# Some Evidence of a Recent Gigantic Flood on the Lower Colorado River at Grand Wash Cliffs and Hualapai Plateau, Arizona

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## Abstract

**In the early 20th century, J. Harlen Bretz concluded from geomorphic evidence that, contrary to conventional wisdom, the Channeled Scablands of eastern Washington had been formed by a colossal Pleistocene flood. Similarities between features of eastern Washington and western Arizona near the Lower Colorado River suggest the possible extrapolation of Bretz' work to Arizona. Dry Falls, Washington and Grand Wash Cliffs, Arizona both exhibit: 1) depth indicators, 2) floodwater scouring, 3) headward channel erosion, 4) backfilled channels, 5) dry water falls, and 6) flood bars. The evidence suggests that floodwaters stripped about 150 meters of sedimentary rock from the Hualapai Plateau and formed a giant waterfall at the Grand Wash Cliffs until headward channel erosion captured the floodwaters, carving the Grand Canyon. Thus it is possible that the Grand Canyon at the Hualapai Plateau and Grand Wash Cliffs area was carved by a cataclysmic flood. It is not clear whether this took place in the late stage of the Genesis Flood, or later.**

## Introduction

In 1919, J. Harlen Bretz published his first paper on the Channeled Scablands of eastern Washington State (Bretz, 1919). He had come to the remarkable conclusion that a large Pleistocene flood had swept across eastern Washington stripping off the surface loess and underlying layers of basalt, leaving intertwining channels, flood bars, and dry falls.

For the next 45 years Bretz fought a bitter battle against existing strict uniformitarian beliefs. Finally, in 1965, after an extensive field trip through Montana, Idaho, and the Scablands, several geologists of the International Association of Quaternary Research wired Bretz the message, "We are now all catastrophists." (Bretz, 1969, p. 541) But of course, they did not mean catastrophists in the Biblical sense of the word.

Although rapid erosion of Grand Canyon has been suggested for a long time (Newberry, 1861; Blackwelder, 1934; Bowles, 1978; Douglass and Meek, 2000; Lundstrom, 2000; Schmidt, 2000) predominant interpretations all involve slow processes acting over long ages of time. By 1932, Bretz had published 12 papers (see reference section), but his concepts had not been extended to other areas. One such area is the Grand Wash Cliffs and the Hualapai Plateau in Arizona. Geologists who performed the primary research in this region (Longwell, 1936; 1946; Young, 1966; Lucchitta, 1967) made no reference to his work.

Creationists have proposed the rapid erosion of the Grand Canyon (Burdick, 1974; Austin and Whitmore, 1986; Holroyd, 1987; 1990; Austin, 1988; Brown, 1989; Williams, et. al., 1992; Oard, 1993; Austin, et. al., 1994) and some (Austin, Oard and Williams, op cit.) noted similarities between the Lower Colorado River and eastern Washington. This paper is the beginning of a much needed closer look at erosional and depositional features of the Grand Wash Cliffs and Hualapai Plateau area, which may be analogs to the Channeled Scablands, and may have been created by a flood similar to the Bretz Flood (I suggest the use of "Bretz

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**Figure 1. The Channeled Scablands of eastern Washington State appear as the black intertwining lines crisscrossing the map. The Bretz Flood started at the upper right then flowed southwestward between the Columbia River to the north and west and the Snake River to the south. The gray areas show approximately where the floodwater ponded behind restrictions to the flow. The floodwater exited at bottom center following the Columbia River Gorge to the Pacific Ocean.**

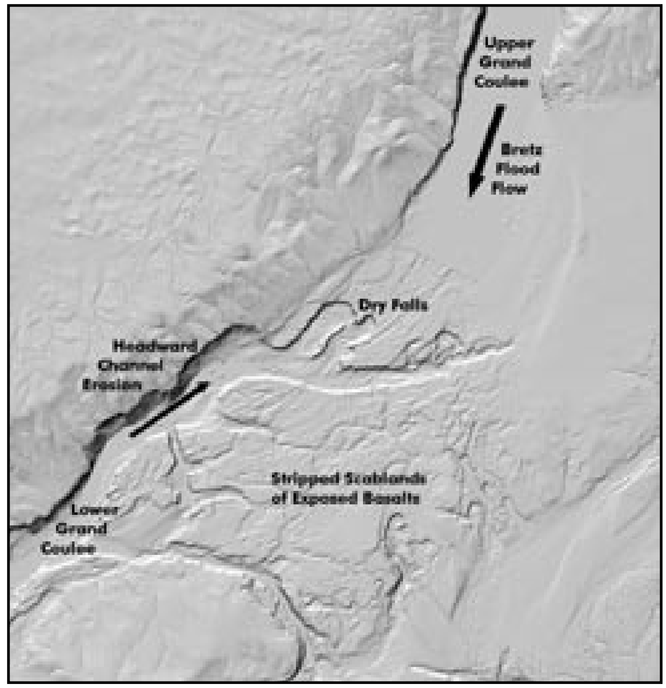


**Figure 2. A channel nearly 50 m deep exited the Upper Grand Coulee, at top center and stripped the loess leaving exposed basalt. The floodwater channeled again well below where Dry Falls is now. Headward erosion through the scabland formed Lower Grand Coulee. Had the floodwater continued its headward erosion, it would have continued through the Upper Grand Coulee, previously formed by headward erosion.**

Flood” rather than “Missoula Flood” or “Spokane Flood” in honor of J. Harlen Bretz and his work).

