Chapter 46

Western European Planation Surfaces

European Planation surfaces are fragmentary as a result of heavy erosion, most likely caused by late Flood erosion and their abundant rainfall.[1] Although they are fragmentary, planatin surfaces are numerous. In western Europe they generally are found at high altitudes.[2,3] Central Europe seems to have a larger proportion of planation surfaces than the rest of Europe. They too are found at high altitudes.[4]

Norway

The mountains of Norway include remnants of a mountaintop planation surface,[5,6,7] especially in southern Norway. In referring to Norway, Rohrman and others state:

> The morphology of southern Norway is characterized by high mountain peaks rising above an elevated upland plateau which itself is deeply incised by narrow valleys and fjords. The slightly undulating upland plateau is generally termed the "paleic surface"… It is thought to have formed by deep weathering in relatively warm climates…and can be mapped throughout Norway.[8]

The description of this planation surface is the same as others around the world in that monadnocks (inselbergs) remain on the surface as erosional remnants (see Part XI) and the surface was dissected *after* formation. Ollier and Pain tell us:

> The reality is that the Caledonian [Norwegian] structures were eroded to a plain, the planation surface was warped up much later to form a plateau, and later erosion made the mountains of Norway.[9]

Some have thought this planation surface to be very old and exhumed from underneath a cover of overlying sediments,[10] but I doubt whether there is any evidence for this. Others think the planation surface was formed at a low altitude and then uplifted in the mid to late Cenozoic,

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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] Aseev, A.A., N.S. Blagovolin, and L.R. Serebryannyi, 1984. Exogenic landforms of Europe. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 30–48.
[3] Embleton, C. and J. Demek, 1984. Introduction to Hercynian Europe. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 165–167.
[4] King, Ref. 1, p. 395.
[5] King, Ref. 1, pp 404–406.
[6] Whalley, W.B., B.R. Rea, M.M. Rainey, and J.J. McAlister, 1997. Rock weathering in blockfields: some preliminary date from mountain plateaus in North Norway. In, Widdowson, M. (editor), *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation*, Geological Society of London Special Publication No. 120, The Geological Society of London, London, U.K., pp. 133–145.
[7] Rudberg, S., 1984. Scandinavian highland. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 92–104.
[8] Rohrman, M., P. van der Beek, P. Andriessen, and S. Cloetingh, 1995. Meso-Cenozoic morphotectonic evolution of southern Norway: Neogene domal uplift inferred from apatite fission track thermochronology. *Tectonics* 14(3):707.
[9] Ollier C. and C. Pain, 2000. *The Origin of Mountains*, Routledge, London, U.K., p. 2.
[10] 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.

resulting in terrain similar to that found over many other continental areas, such as in eastern Australia with its tableland planation surface with an escarpment that separates a coastal plain.[11] Interestingly, glaciation had little effect in destroying the planation surfaces, proving glaciation of the area was short and not particular erosive.[12]

A lower planation surface lies along the west coast of Norway called a strandflat. It is possible that this could be a true marine planation surface that formed after the Flood, or it could be an exhumed planation surface.[13] Another possibility is the strandflat may be a very late Flood planation surface. More research is required to understand the origin of strandflats.

Figure 46.1 The near flat erosion surface of eastern Sweden taken from a monadnock.

Sweden and Finland

According to the uniformitarian ice age model, 2.6 million years and 30 or more ice ages have come and gone in the low altitudes of Sweden and Finland. Planation surfaces continue eastward into northwest Russia.[14] Amazingly, these areas still maintain several dissected

[11] Lidmar-Bergström, K., C.D. Ollier, and J.R. Sulebak, 2000. Landforms and uplift history of southern Norway. *Global and Planetary Change* 24:211–231.
[12] Oard, M.J., 2004. *Frozen In Time: The Woolly Mammoth, the Ice Age, and the Bible*, Master Books, Green Forest, AR.
[13] Lidmar-Bergström *et al*., Ref. 11, p. 226.
[14] Rudberg, Ref. 23, pp. 74–76.

planation surfaces with monadnocks (Figure 46.1).[15,16,17,18] Even less expected are the granitic tors in places (see Chapter 53). A tor is "A high, isolated crag, pinnacle, or rocky peak; or a pile of rocks, much jointed [cracked] and usually granitic…"[19] A moving ice sheet should have easily eroded them. Interestingly, in places pre-glacial soils still exist.[20] None of these observations make sense when we assume dozens of ice ages over millions of years. They instead imply glaciation was short and not very erosive.[12]

