

Assessing effects of long-term ocean acidification at volcanic CO₂ vents

Laura Pettit

Examination of the effects of elevated CO₂ levels on the function of benthic communities and the commercial species they support (Objectives a-c and deliverables 3 and 4 of the UKOARP).

Supervised by

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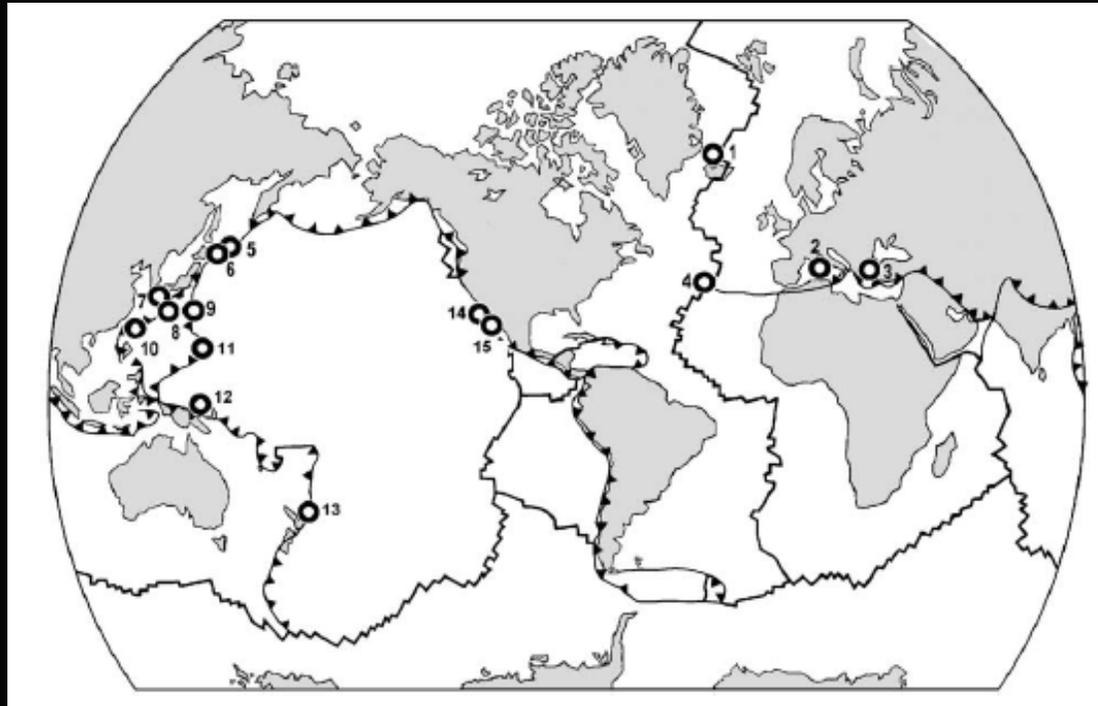
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Project background....CO₂ vents

