

# The remarkable African Planation Surface

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Geomorphology, within the uniformitarian paradigm, has great difficulty explaining the origin of landforms. One of these landforms, most of which were once much larger, is the planation surface. Planation surfaces are common and worldwide. They are not forming today but are being destroyed. Africa is covered with the most planation surfaces of any continent, but the number and age of the planation surfaces has always been controversial. A new synthesis of African planation surfaces concludes that there is one large, warped planation surface on Africa, called the African Surface. Most of the African Surface is capped by a chemical precipitate called a duricrust, the origin of which is a puzzle. Planation and erosion surfaces could readily have formed as the floodwater retreated off the continents during uplift.

Geologists once thought that by throwing out the Genesis Flood in Earth history they could easily explain the features of the earth's surface. William Morris Davis, the most renowned geomorphologist in the early and mid-twentieth century, stated:

“The emancipation of geology from the doctrine of catastrophism was a necessary step before progress could be made towards an understanding of the lands.”<sup>1</sup>

As a result of this shift in worldview in the late nineteenth century, he went on to predict that the understanding of geomorphological features was just around the corner:

“It cannot be doubted, in view of what has already been learned to-day [sic], that an essentially explanatory treatment must in the next century [twentieth century] be generally adopted in all branches of geographical study.”<sup>2</sup>

However, such a prediction has proven false, and uniformitarian<sup>3</sup> scientists are no closer to finding solutions for the many geomorphological puzzles on the earth's surface than they were over a century ago. In fact, they are not optimistic at all and have essentially abandoned most efforts to explain the origin of landforms. Could it be that the main problem is that they adopted the wrong worldview?

## What is geomorphology?

Geomorphology is a subfield of geology which is defined as:

“The science that treats the general configuration of the Earth's surface; specif. the study of the classification, description, nature, origin, processes, and development of present landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features.”<sup>4</sup>

A landform is

“Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape, and produced by natural causes; it includes major forms such as plain, plateau, and mountain, and

minor forms such as hill, valley, slope, esker, and dune.”<sup>5</sup>

Other names for geomorphology are ‘physiography’ and ‘physical geography’. Various regions of the earth have been subdivided according to similar geomorphology and are called ‘provinces’.

The definition of ‘landform’ from the fifth edition of the *Glossary of Geology* is the same as the one from the older *Dictionary of Geological Terms*,<sup>6</sup> except for the addition of the phrase “by natural processes”. Such an addition is unwarranted in a definition that should be purely descriptive. It is similar to the definition of science that deals with past events but excludes an Intelligent Designer. If the naturalistic addition is to be always applied to the past, then how can archaeology be called a science, unless it explains all the objects and marking that they find as a result of natural processes? When dealing with features formed in the past, we should always be open to the possibility of Intelligent Design.

## Geomorphology has failed to explain landforms

The science of geomorphology provides a description of a plateau, giving its height, width, slope, etc. and classifies it in relation to other plateaus. This is the science in the analysis of landforms. But geomorphologists have also attempted to explain the *origin* of the plateau, as well as other landforms. Such an endeavor will depend upon one's assumptions of the past or one's worldview, which for mainstream geomorphologists has been naturalistic. There is a huge amount of literature on this subject, but these explanations have commonly been failures. Therefore, geomorphologists have mostly given up attempting to explain the origin of landforms since the 1960s and 1970s.<sup>7,8</sup> The origin of landforms in geomorphology is in such disarray that after 200 years, scientists cannot even provide a credible hypothesis for the geomorphology of southeastern England—an area where the science of geomorphology first developed.<sup>9</sup> They have retreated to studying *small* processes observed today, such as river erosion, weathering, landslides, etc. This modern emphasis is called *process geomorphology*, and focuses on small timeframes and areas, while ignoring the origin of landforms altogether.<sup>10</sup> Geomorphologists still

hope that someday they will be able to understand the origin of landforms by studying all these observable processes, of course thinking in strict uniformitarian terms. They are confident that a study of tectonics, horizontal or vertical earth movements, will eventually enliven “long-standing problems of landscape evolution and rates of landscape change that had been largely ignored in the preceding decades.”<sup>11</sup>

### Surficial erosion and planation surfaces

One of those mysterious geomorphological features unexplained is a surficial erosion or planation surface. An erosion surface is defined as: “A land surface shaped and subdued by the action of erosion, esp. by running water. The term is applied to a level or nearly level surface.”<sup>12</sup> An erosion surface is a rolling surface with slight relief. A planation surface is generally considered a flat to nearly flat erosion



**Figure 1.** Top of the planation surface in the western Cypress Hills. This surface is capped with an average of about 23 m of well-rounded quartzite gravel and boulders from across the continental divide, over 400 km away.



**Figure 2.** Lake Missoula flood bar along the Snake River, Washington, west of Little Goose Dam. The bar is about 60 m thick and made up of practically all basalt gravel eroded from the Columbia River Basalt substrate.

surface.<sup>13</sup> Some planation surfaces are extraordinarily flat (figure 1). The definition includes erosion by water because many surficial erosion and planation surfaces are capped by a veneer of generally rounded rocks—rounded by the action of water.

