

Each **tectonic belt** is separated by faults of fracture zones representing ancient oceanic and North American plate boundaries. Rock types found within the belts include: **granitic plutons, metamorphosed rocks, and ophiolites**, and younger sedimentary and volcanic rocks. The Smartville Complex contains all of the rock types mentioned above. It is currently believed to have formed along the 160 million years old (Jurassic) western margin of North America.

Over time, erosion by the South Yuba River, exposed various rock types that compose the canyon you can walk along today. As you explore the Park, see if you can identify the rocks that you encounter.

### Glossary of Terms:

**Batholith** – large mass of plutons

**Country rock** – native rock into which a pluton intrudes

**Diabase** – fine-grained igneous volcanic rock

**Dike** – new rock that fills cracks in existing rock

**Igneous** – rock solidified from molten or partially molten material

**Metamorphosed** – consolidated rock altered in composition by heat and pressure

**Ophiolite** – sedimentary and igneous oceanic crustal and upper mantle rocks

**Placer deposit** – gold bearing gravel deposited by water and gravity

**Plate Tectonics** – a theory explaining the motion of the earth's crustal plates

**Pluton** – large rock body formed under the surface from cooling magma

**Tectonic Belts** – group of rocks folded together

**Xenolith** – country rock introduced into magma

This was an important gold-bearing area during the California Gold Rush in the 1850's and again in the 1930's during the Great Depression. Gold ore deposits are far younger than the Smartville Complex. They formed during the 120-100 million years ago when gold-bearing fluids filled rock fractures and cooled to form gold-rich veins. Weathering and erosion freed gold from the veins and then transported the gold to creeks, streams and the Yuba River. The river emerged from the steep gorge upstream, and, as it slowed, it dropped much of the heavy gold particles; forming auriferous gravels. Gold deposits formed by these processes are known as **placer deposits**. Gold can be separated from placer deposits and concentrated using various methods, including gold panning.



*The Park wishes to thank Bruce Pauly, California State College East Bay, for use of his original document, which provided the foundation for this guide.*

*References can be found at the Visitor's Center.*

## Self-Guided Geology Hike of the South Yuba River State Park



The South Yuba River has cut across the Sierra Foothills topographic surface to expose the inner anatomy of the Sierra Nevada Mountains. Millions of years of Earth's geologic history are exposed, but unlike the Grand Canyon, the rocks are complexly faulted and folded. The 20-mile scenic South Yuba River canyon cuts through four major **tectonic belts** which arrived in their current position through the process of **plate tectonics**. Oldest to youngest; the Eastern Belt, the Feather River Belt, the Calaveras Complex, and the western Smartville Complex exposed in Bridgeport along the Buttermilk Bend Trail.



(530) 432-2546

17660 Pleasant Valley Road Penn Valley, CA 95946



(1) Along the river bed you can investigate the many types of rocks that have been eroded from the local tectonic belts and transported and deposited where you find them today.

(2) The rock grotto consists of weathered, **metamorphosed** granitic rocks belonging to the Smartville Complex. Although texturally similar to fresh granite, metamorphism and weathering has given them a brownish, greenish appearance. Coarse visible grains indicate that these plutonic rocks cooled slowly at great depth within the Earth's crust.

(3) Fresh exposure of the rocks a few steps further illustrate the extent of the weathering on exposed granitic rocks.

(4) Past the grotto, notice the rocks at river elevation; these large bluish rocks have whitish veins cutting through them. Texturally similar to the coarse-grained plutonic rocks of the grotto, the erosional power of the river has scoured and polished the rocks, giving them a smooth feel, and bluish appearance. The Sierra Nevada **batholith** and a nearby **dike**, and are dated near 100 million years younger than the rock grotto.



(2) Rock Grotto

(5) On your left is an outcrop of light-colored rock with a prominent dark, vertical band. The lighter-colored rock appears to be granitic. The darker vertical rock (**diabase**) is finer grained, with more iron and magnesium, it formed closer to the Earth's surface where it cooled rapidly. The darker rock appears to have cut through the lighter host rock, and is younger, and known as a **dike**.

(6) On the left is another outcrop of diabase, the darker-colored, finer grained rock seen at the previous outcrop.

Steep rock steps down to the river provide a close view of polished bluish granitic rocks.

(7) Toward the end of the rock retaining wall is an example of a dark **xenolith**. These are probably pieces of **country rock** (older rock surrounding the magma) that fell into the newly forming granitic magma.

(8) Here you can find an example of orange lichen. Despite appearing inhospitable, rocks have cracks and minerals that are exploited by plants. Different types of lichen prefer minerals found in high concentrations in specific rocks; this can help geologists map similar rock formations. Bryophytes, lichens, succulents, and mosses also make their home on rocks.

(9) You can observe the linear trend of the creek that suggests a zone of weakness, possibly due to a fault.

Continue on the trail (0.5mi) or return to the parking lot.



**RULES:**

Always stay on the path.

Please keep your dog on leash.

Please do not to take any rocks; they are an important part of our park to leave for future visitors.

Panning for gold within the park is still allowed today, hands & pans only.

**5) Diabase Dike**



**7) Xenolith**