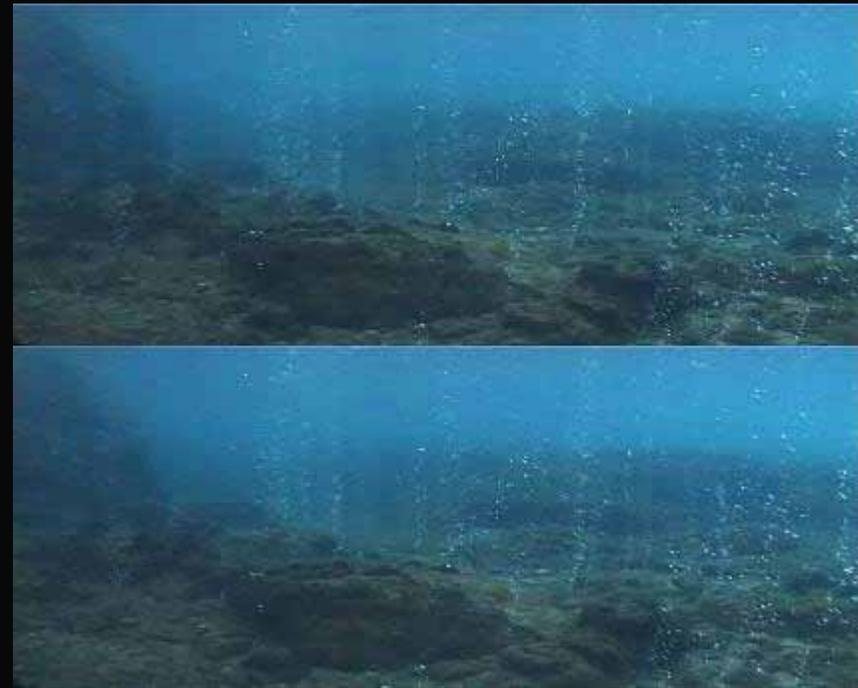
- integrate effects on biogeochemical cycles over millenia
- can test models and scale-up lab. and mesocosm experiments
- identifies tolerant species e.g. seagrass and invasive algae
- show where ecological tipping points occur along gradients of increasing CO₂ levels



Tarasov (2005) Chem Geol

Ischia monitoring since 2008

pH_T, Total Alkalinity, Salinity, and Temperature to calculate $p\text{CO}_2$, CO_3^{2-} , HCO_3^- , DIC, Ω_{arag} , Ω_{calcite}



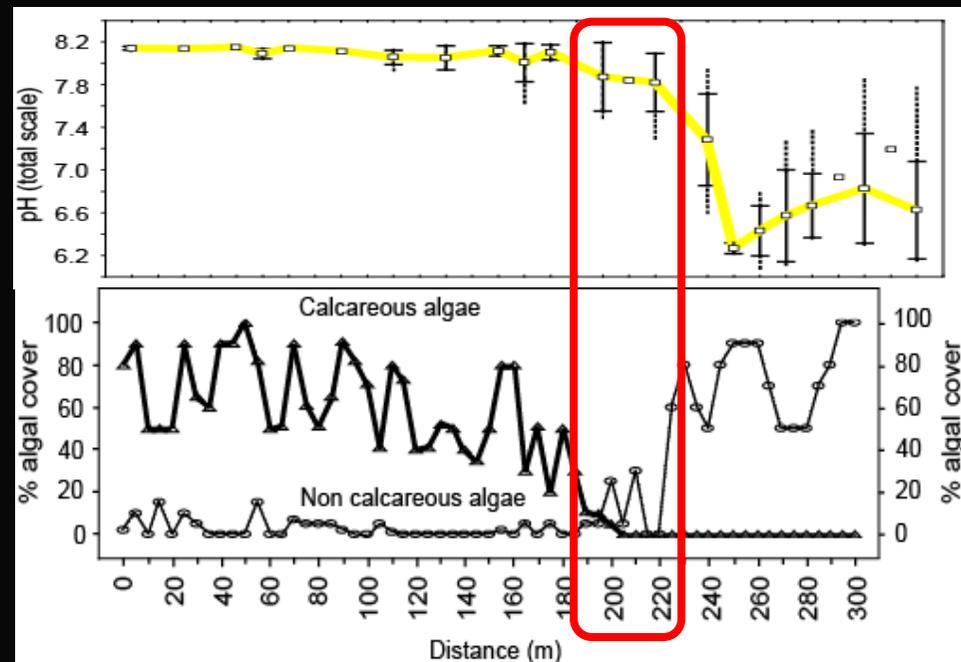
Biodiversity

Intertidal and subtidal abundances of protists, flora and fauna

Ecology

e.g. recruitment, growth, reproduction

Transplantations used to look at processes such as photosynthesis and calcification



Hall-Spencer JM et al. (2008) Nature 454, 96-99.

