Chapter 48

Other Continental Planation surfaces

Every continent has planation surfaces and these include Asia, Antarctica, New Zealand, and Greenland. This chapter will briefly describe a few of them from the scientific literature.

Asia

Asia undoubtedly has as many planation surfaces as Europe, but information on Asia, in English, is limited. World traveler and geomorphologist, Lester King, briefly mentions them in his survey of worldwide planation surfaces.[1] Ollier and Pain write of remnant planation surfaces on top of the Tien Shan, Altai, Transbaikal, and Sayan Mountains of Central Asia.[2] Remnant planation surfaces are seen on many other mountaintops in China.[3] This includes the tops of some granite mountains that have been dated Mesozoic by uniformitarian scientists.[4]

Asia probably possesses the second largest planation surface in the world; the African Surface being the first (see Chapter 42). It is the Tibetan Plateau that covers an area of about 273,000 mi^2 (700,000 km^2). One Chinese scientist described it as a "…vast planation surface."[5] Dewey and others called it, "…a remarkably level plateau…"[6] The plateau has since been heavily dissected by erosion.[7] The large-scale picture shows it to be extremely flat as described by Fielding *et al*: "Concerning the first factor, at moderate to long wavelengths from tens to hundreds of kilometres, central Tibet is extremely flat…"[8] Why Tibet is so flat over much of its area is a mystery since it is within a plate tectonic collision zone: "How can central Tibet have low relief in spite of its location in the middle of an active continental collision zone?"[8] Is it possible there is not a collision zone there after all?

The Himalaya Mountains south of the Tibetan Plateau may also have been a planation surface before the mountains uplifted and were eroded. Kalvoda states:

> The denudational relicts left over from the planation of the Tibetan Himalaya, dating from pre-Quaternary times, and preserved in the form of flat ridges and planed surfaces; occur mostly in the crests of anticlines and their limbs, whereas rivers are developed along synclines.[9]

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[1] King, L.C., 1967. *The Morphology of the Earth—A Study and Synthesis of World Scenery*, Hafner Publishing Company, New York, NY.
[2] Ollier C. and C. Pain, 2000. *The Origin of Mountains*, Routledge, London, U.K., pp. 144–147.
[3] Zhang, K., 2008. Planation surfaces in China: one hundred years of investigation. In, Grapes, R.H., D. Oldroyd, and A. Grigelis (editors), *History of Geomorphology and Quaternary Geology*, Geological Society of London Special Publication No. 301, pp. 171–178.
[4] Zhang, Ref. 3, p. 176.
[5] Wright, J.S., 2001. "Desert" loess versus "glacial" loess: quartz silt formation, source areas and sediment pathways in the formation of loess deposits. *Geomorphology* 36:240.
[6] Dewey, J.F., R.M. Shackleton, C. Chengfa, and S. Yiyin, 1988. The tectonic evolution of the Tibetan Plateau. *Philosophical Transactions of the Royal Society, London* A327:379–413.
[7] Fielding, E.J., 2000. Morphotectonic evolution of the Himalayas and Tibetan Plateau. In, Summerfield, M.A. (editor), *Geomorphology and Global Tectonics*, John Wiley & Sons, New York, NY, pp. 201–222.
[8] Fielding, E., B. Isacks, M. Barazangi, and C. Duncan, 1994. How flat is Tibet? *Geology* 22:166.
[9] Kalvoda, J., 1992, *Geomorphological Record of the Quaternary Orogeny in the Himalaya and the Karakoram*. Elsevier, New York, NY, pp. 114–115.

Accordant levels at the tops of the Himalayas suggest a massively eroded planation surface to Ollier and Pain.[10]

The Tien Shan Mountains north of the Tibetan Plateau show remnants of a mountaintop planation surface.[11,12] The Gobi Altay and Altay ranges of Mongolia, east of the Tien Shan Mountains, have flat summits that are considered to be remnants of a very extensive planation surface.[13] This surface includes the planation surface at the top of the Tien Shan and West Sayan Mountains. Some of these mountains have never been glaciated.[14] Especially strange, according to the uniformitarian principle, is these flat surfaces are supposed to be about 150 million years old! This is highly unlikely, see Chapter 35 for further discussion. A number of uplifted mountain ranges in northeastern Asia have beveled crestlines.[15] The Cherskii Mountains of northeastern Siberia possess planation surfaces.[16] The same can be said for a few mountain ranges in Southeast Asia.[15]

