Chapter 67

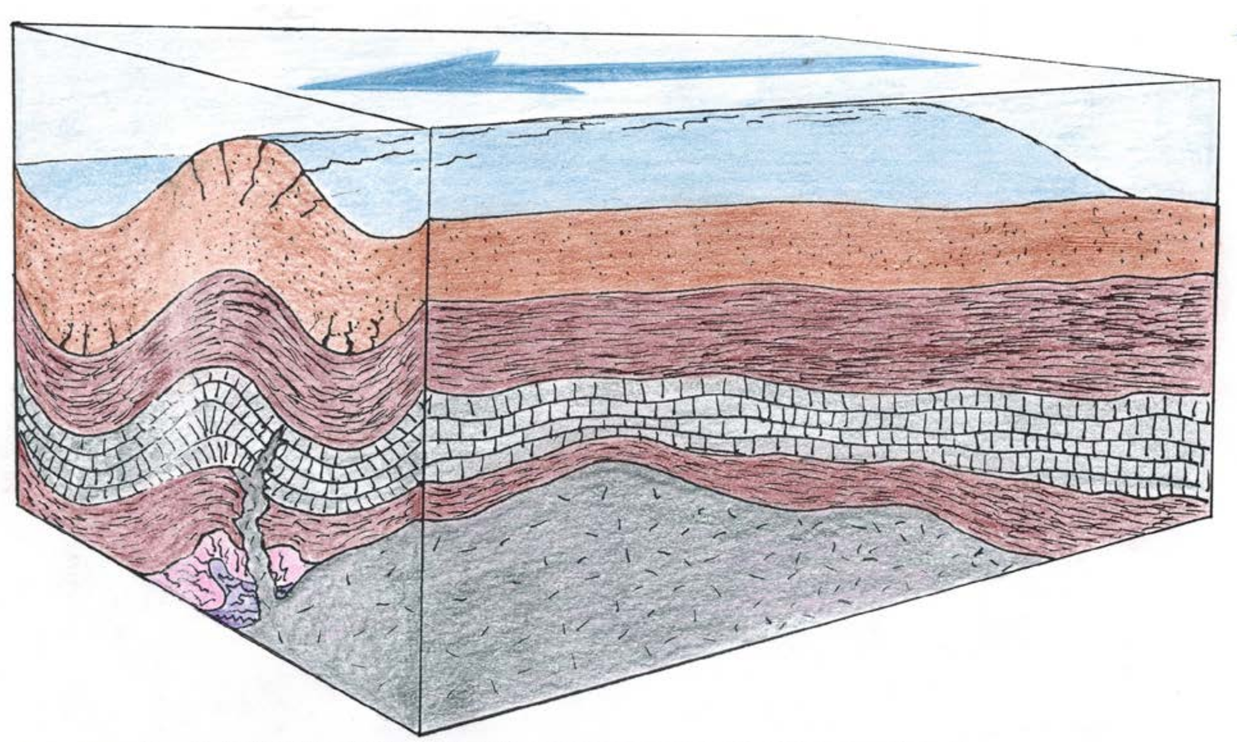
Pediments Formed in the Retreating Stage of the Flood

If present-day processes do not have the power to form pediments, then sometime in the past there had to have been a far more powerful force involving water. Even Crickmay's superfloods are not large enough to top mountains. This leaves the Genesis Flood as the only option left.

Pediments are surficial landforms that are commonly found in valleys and show little modification subsequent to the planation that molded them. Therefore, it is reasonable to place pediments as one of the very last landforms shaped by the Retreating Stage of the Flood. This would place their origin at the very end of the Channelized Flow Phase.[1,2,3,4]

A Pediment Formation Hypothesis

It is my conviction pediments were formed by deep erosive currents that flowed *parallel* to a barrier, such as a mountain range or within a valley. This flow of water Flood would be similar to Crickmay's superflood, but on a much larger scale. It had to fill the *entire* valley close to the mountaintops, which lower with time (Figure 67.1).

