

# Assessing effects of long-term ocean acidification at volcanic CO<sub>2</sub> vents

Laura Pettit

Examination of the effects of elevated CO<sub>2</sub> 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

Jason Hall-Spencer (UoP, EPOCA & MEDSEA PI)

Martin Attrill (UoP 2<sup>nd</sup> supervisor)

Colin Brownlee (MBA, EPOCA PI)

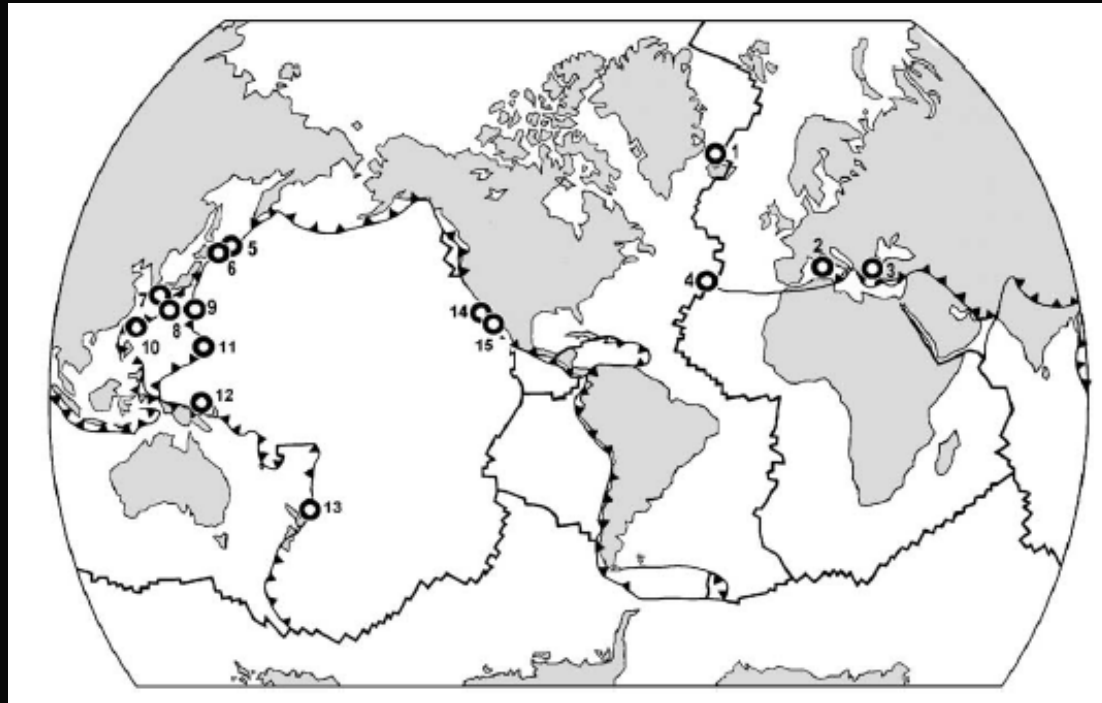
Sophie Martin (Roscoff)

Jelle Bijma (AWI, BIOACID & MEDSEA PI)

Piero Calosi (UoP Internal assessor)

## Project background....CO<sub>2</sub> vents

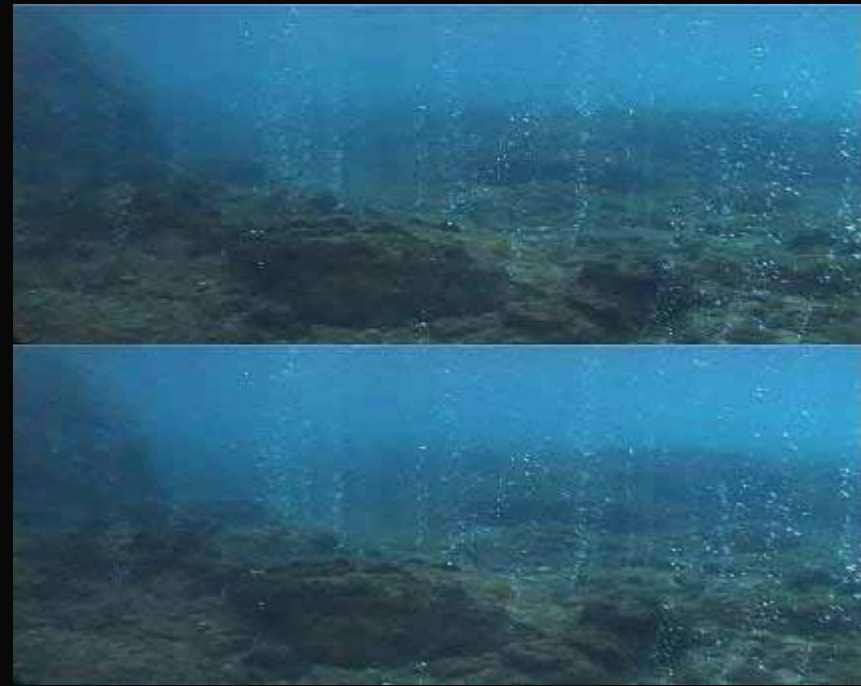
- integrate effects on biogeochemical cycles over millenia
- can test models and scale-up lab. and mesocosm experiments
- identifies tolerant species e.g. seagrass and invasive algae
- show where ecological tipping points occur along gradients of increasing CO<sub>2</sub> levels



