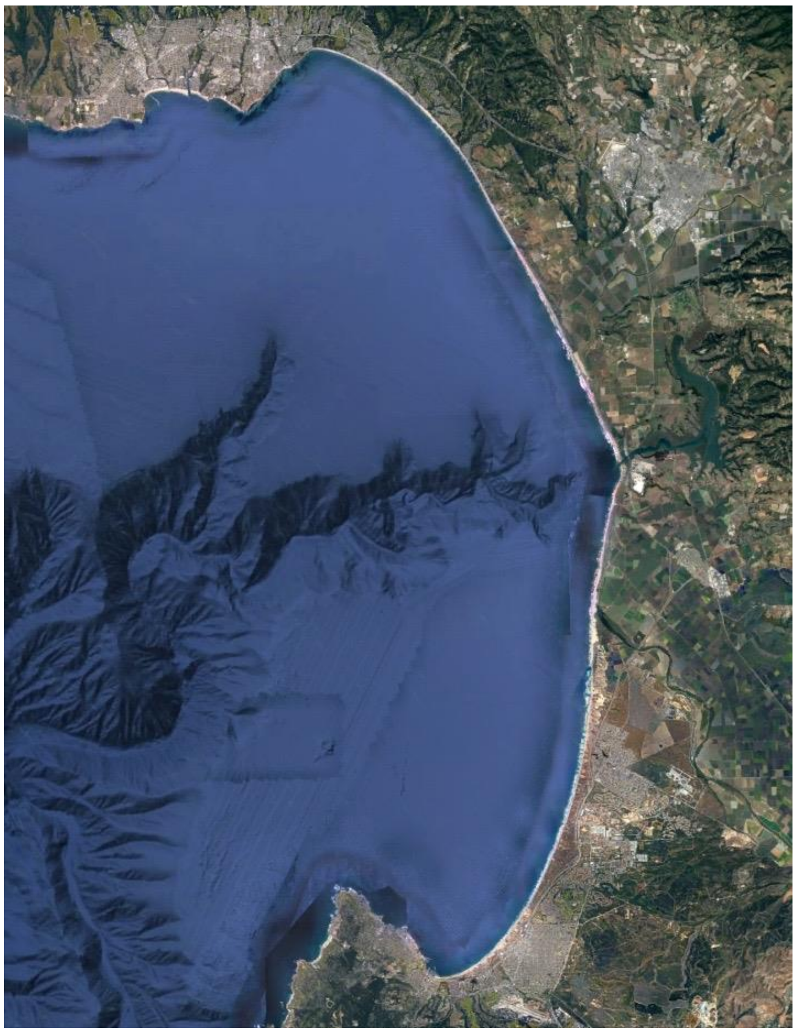
Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Distinguished Professor of Earth and Planetary Sciences, UC Santa Cruz.

#241 July 23, 2017
Another Shoreline Mystery



A satellite view of Monterey Bay taken from Google Earth

Those scallops in the sand in the last article are called beach cusps, and thank you to those readers who emailed ideas on their origins. All were interesting and some of them reminded me of a memorable quote from a good friend and very smart coastal engineer at UC Berkeley who once said to me: Gary, for every complicated problem there is always a simple answer, and it's always wrong.

But there were some good responses. Virtually all of them mentioned waves as the dominant, or at least one of the dominant forces, which is absolutely true. The curious thing is how the waves, which seem pretty similar as they break on the beach, are capable of generating such extremely uniform shapes for thousands of feet or several miles along the shoreline.

There are two basic theories or ideas that have been put forward over the years for the origin of beach cusps, and simply put, they are 1] a self-organizing phenomenon, where one disturbance along the shoreline, such as waves reflecting off of some object and creating an erosional form, is repeated forming an entire series of similar shapes; and 2] edge waves, whereby the waves approaching the shoreline are not of perfectly uniform height along or parallel to the beach, so when they break, water runs up further at some evenly spaced locations than others, and begins to form these erosional crescents. Sounds really simple, doesn't it?

Go to: https://en.wikipedia.org/wiki/Beach_cusps for a more detailed explanation because I have to have some space to describe the next mystery.

A high altitude aerial photograph of the California coast, and Google Earth is ideal for this view and challenge (and if you don't have Google Earth on your computer you can download it for free- believe me it's worth it) reveals some nearly perfectly curved sections of shoreline. Half Moon Bay was named after its smooth curved shape. But Drakes Bay, Bolinas and Stinson Beach, Pismo Beach and Avila, San Pedro Bay in its pre-breakwater configuration, and Coronado and the Silver Strand in San Diego are other good examples of shorelines, which have or had a nearly perfect hooked shape under natural conditions, uncoiling or unwinding from north to south.

We all believe we are pretty special living here on the central coast, but Monterey Bay is also unique in having smooth curved shorelines at both ends of the bay. The northern end actually has two hooked shaped sections; one begins at Cowells and extends south and east towards the west jetty at the harbor. The second begins where Depot Hill meets New Brighton State Beach and gradually unwinds with a smooth curve extending downcoast towards Moss Landing.

At the southern end of the bay, the irregular rocky granitic coastline of the Monterey peninsula changes at the Monterey breakwater into a smooth sandy beach that curves gently upcoast. This curve is interrupted only once, by the bulge of sand deposited at the mouth of the Salinas River. All of this is really clear on Google Earth, but without it or an aerial photograph, none of this will probably make any sense at all.

Each of these bays starts with a tight curve, usually downcoast from a rocky or resistant headland, and then gradually unwinds proceeding downcoast away from the headland, much like the shell of an abalone or some other mollusk grows. Some are more perfect and uncoil more completely than others, but there are many of these features along California’s 1100 mile coastline.

The attached Google Earth Image of Monterey Bay will give you something to look at while you are trying to answer the question: Why or how do these perfectly curved, hook shaped shorelines form?