Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.13208

# Faster crystallization during coral skeleton formation correlates with resilience to ocean acidification

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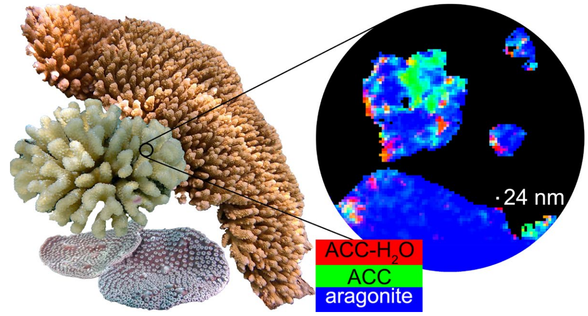


Coral skeletons are made of aragonite ($CaCO_3$) forming by attachment of amorphous particles and ions, continuously added to the skeletons' growing surface[1]. Amorphous particles are formed just outside the skeleton, in intracellular vesicles within calicoblastic cells. This observation was repeated in three diverse genera of corals: *Acropora* sp., *Stylophora pistillata* differently sensitive to ocean acidification (OA)[2] and *Turbinaria peltata*. Thus, particles are formed away from seawater, in a presumed intracellular calcifying fluid (ICF) in closed vesicles and not, as previously assumed, in the extracellular calcifying fluid (ECF), which, unlike ICF, is partly open to seawater. After particle attachment, the growing skeleton surface remains exposed to ECF, and, remarkably, its crystallization rate varies significantly across genera. The skeleton surface layers containing amorphous pixels vary in thickness across genera: ~2.1 $\mu$m in *Acropora*, 1.1 $\mu$m in *Stylophora*, and 0.9 $\mu$m in *Turbinaria*. Thus, the slow-crystallizing *Acropora* skeleton surface remains amorphous and soluble longer, including overnight, when the pH in the ECF drops. Increased skeleton surface solubility is consistent with *Acropora*'s vulnerability to OA, whereas the *Stylophora* skeleton surface layer crystallizes faster, consistent with *Stylophora*'s resilience to OA. *Turbinaria*, whose response to OA has not yet been tested, is expected to be even more resilient than *Stylophora*, based on the present data[3].

1 C-Y Sun, CA Stifler, RV Chopdekar, CA Schmidt, G Parida, V Schoeppler, BI Fordyce, JH Brau, T Mass, S Tambutté, PUPA Gilbert. From particle attachment to space-filling coral skeletons Procs Natl Acad Sci 117, 30159-30170 (2020).

2 AA Venn, E Tambutte, N Caminiti-Segonds, N Techer, D Allemand, S Tambutte. Effects of light and darkness on pH regulation in three coral species exposed to seawater acidification. Sci Rep 9, 2201 (2019).

3 CA Schmidt, CA Stifler, EL Luffey, BI Fordyce, A Ahmed, G Barreiro Pujol, CP Breit, SS Davison, CN Klaus, IJ Koehler, IM LeCloux, C Matute Diaz, CM Nguyen, V Quach, JS Sengkhammee, EJ Walch, MM Xiong, E Tambutté, S Tambutté, T Mass, PUPA Gilbert. Faster crystallization during coral skeleton formation correlates with resilience to ocean acidification. J Am Chem Soc 144, 1332-1341 (2022).