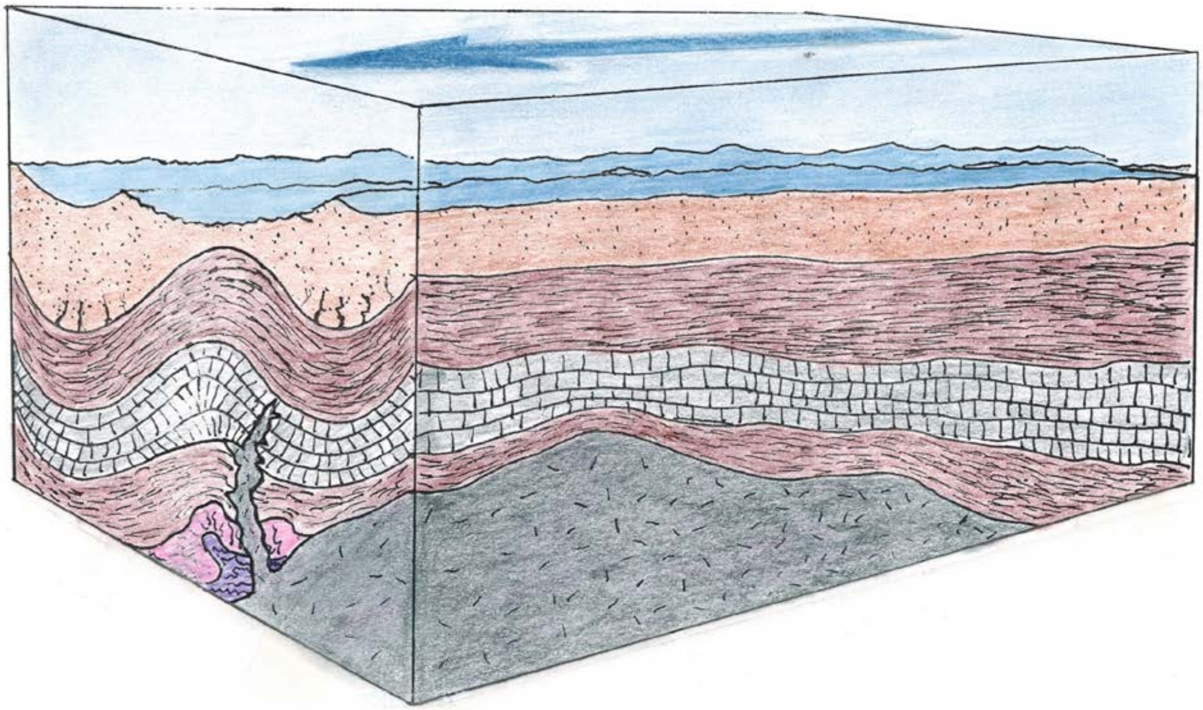


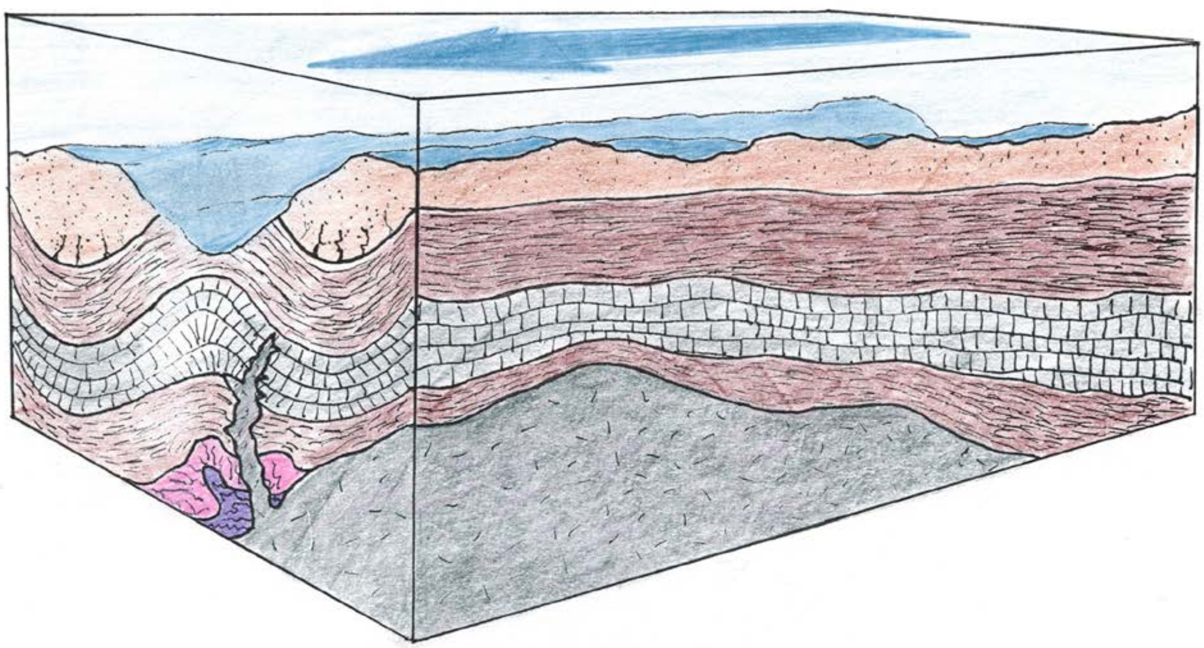
[1] Walker, T., 1994. A Biblical geological model. In, Walsh, R E. (editor), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, Pennsylvania, pp. 581-592.

[2] Oard, M.J., 2001. Vertical tectonics and the drainage of Floodwater: a model for the middle and late diluvian period—Part I. *Creation Research Society Quarterly* 38 (1):3-17.

[3] Oard, M.J., 2004. Pediments formed by the Flood: evidence for the Flood/post-Flood boundary in the Late Cenozoic. *Journal of Creation* 18(2):15-27.

[4] Oard, M.J., 2008. *Flood by Design: Receding Water Shapes the Earth's Surface*. Master Books, Green Forest, AR.





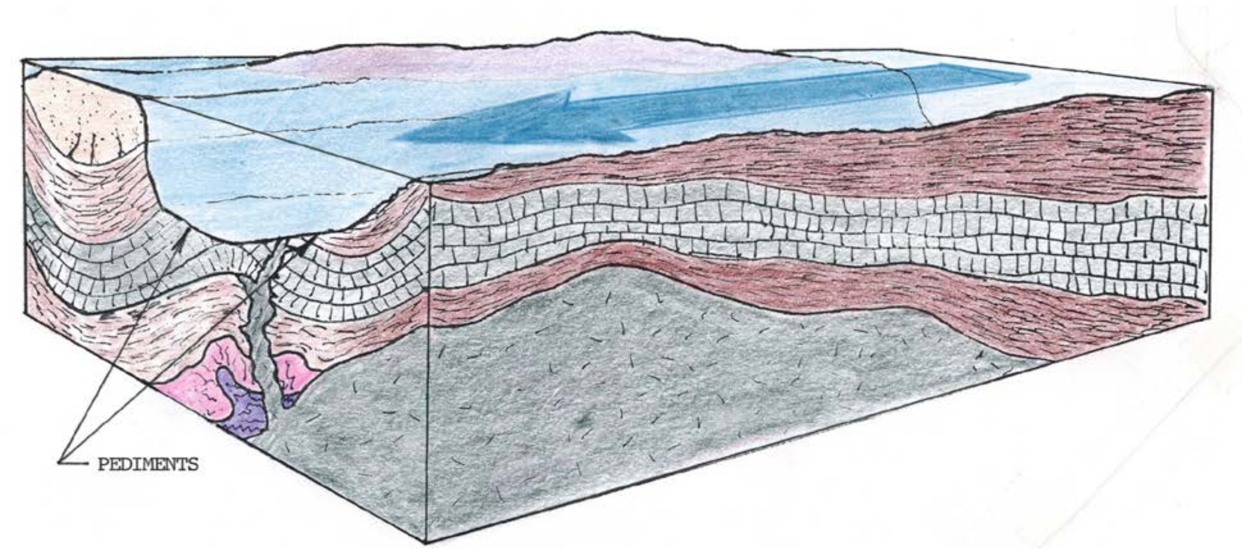
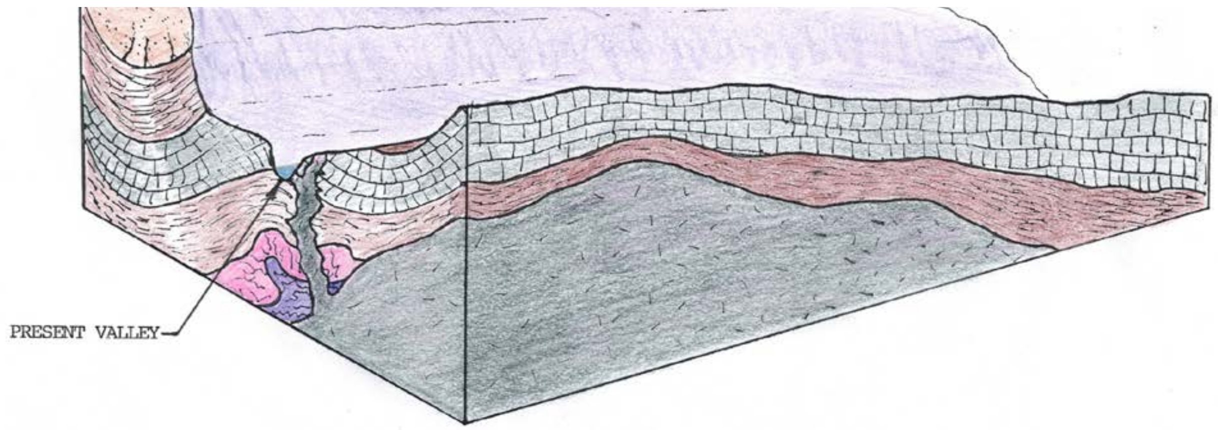