## Synopsis of the Bretz Flood

During the post-Flood Ice Age, a lobe of ice blocked the Clark Fork River where it empties into present-day Pend Oreille Lake, near Sandpoint, Idaho, creating Glacial Lake Missoula. Eventually the great ice sheets began to melt. Meltwater and rivers fed Lake Missoula, and it attained a depth of nearly 607 m (1,990 ft). The glacial ice that dammed Lake Missoula was then breached, resulting in catastrophic discharge of the water overland to the sea (Figure 1). The floodwater spread out westward across the Spokane Basin, followed the Columbia River Valley, and then overtopped hills on the south side of the valley. The raging water rushed across eastern Washington, eroding the loess (surface soil) and gouging the underlying basalt to create the Scablands.

Of particular interest is Dry Falls, a spectacular feature that may be typical of such large scale flooding. A channel nearly 50 m (165 ft) deep exited the Upper Grand Coulee, eroding loess and basalt, and forming a large scabland area (Figure 2). High flow velocity resulted in the plucking of large blocks, causing coulees to be eroded headward through and around the scablands. Flood bars formed in areas of slack flow. At peak flow, this area probably looked like gargantuan rapids.

> The magnitude of the Bretz floods strongly suggests that all these features were formed beneath the surface of the floods, and that there were no true waterfalls in eastern Washington during the maximum spate of each flood. (Allen, Burns, and Sargent, 1986, p. 114).

As the flow began to dissipate, water drained into the coulees as waterfalls, seen today as 90-m (295-ft) cliffs and blue lakes marking the site of the cataracts, subsequent waterfalls, and accompanying plunge pools (Figure 3).

Where as some have envisioned several floods across the Scablands as illustrated above by Allen, Burns, and Sargent (1986. p. 144), Oard (2000; 2003) shows that the evidence best fits a single Lake Missoula and associated flood.

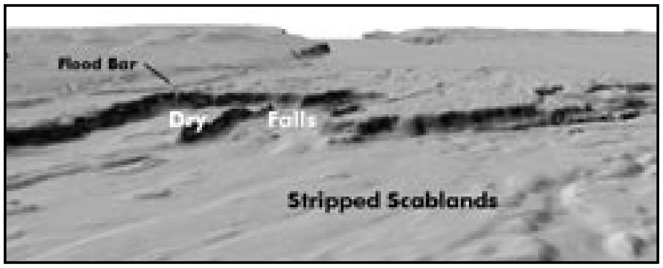


**Figure 3. This is a digitally produced panorama of Dry Falls. The Bretz Flood flowed from the Upper Grand Coulee at top center down toward the lower left. There are stripped Scablands both above and below Dry Falls. Vertical exaggeration: 1x.**


**Figure 4. Location of Grand Wash Cliffs.**

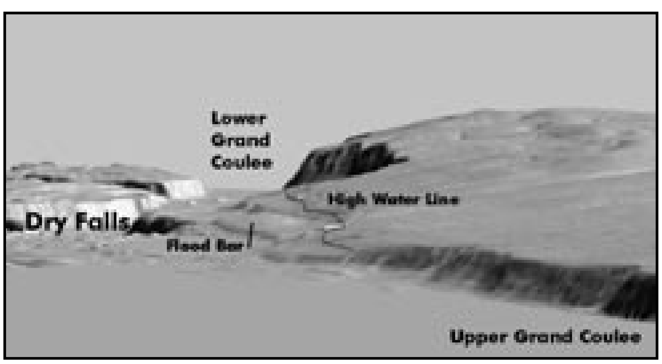


**Figure 5. This digital view is from upstream of Dry Falls looking toward Lower Grand Coulee. The depth of the floodwater is indicated by shoreline markings about 50 meters high on the hillside and cliff (lower right). A further indication of the depth is a slack-water flood bar 31 meters thick and 2.3 kilometers long at the foot of the hillside next to Dry Falls. Vertical exaggeration: 2x.**

## A Comparison of Dry Falls and the Grand Wash Cliffs Area

Along the Colorado River in the region about the Grand Wash Cliffs (Figure 4) certain erosional and depositional features can be found that appear to be comparable with those formed by the Bretz Flood at Dry Falls.

### Depth Indicators

At Dry Falls, the depth of the floodwater is indicated by shoreline markings about 50 m (165 ft) high on the hillside along side Dry Falls (Figure 5). Below the high water indicator the slope of the hillside is foreshortened (i.e., made steeper by the floodwater). The cliff in the lower right had been cut by earlier headward erosion that created the Upper Grand Coulee. A similar feature is found on the Hualapai Plateau above the Grand Wash Cliffs near the mouth of the Grand Canyon (Figures 6 and 7). This eroded cliff structure that curves across the plateau for 3 km (1.9 mi) exposes some of the "Paleozoic" strata which comprise the Hualapai Plateau. The top of the eroded cliff, ~150 m (492 ft) high, likely indicates the high water elevation above the Hualapai Plateau in this area. This is about three times the depth of the water at Dry Falls.

### Geomorphic Scouring

In the scablands above and below Dry Falls, there are areas of exposed basalts (Figures 2 and 3) that were scoured by the floodwaters. A similar feature exists on the Hualapai Plateau above the Grand Wash Cliffs.

> The Hualapai Plateau consists of *an erosion surface* that slopes gently northeast and is cut into Paleozoic rocks … and, locally, into Precambrian rocks... (emphasis added) (Lucchitta, 1972, p. 1940; cf. Figure 7).

About 50 meters (165 ft) of sediments on the Hualapai

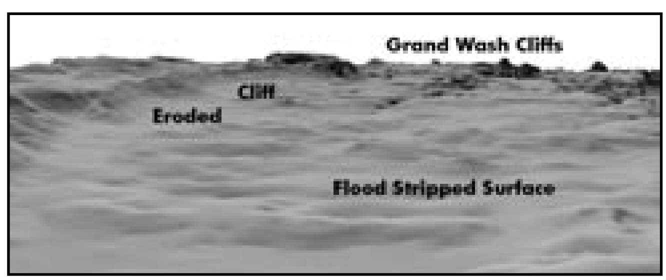


**Figure 6. This panorama across the Hualapai Plateau above the Grand Wash Cliffs shows an eroded cliff 150 meters high. This cliff stands beside the large flood stripped surface between it and Grand Canyon to the right. The top of the cliff likely indicates the floodwater depth above the Hualapai Plateau. Vertical exaggeration: 1x.**

Plateau were apparently scoured away by sheet erosion leaving the eroded cliff structure (Figure 8).

