Part VI

Geomorphological Evidence

This part summarizes a host of geomorphological evidence that the Flood/post-Flood boundary is in the late Cenozoic. I start out by showing that thousands to tens of thousands of feet of continental erosion occurred in the Cenozoic. During this erosion, special erosional features formed, such as erosional escarpments that are thousands of feet tall. Planation surfaces also were cut worldwide with some of them very large. Then, I document how resistant rocks are carried far from the eroding mountains, sometimes hundreds of miles, and in south central Asia have accumulated thousands of feet thick all around the edge of the mountains. Next, I document how deep continental valleys and canyons were eroded catastrophically by huge flows of water. The origin of pediments is a major mystery of geomorphology and yet there are thousands of them across the Earth. There are also thousands of water and wind gaps across the Earth, and deep submarine canyons, some the size of Grand Canyon, are cut perpendicular to the shoreline from the continental shelf to the deep sea.

All these Earth surface features formed in the Cenozoic and are impossible to nearly impossible to have been form by slow processes of erosion over millions of years, the uniformitarian view. At the same time, post-Flood catastrophism is unable to explain them.

Chapter 21

Huge Erosion of the Continents

One of the most direct methods for finding the Flood/post-Flood boundary is to calculate the amount of continental erosion in any one area.[1,2] There was abundant erosion during Flood runoff, as the continents and mountains rose up out of the Floodwater, and valleys, basins, and the ocean bottom sank, according to Psalm 104:6–9. Little erosion took place after the Flood, if we consider the present rate of erosion and adjusting for the higher precipitation and runoff during the Ice Age.[3]

Any type of post-Flood catastrophe would be expected to cause much more erosion, of course. Advocates generally place these catastrophes within the first few hundred years after the Flood. So, erosion would be greater in this scenario, presumably by water or mass flow or mass wasting (the flow of debris down a slope). Furthermore, the erosional products during the post-Flood period should be located just downslope from the catastrophe, and so we should find most of the debris still on the continents. Therefore, the *magnitude* of the continental erosion should be able to inform us on which boundary makes the most sense.

Methods of Estimating Continental Erosion

There are several methods for estimating the amount of erosion in a given region. Some of them are indirect, such as chemical and cosmogenic isotopic methods that rely on radiometric dating. Since these methods are based on uniformitarian assumptions, other methods will be used, even though the chemical and cosmogenic methods commonly yield significantly greater erosion than the methods actually employed in this chapter.

Minimum erosional values can be determined from the height of tall erosional remnants, called inselbergs (they are also called monadnocks, bornhardts, or tower karst in limestone terrain).[4] Examples include Devils Tower in northeast Wyoming, USA, and Ayers Rock in central Australia. There are thousands of these erosional remnants across the Earth. Tall erosional remnants with cliffs, like Steamboat Rock (Figure 21.1) in the Upper Grand Coulee of central Washington State, USA, were formed rapidly within days in the massive Lake Missoula flood at the peak of the Ice Age.[5] Thus, it appears that catastrophic floods will rapidly create these remnants by eroding all the rock around them. Since erosional remnants are often sedimentary rocks and the rock is well indurated at the top, it is not unreasonable to add another 1,000 feet (300 m) or more to represent the minimum overburden necessary for compaction and lithification. Because this amount is so uncertain, only the top of the erosional remnant will be used in estimating erosion, and as a result the estimates presented here will be minimums.

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[1] Oard, M.J., 2013. Surficial continental erosion places the Flood/post-Flood boundary in the late Cenozoic. *Journal of Creation* 27(2):62–70.
[2] Oard, M.J., 2013. Massive erosion of continents demonstrates Flood runoff. *Creation* 35(3):44–47.
[3] Holt, R.D., 1996. Evidence for a Late Cainozoic Flood/post-Flood boundary. *Journal of Creation* 10(1):128–167.
[4] Oard, M.J., 2008 *Flood by Design: Receding Water Shapes the Earth's Surface*. Master Books, Green Forest, AR.
[5] Oard, M.J., 2004. *The Missoula Flood Controversy and the Genesis Flood*. Creation Research Society Monograph No. 13, Chino Valley, AZ.

Figure 21.1. Steamboat Rock, a 900-foot (275 m) high vertically-walled erosional remnant, formed during the rapid erosion of Grand Coulee by the Lake Missoula flood.

An anticline is a fold, convex upward, whose core contains older rocks.[6] When the center axis of an anticline is eroded, the amount missing can be calculated from the dip of the strata on the limbs, assuming that the layers were the same thickness over the eroded top of the anticline. Figure 21.2 illustrates the hypothetical uplift of an anticline and subsequent erosion of its top during the Flood. Calculating the missing section at the center of the anticline is relatively easy with trigonometry. Essentially, it calls for projecting dipping beds on the limb up to the axis, and then subtracting the elevation of the existing rock. If the beds thinned over the axis, a common occurrence, the calculation would be too high but still a good estimate.

A third method is done by using coal rank at or near the surface. The formation of coal is related to temperature, with rank increasing with higher temperature from lignite, to bituminous, to anthracite. Since temperature is a function of depth of burial, higher rank coals suggest deeper burial and thus, greater erosion after burial. Other factors can complicate the calculation, but coal rank does provide a minimum estimate, but it is still an educated guess. In any case, the presence of bituminous or anthracite coal at or near the surface typically suggests prior burial under around 10,000 feet (3,000 m) or more of sedimentary rocks and unconsolidated sediments.

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[6] Neuendorf, K.K.E., J.P. Mehl, Jr., and J.A. Jackson, 2005. *Glossary of Geology*, Fifth Edition. American Geological Institute, Alexandria, VA, p. 28.

A fourth and final method for determining erosion on a regional scale is to estimate the volume of sedimentary rocks within the continental margin, which includes the continental shelf and slope, and along "passive continental margins" the continental rise. If the drainage area for these sedimentary rocks can be estimated, a rough estimate of total erosion can be made.

