Under the sea: Study reveals secret building blocks of northern algae

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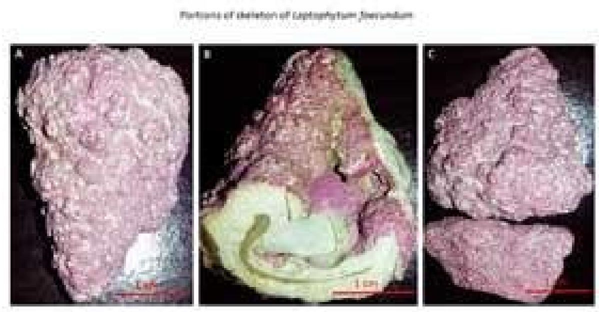

Credit: University of Toronto Mississauga

New research from U of T 's Mississauga and Scarborough campuses reveals fascinating secrets about the complex structure of a marine organism found around the globe. The data provides important new insights about a molecular mineralization process creates the unique structure of a marine plant.

Coralline algae is found around the globe where it grows in rock-like clusters on the ocean floor in both warm and cold waters, and often forms the structural base for coral reefs. The growth patterns of coralline algae can provide important information about past climate events and how aquatic organisms are reacting to new conditions caused by global climate change.

For the study, researchers studied *Leptophytum foecundum*, a coralline algae found in the frigid waters off the coast of Labrador, Canada. "It's a highly abundant species," says Azizur Rahman, a researcher with UTM's Climate Geology Research Group and lead author on the study. Despite its ubiquity, however, little is about how the algal skeleton forms and grows. "Our research seeks to understand the skeletal structural system of the algae and to explore functional molecules in the biomineralization process," he says. "Our results show, for the first time, how a natural polymer known as chitin contributes to the development of coralline algae, and provides new insight into the role that chitin plays in controlling the process of mineral formation in marine environments."

Chitin (pronounced kite-in) is naturally occurring polymer found in the makeup of coralline algae, as well as crustaceans, insects, fungi and nematode eggs. The polymer is strong, flexible and translucent, and its fiber-like form is used in environmental applications, such as improving water quality in aquaculture farms and aquariums, and biomedical applications such as wound dressing and stem cell therapies. In coralline algae, chitin hardens or calcifies the cell walls of the marine plant, creating the rock-hard skeleton of the algae.

The researchers developed a new tool to analyze the algae, building on a previous study by Rahman and collaborator Professor Jochen Halfar of UTM's Department of Chemical & Physical Sciences. "Previously, it was thought that biopolymers like chitin had no role in the calcification process," Rahman says. Their results revealed that chitin plays an important role by enabling the formation of magnesium calcite, an important building block in the hard skeleton of *Leptophytum foecundum*. "We have shown, for the first time, that chitin takes a key role in the process of mineral crystallization in marine organisms."

Rahman notes that chitin is not found in other calcifying marine organisms, such as coral, but adds that further investigation may reveal the polymer in other varieties of coralline algae. The polymer also appears to provide protection from the impacts of climate change. "Chitin contains polysaccharides, which increases the resistance of calcifiers, like coralline algae, to negative effects of ocean acidification," Rahman says.

"Our findings deliver new information about the marine ecosystem and our understanding of marine environmental changes," he says. "The results could influence our thinking about the future response of coralline algae to global climate change."

The study was published in the September 2019 issue of *Scientific Reports*.

More information: M. Azizur Rahman et al. The role of chitin-rich skeletal organic matrix on the crystallization of calcium carbonate in the crustose coralline alga Leptophytum foecundum, *Scientific Reports* (2019). DOI: 10.1038/s41598-019-47785-2

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