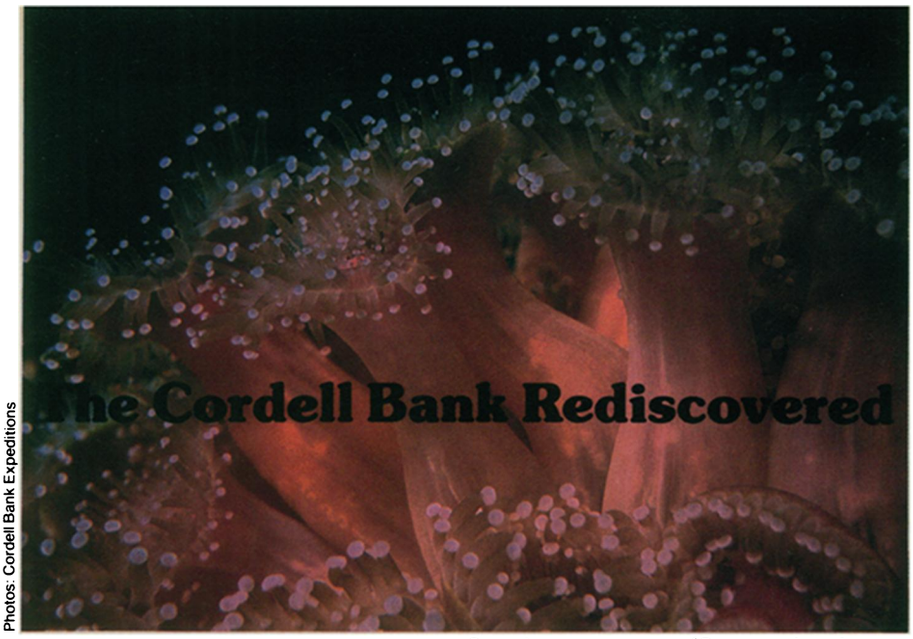


Photos: Cordell Bank Expeditions

A tiny underwater island rises from obscurity to pose for some unusually detailed sonar maps

Strawberry anemones (Corynactis californica) *and other sea life flourish on the Cordell Bank.*

By STEFI WEISBURD

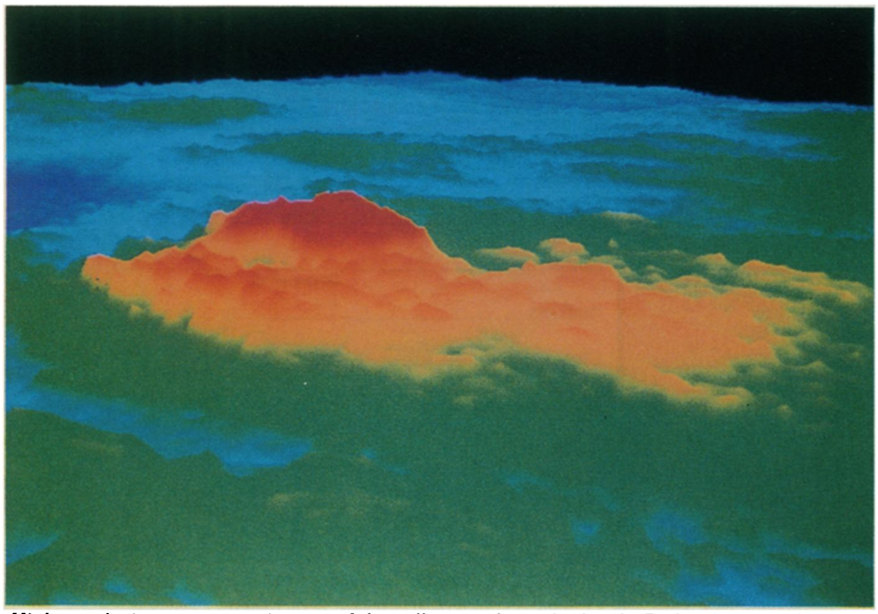
Ten years ago, physicist Robert W. Schmieder was studying a nautical chart of California waters when he noticed the Cordell Bank, a shallow rise 50 miles northwest of San Francisco. Because such shallow banks can be oases for sea life and attractive spots for dives, Schmieder assumed that the 9-by-5-mile Cordell Bank had already been well explored. But when he contacted the U.S. Coast Guard, the California Academy of Sciences and other institutions, he could find no one who had ever visited the underwater island.

