PART VII

The Puzzle of Planation Surfaces

During the Retreating Stage of the Flood, the mountains rose and the valleys (basins) sank (Psalm 104:8) and the Floodwater receded off the continents. This great tectonic movement caused the Floodwater that entirely covered the Earth at Day 150 to retreat off the soon-to-be exposed land. Great sheet erosion of the rising continent ensued during the Sheet Flow Phase of the Flood, leaving behind escarpments, tall erosional remnants, arches, large natural bridges, long-transported gravel, and other features. At the same time, this great erosion scoured the land and formed *erosion and planation surface*. Planation surfaces are common, yet a major mystery of uniformitarian geomorphology. This and subsequent parts will explore the subject of the ubiquitous planation surfaces on all the continents and what they means.

Chapter 32

What Is a Planation Surface?

According to the *Glossary of Geology*, an erosion surface is: "A land surface shaped and subdued by the action of erosion, esp. by running water. The term is generally applied to a level or nearly level surface"[1] An erosion surface is generally synonymous with a planation surface, except that an erosion surface is generally regarded as a rolling surface of low relief. A planation surface is nearly flat. Planation and erosion surfaces can be seen in many areas of the world.[2] Today, comparatively small planation surfaces (strath terraces) are formed when a river floods, overflows its banks, and planes bedrock to a horizontal or near horizontal surface.[3] But, present processes do not form planation surfaces of any *significant size.* The large surfaces that frequent the Earth's surface are contrary to the principle of uniformitarianism.

Figure 32.1. A planation surface on top of a small plateau in the Bighorn Basin, just west of Greybull, Wyoming. Note that the strata dip to the west at about 30° (view south).

[1] Neuendorf, K.K.E., J.P. Mehl, Jr., and J.A. Jackson, 2005. *Glossary of Geology*, Fifth Edition. American Geological Institute, Alexandria, VA, p. 217.
[2] Oard, M.J., 2006. It's plain to see: flat land surfaces are strong evidence for the Genesis Flood. *Creation Ex Nihilo* 28(2):34–37.
[3] 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, pp. 205, 214.

The Difference Between an Erosion and Planation Surface

The threshold between an erosion and planation surface is rather arbitrary. Geomorphologist R.J. Small recommends the term "erosion surface" be abandoned and substituted with "planation surface".[4] I agree with Small and will mostly use the term *planation surface*, since it is more descriptive. Figure 32.1 shows a planation surface on top of a small plateau in the northeast Bighorn Basin, just west of Greybull, Wyoming. A plateau is a relatively elevated area of comparatively flat land that is commonly limited on at least one side by a cliff or an abrupt descent to lower ground. It is higher than a plain and more extensive than a mesa, which can generally be considered a small plateau. A butte is a plateau that is even smaller than a mesa. Figure 32.2 shows the difference between a plateau, mesa, and a butte. A spire is like a butte but not flat on the top.

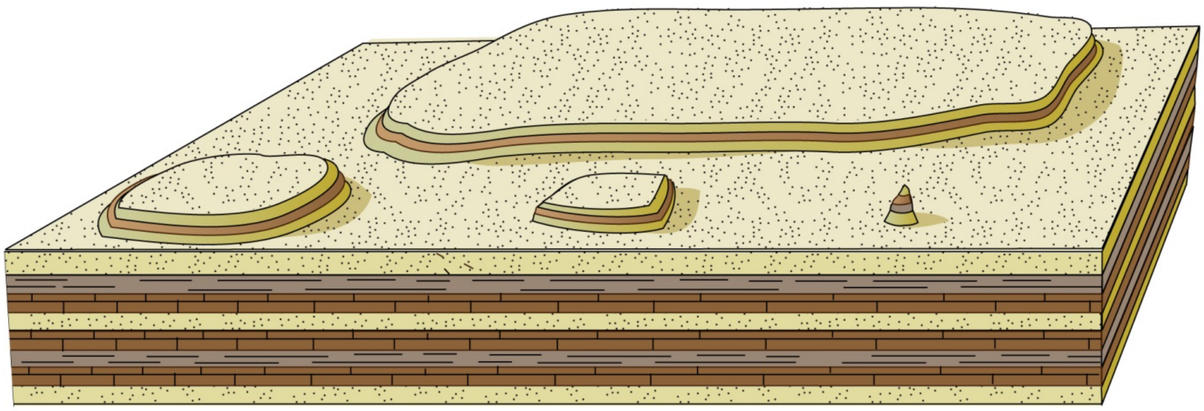

Figure 32.2. The difference between a plateau, mesa, butte, and spire with decreasing area of the top going from plateau to spire (from Oard, 2008, Figure 5.15, Flood by Design: Retreating Water Shapes the Earth's Surface).