**Headward Channel Erosion**

Lower Grand Coulee, which ends at Dry Falls, was formed by headward erosion during the Bretz Flood (Figure 2). A similar erosional feature, the Lower Granite Gorge of Grand Canyon, starts at Grand Wash Cliffs and extends up into the plateau lands. It also may have formed by headward erosion as floodwater flowed across the Hualapai Plateau and over the Grand Wash Cliffs (Figure 7). As the canyon eroded into the plateau it might have captured and channeled the floodwater off of the plateau. This redirection of the flow would have reduced the amount of water falling over Grand Wash Cliffs, until all the water would eventually have been captured in the canyon, and no water would be falling over the cliffs. The "falls" would essentially be moving upstream with the head of the channeling erosion.

Several tributary canyons extending southwest from Lower Granite Gorge were likely cut at this time on the

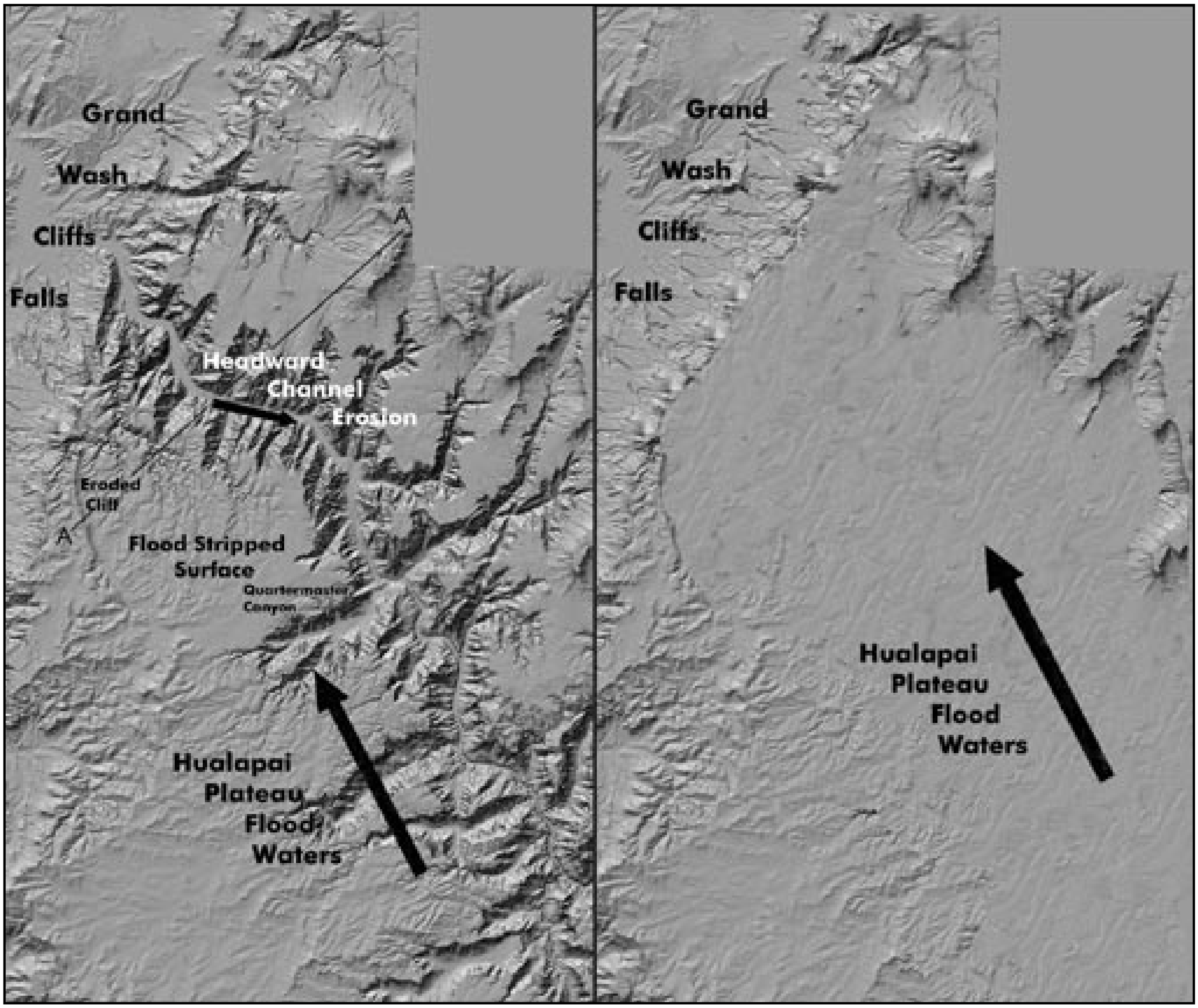


**Figure 7. The left hand DEM shows the Hualapai Plateau, Grand Canyon and the Grand Wash Cliffs as they exist now. The right shows what the Hualapai Plateau may have looked like during initial stages of flooding. Water flowed across the Hualapai Plateau above the Grand Wash Cliffs and sheet-erosion created the eroded surface area. The Hualapai Plateau slopes slightly to the north. The waterfall over Grand Wash Cliffs was some 1050 meters high. Headward erosion carved this section of the Grand Canyon from a channel forming at Grand Wash Cliffs. Vertical exaggeration: 1x.**