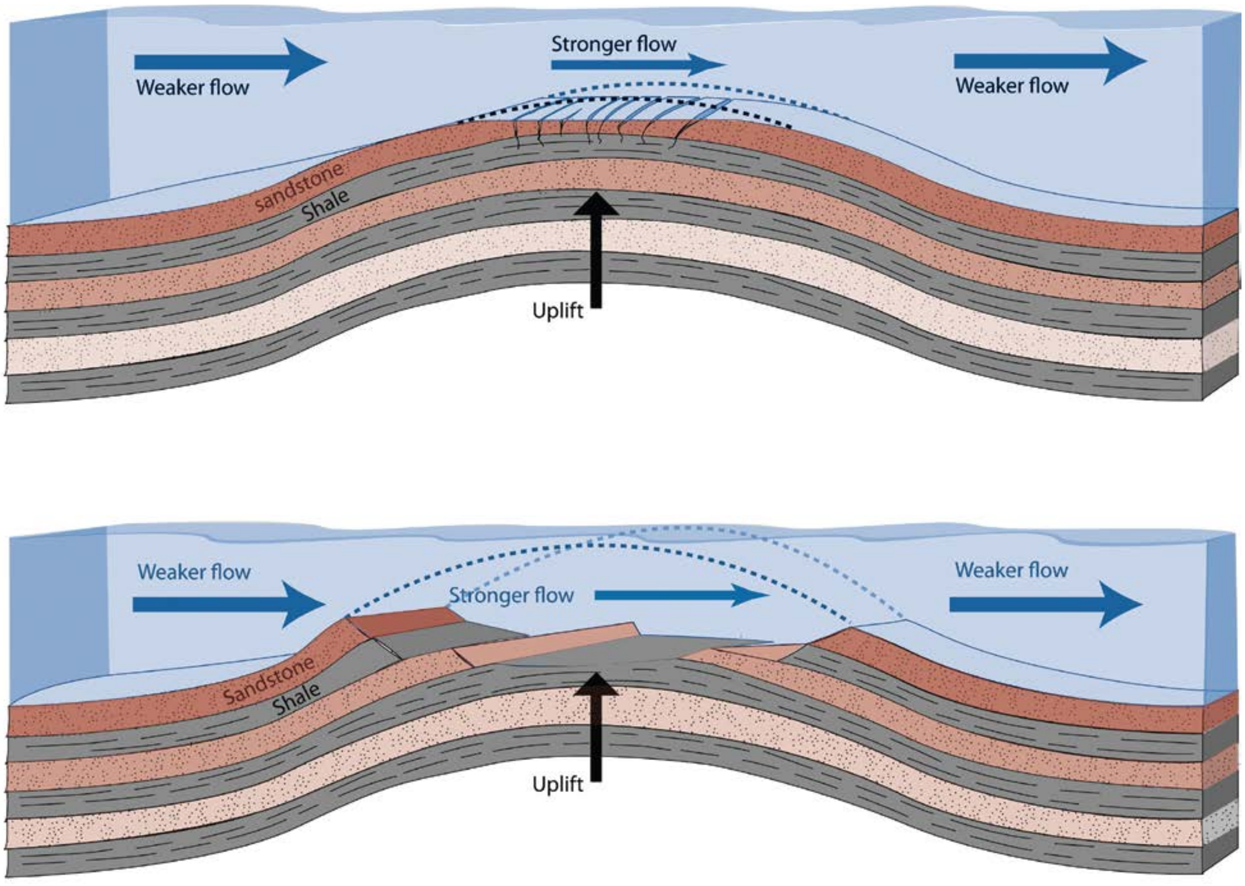

Figure 21.2. Schematic of the rapid Flood erosion of an anticline leaving behind dipping limbs.

Large-Scale Erosion of the Continents

Regardless of the method used, it appears that an extremely large amount of the sediments deposited on the continents and other igneous and metamorphic rocks have been eroded. [7] We live on a scoured land. Landforms suggest that the erosion occurred in one of two manners: (1) by widespread sheet erosion, and (2) by channelized erosion afterwards. Examples of sheet erosion in several locations can help us gain an appreciation for the total amount of erosion that has taken place in the continental interiors.

Colorado Plateau

The thick sedimentary rocks of the Colorado Plateau (Figure 21.3) are generally mildly deformed into domes and basins (anticlines and synclines, respectively). The domes have been

[7] Oard, M.J., 2013 (ebook). *Earth's Surface Shaped by Genesis Flood Runoff.* http://Michael.oards.net?GenesisFloodRunoff.htm.

heavily eroded. Using direct measurement of the dip of sedimentary rocks, an estimate of the erosion over the domes can be made.

