Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19870

Crustose Coralline Algae dissolution buffers coral reef environments

DR. OSCAR BRANSON[1], MICHAEL J ELLWOOD[2], CHRISTOPHER CORNWALL[3], WILLIAM MAHER[2], YAOJIA SUN[2], KATHERINE D HOLLAND[2], PATRICK GOODARZI[2], HAYDEN MARTIN[2] AND STEPHEN EGGINS[2]

[1]University of Cambridge
[2]Australian National University
[3]Victoria University of Wellington

Presenting Author: ob266@cam.ac.uk

Coral reefs exist in a dynamic balance of formation and erosion processes. In the long term, the rates of calcium carbonate formation must exceed physical, biological and chemical erosion for a reef to be stable. Historically, many studies of calcification rates have either focused on the response of individual corals or entire reef communities to ocean acidification, with the assumption that corals are responsible for the primary calcification signal within the reef community. However, reef communities host a complex community of calcifiers, which are often neglected in reef carbonate budgets, and are essential to the existence of the reef.

Here, we explore the contribution of one such calcifier, Crustose Coralline Algae (CCA), to the calcification dynamics of One Tree Island, Great Barrier Reef. We isolate distinct sub-communities on the tidal reef flats using sealed domes, and examine the rates of respiration, photosynthesis and calcification of each sub-community over a 24 hr cycle in both summer and winter. The reef flat maintains a stable windward barrier that shelters the lagoon environment, and is critical to the survival of the reef. We find that the environment is extreme and dynamic, with large diurnal variations in temperature (±10 °C), pH (± 1 unit), DIC (±500 µmol kg-1) and TA (±300 µmol kg-1). The chemical variability is the result of photosynthesis-driven calcification in the day, and respiration-driven dissolution at night. We find that corals and CCA both contribute substantially to daytime calcification, whereas only CCA formed of more soluble high-Mg calcite dissolve at night. Thus, CCA dissolution buffers the reef system, preventing corals experiencing waters that are under-saturated with respect to aragonite. This may make coral reef systems more vulnerable to ocean acidification than predicted by coral-based experiments, as the CCA are a critical contributor to reef cementation and the protective structures that allow coral reefs to exist.