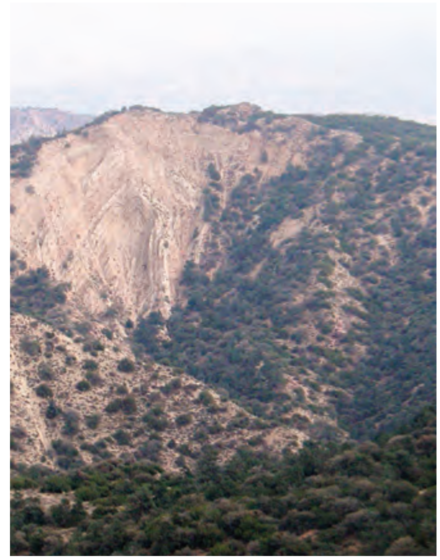
Hungry Valley SVRA

State Vehicular Recreation Area



Diverse Expression of the San Andreas Fault

In general terms, the San Andreas Fault is a system of faults that has evolved through time. The San Andreas Fault system marks the boundary between the Pacific and the North American tectonic plates which are sliding past each other.

In places, the San Andreas Fault is a well-defined single strand. In other places, it consists of several roughly parallel faults (referred to as strands). Sometimes the fault interacts with other faults in complex ways with active movement shifting to another trace and initiating a new active strand.

Feature/Process:
Seismic and tectonic geology along the plate boundary, and fossils

Along the lengthy plate boundary the net movement is right-lateral (one side of the fault moves to the right relative to the other side). With slight jogs or turns along the fault, secondary zones of compression form hills and zones of extension form basins.

As the plate boundary develops and movement shifts from one strand to another, the focal points of secondary compression and extension may shift. The Ridge Basin is a case where an extensional ("pull apart") basin came to be squeezed up in a zone of compression as movement shifted from one fault strand (the San Gabriel Fault) to a newer one (the current San Andreas Fault). This is called "basin inversion" by geologists who delight in the fact that uplifted sediments that were once deeply buried are now exposed and available for study. The broader setting of this adjustment zone is called the Big Bend of the San Andreas Fault.

What you can see: Tilted and folded sedimentary rocks, differential erosion, “bad lands” topography, fossil burrows of predatory insects (tiger beetle larvae), and fossil clams and snails.

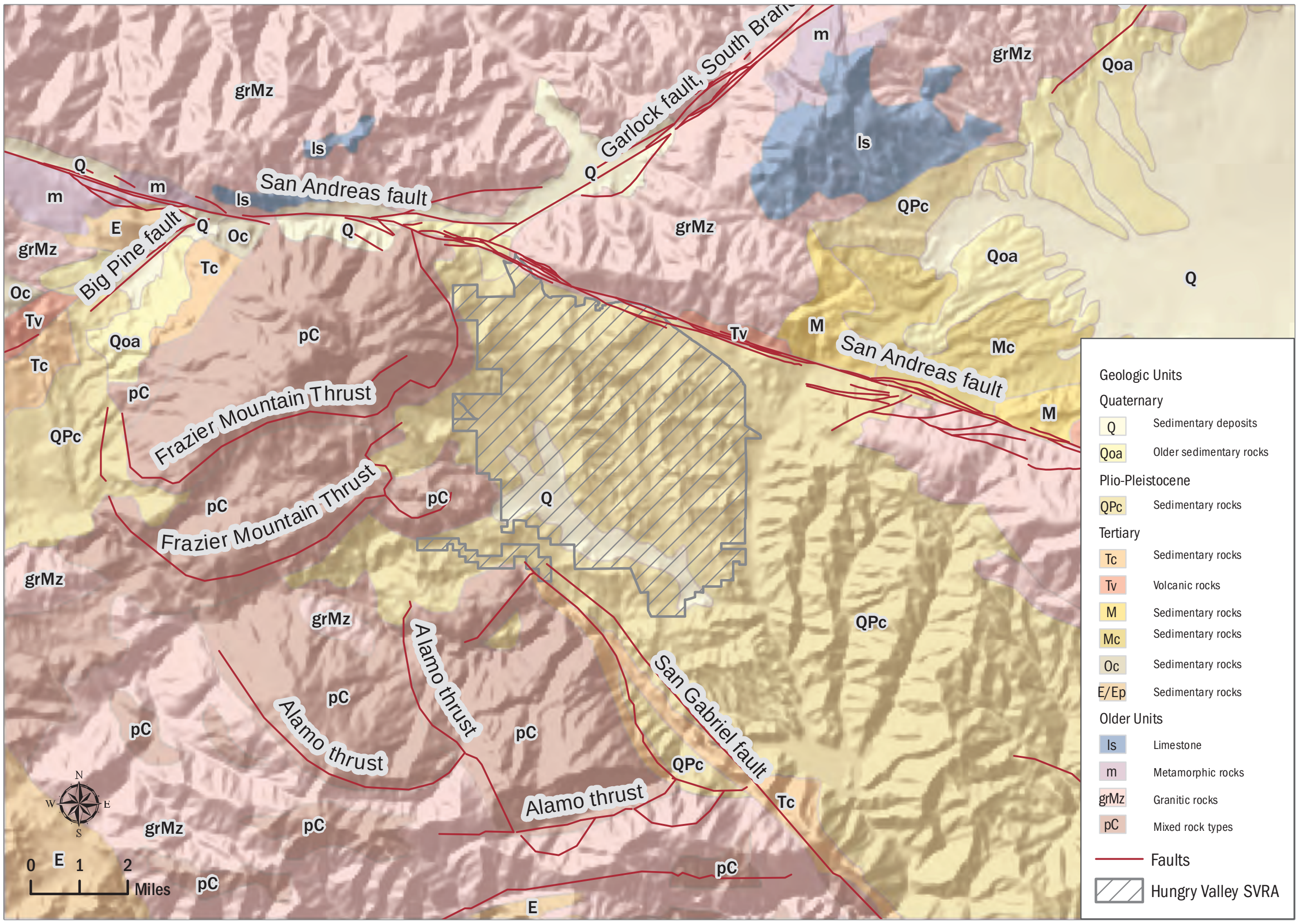
Why it’s important: Hungry Valley SVRA lies in the heart of a complex geologic structure know as the Ridge Basin. The highly deformed rocks within the park bear stark witness to the tremendous forces that characterize the interplay between the San Andreas and San Gabriel Faults, which bound the basin and the park.