Figure 67.1a-e. Block diagram showing the developing of pediments along the sides of mountains during the downvalley drainage and erosion of the Floodwater (drawn by Peter Klevberg).



What particular properties of Floodwaters rushing down valleys would produce pediments? Since pediments have not been significantly altered since formation, they probably represent the erosive effects of the *last strong current velocity*. All this happened during powerful downward erosion of the valley fill in valleys and basins of the Rocky Mountains (Figure 67.2):

> The most recent significant geomorphic event affecting the Laramide region [the Rocky Mountains] involves the exhumation of the range-bounding, sediment-filled basins. Many of these basins have been eroded to depths of 1 km [0.6 mi] or more…[5]

After strong currents finished eroding, the current waned and cobbles and boulders that mostly were responsible for erosion of the valley fill was deposited as a lag on top of the pediment (see

---

[5] 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, Willet, S.D., N. Hovius, M.T. Brandon, and. M. Fisher (editors), *Tectonics, Climate, and Landscape Evolution*, Geological Society of America Special paper 398, Boulder, CO, p. 398.

Figure 64.7). If the velocity did not increase again, the pediment with its gravel cap would be preserved to this day.

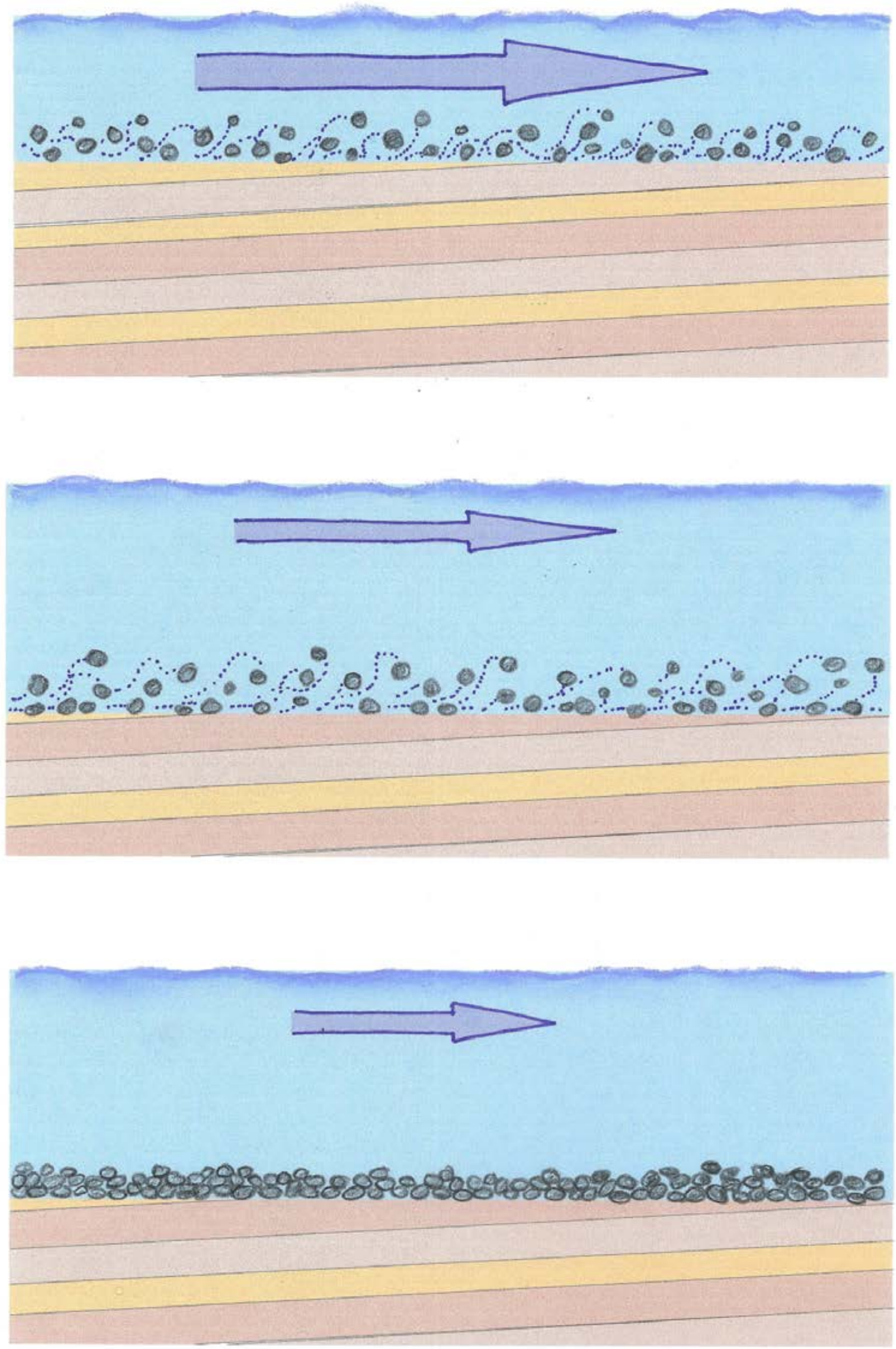


Figure 67.2. Vertical cross section parallel with the channelized flow down the valley showing cobbles and boulders moving and bouncing along the bottom, eroding the sediments and sedimentary rocks of the valley fill (drawn by Mrs. Melanie Richard). As the current wanes (velocity proportional to length of arrow), the cobbles and boulders are deposited as a lag on the pediment.

The rocks topping the pediments would mostly be rounded by the water action. They would come from the upcurrent direction as well as the mountains slopes, since the Flood water also drained from the mountain sides and the side valley from the surrounding mountains. This is what we observed in pediment gravel.

