Part XVII

Gaps in Uniformitarian Hypotheses

With thousands of water and wind gaps across the earth, one would expect a good uniformitarian explanation of these features, especially since they have been studied for so long—that is if uniformitarianism (or actualism) were true for the past. In 1869, John Wesley Powell rafted the Green River through the deep water gap in the Uinta Mountains. He was convinced that an "antecedent river" cut this water gap as the Uinta Mountains slowly uplifted.[1] Despite this and many other hypotheses, uniformitarian scientists have been unable to explain water gaps.

There are five uniformitarian hypotheses to explain the origin of water gaps, also called transverse drainage.[2] Two of these, the surface expression of faults cutting through the mountains and William Morris Davis' relief inversion plus reversal in drainage are not considered significant today. So, there really are only three main uniformitarian hypotheses: (1) the antecedent stream (or river), (2) the superimposed stream, and (3) stream piracy.[3] Various water gaps are explained by one or more of these ideas in combination. However, as we analyze each, we will see that all have serious shortcomings.

A fourth, the lake spillover hypothesis, has recently been revived, but it applies to very few water gaps. In isolated cases, this explanation may be true. Some water gaps, such as those in the Zagros Mountains, are explained by one or more of these hypotheses in combination. However, as we analyze each, we will see that all have serious shortcomings, so it is questionable whether two or more failed hypotheses can work.

---

[1] Ranney, W., 2005. *Carving Grand Canyon: Evidence, Theories, and Mystery*, Grand Canyon Association, Grand Canyon, AZ, pp. 62–67.

[2] Oberlander, T., 1965. *The Zagros Streams: A New Interpretation of Transverse Drainage in an Orogenic Zone*, Syracuse Geographical Series No. 1, Syracuse, NY, pp. 2–4.

[3] Stokes, M. and A.E. Mather, 2003. Tectonic origin and evolution of a transverse drainage: the Río Almanzora, Betic Cordillera, Southeast Spain. *Geomorphology* 50:76.

Chapter 80

Antecedent Stream Hypothesis—Mostly Rejected

As defined in Chapter 75, an antecedent stream is: "A stream that was established before local uplift or diastrophic movement was developed across it and that maintained its original course after and in spite of the deformation by incising its channel at approximately the same rate as the land was rising; a stream that existed prior to the present topography"[4] This long definition is stated for streams, but the definition also applies for rivers, in other words any flowing body of water. The hypothesis postulates that a river was flowing *before uplift* on a landscape of low relief or nearly flat. Then a barrier, such as a mountain range, uplifted in the path of the stream, but the uplift was "so slow" that the stream or river was able to maintain its course by eroding down into the rising landscape (Figure 80.1). the hypothesis of an antecedent streams applies mainly to *large* rivers because supposedly only large rivers have enough erosive power to keep up with uplift.[5]

Figure 80.1. Plaque of the antecedent river hypothesis of the Yakima River through a lava ridge. The Yakima River supposedly came first and then the ridge slowly uplifted while the river eroded the ridge at the same location.

[4] Neuendorf, K.K.E., J.P. Mehl, Jr., and J.A. Jackson, 2005. *Glossary of Geology*, Fifth Edition. American Geological Institute, Alexandria, VA, p. 27.
[5] Ahnert, F., 1998. *Introduction to Geomorphology*, Arnold, London, U.K., p. 201.

Origin of the Hypothesis

The antecedent stream hypothesis seems to have been the first hypothesis used to account for water gaps. It was first described in the early 1960s.[6] John Wesley Powell simply *assumed* it and applied it to the Green River passing through the eastern Uinta Mountains in a slot canyon (see Chapter 76 and Figure 76.3), as well as the Colorado River rushing through Grand Canyon. The rivers were thought to have first flowed on a generally flat land where the mountains and plateaus slowly uplifted while the rivers stayed the course. Most geologists after Powell accepted this hypothesis for the Green and Colorado Rivers and applied it widely to many other rivers and streams around the world.

Should Apply to Most Mountains

The antecedent stream hypothesis is especially popular in areas where streams have eroded gaps across mountains that were uplifted late in the uniformitarian geological timescale, like the Himalayas, the Alps, and the Cascade Mountains of the northwest United States. Most mountains are now thought to have uplifted late in the Cenozoic.[7] The antecedent stream hypothesis *should be* widely applicable, especially since vertical earth movements are generally quite slow within the uniformitarian timescale. Rivers should be easily capable of rapid vertical incision without changing their courses.[8]

