Coral symbiotic algae calcify outside their coral host

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Dinoflagellates of the genus Symbiodinium are of central importance for coral reef ecosystems. They form mutualistic symbioses with reef-building corals in which they provide their hosts with photosynthates and they actively support the reef-building process by enhancing coral calcification. However, this symbiotic lifestyle is not strictly obligatory, i.e. Symbiodinium spp. are also capable of living outside their hosts. These free-living populations represent an important pool for the acquisition of symbionts by coral juveniles and could play a pivotal role in maintaining coral functional diversity and reef ecosystem viability, yet their biology and ecology remain largely unknown.

An international team lead by researchers from CESAM now discovered that free-living Symbiodinium spp. in culture commonly form calcifying bacterial-algal biofilms and produce calcified structures named "symbiolites" that encase Symbiodinium as endolithic cells. The study demonstrates that this calcification reaction is driven by algal photosynthesis but that bacterial communities also play a critical role in the process. Interestingly, the Symbiodinium cells inside of symbiolites remain alive for weeks and can later leave their mineral cages and return to the environment. Thus, symbiolites could act as a temporary refuge in the sense of a "safe house", providing a barrier against grazing and exposure to UV radiation.

These findings indicate that the formation of symbiolites could comprise part of a temporary endolithic phase in the Symbiodinium life history; an insight that offers new perspectives on fundamental questions regarding the biology and ecology of these important dinoflagellates. Further, the results suggest that Symbiodinium may play an important role in mineralization processes outside the coral host and may eventually help explain how changes in ocean chemistry over millions of years led Symbiodinium to ultimately establish a symbiotic lifestyle.

FIGURE 1
Coloured scanning electron micrograph, showing a symbiolite in partial view - deposited calcium carbonate (blue), organic matrix (olive green), Symbiodinium cells (lime green) and bacteria (orange). Adapted from Frommlet et al. 2015.

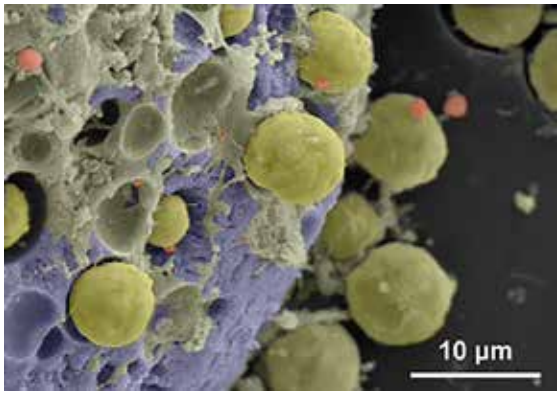

FIGURE 2
Confocal laser scanning micrograph of symbiolite fluorescence properties – organic matrix (blue), calcium carbonate (green), Symbiodinium chlorophyll fluorescence (red). From Frommlet et al. 2015.