There seems to be some confusion associated with planation surfaces. A planation surface is *eroded into hard rock* or sometimes into unconsolidated sediment by some *watery erosive mechanism*, usually leaving behind a veneer of rounded rocks on top. The rounded rocks show that water formed the planation surface. Planation surfaces are not to be confused with other flat surfaces of different origin. They are not planar surfaces of deposition, in which sediments are deposited, such as in river terraces, river bars, flood plains, or alluvial fans. Some of the great gravel bars from the Lake Missoula flood, for instance, along the Snake River Valley (figure 2), have a gently-sloping, nearly-flat surface. From a distance, the bar in figure 2 appears to be a planation surface, but the bar was formed by the *deposition* of about 70 m of basaltic coarse gravel from running water during the Lake Missoula flood.<sup>14</sup>

Furthermore, planation surfaces have been called by many names over the years. (I will not deal with *exhumed* planation surfaces, those surfaces planed and then covered by sedimentary rocks and then re-eroded. *Exhumed* planation surfaces (also called angular unconformities) are real planation surfaces formed earlier than surficial planation surfaces.) In William Morris Davis’s ‘cycle of erosion’, the final stage is called a ‘peneplain’. A peneplain is: “A term introduced by Davis (1889a, p. 430) for a low, nearly featureless, gently undulating land surface of considerable area.”<sup>15</sup> References to peneplains were common in the literature of the early and mid-twentieth century—so much so that a backlash occurred to the point that a few geomorphologists did not even believe planation surfaces existed.

Regardless of Davis’s hypothesis, a peneplain is really an erosion surface, *not* a planation surface; peneplain means ‘nearly a plain’. The formation of a flat planation surface supposedly would take much more time to form, possibly ten times as long, than a rolling erosion surface from a mountain range in the uniformitarian paradigm. Of course, this assumes that natural processes acting over long periods of time are even able to form a planation surface, which is contrary to observations today (see below). Other terms for large-scale erosion surfaces are ‘pediplain’, ‘panplain’, and ‘etchplain’. All these terms are specific to certain hypotheses for the origin of erosion or planation surfaces. So, I will not use terms with the baggage of hypothetical mechanisms, but will use the purely descriptive term ‘planation surface’ and sometimes ‘erosion surface’.

Once a planation surface formed, it was subjected to many processes that would have either destroyed or reduced its size: erosion, dissection,

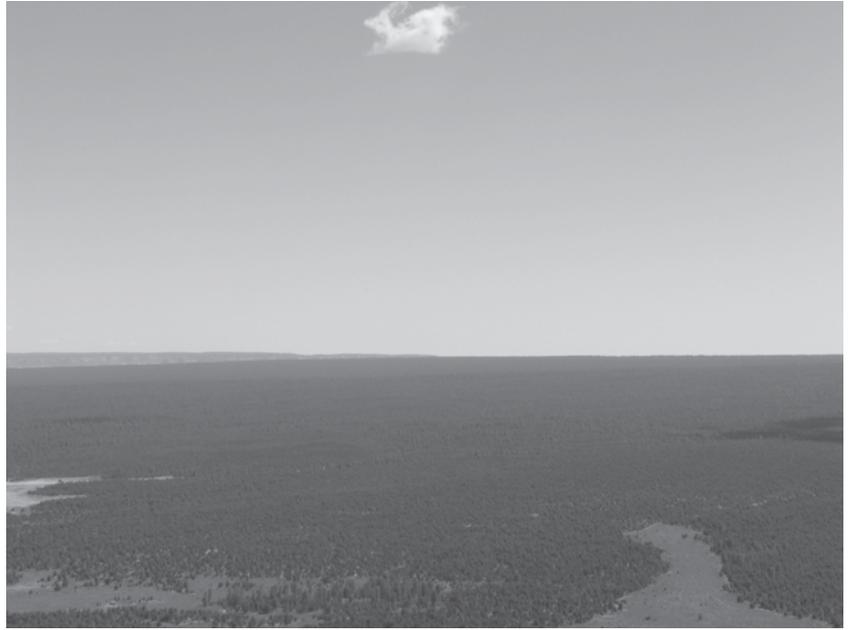
tectonic breaking up, and tilting. I.e. what is left is considered an erosional remnant of a planation surface that was once much larger.

