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CORALLINE ALGAE AT INCREASED CO₂: A GLOBAL RESPONSE TO OCEAN ACIDIFICATION

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Coralline algae are an ecologically important part of benthic communities worldwide and there is growing concern that ocean acidification can severely impact their calcite skeletons. Laboratory studies of coralline algae in simulated ocean acidification conditions have revealed wide response variability, making it difficult to assess their future biodiversity and contribution to ecosystem function. Here, we used natural gradients in seawater carbonate chemistry in widely separated biogeographic regions (Mediterranean, NW Pacific) to investigate the effects of ocean acidification on coralline algal biodiversity, abundance and skeletal mineralogy. Molecular identification showed a decrease in the taxonomic diversity of coralline algae with increasing acidification and more than half of the taxa were lost in high $p\text{CO}_2$ conditions.

The success of some coralline species in acidified conditions may relate to their ancient evolutionary history as well as their present-day exposure to environmental variability. The Sporolithales is the most ancient order and evolved when ocean chemistry favoured low Mg-calcite deposition, although it has survived past ocean acidification events is less diverse today and was intolerant of ocean acidification in our molecular surveys. The Corallinales is the most recent order, it evolved when ocean chemistry favoured aragonite and high Mg-calcite deposition, it had the highest diversity at our high $p\text{CO}_2$ sites. The CO_2 gradients we surveyed did not affect the skeletal mineralogy of the coralline algae but the cover of coralline algae declined with the increasing $p\text{CO}_2$, as did the thickness of their carbonate deposits, highlighting the lower fitness of this group as a whole under future high $p\text{CO}_2$.

Keywords: Biodiversity, climate change, evolutionary history