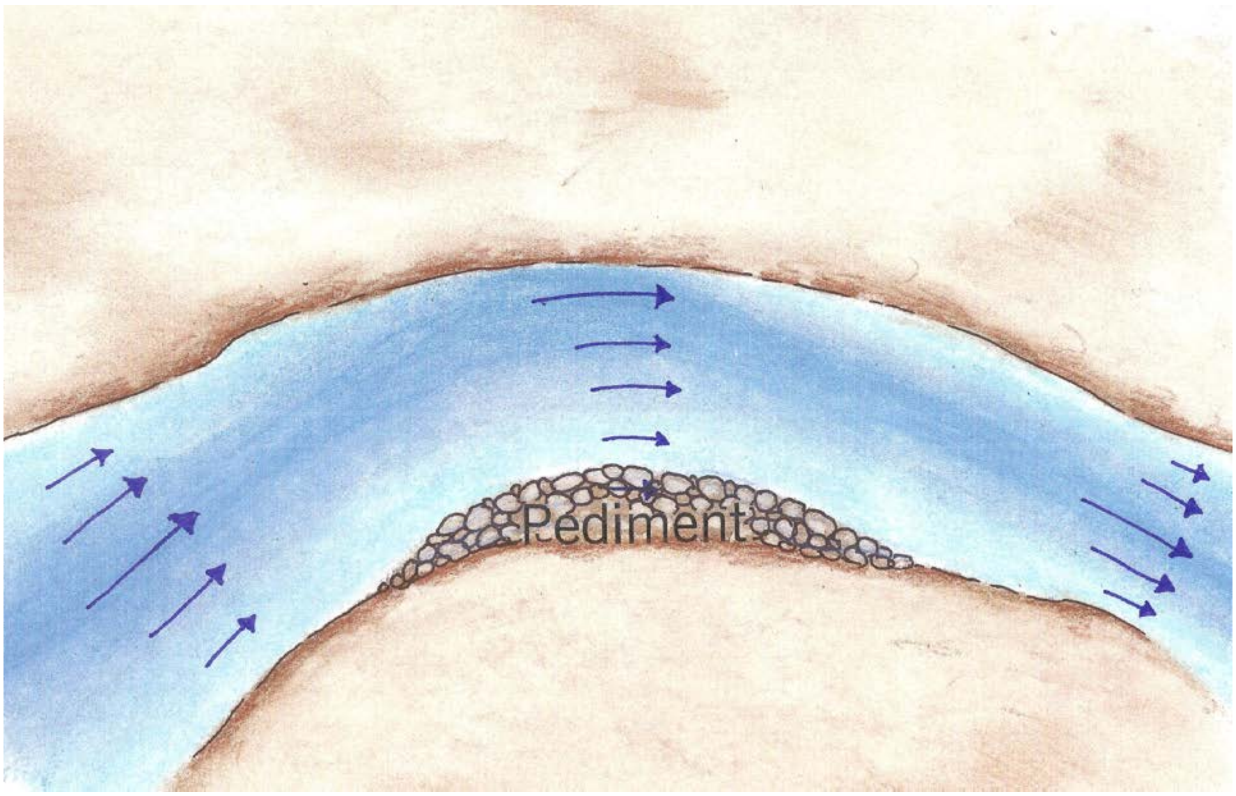


Figure 67.3. Plan view of how pediments form on one side of a valley (drawn by Mrs. Melanie Richard). The length of the current arrows are proportional to current velocity.

As a late Flood channelized current raced down a valley, the velocity would vary across the valley (Figure 67.3). When the current slackened above a newly-formed pediment on one side of a valley, the current would be strong enough to continue erosion on the other side of the valley (Figure 67.4). This may explain why pediments are commonly observed on one side of the valley and not on the other. In the Jefferson Valley of southwest Montana from Dillon to Whitehall, pediments are preferentially developed on the *inside* bends of slight valley curves (see Figure 64.1 and Chapter 68). This location is where the Floodwater would be slower, preserving the pediment, similar to a slip-off slope in incised meanders (see Chapter 61).

For instance, if a current were moving at 65 mph (105 kph) along the side of a valley, it would erode either the valley fill, the edge of the mountain, or both. As the current slowed through some threshold, say 30 mph (50 kph), it would stop eroding, and some of the bedload gravel would be deposited on the freshly-eroded surface. A smooth pediment with a thin veneer of mostly rounded cobbles and boulders would remain.