Planation surface remnants can be observed on mountaintops, at the edges of mountains (these are called pediments), plateaus, plains and flat valley bottoms. In areas with sedimentary rocks at the surface, a planation surface can occur on horizontal layers, such as in the Grand Canyon area (figure 3), where 1,800 to 3,000 m of sedimentary rocks have been eroded to form this planation surface during what is called by uniformitarian geologists the Great Denudation.<sup>16</sup> After the erosion, a nearly flat planation surface was left behind. But the most distinctive planation surfaces are flat surfaces cut on tilted sedimentary rocks (figure 4). These strata-truncating planar surfaces are universally accepted as planation surfaces.<sup>17</sup> Sedimentary rocks are commonly made up of alternating soft and hard rocks. Slow erosion over millions of years would have resulted in the harder rocks left as ridges and the softer rocks eroded to valleys. But during the formation of the planation surface, the shearing mechanism beveled both hard and soft tilted sedimentary rocks at the same angle. Such a feature requires a strong current of water. So, planation surfaces are observed to be *independent* of rock hardness on the regional scale.<sup>18</sup> For instance, Wallace Hansen notes that the Gilbert Peak planation surface on the north slopes of the Uinta Mountains in Wyoming “truncates rocks of all ages indiscriminately, from Bridger to Precambrian.”<sup>19</sup> The Eocene Bridger Formation is relatively soft, while the Precambrian rocks are hard.

### Planation surfaces common and worldwide

Planation surfaces of many sizes, usually carpeted by cobbles and boulders, are common on *all* the continents.<sup>20</sup> They sometimes occur at different levels in a region. Though there is still controversy over the exact number of levels and the age of planation, there is no doubt that the planation surfaces exist. Some surfaces are dated at over 100 Ma old, despite the fact that current erosion rates should have destroyed the surface within a few million years. Such old planation surfaces indicate that those many millions of years are non-existent.

Lester King is the premier geomorphologist to study and describe planation and erosion surfaces from all over the world.<sup>21</sup> Despite the questions on the number and age



**Figure 3.** Planation surface in the Grand Canyon area after about 1.5 to 3 km of sedimentary rock was eroded.



**Figure 4.** A planation surface on top of a small plateau in the northeast Bighorn Basin, just west of Greybull, Wyoming. Note that the strata dip to the west (i.e. to the right) at about 30° (view south).

of planation surfaces, Twidale accepted the general scheme of geomorphologist Lester King: that remnants of planation surfaces grace the scenery of all the continents at generally three levels,<sup>22-24</sup> although King himself vacillated on the number of levels. These planation surfaces are often found high in the terrain,<sup>25</sup> and can be amazingly flat. In referring to one of his three levels, King exclaimed: “A planation of extraordinary smoothness developed over enormous areas in *all* the continents [emphasis original].”<sup>26</sup>

Planation surfaces are more common and much easier to recognize in Africa (see below) and Australia than on other continents.<sup>27</sup> Figure 5 shows an erosion surface that beveled



**Figure 5.** Erosion surface on near-vertical meta-sedimentary rocks beveled on the New England Tableland, eastern Australia. Later more channelized erosion carved the gorge, now home to the Wollomombi Falls.



**Figure 6.** Lake on the Piedmont, east of the Blue Ridge Mountains, near Parkersville showing general flatness of the terrain.



**Figure 7.** Walden Ridge, southeast Cumberland Plateau (view west from east of Chattanooga, Tennessee).

vertical strata west of the Great Escarpment in east central Australia. This erosion surface covers much of the high terrain of eastern Australia and is locally referred to as the Tableland.

One of the most perplexing planation surfaces in Australia is the Nullarbor Plain in south-central Australia that covers 200,000 km<sup>2</sup>. This limestone plain is so flat that the Transcontinental Railway stretches almost 500 km *without deviation*.<sup>28</sup> The origin of the Nullarbor Plain is a great mystery:

“The flatness of the Nullarbor Plain ... has long puzzled investigators ... It is not a structural feature, ‘a single exposed bedding plane’, but what degradational process could produce such a feature? The surface, some 200,000 km<sup>2</sup> in extent, is eroded in flat-lying Miocene limestone, but at least 60 m of section have been removed near the southern or coastal margin of the plain.”<sup>29</sup>

Earlier workers considered the Nullarbor Plain an emergent seafloor since the limestone is of marine origin, but the plain is now considered a terrestrial planation surface caused by erosion.<sup>30</sup> Despite being around 10 Ma old within the uniformitarian timescale, it is remarkably flat!

Asia is also marked by abundant erosion and planation surfaces, such as the Tibetan Plateau, which has been heavily dissected by later erosion.<sup>31</sup> A Chinese scientist described it as “a vast planation surface”.<sup>32</sup>

Planation surfaces show up on the continent of Antarctica. They are seen on the tops of many of the mountains that stick up above the Antarctica Ice Sheet, for instance in the Transantarctic Mountains<sup>33</sup> and in some of the West Antarctic Mountains.<sup>34</sup>

Planation surfaces are widespread in the Andes Mountains and the eastern Andean foothills of South America.<sup>35–38</sup> These surfaces range up to 2,000 km<sup>2</sup> in extent and truncate folded sedimentary rock as ‘young’ as Cenozoic in Bolivia. The eroded material has been largely removed from the area, and gravel caps some of the surfaces. The surface has been deeply dissected since planation.

