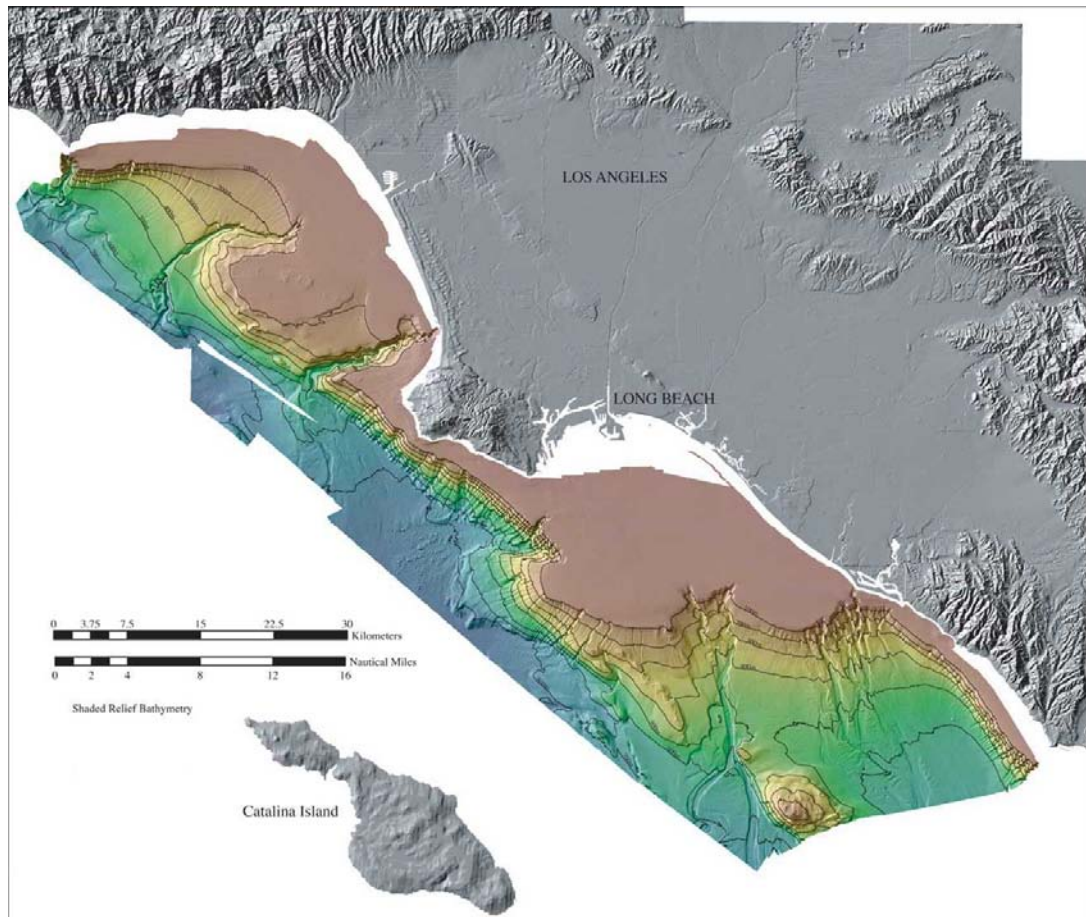


Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

#42 November 21, 2009

Grand canyons on the seafloor



Several prominent submarine canyons have cut across the continental shelf and slope off of southern California, including Santa Monica, Redondo and Newport canyons.

The presence of canyons on the seafloor, similar to those on land, came as a surprise to early oceanographers who first noticed them on their depth recorders slicing into the continental shelf and slope off of the mid-Atlantic coast over a century ago. As active scientific exploration of California's offshore area began in the early 1900s, a number of submarine canyons were soon discovered here also. Those immediately offshore of the Scripps Institution of Oceanography at La Jolla, appropriately named Scripps Canyon and La Jolla Canyon, were among the first

charted and studied in detail, and before long canyons were discovered scattered along the entire length of California's coast.

Most of the largest submarine canyons were given names, usually based on their proximity to some nearby community or landform, so we ended up with Coronado Canyon, Newport Canyon, San Pedro Canyon, Redondo Canyon, Santa Monica Canyon, Dume Canyon, Mugu and Hueneme canyons along the southern California coast. Carmel, Monterey and Soquel canyons are the most prominent submarine canyons along the central coast.

Submarine canyons are similar in many ways to river canyons or drainage systems on land. They are dominantly erosional features that are carved into the continental shelf and slope, often exposing bedrock in their walls. They typically have windy or sinuous courses and may have a number of tributaries. All submarine canyons extend from the outer edge of the continental shelf, down the continental slope to the deep sea floor. While some of California's canyons extend no closer to shore than the edge of the shelf, others extend completely across the shelf nearly to the beach. Most of the prominent southern California canyons, as well as Carmel and Monterey canyons, extend into shallow water near river mouths, which gave some clue as to the origins of these mysterious sea floor features.

Following the initial discovery of submarine canyons off the Atlantic coast, and for many years thereafter, there were two competing views on the origins of these little understood seafloor features. Because they seemed to resemble river valleys or canyons on land, and because many of the submarine canyons first surveyed were located directly offshore from river mouths, some scientists believed that these undersea features must have been eroded by the adjacent rivers when sea level was lower during past Ice Ages. We knew that the continental shelves were exposed during those glacial periods, so the belief was that rivers simply continued cutting their channels across the now exposed sea floor. This wasn't a problem for the sections of the canyons that crossed the continental shelf, which only extended to depths of 350 to 400 feet, but presented some serious difficulties for the portions that extended down the continental slope to the deep sea floor, some 10,000 feet deeper. Relying on rivers to cut the canyons to depths of 10,000 feet or more would have required draining most of the water from the world's oceans. Over time, however, the advocates for the river erosion hypothesis for submarine canyons realized that emptying the oceans simply wasn't geologically possible. There just wasn't any place to put that huge volume of water. Stay tuned.