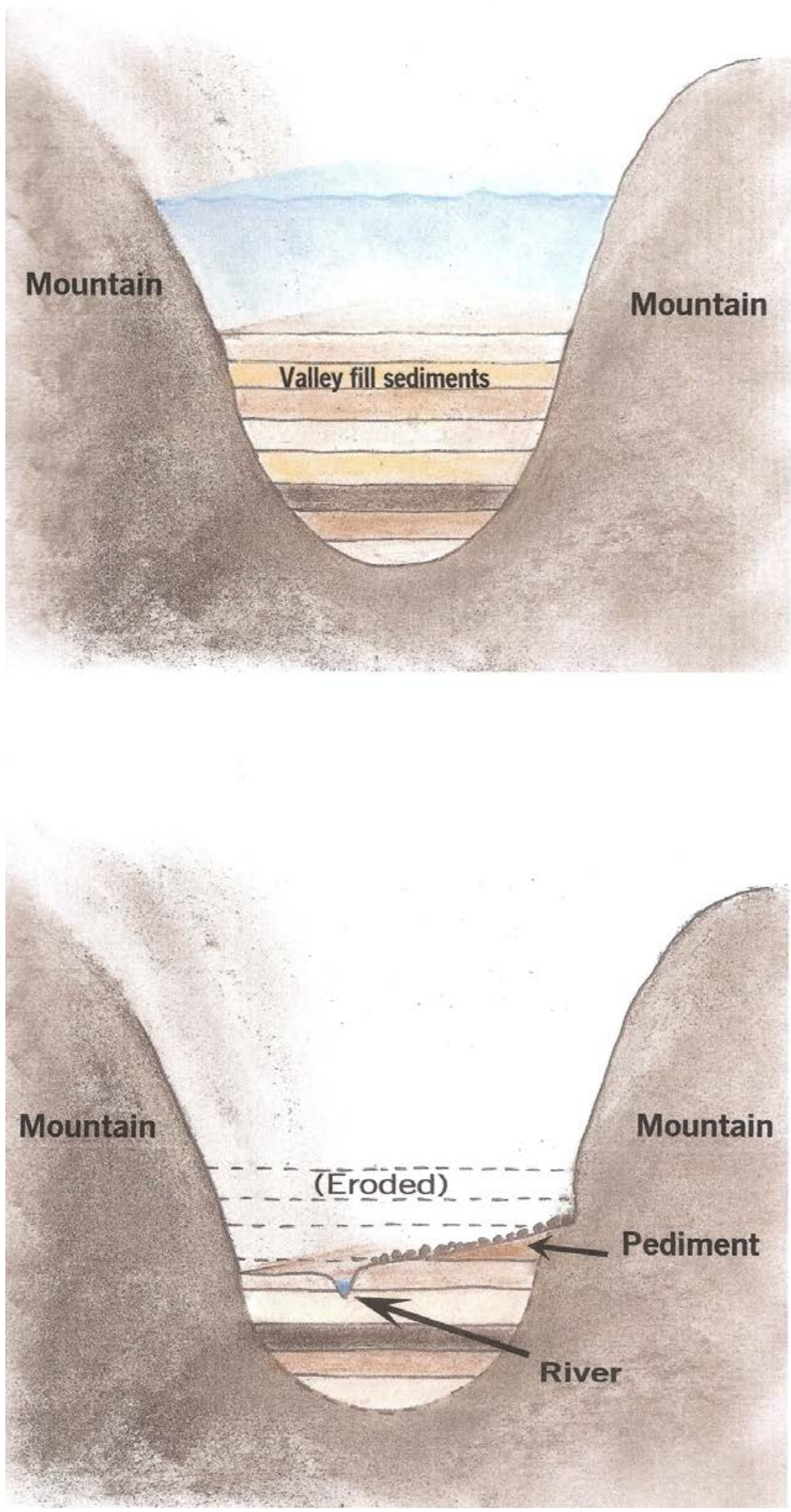


Figure 67.4. Vertical cross section perpendicular to the valley of how pediments form on one side of a valley during erosion of the valley fill sediments and sedimentary rock (drawn by Mrs. Melanie Richard).

Explanations for Pediment Variability

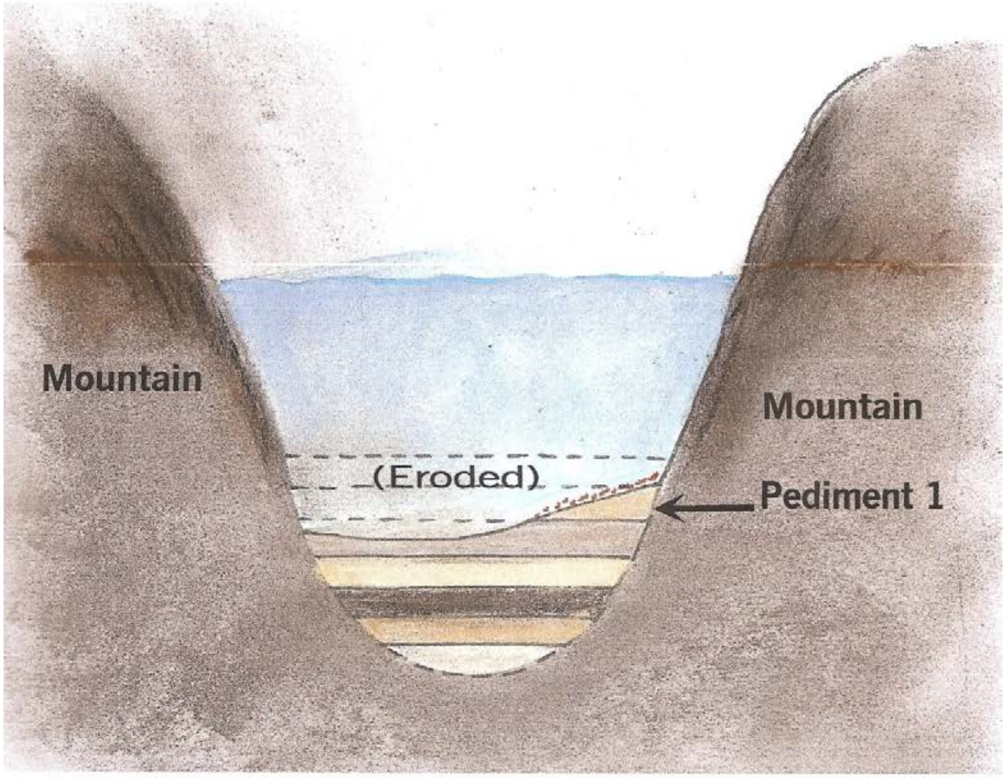
The above is the general case, but with nature there are always exceptions and complications. Variable currents velocities flowing down the valley would tend to shift and change with time. So, once a pediment is formed, it can be partially eroded, leaving behind a *pediment erosional remnant*. The main erosion could be on one side of the valley, right at the mountain slope where the pediment developed, or both. Further erosion close to the mountain leads to a beheaded pediment (Figure 67.5).

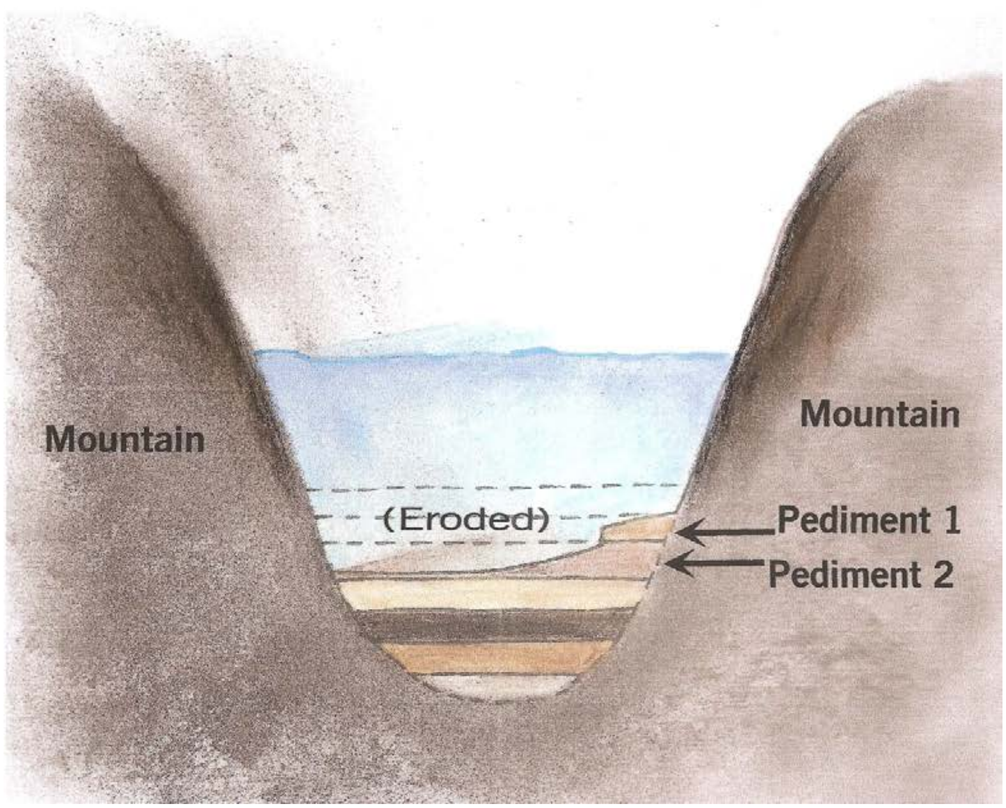
Figure 67.5. A pediment remnant, cut off (beheaded) from the mountains to the left, 4 miles north of Twickenham, John Day Country, north central Oregon.

