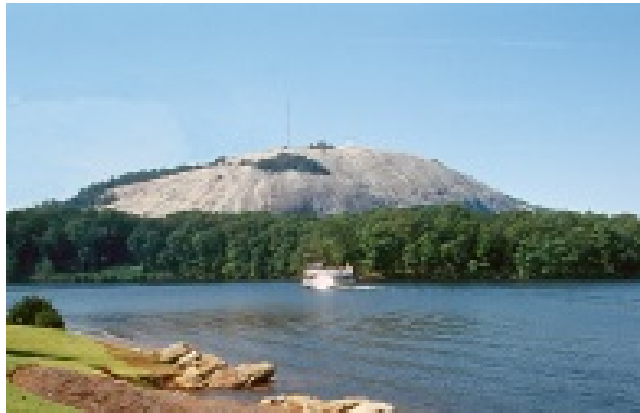


Figure 40.4. Stone Mountain, Georgia, monadnock (photo courtesy of Carl Froede).

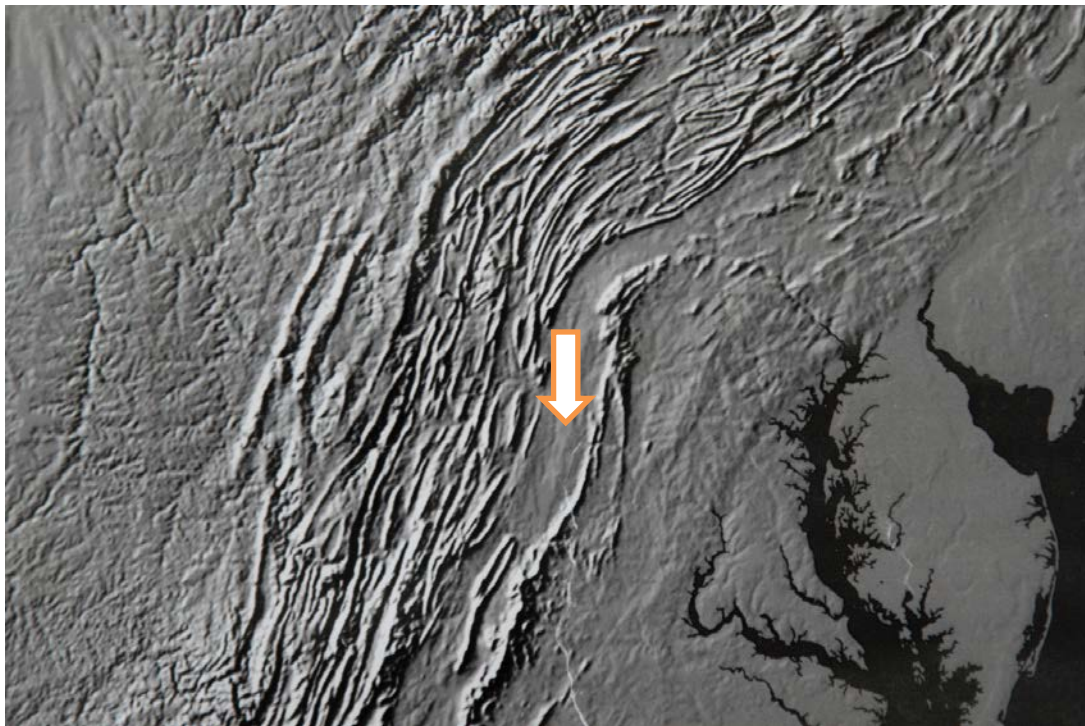


Figure 40.5. The distinctive geomorphology of the Appalachians Mountains in southern Pennsylvania, Maryland, and eastern Virginia (from Landforms of the Conterminous United States). The Great Valley is shown by an arrow.

The crests of the ridges are generally hard sandstone or conglomerate and are moderately even or level, and of similar elevation at the top. The ridges are rarely wide enough to have a flat surface. The valleys are mostly underlain by softer shales. Differences in the hardness of the rocks probably explain the highs and lows. This is different from the erosion of the Piedmont, which has considerable differences in rock type and hardness but has been planed generally flat. The level tops of many of the ridges in the Valley and Ridge Province suggested to William

Morris Davis,⁶ and other that their crests represent the remnants of an extensive erosion surface. It was named the “Schooley peneplain” by William Morris Davis.⁷ A lower peneplain developed in the valleys and was named the “Harrisburg peneplain.” However, the accordant tops of the ridges need not represent a single regional erosion surface, but merely differential erosion of hard and soft rocks that have been folded.⁶ Thornbury suggested:

We must, of course, always keep in mind the possibility that the topography of the Ridge and Valley province can be interpreted reasonably without resort to erosion cycles and peneplains.⁸

Therefore, I will not treat the accordant ridge tops of the Valley and Ridge Province as a regional planation surface, although it very likely represents one.



Figure 40.6. Rounded hills called monadnocks (arrow) above flat floor of the Great Valley (view northwest from Rocky Top Overlook, Shenandoah National Park, Virginia).

⁶ Hack, J.T. 1989. Geomorphology of the Appalachian Highlands. In, Hatcher, Jr., R.D., W.A. Thomas, and G.W. Viele (editors), *The Geology of North America, Volume F-2, The Appalachian-Ouachita Orogen in the United States*, Geological Society of America, Boulder, CO, pp. 459–470.

⁷ Johnson, D.W. (editor), 1954. *Geographical Essays by William Morris Davis*. Dover Publications, Mineola, NY, p. 489.

⁸ Thornbury, Ref. 5, p. 127.



