Marine Algae Cultured in Enriched Medium Demonstrate Increased Uptake of Minerals Involved in Human Calcium Metabolism

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Introduction

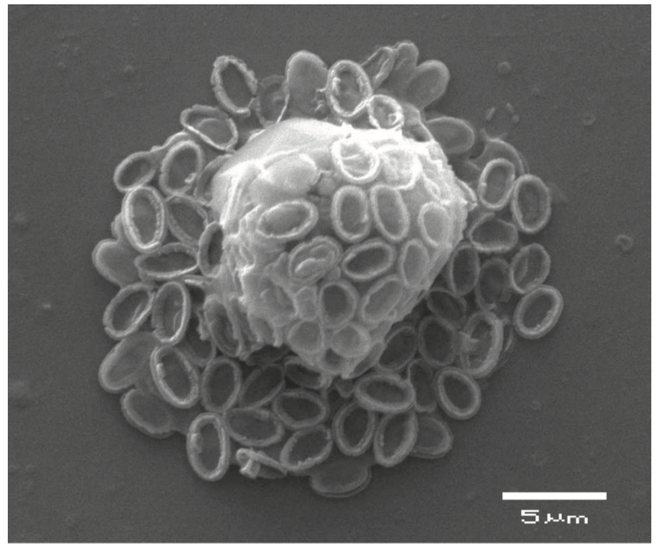
Coccolithophores are a single celled marine alga that are distributed worldwide and known for their novel ability to biomineralize inorganic scales (coccoliths).

Coccoliths are...
- High in calcium (Ca^{2+})
- Low in magnesium (Mg^{2+})
- Low in strontium (Sr^{2+})

which closely match the levels found in ocean water. We were interested is manipulating these levels in culture to enhance calcite ($CaCO_3$) bioavailablity for human metabolism and bone growth. Research has shown that calcium Ca^{2+} ingested with appropriate quantities of Mg^{2+} and Sr^{2+} elicit a greater positive human response when compared to Ca^{2+} ingested on its own. Of the 163 known species of coccolithophores,

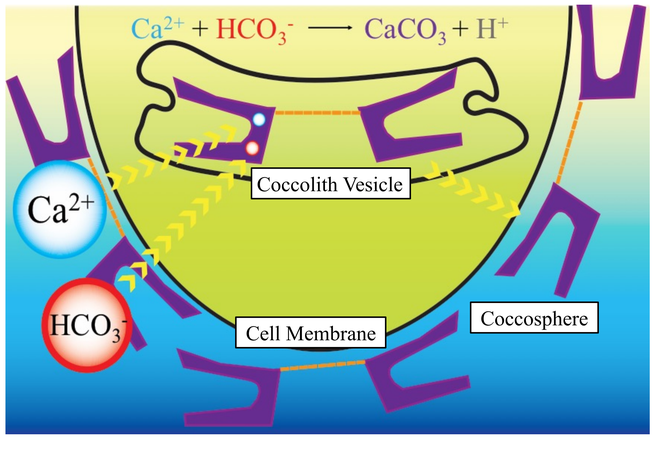
Pleurochrysis carterae is know for...
- High surface area of individual scales.
- Rapid growth rate.
- Ability to grow in a wide variety of cultured conditions.

In this study, we manipulate the ratios of Mg^{2+}, Ca^{2+}, and Sr^{2+} in the culture media and examine uptake into the coccolith. There is still speculation on the exact biochemical pathway used by coccolithophores, but this study is a step towards increasing what we know about coccolithophore mechanics to further bio prospect this group of algae.