The variable currents could also cause multiple pediments or pediment remnants at different altitudes within a valley. After one pediment was formed by a decrease in current velocity, an increase in velocity would erode and leave behind a pediment erosional remnant. Then the current could form a pediment lower down. This continuing process could ultimately form three pediment levels in a valley. This process is illustrated in Figure 67.6.

Valley erosion can not only leave pediment erosional remnants, but also remnants of the valley fill or mountain bedrock above the level of the pediment. These erosional remnants would be inselbergs or monadnocks (see Figures 66.6 as an examples of inselbergs on a pediment).

After the pediment formed, water draining from the adjacent mountains and into the valley would also erode the pediment forming little valleys perpendicular to the mountains. After the Flood, these valleys would direct the flow of water issuing from the streams coming out of the mountains and deepen the valleys or deposit an alluvial fan on top of the pediment. Many pediments are significantly dissected by perpendicular water flow (see Figure 66.4 for an almost completely dissected pediment).


Mountain
Mountain
(Eroded)
Pediment 1


Mountain
Mountain
(Eroded)
Pediment 1
Pediment 2

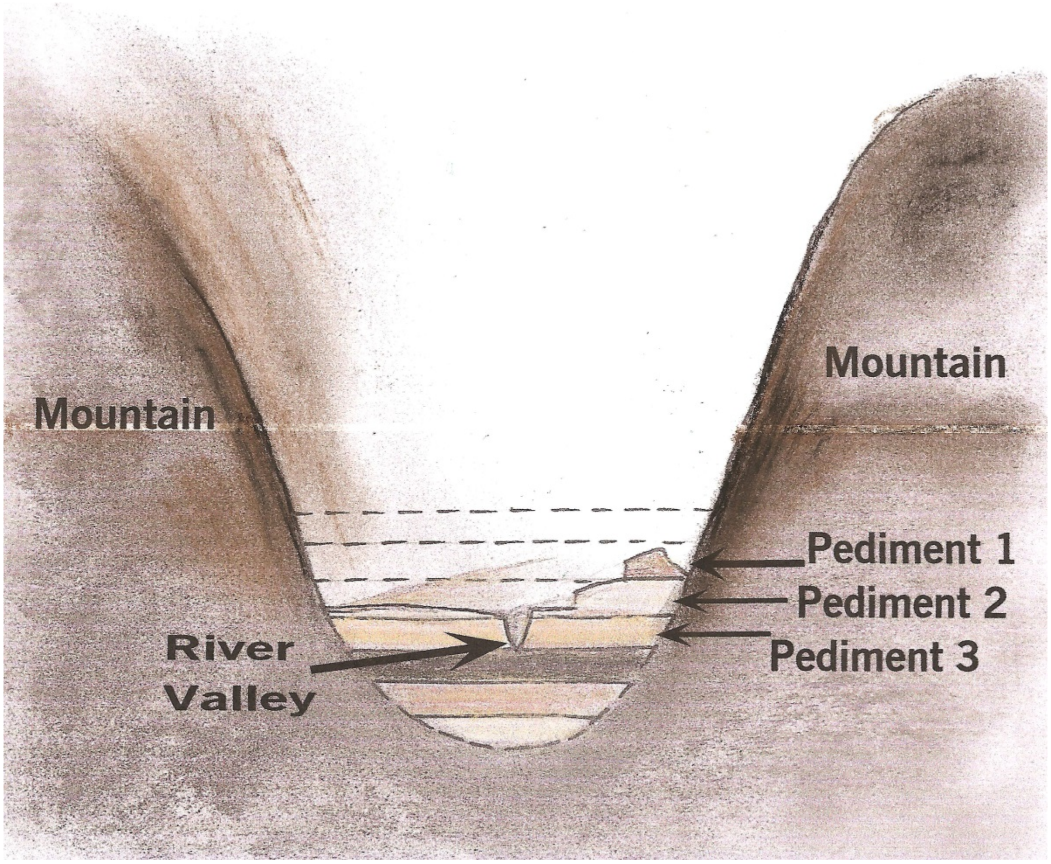


Figure 67.6. Schematic of the formation of three pediments in a valley (drawn by Mrs. Melanie Richard). Gravel shown on first pediment only (Figure 67.6a).

Formation of Pediment Passes and Domes

On a regional scale, the Flood would most likely create different current velocities on opposite sides of a mountain range. The sedimentary rock or mountain edge would then be variably eroded, so that pediments would form at *different* elevations on either side. If the erosion of the mountain range is substantial, then the pediments could connect at the mountaintop in a *pediment pass* (Figure 67.7). In this case, the top of these pediments at the ridge crest would not need to be at the same elevation, like the pediment passes in the Sacaton Mountains of Arizona.[6,7] A pediment pass seems fatal to any hypotheses that relies on a stream that flows out of the mountains themselves (see Chapter 66).

[6] Howard, A.D., 1942. Pediment passes and the pediment problem (Part I). *Journal of Geomorphology* 5(1):3-31.
[7] Howard, A.D., 1942. Pediment passes and the pediment problem (Part II). *Journal of Geomorphology* 5(2):95-136.

