What Lands We Cross—

— When We Take Our Trips

by William Wallace

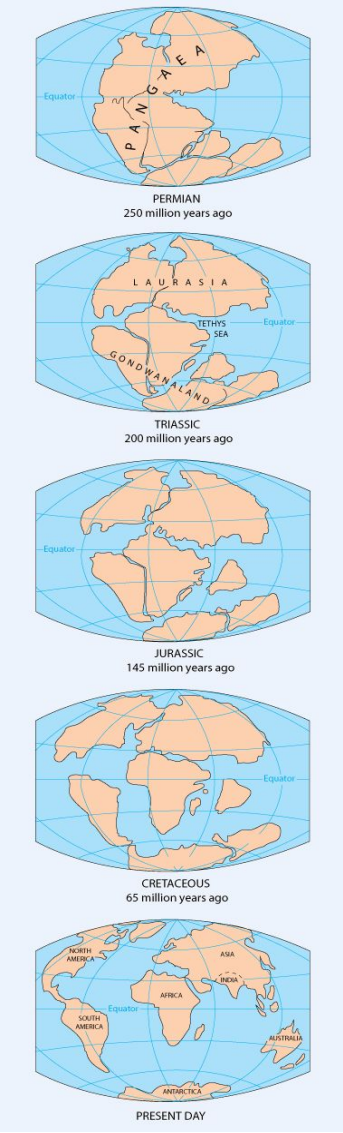
<u>FOREWORD</u>: It's my view that the universe was created with an absolute plan and identifiable purpose. We living, thinking beings were not an afterthought, but *a part of* the plan and purpose. I believe that it pleases the Creator when we use our life to respect the creation. So let's wander and wonder, seek out and study, and maybe even solve the Creator's mysteries.

I think it would be a shame if we who travel these sacred lands return home the same as when we came. Therefore, adventurers of Falling Creek Camp, I offer this challenge. Enjoy nature. And as you do, also grow mentally and spiritually while improving your outdoor skills. Seek to fully appreciate what has been given to you. Immerse yourselves in your activity in every way. It will help you understand the Purpose and the Plan: why you're here and where you can go next. In doing so, you may continue your discovery of who you are.

"Wally"—March 1, 2020

<u>INTRODUCTION</u>

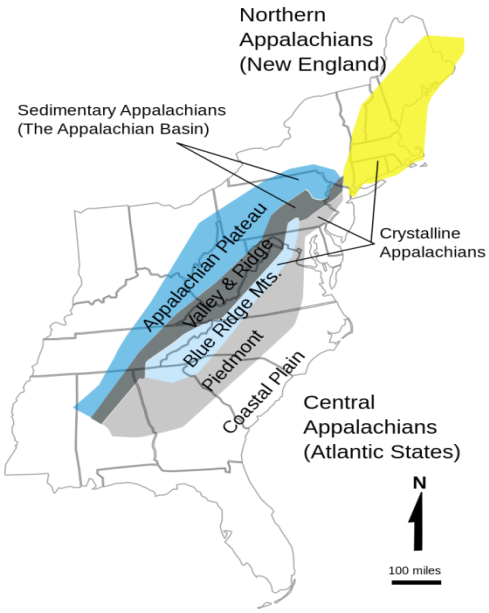
Before Life: The geological history of a place often lays the foundation for the history of humans who came much, much later. "Today" is a grain of sand on the vast beach of time. Going back, we would see at our camp great rift valleys, shark filled waters, and mountains whose peaks kiss the heavens. We'd hear violent volcanoes and be shaken by tumultuous earthquakes. We'd witness the building of new mountains and the re-arrangement of ocean basins by plate tectonics; the recycling of old rocks into new ones; landscapes sculptured by wind and rain; great rocks broken apart by ice, rivers, glaciers, and much later, the roots of plants. We can't go back in time, but the rocks carry the story forward to us. So, let us not be oblivious to this utterly wonderful land that God has bestowed.