Notice that the definition of an erosion surface includes the mechanism of erosion, *running water*. The reason for assuming water created the planation surface is because rounded rocks are common on planation or erosion surfaces (Figure 32.3). Rocks are almost always rounded by water action. (Weathering can occasionally produce rounded rocks generally in place, but this happens mainly in granitic or basaltic type rocks (Figure 32.4). It is also possible for watery mass flows to round basal rocks. These are rare exceptions rather than the rule and there is no ambiguity.)

Planation Surfaces Eroded by Water

It is important to note a planation surface is *eroded into hard rock* or sometimes into unconsolidated sediment by some *erosive watery mechanism*. It is not a surface of deposition, as are river terraces, river bars, flood plains, or alluvial fans (see Appendix 15). Some of the large gravel bars from the Lake Missoula flood, as the one along the Snake River Valley in Figure 32.5, have a gently sloping nearly flat surface. From a distance, the bar in Figure 32.5 appears to be a planation surface, but the bar was formed by the *deposition* of basaltic cobbles and boulders from running water. It is not a planation surface but instead a deposit of gravel.

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[4] Small, R.J., 1978. *The Study of Landforms: A Textbook of Geomorphology*, second edition, Cambridge University Press, London, U.K., p. 249.

Figure 32.3. Rounded quartzite rocks on a dissected planation surface in the southwest Gallatin Valley, Montana (Doug Braaksma provides the scale).

Planation Surface Complications

In this and subsequent chapters, I will discuss planation surfaces, not *exhumed* planation surfaces (see Appendix 15). Exhumed surfaces originally were eroded to a flat surface and subsequently covered by sedimentary rocks, which were later eroded down to the original planation surface. Most of the time, it is easy to distinguish an exhumed planation. Exhumed planation surfaces are real planation surfaces. Sometime, they are angular unconformities in which the sedimentary beds above a buried planation surface are at a different angle from the beds below.

Planation surfaces have been given various other names, based on various formation hypotheses, such as a peneplane in William Morris Davis's "cycle of erosion" (see Chapter 50). In this book, I will stick just with the descriptive term, planation surface (see Appendix 15).

Planation Surfaces Easy to Recognize

According to Melhorn and Edgar, planation surfaces are generally recognized by three criteria: 1) paleosols or weathered surfaces; 2) accordancy or similar height of the summits of plateaus, ridges, hills, or mountains; and 3) beveled or sheared surfaces of tilted strata.[5] A paleosol is thought to be a buried soil.

Figure 32.4. Spherical weathering of granite (lens cap on edge), Cowles Mountain between Santee and San Diego, California.

Paleosols and Weathered Surfaces Inadequate

The first criterion is questionable. There are problems with identifying a true buried soil from an altered layer that is not a soil.[6,7,8,9,10,11,12] Surficial paleosols or weathered surfaces are not as distinctive as planation surfaces. I will not discuss them, except in regard to whether the weathering processes actually created the erosion or planation surface in Chapter 51.

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[5] Melhorn, W.N, and D.E. Edgar, 1975. The case for episodic continental-scale erosion surfaces: a tentative geodynamic model. In, Melhorn, W.N. and R.C. Flemal (editors), *Theories of Landform Development,* George Allen and Unwin, London, U.K., pp. 247–248.

[6] Ruellan, A. 1971. The history of soils: some problems of definition and interpretation. In, Yaalon, D.H. (editor), *Paleopedology: Origin, Nature and Dating of Paleosols,* Israel University Press, Jerusalem, Israel, pp. 1–14.

[7] Valentine, K.W.G. and J.B. Dalrymple, 1976. Quaternary buried paleosols: a critical review. *Quaternary Research* 6:209–222.