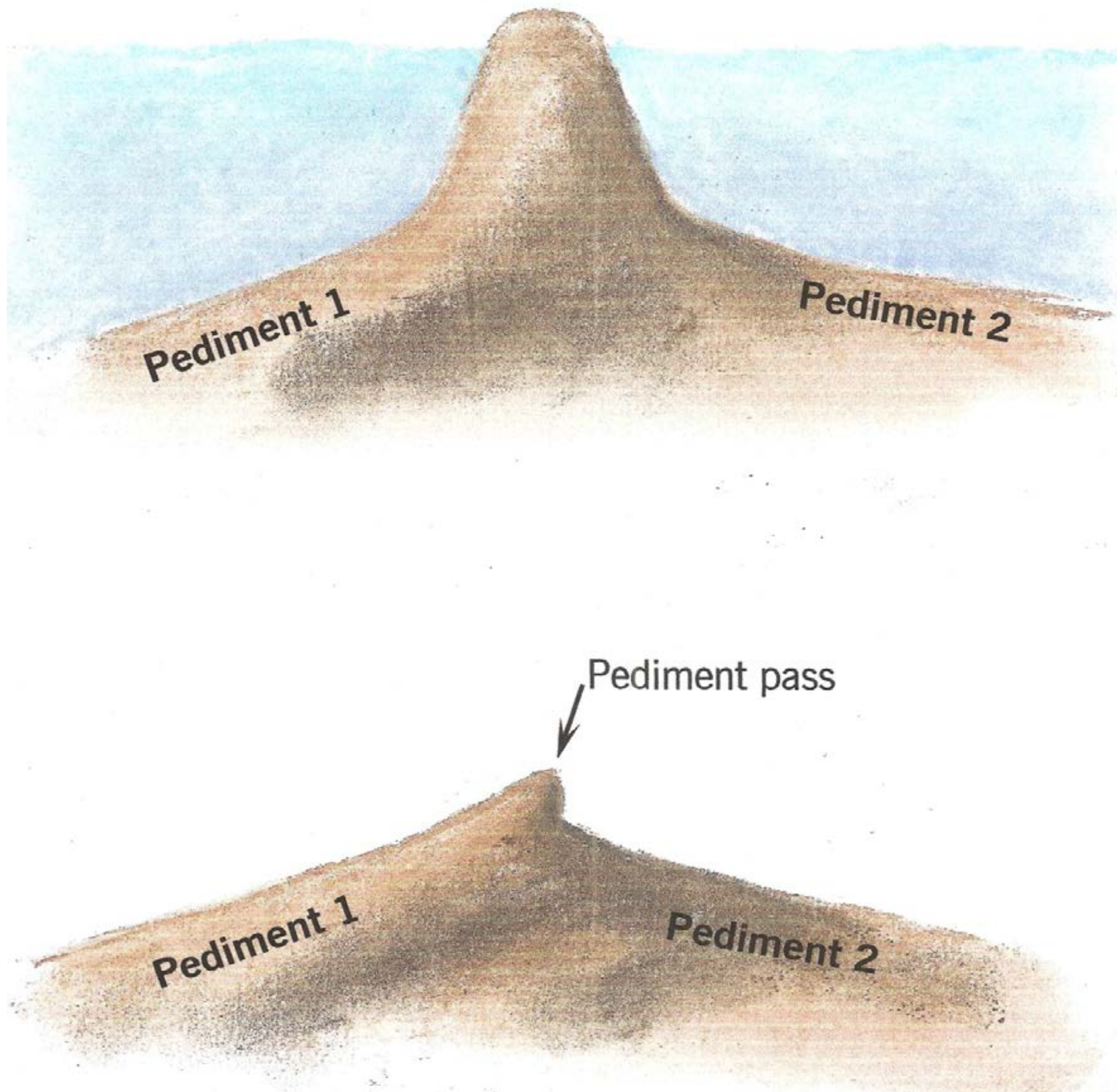


Figure 67.7. Illustration of the formation of a pediment pass (drawn by Mrs. Melanie Richard). In Figure 67.7a the water is flowing towards the reader and forming pediments on either side of a mountain range. Figure 67.7b shows the pediments have been eroded up to the top of the mountain range, but converge at a different altitude. The rest of the mountain range not shown.

Furthermore, if the eroding mountains are small and maybe one or a small cluster of mountains, it is possible that the Flood currents would erode the entire mountain into a circular or elliptical-shaped pediment, as in the granitic Cima Dome in the eastern Mohave Desert (see Figure 66.6).[8,9,10,11,12] After years of controversy, Cima Dome is now considered a pediment

---

[8] Oberlander, T.M., 1972. Morphogenesis of granitic boulder slopes in the Mojave Desert, California. *Journal of Geology* 80(1):1-20.

[9] Oberlander, T.M., 1974. Landscape inheritance and the pediment problem in the Mojave Desert of Southern California. *American Journal of Science* 274:849-875.

[10] Davis, W.M., 1938. Sheetfloods and streamfloods. *GSA Bulletin* 49:1,337-1,416.

around an eroded mountain, except that the mountain itself has been removed through erosion leaving a few monadnocks. Figure 67.8 illustrates how this can happen during Flood runoff.