Over 700 million years ago, we were covered by a thick layer of ice. All land was grouped together at the equator, as a supercontinent known as Pangaea (see right). The movement of Earth's plates caused its break-up and the subsequent formation of our mountains. About 300 million years ago, a continental collision between North Africa and North America pushed up a huge chain of mountains, rising up to heights that rival the top of Mt. Everest. We now refer to them as the early Appalachians. We can see evidence of this by studying the rock outcroppings near Brevard, NC—think Camp Illahee—where rocks once belonging to Africa were scraped off onto our continent.

Cometh Life: There was diversity around the early Appalachians. Even though the upper elevations were laden with ice, down lower a migration of insects, amphibians, and primitive reptiles began to occupy the swampy land, as sharks occupied the seas. Mammals did not yet exist; nor birds, nor dinosaurs, nor flowers. Then, around 100 million years ago, our land began to see its first dinosaurs. Birds and mammals came next, but humans were yet a ways off.

The Blue Ridge Mountains: This magnificent range comprises almost one-third of the Appalachians, which stretch from Alabama to Newfoundland. It is referred as the "blue ridge" due to a chemical exuded by the trees, causing the ever present haze to appear blue. The Blue Ridge starts in Pennsylvania and ends in Georgia, and contains much of the Appalachian Trail and all of the Blue Ridge Parkway. The Eastern Continental divide, separating the Atlantic Ocean from the Gulf of Mexico, lies upon its ridges. This ridge of mountains sports 125 peaks above 5,000' in elevation, including 43 peaks above 6.000 feet. At its highest is Mt. Mitchell, at 6684' above mean sea level (msl), the highest point east of the Mississippi River. In South Carolina, they reach elevations of 3400 feet.



Blue Ridge Escarpment (BRE): This major geological formation, running from Virginia to South Carolina, marks the *fall line*, so called because it the spot where the mountains fall off about 2,000' into the much lower elevations of the Piedmont. The "falling" took place along the Brevard Fault, a vertical crack in the earth's crust along which the mountains were thrust upward. This zone of upheaval extends from Alabama to Virginia, crossing North and South Carolina. The photo to the left was taken from Caesars Head, SC. It shows the severe topography of the BRE.

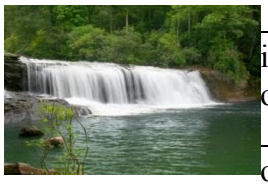
Another major fault in the region is the Linville Falls Fault. Several hundred million years ago, the Linville Falls Fault carried approximately one-billion-year-old rocks over the younger 700 million year old Grandfather Mountain Formation. Erosion through the billion-year-old rocks has exposed and created the rugged, scenic terrain of Grandfather Mountain that we enjoy today. A good place to experience the more severe elevation changes of the BRE is on the section of I-40 from Asheville to Old Fort, NC. In less than 5 miles, the road drops 1,500 feet, making that part of the road one of the steepest sections of interstate highway in the nation.

The technical definition of an escarpment is a steep cliff formed by faulting or erosion. The Cherokee called the BRE "Blue Wall", but for the purposes of this discussion, think of it—not as a cliff or wall, but a vast area rising from the Piedmont of South Carolina to camp's location on the edge of the fall. This broader tract of land in South Carolina alone takes up 150,000 acres of land. (You travel through this area on the way to Lake Jocassee and Lake Tugaloo.) That amounts to 235 square miles, or a square measuring 15.3 miles by 15.3 miles. (A square mile has 640 acres in it. An acre is approximately the area contained by the goal line of one football team to the 10 yard line of the other.) Imagine drawing a line west of camp to DuPont State Forest, then north to Pisgah National Forest, east to the Asheville Regional Airport, and finally, back to camp. This boundary would enclose an area similar to South Carolina's portion of the Blue Ridge Escarpment.

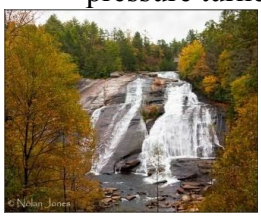
FEATURES NEAR THE BLUE RIDGE ESCARPMENT

1. DuPont State Forest, Waterfalls Galore—Rivers and creeks thread their way through this 10,473 acre tract of recreational delight. The most prominent, Little River, begins in the springs of the high grounds along the NC / SC border, the edge of the BRE, and winds its way north to join the French Broad River at a point between Pisgah Forest and Brevard, near the put-in for one of our flat water paddling trips.

