Fort Ross State Historic Park

San Andreas Fault

The San Andreas Fault extends over hundreds of miles from the Gulf of California north to Shelter Cove near Cape Mendocino. Where it passes through Fort Ross State Historic Park, the San Andreas consists of a number of interconnected fault strands along a zone about 600 feet wide. Geomorphic features indicative of active strike-slip (lateral) movement along the fault zone include elongated hillocks known as pressure ridges and (where they block drainages) shutter ridges. Offset drainages are another common fault-generated feature at the park. A prominent example of an offset creek is the west-flowing Fort Ross Creek, which takes an abrupt turn northward where it encounters a short ridge along the east edge of the fault zone. After a short distance, it turns west again to follow its old course, which has been offset to the north by movement along the fault. The fault's influence on the landscape was dramatically

Features:

Seismic and coastal geomorphology along the plate boundary and an exotic terrane

Why it's important: The landforms and underlying geology at Fort Ross illustrate a dynamic history of shifting tectonic plates (giant fragments of the earth's crust) and fluctuating sea level. The park is situated at the active continental margin, where the Pacific plate and the North American plate are moving slowly past each other along the San Andreas Fault. To the west, rocks of the Point Arena terrane represent a displaced sliver of the earth's crust that has been dragged northward along the fault for millions of years. East of the fault, entirely different rocks form the core of the northern California Coast Ranges. Marine terraces at the park represent ancient shorelines and sea cliffs preserved though the interplay of climate change and tectonic uplift. Understanding the tectonic processes that helped shape the spectacular setting of Fort Ross enriches appreciation during a visit to the park. The visitor center has interesting historic photos of damage due to the 1906 earthquake.

Before the 1906 quake ...

... and after

Photo: UC Berkeley, Bancroft Library

displayed during the great San Francisco Earthquake of April 18, 1906, when the fault ruptured from south of San Francisco to well north of Fort Ross. Roads and fences in the Fort Ross area were reportedly instantaneously offset between 7.5 feet and 12 feet horizontally, and uplifted on the west side of the fault by as much as three feet. Shaking from the event also triggered landslides in the immediate area.

Point Arena Terrane

The geologic term "terrane" (distinct and different from terrain) refers to a large fault-bounded packet of rocks with a geologic makeup and history distinctly different from surrounding rocks. Although the Point Arena terrane is traveling northward with the Pacific plate, it isn't truly a part of it. The Pacific plate is composed largely of oceanic crust formed by volcanic eruptions along a mid-ocean rift. Through collisions with the adjacent North American plate, slivers of continental crust and material deposited along the plate boundary were caught up with the Pacific plate, then dragged northward and strung out along the west side of the San Andreas Fault. The Point Arena terrane represents the northernmost of these displaced terranes along the fault.

In the Fort Ross area, the Point Arena terrane consists of layered Paleocene to Miocene age (5 to 65 million years old) sedimentary rocks. The rocks are interpreted to have formed from material eroded off the continent to the east and deposited on a submarine fan off the continental shelf. The results of this process are alternating

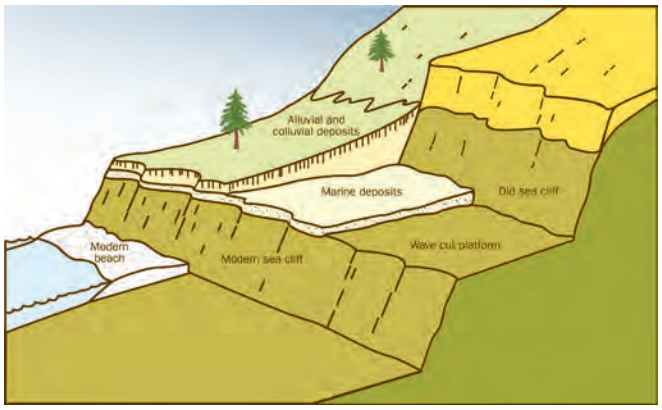
Photo:: 2002–2012 Kenneth &Gabrielle Adelman—Adelman@Adelman.com

What you can see: As Highway One approaches Fort Ross from the south, the road winds precariously along steep mountainsides that descend directly into crashing waves. Shortly before reaching the park, the highway crosses onto a bench that opens up between the mountains and the shoreline. This change in the landscape occurs where the San Andreas Fault trends onshore, and a unique packet of rocks known as the Point Arena terrane emerge along the west side of the fault to form the narrow coastal plain where the fort is located. A close look at this coastal plain reveals a flight of broad "steps" that represent a series of progressively older and more elevated marine terraces cut into the Point Arena terrane bedrock. Along the eastern portion of the park, the presence of the active San Andreas Fault zone has produced abrupt changes in stream direction and formed elongated hillocks.

light-colored sandstone and dark mudstone layers, which can be seen along the cliffs and shoreline below the fort. Other displaced terranes along the fault are notable for the presence of granitic rocks, and have been grouped into what is called the Salinian block. Similarities between granitic rocks of the Salinian block and granitic rocks in southern California indicate the Salinian block likely originated in an area around the northwestern Mojave Desert. Because the Point Arena terrane is located along the west side of the San Andreas Fault, it is commonly regarded as part of the Salinian block. However, the Point Arena terrane does not appear to include granitic rocks, and how far south it may have originated is less clear.

Marine Terraces

Four separate levels of marine terraces have been recognized within the park, with the oldest located roughly 230 feet above sea level. Each terrace consists of a wave-cut bedrock platform (bench) with a thin, discontinuous blanket of marine and younger non-marine deposits. The origins of the terraces are tied to changes in climate and associated fluctuations in eustatic (worldwide) sea level during the Pleistocene epoch 11,000–1.1 million years ago. Wave-cut platforms and sea cliffs formed at interglacial high-stands (peaks in sea level) as wave action beveled the platforms while eroding back the bedrock cliffs. Progressive tectonic uplift of the region lifted the terraces above subsequent sea level high-stands and thereby preserved them. Terraces in the area have been dated and correlated with sea level high-stands between 80,000 and 300,000 years ago. The uplift rate in this region ranges from 0.3 mm to 0.6 mm per year, based on these ages and the current terrace elevations.



Marine terraces consist of a wave-cut bedrock platform (bench) with a thin, discontinuous blanket of marine and younger non-marine deposits. The origins of the terraces are tied to changes in climate and associated fluctuations in eustatic (worldwide) sea level during the Pleistocene epoch 11,000–1.1 million years ago. Modified from Weber and Allwardt, 2001.

Final Thoughts

Here two powerful land-forming forces (the San Andreas Fault and the surf) meet. The interplay of these forces has produced a landscape full of diverse forms and uncommon beauty.

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