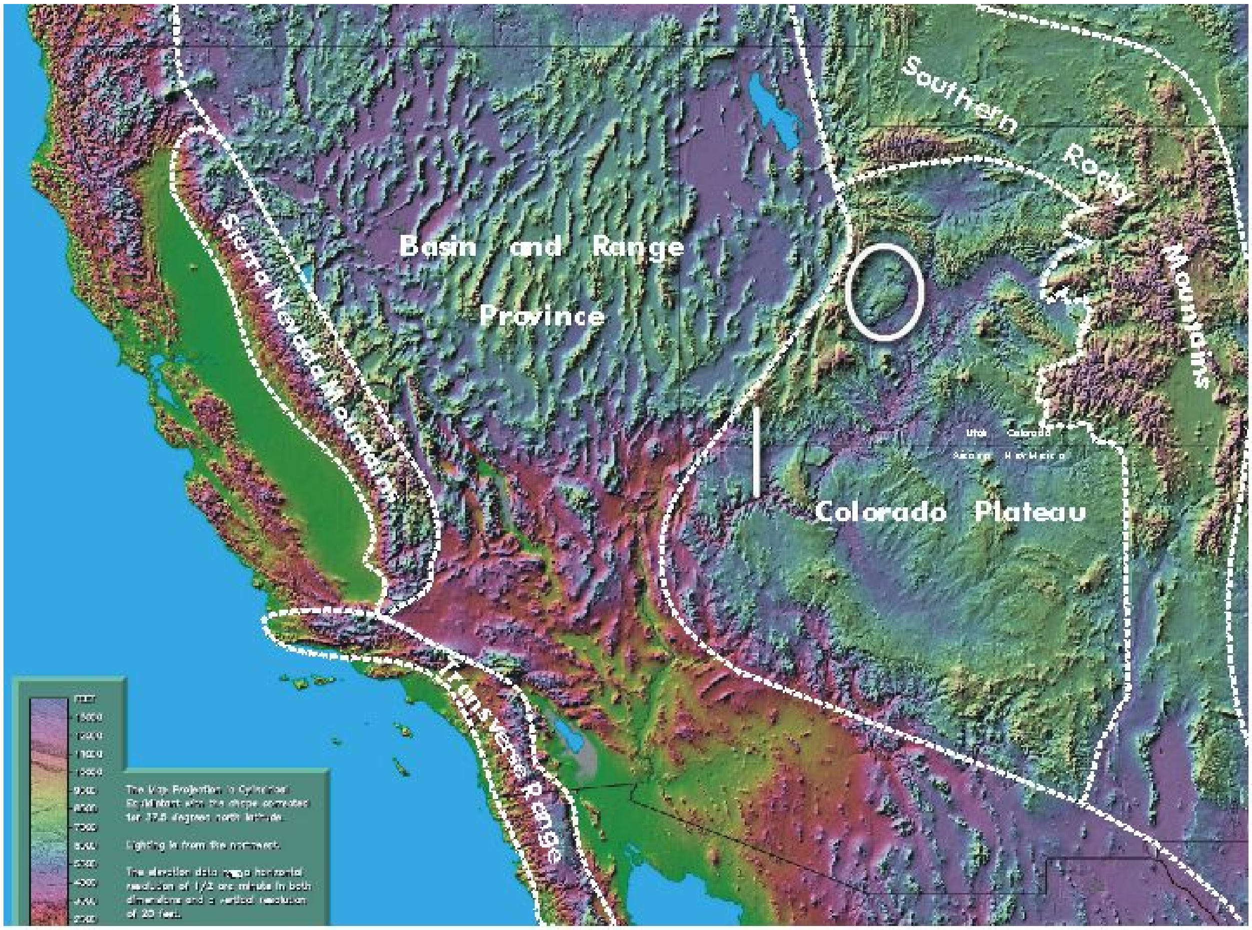

Figure 21.3. The Colorado Plateau of the southwest United States (map background provided by Ray Sterner with the provinces drawn by Peter Klevberg). San Rafael Swell noted by an ellipse, and the location for the estimate of erosion in the Grand Canyon area based on the Grand Staircase northern limb of an anticline is indicated by the north-south line.

The Grand Staircase is part of the western Colorado Plateau, and is shown in Figure 21.4 from the north slope of the Kaibab Plateau, north of Grand Canyon. It represents the eroded north limb of a huge east-west orientated anticline that was once centered near Grand Canyon. The sedimentary rocks that form cliffs in the Grand Staircase are about 10,000 feet (3,000 m) thick. They are erosional remnants of strata that once extended far south over the Grand Canyon area. Since the assumption of constant thickness might be overly generous, I will assume that the missing sedimentary layers thinned by about forty percent on the top of the anticline to the south. Based on this estimate, the minimum amount of erosion creating the Grand Staircase would have been 6,000 feet (1,830 m).

Furthermore, if the 2,000-foot (600 m) thick, widespread Marysvale Volcanic Field, which overlies the Grand Staircase to the north (Figure 21.5), was present to the south, it would add that thickness to the eroded sedimentary rocks, bringing the minimum thickness up to 8,000 feet (2,430 m). Therefore, estimates of erosion range from 8,000 to a maximum of 12,000 feet (2,430 m up to 3,600 m) over the Grand Canyon area—before the canyon was carved!

The top layer of the Grand Staircase, the Claron Formation (earlier wrongly considered the Wasatch Formation) is dated as early Cenozoic. The Marysvale Volcanic Field is dated from the mid Cenozoic to the early late Cenozoic.[8] Since all of these rocks had to be emplaced *before* erosion, the sheet erosion of all the Grand Staircase rock, from northern Arizona and southern Utah, must have occurred in the *late Cenozoic*, arguing for a Flood/post-Flood boundary in the very late Cenozoic in the Grand Canyon area.

Figure 21.4. The northward dipping strata of the Grand Staircase (view north from the Kaibab Plateau just north of Grand Canyon, northern Arizona, USA).

This sheet erosion created a planation surface in the Grand Canyon area (Figure 21.6). Planation surfaces of this scale are not forming today (see Chapter 23). This erosion-caused planation surface also formed late in the Cenozoic.

[8] Rowley, P.D., H.H. Mehnert, H.H., C.W. Naeser, L.W. Snee, C.G. Cunningham, T.A. Stevens, J.J. Anderson, E.G. Sable, and R.E. Anderson, 1994. Isotopic ages and stratigraphy of Cenozoic rocks of the Marysvale Volcanic Field and adjacent areas, west-central Utah. *U.S. Geological Survey Bulletin 2071*, U.S. Government Printing Office, Washington, D.C.

