

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

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The Purisma—From Clams to Cetaceans



Whale ribs and vertebrae from the Purisima Formation on display at the Seymour Center at Long Marine Lab.



Layers of clam shells from the seacliff at Depot Hill, Capitola.

The Santa Cruz Mudstone, which extends north along the coast from West Cliff to Davenport and beyond, is pretty boring and monotonous as far as rocks go. There's just not a lot to see in the mudstone, with the exception of some of the world's largest sandstone intrusions at Yellow Bank Beach. The Purisima Formation, on the other hand, from Pleasure Point and continuing through Capitola and into the bay, has about as much as you could want in a local pile of rocks.

For geologists, it's mostly all about how, where, and when did these rocks form. We spend our lives asking and then trying to answer what seem like relatively simple questions. And as many times as I've looked at the fossil beds and whale bones in the Purisima, the answers still aren't completely clear.

Geologists have worked from the principle of uniformitarianism, or the present is the key to the past, for perhaps 200 years. I think it might be the opposite for history, where the past hopefully provides some insight to the present.

So if we see an outcrop of rocks, perhaps in a road cut or a sea cliff, and we notice the grain size and layering of the sediment looks the same as we might see in a modern sand dune, we can reasonably conclude that these ancient layers exposed in the road cut were deposited by wind in the past. The sand dunes of the present inform us about the ancient preserved dunes of the past.

The Purisima Formation contains a lot of clues about its history. The layers of clam shells exposed in the 70-foot high cliffs of Depot Hill, and the scattered cetacean (whales in some cases) bones that are also commonly found in rocks that have fallen from the cliffs, provide some evidence. You may also recall several years ago when the skeleton of a small whale was found embedded in the bluff during the construction of the seawall along East Cliff near Pleasure Point.

Take a trip out to the Seymour Center at Long Marine Lab, and notice the three large slabs of Purisima bedrock right in front of the world's largest blue whale skeleton. Each contains vertebrae and ribs of a 7 million year old whale, or perhaps several whales. These boulders were collected below the cliffs at Depot Hill and give us some sense of what this area was like in the not too distant (geologically speaking) past.

So playing detective, where would you look today to find an environment where huge numbers of clams lived and died, and also where whales might occasionally die and sink to the seafloor to be buried in the sediment? It was a marine

environment, probably where water was not terribly deep, perhaps not that different than Monterey Bay today. We got clams and recently, lots of whales.

The other question to answer is why did so many clam shells end up in these particular layers, and why did the whales choose to die here? Well, good questions. Where might we find remains like these today? We do see lots of clamshells scattered along the beach at low tide along some Monterey Bay beaches, and also concentrations of shells along tidal channels in places like San Francisco Bay. But the whales? I'm open to ideas on this one.

If we look at the exposures or outcrops of the Purisima Formation today, this gives us some idea of the area that was occupied by the former Purisima Sea 7 million or so years ago. These rocks extend along the coast from the end of Swift Street on the west side to Aptos Seascap to the southeast. They also extend 6 to 8 miles inland and underlie most of the watersheds of Soquel and Aptos Creeks.

It's the Purisima Formation, these fossil-rich sandstones and mudstones, which supply almost all of the water to the Soquel Creek Water District. Rainfall and stream flow, percolating down from the surface has been stored in the pore spaces between all of the sand grains of the rock over thousands of years.

Resting on top of the Santa Cruz Mudstone and exposed on the bedrock platform just below the sidewalk at the end of Swift Street, is the next youngest sequence of rocks, the Purisima Formation, just a few inches thick here. This roughly 7 million year old formation is a far more interesting sequence of sedimentary rocks. And perhaps without knowing it, many locals have a chunk of the Purisima, filled with mollusk shells or perhaps a piece of bone, sitting on their bookshelf, windowsill or front porch.