Chapter 60

Strath Terraces

All over the world we find terraces flanking the sides of valleys. Generally, they run parallel to and above a river and its immediate floodplain. Most of them are composed of gravel that was laid down when a river overflowed its banks. I call these gravel terraces for obvious reasons. Figure 60.1 shows a schematic of how they were formed. The largest ones were deposited by melt-water from the Ice Age. An example of this kind of terrace is found in the upper Snake River Valley of Jackson Hole Valley, Wyoming. It formed when the Yellowstone ice cap melted (Figure 60.2).

Strath terraces are similar to gravel terraces in that they lie along the sides of a valley. Their uniqueness lies in that they are elongated planation surfaces cut in bedrock and covered with a thin layer of gravel, cobbles, and boulders (Figure 60.3). Uniformitarian scientists think strath terraces are remnants of a flat, broad valley floor (a strath) that was carved flat in bedrock, with subsequent downcutting leaving the side of the old rock floor hanging along the sides of the valley.[1] Flat bottom valleys, according to their hypothesis, represent a period of valley widening with no deepening. I mostly agree with their interpretation, except I am convinced a river did not erode the old bedrock floor nor did it cause the subsequent downward erosion. Rivers tend to mostly cut downward, for planatin across the whole valley, a valley-side flow of water is required. Melting at the end of the Ice Age with its occasional turbid valley-wide flooding could carve strath terraces.

Strath Terraces Common along Valleys All over the World

Just like with gravel terraces, strath terraces are also found along valleys all around the world. Many are in the western United States and line the rivers and streams that drain the western Oregon coastal range. [2,3,4] Uniformitarian scientists consider these terraces are mostly from glacial deposition and erosion from dozens of ice ages:

> The well-preserved strath-terrace sequences found in many river systems of western North America record discontinuous incision into bedrock throughout the late Quaternary…[5]

A classic location for analyzing these terraces is the upper Wind River basin. It lies between the Wind River Mountains to the south and the Absaroka Mountains to the north.[6]

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[1] Neuendorf, K.K.E., J.P. Mehl, Jr., and J.A. Jackson, 2005. *Glossary of Geology*, Fifth Edition. American Geological Institute, Alexandria, VA, p. 632.

[2] Hancock, G.S. and R.S. Anderson, 2002. Numerical modeling of fluvial strath-terrace formatin in response to oscillating climate. *GSA Bulletin* 114(9):1,131–1,142.

[3] Merritts, D.J., K.R. Vincent, and E.E. Wohl, 1994. Long river profiles, tectonism, and eustasy: a guide to interpreting fluvial terraces. *Journal of Geophysical Research* 99(B7):14,031–14,050.

[4] Personius, S.F., 1995. Late Quaternary stream incision and uplift in the forearc of the Cascadia subduction zone, western Oregon. *Journal of Geophysical Research* 100:20,193–20,210.

[5] Hancock and Anderson, Ref. 2, p. 1,132.

[6] Oard, M.J., 2014. Were the Wind River Terraces Caused by Multiple Glaciations? *Creation Research Society Quarterly* 51(3):154–177.