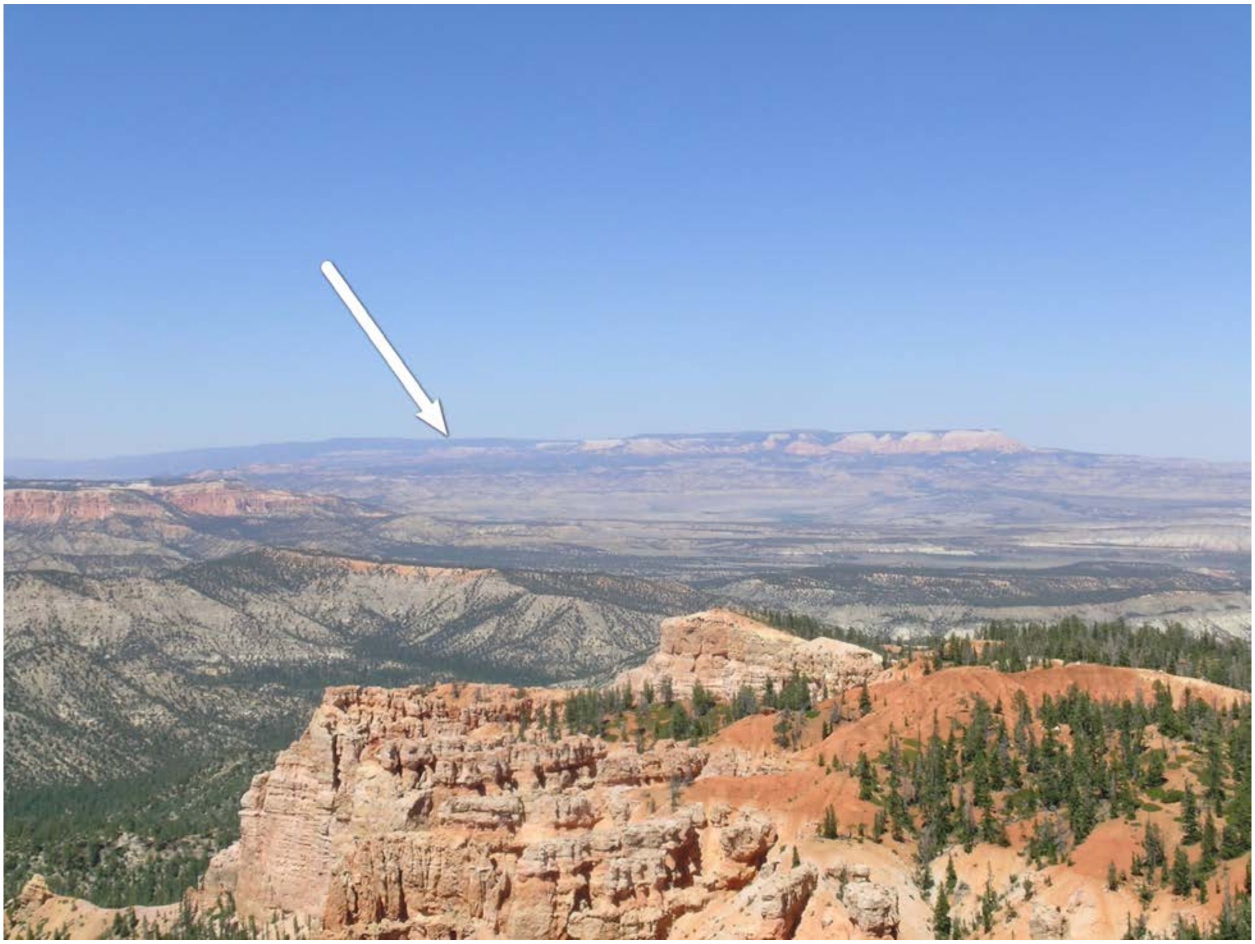

Figure 21.5. The Aquarius Plateau to the north (arrow) on top of the Claron Formation of the fifth stair of the Grand Staircase (view northeast from Bryce Canyon National Park in south-central Utah, USA).

Another location on the Colorado Plateau where erosion can be mechanically calculated is at the San Rafael Swell, in the northwestern Colorado Plateau, shown by the ellipse in Figure 21.3. It is 120 km by about 65 km.[9] The sedimentary rocks of the north limb of the San Rafael Swell, north of Price, Utah, make up the Roan and Book Cliffs and dip about 8° down toward the north-northeast I calculated the amount of missing section above Price, Utah, where the sedimentary rocks start to flatten out.[10] Including a conservative dip of 6°, the amount of missing section was calculated from 12,000 to 15,000 feet (3,660 to 4,575 m). It is likely that the thickness should be greater because north of a high pass on Highway 191, erosional remnants of the top formation, the Green River Formation, are about 2,000 feet (600 m) high, indicating that this depth of sedimentary rock once extended over the anticline. So, the total minimum erosion from the San Rafael Swell is 14,000 to 17,000 feet (4,200 to 5,100 m) (Figure 21.7)! Note in Figure 21.7 that the top formation eroded is the early Cenozoic Green River Formation. I will have more to say about this formation in Chapter 36.

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[9] Huuse, M., S.J. Shoulders, D.I. Netoff, and J. Cartwright, 2005. Giant sandstone pipes record basin-scale liquefaction of buried dune sands in the Middle Jurassic of SE Utah. *Terra Nova* 17:81.

[10] Oard, M.J. and P. Klevberg, 2005. Deposits remaining from the Genesis Flood: Rim Gravels in Arizona. *Creation Res*
earch Society Quarterly 42(1):1-17.

Figure 21.6. The Grand Canyon planation surface, northern Arizona, USA (view north from the top of Red Butte).

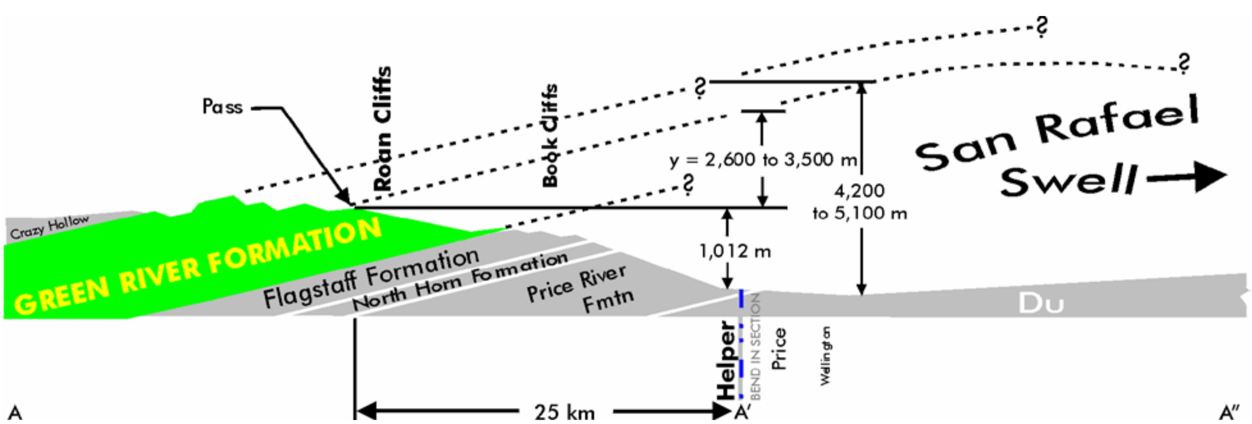

Figure 21.7. The eroded north limb of the San Rafael Swell showing 4,200 to 5,100 m of erosion over Price, Utah, USA. The dashed lines with question marks represent the extrapolation of the sedimentary rock up the San Rafael Swell assuming no change in thickness (drawn by Peter Klevberg).