[8] Birkeland, P. W. 1984. *Soils and geomorphology*, Oxford University Press, New York, NY, pp. 30–33.

[9] Klevberg, P. and R. Bandy, 2003. Postdiluvial soil formation and the question of time Part I—pedogenesis. *Creation Research Society Quarterly* 39(4):252–268

[10] Klevberg, P. and R. Bandy, 2003. Postdiluvial soil formation and the question of time Part II—time. *Creation Research Society Quarterly* 40(2):99–116.

[11] Klevberg, P., M.J. Oard, and R. Bandy, 2003. Are paleosols really ancient soils? *Creation Research Society Quarterly* 40(3):134–149.

[12] Klevberg, P. and M.J. Oard, 2005. Drifting interpretations of the Kennedy gravel. *Creation Research Society Quarterly* 41(4):289–315.

Figure 32.5. Lake Missoula flood bar along the Snake River, Washington.

Accordant Summits Uncertain

The second criterion infers a flat or gently-sloping planation surface has been dissected to such an extent that only accordant ridges or mountain tops remain (see Figure 23.2) In this definition, the accordant ridges or mountain peaks define the level of a much dissected planation surface. This is propagated by evolutionary geomorphologists, Cliff Ollier and Colin Pain, who emphasize that continental sedimentary rocks were folded and faulted, planed, uplifted, and eroded in late Cenozoic (see Figure A1.1).[13] The Cenozoic is the last era in their geological time scale (see figure 5.3); it is recent from their point of view.

However, mere accordance of summits is equivocal, since accordant summits may be caused by other processes than the near destruction of a planation surface. These could include the regularity of folding with the resistant rocks forming the fold limbs of the accordant ridges.[14,15] Sometimes geologists have assumed that accordant mountain peaks within a mountain range or within several nearby ranges represent vestiges of a planation surface. This may be true, but it is still uncertain without some obvious remnant of the originally *flat* surface. Where the evidence is more abundant (e.g. flat-topped mountains), accordancy of summits is usually a valid criterion for the recognition of a mostly dissected planation surface.[16]

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[13] Ollier C. and C. Pain, 2000. *The Origin of Mountains*, Routledge, London, U.K.
[14] Hack, J.T., 1975. Dynamic equilibrium and landscape evolution. In, Melhorn, W.N. and R.C. Flemal (editors), *Theories of Landform Development*, George Allen and Unwin. London, U.K., p. 94.
[15] Selby, M.J., 1985. *Earth's Changing Surface: An Introduction to Geomorphology*, Clarendon Press, Oxford, U.K., pp. 521–523.
[16] King, L.C., 1983. *Wandering Continents and Spreading Sea Floors on an Expanding Earth*, John Wiley and Sons, New York, NY, pp. 177–196.