Planation surfaces are abundant in all of China. The mountaintop planation surfaces in western China are even capped by water-lain gravels.[17] Planation surfaces are not presently forming or expanding. If uniformitarianism were true they should be, but instead of growing they are being destroyed by erosion. Another example of planation surfaces in western China is the upper Huang He drainage basin. Its' structure is beveled leaving inselbergs behind. The surface was then dissected.[18] It is said of this area:

> The belonging landforms reveal remnants of former land surfaces which appear as plateau flats, summit levels, and rock-cut valley terraces. They are interpreted as relics of planation surfaces, pediments, and valley bottoms.[19]

Planation surfaces are also noted in Guizhou Province, south China.[20]

The Ordos Plateau of central China is a rectangular area bounded by the Yellow River (Huang He) on three sides that spreads out of the northeastern Tibetan Plateau. The river first flows north along the western Ordos Plateau, then east through the Hetao graben, and then south through 440 miles (700km) long Jinshaan Canyon. The Ordos Plateau covers around 39,000 mi^2 (100,000 km^2) sloping down towards the east at a mean altitude of 3,300 to 4,900 feet (1,000 to

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[10] Ollier and Pain, Ref. 2, p. 34.
[11] King, Ref. 1, p. 528.
[12] Abdrakhmatov, K.Ye., et al., Relatively recent construction of the Tien Shan inferred from GPS measurements of present-day crustal deformation rates. *Nature* 384:450–453.
[13] Jolivet M., *et al*., Mongolian summits: an uplifted, flat, old but still preserved erosion surface. *Geology* 35:871–974.
[14] Jolivet M., *et al*., Ref. 13, p. 871.
[15] King, Ref. 1, p. 526.
[16] Fujita, K., D.B. Cook, H. Hasegawa, D. Forsyth, and R. Wetmiller, 1990. Seismicity and focal mechanisms of the Arctic region and the Northern American plate boundary in Asia. In, Grantz, A., L. Johnson, and J.F. Sweeney (editors), *The Arctic Ocean Region, The Geology of North America, Volume L*, Geological Society of America, Boulder, CO, p. 88.
[17] Fothergill, P.A. and H. Ma., 1999. Preliminary observations on the geomorphic evolution of the Guide Basin, Qinghai Province, China: implications for the uplift of the northeast margin of the Tibetan Plateau. 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 Special Publication No. 162, The Geological Society, London, U.K., pp. 183–200.
[18] Lehmkuhl, F. and J. Spönemann, 1994. Morphogenetic problems of the upper Huang He drainage basins. *GeoJournal* 334:31–40.
[19] Lehmkuhl, F. and J. Spönemann, Ref. 18, p. 31.
[20] Linhua, S., Z. Yaoguang, F. Jinfu, and G. Zhongxong, 1983. Karst development and the distribution of karst drainage systems in Dejiang, Guizhou Province, China. *Journal of Hydrology* 61:3–17.

1,500 m) above sea level. It is a planation surface that truncates tilted sandstone and shale and was formed by currents flowing westward, opposite the general slope of the surface today.[21] Thus, the planation surface must have been tilted eastward due to the rise of the Tibetan Plateau.[22]

Isolated, laterized (iron-oxide capped) plateaus are remnants of a much dissected planation surface on top of the Western Ghats of Western India.[23] The Karnataka Uplands of southern India[24] are also a planation surface.

Figure 48.1. Flat-topped Starr Nunatak, a likely remnant of a planation surface, sticking up above the Antarctic Ice Sheet near the coast of Victoria Land (Wikepedia).

Antarctica

Planation surfaces are also in Antarctica. They can be seen at the tops of the mountains that project above the ice sheet called nunataks (Figure 48.1). They are mostly around the margins of the ice sheet,[25] as with the Prince Charles Mountains, the Transantarctic Mountains, Ellsworth

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[21] Oard, M.J., 2014. Planation surface and strath terraces point to a Flood origin of the Chinese Loess Plateau. *Journal of Creation* (in press).

[22] Pan, B., Hu, Z., Wang, J., Vandenberghe, J., Hu, X., Wen, Y., Li, Q., and Cao, B., 2012. The approximate age of the planation surface and the incision of the Yellow River. *Palaeogeography, Palaeoclimatology, Palaeoecology* 356–357:54–61.

[23] Widdowson, M., 1997. Tertiary palaeosurfaces of the SW Deccan, Western India: implications for passive margin uplift. In, Widdowson, M. (editor), *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation*, The Geological Society of London Special Publication No. 120, pp. 221–248.

[24] Gunnell, Y., 1997. Topography, palaeosurfaces and denudation over the Karnataka Uplands, southern India. In, Widdowson, M. (editor), *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation,* The Geological Society of London Special Publication No. 120, pp. 249–267.

