



Wilder Ranch State Park



Climate and Sea Level Change

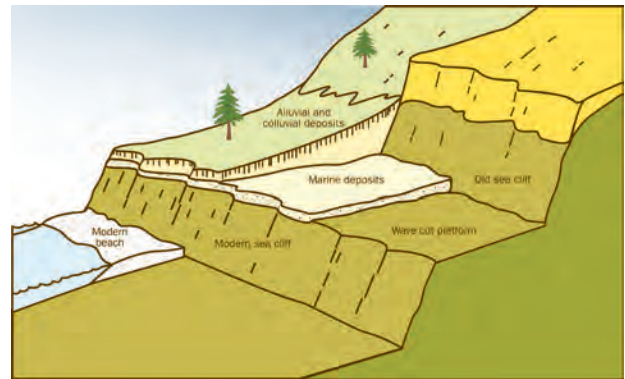
Cyclical changes in climate over the last 1.8 million years were accompanied by fluctuations in sea level due to variations in the amount of water taken up by continental glaciers and polar icecaps. In between some of these hot to cold cycles, worldwide sea level is estimated to have fluctuated by more than 400 feet. Scientists from disciplines as diverse and varied as oceanography, meteorology, paleontology, seismology, and geomorphology have pieced together information on ancient climates, marine terraces, coral reefs and other related issues from around the globe to produce a record of sea level changes through time.

Features/Processes:

Differential erosion, caves, wave-cut platform

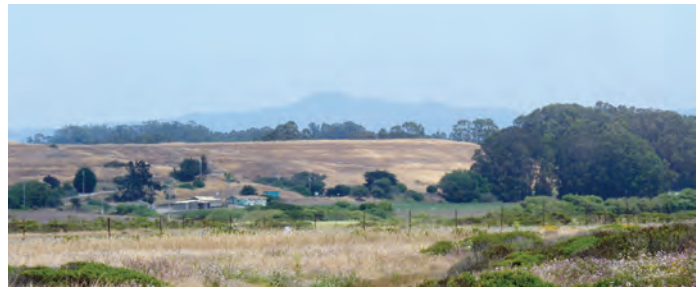
Wave-cut Platforms Transformed to Terraces

The wave-cut platforms and sea cliffs at Wilder Ranch State Park embody ancient shorelines, that existed at peaks (high-stands) in sea level. When the ocean level dropped during a glacial period, the shoreline was left dry and, through continued tectonic uplift of the region, was preserved from being completely erased during subsequent sea level high-stands. Thin mantles of marine sediments with shells, and remains of marine organisms which were present on the platforms when the ocean receded, cover the terraces. With the passage of time, the ancient cliffs eroded to the gentler angles seen today and they shed material onto the marine deposits along their base. The resulting sequence of 1) a wave-cut bedrock platform, 2) an overlying blanket of sandy marine deposits, and usually 3) a mantle of younger material washed from the hillside, collectively form the terraces. This sequence is beautifully exposed along the sea cliffs and in the steep-sided drainages that have cut through the terraces at the park.



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.

Why it's important: The park is situated in the California Coast Ranges at the continental margin, a tectonically active zone where the San Andreas Fault system forms the boundary between the Pacific plate and North American plate. As these two enormous pieces of the earth's crust grind slowly past one another, the lands along the plate boundary have been sheared, buckled, squeezed and deformed on a monstrous scale. The Santa Cruz Mountains have developed near where the San Andreas Fault makes a slight bend to the west. As the Pacific plate pushes northward through this bend, it causes compression of the crust, and uplift of the region that is ongoing today. The terraces of Wilder Ranch State Park provide an opportunity to better understand how fast this regional uplift has been occurring.



There are as many as five separate levels of marine terraces preserved in different areas of the park. The terraces increase in age with elevation, and extend to almost 800 feet above current sea level. Through a variety of dating methods, scientists have developed a chronology of terrace development spanning more than 200,000 years. From these data, the rate of tectonic uplift over this period has been between two and four inches per 100 years, providing a good idea of just how tectonically active the area has been.



Sculpted Sea Caves

Some of the more enticing shoreline features at Wilder Ranch State Park may be attributed to differential erosion. The offshore wave-cut platform and cliffs at the park have been carved into the approximately 20-million-year-old Santa Cruz Mudstone. Cliff retreat is relatively slow along this section of the coast because of the uniform and generally resistant nature of this bedrock unit, together with the protection provided by the offshore platform that absorbs much of the ocean's wave energy. The sandy beaches along this section of the coast are confined to where coastal streams have eroded the cliffs from the landward side. Erosion by the sea is concentrated along zones of weakness within the bedrock, most notably along joints (fractures) and sandstone dikes (near-vertical intrusions of sand injected into the mudstone from deeper sand layers before the rock had hardened). More rapid erosion along these zones of weakness has produced a variety of interesting forms, beginning with surge channels and clefts separating sections of the shore platform. Some of the surge channels advance to form sea caves and arches cut deep into the cliffs, and ultimately may form isolated coves and headlands once caves and arches collapse.



What you can see: Looking toward the Santa Cruz mountains, visitors will notice a series of flat-lying areas separated by low, steep slopes. This distinctive landscape of naturally formed terraces represents a series of ancient, shallow seafloors and shoreline cliffs formed over thousands of years that have been gradually uplifted with the elevation of the mountains. This process continues today, as waves slowly erode back the bedrock cliffs of Santa Cruz Mudstone to leave a gently sloping rock platform in their wake. Most of this actively forming wave-cut platform is under water, but portions are revealed at low tide to form the perfect venue for an abundance of captivating tide pools. The usually sheer cliff face is occasionally broken by wave-swept sea caves eroded deep into the bluffs, or cut entirely through protruding headlands to form arches. Where small streams meet the sea, the rocky shore gives way to picturesque pocket beaches and inlets.

Final Thoughts

The dramatic landscapes of Wilder Ranch State Park offer fascinating features to view during a day visit. Experiencing the bold processes that shaped the landscape leaves an impression that endures long after leaving the park, and provides reminders of the dynamic world we inhabit along the California coast.

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