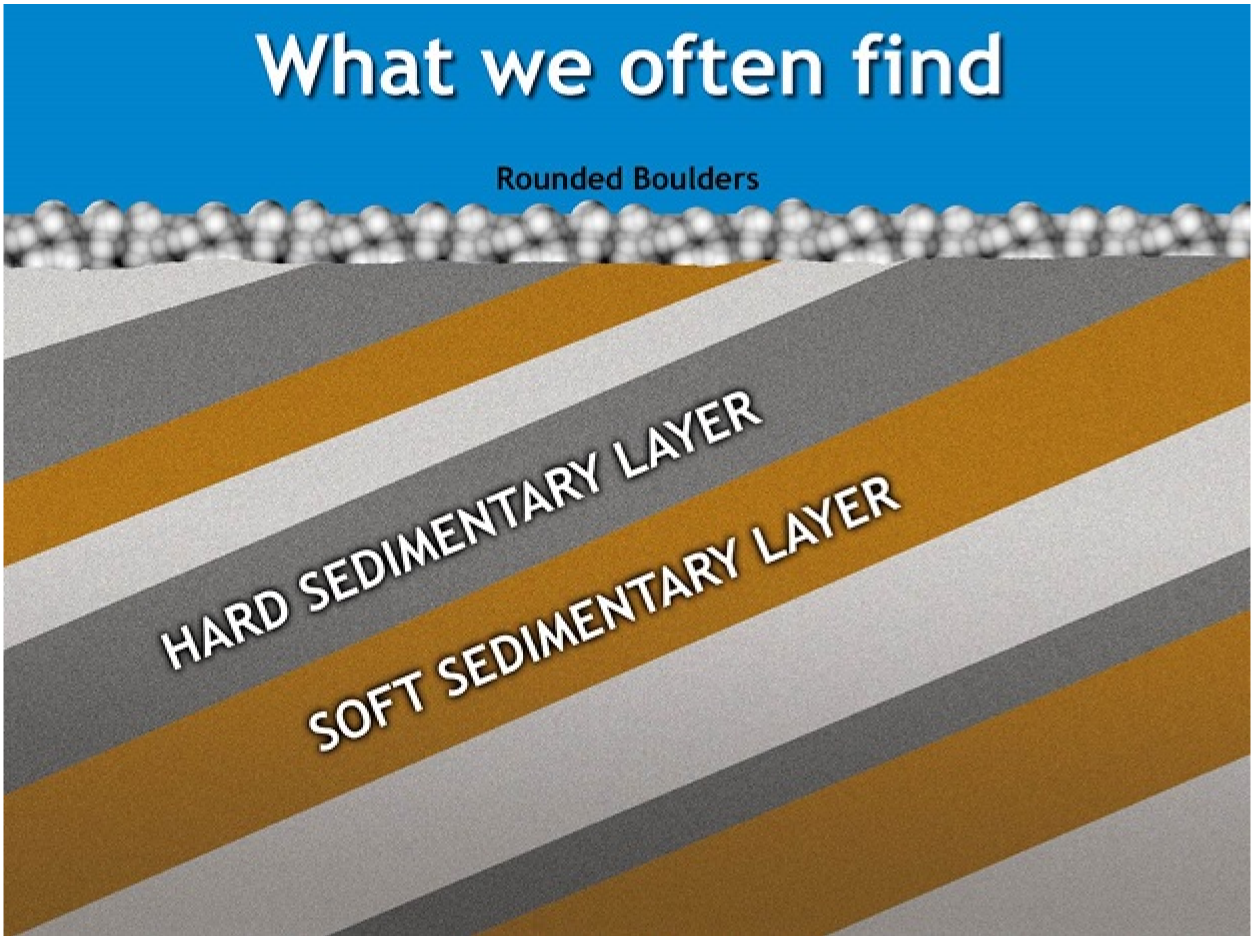

Figure 32.6. Schematic of a planation surface that shears hard and soft rocks the same (drawn by Peter Klevberg).

Beveled Surfaces Are Planation Surfaces

The third criterion—a beveled surface cut on tilted strata—is almost universally attributed to scour or erosion, usually by running water, forming a planation surface.[17,18,19] Figure 32.1 is an example of a planation surface cut on tilted sedimentary rocks. They shear tilted sedimentary strata of *both hard and soft rocks across a plane* (Figure 32.6). Amazingly, planation surfaces are eroded *independent* of rock hardness on the regional scale.[16] Wallace Hansen commented on the Gilbert Peak erosion surface on the north slopes of the Uinta Mountains in Wyoming, that it "...truncates rocks of all ages indiscriminately, from Bridger [Eocene] to Precambrian."[20] Appendix 17 will describe the Gilbert Peak erosion surface in more detail. The rocks below most planation surface vary significantly in hardness. Normal erosional processes erode the soft rocks more than the hard rocks, and given millions of years of time, the terrain would look like the surface shown in Figure 32.7.

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[17] Crickmay, Ref. 3, pp. 1–271.
[18] Small, Ref. 4, p. 77.
[19] Ollier, C. 1981. *Tectonics and Landforms*, Longman, New York, NY, p. 153.
[20] Hansen, W.R. 1965. Geology of the Flaming Gorge area Utah-Colorado-Wyoming. *U. S. Geological Survey Professional Paper 490*, Washington, D.C., p. 115.