"As scientists, it was pretty obvious that we had to go there and explore," says Schmieder, now head of Cordell Bank Expeditions, based in Walnut Creek, Calif. "And when we finally made it, we were astonished at what we found."

Schmieder and others discovered that the rocky bank is smothered by a lush array of fluorescent strawberry anemones, yellow hydroids, pink tree-like hydrocorals, sponges, algae and other sea life growing rampant atop one another. Unusually clear water allows sunlight to bathe the bank, bringing the nutrients needed to support a remarkably large and complex oceanic food web — from microscopic algae to multitudes of fish, sea birds and even some blue whales.

So far, divers have found more than 400 plant and animal species at the bank, including a few newly identified and several rare and endangered organisms. And now, as a result of Schmieder's expeditions, Cordell Bank is on its way to being formally designated a national marine sanctuary by the National Oceanic and Atmospheric Administration (NOAA).

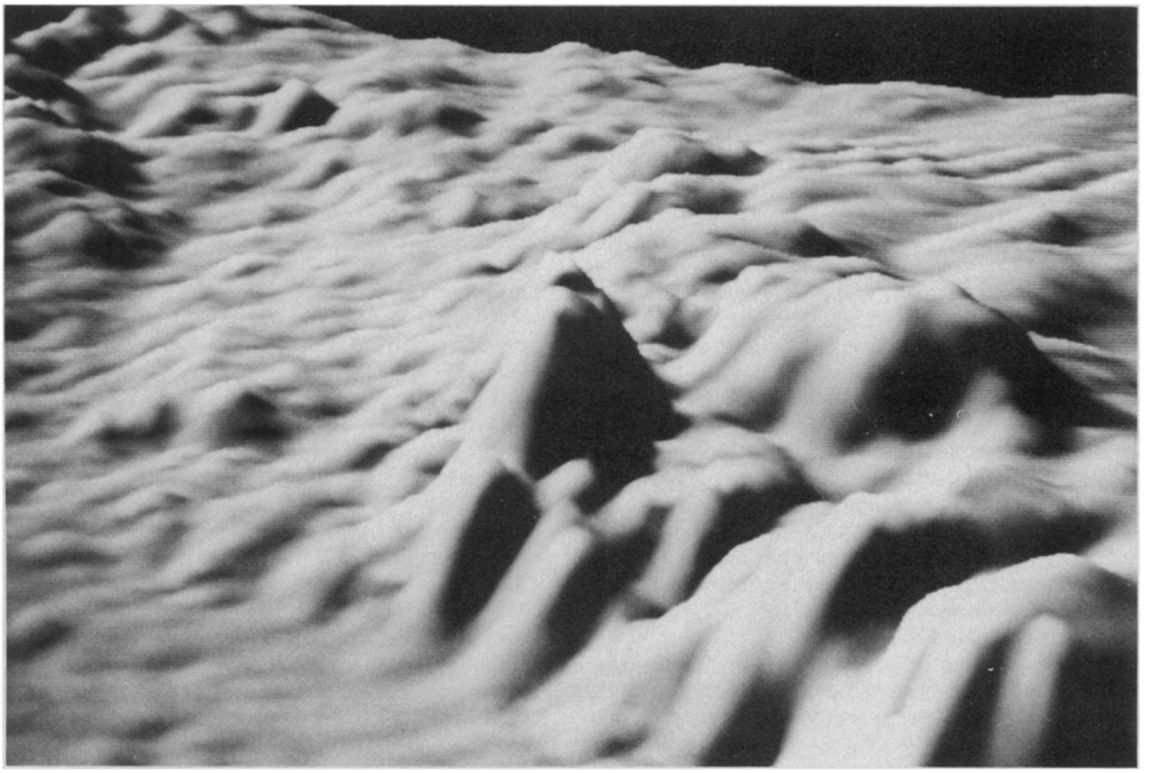
But beyond its importance as a microcosm of ocean life, the bank has gained another significance: It has been the subject of the most detailed mapping and imaging in NOAA's survey of the United States' Exclusive Economic Zone (EEZ).



High-resolution computer image of the tallest peak on the bank. Red indicates where the bank lies 120 to 150 feet below the surface; the deepest areas are in blue. The red-orange ridge is about 200 feet long.

