

Aragonite is calcite's best friend at the seafloor

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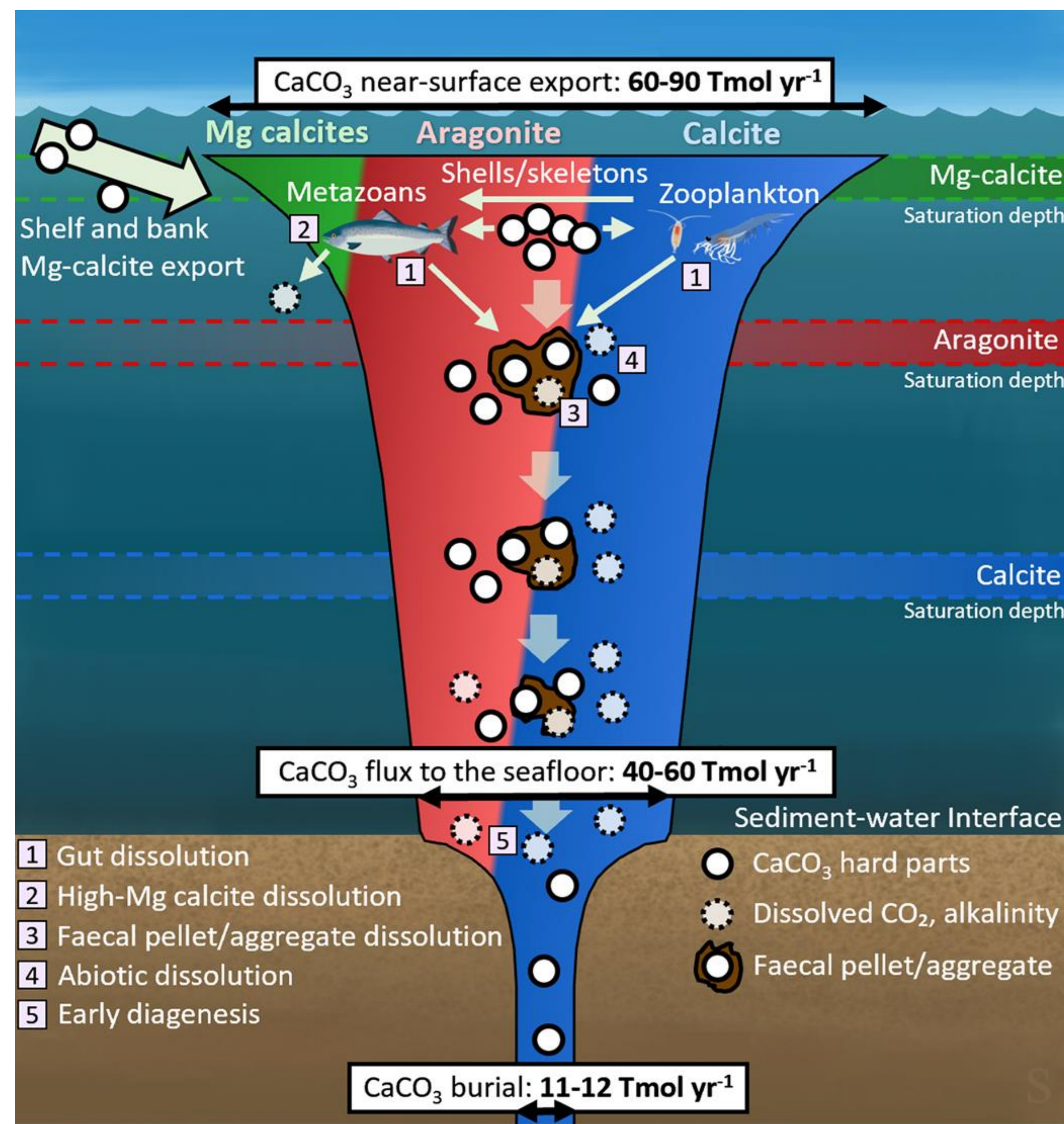
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The marine calcium carbonate cycle



Modified by Jordan Stone from Sulpis et al. (2021)

Main **aragonite** producers in the open ocean are pteropods. Aragonite is more soluble than calcite.