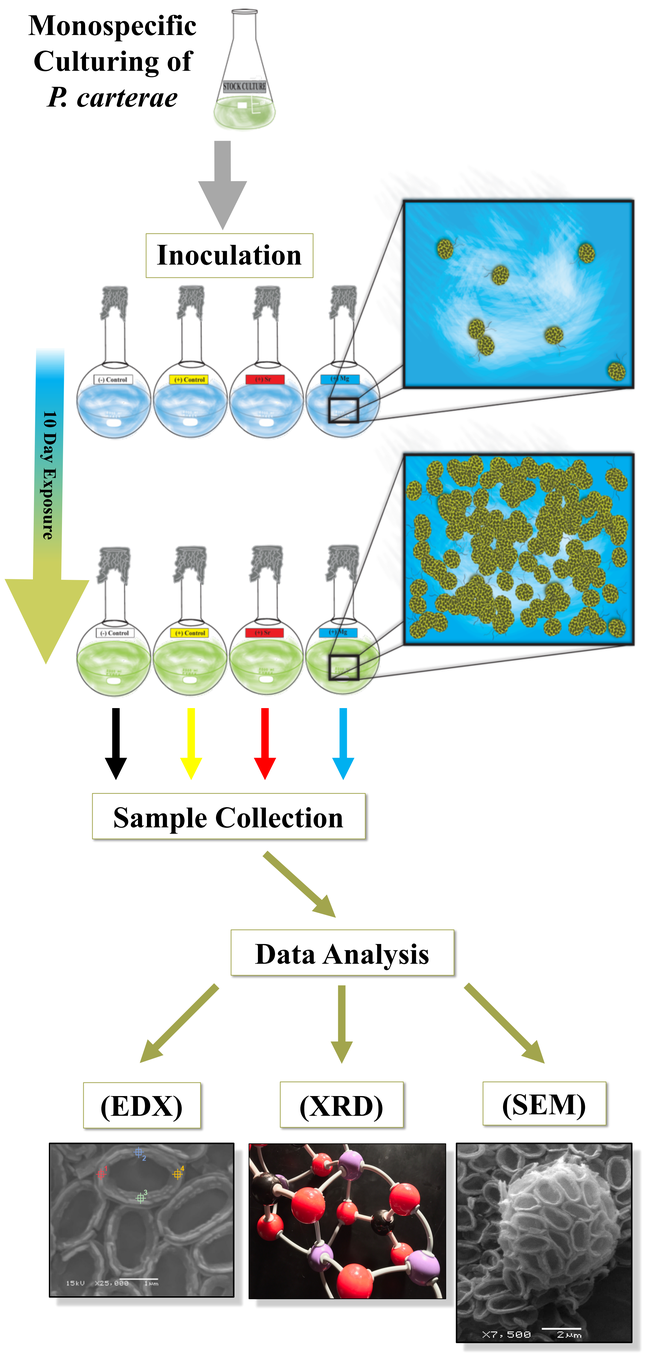


Research Questions

- Can the concentration of coccolith Sr^{2+} and Mg^{2+} be increased?
- Will the crystal structure of calcite change?
- Will modifications in culture conditions affect morphology?

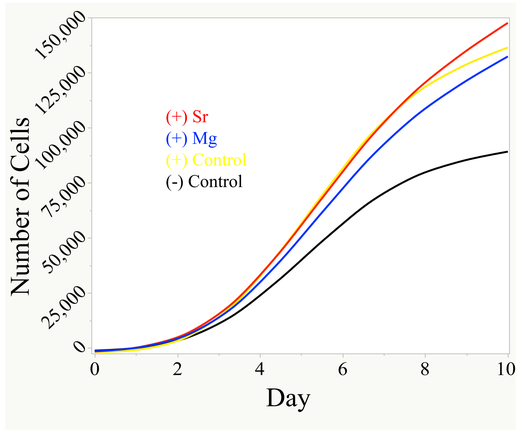


Methods



Results

- Coccolith Sr^{2+} increased from ND to 11%
- Mg^{2+} increased significantly (t-test against control)
- Calcite structure was unchanged
- Growth rate was not effected
- Coccolith morphology was unaltered
- Cells cultured in enriched media have growth rates similar to those seen in normal culture conditions.



Discussion

Chemical composition of coccoliths is influenced by the ratios of alkaline earth metals available during coccoltih formation. These results are important in terms of human health. Survivability of the cells in altered media and the successful incorporation of strontium and magnesium into the coccolith crystal makes coccolithophores a distinct and commercially exploitable resource for biomimetic calcite.