Ridge Basin Formation

The Ridge Basin began to form approximately 11 million years ago. Movements on the San Gabriel and San Andreas Faults pulled the earth’s surface apart creating a basin. At that time, the San Gabriel Fault was the region’s principal tectonic feature, not the San Andreas. Like the San Andreas, it accommodated principally right-lateral movement with secondary vertical movement.

The basin continued to subside and simultaneously to collect sediment eroded from the flanking range that was uplifted along the San Gabriel Fault. More than 30,000 vertical feet of sediment accumulated in the basin. The sediment deposits provide a seven million year long record of the interplay between basin development and fault movements.

During this period, the primary motion changed from vertical to horizontal (strike-slip faulting) and more of the movement was being taken up on the San Andreas Fault. About four million years ago, tectonic forces were transferred to the San Andreas Fault and the San Gabriel Fault became much less active.



Stress from the San Andreas Fault compressed and uplifted the sedimentary rocks that had filled the Ridge Basin. These uplifted basin rocks have been dissected and eroded with many rugged canyons. Resistant sandstone and conglomerate layers interlace with weaker shale and siltstone layers. This contrast in resistance to erosion creates the badlands topography that characterizes the eastern half of the park.

Movements on the San Gabriel and San Andreas Faults pulled the earth's surface apart creating a basin.

The compressive forces exerted by the San Andreas Fault as it bends westward at Frazier Mountain led to the creation of the Frazier Mountain and Dry Creek Faults. Movement along these compressive faults resulted in older, metamorphic basement rocks being placed on top of (thrust over) the younger sedimentary rocks of Hungry Valley.

Changing Environment

The texture and composition of the sediments and the presence of key fossils indicate that the evolving basin hosted a sequence of several different environments including a deep lake, a shallow lake, a marine embayment, and alluvial fans. Close examination of finer-grained sandstones and mudstones will often reveal tubular shapes randomly distributed through the rock. These are the fossil burrows of predatory insects (tiger beetle larvae) that were hunting on the mud flats on the shores of ancient streams and quiet backwaters.

Other fossils that may be observed include clams and snails. One may also discover beds that contain layers of densely packed fossil shell fragments (fossil “hash”). These are what paleontologists refer to as “death assemblages”, i.e. the animals die and their remains are washed into quiet backwaters or eddies, where they are fossilized.

Final Thoughts

The Ridge Basin is a virtual laboratory where the “evolution” of a plate boundary can be studied in detail. Lessons learned here can be applied to other areas that seem to be currently evolving in similar ways, such as the Salton Sea region.

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