As in other parts of the world, the number of planation surface levels has been controversial. One scientist counted 13.[21] But, most have settled on three or four levels.[22,23] This number could still be due to uniformitarian assumptions about the ages of the rocks. The oldest is thought to be "Precambrian," so investigators assume that it must have been protected for hundreds of millions of years by a cover of sedimentary rocks that was exhumed late in geological time (see Appendix 15).[22,24] An "exhumed surface" appears to be an automatic fallback position to explain "old" planation surfaces. Discounting the dissection, this Precambrian surface is extremely flat: "In parts of southern and eastern Sweden the present land surface is an exhumed, extremely flat sub-Cambrian [Precambrian] peneplain [planation surface]."[25]

France

The Armorican Massif which includes the uplands of Normandy in northwest France has several planation surfaces showing erosional remnants.[26] The planation surfaces represent remnants of a regional surface, with a relatively high relief of the area caused by differential vertical tectonics.[27] The planation surface remnants are capped by quartz-rich gravel.

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[15] Hättestrand, C. and A.P. Stroeven, 2002. A relict landscape in the centre of the Fennoscandian glaciation: geomorphological evidence of minimal Quaternary glacial erosion. *Geomorphology* 44:127–143.

[16] Lidmar-Bergström, K., 1989. Exhumed Cretaceous landforms in south Sweden. *Zeitschrift für Geomorphologie N. F. Suppl.-Bd* 72:21–40.

[17] Miskovsky, K., 1985. The Baltic Shield relief and its development. *Fennia* 163:353–358.

[18] Söderman, G. 1985. Planation and weathering in eastern Fennoscandia. *Fennia* 163:347–352.

[19] Neuendorf, K.K.E., J.P. Mehl, Jr., and J.A. Jackson, 2005. *Glossary of Geology*, Fifth Edition. American Geological Institute, Alexandria, VA, p. 676.

[20] Elvhage, C. and K. Lidmar-Bergström, 1987. Some working hypotheses on the geomorphology of Sweden in the light of a new relief map. *Geografiska Annaler* 69A:343–358.

[21] Fogelberg, P., 1985. A filed symposium on preglacial weathering and planation held in Finland, May 1985. *Fennia* 163:283–287.

[22] Lidmar-Bergström, K., S. Olsson, and M. Olvmo, 1997. Palaeosurfaces and associated saprolites in southern Sweden. In, Widdowson, M. (editor), *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation*, Geological Society of London Special Publication No. 120, The Geological Society of London, London, U.K., pp. 95–124.

[23] Rudberg, S., 1984. Fennoscandian shield. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 55–76.

[24] Lidmar-Bergström, K., 1985. Regional analysis of erosion surfaces in southern Sweden. *Fennia* 163:341–346.

[25] Lidmar-Bergström, K., 1999. Uplift histories revealed by landforms of the Scandinavian domes. 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.

[26] Joly, F. and C. Embleton, 1984. Amorican Massif. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 178–182.

[27] Bonnet, S., F. Guillocheau, J.-P. Brun, and J. Van Den Driessche, 2000. Large-scale relief development related to Quaternary tectonic uplift of the Proterozoic-Paleozoic basement: the Armorican Massif, NW France. *Journal of Geophysical Research* 105(B8):19,273–19, 288.

The Massif Central in south central France is beveled and exhibits several planation surfaces, the largest being an upland planation surface.[28] The Rhine rift valley cuts north-south through a broad arch or anticline. The Vosges Mountains in eastern France are on the west margin of the uplift and have a planation surface at the top.[29] The Ardennes Mountains of northeast France and adjacent northern Luxembourg, southern Belgium, and northwest Germany has a highly complex set of planation surfaces.[30]

Spain

The Iberian Range, the next range south of the Pyrenees, lies in eastern Spain. It has strongly dissected planation surfaces that bevel tilted rocks, but whether there is one that has been faulted up to various heights or there are numerous planation surfaces is debated.[31] Twenty percent of the area represents planation surfaces. The one that is considered the oldest is poorly preserved and lies at the top of the range. It mainly consists of accordant summits.[32] A little lower an obvious planation surface truncates folded sedimentary rocks. There are also several other even lower planation surfaces. The lowest are pediments at the edges of higher terrain (see Part XIV for information on pediments). Once again, the origin of these planation surfaces is a mystery to uniformitarian geologists:

> Erosion surfaces have long been recognized in the central—eastern part of the Iberian Chain… Nevertheless, no consistent model has been proposed to date to explain the complex relationships between erosion, sedimentation and tectonics during the Tertiary in this area.[33]

A similar geomorphology is eroded onto the Iberian Massif of western Spain. [34,35,36] Rounded quartzite rocks, some large, cap some of these planation surfaces.