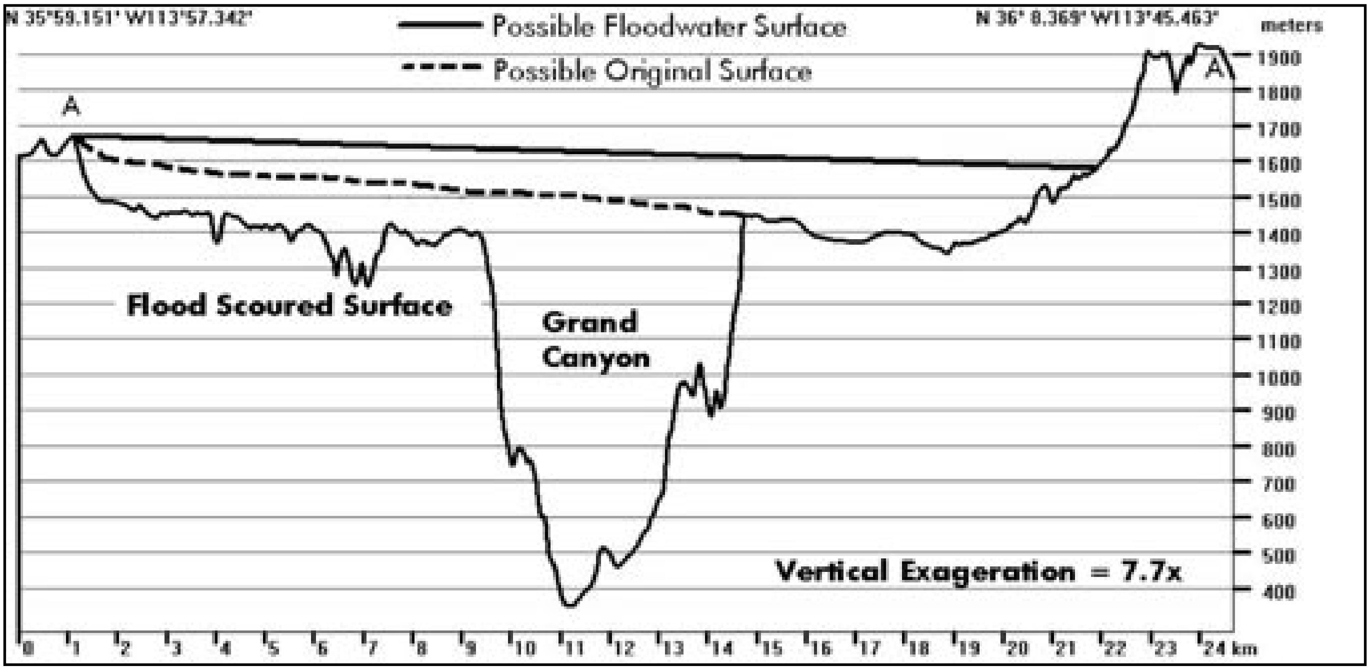


**Figure 8. Cross-section A-A' from Figure 7, left panel. The dashed line is thought to be the original surface of the Hualapai Plateau before floodwater eroded it to its present elevation. Because the current was turning right, sheet erosion was most effective to the left. Grand Canyon was later carved by headward erosion.**

northward-sloping Hualapai Plateau. Each successive tributary canyon to the east would have cut off the flow on the plateau to those farther west. Then, once the headward erosion of the Lower Granite Gorge followed the Hurricane fault northward (Young, 1970, p. 113), there would be no more water on the Hualapai Plateau and the southwestern tributaries would cease to be cut. They would have been subsequently filled with sediment-laden water as happened during the Bretz Flood (see below).

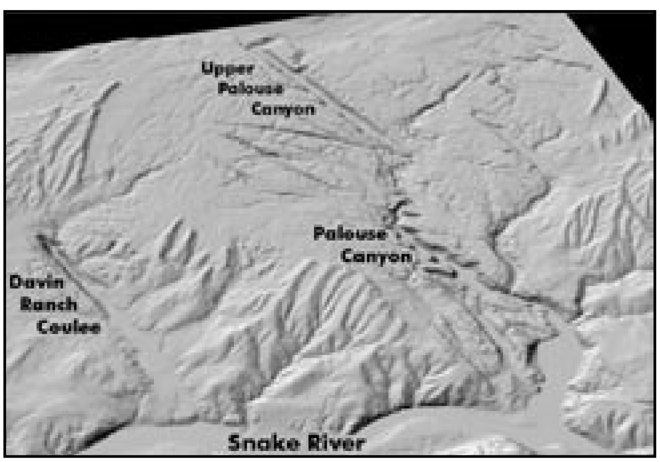


**Figure 9. The Davin Ranch Coulee is approximately eight kilometers west of Palouse Canyon. Both canyons were cut by the Bretz Flood (from the top right) as it spilled into the Snake River Basin. Eventually, Upper Palouse Canyon captured most of the floodwater. The inactive Davin Ranch Canyon was backfilled with conglomerate. Vertical exaggeration: 1x.**

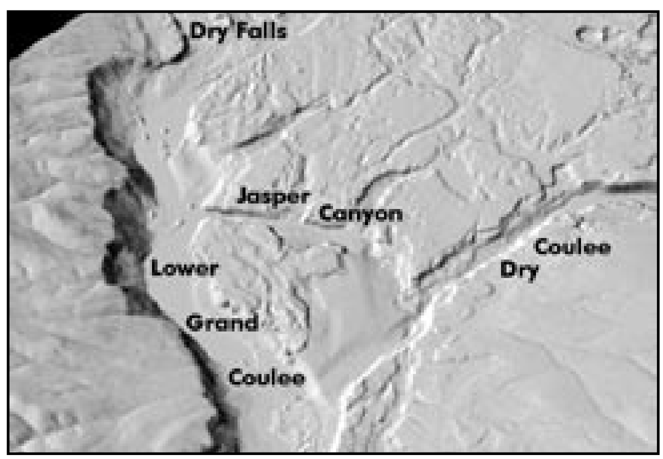


**Figure 10. At Dry Falls the Bretz Flood was channeled into the Lower Grand Coulee, stopping the flood from flowing across the channeled scablands to Jasper Canyon and Dry Coulee. The flood in the Lower Grand Coulee backfilled Jasper Canyon and Dry Coulee with conglomerate bars. Vertical exaggeration: 1x.**