Based on geological clues on the Colorado Plateau at the Grand Staircase and the Roan and Book Cliffs, an average of 8,200 to 16,400 feet (2,500 to 5,000 m) of erosion occurred over the *entire* Colorado Plateau! [11] Since the Colorado Plateau represents an area of about 132,000 mi^2 (337,000 km^2), the volume of rock removed by erosion is 205,000 to 415,000 mi^3 (842,000 to 1,700,000 km^3). Since these sediments are not found on the continent, they must have been carried completely off the continent by large-scale high velocity currents, consistent with the Retreating Stage of the Flood. The eroded debris was deposited along the continental margin (see Chapter 11). Therefore the huge erosion in the Cenozoic places the Flood/post-Flood boundary in the very late Cenozoic on the Colorado Plateau.

Appalachian Mountains

We have all heard that the Appalachian Mountains of the eastern United States appear old and worn down by erosion. Pazzaglia and Gardner quantify this perception in their estimate of total erosion from the mountains by arguing that over 4.4 miles (7 km) of rock was removed.[12] The proposed age of the Appalachians is a conclusion of uniformitarian geology, one that assumes it takes hundreds of millions of years to erode and smooth the mountains. Their rounded appearance does give the impression of great age. However, large-scale erosion could have smoothed these mountains in the last half of the Flood. If so, is their estimate of erosion still valid? I applied two different methods that yielded the same result of about 4 miles (6.4 km)![13]

The first method is measuring the coal rank at or near the surface. Coal is common in sedimentary rocks just west of the Blue Ridge Mountains. It ranges from high-rank anthracite to medium-rank bituminous, with the rank generally increasing to the southeast.[14] Friedman and Sanders stated anthracite coal of the Catskill Mountains of New York indicate about 4 miles (6.4 km) of erosion occurred there, assuming a normal temperature gradient with depth in the earth.[15] If they are correct, their argument would also apply to anthracite coal found near the surface in the sedimentary rocks west of the Blue Ridge Mountains. If the downward temperature rise were higher temperature in the past, less overburden would be required to form anthracite, and consequently, less erosion after formation of the coal.[14] Since we do not know of what past temperature changes with depth were, I assumed the present change. Areas with lower rank bituminous coal would require less overburden than anthracite. For these latter areas, 2.5 to 4 miles (4.0 to 6.4 km) of erosion is probably a reasonable estimate.

The second method is by estimating the volume of sedimentary rocks found on the continental margin. East of the Appalachians, especially in the southern ranges, is a piedmont of metamorphic and igneous rocks. Further east, a sedimentary wedge marks the westward terminus of the continental margin sediments. The boundary of this wedge often occurs at the Fall Line. The sedimentary rocks from the Fall Line to the continental rise represent a seaward prograding

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[11] Schmidt, K.-H., 1989. The significance of scarp retreat for Cenozoic landform evolution on the Colorado Plateau, U.S.A. *Earth Surface Processes and Landforms* 14:93-105.
[12] Pazzaglia, F.J. and T.W. Gardner, 2000. Late Cenozoic landscape evolution of the US Atlantic passive margin: insights into a North American Great Escarpment; in: Summerfield, M.A. (ED.), *Geomorphology and Global Tectonics*, John Wiley & Sons, New York, NY, p. 287.
[13] Oard, M.J., 2011. Origin of Appalachian Geomorphology Part I: erosion by retreating Floodwater. *Creation Research Society Quarterly* 48(1):33–48.
[14] Hower, J.C. and S.M. Rimmer, 1991. *Organic Geochemistry* 17(2):161–173.
[15] Friedman, G.M. and J.E. Sanders, 1982. Time-temperature-burial significance of Devonian anthracite implies former great (~6.5 km) depth of burial of Catskill Mountains, New York. *Geology* 10:93–96.

and thickening wedge of sediments and sedimentary rock (see Figure 11.5).[16,17] These sediments and sedimentary rocks most likely are the eroded remnants of a much higher Appalachian chain, probably resulting from late Flood vertical tectonics, described in the Bible as the uplift of the continents and the sinking of the ocean basins.[18] Based on the total amount of sedimentary rocks offshore, the total amount of erosion from east of the Appalachian divide is about 3.75 miles (6 km).[13]

Poag and Sevon state: “The primary forcing mechanisms considered have been tectonic and isostatic uplift and subsidence…”[19] Tectonic uplift of the eastern United States is believed to have caused the erosion of the Appalachians, while the total amount of subsidence off the coast along the continental margin made room for the eroded sediments and is believed to be 8.75 miles (14 km)![18,20] This statement reminds us of Psalm 104:8a, the mechanism God applied to drain the Floodwater: “The mountains rose; the valleys sank down…” Isostatic uplift is a secondary, smaller tectonic force caused by the removal of rock. Conversely, the addition of sediments is also a secondary mechanism that will add to the great downwarping of the ocean basin.

Other Examples of Massive Continental Erosion

Other areas of North America demonstrate similarly significant erosion. More than a mile (1.6 km) of rock was eroded from southern Arizona during the Cenozoic.[10] A few miles of strata disappeared from the Rocky Mountains, foothills, and western Plains of southern Canada in the late Cenozoic.[21,22]

North America is not unique in this regard. Large-scale erosion scoured other continents, especially in mountainous areas.[23,24] Although many more estimates of continental erosion can be found in the geological literature, a few will suffice to show that what happened in North America was typical of late Flood erosion everywhere on the continents.

