Consiglio Nazionale delle Ricerche
ISTITUTO DI GEOLOGIA AMBIENTALE E GEOINGEGNERIA

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GSA 2015
Baltimore, Maryland, USA

The response of living foraminiferal assemblages to hydrothermal vent influence: an example from the Pontine Archipelago (Tyrrhenian Sea, Italy)

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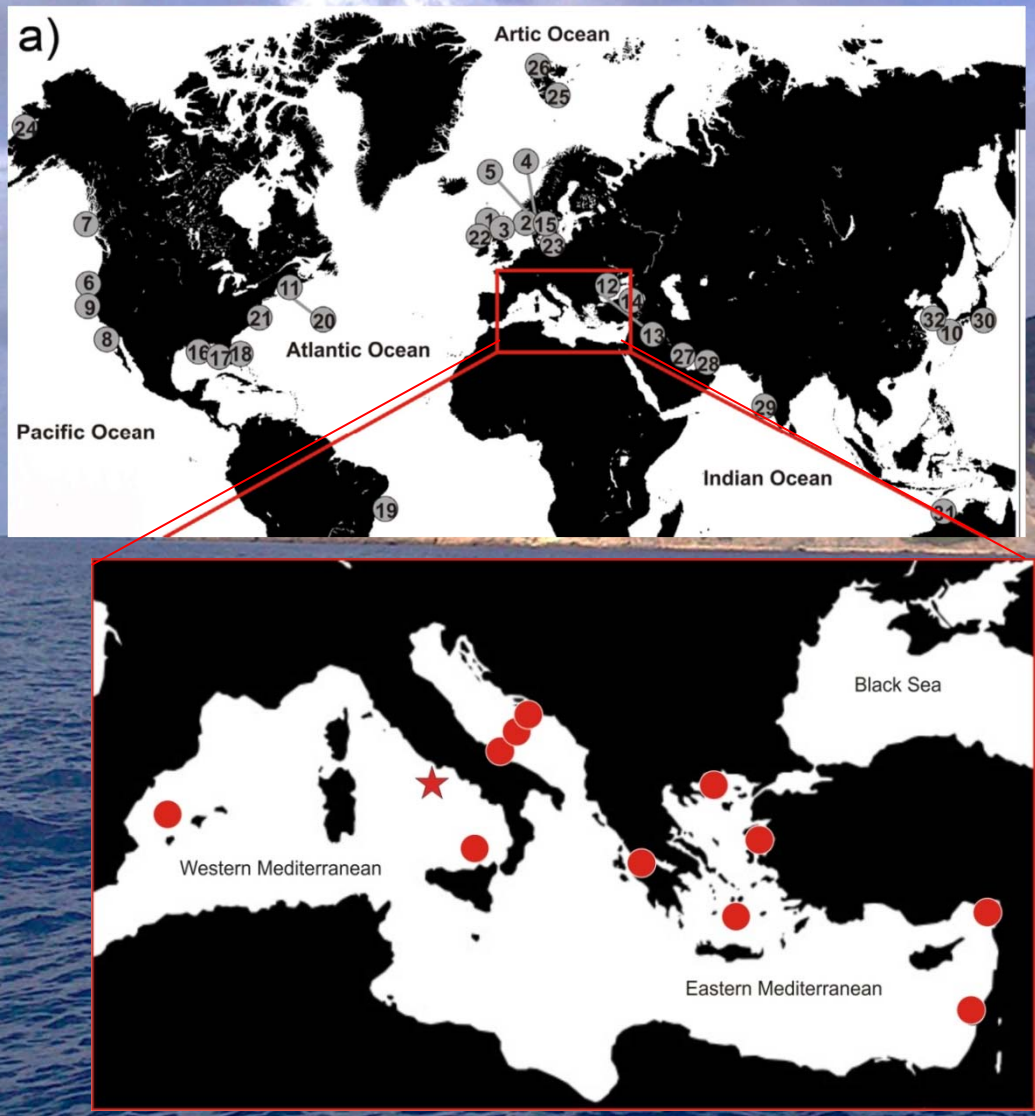
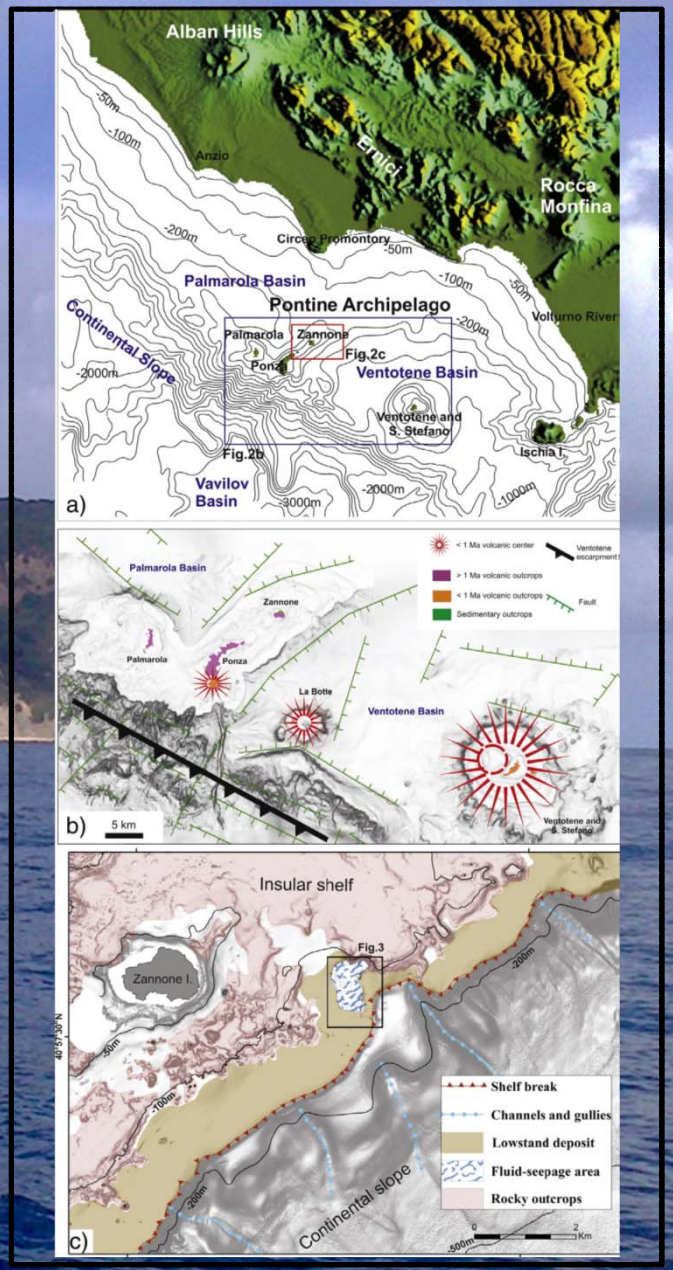
Geological setting