The Pyrenees also have numerous planation surfaces that truncate the mountain structure.[37] The planation surfaces are mainly at two altitudes and dissected. There is an extended, dissected planation surface at the top of the eastern Pyrenees. A lower surface, probably a pediment

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[28] Joly, F, 1984. Massif Central. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 182–193.
[29] Demek, J. and C. Embleton, 1984. Rhineland. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 201–202.
[30] Demek, J. and C. Embleton, 1984. Ardennes. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 209–210.
[31] Casas-Sainz, A.M., and A.L. Cortés-Gracia, 2002. Cenozoic landscape development within the Central Iberian Chain, Spain. *Geomorphology* 44:19–46.
[32] Gutiérrez-Elorza, M. and F.J. Gracia, 1997. Environmental interpretationand evolution of the Tertiary erosionsurfaces in the Iberian Range (Spain). In, Widdowson, M. (editor), *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation*, Geological Society of London Special Publication No. 120, The Geological Society of London, London, U.K., pp. 147–158.
[33] Casas-Sainz and Cortés-Gracia, Ref. 31, p. 20.
[34] Sala, M., 1984. Pyrenees and Erbo Basin complex. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 283–285.
[35] Ballesteros, E.M., J. G. Talegón, and M.A. Vicente Hernández, 1997. Palaeoweathering profiles developed on the Iberian Hercynian basement and their relationship to the oldest Tertiary surface in central and western Spain. 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. 175–185.
[36] Sala, M., Iberian Massif. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 294–322.
[37] Sala, Ref. 34, p. 273.

formed along the edges of the mountains.[38] The erosion that created the eastern Pyrenees planation surfaces filled up the basins to the north and south with up to 10,000 feet (3 km) of conglomerate, much of it was subsequently eroded.[38,39] The formation of the mountaintop planation surfaces is a mystery and the filling of the adjacent valleys with conglomerate does not help, neither does the idea of planation happening during an Ice Age.[38]

The Pyrenees are similar to planation surfaces found in mountain ranges all over the world, as this ebook attests:

> This later definition [of a peneplain] derives from numerous works which have interpreted the occurrence of highly elevated, more or less flat, erosional surfaces *in mountain ranges throughout the world* as remnants of originally low peneplains, later uplifted and now dissected by the recent drainage network…(emphasis and brackets mine).[40]

Since these authors are referring to nearly flat erosion surfaces, they should be properly called planation surfaces. There are also incised planation surfaces at 3,300 to 6,600 feet (1,000 to 2,000 m) on the north flank of the Pyrenees.[41]

Remnants of summit planation surfaces also are found in the Baetic Cordillera of southern Spain.[42,43]

Corsica and Sardinia

Some scientists have thought there once was a planation surface on the top of western Corsica that was probably eroded.[44] But a planation surface still exists on Sardinia which is thought to have been exhumed because it is dated so old.[45]

Germany

A number of high altitude massifs in Germany have planation surfaces. The Black Forest on the east side of the Rhine Valley rift has several small planation surface remnants remaining after intense dissection.[46] The highest, at the tops of the plateaus, truncates igneous and metamorphic rocks. It is remarkably flat at an altitude of about 4,775 feet (1,455 m) with a few higher altitude inselbergs.[47] There are lower altitude benches or planation surfaces, as well as strath terraces which are terraces cut in hard rock high above a river or valley. There is no rock or structural

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[38] Calvet, M. and Y. Gunnell, 2008. Planar landforms as markers of denudation chronology: an inversion of East Pyrenean tectonics based on landscape and sedimentary basin analysis, In, Gallagher, K., S.J. Jones, and J. Wainwright (editors), *Landscape Evolution: Denudation, Climate and Tectonics Over Different Time and Space Scales*, Geological Society, London, Special Publication 296, pp. 147-166.

[39] Coney, P.J., J.A. Muñoz, K.R. McClay, and C.A. Evenchick, 1996. Syntectonic burial and post-tectonic exhumation of the southern Pyrenees foreland fold–thrust belt. *Journal of the Geological Society, London* 153:9-16.

[40] Babault, J., J. Van Den Driessche, and S. Bonnet, 2005. Origin of the highly elevation Pyrenean peneplain. *Tectonics* 24:1.

[41] Ollier and Pain, Ref. 9, p. 83.

[42] Sala, M., 1984. Baetic cordillera and Guadalquivir Basin. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 323–340.

[43] King, Ref. 1, p. 530.

[44] Demek, J., 1984. Corsica. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 198–199.

[45] Sestini, A., 1984. Sardinia. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 200–201.

[46] Demek and Embleton, Ref. 29, pp. 202–204.