If you could tube the entire distance, you would cross over falls with names like Hooker, Triple, High and Bridal Veil. DuPont has such a proliferation because it is an area marked by steep slopes and bedrock that doesn't erode easily. These are exactly the features that challenge our mountain bikers.



Hooker Falls (left) has the most vertical walls due to the intersection of horizontal and vertical cracks. This causes blocks of rock, weakened by the water, to fall off into the pool below. Triple Falls (right) has three distinct drops, resulting in a 50' loss of elevation. Between each fall are large, flat planes. It is thought that these horizontal stretches were formed deep underground where the heat of pressure turned the earth's crust to putty, and was "squirted" onto underlying layers.



High Falls (left), as its name implies, has the furthest drop of the three, but the gentlest slope. Perhaps this is because there are fewer vertical cracks to cause blocking; or maybe it's in the character of the bedrock. It would take lots of study to tell for sure.

Bridal Veil Falls (right) is featured in the movie, *Last of the Mohicans,* and is the farthest upstream. If you saw *Mohicans*, you will remember the part where the brave jumped through a curtain of water into a pool below. The actor was able to get behind the falls due to a shallow cave, which was formed by a layer of rock overlying a softer layer that eroded away more quickly.

The camera was also behind the falls, filming his leap through the curtain. But, unbeknownst to the movie goers, there is no pool on the outside for him to jump into—only a gently sloping rock. The outside take was of a pool elsewhere in the forest. (DuPont, itself, was the location for some of the scenes in *The Hunger Games*.)

DuPont State Forest is remarkable for more than its waterfalls. There are several locations that are the favorites of hikers and bikers. The top of Cedar Rock Mountain is a popular destination for both. Much of the trails traverse bedrock made of granite. This is a type of rock created eons ago when magma got close enough to the earth's surface to cool into a very hard mass. (Granite is made of quartz, feldspars, and mica type minerals.) The biker to the right has almost arrived at the top of Cedar Rock. He is biking on the Cedar Rock Trail, one of my favorites. The Big Rock Trail is more difficult going up, and more fun going down.

Be sure to stay off the moss. It is unique for its brittle nature, and therefore, is readily destroyed. You may feel it gently. One of my most memorable trips on this trail featured a 2' long copperhead warming itself on the rock.

2. Grandfather Mountain, from Valley to Peak in 750 Million Years—On the way to hiking in the Linville River Gorge, or climbing on Table Rock, or paddling the Upper New River, we come out of the valleys and climb up Hwy 221, cross the BRE, and drive past this conglomerate rock, which brags on its "mile-high swinging bridge". America's highest suspension foot bridge isn't actually one mile above ground (Wouldn't that be something?!), but one mile above sea level. It's only 80' above a gully that separates Grandfather Mountain from Linville Peak. From the top, you can get a 360° view of our northern mountains.

The rock of the mountain is conglomerate in nature, meaning that its granules were cemented together and contain pebbles that were rounded off from having been tumbled downstream on their way to the ocean. The immense pressure of overlying rock changed the conglomerate into a new and hard rock. The softer over-layers were eroded away, leaving what we now call Grandfather Mountain.

3. The Rim & Gorge of the Linville River: falls, faults, and geologic windows—Have you ever climbed the crags of Table Rock, or trekked the trails of the Linville River? (If not, sign up now.) Its flow of water emerges from the ground at the feet of Grandfather Mountain, winds its way through communities, under highways, and even becomes a lake at one place. Then it makes a small drop (lower-left) upstream from the larger, 150-foot falls (lower-right). No one has ever survived a trip over the lower falls, which has more ledges than shown in this photo. That's why the Cherokee, who named the river *Eeseeoh,* (meaning "river of many cliffs") executed their criminals by throwing them into the river at the top of the Lower Falls.

From here the Linville River carved out a severe gorge through which many FCC campers have visited. Its eastern rim offers climbing and hiking opportunities, with names such as Table Rock, the Chimneys, the Mummy, the Daddy, Shortoff Mtn, and includes all the intricate trails you hike to reach these spots. From the western rim you can visit the famous Wiseman's View. From here, many people have marveled over the legendary Brown Mountain Lights, a spooky night-time treat that features mysterious lights rising out of the Linville River and drifting up and back before fading out of sight.