[25] Ollier and Pain, Ref. 2, p. 214.

Land of the southern Antarctic Peninsula, and Marie Byrd Land.[26,27,28,29,30] George Denton and David Sugden claim there are three planation surfaces on the Transantarctic Mountains next to the Dry Valley region.[31] Summerfield and others show a map of planation surfaces, some with inselbergs.[32] Mountain top planation surfaces cover a distance of 1,560 miles (2,500 km) between Marie Byrd Land and Ellsworth Land as well as on the northern Antarctic Peninsula.[33]

In Marie Byrd Land, flat topped, granitic nunataks rise above the ice sheet of West Antarctica:

> The key structural datum in Marie Byrd Land is a very flat pre-volcanic erosion surface. It is exposed as isolated block faulted remnants along the coast of Marie Byrd Land and adjacent regions to the east, from 70°W to 140°W, and at elevations ranging from roughly 200 m to 2700 m above sea level…[34]

These are similar to the top of the Beartooth Mountains of south-central Montana and north-central Wyoming (see Chapter 38). It is important to remember that present processes do not form flat planation surfaces on granite.

Greenland

Distinctive uplifted and dissected planation surfaces are found along the eastern and western margin of Greenland, where the mountains rise above the ice sheet (Figure 48.2).[35,36] In central east Greenland, the planation surface is clearly visible on uplifted blocks from 0.6 to 1.56 miles (1 to 2.5 km) above msl.[37,38]

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[26] Tingey, R.J., 1985. Uplift in Antarctica. *Zeitschrift für Geomorphologie N. F. Suppl.-Bd* 54:85–99.
[27] Wellman, P. and R.J. Tingey, 1981. Glaciation, erosion and uplift over parts of East Antarctica. *Nature* 291:142–144.
[28] Rutford,R.H., C. Craddock,and T.W. Bastien, 1968. Late Tertiary glaciation and sea-level changes in Antarctica. *Palaeogeography, Palaeoclimatology, Palaeoecology* 5:15–39.
[29] Armienti, P. and C. Baroni, 1999. Cenozoic climatic change in Antarctica recorded by volcanic activity and landscape evolution. *Geology* 27:617–620.
[30] Laudon, T.S., 1972. Stratigraphy of eastern Ellsworth Land. In, Adie, R.J. (editor), *Antarctic Geology and Geophysics*, International union of Geological Sciences, Universitetsforlaget, Oslo, Norway, pp. 215–223.
[31] Denton, G.H. and D.E. Sugden, 2005. Meltwater features that suggest Miocene ice-sheet overriding of the Transantarctic Mountains in Victoria Land, Antarctica. *Geografiska Annaler* 87A:67–85.
[32] Summerfield, M.A., D.E. Sugden, G.H. Denton, D.R. Marchant, H.A.P. Cockburn, and F.M. Stuart, 1999. Cosmogenic isotope data support previous evidence of extremely low rates of denudation in the Dry Valleys region, South Victoria Land, Antarctica. 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 Special Publication No. 162, The Geological Society, London, U.K., pp. 85–91.
[32] Joly, F. and C. Embleton, 1984. Amorican Massif. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 255–267.
[33] LeMasurier, W.E. and C.A. Landis, 1996. Mantle-plume activity recorded by low-relief erosion surfaces in West Antarctica and New Zealand. *GSA Bulletin* 108:1,450–1,466.
[34] LeMasurier, W.E. and D.C. Rex, 1983. Rates of uplift and the scale of ice level instabilities recorded by volcanic rocks in Marie Byrd Land, West Antarctica. In, Oliver, R.L., P.R. James, and J.B. Jago (editors), *Antarctic Earth Science*, Cambridge University Press, New York, NY, pp. 663–664.
[35] Ahlmann, H.W., 1941. The main morphological features of northeast Greenland. *Geografiska Annaler* 23:148–182.
[36] Wager, L.R., 1933. The form and age of the Greenland ice cap. *Geological Magazine* 70:145–156.
[37] Peulvast, J.-P., 1970. Pre-glacial landform evolution in two coastal high latitude mountains: Lofoten-Vesterålen (Norway) and Scoresby Sund area (Greenland). *Geografiska Annaler* 70A:351–360.
[38] Brooks, C.K., 1985. Vertical crustal movements in the Tertiary of central East Greenland: a continental margin at a hot-spot. *Zeitschrift für Geomorphologie N. F. Suppl.-Bd* 54:101–117.

Figure 48.2. Planation surface on the tops of the southeast mountains of Greenland (Wikipedia).