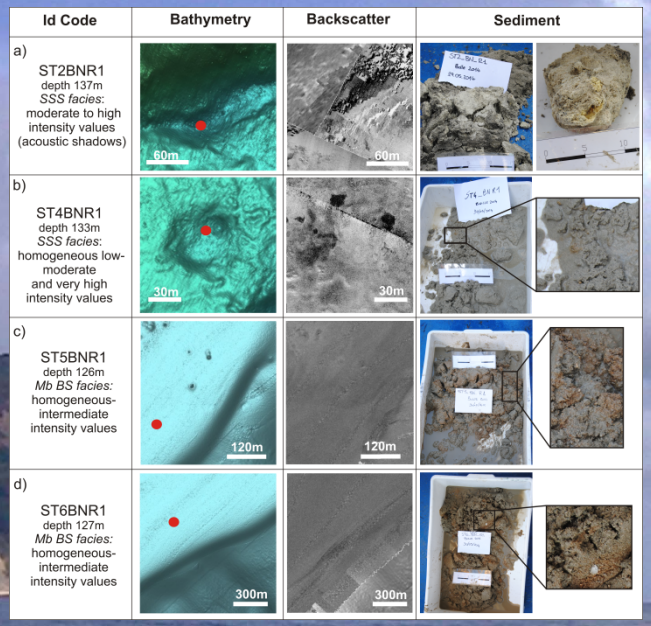


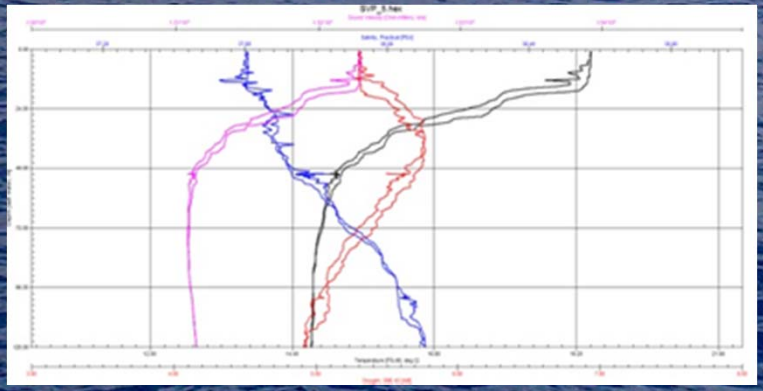
Ingrassia et al., 2015

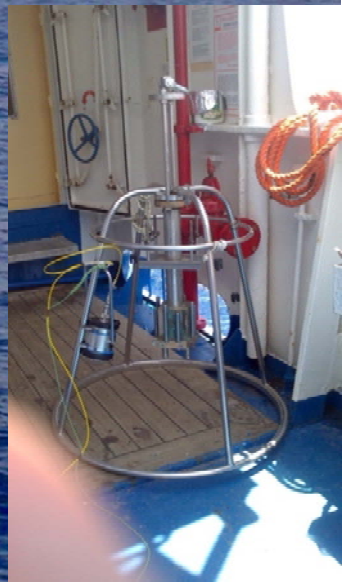
Methods

BOLLE 2014" Cruise - June 2014 aboard to the R/V Urania

- Microfauna/Macrofauna
- Sedimentological analyses
- Geochemical analyses
- ROV videos
- Multibeam and seismic data (EG&G 260 SideScan Sonar)
- SEM analysis (EDS microanalysis)



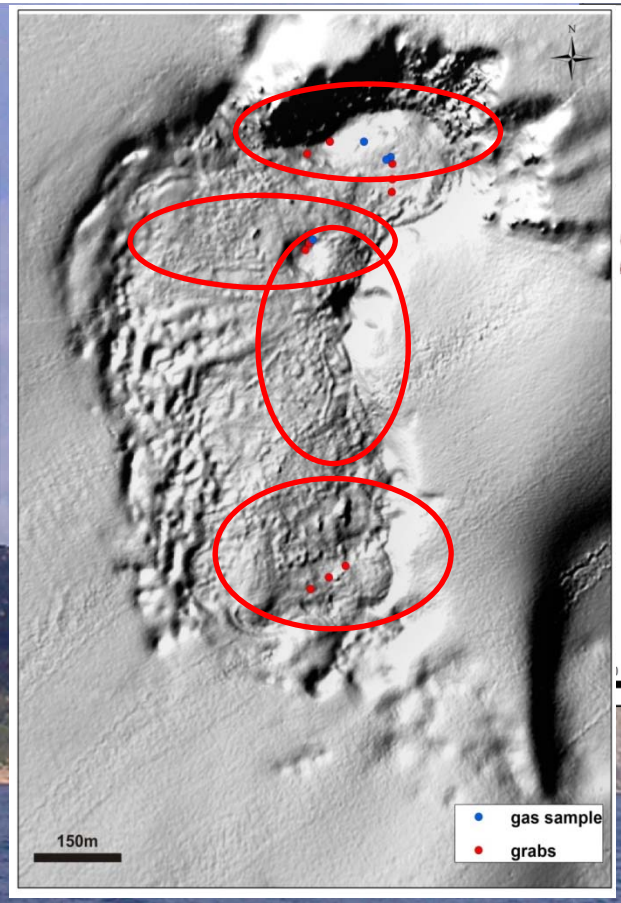


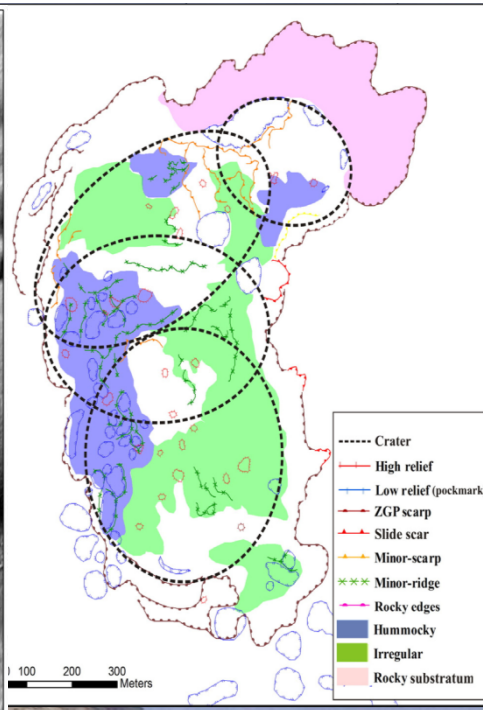


Results

Zannone Giant Pockmark (ZGP):