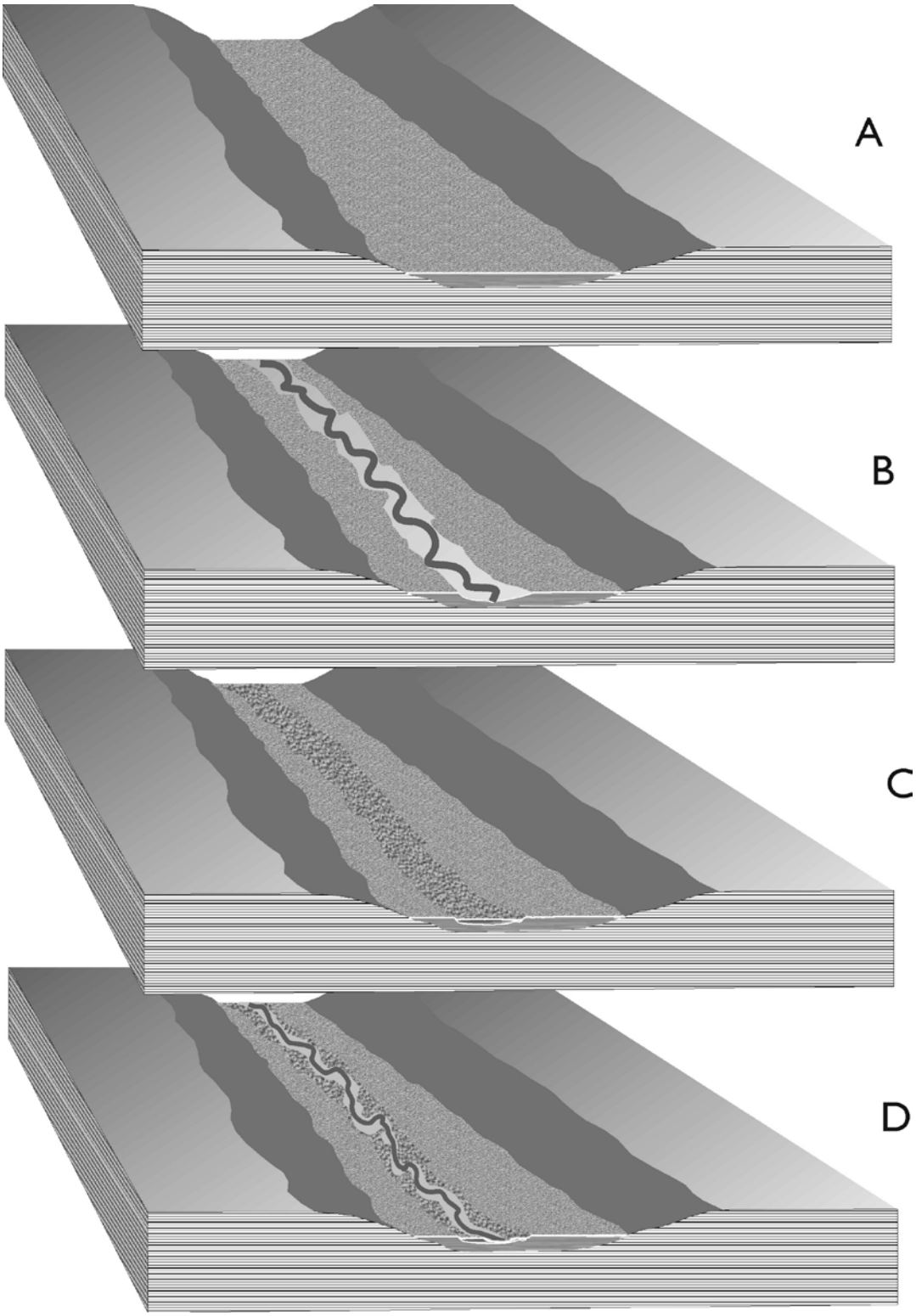

Figure 60.1 The formation of two gravel terraces in a river valley. A) The river valley is first carpeted with a layer of coarse gravel. B) The river erodes this gravel, leaving gravel terraces on either side of the valley. C) A second depositional event partially fills the eroded valley with coarse gravel. D) The river erodes the second layer resulting in new gravel terraces (drawn by Peter Klevberg).

Figure 60.2 A large terrace along the Snake River at Snake River Overlook, Jackson Hole, Wyoming, caused by outwash from the melting Yellowstone ice cap.

Strath terraces are also common in the valleys that dissect the Appalachian Plateau Province west of the Valley, and Ridge Province of the Appalachians. One level is generally called the Parker Strath terrace, about 330 feet (100m) above the bottom of the valleys.[7] Figure 60.4 shows the Parker Strath terrace along the edge of the Cumberland Plateau of the southern Appalachian Plateau.

Strath terraces are also reported in Alaska, eastern Tibet and eastern Bolivia;[8] Taiwan;[9,10] the Tien Shan Mountains;[11] along the Somme river of France,[3] and along the valleys of the western

[7] Oard, M.J., 2011. Origin of Appalachian Geomorphology Part II: formation of surficial erosion surfaces. *Creation Research Society Quarterly* 48(2):111–113.
[8] Montgomery, D.R., 2004. Observations on the role of lithology in strath terrace formation and bedrock channel width. *American Journal of Science* 304:454–476.
[9] Yanites, B.J., G.E. Tucker, K.J. Mueller, and Y.-G. Chen, 2010. How rivers react to large earthquakes: evidence from central Taiwan. *Geology* 38(3):639–642.
[10] Shyu, J.B.H., K. Sieh, J.-P. Avouac, W.-S. Chen, and Y.-G. Chen, Millennial slip rate of the Longitudinal Valley fault from river terraces: implications for convergence across the active suture of eastern Taiwan. *Journal of Geophysical Research* 111 (B08403):1–22.
[11] Molnar, P. *et al*., 1994. Quaternary climate change and the formation of river terraces across growing anticlines on the north flank of the Tien Shan, China. *The Journal of Geology* 102:583–602.

Andes of South America.[12] These are just a sample from the available literature. Most likely there are Strath terraces by the thousands in other areas that have yet to be reported.