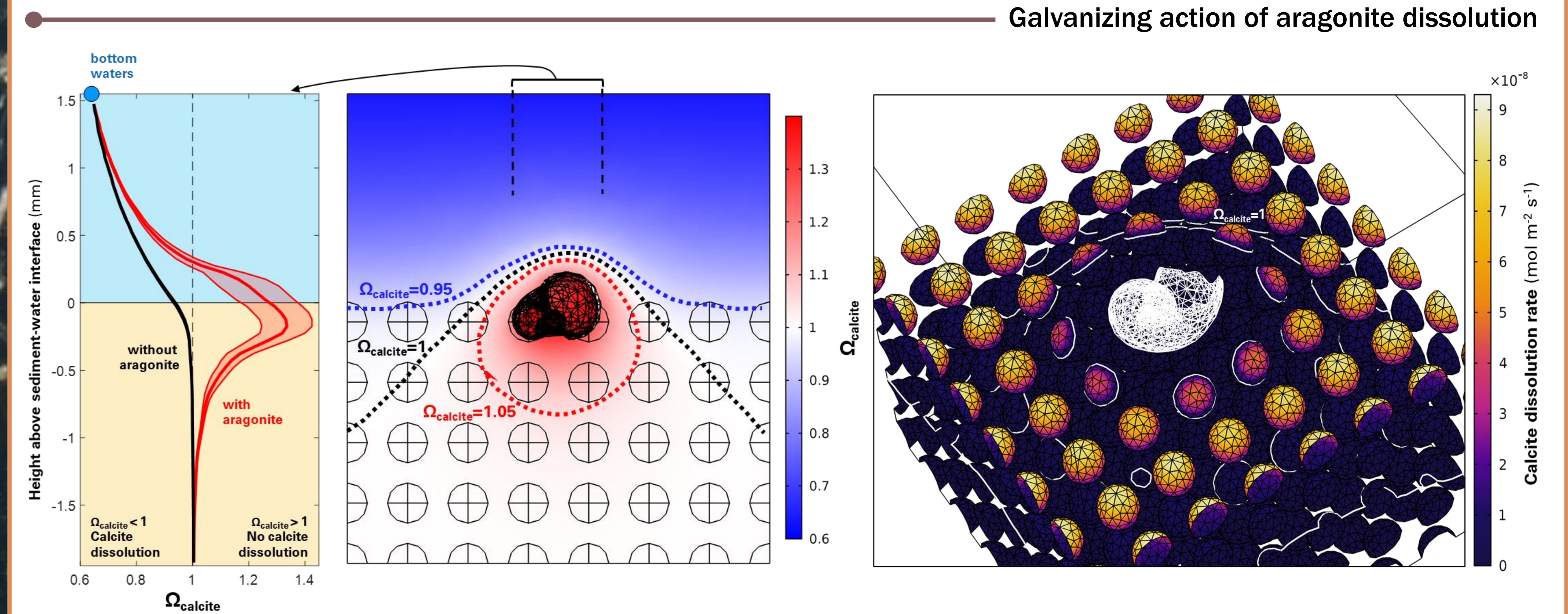
It's traditionally thought that open-ocean aragonite production is small, and that only **calcite** is preserved in sediments because **aragonite** is more soluble and does not reach the seafloor.

But recent research shows it is not true because:

- **Aragonite** production could be **at par** with **calcite** (Buitenhuis et al. 2019)
- There is a lot of **aragonite** and **pteropod genetic material** near the seafloor (Dong et al. 2019; Boeuf et al. 2019)

What is the role of aragonite dissolution at the seafloor in the global CaCO₃ cycle?