Many Severe Problems with the Hypothesis

Despite its early appeal and applicability the hypothesis has many challenges. The water gaps in Wales are cut through "old" mountains.[9] The rivers would then have to be *even older*, which is considered an impossibility by uniformitarian scientists. So, the Wales water gaps are assumed to have originated by the superimposition hypothesis (discussed in the next chapter)—apparently their only alternative. Superimposition apparently just fills a theoretical void. In order to demonstrate antecedence, they must prove the river in question *predates* the uplift. This is very difficult.[10]

Adding to their difficulties, uplift must be slow enough for the river's course to not be deflected.[11] Some investigators claim river erosion would be too slow in comparison to mountain uplift. As a result the river should be diverted and transverse gorges should never form through antecedence. Although Twidale disagreed, he did admit antecedent rivers or streams are now considered *rare*.[12]

Another problem is that the hypothesis represents a *special conjunction of time and erosion*. If the river is flowing through an enclosed basin and the adjacent mountains rise too fast, there should be river or lake deposits upstream from the barrier, within the basins. These deposits

---

[6] Douglass, J.C., 2005. *Criterion Approach to Transverse Drainages*. PhD thesis, Arizona State University, Tucson, AZ, p. 11.
[7] Ollier C. and C. Pain, 2000. *The Origin of Mountains*, Routledge, London, U.K.
[8] Small, R.J., 1978. *The Study of Landforms: A Textbook of Geomorphology*, second edition, Cambridge University Press, London, U.K., p. 239.
[9] Small, Ref. 8, p. 242.
[10] Twidale, C.R., 1976. *Analysis of Landforms*, John Wiley & Sons Australasia Pty Ltd, New York, NY, p. 438.
[11] Ranney, W., 2005. *Carving Grand Canyon: Evidence, Theories, and Mystery*, Grand Canyon Association, Grand Canyon, AZ, p. 65.
[12] Twidale, Ref. 10, p. 439.

should exist despite whether the river successfully erodes through the barrier or not.[13] Such deposits are rarely if ever found.

If a water gap through one barrier is difficult to achieve, *aligned water gaps* through multiple uplifts in a generally straight line is that much more improbable. Aligned water gaps are found in the Appalachian Mountains (see Chapter 77).

The antecedent stream hypothesis appears to be a very simplistic explanation with little or no evidence. Sometimes, this idea is put forward simply because the alternatives seem even more improbable.[14] It is almost impossible to demonstrate the antecedence hypothesis. Twidale noted the difficulty of "proving" antecedence:

> It is fair to state that though many rivers of tectonically active regions are probably of such an origin [antecedence], but like warping in relation to river capture, it is difficult to prove. The ages of the river and of the implied tectonism have to be established, and this is rarely possible.[15]

Antecedence Never Had Any Evidence

Most water gaps were once assumed to have formed by antecedence. But after more knowledge was gained, a large majority had to be "reinterpreted". So, another hypothesis had to take its place. One example is the water gaps on the Laramie, Arkansas, North Platte, and South Platte Rivers in the east central Rocky Mountains. They were previously thought to have been cut by antecedent streams, but are now considered a consequence of superimposed streams.[16] Regardless of the merit of the new hypothesis, such rejection of the antecedent stream hypothesis suggests that there was in reality little or no evidence for the hypothesis in the first place.

The Green River water gap through the Uinta Mountains (see Figure 76.3) was considered a "classic" example of the antecedent stream hypothesis, but this mechanism has since been refuted by Twidale.[15] The evidence was quite limited to start with; the hypothesis was simply speculation. There is now strong evidence against antecedence in the vast majority of water gaps. Chorley and others confessed:

> In practice it is often difficult to assign a cause to such [stream] discordance; indeed, the type example of supposed antecedence, that of the Green River cutting across the Uinta Mountains in northern Utah, is now considered to be due, in part at least, to superimposition.[17]

Table 80.1 summarizes these difficulties with the antecedent stream hypothesis.

---

[13] Humphrey, N.F. and S.K. Konrad, 2000. River incision or diversion in response to bedrock uplift. *Geology* 28:43–46.
[14] Small, Ref. 8, p. 241.
[15] Twidale, C.R., 2004. River patterns and their meaning. *Earth-Science Reviews* 67:193.
[16] Short, N.M. and R.W. Blair, Jr. (editors), 1986. *Geomorphology from Space: A Global Overview of Regional Landforms*, NASA, Washington, D.C., p. 42.
[17] Chorley, R.J., S.A. Schumm, and D.E. Sugden, 1984. *Geomorphology*, Methuen, London, U.K., p. 21.

1. Antecedence thought common, but now considered rare
2. Streams must predate mountain uplift
3. Mountain uplift must be slow enough to not deflect the stream
4. The uplifting mountain never blocked the stream to form a lake
5. Cannot demonstrate its plausibility
6. Aligned water gaps nearly impossible to explain by antecedence

Table 80.1. Problems with the antecedent stream hypothesis.