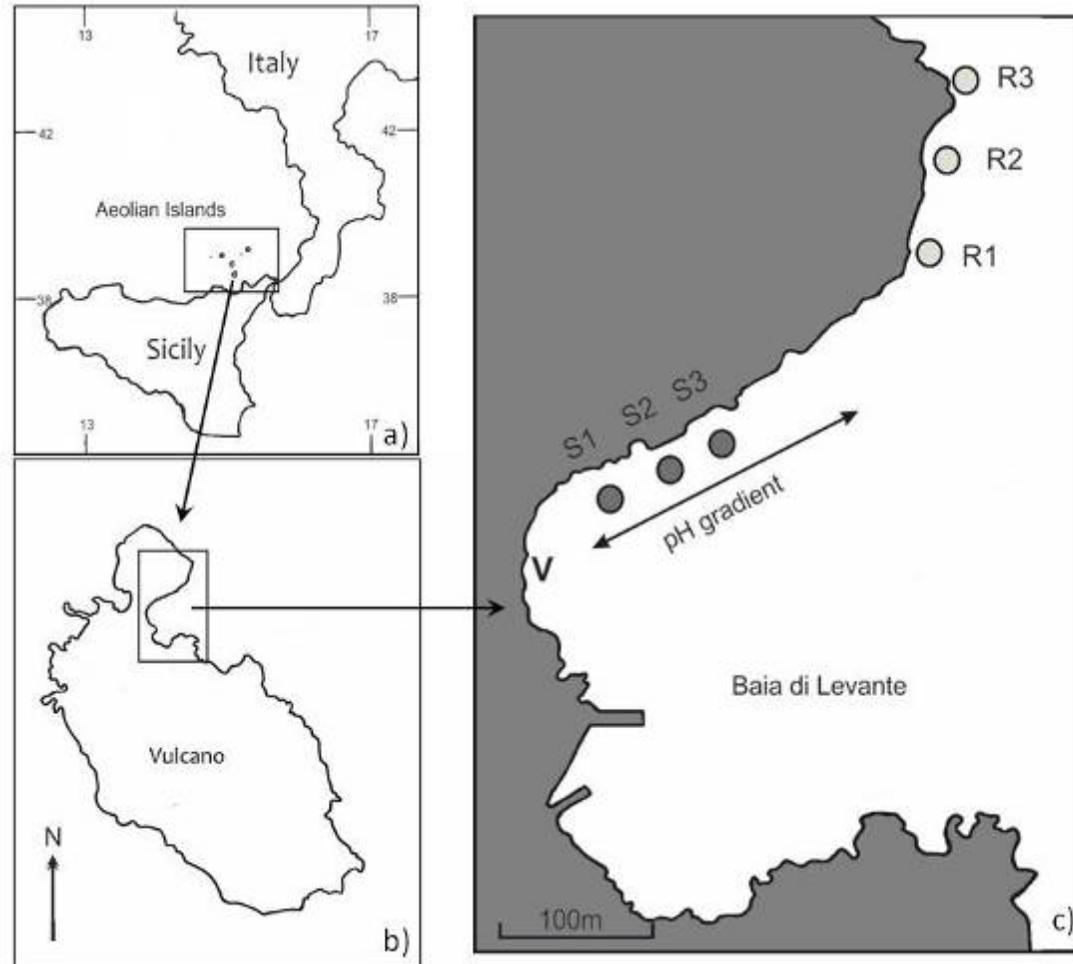


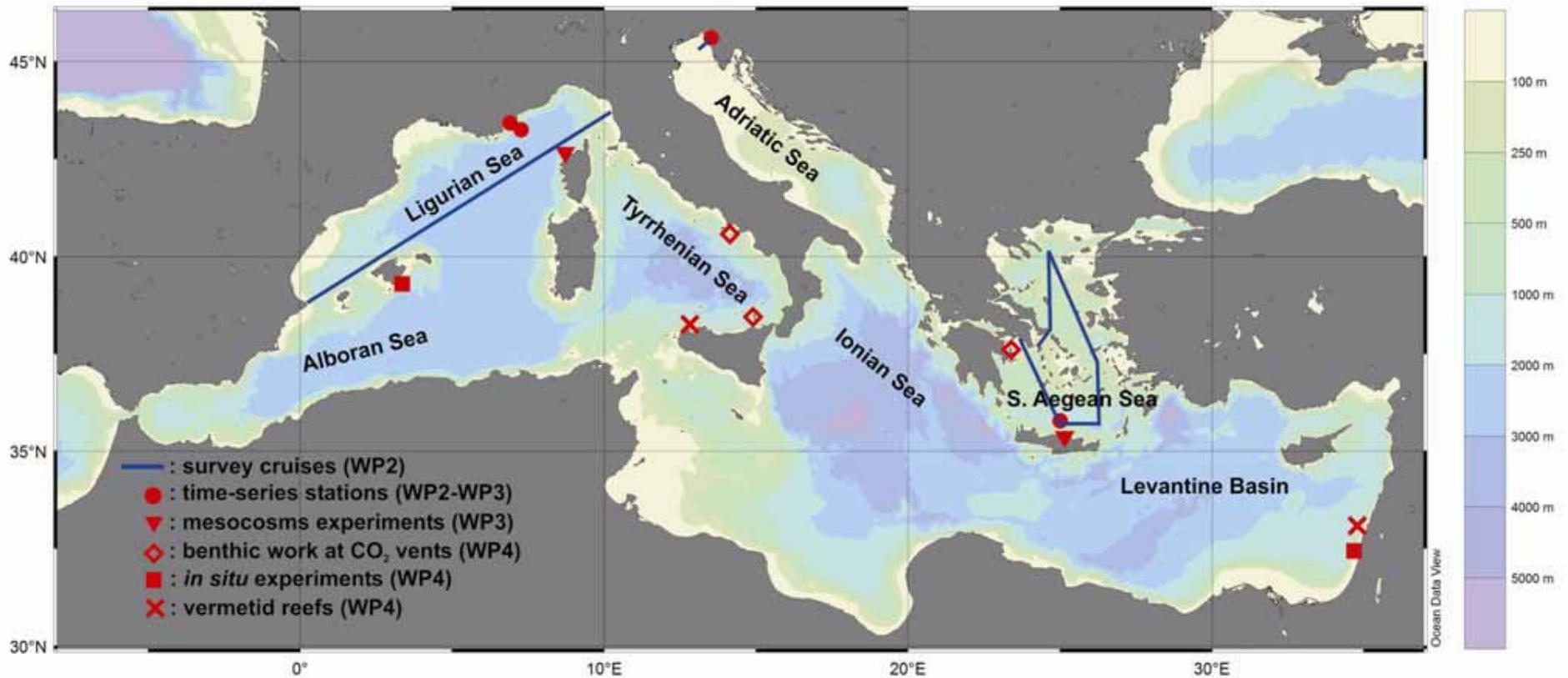
250 taxa now examined; seagrass epiphytes (Martin et al. 2008), calcification of bryozoans (Rodolfo-Metalpa et al. 2010) recruitment of nematodes, polychaetes, molluscs, crustaceans and chaetognaths (Cigliano et al. 2010), diversity of foraminifera (Dias et al. 2010), macroalgal community structure (Porzio et al. in press).

Hypotheses:

- 1) Year 2100 levels of ocean acidification may enhance the growth and reproduction of invasive species in natural settings,
- 2) chronic hypercapnia can reduce benthic biodiversity, including the loss of calcified species, with negative effects on ecosystem function in intertidal and subtidal habitats,
- 3) transplant experiments, coupled with sampling along pCO₂ gradients, confirm that some species adapt to long-term acidification by altering skeletal mineralogy,
- 4) active metazoans (e.g. shrimp and fish) withstand high levels of CO₂ as adults but do not complete their life-histories at naturally acidified sites.

My main study site $38^{\circ}25' N$, $14^{\circ}57' E$ <10 m deep





But... currently sorting foram samples from CO2 vents in Sea of Cortez