**Backfilled Channels**

Davin Ranch Coulee, approximately 8 km (5 mi) west of Palouse Canyon, was cut by the Bretz floodwaters at the same time as Palouse Canyon (Figure 9). But, Upper Palouse Canyon eventually captured most of the floodwater. Water in the Snake River Canyon then backfilled the inactive Davin Ranch Coulee with conglomerate. Similarly, Dry Falls captured floodwater for the Lower Grand Coulee (Figure 10) and Jasper Canyon and Dry Coulee were backfilled with conglomerate.

In Arizona, Meriwhitica Canyon (Figure 11) is backfilled similar in style to the Davin Ranch Coulee. The Hindu Canyon/Lost Man Creek channel conglomerate has its counterpart in the Jasper Canyon/Dry Coulee fill. It is possible that Peach Springs Canyon, Milkweed Canyon and Spencer Canyon were all filled after Lower Granite Gorge captured the proposed Hualapai Plateau flood. Lucchitta (1972, p. 1941) concluded that the conglomerate fill in these canyons "could have come only from Precambrian rocks in the present basin and range province to the west and southwest." According to Young (1966), these canyons were cut early by run-off from hypothetical mountains to the south and filled with conglomerate from the same source, rather than forming at the same time as the Grand Canyon. This interpretation was developed because Grand Canyon is thought to be younger than the Hualapai Limestone of the Muddy Creek formation at the mouth of Grand Canyon, dated at 5 to 6 Ma (Lucchitta, 1979, p. 82). Likewise,

