

## Sycamore Canyon Geology

The first outcrop you come to after leaving the parking area is a dark, fine-grained sheeted igneous<sup>1</sup> rock with no visible quartz. This is probably a basalt<sup>2</sup>. This formation lasts only a short distance.

From there down, the rock formations are made up of layers of rhyolite<sup>3</sup> flows which solidified from silica (SiO<sub>2</sub>) rich lava, tuffs<sup>4</sup> which are compacted volcanic ash, and volcanic sediments. A large portion of the tuff and volcanic sediments are made up of material which settled out of the air after being blown out by volcanic explosions and eruptions.

At first, the canyon walls are made up of unbedded horizontal flows of rhyolite which are weathered to rounded shapes. Some flow breccia<sup>5</sup> is also seen here. This breccia is formed when a layer of cooled lava that has solidified at the top of the flow is broken up by the movement of the still fluid, taffy-like mass, and incorporated into the top layer as large angular pieces. Below the breccia the flow is fine-grained and may show banding. The banding is caused by minerals which were able to segregate during cooling. However, large crystals are not present since the cooling was too fast to allow crystal growth.

On the trail you will see vugs (a cavity or hole in the rock) filled with a bluish-white mineral called chalcedony which is microcrystalline quartz. Also you will see spherical cavities filled with needle-like quartz and feldspar crystals growing outward from the center. They are called spherulites and were formed by gases and liquids trapped within the cooling lava.

About one mile from the start, a flow breccia forms a dam across the stream. In the right season you can enjoy a cool swim in the pool below the dam. The breccia that forms the dam is a lot harder than the rock that was eroded away to form the downstream pool.

About another mile down the canyon there is a drastic narrowing and the floor of the canyon and the walls are swept clean of all debris by the fast flowing water. You will see areas of well-bedded steeply dipping formations containing pebbles in some places. There are tuffaceous sediments and the fine-grained areas are air-fall tuffs. The air-fall tuff layers are formed by volcanic ash settling out of the sky during eruptions and explosions. You can see the difference between these well-bedded pebbly layers and the very fine-grained layers of rhyolite lava flow which solidified from lava flowing out of a volcanic crater.

This hike turned around at this point due to the difficult terrain below this very interesting area. Somewhat below this point, Penasco Canyon comes into Sycamore Canyon. Just upstream of this confluence there is a flow of volcanic glass called obsidian that was

formed by rapid cooling at the base of a lava flow. This obsidian is very fine-grained and its composition is the same as quartz but is black due to coloring by iron oxide. It is unfortunate that we couldn't get to Penasco Canyon to see the obsidian formation and likely some other interesting rocks.

---

<sup>1</sup> Igneous rocks, as the name indicates, are those that have been formed by the cooling and subsequent solidification of a once hot and fluid mass of rock material known as magma.

<sup>2</sup> Basalt. The basalts are dense fine-grained rocks that are of very dark color, green or black. They are composed of a soda-lime feldspar with pyroxene, iron ore, often more or less olivine, and at times biotite, mica, or hornblende.

<sup>3</sup> Rhyolite. Rhyolite consists chiefly of alkaline feldspars and quartz. This is the same composition as a lot of granites, but are very fine-grained and do not show the large crystals of feldspar and quartz as in the granites.

<sup>4</sup> Tuffs. Tuff is a layered rock that was formed by the settling of volcanic material blown out of a volcano and then settling out of the air. The coarser pieces lie on the bottom, while the smaller, slower falling pieces lie on top, grading down to fine dust.

<sup>5</sup> A breccia is a rock mass with angular pieces of rock of all sizes. The pieces are sharp-edged and they differ from a conglomerate whose rocks are rounded by erosion. Breccia is formed by solidified rock at the top of a lava flow being mixed into the still molten, moving mass of magma.

Prepared in January 2004 by Nello Modesto. Prepared for the Web Site by Jean Husemann.