Tarasov (2005) Chem Geol

## Ischia monitoring since 2008

pH<sub>T</sub>, Total Alkalinity, Salinity, and Temperature to calculate pCO<sub>2</sub>, CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>3-</sup>, DIC, Ω<sub>arag</sub>, Ω<sub>calcite</sub>



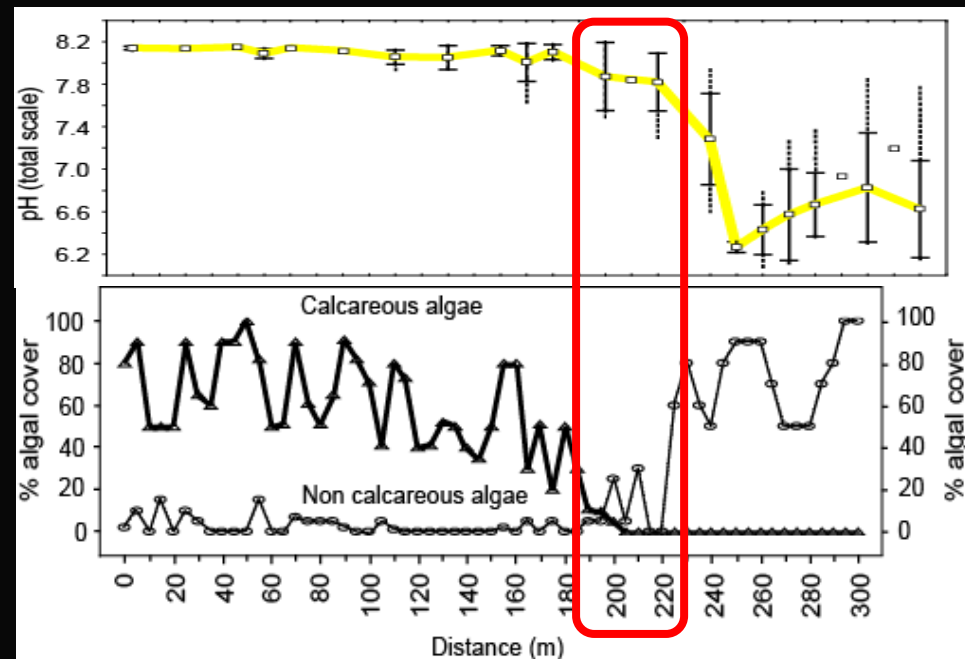
## Biodiversity

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.





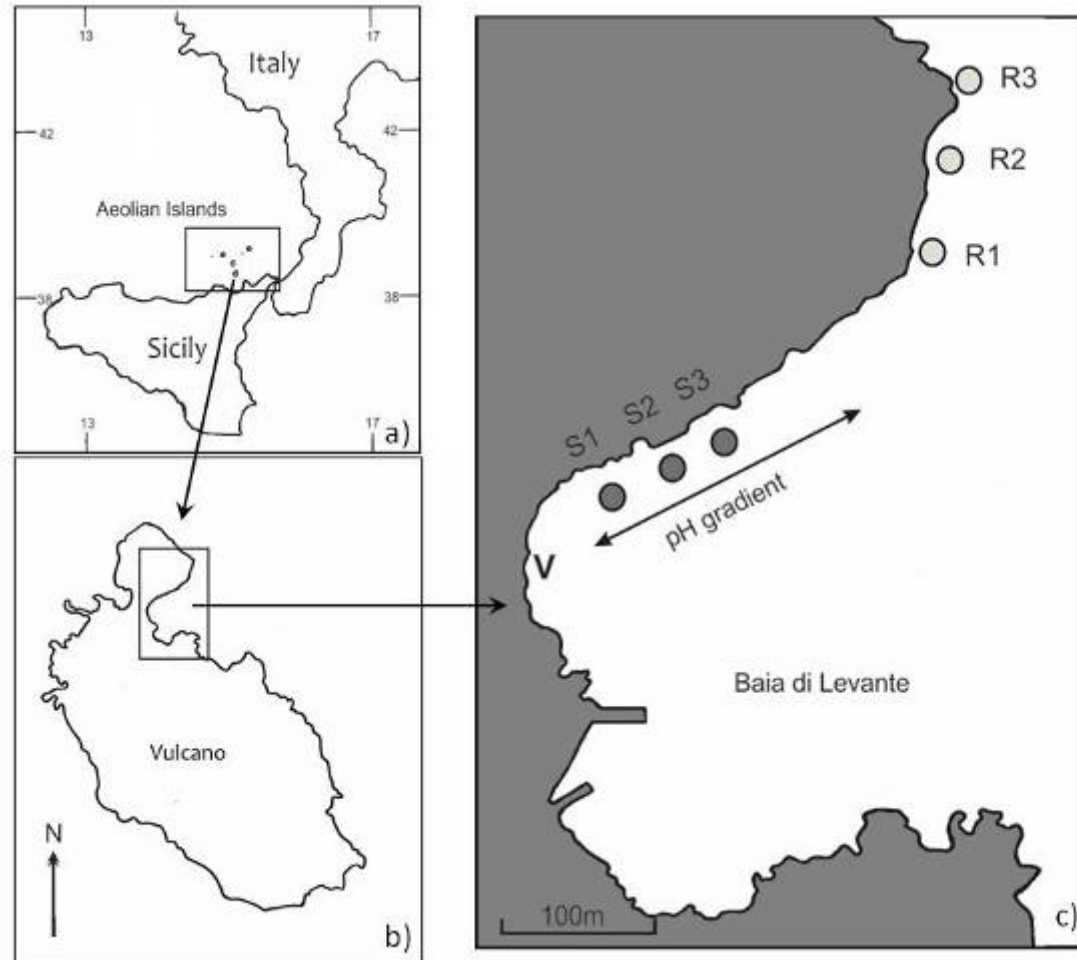
250 taxa now examined; seagrass epiphytes (Martin et al. 2008), calcification of bryozoans (Rodolfo-Metalpa et al. 2010) recruitment of nematodes, polychaetes, molluscs, crustaceans and chaetognaths (Cigliano et al. 2010), diversity of foraminifera (Dias et al. 2010), macroalgal community structure (Porzio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