The planation surfaces of west central Greenland have been studied the most. The planation surface, as in so many others, has been uplifted and dissected "in the late Cenozoic" at the same time as the offshore area subsided.[39,40,41] An upper planation surface at the tops of the mountains and a less-developed lower planation surface is about 3,300 feet (1 km) lower forming wide valleys. The uplift resulted in a Great Escarpment separating a coastal plain (see Chapter 11). The planation surfaces sheer hard and soft rocks equally:

> The [upper] surface is post-Eocene and its formation has been independent of rock types as it cuts across both resistant Precambrian basement and more easily eroded Eocene and Paleocene [early Cenozoic] volcanic rocks.[42]

The uniformitarian hypothesis for the explanation of these planation surface is that they formed by vast, braided rivers and streams that eroded it down to sea level. [43] This pattern is also similar to southern Norway.[44]

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[39] Japsen, P., J.M. Bonow, P.F. Green, J.A. Chalmers, and K. Lidmar-Berström, 2009. Formation, uplift and dissection of planation surfaces at passive continental margins – a new approach. *Earth Surface Processes and Landforms* 34:683–699.

[40] Chalmers, J.A., 2000. Offshore evidence for Neogene uplift in central West Greenland. *Global and Planetary Change* 24:311-318.

[41] Japsen, P., J.M. Bonov, P.F. Green, J.A. chalmers, and K. Lidmar-Berström, 2006. Elevated, passive continental margins: long-term highs or Neogene uplifts? New evidence from West Greenland. *Earth and Planetary Science Letters* 248:330-339.

[42] Bonov, J.M., K. Lidmar-Bergström, and P. Japsen, 2006. Palaeosurfaces in central West Greenland as reference for identification of tectonic movements and estimation of erosion. *Global and Planetary Change* 50:164.

[43] Bonov, J.M., P. Japsen, K. Lidmar-Bergström, J.A. Chalmers, and A.K. Pedersen, 2006. Cenozoic uplift of Nuussuaq and Disko, West Greenland—elevated erosion surfaces as uplift markers of a passive margin. *Geomorphology* 80:325-337.

Figure 48.3. Otago area (in green) on southern part of South Island, New Zealand (Wikipedia).

[44] Bonov, J.M., K. Lidmar-Berström, P. Japsen, J.A. chalmers and P.F. Green, 2007. Elevated erosion surfaces in central West Greenland and southern Norway: their significance in integrated studies of passive margin development. *Norwegian Journal of Geology* 87:197-206.

New Zealand

New Zealand is very mountainous, but even here planation surfaces are found, mainly on South Island.[45,46,47] It is thought that the planation surface on South Island once covered an area greater than 39,000 mi^2 (100,000 km^2) but has been eroded and uplifted since formation:

> In New Zealand, a low-relief erosion surface is well preserved over an area in excess of 100 000 km^2. It is conspicuous in upland areas of southern South Island…, where it occurs as a flat summit surface that truncates upper Paleozoic-Mesozoic schists and graywackes. It is veneered in many areas by fluvial gravel and in others by thin sequences of shallow-marine deposits … In addition, the surface also bevels basement rocks at scattered localities on the northern part of the South island…[48]

The word "fluvial gravel" is used because the rocks that sometimes cap the planation surface are rounded. The uniformitarian scientists simply assume that the rounding was done by a river, when founding can occur by any type of moving water.

A part of this eroded and uplifted planation surface is described in southern South Island as the Otago "peneplain" (Figure 48.3) easily recognized at the tops of the Old Man and Garvie Mountains.[49,50] This planation surface bevels schist, a metamorphic shale, at an angle to the bedding of up to 20°. The planation surface is not flat but is rolling, as expected with an erosion surface. This is attributed to faulting, folding, and erosion in the late Cenozoic.

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[45] Cotton, C.A., 1917. Block mountains in New Zealand. *American Journal of Science* 44(262), fourth series:249–293.
[46] Cotton, C.A., 1958. Fine-textured erosional relief in New Zealand. *Zeitschrift für Geomorphologie* 2:187–210.
[47] Cotton, C.A., 1939. Lateral planation in New Zealand. *The New Zealand Journal of Science and Technology* 20:227B–232B.
[48] LeMasurier and Landis, Ref. 33, p. 1,453.
[49] Stirling, M.W., 1990. The Old Man Range and Garvie Mountains: tectonic geomorphology of the Central Otago peneplain, New Zealand. *New Zealand Journal of Geology and Geophysics* 33:233–243.
[50] Stirling, M.W., 1991. Peneplain modification in an alpine environment of Central Otago, New Zealand. *New Zealand Journal of Geology and Geophysics* 334:195–201.