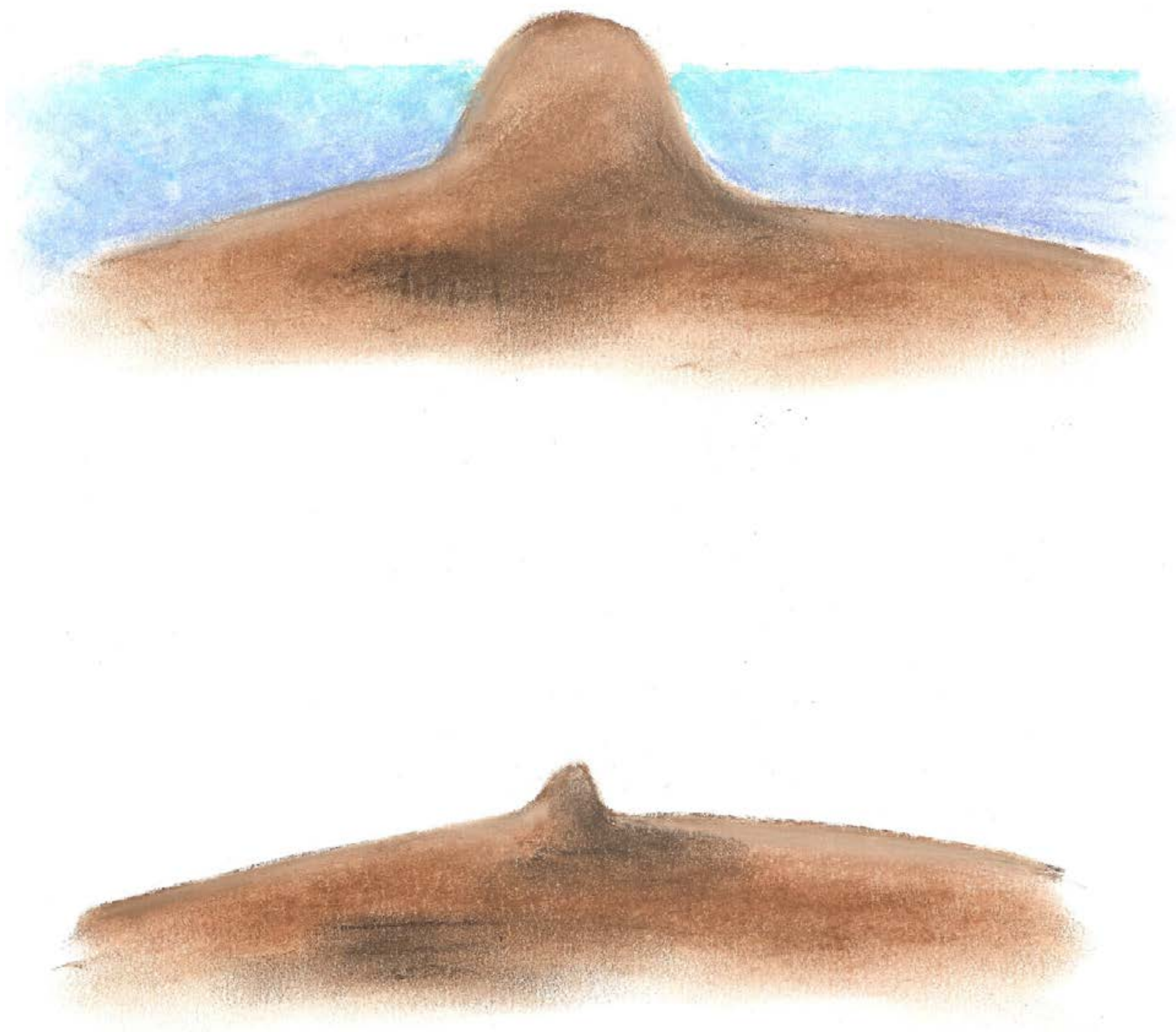


Figure 67.8. Illustration of the formation of Cima Dome with a monadnock (drawn by Mrs. Melanie Richard).

Mainly Formed in Channelized Flow Phase of the Flood

Pediment formation would take place as the water level dropped and the Floodwaters drained from the land. It is possible some of the higher pediments or pediments within very wide valleys, like those found along isolated mountain ranges on the high plains of Montana, formed during the Sheet Flow Phase of the Flood or during the early transition to channelized flow when the channelized currents were around 50 miles (80 km) wide (see Chapter 68). So, a small number of pediments may have formed during the Sheet Flow Phase, but the vast majority likely were

[11] Sharp, R.P., 1957. Geomorphology of Cima Dome, Mojave Desert, California. *GSA Bulletin* 68:273-290.
[12] Dohrenwend, J.C., 1994. Pediments in arid environments. In, Abrahams, A.D. and A.J. Parsons (editors), *Geomorphology of Desert Environments*, Chapman & Hall, London, U. K., pp. 325.

shaped by the Channelized Flow Phase,[1] since pediments are usually found in mountain valleys and represent the last erosive event. Either way, pediments would be relicts of the Retreating Stage of the Flood.

Eventually the valley-wide current narrowed and became very shallow. It could have easily eroded a narrow "valley" within the larger valley. After the Floodwater drained from the valley, a river or stream may have flowed through the valley within the valley and deepen the channel a little. Conversely, it is possible that the river eroded all or most of sediments or sedimentary rocks immediately near the river.

Why Are Pediments Missing from Some Valleys?

Although pediments are common in the mountain valleys of the Rocky Mountains, there are many valleys that have no pediments. Pediments are well developed in the valley between Butte and Deer Lodge, Montana, but a little north of Deer Lodge, the valley turns from north-south to more northwesterly and the pediments end (see Chapter 68). The flow of water had to continue down this northwesterly trending valley from Deer Lodge to Missoula, Montana. So, why aren't there any pediments in this segment of the valley?

I believe the reason is pediments are formed by rapidly flowing currents parallel to the axis of the valley. This means that there must have been few obstacles to block or slow down the velocity and few tectonic disturbances. Pediments seem to be formed in valleys or valley segments that have few if any obstructions to flow and where the tectonics between the rising mountains and sinking valleys had mostly ended. However, the valley northwest of Deer Lodge enters the Lewis and Clark fault zone, where tectonic activity likely was significant late in the Flood. Some of the strata in this valley is tilted vertically, showing strong tectonics. So, I surmise the tectonic activity in the valley northwest of Deer Lodge and the blocking of the currents caused by rising barriers slowed the down valley current too much to form pediments. It is possible that these principles apply more widely to other valleys that have no pediments.

Summary

To recap, as the continents uplifted and the ocean basins sank, the Floodwaters drained toward the present day oceans. The sheet flow transformed into a channelized flow as more and more mountains and plateaus were exposed. Mountains and valleys at first were completely submerged. The churning Floodwaters settled a little and caused valley sediments to accumulate thicker than they are today. As the flow became increasingly channelized it continued to drain forming the pediments. In many valleys, the confined walls likely caused the Floodwater to accelerate. Cobbles and boulders, including exotic rocks from upstream and rocks from adjacent mountain ranges, moved at high speeds along the bottom of the channelized flows causing massive erosion to the valleys and the sides of the mountains. It is at this time that the pediments formed and were capped with a veneer of mostly rounded rocks, deposited as the current decreased. Variable current velocities both in time and space within the valleys resulted in pediment erosional remnants, beheaded pediments, multiple pediments, and inselbergs on the pediments. The Channelized Flood Phase of the Flood can account for what we see in the field.

Pediments Point to a Global Flood, Not a Local Flood!

Pediments are a worldwide phenomenon (see Chapter 65). The world map in Figure 65.1 shows the pediments described in over 900 literature references. The summary ends in the early

1970s.[13] Pediments abound in the low and mid-latitudes. They are so ubiquitous in arid and semi-arid environments, that they are considered a “normal” landform for that environment.[14] Many pediments in high latitudes probably have been erased by erosion from heavy precipitation or glaciation. But, there are still many left giving credence to the fact that pediments are not that old.

The fact that pediments are common and occur globally and were carved during Flood runoff, is further proof that the Genesis Flood as described in the Bible was a *global* event and not a local flood!

[13] Whitaker, C.R., 1973. *Pediments: A Bibliography*. Geo Abstracts Ltd, University of East Anglia, Norwich, England.
[14] Small, R.J., 1978. *The Study of Landforms: A Textbook of Geomorphology*, second edition, Cambridge University Press, London, U K., p. 325.