Geology of the Falls: The Upper Falls (above left) cascade over what used to be granite, about 745 million years ago (mya), and was changed much later by heat and pressure into a metamorphic rock. Five hundred forty mya, the Lower Falls (right) used to be beach sand (quartz) and was metamorphosed into quartzite. What separates the two areas is the world-famous Linville Thrust Fault that developed later (320 – 260 mya) during the collision between continental plates. (It was the same collision that pushed up our early Appalachian Mountains.) So what we see is the older layer of the Lower Falls pushed over the top of the younger layer of the Upper Falls. This is a dead giveaway that you have crossed a fault. So when you view the Upper Falls from the overlook, glance at your feet to see the layers of rock folded by this thrusting. Imagine pushing a sofa over a loose rug. The folding in the rug is the same as the folded layers of rock.

Keep in mind that all of this happened about 10 miles below the earth's surface, long before there was a river. (If that is confusing to you, don't worry; it's not your *fault*.) Much, much later the Linville River carved out its path through this geological location, exposing the rocks for our study. This erosion gives us a tectonic "window". Not only does the window allow us to learn about the geology of the upper and lower falls, but it gives us such wonders as Grandfather Mountain.

4. Mount Mitchell State Park—Every school kid in western North Carolina knows that Mount Mitchell is the highest point east of the Mississippi River. The Rocky Mountain Range sports many peaks above 14,000 feet, whereas Mount Mitchell is "only" 6,684 above sea level. As a faithful resident of North Carolina, I am always quick to point out that the Rocky peaks are *not* "more than twice as high" as ours. For instance, Longs Peak (see right) is 14,259 feet *above sea level*. But the base of the valley upon which Longs Peak rests is typically 8 to 9 thousand feet above sea level. For instance, Lake Granby, ten miles to the southwest, is 8,280' msl, making the actual prominence 5,979 feet from base to peak.

Mount Mitchell is the tallest peak out of a dozen that dot the Black Mountains (see left). If you're

paddling the South Toe River, you're in the shadow of a peak about 4,000 feet above you. Compare this to the Longs Peak's 6,000' prominence. So the real height of Mount Mitchell above its base is only two thousand feet shorter that Longs Peak's—hardly over twice as tall. Nyah-nyah, Rocky lovers.

Author's Note: My seemingly competitive attitude regarding Longs Peak vs. Mount Mitchell is mostly in jest. Back in the 1970's, it was my distinct pleasure to hike, with what became lifelong friends, to the top of Longs Peak. It was difficult and somewhat dangerous, but the rewards were great. One everlasting memory was *crawling* to the edge of the cliff and looking straight down hundreds of feet to the valley below. Oh, wow.

Geology of Mount Mitchell: In fact, the topographic change of the top to the base is similar to the top of the South Rim of the Grand Canyon to the Colorado River below. The climate is quite unusual for western North Carolina. The daily high temperature in July is only 68°F. The highest ever recorded is 81°, and the lowest was thirty-four degrees *below zero Fahrenheit.* And, that's actual, not wind chill. Speaking of which, the mountain top is famous for its howling winds. Add to all that an average snowfall of 96" per year, and you'd better be dressed for cold weather extremes. Due to these climatic extremes, a trip from Marion, NC at 1,404' msl to the top would give you the same change in plant life that you would get on a trip from Georgia to Maine.

So, how did the Black Mountains get to be so tall? Well, first of all the original rock was granite, formed by a slow cooling of magma underneath the earth's crust. Then North America collided with Africa, pushing up the Appalachian Mountain Chain. The early Appalachians were the size and shape of some Himalayan ranges. During all this compression and expansion, the granitic base was metamorphosed into terranes of rock made of lots of feldspars, micas, quartz (left) and kyanite (right), the latter two being the hardest. As millions of years of erosion wore these sentinels down to their present size, these two minerals, prevalent in the Black Mountains, resisted erosion. Hence, Mount Mitchell remains the highest point east of the Mississippi.