Results

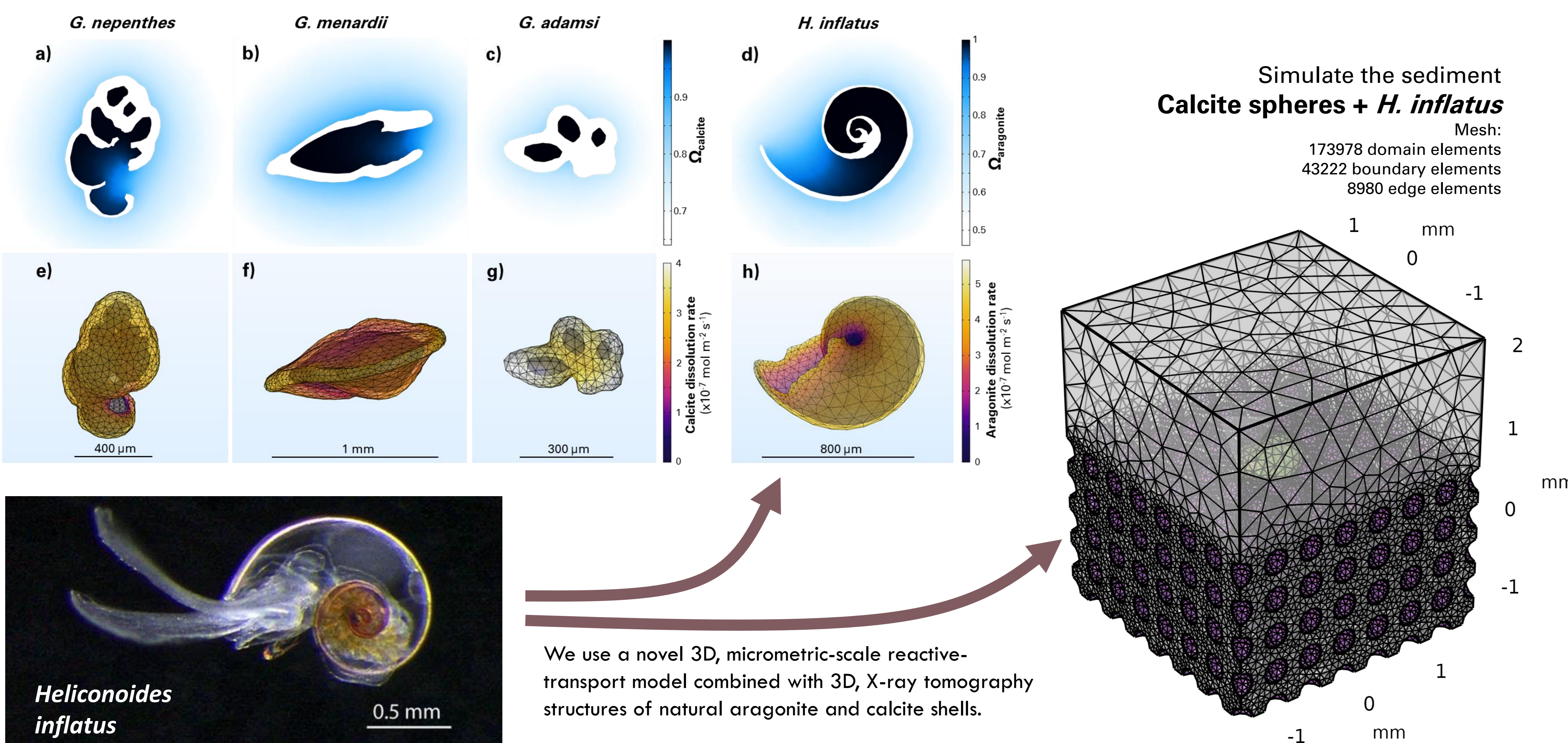


Dissolution products diffuse from the pteropod shell upward to the bottom waters, but also downward and sideways, and a halo of calcite supersaturation develops in the porewaters beneath the dissolving aragonite. This causes the calcite grains surrounding the pteropod to be partially in contact with supersaturated water, thermodynamically preventing their dissolution, despite the bottom waters overlaying this sediment being strongly undersaturated with respect to calcite.

The predicted seawater calcite supersaturation that surrounds dissolving aragonite particles at the seafloor could account for some of the calcite recrystallization occasionally observed on the surface of preserved foraminifera (Collen et al., 1979; Pearson et al., 2015).