Divers measure distances between features on the bank to check the accuracy of the sonar data and imaging. Sea life flourishes on the bank because light penetrates the clear water; this picture was taken using only natural light.

The EEZ, as established by President Reagan three years ago, is an area extending 200 miles off U.S. coastlines. NOAA has been able to chart the bathymetry, or depth contours, of the EEZ ocean bottom in remarkable detail and over large areas by using state-of-the-art swath, or multibeam, sonar sounding systems. Because Cordell Bank lies much closer to the ocean surface — 120 feet at its highest peaks — than most of the EEZ, the resolution of swath data for the bank is among the highest achieved in NOAA's program.



Using NOAA's raw data tapes, Kruse and Schmieder have generated computer images that have the highest resolution of any seafloor images produced in the Exclusive Economic Zone mapping program. The smallest feature that can be resolved in this image is 4-by-4 meters in size. The pinnacle in the middle of this picture was discovered when the researchers processed the sonar soundings. It is the second-highest peak on the Cordell Bank, measuring 100 feet tall and reaching to 120 feet below the ocean surface.

The Navy, however, has worried that the high accuracy and fine detail of EEZ swath maps in general would enable foreign submarines to navigate without detection in U.S. waters, and so it has insisted that NOAA's mapping data be classified (SN: 3/15/86, p.170). Ironically, the Cordell Bank, with its exceptionally high-resolution swath data, has the added distinction of being one of two tiny spots in the 3.9 billion acres of the EEZ that have escaped classification.

This is partially because NOAA had contracted with Schmieder and William A. Kruse of Kruse Imaging in Palo Alto, Calif., to produce detailed images of the bank before the Navy's position had strongly solidified. In the end, the Navy decided to release the Cordell Bank data because of the bank's small size and its biological importance.

Kruse and Schmieder worked with data collected by NOAA's research ship *Davidson* when it surveyed the bank in May 1985. (The ship was named, coincidentally, for George Davidson, who first discovered Cordell Bank in 1853.) Because NOAA is charged with making nautical charts over large areas, it normally filters out a lot of the fine details in its routine data processing. For the Cordell Bank, NOAA used only about 2 percent of the soundings to make its maps on scales in the range of 1:20,000. In such maps, features smaller than about 40 meters are lost. For researchers like Schmieder who want to use bathymetric maps to find biologically interesting places to dive, these maps would have little value. Sea life tends to congregate on the tops of narrow ridges and pinnacles, many of which are smaller than 40 meters across.

It's as if NOAA were surveying entire mountains with a microscope, says Schmieder. "They are compiling this incredible amount of data with extraordinarily high resolution, but no one is doing anything with it because no one has access to it or the interest or motivation."

Kruse and Schmieder appear to be the exception. To aid their biological studies and to explore for NOAA how much detail the basic swath data will allow, they have made maps of the bank using all 6 million soundings of NOAA's data. Using copies of NOAA's data tapes and a small computer, they have produced images of the bank with a resolution down to 4 meters. According to Schmieder, their pictures are comparable to the best spacecraft images of the moon. He says they are now working on a way to improve the resolution in certain areas of the bank to 2 meters.

"With the images, we now have a whole new set of insights on the bank," says Schmieder. The pictures of the bank have revealed fault lines and other geologic features — including the second-shallowest pinnacle on the bank — that were previously unknown. Subsequent dives have confirmed the accuracy of the swath system in pinpointing and measuring the depths of bank features.

The images also show a series of terraces running around the perimeter of Cordell Bank, which Schmieder thinks were cut into the bank when the sea level fell below the bank's top during the last 100,000 years. The sonar soundings enabled him to estimate the heights of these terraces. In a paper to be published in CALIFORNIA GEOLOGY, he shows that these correlate well with the heights of terraces known to have been cut by sea level drops in other places along the California coast.

In addition to learning about the geology of Cordell Bank, Kruse and Schmieder have devised ways to improve the processing of the NOAA data. Schmieder would now like to expand their imaging work to an area near California's Point Sur that he says is similar to Cordell Bank.

But Capt. Christian Andreasen, head of the NOAA EEZ mapping program, says he thinks it unlikely that any more sections of the EEZ will be released from classification by the Navy. If Andreasen is correct, the Cordell Bank may have to stand as the only public showcase of what NOAA's mapping systems can really do. □