

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

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Ancient mud, diatoms, and whales



Shells preserved in Purisima Formation mudstone from Depot Hill, Capitola.

Westsidiers and eastsidiers each have their own world-class surfing spots; they also each have distinct bedrock and coastlines. The rocks underlying West Cliff from Almar Avenue north to beyond Davenport are mudstone, the Santa Cruz Mudstone to be precise. Although the mudstone does erode over time, this stuff is actually pretty hard because of its high silica content; in some places it's almost like porcelain and it puts up a good fight against the incessant wave attack. Most of the silica came from the shells of the billions of ancient diatoms that populated the sea that covered the Santa Cruz area 7 to 9 million years ago when the mud was deposited.

From Almar Avenue southeast to Rio Del Mar, the cliffs consist of the Purisima Formation, which is younger by several million years and which is a mixture of sandstone, siltstone and mudstone. Most beach goers in Santa Cruz County have a chunk of Purisima stuffed with fossil clam shells somewhere on their front porch, window sill or book shelf. If you walk along the shoreline below Depot Hill in Capitola on a low tide, keeping your eye on the overhanging cliff, you can see huge slabs of Purisima that have fallen from the cliffs. Many of these are molluscan graveyards. If you look carefully, you can also almost always find a few fossilized whale bones embedded in the rock as well. In contrast to the Santa Cruz Mudstone, the Purisima is much weaker and is also extensively jointed or fractured so yields more readily to wave attack.

For ten miles or so of the coastline of northern Santa Cruz County, sedimentary intrusions, or sandstone dikes and sills, have been well preserved within the mudstone seacliffs. Most of us are more familiar with volcanic intrusions, where hot lava under pressure works its way upward towards the Earth's surface and leaves behind dikes and sills of hardened lava. Somewhat surprisingly, there are also sedimentary or cold intrusions. These seemed to have been created when deeper, fluid saturated sediment was liquefied like quicksand, perhaps by a long ago earthquake, and forced upward like toothpaste squeezed out of a tube.

From the beaches of Wilder Ranch to beyond Davenport, a bizarre variety of these unique features are exposed along the coastline. Near the little settlement of Majors, they can actually be seen from Highway One in road-cuts without even getting out of your car. In other cases, a short walk to one of the nearby pocket beaches will reveal some landforms not visible in many other places in the world.

While their origins aren't completely clear, an early geologist working his way up the coast first recognized these intrusions a century ago in the cliffs south of Davenport. Yellow Bank Beach is named after the yellow or orange sandstone exposed in the cliffs, believed to be the largest exposures of this phenomenon anywhere on Earth! Some outcrops of the sandstone intrusions are oil-bearing and form natural asphalt deposits, which were quarried at several sites a mile or two inland in Bonny Doon from about 1888 to the 1940's. This asphalt was reportedly transported to San Francisco in the 1890's to pave the city streets.