Surface area: 0.5 km^2
Length: 900 m
Width: 500 m
Depth: 140-150 m wd
Morphology: elongate shape, gently trending NNW–SSE. The ZGP can be interpreted as the result of the coalescence of wide crater features 200–500 m wide

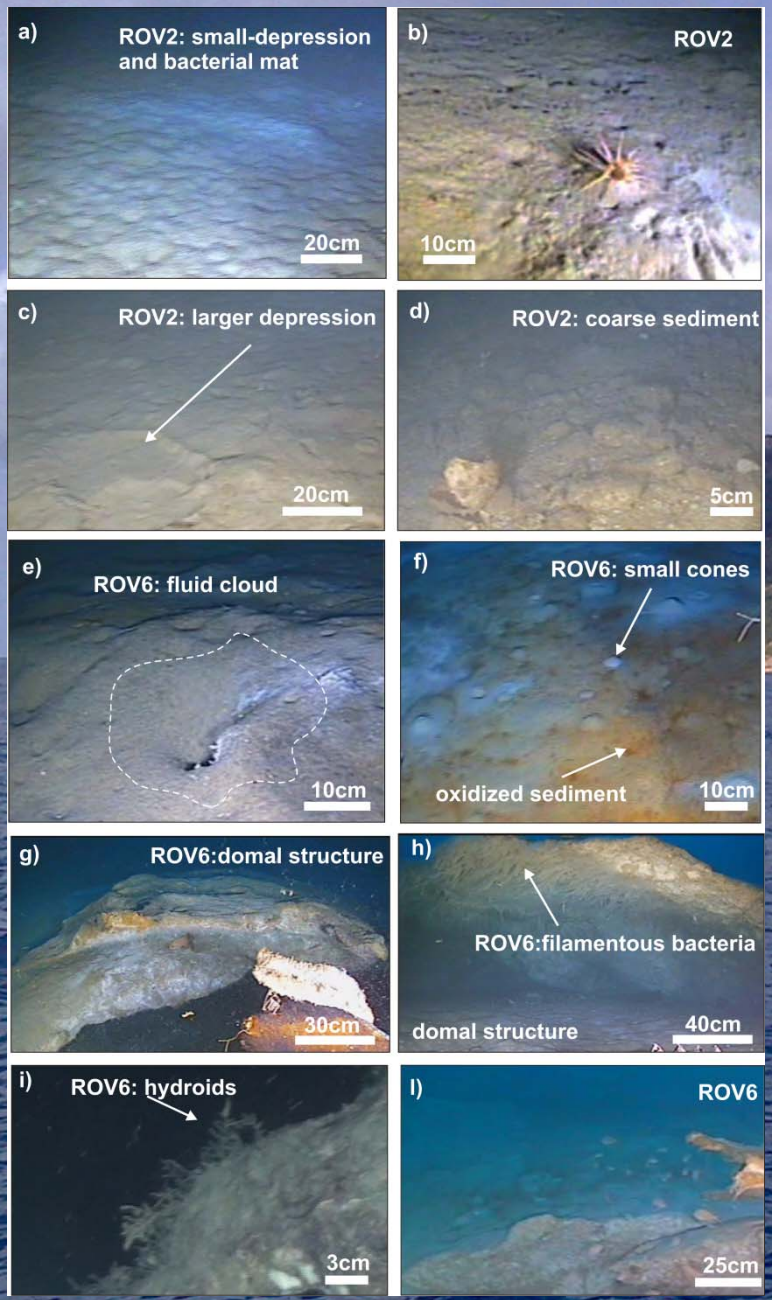




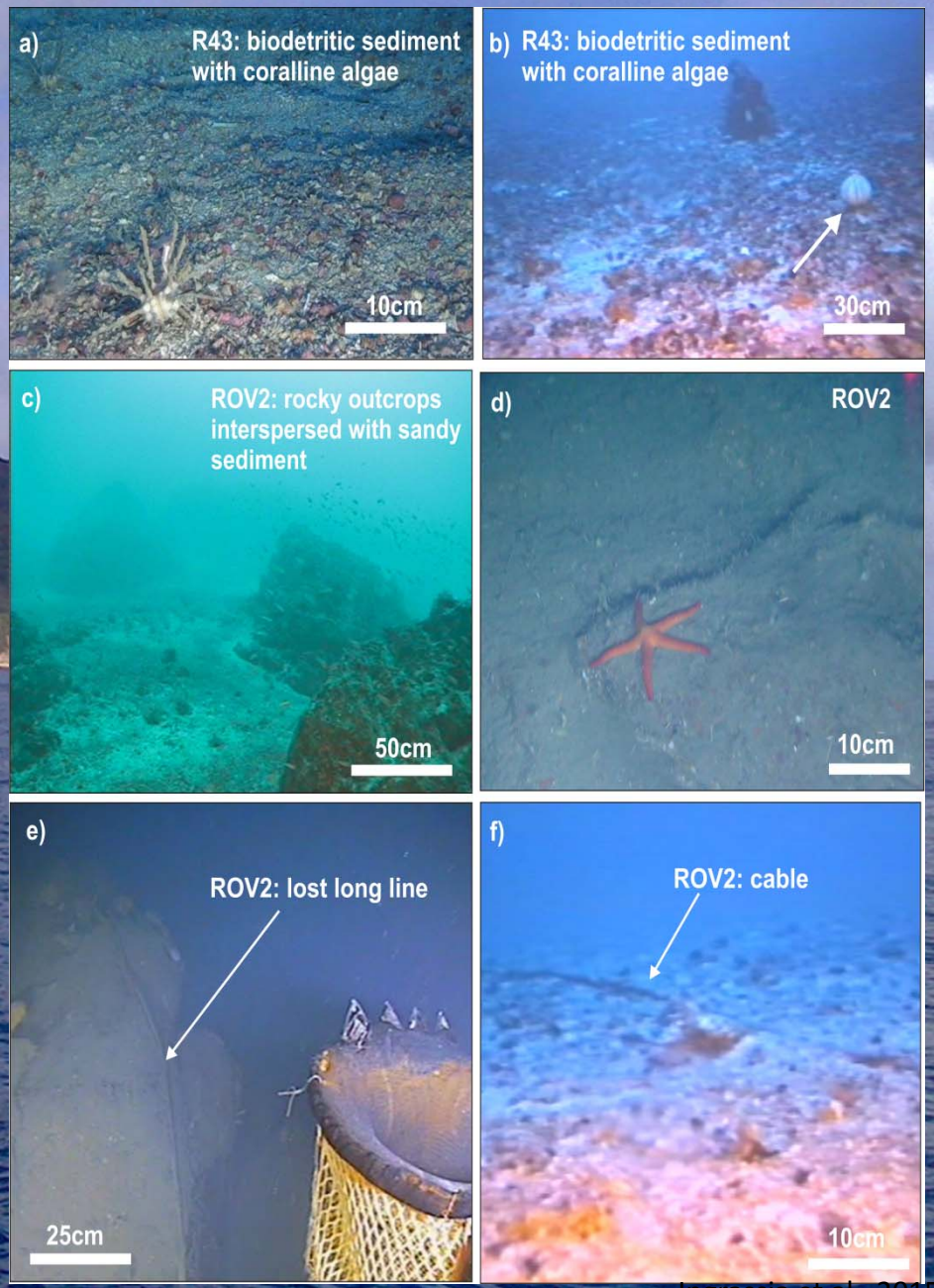
The northern, central and the eastern sectors of the ZGP appear to be characterized by:

- small-scale cones and depressions of submetric and centimetric size (vertical relief less than 1–2 m and diameter ranging from 5 to 25 m)
- bubble streams concentrated in the northern sector
- lithified pavements with white bacterial mats, generally not colonized by macrofauna

Venting areas



No venting areas

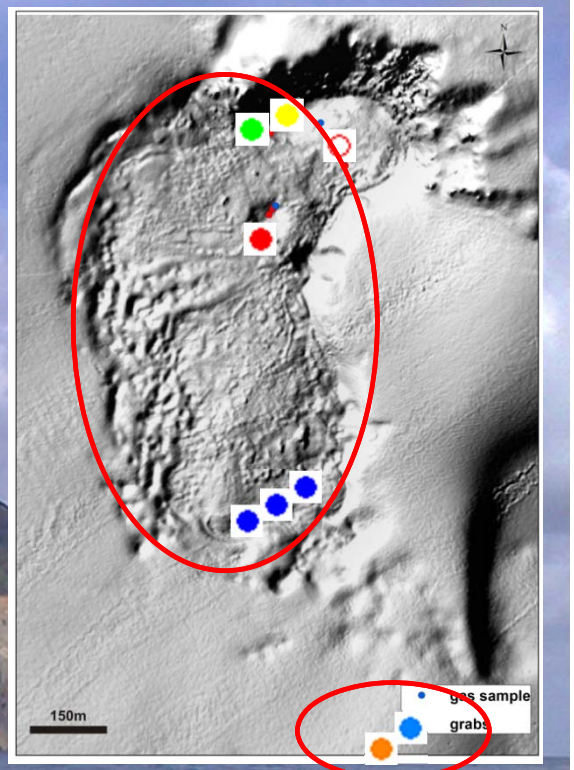


Ingrassia et al., 2015

Geochemical analysis

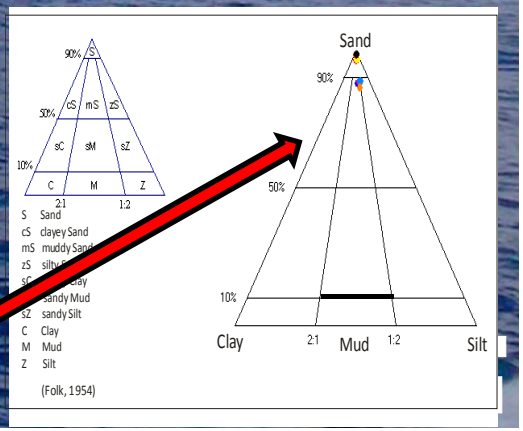
- Gas chromatography analysis of the dissolved gases in water column samples collected in the ZGP reported values of 870 ppm of pCO_2, 2.76 ppm of pCH4 and 0.045 ppm of pC_2H_6.
- Water column samples collected outside the ZGP returned 500 ppm of pCO_2, 0.88 ppm of pCH_4 and not trace of C_2H_6.

#	Sample-depth	He	H_2	O_2	N_2	CO	CH_4	CO_2	He/Ne	R/Ra
1	BT3-2 50m		$1,3x10^{-2}$	4,93	11,03	2,50E-05	$7,1 x10^{-4}$	0,56	0,29	0,8
2	BT3-2 100m		$1,6 x10^{-2}$	4,21	9,84	1,40E-05	$9,4 x10^{-4}$	0,58	0,34	0,86
3	BT3-1 bottom	$2,3 x10^{-4}$	$7,0 x10^{-3}$	4,64	10,96	1,30E-05	$1,8 x10^{-3}$	0,72	0,32	1,02
4	BT4-3 50m		$2,4 x10^{-3}$	4,02	8,1	1,30E-05	$9,2 x10^{-4}$	0,59	0,33	0,89
5	BT4-2 100m		$4,7 x10^{-3}$	3,96	9,76	2,00E-05	$1,4 x10^{-3}$	0,58	0,32	0,88
6	BT4-2 bottom		$1,2 x10^{-3}$	3,66	7,99	2,00E-05	$7,5 x10^{-4}$	0,7	0,34	0,94
7	BT6-3 50m		$1,6 x10^{-3}$	4,44	10,76	3,00E-05	$3,3 x10^{-4}$	0,46	0,33	0,85
8	BT6-2 100m		$7,0 x10^{-3}$	4,41	10,84	1,80E-05	$2,7 x10^{-4}$	0,56	0,24	0,83
9	BT6-1 bottom		$1,5 x10^{-2}$	2,37	7,77	1,40E-05	$8,1 x10^{-4}$	0,72	0,35	0,89
10	BT7-1 bottom		$1,9 x10^{-2}$	3,72	9,3	1,40E-05	$4,9 x10^{-4}$	0,72	0,31	0,84
11	BT8-1 bottom		$4,3 x10^{-3}$	4,22	10,23	2,30E-05	$1,1 x10^{-4}$	0,53	0,32	0,85
ASSW		*$4,8 x10^{-5}$*		*4,8*	*9,6*		*$1,0 x10^{-6}$*	*0,24*		



Grainsize analysis

Cruise	Sample		Sand	Silt	Clay	M_z (phi)	σ_I (phi)	D_{50} (mm)
Bolle2014	ST1BNR2		96,35	1,74	1,91	2,63	0,53	0,165
Bolle2014	ST2BNR1		96,65	2	1,35	1,92	1,09	0,205
Bolle2014	ST2BNRa		98,35	0,99	0,66	1,32	1,31	0,288
Bolle2014	ST3BNR3		87,92	6,61	5,47	2,73	1,70	0,161
Bolle2014	ST4BNR1		98,39	0,86	0,75	2,53	0,48	0,170
Bolle2014	ST5BNR1		88,56	7,01	4,43	2,02	2,12	0,249
Bolle2014	ST6BNR1		88,73	7,25	4,02	1,98	2,03	0,287
Bolle2014	ST6BNR3		86,36	8,28	5,36	2,22	2,10	0,220