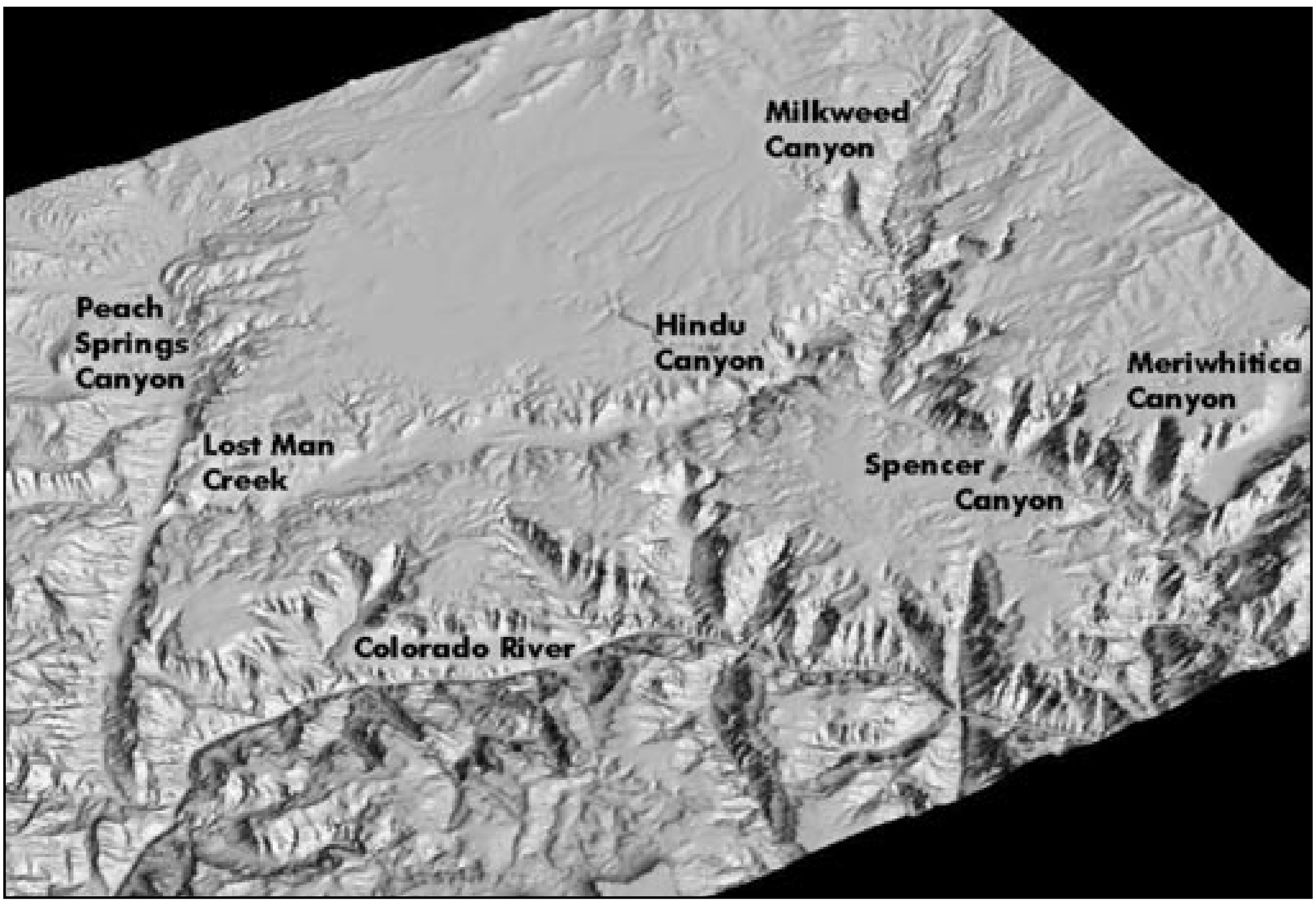


**Figure 11. View from the southwest across the Hualapai Plateau from the Lower Granite Gorge of the Grand Canyon. Peach Springs, the Hindu Canyon/Lost Man Creek, Milkweed, Spencer, and Meriwhitica canyons were backfilled with arkosic conglomerates, limestones, red siltstone and claystone sediments, probably after the Lower Granite Gorge eroded headward (to the left) past the mouths of the canyons. Peach Springs and Milkweed Canyons still have portions of the backfill in the upper part of each canyon. The Hindu Canyon/Lost Man Creek Channel and Meriwhitica Canyon backfill remains because the drainage basins are much smaller than the basin of Peach Springs or Milkweed Canyons. Vertical exaggeration: 1x.**

the Hualapai Limestone is considered younger than the Peach Springs Tuff, dated at 18.3 Ma (Young, 1970, p. 110), and the Peach Springs Tuff must be younger than the canyons and conglomerate because it covers both. Therefore, based on isotopic dates, the canyons containing the conglomerate must be older than Grand Canyon. And, consequently, the "Colorado River tributaries are developing on these Cenezoic [sic] deposits and have partially exhumed the older channel system in the major canyons which are tributary to the Colorado" (Young, 1970, p. 110). However, I consider isotopic dating to be a useless tool and so do not thereby limit my search for interpretations that fit the observations.

Rock exposed in Grand Canyon is of the same type as the arkosic conglomerates, limestones, red siltstone and claystone found in the side canyons. So, Peach Springs Canyon, the Hindu Canyon/Lost Man Creek channel, Milkweed Canyon, Meriwhitica Canyon and even Quartermaster Canyon (Figure 7) could just as easily have been filled by detritus from the headward erosion of the Grand Canyon as from the hypothetical mountains proposed by Young.

After the tributary canyons were filled with sediments, lava flows and volcanic tuff (Peach Springs Tuff), covered them. Then, local detritus from the Music Mountains would have washed northward across the lava flows of the Hualapai Plateau. After the carving of the Grand Canyon, rainfall and associated local flooding may have begun re-excavating the side canyons as tributaries to the Colorado River. Peach Springs and Milkweed canyons still have significant portions of the sediment fill in their upper reaches. The Hindu Canyon/Lost Man Creek Channel and the Meriwhitica Canyon fill have likely remained largely in place because those drainage basins are much smaller than those of Peach Springs or Milkweed canyons. The relative size of the proposed flood event at the Hualapai Plateau can be estimated by comparison to the Jasper Canyon/Dry Coulee system fill, which is 5.7 km (3.5 mi) long, with that of the Hindu Canyon/Lost Man Creek Channel, which is 14.3 km (8.9 mi) long. Also, the backfill in the Davin Ranch Coulee is 5 km (3 mi) long, while in Meriwhitica Canyon it is over 9 km (5.5 mi) long.

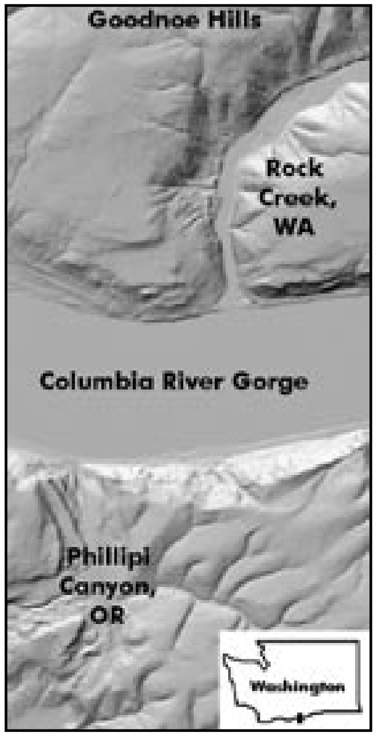


**Figure 12. Rock Creek and Philippi Canyon are on opposite sides of the Columbia River Gorge about three kilometers apart. Vertical exaggeration: 1x.**

## Dry Waterfalls

The Dry Falls cliffs, some 90 m (295 ft) high, stand as stark reminders of the Bretz Flood that carved the Upper and Lower Grand Coulees (Figure 3). At the Grand Wash Cliffs, much of the original cliffs have been eroded away due to the headward erosion of the Grand Canyon. However, Figure 7 gives an indication of what the Hualapai Plateau may have looked like before this section of Grand Canyon was carved. The fall of the water down the Grand Wash Cliffs was some 1,050 m (3,444 ft), more than 12 times the height of Dry Falls.

## Flood Bars

Giant flood bars formed during the Bretz Flood in areas of slack water throughout its drainage area (Figures 3 and 5). Two of those bars are found in the Columbia River Gorge near Goodnoe Hills, WA (Figure 12). In this part of the gorge, the flood reached a depth of about 260 m (853 ft). At the mouth of Rock Creek, WA, a bar 150 m (490 ft) high and 1.1 km (3,600 ft) long was formed in slack water backing up into Rock Creek Canyon (Figure 13). The bar consists of unsorted conglomerate with local angular clasts mixed with well-rounded river rock from upstream.

A second flood bar is located a little over 3 km (1.9 mi) away, in Philippi Canyon, OR (Figure 14). It contains the same mixture of rock and sand as the Rock Creek bar. Water from the Bretz Flood overflowed the Columbia River Gorge through Philippi Canyon, spilling over into the nearby John Day River Canyon. Exotic river rock was found just below the still-discernable high water mark of the Bretz Flood in Philippi Canyon. Many other side canyons of the Columbia River Gorge have similar flood bar deposits.