[47] Huguet, F., 2004. Piedmont benchlands of the southern black Forest (Germany) correlative with the Cenozoic tectonic and climatic history of the area. *Norsk Geografisk Tidsskrift—Norwegian Journal of geography* 58:49–60.

control of these planation surfaces,[48] which defies the concept of slow erosion over millions of years. The geomorphology exhibited in the Black Forest is similar to many of Europe's mountainous areas.[47]

A little farther north is the Middle Rhine Highlands with planation surfaces cutting across the structure of the rocks.[49] Other planation surfaces in Germany top the Harz Mountains[50] and the Thuringia upland.[51]

Figure 46.2. The accordant summits of the mountains of northeastern Switzerland and southeastern Germany.

The Alps

The Alps generally have accordant mountain tops near the same elevation over wide areas (Figure 46.2). This has caused many geomorphologists to suggest that the top of the Alps represents a planation surface that was totally eroded, so that no flat mountaintops remain.[52] The

[48] Davis, W.M., 1932. Piedmont benchlands and primärrümpfe. *GSA Bulletin* 43:399–440.
[49] Demek and Embleton, Ref. 29, pp. 205–209.
[50] Demek, J. and C. Embleton, 1984.Weser-Saale Hill country. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 214–215.
[51] Demek and Embleton, Ref. 50, pp. 215–216.
[52] Ollier and Pain, Ref. 9, p. 34.

planation surface has a special name called a "Gipfelflur." It was thought to have formed at low altitudes and then uplifted in the Pliocene within uniformitarian geological time.[53]

Some of the lower altitude mountains, the top of the Jura Mountains northwest of the main Alps, as well as some of the foothill areas, show planation surfaces that bevel (cut through) the strata.[54,55]

Italy

Italy is quite mountainous, but there are a number of planation surfaces there as well. The Apennine Mountains that form the north-south spine of Italy rose in the late Cenozoic according to uniformitarian geology. Many planation surfaces or possible planation surface remnants have been suggested.[56] They bevel deformed sedimentary rocks and can be remarkably flat.[57] Ollier and Pain state:

> After the nappe [overthrust] movement came a period of erosion which created an essentially flat planation surface cutting across earlier rock structures. Regardless of arguments about the age and perfection of the planation surfaces, the old structures associated with the nappes are eroded, and vertical uplift made the present Apennines, mainly in the last 2 million years.[58]

Presently, the planation surfaces lie at many altitudes, some even below sea level, with even small, scattered ones on the highest mountains.[59] Small planation surfaces are carved into mountain slopes and are considered strath terraces.[60] Because the planation surfaces are also assigned to the late Cenozoic, uniformitarian scientists wonder if there is enough time for their formation: "One may wonder whether this time interval was long enough to allow the carving of planation surfaces in the present-day chain area."[61] Ollier and Pain sum up the sequence of events that formed the planation surfaces and the mountains of Italy.

1 there was a single planation surface across the Italian peninsula;
2 it was very flat;
3 it is better preserved on harder rocks and in the higher parts of the local relief;
4 it cuts terrain ranging in age from Palaeozoic to early Lower Pliocene;
5 it smoothed tectonic structures developed on the older terrain;

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[53] Ollier and Pain, Ref. 9, pp. 60–63.
[54] King, Ref. 1, p. 530.
[55] Fink, J. and B. Bauer, 1984. Eastern Alps. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp.243–249.
[56] Sestini, A., 1984. Appennines [sic] and Sicily. In, Embleton, C. (editor), *Geomorphology of Europe*, John Wiley & Sons, New York, NY, pp. 341–354.
[57] Coltorti, M. and P. Pieruccini, 2000. A late Lower Pliocene planation surface across the Italian Peninsula: a key tool in neotectonic studies. *Journal of Geodynamics* 29:323–328.
[58] Ollier and Pain, Ref. 9, p. 66.
[59] Amato, A. and A. Cinque, 1999. Erosional landsurfaces of the Campano-Lucano Apennines (S. Italy): genesis, evolution, and tectonic implications. *Tectonophysics* 315:259.
[60] Basili, R., F. Galadini, and P. Messina, 1999. The application of palaeoland surface analysis to the study of recent tectonics in central Italy. 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. 109–117.
[61] Bartolini, C., 1999. An overview of Pliocene to present-day uplift and denudation rates in the Northern Apennine. 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. 119–125.

6 it is buried in places under continental and marine deposits younger than late Lower Pliocene;
7 after the end of the Lower Pliocene it was displaced and deformed by limited thrust re-activation and by high angle normal faults;
8 the planation surface was created in a relatively short time, much less than is usually assumed.[62]

[62] Ollier and Pain, Ref. 9, p. 72.