

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

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Waves will eventually wear away the rocks



Arch rock that formerly existed at the end of Woodrow Avenue. Photo taken by Jim Phillips in the mid-1970s.

To a geologist, the entire Earth is a giant jigsaw puzzle. Many of us spend virtually our entire careers looking for clues to the formation or evolution of some chunk of the Earth, a mountain range, a river valley, an ocean basin, or stretch of coastline. In my case, the last 43 years has been pretty much focused on trying to understand the coast of California. It's a messy piece of real estate, and it's always changing, which further complicates sorting out the pieces and reconstructing the history.

My last column focused on West Cliff and the process of trying to figure out where an old arch stood from today's perspective. I asked readers to let me know what they thought. A local legend, surf and skateboard artist Jim Phillips, kindly sent me

a photograph he had taken in the mid-1970s, which still showed Arch Rock out near the end of Woodrow. Jim had also sent a nice drawing he had made of the arch, which was published in the old Santa Cruz Weekly.

So I went back out to the end of Woodrow, where the old Gazebo once stood, with Jim's photograph in hand to try and see if I could relocate the site of the arch. I was surprised that even with a photograph that was only 40 years old, I still wasn't sure exactly where that old arch had been.

But then West Cliff has gone through a lot of storms since the 1970s. Literally, millions of waves have battered the cliffs, and taken a lot of rock with them. Despite the endless pounding by the waves, there are some areas that put up a lot more resistance than others, Lighthouse Point, San Lorenzo Point at the river mouth, and Soquel or Pleasure Point are three good examples.

Every point or headland that juts out into the waves is an example of rock strength persisting over wave attack, at least for hundreds of years. The oldest photograph we have come across shows Point Santa Cruz or Lighthouse Point looking about the same in 1876 as it does today.

Seal rock has survived at least as long. There used to be two seal rocks, but one succumbed to the waves sometime between 1956 and 1963.

A logical question I've asked myself many times is, why? Why does Lighthouse Point, San Lorenzo Point or Pleasure Point manage to survive through all the Pacific Ocean can throw at it for centuries, while the rocks on either side are eroded or collapse?

There is a simple answer, but it may not be very seem particularly earthshaking. The rocks in these areas, and at Seal Rock, are harder or more resistant to wave attack than the rocks to either side.

Waves and a rising sea level will eventually win the battle, but the Purisima Formation bedrock that makes up these protruding points is doing pretty well. This is the same formation that underlies Opal Cliffs and Depot Hill; but the sandstone and mudstone here is more failure prone and retreats at a foot or so each year on average. Seawalls and riprap have temporarily halted or slowed this in many places, however.

Most likely it is the degree of cementation or consolidation of the rocks at each of these points that provide their strength. But structural weaknesses also play a role. Joints, which are cracks or fractures produced by years of stress that these rocks have been through, provide zones of weakness that waves can attack like a wedge.

A careful observer can recognize these joint patterns in the rocks on the west side of Lighthouse Point, and along much of West Cliff. They allow the waves to focus their energy and, over time, give the regular geometric shape to much of our local coastline.