- The most part of the samples belongs to muddy sand unit

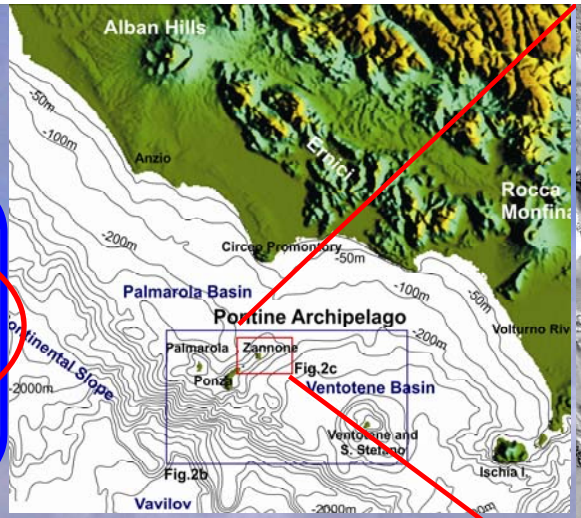
Microfauna

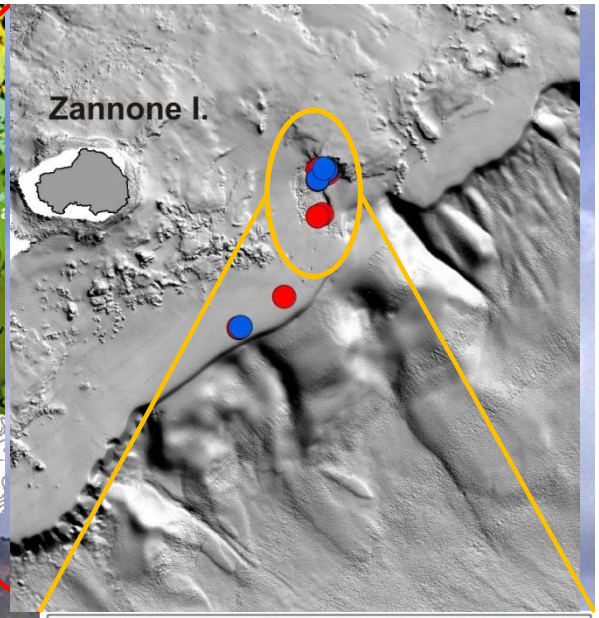
6 Stations: 4 inside ZGP and 2 outside ZGP at 120/140m wd. In each Station three replies were collected for a total of 18 grab samples

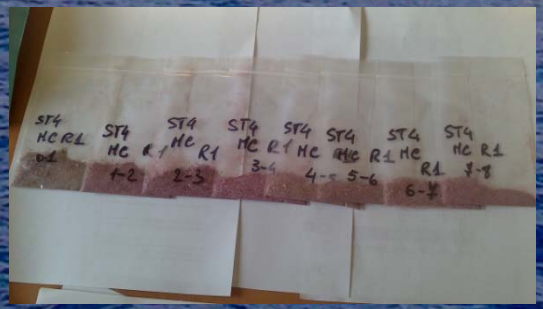
For each of the collected grab samples, small cores (10-15 cm thick) were analyzed and along them samples were collected continuously every 1 cm

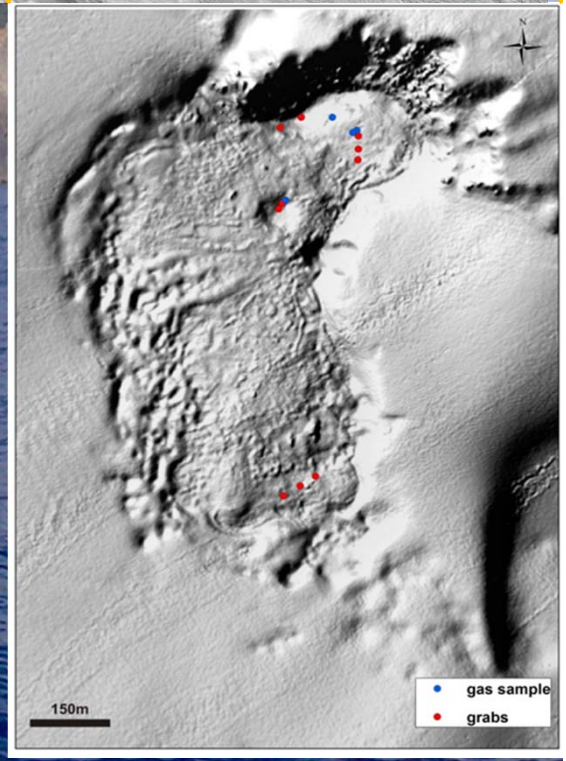
The samples were stained and preserved in a solution of 2 g/l of Rose Bengal and ethanol. After 15 days, the samples were wet-sieved through a 63 µm sieve and then dried at 40°C

Living and dead assemblages were analyzed. Faunal Density (ind/gr dry sed.), Diversity Index (Shannon H, Fisher alpha index)