On each side of the mouth of Grand Canyon, two flood bars formed in eddies against the Grand Wash Cliffs (Figure 15) similar to those in the Columbia River Gorge. The one on the north side of the river (on the left) is over 377 m (1,237 ft) high and 5.7 km (3.5 mi) long. This flood bar is described as a debris fan by Lucchitta:

> The west-draining canyons are short and steep. Where they debouched into the Grand Wash trough, the washes that carved the canyons have deposited fans of locally derived material. One such fan emerges from Pierce Canyon, whose mouth is only 1.5 miles (2.5 km) north

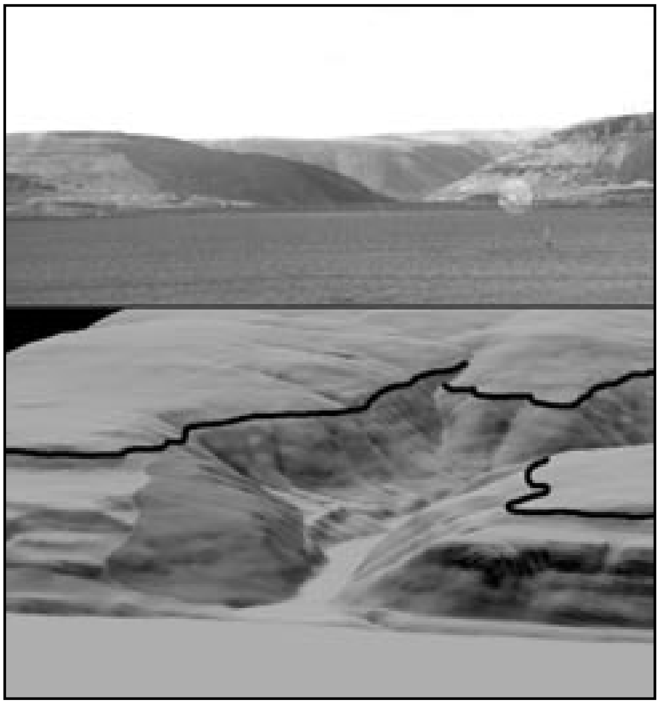

Figure 13. Rock Creek flood bar (darkened area to left in both photo and image) extends into Rock Creek Canyon about 1.1 km (3,609 ft) and reaches up the canyon about 150 m (492 ft). The highest elevation of the Bretz Flood is shown by the black line on the image. Note the large truck (circled) for scale. The flood flowed from right to left. Vertical exaggeration: 2x.

> of the Grand Canyon. The fan was deposited across the mouth of the present Grand Canyon. This could not have happened if the Grand Canyon and the Colorado River existed in their present location at the time. (Lucchitta, 1990, p. 327).

However, in similar nearby deposits that have also been interpreted as debris fans, I have found common river rock whose source could not be locally derived nor be debris fan constituents. Because Lucchitta believes that the deposition in Pierce Canyon is a debris fan, he concludes that it could only have been deposited before the river flowed through the area separating the smaller "debris fan" on the south side from the large one to the north.

The smaller flood bar on the south side of the river is about 246 m (800 ft) high and 1.2 km (0.75 mi) long. Longwell (1936, p. 1457) described and interpreted these formations as "coarse, cemented fan deposits, well exposed in cliffs on both sides of the river…"

A comparison with the Bretz flood may give an approximate amount of time for the floodwater on the Hualapai Plateau to cut and fill the side canyons. Down stream from

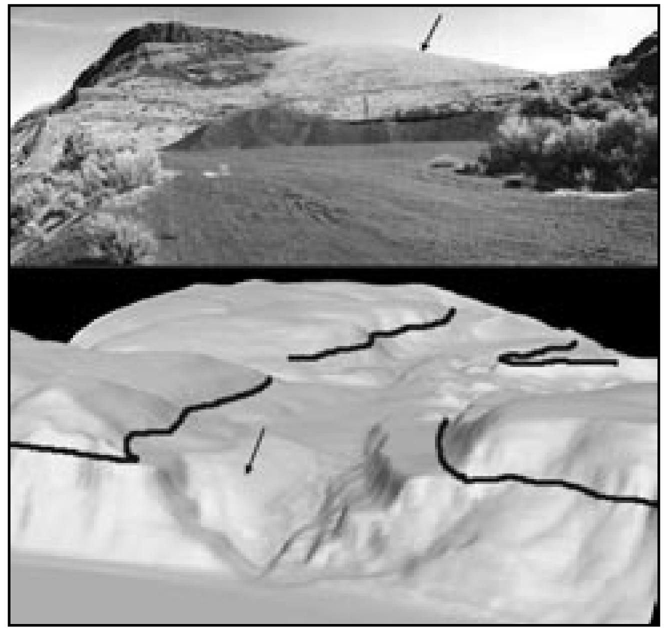

Figure 14. The Philippi Canyon flood bar in a photo (above) from a borrow pit at the mouth of the canyon and in an image (below). The black line shows the highest elevation of the Bretz Flood. The floodwater flowed left to right down the Columbia River Gorge. Vertical exaggeration: 2x.

