

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

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Hydrocarbons in the hills



An exposure of asphaltic sandstone (black on the right side of the photograph) in a seacliff near the mouth of Majors Creek.

It's the climate, coastline and beaches that drew many of us to the Monterey Bay area and that has drawn visitors for well over a century. Main Beach and the Boardwalk, surfing and sailing, fishing and fish restaurants, and the rest of the visitor serving establishments are at the core of our local economy.

Stepping back to the late 1800's would have seen an economy based on some other natural resources; instead of sand, sun and salt water, it was lime, leather and lumber. The production of cement from the marble on both the Cowell Ranch and in the hills above Davenport was a big part of Santa Cruz County for a century.

Another geologic resource from the north coast, less well known and with a shorter history was hydrocarbons- natural asphalt and oil.

The first paved roads built in the world were of rock asphalt. Paris reportedly paved its first street with this material in 1854. Not to be outdone, in 1872 Union Square in New York City became the first street paved in the United States with rock asphalt brought all the way from Switzerland. Two decades later in 1891, Salt Lake City paved its first street with asphalt brought from Santa Cruz. The 1890s also saw asphalt from the Santa Cruz quarries shipped to San Francisco and also Seattle to pave streets.

You might ask, asphalt in Santa Cruz? A State Mining Bureau report from 1894-96 describes asphalt beds located on Rancho Refugio between Majors and Baldwin creeks. "About six miles northwest of Santa Cruz and near the ocean are extensive beds of bituminous rock, which at present are being successfully quarried and utilized for making pavement. In fact, it is regarded by those in a position to know best, that bitumen is the pavement of the future, and in the beautiful city of Santa Cruz it is the pavement of the present. These beds of bituminous rocks cover an area perhaps a mile square, and are the residuum of oil beds in a period not geologically remote....It is in the head of a canon on the Baldwin Ranch, 5 miles northwest from Santa Cruz and 2 miles from the coast at 500 feet elevation.... A good road has been made from the mine to the county road on the coast." This area was known at various times as the Asphalt Beds, the Petroleum Works and later the Baldwin Mine.

Today driving north on Highway 1, you can glance up Majors Creek Canyon, just before you reach the former red, white and blue mailbox on the opposite side of the road. Looking inland and up that canyon you can see massive, steep black cliffs, which are composed of bitumen-saturated sandstone, or rock asphalt. A large portion of the cliffs on the north side of the canyon collapsed in a massive landslide in 1960, damming Majors Creek and forming a small lake. A few hundred yards further a turnoff on the left takes you through the little community of Majors, which used to have a small school known as the Petroleum School.

The rock asphalt or bitumen-saturated sandstone in this area was injected from below into the Santa Cruz Mudstone in a fluid state. Numerous sandstone dikes and sills, many of which contain bituminous material, are exposed in the seacliffs and road cuts between Wilder Creek and Greyhound Rock. The Santa Margarita Sandstone, the source of these intrusions and a geologic formation quarried for sand across Highway 1 from the entrance to Wilder Ranch State Park, contains

varying amounts of bitumen. The hydrocarbons are believed to have migrated into the Santa Margarita Sandstone from the underlying Monterey Shale, one of California's largest oil producers.

The asphaltic content of the sand ranges from about 4 percent to as much as 18 percent by weight. These oil-impregnated layers are up to 40 feet thick and when sufficiently warmed by the sun, tar may drip out of the bituminous sands. An estimated 614,000 tons of asphaltic paving material, worth approximately \$2,360,000, was produced from this area between 1888 and 1914. Production was intermittent after the 1920's, with the last of the quarries ceasing operations in the 1940's.

The presence of the asphalt along the north coast, and the discovery of oil in southern California, led to the drilling of a number of wells on the north coast coastal terraces in 1901. While fortunes were expected, the amounts recovered were small. Local consulting geologist and old friend Jerry Weber, reports that in 1955, Husky Oil Company in partnership with the Swedish Oil Shale Company, began an experimental project using gas-fired burners inserted into shallow wells in the asphalt sands in an effort to liquefy and extract petroleum. Over a 3-year period, a total of 228 burner-producer wells were drilled in these hills, raising down-hole temperatures to 600 degrees Fahrenheit. When completed, 2,665 barrels of oil and 4,520 million cubic feet of natural gas were recovered. While this was a reasonable recovery rate, fuels costs and high heat losses made this an uneconomical project.