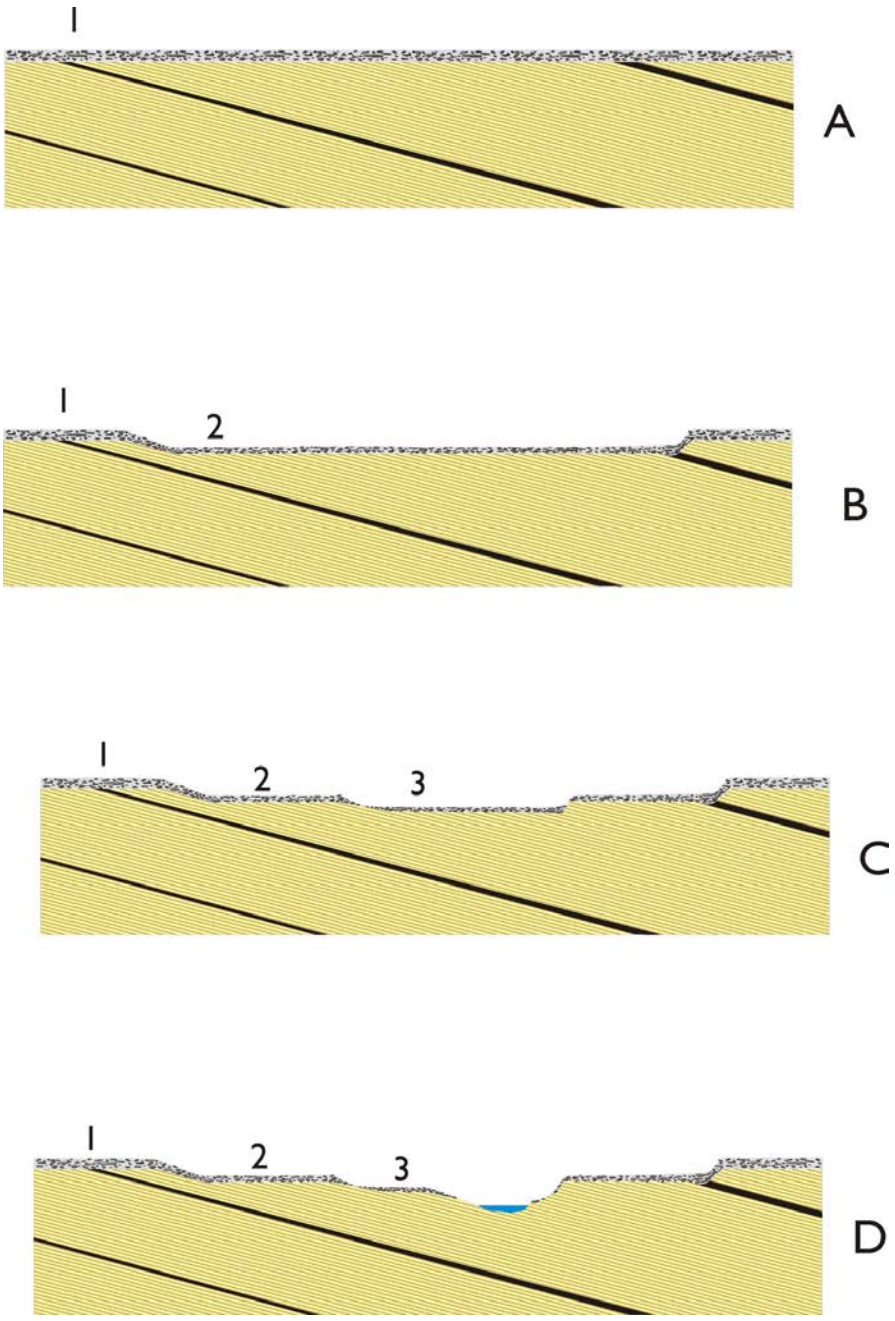

Figure 60.3. The formation of three strath terraces in a river valley. A) The river first erodes a nearly flat planation surface, or "strath," on hard rock and deposits a thin veneer of coarse gravel across the entire valley. B) The river erodes some of the bedrock, leaving strath terraces on either side of the valley. C) A second erosional event creates a second set of strath terraces. D) A third episode forms a third set of strath terrace (drawn by Peter Klevberg).