An interesting aside is the argument between Elisha Mitchell and T. L. Clingman, who were both involved in surveying the mountains in our area after the Civil War. Clingman claimed that the tallest peak in our present day Smoky Mountains, later named Clingman's Dome, was higher than the mountain Mitchell measured, later named for him. The two did not like each other, and the competition was settled by Arnold Guyot, who determined that Mount Mitchell is 39' higher. (Guyot also has a mountain in the Great Smoky Mountains named for him.)

Speaking of tallest mountains, people are serious about the height of their favorite peak. One winter, while hiking from Davenport Gap to Newfound Gap, I learned of a pile of rocks on top of Mt. LeConte. It seems that dedicated LeConte lovers are trying to make it the highest peaks in the Smoky Mountains by creating a giant rock cairn (right). Now, it is the tradition for hikers is to pick up a rock and add it to the cairn as they pass by. In the photo, taken in 2014, it looks to be about 10' high. So it still has about 50 feet to go.

5. The Chattooga River—Those of you who have hiked along the Chattooga River to Lake Tugaloo are familiar with both Bull Sluice (right) and Woodall Shoals (left), the latter being a smorgasbord of geological information for anyone who is interested. The story is revealed by studying an 8,000 square foot outcropping of rock that displays myriad folds, layers, fractures, potholes, and sausage-shaped rocks called "boudins". (Boudin is Cajun for sausage, and is pronounced "boo dad" without the second d. I like to include boudin in my Cajun chili recipe.)

Bull Sluice is the last rapids in Chattooga's Section 3. It's a popular destination for boaters and swimmers. The boaters like to run it before entering the more difficult Section 4, which features Woodall Shoals. The swimmers either bat around in the sluice or paddle around in the calmer waters. There's even a beach for them.

A note on potholes (see left): they are formed by the swirling of sand and pebbles caught in eddies and micro-hydraulics. Over the years, the scouring effect carves them out. I used to swim in one that was 10' across and 20' deep. Once, a fellow wilderness guide took his clients to some ancient potholes to show them this process. To demonstrate the depth of the features, he dove to the bottom of a really big one. Unknown to the visitors, it was connected at the bottom to another just behind where they were standing. Starr silently slipped up behind them, all of whom were peering down into the hole where he disappeared. Just as they were on the edge of panic, he spoke. "What are y'all looking at?" That's my favorite pothole story, but a

more tragic situation occurred when a fisherman wearing hip-high waders drowned after he stepped into one at Cove Creek, Pisgah National Forest.

