

# NEW VOLCANIC CO<sub>2</sub> VENTS ALONG THE COAST OFF THE ISCHIA ISLAND (ITALY) PROVIDE A GLIMPSE OF THE POTENTIAL IMPACTS OF OCEAN ACIDIFICATION

N Teixidó<sup>1</sup>, E. Ballesteros<sup>2</sup>, K. Kroeker<sup>3</sup>, F. Micheli<sup>4</sup>, MC. Gambi<sup>1</sup>

(1) Stazione Zoologica Anton Dohrn, Villa Dohrn-Benthic Ecology, Ischia (Naples), Italy

(2) Center for Advanced Studies of Blanes (CEAB-CSIC), Spain

(3) University California of Santa Cruz (UCSC), USA

(4) Hopkins Marine Station (HMS-SU), USA



E-mail: nteixido@icm.csic.es



## Background:

During the last 6 years, studies using a shallow volcanic CO<sub>2</sub> vent system near Castello Aragonese on the island of Ischia (Italy) have generated key insights on the direct and indirect effects of Ocean acidification (OA). These natural CO<sub>2</sub> vents cause local acidification of seawater by as much as 1.5 pH units below the average ocean pH of 8.1-8.2.

## Corresponding to this pH drop:

- Decrease of benthic diversity and biomass of organisms (1, 2)
- Changes on the relative abundance of species, with some species dropping out while others appear to benefit from decreased predation or altered resource availability and competition (3).

## Major aims:

Here, we present newly discovered vent sites along the coast of Ischia across depths of 3-48 m (4) (Fig. 1). These sites span a variety of different habitats such as *Posidonia oceanica* seagrass meadows, gravel and sandy bottoms, semi-dark cave habitats and coralligenous outcrops, the latter dominated by calcifying organisms that are particularly vulnerable to OA.

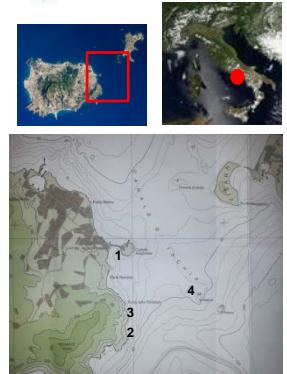
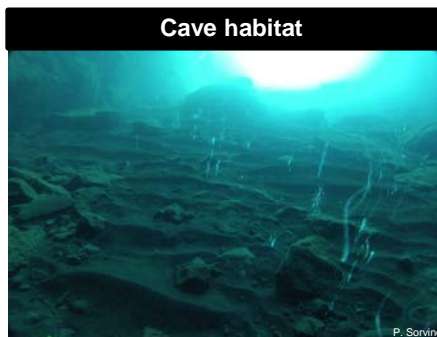
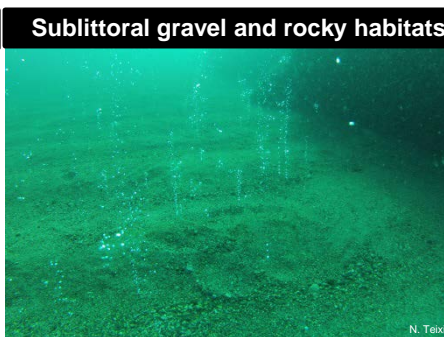


Fig. 1 Map of the east coast off Ischia Island (Italy) where CO<sub>2</sub> vent systems occur: 1= Castello Aragonese, 2= Mago's cave, 3= Chiame del Lume, 4= Madonnina Bank.

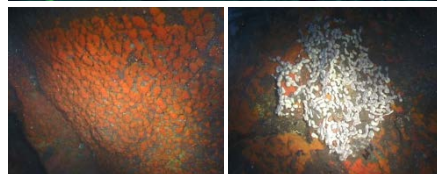
## New CO<sub>2</sub> vent sites along the coast of Ischia where additional habitats can be studied



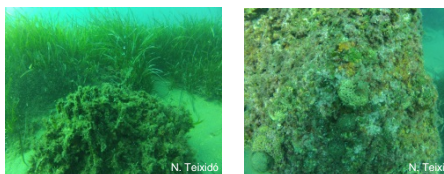
Cave habitat



Sublittoral gravel and rocky habitats



**Mago's cave:** CO<sub>2</sub> vents are on the sea-bottom at the entrance of the main semi-dark chamber of this semi-submerged cave. Depth: 6-7 m. The scleractinian coral *Astroidea calycularis* and the demosponge *Chondrilla nucula* are abundant. pH= 7.8 ± 0.06 (SD).



