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# Geochemical Tracers of Biomineralisation Processes

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Biominerals play a central role in Earth's past, present and future climate, but there are major gaps in our understanding of how they form. We consider how the geochemistry of calcium carbonate biominerals may be used to interrogate the mechanisms that produce them.

We review the range of biological and mineral processes that are thought to be involved in biomineralisation, set out a conceptual framework for how these processes combine to determine the geochemistry of the biomineral structure, and consider characteristic geochemical patterns that can be diagnostic of specific biomineralisation mechanisms.

We then consider four distinct areas relevance to different aspects of biomineralisation, delving into the fine mineralogical and biological controls on biomineral geochemistry. We begin on the inorganic side, with a consideration of kinetically-controlled trace element partitioning and isotope fractionation, before delving into the uncertainties that arise from the formation and transformation of amorphous calcium carbonate phases that have been involved in numerous organisms. We then consider the impact of biological transport processes on geochemistry be examining the geochemistry of corals and foraminifera, which have some degree of connection to external seawater during calcification, and coccolithophores, which calcify in an environment that is completely isolated from seawater.

We provide an overview of how biomineral geochemistry can be used to understand the mechanisms of biomineralisation and environmental sensitivities of marine calcifiers, and highlight the key knowledge gaps and challenges for the coming decade.