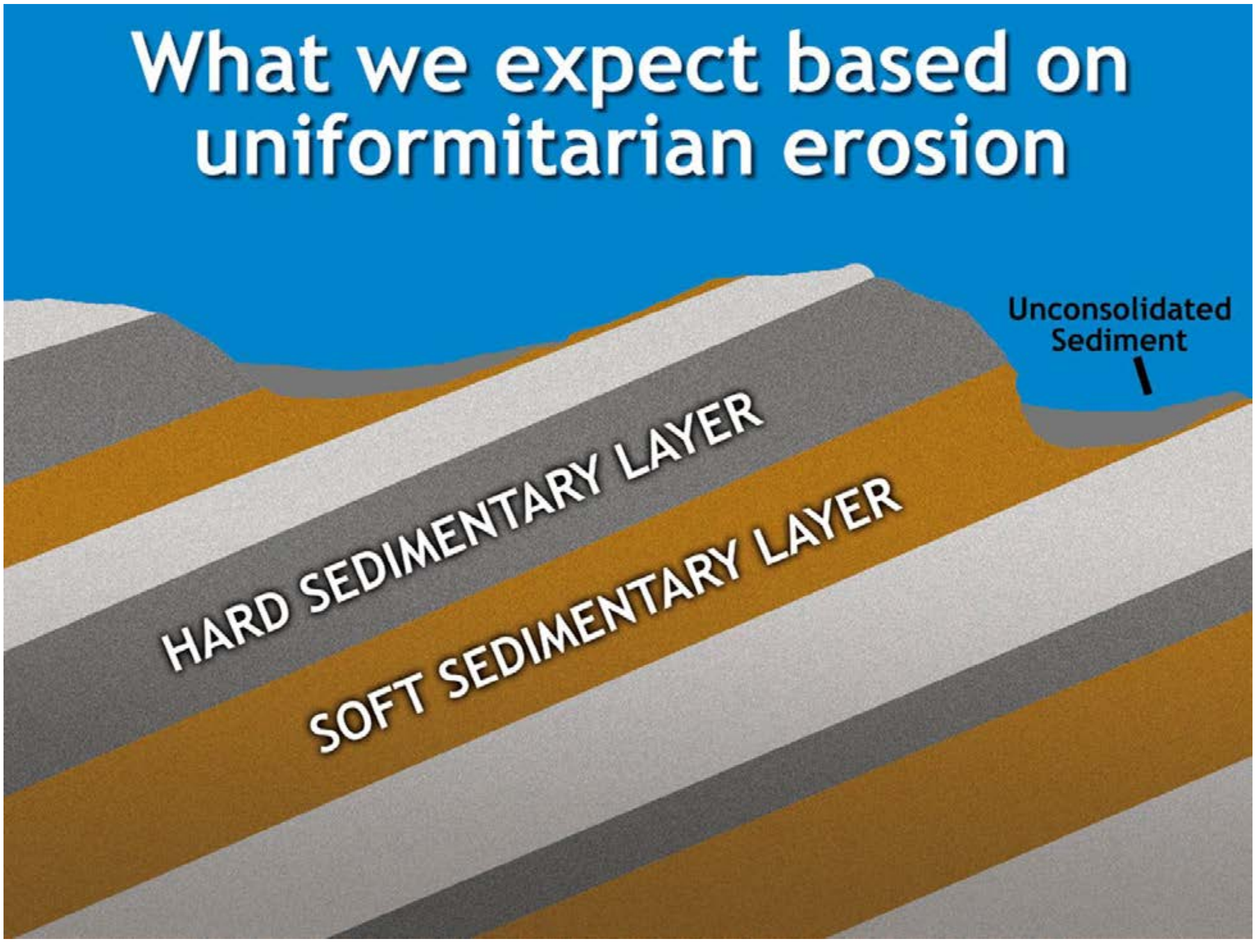

Figure 32.7. Schematic showing what would be expected of erosion over millions of years. The harder rocks would end up as ridges and the softer rocks would become valleys with unconsolidated debris at the bottom (drawn by Peter Klevberg).

