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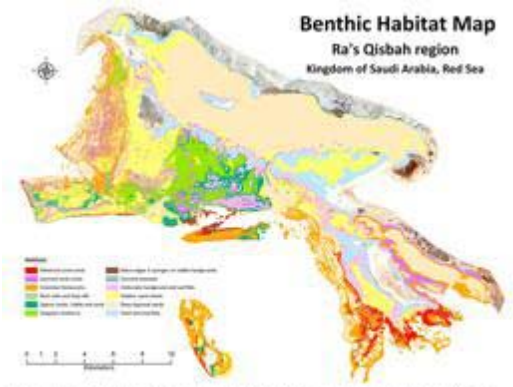
Red Sea corals mapped in unprecedented detail

Maps reveal effects of past climates.

Richard A. Lovett

Using a combination of satellite, aerial and ship-based techniques, a team of US scientists has mapped little-known coral reefs along Saudi Arabia's Red Sea coastline.



Khaled bin Sultan Living Oceans Foundation / NCRI

The map covers 25,000 square kilometres stretching from Egypt nearly to Yemen. Only one other such project has covered more terrain: an effort by the US National Oceanic and Atmospheric Administration (NOAA) in Washington DC has mapped 30,000 square kilometres of American reefs.

The NOAA project, however, showed much less detail than our study, says Sam Purkis of the National Coral Reef Institute at Nova Southeastern University in Dania Beach, Florida. The NOAA study could resolve details that were roughly 1,000 metres apart; Purkis's team, however, managed 7-metre resolution.

Purkis's maps reveal a region of surprising diversity. In addition to barrier reefs, atoll-like features and coastal fringes, the Red Sea reefs contain a broad range of little-understood patterns, ranging from amoeba-like shapes to elongated banks with shallow reefs around the edges and deeper centres.

"We're seeing shapes and morphologies we don't even have names for," Purkis said on 22 February at the American Geophysical Union's biennial Ocean Sciences Meeting in Portland, Oregon.

Ancient templates

One of the oddest shapes - resembling a honeycomb - initially mystified Purkis's team. Similar patterns had been seen elsewhere, but in places where drops in sea level had exposed carbonate rocks to atmospheric weathering that eroded them into a lumpy terrain known as karst. But karst needs rain to form, and the area bordering the Red Sea is desert.


Gwilym Rowlands

Then Purkis's team realized that the region hadn't always been so dry. "It's hyper-arid at the moment," Purkis said, "but between 6,000 and 10,000 years ago, the Saharan region was influenced by monsoon-like activity, producing perhaps tenfold greater rainfall than today."

That was also a time when sea levels were low, exposing the carbonates. So, Purkis's team tried some computer modelling. "If we take a block of carbonate rock and expose it to rainfall synthetically for several thousand years," he said, "we can recreate the morphologies we see in the Red Sea reefs very effectively."

When the sea level rose again, there was too much sediment in the lower areas of the karst for coral to grow, Purkis concluded, forcing coral to grow only on the higher regions. "What that tells us is that these very interesting reef patterns really have nothing much to do with the modern activity of corals," he said. "What we're looking at is an ancient template formed by monsoon erosion that was then simply adopted by the coral reef."

Climate impact

Other scientists are impressed. "This is how it should be with habitat mapping," says Vera Van Lancker, a geologist

with the Royal Belgian Institute of Natural Sciences in Brussels. "They encountered new things, added more scientific disciplines and came to new insights."

Purkis's team now plan to map other reefs around the world.

Gwilym Rowlands

This sort of mapping will also be useful to help scientists understand the effects of climate change on corals, says Ken Caldeira, a geochemist in the Department of Global Ecology at the Carnegie Institution for Science in Stanford, California. "There is very little baseline information that will allow us to track changes in coral-reef cover through time," he says. "Just knowing where the reefs are today will have implications for management."

Having now completed their studies in the Red Sea, Purkis's team now plans a round-the world-cruise, mapping reefs in the Caribbean, South Pacific, Australia, Indonesia and Indian Ocean before returning to the Red Sea in 2012 or 2013 to see how things have changed.

Caldeira hopes that the scientists will also collect data on salinity, water chemistry, pH and nutrients. "That, in conjunction with maps, would help determine what major conditions facilitate the growth of coral reefs," he says. "We can then make projections about which reefs might be affected in the future and determine where to focus conservation efforts."