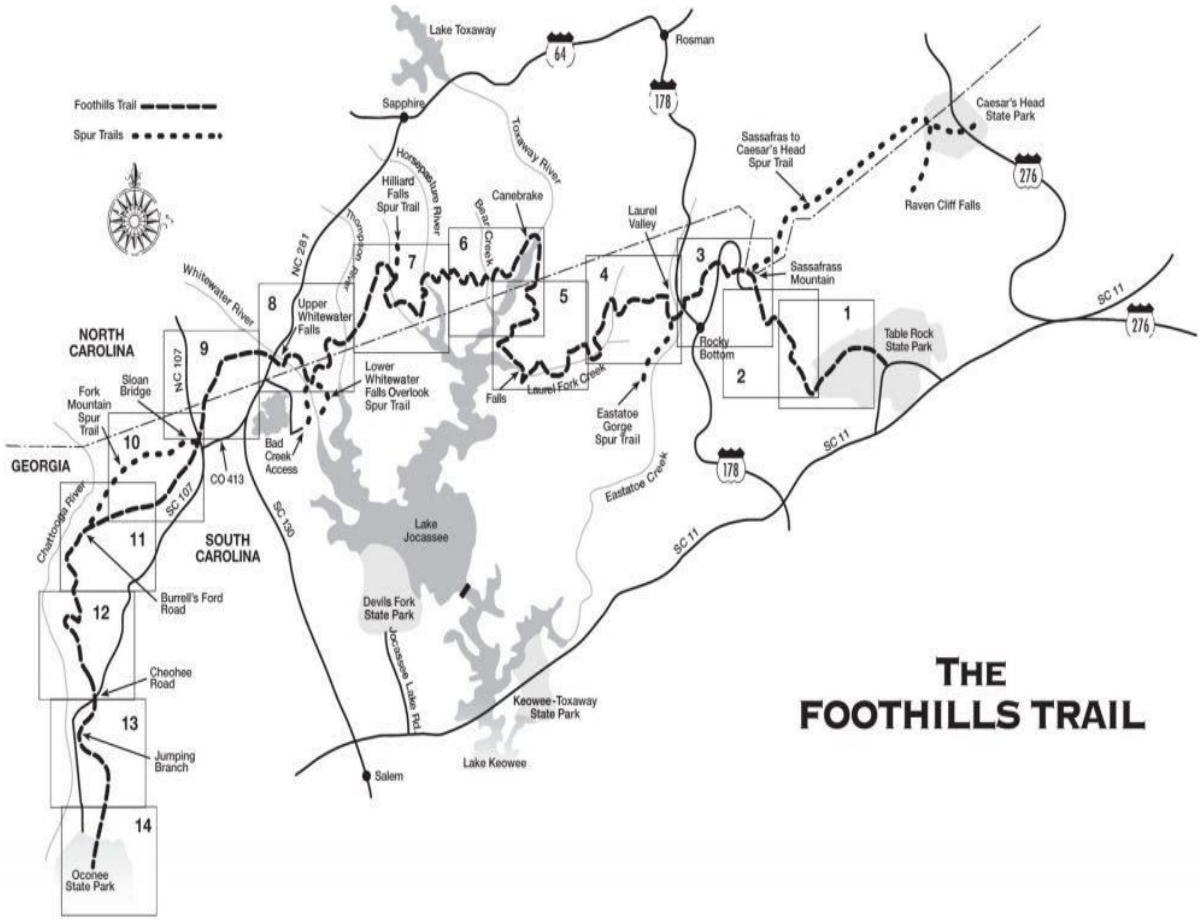
Another interesting note: The Chattooga River was used as the backdrop for many of the scenes in the 1972 movie, *Deliverance*, starring Bert Reynolds, Jon Voight, Ned Beatty, and Ronnie Cox. A lot of the shots were taken at Woodall Shoals, which is considered the most challenging part of the river, and there were many takes that included Lake Jocassee. The greatest difficulty of the project was getting all their stuff into the area. In fact, a whole boat-load of expensive equipment was lost when the raft carrying it overturned. The site of this technical set-back is now known as "Deliverance Rapid." Before the movie, the Chattooga was run by only a small community of skilled white water paddlers. In the several years after the movie's release, thirty-one less skilled people drowned while trying to do the stretch around Woodall Shoals.

Getting back to the geology of Woodall Shoals, the area displays such complexities because it is the site of, not one, but three major geological events, dating back 500 million years ago. From then until now the ancient granite was shaped, re-shaped, and then arranged into the metamorphic display that we can enjoy today. (Note the boudin in the photo to the right.)

6. Caesar's Head & Table Rock—The photo on the right demonstrates that the edges of some escarpments can be quite severe. Caesar's Head State Park, SC sits on top of the dividing line between the Blue Ridge and the Piedmont. Some boundaries are not cliffs, but steep slopes. Those of you who travel I-40 on your way to Linville Gorge traverse such a boundary. When you drive back to camp on SC Hwy 11 from Lakes Tugaloo and Jocassee, keep an eye out for Caesar's Head. You'll be a couple of thousand feet below this look-out, however.