Figure 40.7. Dissected planation surface on the border of Virginia and Kentucky at Breaks Interstate Park on the western edge of the Appalachian Mountains.



Figure 40.8. An erosional remnant of the Allegheny Plateau showing considerable dissection around it (view southwest from Welcome Center Rest Stop, Interstate 15, north central Pennsylvania).

However, the bottom of the Great Valley (see arrow in Figure 40.5) likely is a valley bottom planation surface (see Chapter 33), since in many areas the valley floor is flat and has truncated sedimentary rocks with different degrees of hardness and dip angle. Monadnocks are also found in the Great Valley (Figure 40.6). This planation surface can be equated with the Harrisburg peneplain of Davis's cycle of erosion (see chapter 50).



Figure 40.9. Cumberland Front at the edge of the Cumberland Plateau (view west from Interstate 40 in Tennessee).

Planation Surfaces West of the Valley and Ridge Province

Immediately west of the Valley and Ridge Province is the Appalachian Plateau Province, which stretches from northwestern New York to northeastern Alabama.⁹ It attains a maximum width of 200 miles (320 km) in the Ohio-Pennsylvania-West Virginia area⁵ and occupies more than 26,000 mi² (66,000 km²). The Appalachian Plateau consists of the Allegheny Plateau in the north and the Cumberland Plateau in the south. The boundary between the two is rather arbitrary. Most of the Appalachian Plateau is significantly dissected by streams, and as a result is different from many plateaus found in the western United States, except for the fact that the entire area was planed *first* and then dissected. Briggs subdivided this area into mini-provinces.¹⁰

⁹ Fenneman, Ref. 4, pp. 279–342.

¹⁰ Briggs, R.P. 1999. Appalachian Plateaus Province and the eastern lake section of the Central Lowland Province. In Shultz, C.H. (editor), *The Geology of Pennsylvania*, Pennsylvania Geological Survey, Harrisburg, PA, and Pittsburgh Geological Society, Pittsburgh, PA, pp. 363–377.

The rocks below the Appalachian Plateau are relatively undeformed and horizontal, except in the east.¹¹ The highest point of the plateau is along the eastern margin of West Virginia where its altitude exceeds 4,000 feet (1,200 m) above mean sea level (Figure 40.7). Although the altitude of the plateau varies, it is generally *higher* than the Valley and Ridge Province to the east and the Low Plateaus Province to the west, and is bounded on most sides by outward facing escarpments. One exception is the northwest part of the plateau, from a point east of Columbus to near Cleveland, Ohio. This could have been caused by glaciation, which reached the northern Allegheny Plateau,¹² as evidenced by glacial debris, and the loss of the escarpment in the northwestern plateau.



Figure 40.10. New River Gorge near the New River Bridge, West Virginia.

The Appalachian Plateau Province is considerably dissected by channelized erosion, the type that forms canyons and valleys (Figure 40.8). It is so dissected along its eastern margin that the topography is designated as mountainous—the Allegheny Mountains or Allegheny Front. Relief in the Allegheny Mountains reaches about 1,000 feet (300 m), but it is 2,000 feet (600 m) in the Cumberland Mountains along the eastern Cumberland Plateau, called the Cumberland Front

¹¹ Dennison, J.M., 1976. Gravity tectonic removal of cover of Blue Ridge anticlinorium to form Valley and Ridge province. *GSA Bulletin* 87:1,470–1,476.

¹² Oard, M.J. 2004. *Frozen In Time: The Woolly Mammoth, the Ice Age, and the Bible*. Master Books, Green Forest, AR.

(Figures 40.9). The New River deeply incises the Appalachian Plateau (Figure 40.10). Although localized erosion cuts the Appalachian Plateau Province, the plateau once was a large planation surface (Figure 40.11). The Allegheny Plateau of the northern Appalachian Plateau is rolling and has also been more severely eroded than the Cumberland Plateau, which is quite flat and less dissected (Figure 40.12).



Figure 40.11. Top of rolling, dissected erosion surface of the Allegheny Plateau north central Pennsylvania.

In the western part of the Appalachian Plateau Province, there is a bench about 330 feet (100 m) above the major river valleys, cut into hard rock. It is considered a strath terrace and named the Parker strath in many places (see Figure 60.4). A strath terrace is a narrow planation surface along the edge of a valley or gorge formed during dissection. It likely the same as a pediment. They commonly have a gravel cap and look like regular terraces and consist almost totally of gravel. Strath terraces will be explored in Chapter 60.



Figure 40.12. View northwest of the top of the nearly flat erosion surface of the Cumberland Plateau from Sequatchie Valley, southeast Tennessee.

West of the Appalachian Plateau Province is the Interior Low Plateaus Province.^{13,14} The Province represents a lower erosion surface, called the Lexington Plain. Fairly flat and rolling, it is more a plain than a plateau (Figure 40.13). Its eastern boundary is the escarpment along the west edge of the Appalachian Plateau in eastern Kentucky and Tennessee (Figure 40.14). It extends north to the edge of Ice Age glaciation and west into western Kentucky and Tennessee. Gravels from the Appalachian Mountains cover parts of this surface, especially in western Kentucky (see Chapter 27). The Lexington Plain is less severely dissected than the Appalachian Plateau Province.

¹³ Fenneman, Ref. 4, pp. 411–448.

¹⁴ Thornbury, Ref. 5, pp. 185–211.



Figure 40.13. Erosion surface of the Interior Low Plateaus Province, south central Kentucky.



Figure 40.14. The western escarpment of the Cumberland Plateau (view northwest). The flat surface in the background is the continuation of the Cumberland Plateau that wraps around the valley below.