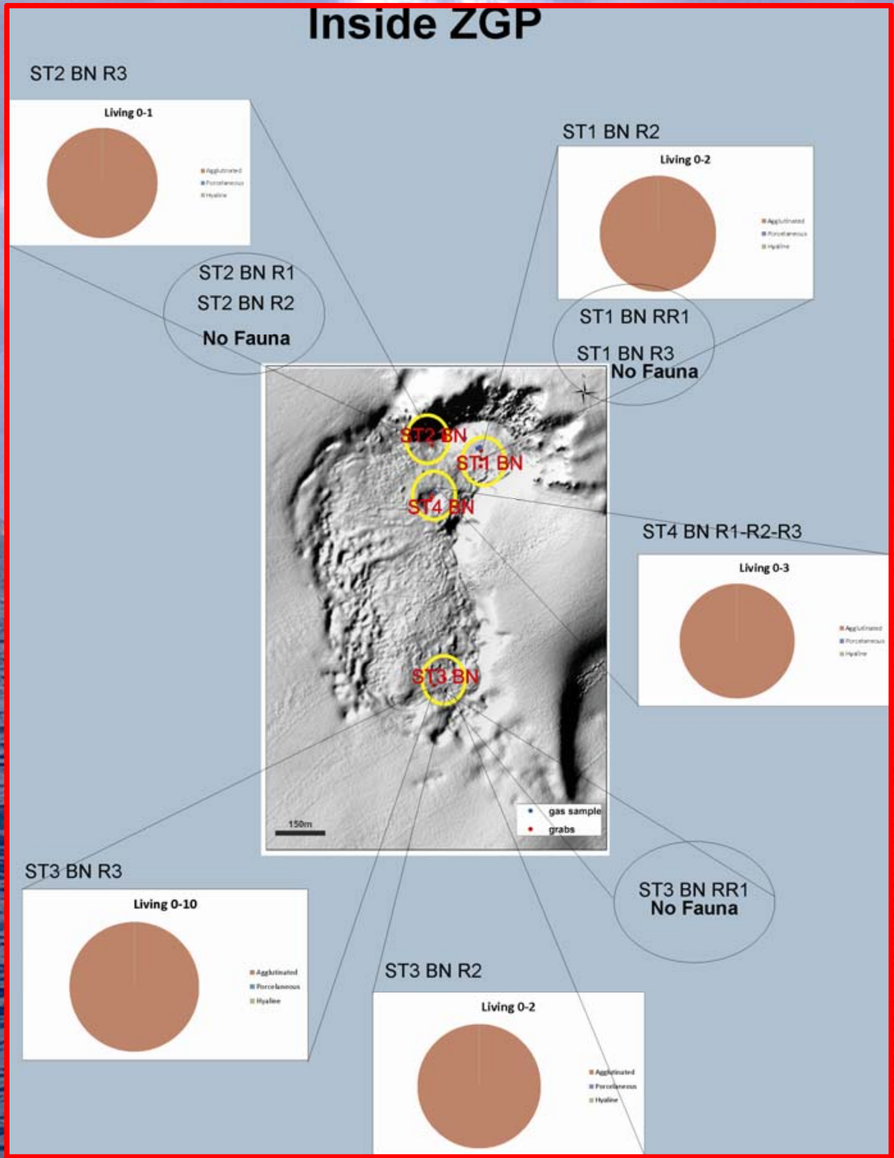


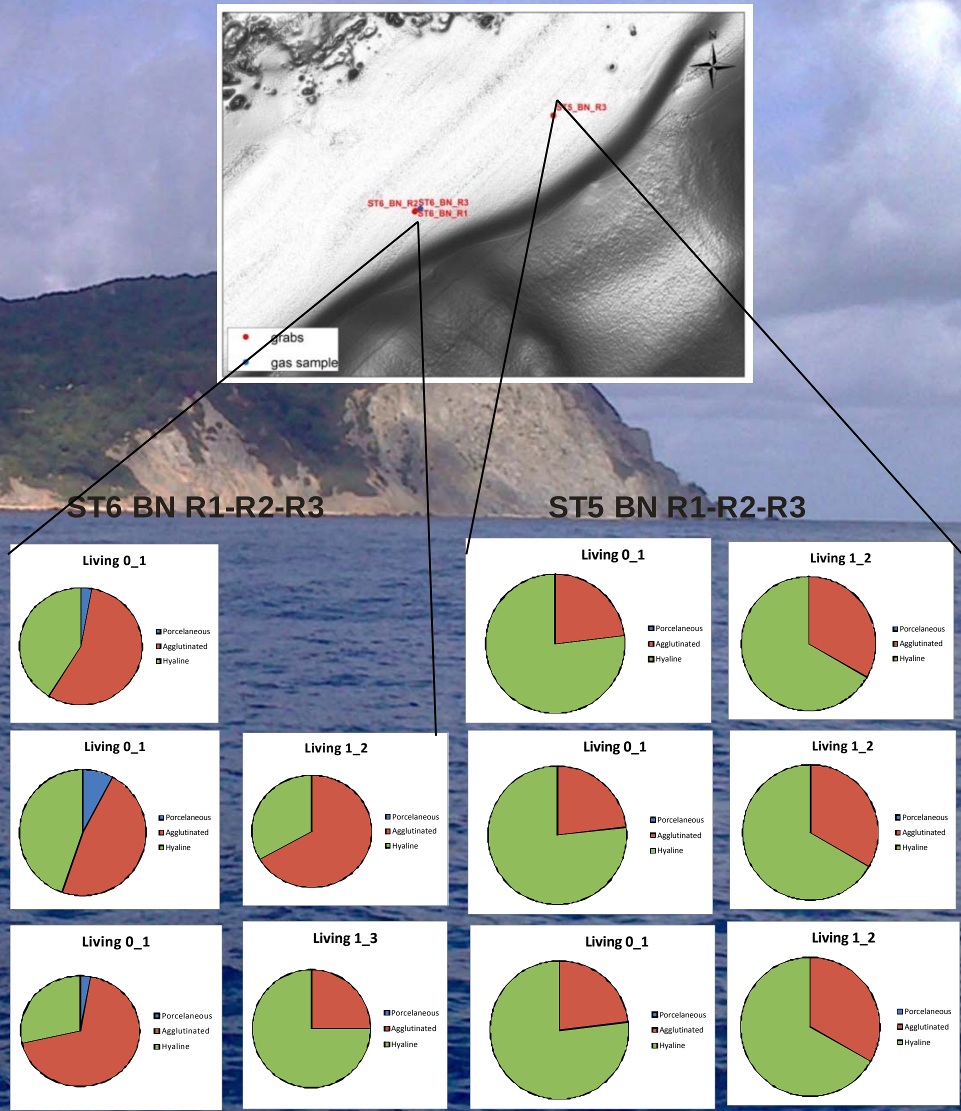


Living Assemblages

Venting areas

No venting areas





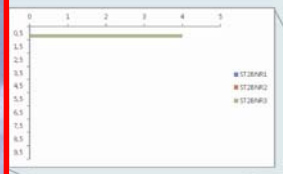
Living distribution

Venting areas

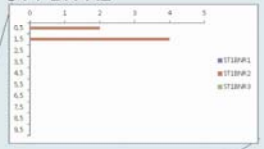
No venting areas

Inside ZGP

ST2 BN R3

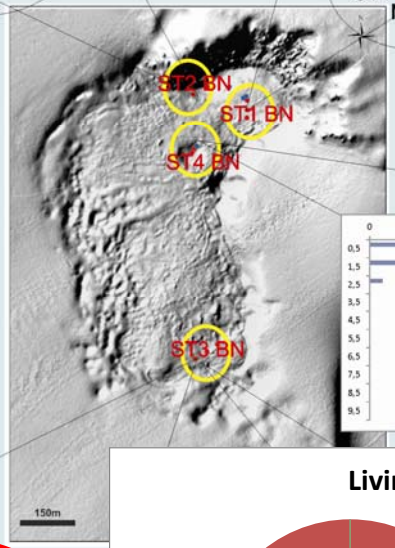


ST1 BN R2

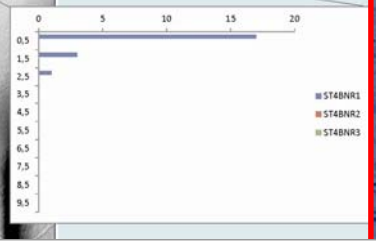


ST2 BN R1
ST2 BN R2
No Fauna

ST1 BN RR1
ST1 BN R3
No Fauna

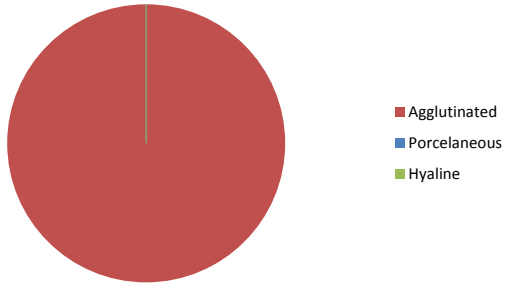


ST4 BN R1-R2-R3

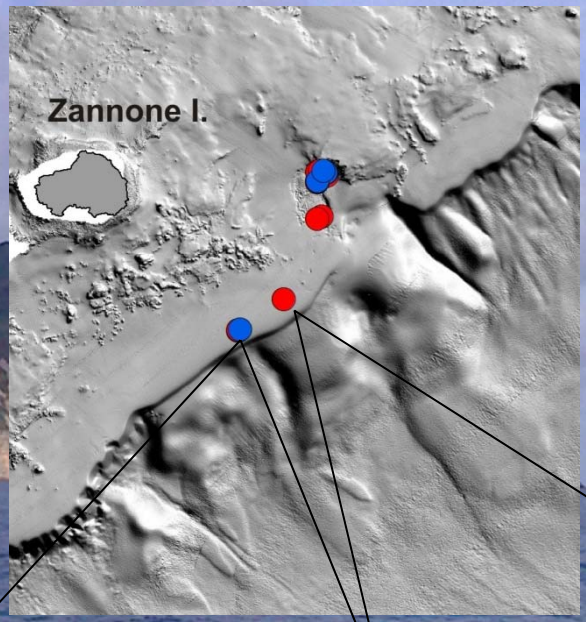