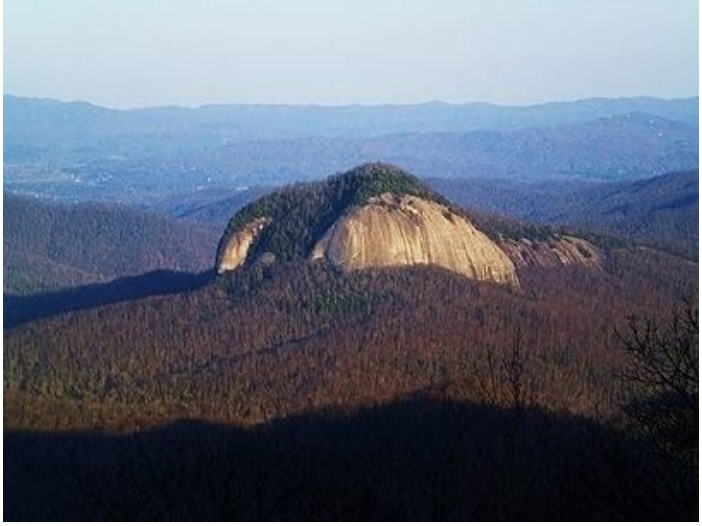
Also from Hwy 11, you'll see this very view of Table Rock (left). Like Caesars Head and Sassafras Mountain, it was formed from continental collisions about 430 mya. A massive intrusion of magma slowly cooled deep in the earth's crust and was changed by a later folding of the earth's crust. If you get to take the Foothills Trail hike (see map below), you will be in the very shadow of Table Rock. As you cross the bridge over Carrick Creek, you will see these folds—like the folds of a rug, which developed as the crust was compressed.

During the ensuing years of uplifting, the weaker surrounding rocks eroded away, leaving the granitic gneiss we call Table Rock. "Monadnock" is the name of a hill or mountain formed in such a way. Looking Glass Rock is another example.



7. Whitewater Falls—Many of you enjoy paddling on Lake Jocassee. One of the four major rivers that feed water into the lake is the Whitewater River. The other three rivers are Toxaway, Horsepasture, and Thompson. (See map on the previous page.) A mere twenty-four minute drive from South Carolina to just across the NC border is Whitewater Falls, the highest waterfall east of the Rocky Mountains. In North Carolina, the waters come crashing down the Blue Ridge Escarpment a dizzying 411'—and then another 400' as the river enters SC. Falling Creek campers who hike the 85-mile Foothills Trail have access to both the upper and lower falls. It is <u>imperative</u> that you never leave the designated trails. People have died trying to get too close. The only viewing is from overlooks built specifically for this.

Going back to the movie *Deliverance*, perhaps you will remember the take-out scene, in which Bert Reynolds was confronted by the sheriff. It took place in the cemetery of Mount Carmel Baptist Church. This location is now 300' under the surface of Lake Jocassee. Now, you are going to say, "But Wally, you said that scenes of the river trip were on the Chattooga River, and the Chattooga doesn't run into Lake Jocassee." Know what? You're right; but that's the way of movies. Remember the way they shot scenes in DuPont State Forest?



Looking Glass Rock—Although this most impressive mountain is not a direct feature of the Blue Ridge Escarpment, no treatise addressed to the people of Falling Creek Camp would be complete without it. First of all, many FCC campers have enjoyed its challenges. Equally important is the fact that one of camps major contributors, Steve Longenecker, was a part of the trio that made the first ascent in 1966. Their route took them up the very center of the photo on the left.

A personal note from the author: Several years after the first ascent, Steve led me up the Nose Route. That changed everything in my future—literally *everything*. I am eternally grateful for the events that led me to meet him.

CLOSING: While driving campers here and there, I enjoy pointing out various things. When I started this paper, I did not set out to write a comprehensive explanation of the geology of our area. But it snuck up on me. Although I enjoy the study, I am not close to being an expert. However, my research allows me to be confident in the facts and theories presented here. So, as a player in the drama of what lands we cross when we take our trips, I hope I can help you to discover your part.

William Wallace
Driver, Falling Creek Camp

From: *Exploring the Geology of the Carolinas—A Field Guide to Favorite Places from Chimney Rock to Charleston*
by Kevin G. Stewart and Mary-Russell Roberson
The University of North Carolina Press, Chapel Hill, NC, 2007
Furman: QE627.5 N8S74

From: *South Carolina's Mountain Wilderness—the Blue Ridge Escarpment*
by Thomas Wyche
Westcliffe Publishers / 2650 S. Zuni St. / Englewood, CA; 1994
Furman: QH105.56B521994
L of C: 94-60962

From: a Word document prepared by Jim Reynolds, Brevard (NC) College geology professor; references contained in Wikipedia; online sites for DuPont State Forest, Grandfather Mtn State Park, Linville Falls, Mount Mitchell State Park, Chattooga River, Caesar's Head, Table Rock, Looking Glass Rock, Lake Jocassee, and Whitewater Falls.