Cuyamaca Rancho State Park

Peninsular Ranges Batholith

The Cuyamaca Rancho State Park lies within the Peninsular Ranges geomorphic province of southern California, which is characterized by a series of northwest trending mountains and valleys that are similar in trend to the San Andreas Fault system that lies to the east. The Peninsular Ranges are chiefly made up of coarsely crystalline igneous rock, termed the Peninsular Ranges Batholith. The events that formed the batholith are complex, but clues to its formation can be gathered from an analysis of geology of the park and surrounding region.

Features/Process:
Petrology of the roots of ancient mountains on an exotic terrane along the plate boundary

Without question, it is the grinding of the North American plate sliding past the Pacific plate known as the San Andreas Fault system that is currently controlling the landforms of the region. But this has been occurring for a relatively brief period

Why it's important:
The rounded hills of granitic and metamorphic rock of the Peninsular Ranges are the deep roots of a much different ancient range that included volcanoes and high mountains possibly like the Andes. By examining these roots, we learn about the internal workings of other mountains.

of geologic time. Before this fault started to rip the state apart, California was the scene of a major mountain building events, which occurred during the Mesozoic era. These mountain building events, known as the Nevadan and Sevier Orogenies, were the result of the collision and subduction of the Farallon oceanic plate beneath the North American continental plate. A modern analogy to this event is that of the Andes Mountains of South America. There, the Andes are constructed of active and inactive volcanoes fed from magma due to the subduction of the Nazca oceanic plate below the South American continental plate.

The geologic record of these mountain building events is evident in the Cuyamaca Rancho State Park area as the Triassic-Jurassic Julian Schist, and the Jurassic and Cretaceous metamorphic and igneous rocks. The following sections discuss those rocks and the implications to the formation of the batholith.

Mountain-Building Events and the Rock Record

Around 165 million years ago, during the Jurassic Period of the Mesozoic Era, the west coast of North America was being subjected to intense volcanic activity. The supercontinent Pangaea was breaking apart and the North American plate was carrying the continent toward the west as it still does today. The Pacific Ocean floor (oceanic crust) broke into several plates, including the Farallon plate, and was pushed under North America. The subducted plates melted at depth beneath the continental margin. Southern California was in a different geographic location, off the coast of the current Mexican mainland and submerged. Many volcanoes formed far to the east

What you can see: A series of granitic and metamorphosed sedimentary rocks that represent past mountain building events.

along the western margin of the continent creating a volcanic island arc. Sediment and volcanic rocks eroded from the volcanic highlands to the east were deposited in the ocean basins to the west.

Further volcanism occurred later in two pulses during the Cretaceous period, which possibly consisted of volcanic islands being formed offshore, where magma erupted and cooled into andesite and basalt. As the continuing plate collision occurred along the western margin, the island volcanoes were moved east and shoved up against the North American continent. The resulting collision compressed and squeezed existing igneous and sedimentary rocks, causing them to be metamorphosed. The constant compression also caused them to be pushed up into huge mountains. Since then, the great mountains have been eroded to their cores.

What Rocks Can Be Seen?

During the mountain building events, volcanoes generated abundant quantities of volcanic rocks. However, these were not the only rocks that were deposited. As some of the magma was trapped below the volcanoes, it cooled beneath miles of overlying rock and sediment. These masses of rock that cooled deep in the earth's crust are Jurassic granodiorite, Cretaceous gabbro and Cretaceous monzogranite. These rocks, along with other similar "granitic" rocks, form the Peninsular Ranges Batholith. The Jurassic rocks are the cores of the ancient volcanoes, and the remnants of sand,

mud and volcanic debris deposited in the ocean basins. These rocks appear layered or banded because they were subject to immense heat and pressure causing the minerals to orient themselves in response to the pressure.

Some of the Cretaceous rocks in the park area also represent the cores of ancient volcanoes, but a slightly different type. The Cretaceous Cuyamaca gabbro, a dark crystalline rock, has been interpreted to be the core of an island volcanic system. The Chiquito Peak monzogranite is much lighter in color and was emplaced around the time of the gabbro, and may represent the partial melting of the continental crust as the magma and island arc system slammed into the North American continent. The Cuyamaca gabbro and Chiquito Peak monzogranite can be observed in the vicinity of the Cuyamaca Rancho State Park Interpretive Center.

Final Thoughts

As a fragment of continent caught on the oceanic plate heading northward toward Alaska, this exotic terrane will undergo many more profound changes. Will it ever make it there before erosion obliterates all vestiges?

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