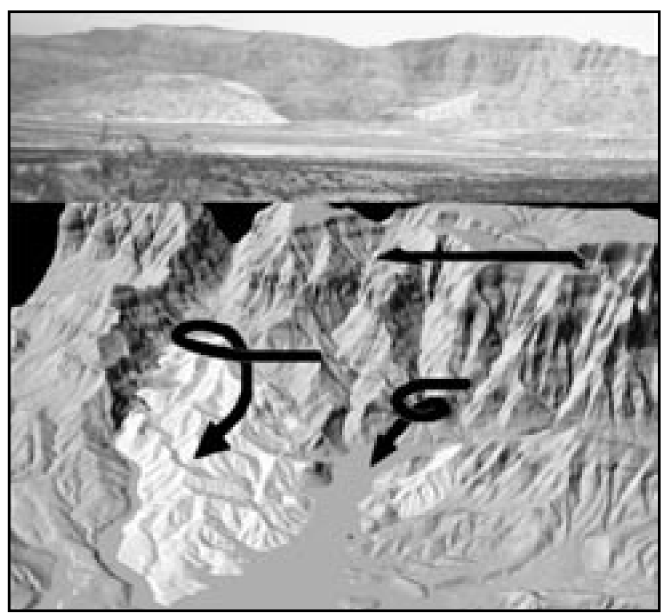

Figure 15. Flood bars on either side of the mouth of the Grand Canyon at the Grand Wash Cliffs are highlighted. The bars probably formed in eddies on either side of the mouth of the Grand Canyon (see image below). The bar on the left lies in a canyon eroded into the cliffs prior to the carving of the Grand Canyon. Highlighting done with Polaroid PhotoMax® Pro. Vertical exaggeration. 1x.

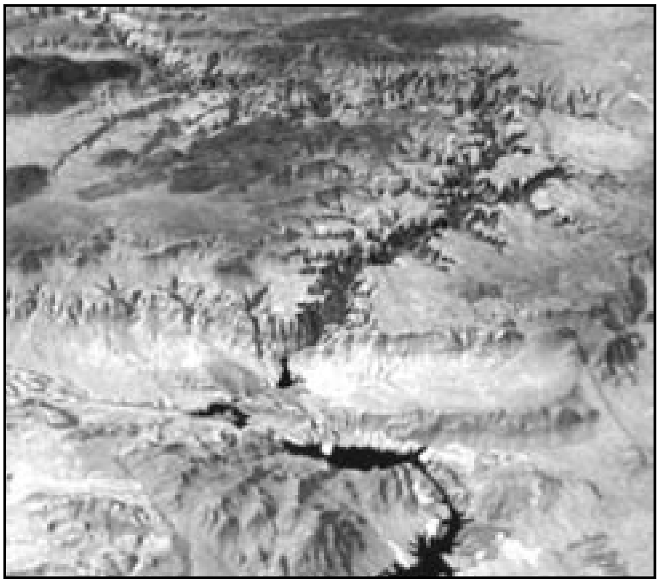

**Figure 16. Satellite image of Grand Canyon and the Grand Wash Cliffs area showing the eastern portion of Lake Mead in the foreground with Grand Wash Cliffs sweeping upward behind. The Grand Canyon twists its way back through plateau lands to the top. Image is available free from <http://aria.arizona.edu/>.**

Dry Falls, the Bretz floodwater ponded due to the restriction at the Wallula Gap narrows. It has been estimated that it took approximately 100 days for the Bretz floodwater to flow through Wallula Gap (Shaw, et. al., 1999, p. 608). This means that all the erosion and deposition caused by the Bretz floodwaters flowing across the scablands was limited to less than 100 days. Since we find similar structures at the White Wash Cliffs and Hualapai Plateau carved by floodwaters, then similar time constraints in terms of days may be applicable. The greater quantity of erosion and deposition at the Hualapai Plateau than at Dry Falls is offset by the greater quantity of water. Thus we may estimate the length of time that floodwaters were on the Hualapai Plateau in terms of hundreds of days rather than millions of years.

## A Proposed Reconstruction of the Lower Colorado River Flood

Prior to the breaching of the Coconino/Kaibab Plateau, there was no Lower Colorado River. Westward of the Grand Wash Cliffs was isolated basin and range topography. At some time, a large quantity of water began flowing onto and across the top of the Hualapai Plateau, stripping off sedimentary strata. A giant waterfall formed on the Grand Wash Cliffs in the vicinity of present-day Pierce Ferry. Grapevine Wash was filled with water and sediment. Then, Wheeler Ridge was overflowed in several places, and Greggs Basin and Grand Wash began to fill with water (Figure 15).

At the Grand Wash Cliffs, the floodwater quickly channeled, eroding headward, and formed what is now the Lower Granite Gorge of the Grand Canyon. Several side canyons were formed in the Hualapai Plateau helping to channel the floodwater from the plateau. These were backfilled at some point during the carving of Lower Granite Gorge. The two flood bar deposits at the mouth of Grand Canyon, composed of "…limestone and sandstone fragments derived from the Paleozoic formations in the [Hualapai] plateau" (Longwell, 1936, pp. 1434–1435) were deposited at this time. I propose that the Lower Colorado River, from Grand Wash Cliffs to Yuma, Arizona (and beyond), was formed as basin after basin was flooded to overflowing during the catastrophic carving of Grand Canyon. The source of the Hualapai Plateau floodwater is currently unknown.

## Conclusion

Similarities exist between geomorphic features found at Dry Falls, Washington, and Grand Wash Cliffs, Arizona. Because the features at Dry Falls are now understood even by uniformitarian geoscientists as having been formed during catastrophic flooding conditions, I consider similar features found at Grand Wash Cliffs and the Hualapai Plateau to have formed by similar events. Thus it is possible to interpret the development of Grand Canyon at the Hualapai Plateau and Grand Wash Cliffs area as carved by a cataclysmic event not long ago. Further research in these areas is encouraged.

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## Notes

Figures 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 14, and 15 were generated by the free software, MicroDEM®, developed by Professor Peter Guth of the Oceanography Department, U.S. Naval Academy, along with his students. A copy of the program can be downloaded from http://www.usna.edu/Users/oceano/pguth/website/microdem.htm. The map data are DEMs (Digital Elevation Models) provided by the USGS and available for free download from Geo-Community at http://data.geocomm.com/dem/demdownload.html. Some figures were modified with graphics and text using Polaroid PhotoMax® Pro.