Geological features in Australia show that this continent was also heavily eroded.[25] For example, 3.75 miles (6 km) of rock probably was removed from the Flinders Range in South

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[16] Klitgord, K.D., D.R. Hutchinson, and H. Schouten, 1988. U.S. Atlantic continental margin; structural and tectonic framework; in: Sheridan, R.E. and J.A. Grow (Eds.), *The Geology of North America, Volume I-2: The Atlantic Continental Margin: U.S.*, Geological Society of America, Boulder, CO, pp. 19–55.

[17] Poag, C.W. and P.C. Valentine, 1988. Mesozoic and Cenozoic stratigraphy of the United States Atlantic continental shelf and slope; in: Sheridan, R.E. and J.A. Grow (Eds.), *The Geology of North America, Volume I-2: The Atlantic Continental Margin: U.S.*, Geological Society of America, Boulder, CO, pp. 67–85.

[18] Poag, C.W. and W.D. Sevon. 1999. A record of Appalachian denudation in postrift Mesozoic and Cenozoic sedimentary deposits of the U.S. middle Atlantic continental margin. *Geomorphology* 2:119–157.

[19] Poag and Seven, Ref. 18, p. 119.

[20] Poag, C.W., 1992. U.S. middle Atlantic continental rise: provenance, dispersal, and deposition of Jurassic to Quaternary sediments; in: Poag, C.W. and P.C. de Graciansky (Eds.), *Geological Evolution of Atlantic Continental Rises*, Van Nostrand Reinhold, New York, NY, pp. 100–156.

[21] Bustin, R.M., 1991. Organic maturity in the western Canada sedimentary basin. *International Journal of Coal Geology* 19:319–358.

[22] Osborn, G., G. Stockmal, and R. Haspel, 2006. Emergence of the Canadian Rockies and adjacent plains: a comparison of physiography between end-of-Laramide time and the present day. *Geomorphology* 75:450–477.

[23] King, L.C., 1983. *Wandering Continents and Spreading Sea Floors on an Expanding Earth*, John Wiley and Sons, New York, NY, pp. 197–214.

[24] Pazzaglia and Gardner, Ref. 12, pp. 283–302.

[25] Galloway, R.W., 1978. Introduction; in: Davies, J.L. and M.A.J. Williams, (Eds.), *Landform Evolution in Australasia*, Australian National University Press, Canberra, Australia, pp. 1–4.

Australia.[26,27] In Europe, about 1.9 miles (3 km) was taken off the Welch Mountains of the United Kingdom.[28] About 0.6 to 1 mile (1 to 1.6 km) of sedimentary rock was stripped from southeast England (Figure 21.8).[29,30]

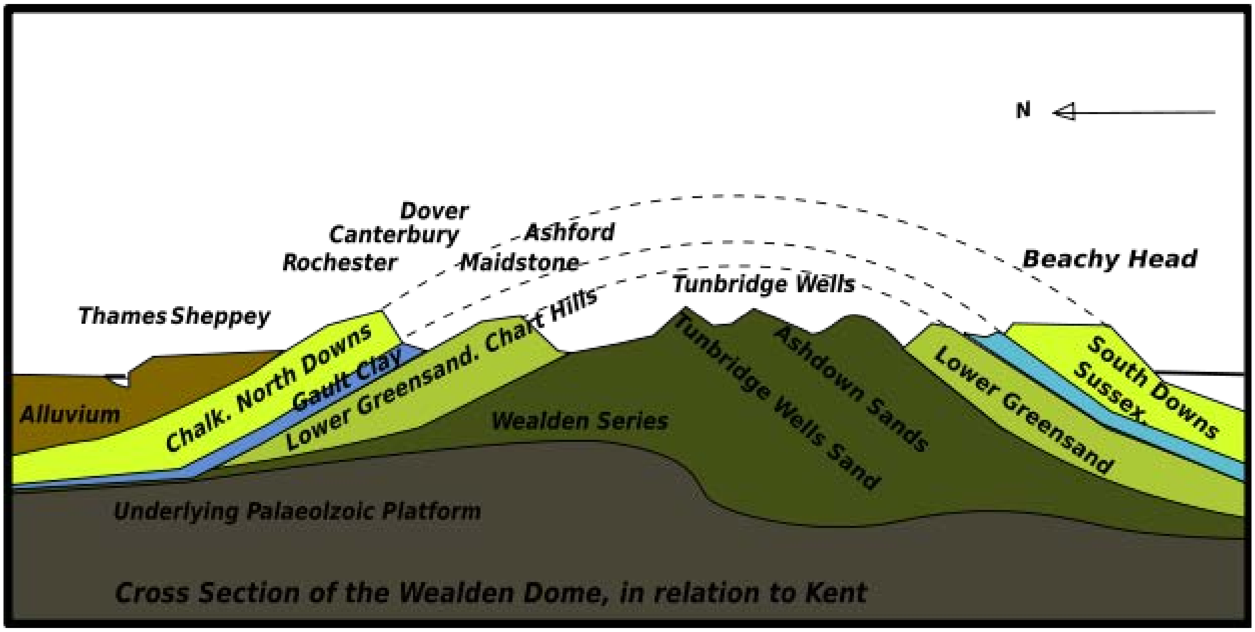

Figure 21.8. Uplifted, eroded Wealden Dome of southeast England (Wikipedia). Total erosion in the center of the dome is about 4,600 feet (1,400 m).

Partridge believes more than 0.6 to 1.8 miles (1 to 3 km) of rock was eroded from southern Africa during the Cenozoic.[31] More impressive is the 2.5 to 4.4 miles (4 to 7 km) of erosion that occurred in the Cenozoic along the coast of the 160-mile (260 km)-long McMurdo sector of the Transantarctic Mountains.[32]

Massive erosion is also evident near large impact craters; 5 to 6.9 miles (8 to 11 km) of sedimentary rocks are believed to have been removed from above the Vredefort impact crater, northeast South Africa, and 3.1 miles (5 km) from above the Sudbury impact crater in southern Ontario.[33]