Numerous planation surfaces exist in Europe.<sup>39</sup> Those in southern England and Wales in the west to the Weald in the east have been studied for many years.<sup>9,40,41</sup> The planation surfaces in Wales are very clear.<sup>42</sup> Tilted chalk ridges in southeast England are beveled flat.<sup>43</sup> The planation surfaces extend westward into Ireland and are poorly understood.<sup>44</sup>

Classic erosion surfaces are widespread in the Appalachians of the eastern United States,<sup>45</sup> mainly on the Piedmont (figure 6) and

Appalachian Plateaus Provinces (figure 7) on either side of the Appalachian Mountains (the Blue Ridge and Valley and Ridge Provinces). The erosion surface equally planed deformed rocks of variable resistance.<sup>46</sup> During widespread planing, the Appalachians were uplifted and eroded.<sup>47</sup>

Many planation surfaces are observed in the Rocky Mountains and High Plains of the United States. Mountaintop planation surfaces exist on the Uinta Mountains, Colorado Front Range, Sierra Nevada Mountains, Wind River Mountains, Absaroka Mountains, Beartooth Mountains, and some mountain crests in Alaska.<sup>48–50</sup> An impressive planation surface in the western United States is the Sherman Surface, which truncates Precambrian granitic rocks just east of Laramie, Wyoming.<sup>51</sup> The surface slopes east and forms the top of Pliocene sediments of the Great Plains in southeast Wyoming and western Nebraska. The surface is also called The ‘Gangplank’ because it is so remarkably smooth, with few residual remnants and little dissection (figures 8 and 9). The surface is dated as ‘late Cenozoic’, late in the uniformitarian geological timescale.

### Reanalysis of King’s African Erosion Surface

Well-known geomorphologist Lester King analyzed erosion and planation surfaces all over the world.<sup>21</sup> He published his results in several books and many journal articles. Since King was from the University of Natal in southeast Africa, he focuses especially on the remarkable planation surfaces in Africa. He recognized that about 60% of the ground surface of Africa consisted of planation surfaces, which are at different altitudes. In fact, Africa is covered by erosion and planation surfaces over more than any other continent. One planation surface stretches 5,000 km east-west and 500 km north-south just south of the Sahara Desert.<sup>52</sup> Partridge called this surface the “African Surface”—a continent-wide erosion surface!<sup>53</sup> Many have seen pictures of numerous animals walking freely over the Serengeti Plain of East Africa (figure 10). How many have noticed how flat the terrain is? Although the rocks beneath the Serengeti are deformed igneous and metamorphic rocks at about 1.5 km ASL (above sea level) in Tanzania, the rocks have been beveled off to a fairly flat erosion surface.

During his career, King had different ideas on the number and age of erosion and planation surfaces.<sup>54</sup> Many other geologists during and after his time also varied significantly on these details.



**Figure 8.** Sherman erosion surface with monadnocks in distance (view southwest from near milepost 346, Interstate 80).



**Figure 9.** Sherman erosion surface in distance (view southeast from near milepost 346, Interstate 80).



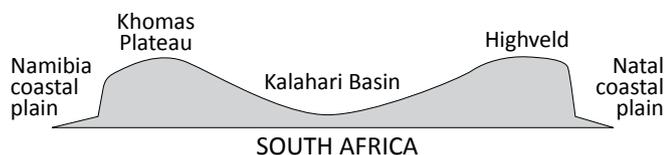
**Figure 10.** The flat planation surface of the Serengeti Plain in East Africa, which truncates deformed igneous and metamorphic rocks in the subsurface.

Hence, there is a highly complicated, diverse, and abundant literature on Africa planation surfaces.<sup>53,55-62</sup> For instance, Ollier and Marker<sup>63</sup> reanalyzed King's African Surface type area in South Africa, and instead of seeing five or six erosion surfaces, they concluded there were only two.<sup>64</sup> There was a high upper 'paleoplain' at about 1.5 km ASL and a coastal erosion surface, separated by the Great Escarpment that rings southern Africa about 100 km inland from the coast (figure 11a and b).

Because of the reaction against William Morris Davis's 'cycle of erosion' and to his followers who envisioned peneplains almost everywhere, many geologists became skeptical that erosion or planation surfaces existed at all.<sup>65</sup> Such an attitude was an over-reaction. The problem mainly had to do with the various hypotheses invented to explain the *origin* of planation surfaces, not really in the actual *existence* of planation surfaces. However, there is no doubt that the African Planation Surface exists, despite the problems that have been associated with defining it:



**Figure 11a.** The Great Escarpment (solid line) is located around southern Africa (after Oard, ref. 67, p. 54). Note that the escarpment is about 100 km inland from the coast, having retreated inland due to erosion.



**Figure 11b.** Cross section through southern Africa showing the flexing upward of the coastal sections and the formation of a seaward-facing Great Escarpment (from Oard, ref. 67, p. 53). The Drakensberg Escarpment between the Highveld and the Natal coastal plain is about 3,000 m high.

"By 1985, although nobody denied the reality of the African Surface, controversy thus persisted over its extent, distribution, age, and characteristics even in the historic type area of African geomorphology that was South Africa."<sup>64</sup>

Burke and Gunnell state elsewhere: "In summary, the evolution of terminology over the past 50 yr reveals ... an unwavering acceptance of the African Surface as a geomorphic reality."<sup>66</sup>

Burke and Gunnell recently attempted a synthesis of the planation surfaces of Africa from a perspective of the whole continent.<sup>54</sup> They tied the planation surfaces into plate tectonics and other major uniformitarian geological events, such as eastern African rifting and the mid- and late-Cenozoic deformation of the crust. This deformation consists of bulging upward swells and the subsidence of strata into basins. These authors expect that their synthesis will not be the last word and that challenges to their system will come, although they seem to be fairly close to the deductions of other geomorphologists:

"Although the term 'African Surface' has been used in many ways in southern Africa, increasing similarities in the use of the term, if not as yet a consensus, are emerging from the work of recent years."<sup>66</sup>

Burke and Gunnell have essentially subsumed all the many planation surfaces into *one* large African Erosion Surface.<sup>54</sup> They do not believe in any older erosion surfaces such as King believed in. Furthermore, the African Surface occurs over most of Africa.

Previous investigators, including King, had mainly correlated planation surfaces by altitude. So, applying plate tectonics, Burke and Gunnell claim that Africa split off from the Pangean supercontinent about 180 Ma ago, and since 180 to 150 Ma ago the continent has essentially been 'stable', until 30 Ma ago.<sup>54</sup> They assume that planation surfaces form in a stable environment. The erosion that formed the African Erosion Surface thus planed down mountains, rift flank uplifts, and volcanoes during this stable period.<sup>65</sup> During this time the surface supposedly denuded to a flat or nearly flat surface. During this approximately 150 Ma, there were occasional regional marine inundations, 'terrestrial' deposition and volcanism in spots to complicate matters. All these events, as well as the age of the African Surface itself, are imprecise within the uniformitarian dating system, although the planation of the surface supposedly culminated about 30 Ma ago in the mid-Tertiary.

Then after 30 Ma ago, the African Surface flexed up or down and the eastern African rift opened up. Africa is mostly composed of a series of large domes with depressions between (figure 11b). So, the nearly continent-wide African Erosion Surface was also flexed and is currently located at different altitudes. Therefore, the African Erosion Surface is considered a composite surface of continental extent.

The flexing upward of large domes caused erosion on the oceanward-side, resulting in the spectacular Great Escarpment that rings southern Africa (figure 11a and b).<sup>67</sup> The Great Escarpment along southeast Africa, called the Drakensberg, is up to 3,000 m high. This timing of uplift makes these great escarpments youthful. They will probably invite an argument over this idea, since many believe these escarpments would take much longer than 30 Ma to erode and hence are believed to be much older by many researchers.<sup>68</sup>

### **Duricrusts on planation surfaces**

One enigmatic feature of the African Erosion Surface is that it is commonly capped by a duricrust, defined as a hard crust on the surface generally found in a semiarid climate.<sup>69</sup> There are generally four types of duricrusts:

1. ferricrete, an iron oxide crust
2. silcrete, a silicon dioxide crust
3. calcrete, a calcium oxide crust and
4. bauxite, an aluminum oxide crust.

The term “laterite” is often used for a crust that has oxides of iron or aluminum or both.<sup>70</sup> Duricrusts are considered chemical sediments. Many geologists believe they were developed within ancient soils.<sup>56</sup>

Duricrusts are also common on erosion and planation surfaces in Australia, but they are less common elsewhere on other continents. They predominate in tropical and subtropical climates, as the definition states, but they are also found in temperate climates, for example a silcrete cap in southern England.<sup>71,72</sup> When eroded in southern England, silcrete boulders are called Sarsen Stones, some of which reach a length of over 4 meters. The origin of this once widespread silcrete cap is unknown.

The duricrusts commonly covering the African Surface are mostly composed of bauxite and laterite.<sup>54,73</sup> A fair percentage of silcrete also occurs.<sup>53</sup>

The duricrust can be fairly thick. For instance, the laterite cap on the African Surface in Uganda may be 30 m thick.<sup>56</sup> This hard duricrust cap has been somewhat responsible for the preservation of local African Surface remnants by protecting the erosion surface from being eroded away after the formation of the duricrust.

An extensive analysis of duricrust caps on erosion and planation surfaces is beyond the scope of this article. However, the formation of duricrusts is not well understood by uniformitarian scientists.<sup>56,74,75</sup> This is very likely because uniformitarian scientists theoretically attempt to account for duricrusts by warm climate soil formation, although some believe duricrusts are formed by groundwater and not by soil formation.<sup>76</sup> There are problems with the soil formation hypothesis because the chemicals to form a duricrust do not seem to come from the parent material beneath or by upward migration of the chemicals.<sup>56,71</sup> It appears that the duricrust is a chemical precipitate that collected on the erosion surface soon after formation. This is shown by duricrusts formed on planation surfaces cut on tilted sedimentary rocks.<sup>56</sup>



**Figure 12.** A planation surface being destroyed east of the Little Rocky Mountains, central Montana, USA.

### **Uniformitarians cannot explain planation surfaces**

The origin of these planation surfaces—ubiquitous across the planet—is a major mystery of uniformitarian geomorphology. We do not observe planation surfaces forming today except where it is assumed that lateral meandering of a river, especially during flooding, planed the top of strata.<sup>77</sup> But such occurrences are rare and of very small scale. We actually observe planation surfaces being destroyed today by the processes of erosion (figure 12). Planation surfaces are relict, formed in the past, by some huge watery agency.

Many hypotheses have come and gone.<sup>78</sup> William Morris Davis’s ‘cycle of erosion’ was considered almost the truth in the early and mid-1900s, but is now considered wrong. The weathering hypothesis seems to be the most popular, but it too has numerous difficulties in forming planation surfaces.<sup>45</sup> Crickmay wrote:

“Flat, near-horizontal land cannot be seen to have been made at the heights at which most of it is now seen. Such landscape as flat-topped hills or high plateaux shows no process in action that might favour or maintain its flatness. Consequently, one cannot say that any geological work now observable has made it as flat and level as it is. The completion of its flattening appears to have been in the past . . . The very existence of much flat, near-level ground at all elevations demonstrates not only its extensive forming, but also its long survival.”<sup>79</sup>

Ollier corroborated: “It is very difficult to know how plains were originally created, but they can undoubtedly be seen in the landscape.”<sup>80</sup>

Bradley summarized work in attempting to understand the many planation surfaces from the Appalachians to the

Coast Ranges of the western United States, focusing on the Colorado Front Range.<sup>81</sup> It is clear that for uniformitarians there is confusion about terminology, dates and the number of surfaces. They seem to despair over ever solving the origin of planation surfaces. All observers of the Colorado Front Range agree that there is at least one erosion surface, but its origin remains unresolved.

Evolutionary geomorphologists Ollier and Pain concluded that the planation surfaces were formed *late* in geological time:

“There is nothing special about the climate in the late Miocene-Early Pliocene period [Late Cenozoic] when there often occurred planation that suggests an increased erosion rate, and in any case the mountains discussed are in a wide range of latitudinal and climatic situations. At present, the cause of the observed high rate of planation remains a mystery.”<sup>82</sup>

They also believe that these planation surfaces were much more extensive, possibly covering much of the continents as now observed with the African Surface, and that later erosion dissected and destroyed the planation surfaces. Flat-topped mountains, commonly seen in many mountain ranges, are the remnants of the planation surface that was not totally destroyed. Ollier and Pain believe that in other mountains that are more jagged, the planation surface was totally eroded.<sup>83</sup> King also accepted the ‘late Cenozoic’ formation of worldwide planation surfaces.<sup>84</sup>

Ollier and Pain further marveled at how such planation could have occurred at all and been so widespread:

“The remarkable thing is that plains of great perfection are ever made, despite all the obvious possibilities of complications. But they are real, and planation surfaces were widespread before the uplift of the many mountains of Plio-Pleistocene age.”<sup>82</sup>

Especially mysterious are planation surfaces carved on *soft* rocks—a rare occurrence. The eroding mechanism beveled the surface of these soft rocks *evenly*, but did not leave a gravel cap. Subsequent slow erosion in soft rocks would have soon caused rills, valleys, and canyons. Not only would a widespread planation surface be difficult, if not impossible, to form on soft rocks by uniformitarian processes, but it would not be preserved for more than several thousand years either! Crickmay expressed astonishment at such planation surfaces:

“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.”<sup>85</sup>

Such planation or erosion surfaces on soft rocks are strong evidence that their formation occurred recently.

### Surficial planation surfaces carved by Flood runoff

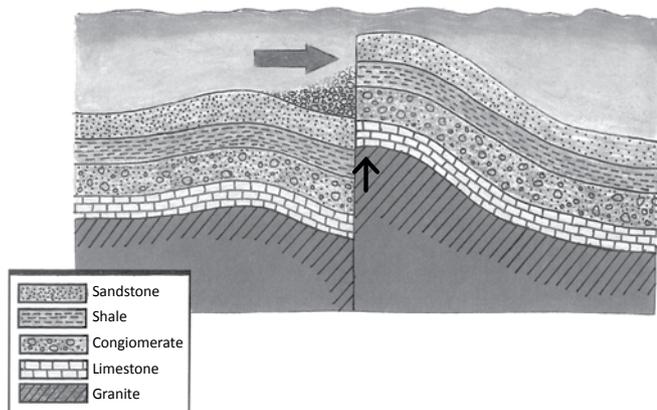
What uniformitarians find so perplexing can readily be explained by the Retreating Stage of the Flood only several thousand years ago.<sup>67,86</sup> Planation and erosion surfaces would have formed during erosion of the continents as the continents uplifted. Hundreds of meters of erosion has commonly occurred on the continents, but thousands of meters of erosion can be shown to have been eroded at some locations.<sup>87–89</sup> Since many of these surfaces were once widespread and later were whittled down to smaller erosional remnants, the erosion of the continents and the formation of planation surfaces can be placed within the Sheet Flow Phase in which wide currents predominated. Planation surfaces likely were beveled during very fast flow, since both hard and soft rocks are planed the same and the surfaces are flat. Erosion surfaces were likely formed in moderate velocity currents, which erode the softer rocks faster than the harder rocks, resulting in a rolling surface. After the formation of erosion and planation surfaces, the duricrusts likely formed by chemical precipitation from the floodwater in favorable areas.

Figure 13 presents a schematic of the formation of the African Surface on Africa as the continent uplifted and the ocean basins sank. Flood erosion at the beginning of the Retreating Stage likely planed much of Africa down to a flat or nearly flat surface (figures 13a and b). Later uplift and regional doming resulted in erosion of the African Surface into remnants of various sizes (figure 13c). The Great Escarpment of Southeast Africa likely was rapidly eroded in a direction toward the interior, as the Floodwater was running more perpendicular off the uplifting land and toward the oceans (figure 13d). The erosion did not form an escarpment inland of the rising dome because of slow water movement. The erosion was more intense as the ocean basins sank relative to the continents, especially along the coast, where deep rifts are sometimes found. The erosion of the Great Escarpment decreased the area of the African surface and formed a coastal plain (figure 13e). In regard to similar features in northwest Africa, Chardon *et al.* stated:

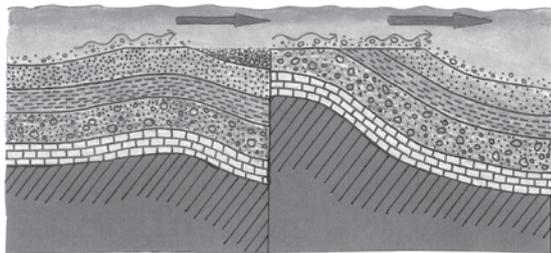
“Furthermore, subsidence of the outer slope of the Guinea passive margin was fast and constant during the Late Jurassic and Lower Cretaceous . . . These movements indicate downwarping of the pre-break-up land surface (i.e. the paleoplain of Ollier and Pain, 1997) and corresponding inland surface uplift.”<sup>90</sup>

Evolutionary geomorphologist Lester King recognized the same pattern as *the land rising and the ocean basins sinking* along the continental margin in southeast Africa with the hinge line near the coast: “These displacements are (or can be) always in the same sense,

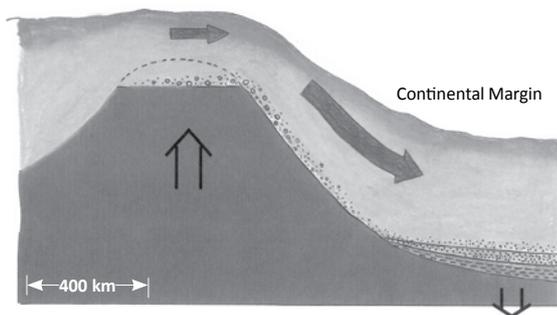
**Figure 13.** Series of schematics showing erosion, planing, and doming of the African continent as it uplifted out of the floodwater while the ocean basins sank (great vertical exaggeration, drawn by Melanie Richard).



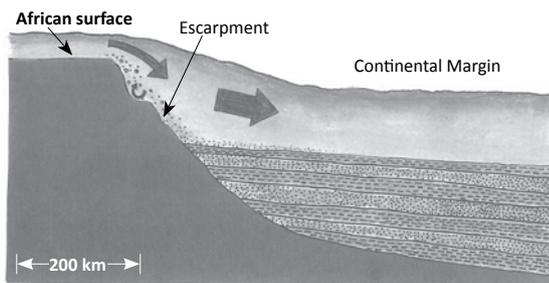
**Figure 13a.** After sedimentation of the African continent, the continent uplifts, faults, and sedimentary rocks tilt.



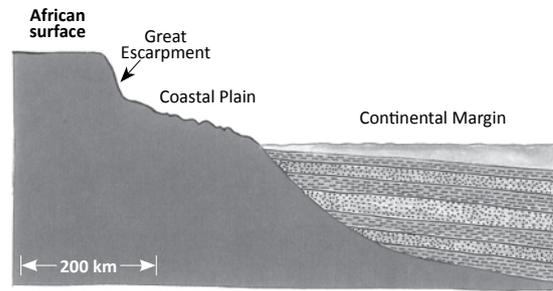
**Figure 13b.** Sedimentary rocks planed by strong Flood currents.



