Erosion Case Study - Grand Canyon: How was it formed?

The truth is that no one knows for sure how the Grand Canyon was formed, however there are some pretty good guesses. The chances are that a number of processes combined to create the views that you see in today’s Grand Canyon. The most powerful force to have an impact on the Grand Canyon is erosion, primarily by water (and ice) and second by wind.

Water seems to have had the most impact basically because our planet has lots of it and it is always on the move. Many people cannot understand how water can have such a profound impact considering that the Canyon is basically located in a desert. This is one of the biggest reasons that water has such a big impact here. Because the soil in the Grand Canyon is baked by the sun it tends to become very hard and cannot absorb water when the rains to come. When it does rain the water tends to come down in torrents (a strong and fast-moving stream of water or other liquid), which only adds to the problem.

The plants that grow in the Grand Canyon tend to have very shallow root systems so that they can grab as much water as possible on those rare occasions when it does rain. Unfortunately these root systems do nothing to deter erosion by holding the soil in place. Deep, strong roots help prevent erosion by creating stability in soil.

Now you've got lots of water, no place for it to go, but down to the Colorado River, and nothing holding the soil and rock in place. The result is frequently a flash flood roaring down a side canyon that can move boulders the size of automobiles, buses and even small houses. If automobiles, buses and small houses are in the way then it will take them too. Luckily no one builds houses in the Grand Canyon so that's not a problem but there are a few autos, vans and buses sitting at the bottom of the Colorado. This mass that moves down a side canyon during a flash flood is more like a fast flowing concrete than water and it can be very dangerous. You should always be well informed of weather conditions when you are hiking through side canyons in the Grand Canyon.

After erosion by liquid water the next most powerful force is probably its solid form, ice. In the colder months, especially on the north rim, water seeps into cracks between the rocks. When the water freezes it expands and pushes the rocks apart and widens the cracks.

Eventually rocks near the rim are pushed off the edge and fall into the side canyons. These rocks sometimes hit other rocks and are stopped but on occasion one fall by a large rock will cause a cascading effect and create a rock fall that will alter the landscape drastically in the side canyon. This is a perfect example how gravity acts as an agent of erosion.

Once the ice had pushed the rocks off the edge and the water in the flash floods has carried them down to the river, then the “Colorado” River itself takes over. The erosive action of the Colorado has been severely constrained by the building of the Glen Canyon Dam, which ended the annual spring floods, but there is still a lot of water flowing relatively quickly through a very narrow gorge. Before building the dam the [Colorado River](http://www.bobspixels.com/kaibab.org/misc/gc_coriv.htm) had spring floods that would exceed a flow rate of 100,000 cubic feet per second (CFS). All of that snow melting in the Colorado Rockies came pouring down through the Grand Canyon in May and June, every year, like clockwork. These spring floods were considerably larger than today’s "trickle" of 8,000-10,000 [CFS](http://www.bobspixels.com/kaibab.org/misc/gc_misc.htm#cfs) at low water and even the 20,000 [CFS](http://www.bobspixels.com/kaibab.org/misc/gc_misc.htm#cfs) peak flow rates.

The Colorado's spring floods used to carry away all of the debris that was deposited in the main channel by the flash floods, but today’s mediocre flow rates have a tough time doing the job. It still gets done to some extent, it just takes a lot longer. In the process of moving the rocks and sediment down the river to the Pacific Ocean the bed of the river is scoured by all of this fast moving debris, which slowly eats away at the banks and bed of the river. This causes the river to widen and cut down deeper into the lower rock layers. Another cause for the slowing of the erosive force of the [Colorado River](http://www.bobspixels.com/kaibab.org/misc/gc_coriv.htm) is the fact that it is now trying to cut through harder granites and schists found at the bottom of the Canyon instead of the softer limestones, sandstones and shales near the top. This rock takes a lot longer to erode and a slower moving river means it takes even longer.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grand Canyon Case Study

Answer the following questions in complete sentences according to the Grand Canyon reading.

1. If the Grand Canyon is in the Arizona desert, how is water a major agent of erosion?
2. How do plant roots affect erosion? Explain this phenomena occurring in the Grand Canyon.
3. Outline the steps leading up to the Grand Canyon’s flash floods. Which agents of erosion are involved?
4. How is the agent of erosion: ice involved in the Grand Canyon? What is this vocabulary word you learned in the weathering lesson?
5. What is it called when rocks hit one another causing them to break? Hint: this can occur down hill or, in a river.
6. Explain the effect the Glen Canyon Dam has had on the Colorado River.
7. Why is erosion a slow process?
8. Take #7 a step further, why has the erosion process has recently slowed more? Hint: think about the rocks.
9. Personal Reflection: From your overall comprehension of this case study, why does this reading begin with “truth is that no one knows for sure how the Grand Canyon was formed, however there are some pretty good guesses?”
10. Draw a picture for each of the four agents of erosion that is taking place in the Grand Canyon. (These four have a tendency to interact with one another, so you may draw one very detailed picture if you would like.)