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[26] Chorley, R.J., S.A. Schumm, and D.E. Sugden, 1984. *Geomorphology*, Methuen, London, U.K., p. 165.
[27] Twidale, C.R. and E.M. Campbell, 2005. *Australian Landforms: Understanding a Low, Flat, Arid and Old Landscape*, Rosenberg Publishing PTY Ltd, Dural Delivery Centre, New South Wales, Australia, p. 195.
[28] Small, R.J., 1978. *The Study of Landforms: A Textbook of Geomorphology*, second edition. Cambridge University Press, London, U.K., p. 266.
[29] Japsen, P., 1997. Regional Neogene exhumation of Britain and the western North Sea. *Journal of the Geological Society, London* 154:239–247.
[30] Jones, D.K.C., 1999. On the uplift and denudation of the Weald. In, Smith, B.J., W.B. Whalley, and P.A. Warke (editors), *Uplift, Erosion and Stability: Perspectives on Long-Term Landscape Development*, Geological Society of London Special Publication No. 162, The Geological Society, London, U.K., p. 32.
[31] Partridge, T.C., 1998. Of diamonds, dinosaurs and diastrophism: 150 million years of landscape evolution in Southern Africa. *African Journal of Geology* 101(13):167-184.
[32] Sugden, D. and G. Denton, G., 2004. Cenozoic landscape evolution of the Convoy Range of Mackay Glacier area, Transantarctic Mountains: onshore to offshore synthesis. *GSA Bulletin* 116(7/8):840–857.
[33] Senft, L.E. and S.T. Stewart, S.T., 2009. Dynamic fault weakening and the formation of large impact craters. *Earth and Planetary Science Letters* 287:471–482.

Rocky Mountain Valley and Basin Erosion

The same methods above provide good estimates of the minimum amount of erosion in valleys and basins that have thick sedimentary rocks. The following examples are from valleys and basins of the Rocky Mountains and from the High Plains of the United States, but other basins and valleys around the world undoubtedly would show a similar picture.

The minimum amount of erosion of the basin or valley fill sedimentary rocks in the Rocky Mountains has been determined by geologists based on the first two methods above.[34] Average estimates in Wyoming range up to 2,800 feet (850 m) (Table 1). Similar estimates in Colorado reach 5,000 feet (1,520 m), and in New Mexico up to 3,300 feet (1,000 m). On a smaller scale, deep valleys were eroded to depths of over 3,300 feet (1,000 m) in the Absaroka Volcanics, after the planation of the top of these volcanic debris flows—all occurring in the mid and late Cenozoic.[35] So this valley erosion occurred after the sheet erosion of the top of the Absaroka Volcanics that formed the planation surface at the top, which lines up with the two phases of the Retreating Stage of the Flood.

Other estimates of erosion from the High Plains of the United States, where the strata are generally flat, include: (1) around 600 feet (180 m) northwest Texas, (2) 600 feet (180 m) southeast Colorado, (3) 400 feet (120 m) northwest Kansas, (4) around 1,300 feet (400 m) western Nebraska, (5) 625 feet (190 m) southwest South Dakota, and (6) less than 330 feet (100 m) in northeast Montana. As in many other locations, the bulk of this erosion occurred in the late Cenozoic.

Basin	Minimum Erosion
Powder River Basin, WY	360 m
Bighorn Basin, WY	470 m
Wind River Basin, WY	850 m
Northern Green River Basin, WY	350 m
Red Desert Basin, WY	640 m
Saratoga Valley, WY	760 m

Table 1. Minimum amount of erosion in selected basins and valleys of Wyoming, USA in meters.[34]

Erosion Was Rapid

Several areas in the western United States demonstrate that the erosion was rapid, as expected during the Retreating Stage of the Flood. For instance, Devils Tower would not remain standing for millions of years while all the surrounding plains were eroded.[36] This is because vertical rock faces are more easily eroded since they are strongly affected by gravity, causing rock slides and falls.[37,38] Furthermore, the extensive vertical cracks of the tower would be prone to destruction by freeze-thaw weathering. Cracks fill with water during storms, and as the water

[34] McMillan, M.E., P.L. Heller, and S.L. Wing, 2006. History and causes of post-Laramide relief in the Rocky Mountain orogenic plateau. *GSA Bulletin* 118(3/4):393–405.
[35] Oard, M.J., 2013. Geology indicates the terrestrial Flood/post-Flood boundary is mostly in the late Cenozoic. *Journal of Creation* 27(1):119–127.
[36] Oard, M.J., 2009. Devils Tower can be explained by floodwater runoff. *Journal of. Creation* 23(2):124–127.
[37] Twidale, C.R., 1968. *Geomorphology*. Thomas Nelson, Melbourne, Australia, pp. 164–165.
[38] Pazzaglia, F.J., 2004. Landscape evolution models; in: Gillespie, A.R., S.C. Porter, and B.F. Atwater (Eds.), *The Quaternary Period in the United States*. Elsevier, New York, NY, p. 249.

freezes during cold periods, the cracks enlarge. As expected blocks of rock frequently break free and fall to the base of the tower each winter.

> While living near the base of the Tower in November 1954, during periods of frost action at night one could hear blocks crash onto the talus. This would happen typically after a snowfall … On a warm sunny day the snow would melt and the moisture would enter the joints [vertical cracks] in the Tower. After dark, the water would freeze and expand, which over time continues to force blocks from the Tower and build more talus.[39]

Devils Tower should have been destroyed quickly in a timeframe of tens of thousands of years, certainly in less than 100,000 years.

Uniformitarian geologists, of course, believe that the whole Grand Canyon area was eroded by water over millions of years during the Great Denudation that formed the Grand Staircase. However, there are subtle but powerful, indications that the Great Denudation was not slow but very rapid, as we would expect in the runoff of the Genesis Flood. This evidence is found largely in the type of rock that eroded from the top of the fifth "stair" of the Grand Staircase. The soft Claron Formation (the Pink Cliffs) makes up the top or the fifth stair, but volcanic rock once capped it, as shown by volcanic rock that crop out on the northern portion of the fifth stair (Figure 21.5). C.H. Crickmay noted the perplexing erosional relationships between the 2,000 feet (600 m) of hard volcanic rock eroded north from the top of the northern Table Cliffs Plateau and the soft and erodible Claron Formation that forms the top of that plateau:

> For example, nothing strikes a visitor more than the preservation of upland surfaces in the High Plateau country of Utah; particularly, the vertical succession of survivals. One of the highest is the Aquarius Plateau, formed on top of about 600 m of resistant lavas. But, protruding from below these volcanics, stands the Table Cliffs Plateau composed of the erodible [sic] Wasatch formation, from which the resistant capping of volcanics has been stripped; nevertheless the unresistant formation has maintained a plateau form while the surround country, over vast areas, has been lowered another 1,200 m or more.[40]

If we closely follow what Crickmay is saying, we see that the hard volcanic rock of the Aquarius Plateau eroded first, exposing the soft strata of the Wasatch Formation (now the Claron Formation). Then about 4,000 feet (1,200 m) of strata below and south of the Claron Formation of the Table Cliffs Plateau was eroded forming the other stairs of the Grand Staircase. During all this time, the *soft* Claron Formation capping the Table Cliffs Plateau was hardly touched!