Methods

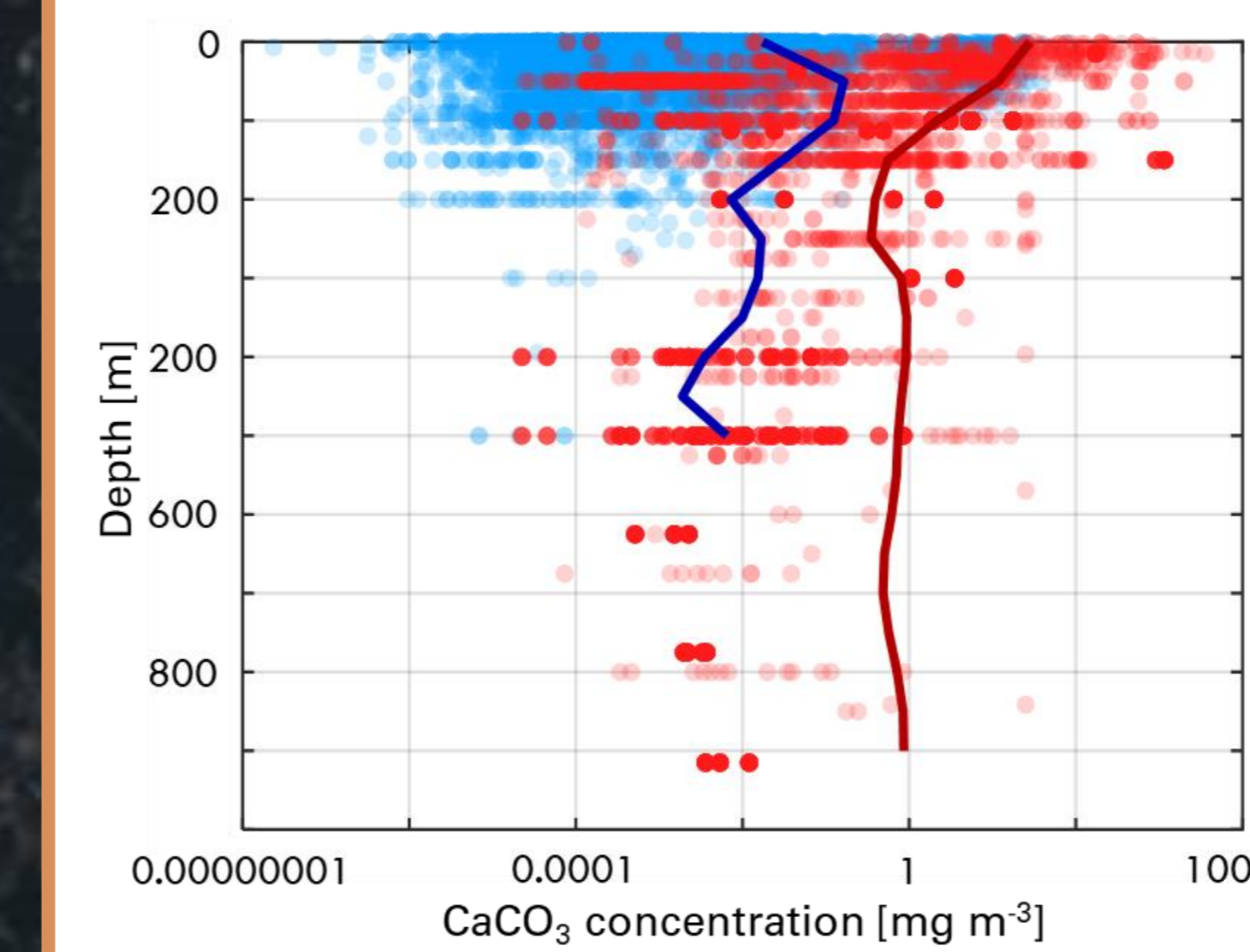
Simulating the dissolution of CaCO₃ shells in seawater



Implications

Is the ocean more buffered than we thought?

Calcite and aragonite concentration in the surface kilometre of the ocean.



Aragonite can only play a meaningful role in calcite benthic dynamics via its galvanizing action if the aragonite flux to and the residence time at the seafloor are high enough.

Depth profile of aragonite and calcite concentrations, from a guided research project by Sjoerd van der Kamp (unpublished).

Locally, aragonite concentrations can be orders of magnitude higher than that of calcite in the surface ocean. If there is a lot of aragonite in the ocean, there is a lot of mineral ready to dissolve and neutralize dissolved CO₂.

Our results highlight the need for future model-, field- and laboratory-based studies about marine CaCO₃ dynamics to consider the presence of several carbonate minerals simultaneously, with different compositions and structures, as they not only passively coexist but chemically interact with each other.

Want to know more?



Preprint describing the findings is online

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