It is true, small-scale, beveled planation surfaces are sometimes found beside some rivers, where it is assumed that the lateral meandering of the river, especially during flooding, planed the top of the strata.[3] These small, strata-truncating planar surfaces are universally accepted as erosion or planation surfaces.[21] If we use the analogy of a small-scale beveled planation surface that formed during a flood we can infer large planation surfaces covering hundreds to thousands to over tens of thousands of square miles were formed by a monstrous flood. Extrapolating from small-scale planation surfaces carved rapidly by water to large-scale planation surfaces that must have also been carved quickly by water is usually too much for uniformitarian geomorphologists to deal with. The origin of large-scale planation surface is an interesting question that will be discussed in Chapter 57. As a result, some geomorphologists have questioned whether such large-scale, nearly flat surfaces are really erosional, nonetheless, those who have worked with such surfaces in the field have readily accepted their erosional nature; they are true planation surfaces. Melhorn and Edgar write:

> The precise mode of formation of erosion surfaces is difficult to conceptualize, and thus is difficult to interpret in terms of landscape evolution. Some writers doubt that

[21] Melhorn and Edgar, Ref. 5, p. 245.

> widespread surfaces exist, though acknowledging that such surfaces of limited extent develop under local controls of climate, base level, etc. Terminological ambiguity adds to the confusion.[22]

Thus, the criterion of a beveled, generally planar surface is the *best* definition for the recognition of a planation surface, no matter whether the surface is small or large. Accordancy of summits could be eroded planation surfaces, but it is not foolproof.

Figure 32.8. The planation surface at top of the Grand Canyon area.

Planation Surfaces on Horizontal Strata

If the sedimentary rocks below the surface are not tilted, the interpretation is more complicated. There are many less-distinctive planation surfaces that are parallel with the underlying strata,[23] as in the planation surface that forms the top of Grand Canyon (Figure 32.8).[24] Because of erosional remnants like Red Butte, we know about 6,000 to 10,000 feet (1,830 to 3,050 m) of sedimentary rock has been eroded from the top of the Grand Canyon area.

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[22] Melhorn and Edgar, Ref. 5, p. 243.
[23] Crickmay, Ref. 3, p. 207.
[24] Austin, S.A., 1994. A creationist view of Grand Canyon strata. In, Austin, S.A. (editor), *Grand Canyon: Monument to Catastrophe*, Institute for Creation Research, Dallas, CA, pp. 77–79.

The erosion left a mostly bedding-parallel planation surface.[25] Red Butte is about 1,000 feet (300 m) above the planation surface of the Coconino Plateau and consists of sedimentary rocks capped by basalt (Figure 32.9). It is not a stretch to see these flat-lying strata with their basalt cap were at one time continuous over much of the area.

Figure 32.9. Red Butte, a 1,000 feet (300 m) erosional remnant on the south rim near Grand Canyon Village.

Planation Surfaces on Soft Rocks Very Young

Planation surfaces are not always eroded on hard rock. Especially mysterious are planation surfaces that were cut on *soft* rocks (Figure 32.10). The eroding mechanism beveled the surface of these soft rocks the same as if they were hard rock, but did not leave a gravel cap. Normal erosion of the soft rocks over thousands to tens of thousands of years would immediately cause rills, valleys, and canyons. The surface would not remain flat for long, especially not over millions of years! Crickmay is amazed by this finding:

> It may, therefore, astonish some persons to note that certain of the stripped plains are made in part on very unresistant formations, such as the Mancos shale. Evidently, the process of making the flat land is not in the least influenced by local unresistance.[23]

These planation surfaces are strong evidence that they are recent and were formed by processes

[25] Oard, M.J., T. Vail, D, Bokovoy, and J. Hergenrather, 2010. *Your guide to Zion and Bryce Canyon National Parks: A Different Perspective,* Master Books, Green Forest, AR.

that are not in operation today.

Despite all the modifying processes and the sometimes questionable nature of some planation surfaces, planation surfaces *commonly* grace the landscape and are readily recognized. In only a few cases are their doubts. Lester King states:

> The recognition of erosion surfaces is not difficult. The field worker in a suitable area can be introduced to the several planations as a palaeontologist learns to recognize fossils or a petrologist rocks—visually; and in a few days can continue to map the planational units with confidence…[26]

Figure 32.10. A planation surface (actually a pediment) on soft rock (arrows) at the Painted Hills, John Day Fossil Beds National Monument, north-central Oregon.

[26] King, Ref. 16, p. 179.