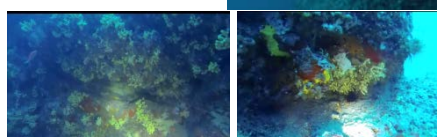
**Chiame del Lume:** CO<sub>2</sub> vents are on gravel sea-bottom at 10-11 m depth, close to rocky areas and *Posidonia oceanica* seagrass meadows. pH= 8.1 ± 0.05 (SD).



Coralligenous habitat



**Pertuso Bank:** It is located approx. 400 m from the **Madonnina Bank**, but non-affected by CO<sub>2</sub> emissions and gorgonian forests are well developed. Depth: 35-38 m.



**Madonnina Bank:** A rocky bank (36-48 m depth) where CO<sub>2</sub> vents are located at 48 m. It is characterized by a reduced consolidated calcareous algal layer and absence of gorgonian forests. Benthic species such as *Aplysina cavernicola*, *Centrostephanus longispinus*, and *Halocynthia papillosa* are found on overhangs and cracks.

Table 1. Provisional benthic species list for the newly discovered CO<sub>2</sub> vent sites. Semi-quantitative estimation: 1: < 5%; 2: 2-25%; 3: 25-50%; 4: 50-75%; 5: > 75%. Calcifiers are shown in bold. C: Chlorophyta; P: Phaeophyta; R: Rhodophyta; TRA: Tracheophyta; POR: Porifera; CNI: Cnidaria; BRY: Bryozoa; MO: Mollusca; ANN: Annelida; CRU: Crustacea; ECH: Echinodermata; TUN: Tunicata; ECHI: Echiurida

Taxa	Mago's Cave	Chiame Lume	Madonnina Bank
<i>Codium bursa</i> (C)		2	
<b><i>Corallina elongata</i></b> (R)		3	
<i>Flabellia petiolata</i> (C)		3	
<i>Halimeda tuna</i> (C)		1	
<i>Halopteris filiformis</i> (P)		3	
<b><i>Padina pavonica</i></b> (P)		3	
<b><i>Encrusting calcareous algae</i></b> (R)		1	1
<i>Posidonia oceanica</i> (TRA)		3	
<i>Aplysina cavernicola</i> (POR)			4
<i>Chondrilla nucula</i> (POR)	4		3
<i>Chondrosia reniformis</i> (POR)	3		2
<i>Crambe crambe</i> (POR)		3	
<i>Haliciona mucosa</i> (POR)			2
<i>Haliciona fulva</i> (POR)			1
<i>Ircinia fasciculata</i> (POR)		2	
<i>Oscarella</i> sp. (POR)			1
<i>Petrobia italiciformis</i> (POR)	3	1	
<i>Phorbas tenacior</i> (POR)	1		
<i>Spirastrella cunctatrix</i> (POR)	3		
<i>Spongia officinalis</i> (POR)			
<b><i>Astroidea calycularis</i></b> (CNI)	4		
<b><i>Balanophyllia europaea</i></b> (CNI)		2	
<b><i>Cladocora caespitosa</i></b> (CNI)		3 (some death)	
<b><i>Parazoanthus axinellae</i></b> (CNI)		2	
<b><i>Calpensia nobilis</i></b> (BRY)		2	
<b><i>Myriapora truncata</i></b> (BRY)	2 (some death)		
<b><i>Sertella</i></b> sp. (BRY)		1	
<b><i>Pinna nobilis</i></b> (MO)		1	
<i>Spondylus gaederopus</i> (MO)		2	
<b><i>Salmacina/Filigrana</i></b> sp. (ANN)			1
<b><i>Balanus</i></b> sp. (CRU)			
<i>Arbacia lixula</i> (ECH)		1	
<b><i>Centrostephanus longispinus</i></b> (ECH)			2
<i>Echinaster sepositus</i> (ECH)			1
<i>Marasterias glacialis</i> (ECH)			1
<b><i>Paracentrotus lividus</i></b> (ECH)			1
<b><i>Sphaerechinus granularis</i></b> (ECH)			1
<i>Halocynthia papillosa</i> (TU)			2
<i>Bonellia viridis</i> (ECH)			1

## These new CO<sub>2</sub> vent sites/systems will:

- help to determine the generality of how OA may result in 'winners' and 'losers', the identity of these species, and the implications for the conservation of the rich diversity of the Mediterranean.
- provide new insights regarding OA's effects on a range of community types, thereby facilitating some generality in our predictions of OA's impacts.

## Funding:

Financial support is provided by the European Union under FP7- People - Co-funding of Regional, National and International Programmes, GA no. 600407 (<http://www.cofundbandiera.cnr.it/>) through the "vulnerCLIMA" project and the National Geographic Society through the "Window to the Future project" (Grant #9771-15)



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