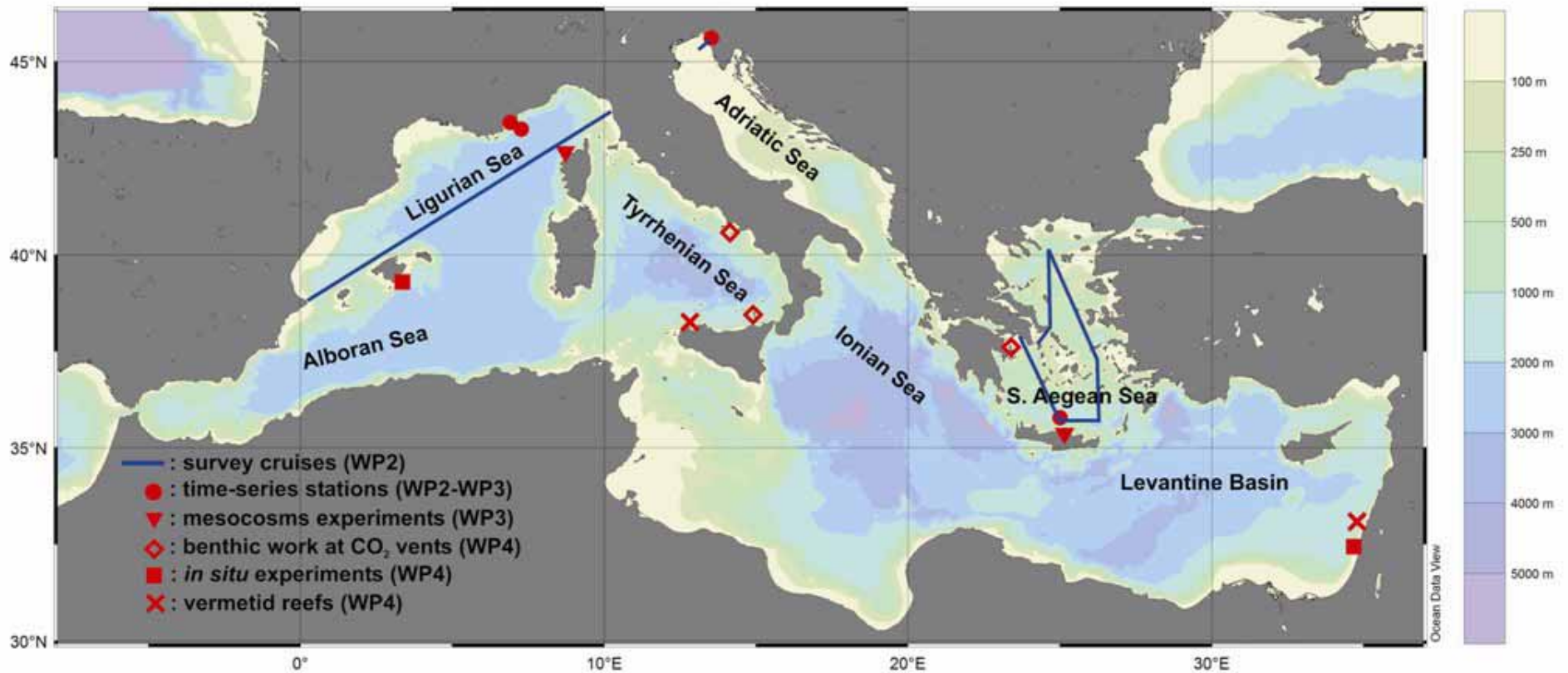
## Hypotheses:

- 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  $p\text{CO}_2$  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  $\text{CO}_2$  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 CO<sub>2</sub> vents in Sea of Cortez