Region of 'super corals' discovered

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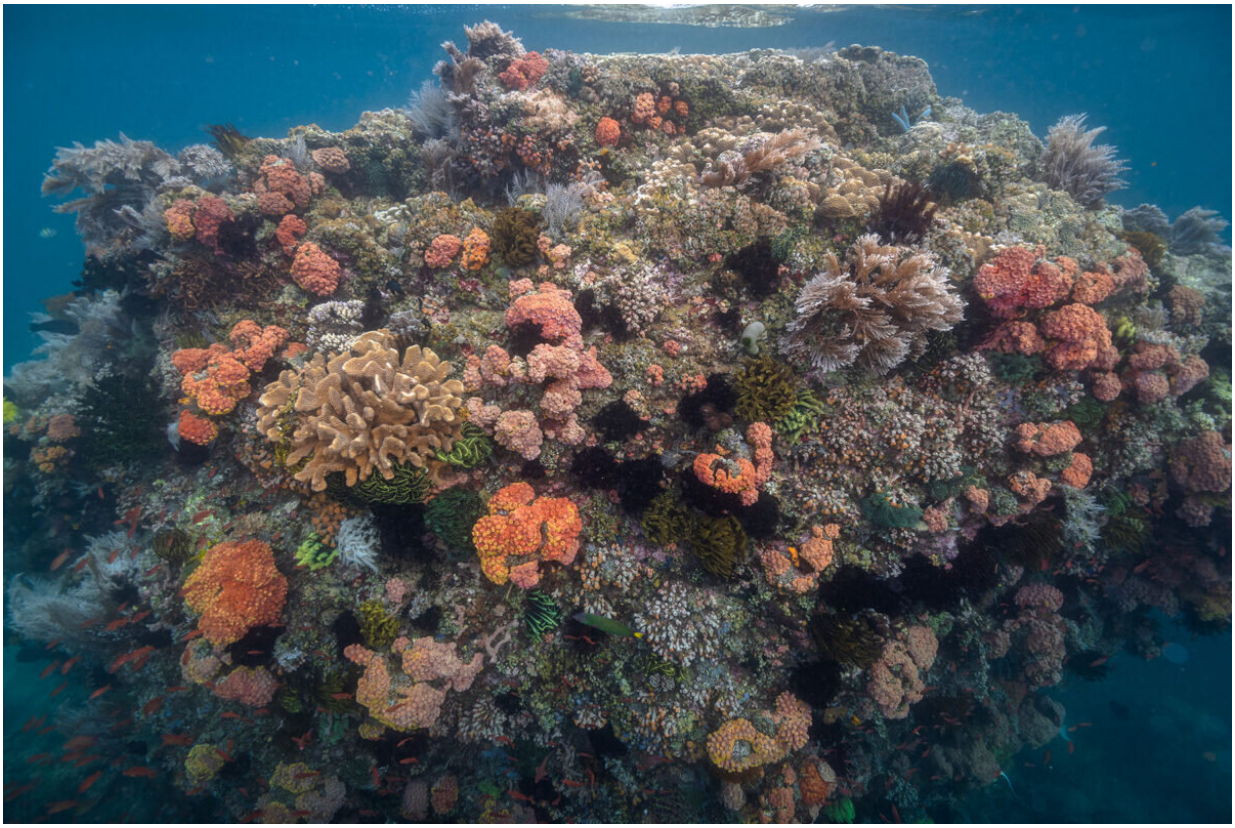

Corals found in an area of the ocean with extremely high levels of Carbon Dioxide in the Verde Island Passage in the Philippines. Credit: University of Texas at Austin

In 2019, a hydrology professor at The University of Texas at Austin set out on a research project to see if he could identify harmful nutrients flowing through groundwater into a delicate coral reef sanctuary in the

Philippines. He achieved this goal, but following the long history of accidental scientific discoveries, he instead stumbled upon something completely unexpected: a region of possible "super corals" that are thriving despite high levels of carbon dioxide.

The findings based on the 2019 field work were published in August in the journal *ACS ES&T Water*.

For the first time, the UT Austin professor, Bayani Cardenas, and a team of international researchers were able to attribute the source of CO_2 and other gases and nutrients in seawater at this location to groundwater, a finding that the researchers believe shows how the undersea reef environment can be vulnerable to the way communities discharge wastewater, agricultural runoff and other byproducts into the sea.

"This is an unseen vulnerability," said Cardenas, a professor in the Department of Geological Sciences at the UT Jackson School of Geosciences. "We've been able to show with this site that groundwater is part of these delicate coral reef environments. There is a connection, and that's still not as accepted in science and in many parts of the world."

More than that, Cardenas said the research has led to new questions—and new research proposals—about the super corals they found that could be replicated elsewhere in the coming years as global CO_2 levels are expected to rise.


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Bayani Cardenas, a professor at the University of Texas Jackson School of Geosciences, prepares to dive during research to track the impact of harmful nutrients flowing through groundwater into a delicate coral reef sanctuary in the Philippines. Credit: University of Texas at Austin

Coral reefs have long been suffering due to climate change, most notably during a global coral bleaching event from 2014 to 2017 that caused heat stress to 75% of the world's reefs, according to the American Meteorological Society. Yet the coral-filled area Cardenas studied in the Verde Island Passage in the Philippines, a region so vibrant and diverse that he refers to it as the "Amazon of the ocean," is thriving despite the vast amounts of CO_2 being pumped in from groundwater.

Lead author Rogger E. Correa, a researcher at Southern Cross University in Australia, estimated that groundwater is pumping about 989 grams of CO_2 per square meter per year into the area they studied, which is known as "Twin Rocks" and borders a chain of volcanoes. That's the equivalent of parking two cars on the seabed and letting them emit carbon dioxide for a full year on every hectare of reef.

To distinguish groundwater from seawater, the scientists submerged devices that measure the levels of CO_2 and radon 222, a naturally occurring radioactive isotope that is found in local groundwater but not in open ocean water. The measurement technique was developed by co-author Isaac Santos, a professor at the University of Gothenburg in Sweden.

This work follows a 2020 study conducted by Cardenas where he discovered CO_2 bubbling up from the seafloor off an area of the Philippine coast so dramatically that he dubbed it "Soda Springs."

The end result from the latest investigation is an entire region of coral reefs that must be studied more closely, said Cardenas, who is a geoscientist and not a coral researcher.

Adina Paytan, a research scientist at the Institute of Marine Sciences at the University of California, Santa Cruz, who was not associated with the study, warned that other human-made stressors, including sedimentation, overfishing and pollution, can still doom coral reefs. But she was heartened that Cardenas' team showed corals can grow in high-carbon environments, a finding that "provides some hope for the future of corals."

More information: Rogger E. Correa et al, Submarine Groundwater Discharge Releases CO2 to a Coral Reef, *ACS ES&T Water* (2021). DOI: 10.1021/acsestwater.1c00104

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