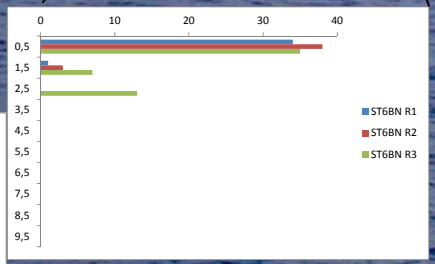
ST3 BN R3

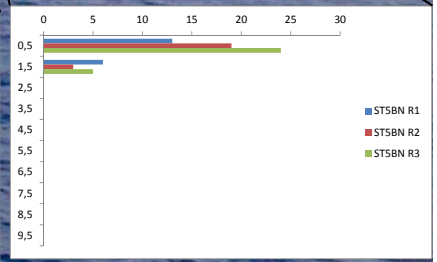
Living 0-10



Out ZPG

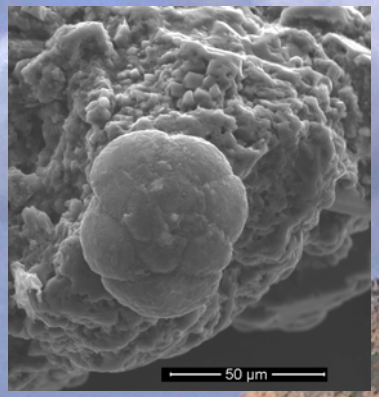


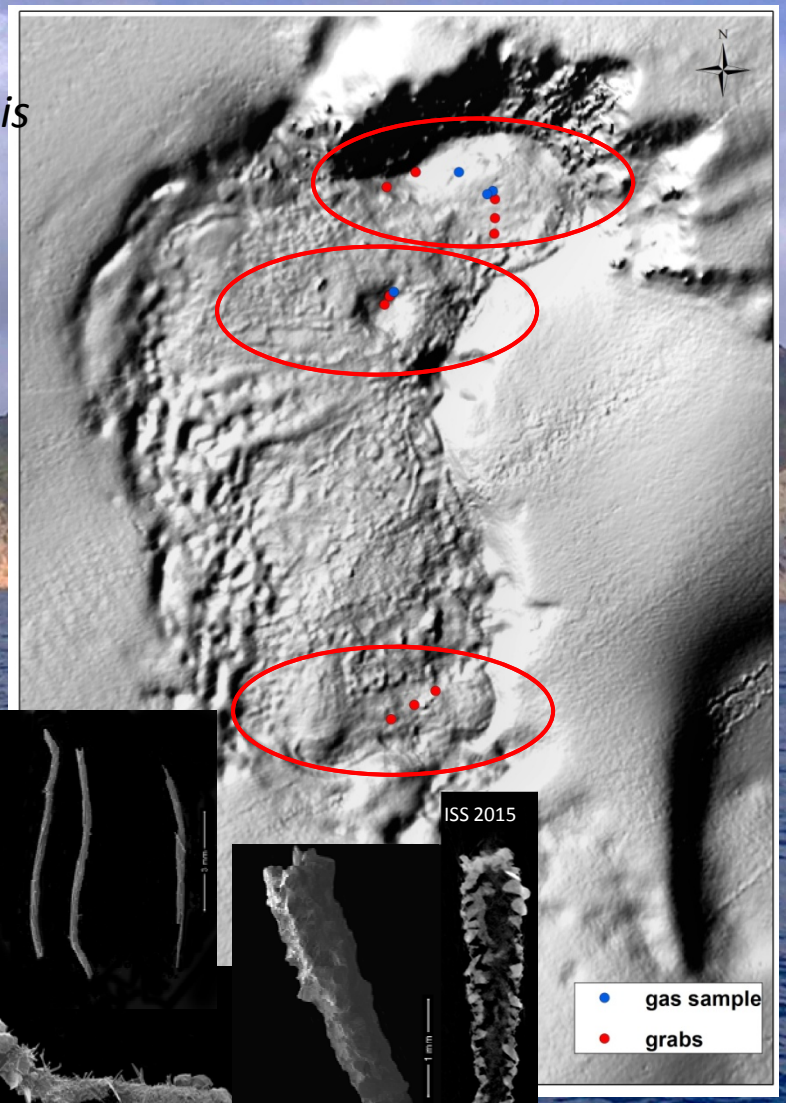




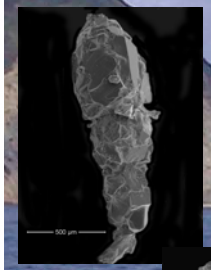
Venting areas living Foraminiferal Assemblages

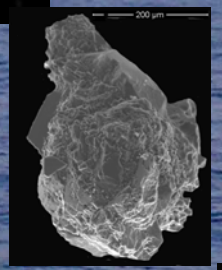
Northern Sector:
Deuterammina rotaliformis

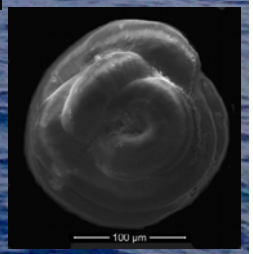




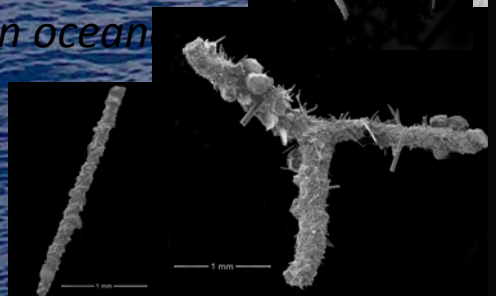
Central Sector:
Lagenammina spp.
Reophax scorpiurus
Glomospira spp.

