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

Pena, V; Harvey, B; Agostini, S; Porzio, L; Milazzo, M; Horta, P; Le, Gall L; Hall-Spencer, J

DOI:
10.1080/00318884.2021.1922050

Publication date:
2021

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

Viviana Peña[1,2], Ben Harvey[3], Sylvain Agostini[3], Lucia Porzio[3], Marco Milazzo[4], Paulo Horta[5], Line Le Gall[2], Jason Hall-Spencer[3,6]

1 BioCost Research Group, Facultad de Ciencias and Centro de Investigaciones Científicas Avanzadas (CICA), Universidad de A Coruña, 15071, A Coruña, Spain;
2 Institut de Systématique Évolution Biodiversité, Muséum national d'Histoire naturelle, CNRS, 57 rue Cuvier CP 39, Paris, France;
3 Shimoda Marine Research Center, University of Tsukuba, 5-10-1, Shimoda, Japan;
4 Department of Earth and Marine Sciences (DiSTeM), University of Palermo, Via Archirafi 20 I-90133, Palermo, Italy;
5 Laboratory of Phycology, Department of Botany, Federal University of Santa Catarina, 88040-970, Florianópolis, Brazil;
6 School of Biological and Marine Sciences, University of Plymouth, PL4 8AA, Plymouth, United Kingdom

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 pCO_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 pCO_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 pCO_2, as did the thickness of their carbonate deposits, highlighting the lower fitness of this group as a whole under future high pCO_2.

Keywords: Biodiversity, climate change, evolutionary history