

**Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.**

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**Living on an ancient seafloor**



*The raised marine terraces of Wilder Ranch can be seen proceeding inland from the present seacliff.*

Even if you never go to the beach, chances are if you drive anywhere in Santa Cruz you are traveling across an ancient beach. Much of the city has been built on an uplifted marine terrace, an old chunk of seafloor now covered with houses, stores, streets, and if you head north, Brussels sprouts. If you start peddling your bike at West Cliff, working your way up Bay Street, you'll notice it's a gentle climb all the way to Escalona Drive. While it's easy driving up that hill, on a bike you notice immediately that you are climbing. Escalona forms the inner edge of the first marine terrace and is the base of an ancient sea cliff. If you are further west and

cross Mission Street at Western Drive, the climb is even steeper. It's obvious even in a car that you are climbing a cliff, an old sea cliff.

Dating of fossils recovered from the terrace surface where it is exposed along West Cliff indicate that this wide, nearly flat bench was formed about 100,000 years ago. Terraces have made development of many of California's coastal communities possible: Mendocino, Half Moon Bay, Santa Cruz and Capitola, for example. Where we don't have terraces, Big Sur for example, there is almost no development, and even building Highway 1 was challenging because of the steep slopes.

Why are these flat terraces so common along California's coast? Creating and then preserving marine terraces requires several things: a slow but continuous uplift of the coastline, an oscillating sea level, and bedrock that is weak enough to be eroded by waves. For millions of years the edge of what is now California was a place where two massive crustal plates collided. While the offshore oceanic plate was forced down under the advancing North American plate, this collision also led to gradual uplift of the coast of ancient California, helping to create the Coast Ranges. Some of this slow uplift continues today.

The second requirement is that sea level rises and falls over time. We know that the Earth's climate has changed constantly over time scales of thousands of years because of the amount of heat we get from the sun. This will be described in a later column so you'll have to accept it for now. Simply put, the closer we are to the sun, the warmer the Earth gets; the farther we are away, the cooler it gets. When the Earth is warm, as it is today, the ice caps and glaciers begin to melt and sea level rises in response. At times of high sea level, the waves are doing their job, washing sand back and forth across the intertidal zone, grinding down the bedrock and forming a flat rocky terrace, visible at low tide today. When the climate cools again, sea level drops, and if the land is rising, we will elevate and preserve a flat marine terrace. Variations in local conditions have led to the preservation of up to 5 terraces in the Santa Cruz area, with Wilder Ranch being a great place to see them on a bike.