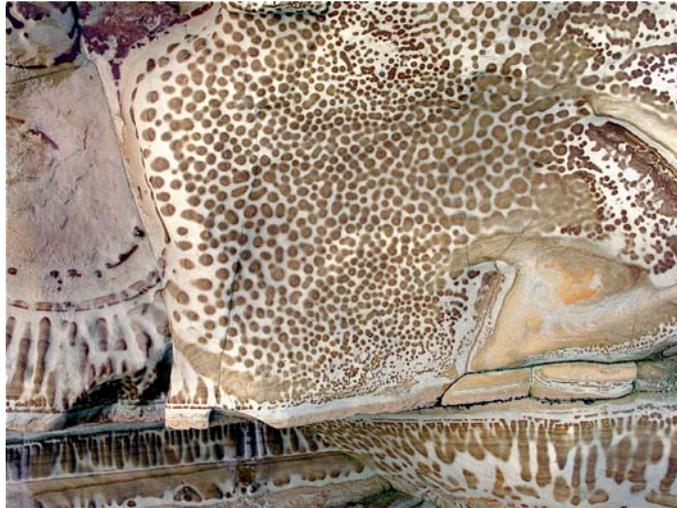


Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

#147 December 14, 2013

West Cliff—Stepping Back in Time



The Santa Cruz Mudstone at Natural Bridges

West Cliff to many is pelicans and cormorants, seals and sea otters, and the occasional whale or dolphin if you're lucky. While I do notice the wildlife, I tend to focus on the rocks. And there are a lot of rocks with some interesting stories and a lot of history along West Cliff. The difference is that are always there, they don't move around, and they're really old.

Geologists think in terms of millions of years, although for most people, anything beyond a few thousand years is ancient history. When my field trip and occasional traveling companion, Sandy Lydon, and I are leading hikes or speaking together, we usually divide things up by time and try not to tread too hard on each other's terrain.

I usually take the last 200 million years of Earth history and Sandy takes the last two hundred years of human history. Seems like a reasonable division of labor. Although he usually has a lot more to talk about than I do, perhaps because he has old newspapers to read and I just have the rocks to look at. But, the advantage is that I can make up stuff; although I think he does that too.

So while I insert a little history into some of my columns, I often check with Sandy first, and he is quite generous in offering me a 2 or 3 paragraph correction of my erroneous information. Sticking with the rocks is a little safer for me.

In the larger geologic scheme of things, the rocks exposed along West Cliff are pretty young, adolescent really. There are just two main rock units out along the cliffs, with some very young beach sand and dirt scattered over the surface.

Scientists like to break down their subjects into workable units, no matter what the science. Biologists use genus, species, families, orders and a few others, while geologists use formations. These are sequences or large masses of rock that are distinct and recognizable over large areas, and represent some set of conditions or an environment that persisted for some lengthy period of time.

Along West Cliff we have two geologic formations that happen to meet each other along the sea cliffs between Swift Street and Almar Avenue. The cliffs extending from Waddell Bluffs south all the way to Swift Street, all consist of a rock known as the Santa Cruz Mudstone. These rocks are believed to have formed on an ancient seafloor about 7-9 million years ago.

The mudstone isn't a terribly exciting stack of rocks as rocks go. It consists mostly of hardened clay or mud, has very few visible fossils, but is nearly 9,000 feet thick. The mud was originally deposited on an ancient sea floor some distance offshore when this entire area was all underwater. The mudstone does contain a lot of silica from planktonic organisms like diatoms, which made siliceous skeletons in that ancient ocean. It also has some interesting weathering patterns.

Years of burial and compaction squeezed out the water and slowly converted the mud to mudstone. The tectonic activity or mountain building along the edge of California in the not too distance past slowly pushed up the Santa Cruz Mountains and lifted the mudstone above sea level where we find it today. Because of the high silica content, the Santa Cruz Mudstone is generally hard and somewhat resistant to wave erosion. It stands in vertical cliffs 40 to 50 feet high or even higher between Scott and Waddell creeks.

The arches at Natural Bridges State Park were carved into the mudstone, and as you proceed along West Cliff towards the lighthouse, you are walking on this formation. However, something special happens at the end of Swift Street, which the casual observer would most likely miss, but that you won't.

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.