If the erosion took millions of years, the soft Claron Formation would have easily eroded after the lava cap was removed. Furthermore, erosion at the higher elevations of the Table Cliffs Plateau would be more rapid, since higher elevations receive more precipitation. Figure 21.9 shows the huge contrast in erosion as seen by Crickmay. The only way the top of the Claron Formation can remain uneroded after the volcanic rock is eroded is if the erosion of the lava happened *rapidly* and not over many tens of millions of years, as envisioned by uniformitarian geologists, but recently. This implies that the entire Grand Staircase was eroded rapidly, consistent with the Retreating Stage of the Flood.

The Grand Canyon area shows another example of rapid erosion. Navajo Mountain near the Utah/Arizona border is about 80 miles (130 km) northeast of Grand Canyon. It is 10,416 feet (3,166 m) above sea level. It is a volcanic mass that was piped into sedimentary rocks. Presently

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[39] Robinson, C.S. and R.E. Davis, 1995. *Geology of Devils Tower, Wyoming*. Devils Tower Natural History Association, p. 36.

[40] Crickmay, C.H., 1974. *The Work of the River: A Critical Study of the Central Aspects of Geomorphology*. American Elsevier Publishing Co., New York, NY, p. 238.

Navajo Mountain stands about 6,000 feet (1,830 m) above the surrounding sedimentary rocks. This amount of the surrounding sedimentary rock must have been quickly eroded from the entire region. It is important to note “quickly” since over time the mountains would have eroded because mountains erode much faster than a generally horizontal surface. Navajo Mountain is similar to Devils Tower but a larger mass and more rounded.

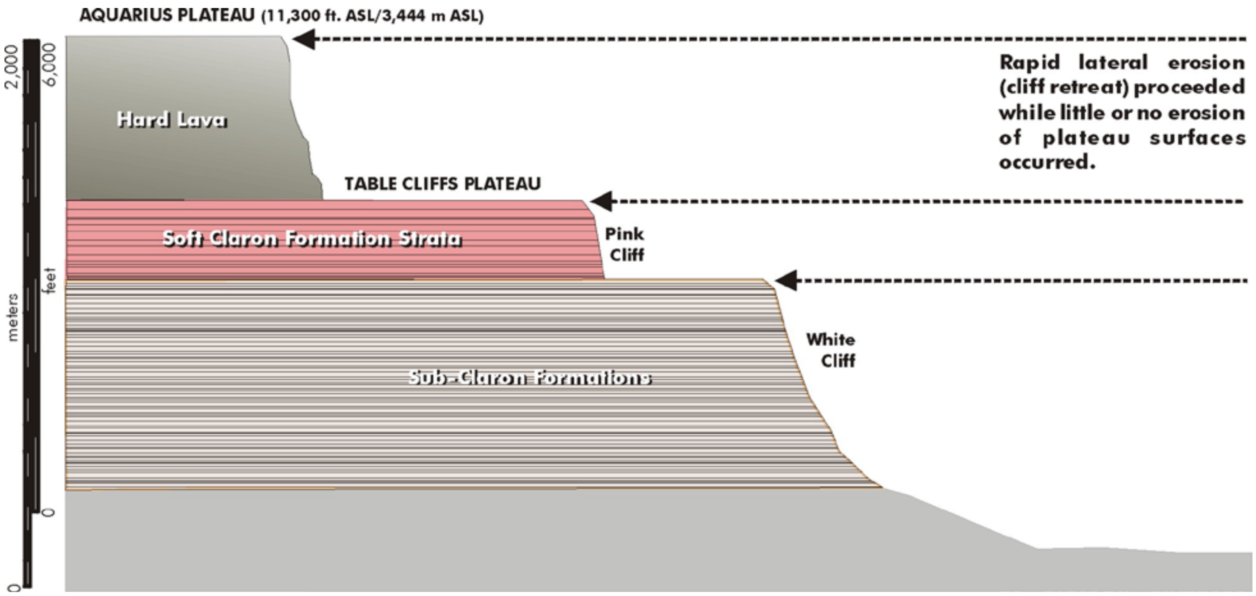

Figure 21.9. Diagram showing the erosion of the Grand Staircase, south-central Utah. The 2,000 feet (600 m) of volcanic rock on top of the Table Cliffs Plateau eroded northward, while the soft Claron Formation underneath hardly eroded downward. The only way this can happen is if the erosion of the volcanic rocks was rapid, implying that the Grand Staircase was eroded rapidly (drawn by Peter Klevberg).

Massive Erosion Indicates the Flood/Post-Flood Boundary Is in the Late Cenozoic

The magnitude of the erosion as summarized above is tremendous. The magnitude and the mechanism of erosion is far greater than that imagined by advocates of post-Flood catastrophism.[41] The implications are evident. I conclude the erosion occurred rapidly in the Cenozoic. The missing sediment is not found downslope on the continents as expected from the uniformitarian and post-Flood catastrophic model. It was swept off the continents and formed the continental margin (see Chapter 11). Continental erosion provides very strong evidence that the Flood/post-Flood boundary is in the late Cenozoic.

[41] Whitmore, J., 2013. The potential for and implications of widespread post-Flood erosion and mass wasting processes; in: Horstemeyer, M. (editor), *Proceedings of the Seventh International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA.