Chapter 38

Planation Surfaces Western United States

There are other planation surfaces in western North America besides those found on the High Plains of Montana and adjacent Canada. It would be a gargantuan endeavor to list and adequately describe all the planation and claimed planation surfaces of western North America, including exhumed surfaces (see Appendix 15). So, to keep this information into one chapter, I will briefly summarize the evidence. In some cases I have visited the regions, and in other cases I rely on the literature.

Figure 38.1. Yosemite Valley, Sierra Nevada Mountains (view east from Glacier Point).

Sierra Nevada Mountains

The Sierra Nevada Mountains of eastern California (Figure 38.1) do not impress anyone as being related to a planation surface. They are a result of uplifting of the Sierras along a fault along its eastern edge (see Figure 25.1); the Owens Valley is the resulting fault valley. The west slope of the Sierras represent a planation surface that has tilted down toward the west,[1] but because it has been greatly dissected by canyons and valleys,[2,3,4,5] it is hard to discern the western Sierras were once a planation surface that was carved mostly on granite. Viewing across several ridges makes it more obvious the western Sierras represent one vast planation surface that was later dissected by canyons and roughened into an erosion surface (see Figure 25.2).

Figure 38.2. An erosional remnant of multiple volcanic debris flows of the Absaroka Volcanics (view northwest from Brooks Lake, Wyoming, at about 9,500 (2,900 m) above msl).

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[1] Wahrhaftig, C., 1965. Stepped topography of the southern Sierra Nevada, California. *GAS Bulletin* 76:1,165–1,190.

[2] Webb, R.W., 1946, Geomorphology of the middle Kern River basin, southern Sierra Nevada, California. *GSA Bulletin* 57:355–382.

[3] Pelletier, J.D., 2007. Numerical modeling of the Cenozoic geomorphic evolution of the southern Sierra Nevada,k California. *Earth and Planetary Science Letters* 259:85–96.

[4] Saleeby, J, Z. Saleeby, E. Nadin, and G. Maheo, 2009. Step-over in the structure controlling the regional west tilt of the Sierra Nevada microplate: eastern escarpment system to Kern Canyon system. *International Geology Review* 51:634–669.

[5] Clark, M.K., G. Maheo, J. Saleeby, and K.A. Farley, 2005. The non-equilibrium landscape of the southern Sierra Nevada, California, *GSA Today* 15(9):4–9.

The Rocky Mountains

The Rocky Mountains are a series of north-south oriented mountain ranges separated by valleys or basins. The tops of many of the mountains are flat and represent an erosional remnant of a once more extensive planation surface.

Beartooth Mountains

The Beartooth Mountains of the Rocky Mountains is located in south central Montana and north-central Wyoming and represent a dissected planation surface at several elevations (see Figure 6.4).[6] These mountains are composed mostly of granite and gneiss. The highest mountains are at about 13,000 feet (3,960 m) msl and have been planed, but are at slightly different altitudes due to faulting. The lower elevations represent a highly dissected, less upward faulted planation surface at about 10,000 to 11,000 feet (3,050 to 3,250 m) elevation. As with the western Sierras, the planation surface can be recognized by viewing across several ridges (see Figure 59.2).

The planation surface at the top of the Beartooth Mountains is likely an exhumed surface[7],[8] (see Appendix 15), since it has a 1,600-foot (488m) patch of Paleozoic strata consisting mostly of limestone on top of the granite (see Figure 6.3).

Absaroka Mountains

The Absaroka Mountains have a planation surface at the top of the southern part.[9] The Absaroka Mountains represent a 6,000-foot (1,830 m) thick accumulation of numerous volcanic breccia flows (Figure 38.2) that cover an area of 9,000 mi^2 (23,000 km^2). Although dated by uniformitarian geologist as Eocene, the flows probably took place early in the Retreating Stage of the Flood and accumulated underwater during Flood runoff. At the end of deposition, the top was eroded into a planation surface.

Wind River Mountains

Farther south of the Beartooth and Absaroka Mountains are the Wind River Mountains of west central Wyoming. Like the Beartooth Mountains, they are made up of granite and gneiss. Their mountain tops are commonly flat (see Figures 33.4), but the bounding sedimentary rocks are also planed (see Figure 33.5). The planation surface on the granite is likely an exhumed surface that formed early in the Flood as part of the Great Unconformity (see Chapter 33).[8] The planed sedimentary rocks banked up against the west side of the mountains likely were planed late in the Flood during Floodwater runoff.

Idaho Batholith

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[6] Bevan, A., 1925. Rocky Mountain peneplains northeast of Yellowstone Park. *The Journal of Geology* 23:563–587.
[7] Simons, F.S. and T.J. Armbrustmacher, 1976. High-level plateaus of the southeastern Beartooth Mountains, Montyana and Wyoming—remnants of an exhumed sub-Cambrian marine plain. *Journal of Research U.S. Geological Survey* 4(4):387–396.
[8] Oard, M.J., 2014. The meaning of the Great Unconformity and Sauk Megasequence. *Journal of Creation* 28(1):12–15.
[9] Love, J.D., J.C. Reed, Jr., and K.L. Pierce, 2007. *Creation of the Teton landscape: A Geological Chronicle of Jackson Hole & the Teton Range*, Grand Teton Association, Moose, WY, pp. 88–89.

A batholith is a large body of granite or granite-like rock with an aerial extent over 40 mi^2 (100 km^2).[10] In west-central Idaho a large mass of granite outcrops called the Idaho Batholith. Early geologists claimed that a planation surface was eroded on the top of the batholith, and then was greatly dissected forming deep, nearly vertical-walled canyons, which nearly destroyed the surface (see Figure 23.2).[11,12,13] Apparently, there is no question about the existence of a planation surface on some of the mountaintops, but there is of its supposed age. [14,15,16]

Figure 38.3. Planation surface on top of the granite and gneiss of the northern Bighorn Mountains. Hills in the distance are Paleozoic erosional remnants.

Front Range of the Colorado Rockies

[10] Neuendorf, K.K.E., J.P. Mehl, Jr., and J.A. Jackson, 2005. *Glossary of Geology*, Fifth Edition. American Geological Institute, Alexandria, VA, p. 58.
[11] Umpleby, J.B., An old erosion surface in Idaho: its age and value as a datum plane. *The Journal of Geology* 20:139–147.
[12] Lindgren, W. and D.C. Livingston, 1918. Discussion: the Idaho peneplain. *Economic Geology* 13:486–492.
[13] Anderson, A.L.,1929. Cretaceous and Tertiary planation in northern Idaho. *The Journal of Geology* 37:747–764.
[14] Blackwelder, E., 1912. The old erosion surface in Idaho: a criticism. *The Journal of Geology* 20:410–414.
[15] Umpleby, J.B., 1913. The old erosion surface in Idaho: a reply. *The Journal of Geology* 21:224–231.
[16] Mansfiled, G.R., 1924. Tertiary planation in Idaho, *The Journal of Geology* 32:472–487.

The Front Range of the Colorado Rockies is a classic area for studying planation surfaces.[17,18,19,20] Both the number and the age of these surfaces, originally called peneplains (see Chapter 50) have been very controversial.[21,22] Because of the buildup of problems, research stopped for two decades: "Except for Moore (1960), little was said for almost two decades. It was as if people despaired of ever solving the erosion-surface problems."[23] There seems to be a consensus that there is one mountaintop rolling planation surface (see Figure 34.1), called the Flattop surface, but its origin is unknown: "The problem of genesis remains largely unresolved."[24] Others also believe there is a second planation surface at 7,500 to 10,000 feet (2,300 to 3,000 m). There is also a well-known pediment at the base of the Front Range called the Rocky Flats pediment (see Volume III on the subject of pediments).[25]

Other Rocky Mountain Ranges

Remnants of a planation surface in the form of flat-topped mountains are seen in many other ranges of the Rocky Mountains. These include the San Juan Mountains, the Sawatch and Mosquito Ranges, the Medicine Bow Mountains, the Laramie Range, the Uinta Mountains, the Big Horn Mountains (Figure 38.3), and the Owl Creek Range.[26] The Manzanita and north Manzano Mountains of New Mexico have some flat-topped mountains.[27] The Highland Mountains of southwest Montana have one flat-topped mountain (see Figure 33.3). I have studied these planation surfaces locally on top of and along the edge of the Uinta Mountains. The study is summarized in Appendix 17.

What Does It Mean?

Ollier and Pain have made a strong case for mountains forming after a continental-scale planation surface wore deformed igneous and sedimentary rocks into a flat surface with the planation surface subsequently being faulted, uplifted, and eroded at variable amounts (see Figure A1.1).[28] During uplift the planation surface was mostly destroyed in many places by dissection and erosion. Evidence remains in the form of scattered flat-topped mountains.

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[17] Howard, A.D., 1941. Rocky Mountain peneplains or pediments. *Journal of Geomorphology* 4(2):138–141.
[18] Lee, W.T., 1922. Peneplains of the front range and Rocky Mountain National Park, Colorado. *U.S. Geological Survey Bulletin 730—A*, Washington D.C.
[19] Gregory, K.M. and C.G. Chase, 1992. Tectonic significance of paleobotanically estimated climate and altitude of the late Eocene erosion surface, Colorado. *Geology* 20:581–585.
[20] Gregory, K.M. and C.G. Chase, 1994. Tectonic and climatic significance of a late Eocene low-relief, high-level geomorphic surface, Colorado. *Journal of Geophysical Research* 99(B10):20,141–20,160.
[21] Madole, R.F., W.C. Bradley, D.S. Loewenherz, D.F. Ritter, N.W. Rutter, and C.E. Thorn, 1987. In, Graf, W.L. (editor), *Geomorphic Systems of North America*, Geological Society of America Centennial Special Volume 2, Boulder, CO, pp. 211–257.
[22] Wahlstrom, E.E., 1947. Cenozoic physiographic history of the front range, Colorado. *GSA Bulletin* 58:551–572.
[23] Madole et al., Ref. 21, p. 218.
[24] Madole et al., Ref. 21, p. 219.
[25] Anderson, R.S., C.A. Riihimaki, E.B. Safran, and K.R. MacGregor, 2006. Facing reality: Late Cenozoic evolution of smooth peaks, glacially ornamented valleys, and deep river gorges of Colorado's Front Range. In, Willett, S.D., N. Hovius, M.T. Brandon, and D.M. Fisher (editors), *Tectonics, Climate, and Landscape Evolution*, GSA Special Paper 398, Boulder, Colorado, pp. 397–418.
[26] Atwood, W.W. and W.W. Atwood, Jr., 1938. Working hypothesis for the physiographic history of the Rocky Mountain region. *GSA Bulletin* 49:957–980.
[27] Reiche, P., 1949. Geology of the Manzanita and north Manzano Mountains, New Mexico, *GSA Bulletin* 60:1,183–1,212.
[28] Ollier C. and C. Pain, 2000. *The Origin of Mountains*, Routledge, London, U.K.

Considering the large number of flat-topped mountains in the Rocky Mountains, Ollier and Pain's theory rings true—the western United States was once a vast planation surface.

A continental-scale planation surface was suggested long ago by Randall Gresens who placed it generally in the mid Cenozoic.[29] It was thought to have extended from British Columbia to Mexico, possibly including the Cascade Mountains of Washington.[30] Regardless of whether Gresens is exaggerating or not, there are enough planation surface remnants on top of the mountains of the western United States to lean toward the idea that Ollier and Pain are correct for the western United States.

Uniformitarian scientists have great difficulty explaining mountaintop planation surfaces: "The age and origin of the high-level erosion surface [in the Wind River Mountains], the Rocky Mountains and others have been the subject of much debate."[31] Of course, planation surfaces are not forming today:

> If rapid development of low relief was part of the normal course of tectonic development, then high-level, low-relief surfaces would be forming today. They are not.[32]

Although planation surfaces defy uniformitarian principle, they can be readily explained by the Flood (see Part XII).

High Plains of North America

There are also planation surfaces along the High Plains east of the Rocky Mountains. I will mention probably the most impressive one, which starts at the top of the Laramie Range of southeast Wyoming and descends gradually and smoothly eastward into northwestern Nebraska (Figures 38.4 and 38.5). Interstate 80 was built on this planation surface. A few erosional remnants rise above the surface in the western part called inselbergs (see Part XI). The planation surface itself, goes by various names, the Sherman Erosion Surface, the Gangplank, or the Cheyenne Tablelands. It truncates various igneous and sedimentary rocks of various supposed ages, strangely (to uniformitarians) all at the same angle.[33] It bevels Precambrian granite in the Laramie Range and the late Cenozoic Ogallala Group in Nebraska.[34] The Ogallala Gravel also caps the erosion surface.[35]

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[29] Gresens, R.L., 1980. Extension of the Telluride erosion surface to Washington state, and its regional and tectonic significance. *Tectonophysics* 79:145–164.
[30] Waters, A.C., 1939. Resurrected erosion surface in central Washington. *GSA Bulletin* 50:635–660.
[31] Steidtmann, J.R., L.T. Middleton, and M.W. Shuster, 1989. Post-Laramide (Oligocene) uplift in the Wind River Range, Wyoming. *Geology* 17:38.
[32] Gregory, K.M. and C.G. Chase, Tectonic and climatic significance of a late Eocene low-relief high-level geomorphic surface, Colorado. *Journal of Geophysical Research* 99(B10):20,141–20,160.
[33] Eggler, D.H., E.E. Larson, and W.C. Bradley, 1969. Granites, grusses, and the Sherman Erosion Surface, southern Laramie Range, Colorado-Wyoming. *American Journal of Science* 267:510–522.
[34] Thornbury, W.D., 1965. *Regional Geomorphology of the United States*, John Wiley & Sons, New York, NY.
[35] McMillan, M.E., C.L. Angevine, and P.L. Heller, 2002. Postdepositional tilt of the Miocene-Pliocene Ogallala Group on the western Great Plains: evidence of late Cenozoic uplift of the Rocky Mountains. *Geology* 30:63–66.

Figure 38.4. The Sherman planation surface with a few inselbergs in the distance (view southwest from near milepost 346 on Interstate 80, west of Cheyenne, southeast Wyoming).

Figure 38.5. The Sherman planation surface (view southeast from near milepost 346 on Interstate 80, west of Cheyenne, southeast Wyoming)