[12] Hall, S.R., D.L. Farber, L. Audin, R.C. finkel, A.-S. Mériauz, 2008. Geochronology of pediment surfaces in southern Peru: implications for Quaternary deformation of the Andean forearc. *Tectonophysics* 459:200

Some Strath Terraces Likely Formed after the Flood

C.H. Crickmay states that small planation surfaces (strath terraces) can form when a river overflows its banks and bevels the bedrock.[13] Modern rivers have been known to produce small terraces. Extensive flooding from Ice Age meltwater and times of heavy early Ice Age rainfall would also form strath terraces. These terraces would form near the valley bottom. This may account for some of the lower-level strath terraces found west of the Oregon coast range[2] and in the western Olympic Mountains of Washington.[14]

Figure 60.4. The rolling Parker strath terrace (left arrow) west of the planation surface of the Cumberland Plateau (right arrow).

Origin of Most Strath Terraces Unknown

Although some strath terraces can be linked to river floods, especially during Ice Age runoff, most strath terraces are difficult to explain especially those where the area was never glaciated: "Despite the widespread use of strath terraces in fluvial and tectonic geomorphology, the

[13] Crickmay, C.H., 1974. *The Work of the River: A Critical Study of the Central Aspects of Geomorphology*, American Elsevier Publishing Co., New York, NY, p. 205.
[14] Wegmann, K.W. and F.J. Pazzaglia, 2002. Holocene strath terrace, climate change, and active tectonics: the Clearwater River basin, Olympic Peninsula, Washington State. *GSA Bulletin* 114(6):731–744.

conditions surrounding planation of a strath surface are not well understood."[15] Hancock and Anderson write:

> The timing, duration, and mechanisms of strath terrace formation are difficult to infer solely from field observations because terrace sequences represent incomplete records, are difficult to date, and formed during fluvial conditions that differ from the present.[5]

Some scientists are convinced the bedrock was bevelled across the entire valley during increased sediment supply when the valley was at a higher level.[16] Others think strath terraces are formed by meander migration and cutoff.[17] Still others state that they are caused by an accelerated incision rate, although the cause is unknown.[2] Accelerated uplift is suggested by others.[3]

High Strath Terraces Formed during Channelized Flood Runoff

Gravel terraces are commonly seen just above the river, except in glaciated areas where the gravel terrace can be significantly higher due to extensive outwash during glacial melting. Interestingly, most strath terraces are found high along the edge of the valleys, sometimes many hundreds of feet above the river:

> In many actively incising river canyons, gravel-capped bedrock (strath) terraces occur tens to hundreds of meters above the active channel and extend discontinuously for kilometers, often paralleling the river profile.[18]

Strath terraces in the Wind River drainage are as high as 820 feet 9250 m) above the Wind River.[19] Since there was only one Ice Age[20] and there has been only about 4,500 years of erosion since the Flood, it is highly unlikely high level strath terraces, which are actually remnants of planation surfaces, were cut after the Flood. This leaves only the runoff stage of the Flood to explain the erosion.[6]

Among the mysteries of strath terrace formation for uniformitarian scientists is they are believed to have formed under unique hydraulic conditions:

> The morphology of the straths underlying the lowest continuous terraces described above clearly indicates that they were formed under hydraulic conditions different from those of modern stream channels.[21]

Straths are considered to have formed across the entire valley by beveling the bedrock below and eroding into the sides of the valley. That is why Wegman and Pazzaglia believe the original strath was formed by simple lateral or horizontal cutting of the river.[22] As already stated, this presents a problem since, since rivers tend to downcut more than erode laterally. This will be discussed further in Chapter 66.

Channelized Flood currents can easily form straths and strath terraces. The currents were mainly confined to valleys. Water would cover the entire valley cutting it deeper and wider and

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[15] Fuller, R.K., L.A. Perg, J.K.Willenbring, and K. Lepper, 2009. Field evidence for climate-driven changes in sediment supply leading to strath terrace formation. *Geology* 37(5):467.
[16] Fuller *et al.* Ref. 15, pp. 467–470.
[17] Finnegan, N.J. and W.E. Dietrich, 2011. Episodic bedrock strath terrace formation due to meander migration and cutoff. *Geology* 39(2):143–146.
[18] Finnegan and Dietrich, Ref. 17, p. 143.
[19] Hancock and Anderson, Ref. 2, p. 1,138.
[20] Oard, M.J., 2004. *Frozen In Time: The Woolly Mammoth, the Ice Age, and the Biblical Key to Their Secrets*, Master Books, Green Forest, AR.
[21] Personius, Ref. 2, p. 20,199.
[22] Wegmann and Pazzaglia, Ref. 14, p. 734.

ending with a flat valley-wide planation surface called a strath. Further downcutting, would leave remnants of the strath along the edge of the valley or even within the middle of a broad valley. The former would actually be a pediment (see Part XIV) while the later a planation surface.