**Figure 13c.** Focus shifted to the rise of Southeast Africa with the uplift and erosion of a dome and the development of the continental margin. (Sedimentary layers not shown.)



**Figure 13d.** Focus shifted to the erosion of the Great Escarpment in Southeast Africa. The escarpment erodes to the left as sediments continue to pile up on the continental margin.



**Figure 13e.** The Great Escarpment now separates the high African Surface from a coastal plain. Eroded sediments formed the continental margin sedimentary rocks.

land up—ocean floor down.”<sup>91</sup> King summarized for the whole world:

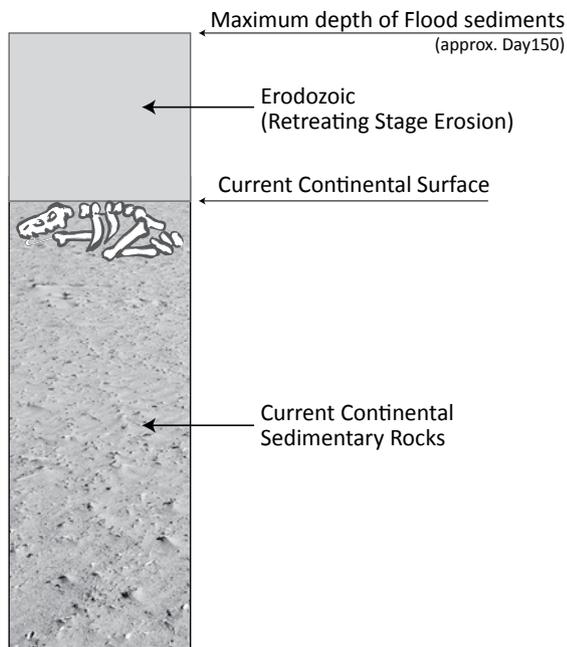
“So the fundamental tectonic mechanisms of global geology are *vertical, up or down*: and the normal and most general tectonic structures in the crust are also vertically disposed ... But one must bear in mind that every part of the globe—on the continents or in the ocean basins—provides direct geological evidence that formerly it stood at different levels, up or down, and that it is subject *in situ* to vertical displacements [emphasis in original].”<sup>92</sup>

What King is saying is that past vertical motions of the earth’s crust are a fundamental, general, and direct deduction. So just as in Psalm 104:8, which says that to drain the floodwater, the mountains rose and the valleys sank down, this theme is seen not only on Africa and its continental margin, but also across the whole earth.

### Summary and discussion

Planation and erosion surfaces are common across the earth. They were once significantly larger, having subsequently been whittled down by erosion and tectonic processes. These surfaces are one of many geomorphological problems that uniformitarian scientists have great difficulty explaining, although they have a number of hypotheses. The main problem is that they are not forming today (except possibly in very small areas adjacent to rivers), but are being destroyed. There has been much contention on the number and ages of planation surfaces. This dispute is nowhere more evident than on the continent of Africa. Renowned geomorphologist Lester King vacillated on the number of African planation surfaces. A recent synthesis has claimed that there is only one planation surface on Africa currently found at different altitudes because of regional tectonics. This planation surface is called the African Surface, which was one of King’s main planation surfaces.

The African Surface, as well as other planation surfaces, were readily formed as the floodwater rushed off the continents during the Retreating Stage of the Flood, while the continents uplifted and the ocean basins sank



**Figure 14.** A simple block diagram showing the current continental sedimentary rocks with the volume of sediments eroded after Day 150, the 'Erodozoic', during the Retreating Stage of the Flood (drawn by Mrs Melanie Richard).

(Psalm 104:6–9). Planation surfaces are powerful evidence for the reality of the Flood. Planation surfaces were formed during widespread erosion of the continents by water, leaving behind erosional remnants, eroded anticlines and transported resistant rocks hundreds of kilometers from their source. The formation of planation surfaces was the *last* great event to affect the continents, the Ice Age notwithstanding. During planing, erosion was up to 5 km in places, such as on the Colorado Plateau<sup>88</sup> and the Appalachians.<sup>89</sup> The literature claims deep erosion at many other locations on the continents.<sup>67</sup>

Planation surfaces not only tell us of the great erosion of the continents, but also demonstrate that the sedimentary rocks left behind underneath the planation surfaces likely were from *before* the Retreating Stage and thus from the early part of the Flood, called the Inundatory Stage.<sup>86</sup> The Retreating Stage was mostly a period of erosion on the continents and not deposition (figure 14). It is called the Erodozoic by Holt.<sup>93</sup> Such a deduction has profound implications for interpretation of the geological column. It implies that no matter what the uniformitarian date of the surface sedimentary rocks on the continents, especially at high altitude, even if dated Pliocene, they are from the first half of the Flood. This deduction makes the Cenozoic on the continents, especially at inland and high-altitude locations, as deposited predominantly during the Inundatory Stage. It also eliminates any significant post-Flood catastrophism. It also implies that the Flood/post-Flood boundary is in the late Cenozoic.

## Acknowledgement

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