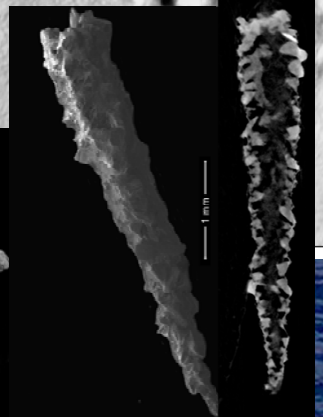






Southern Sector:
Reophax scorpiurus
Hyperammina spp.
Saccorhiza abyssorum
Jaculella acuta
Spiculosiphon ocean

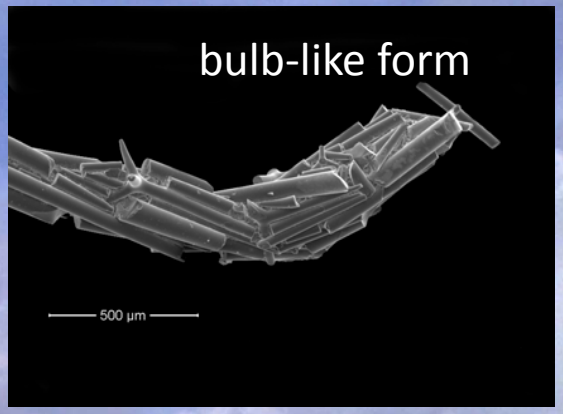


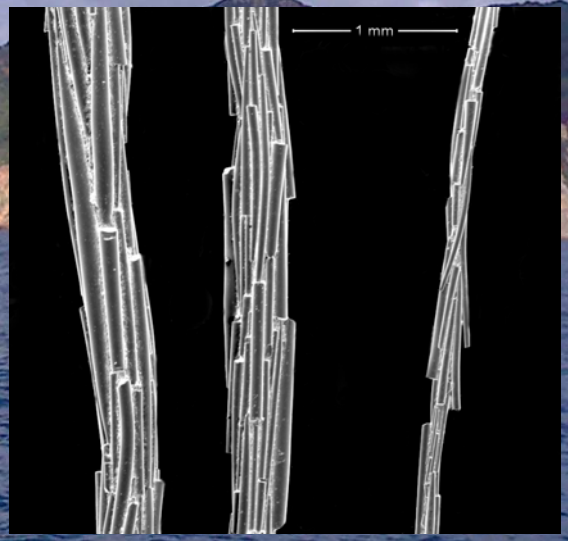


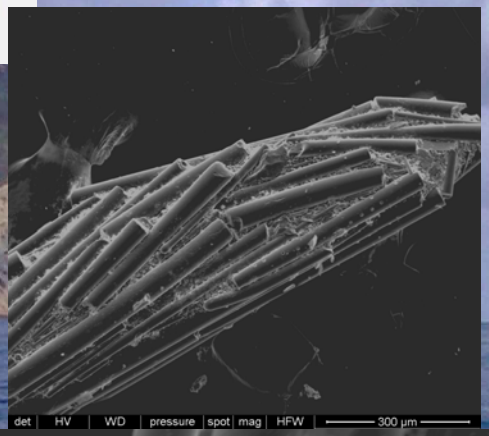
No dead fauna were found inside ZGP

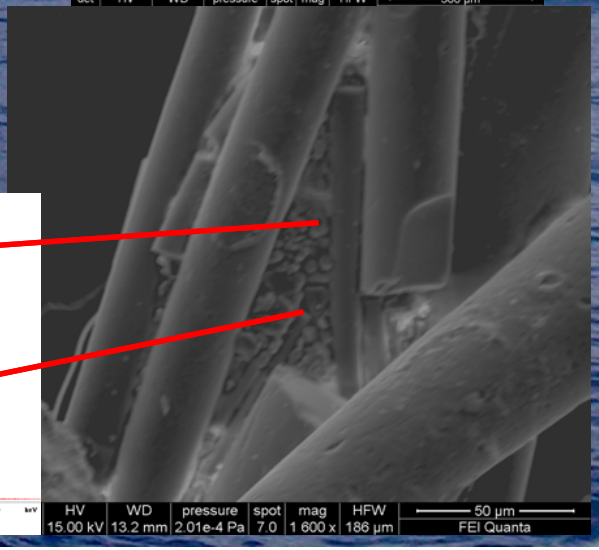
Spiculosiphon oceana

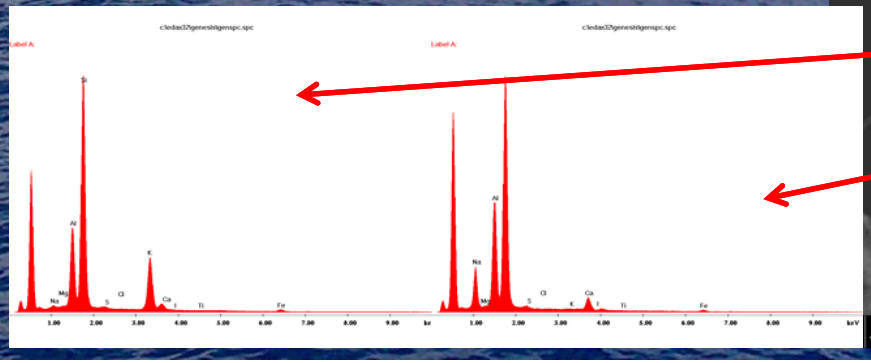
Maldonado et al., 2013





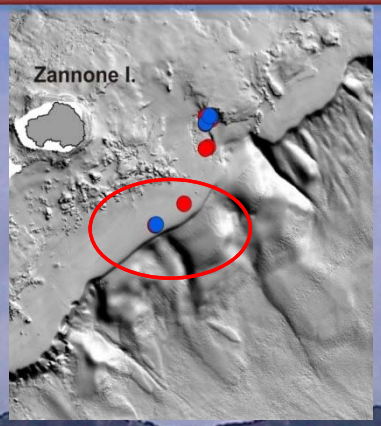






No venting areas Foraminiferal Assemblages

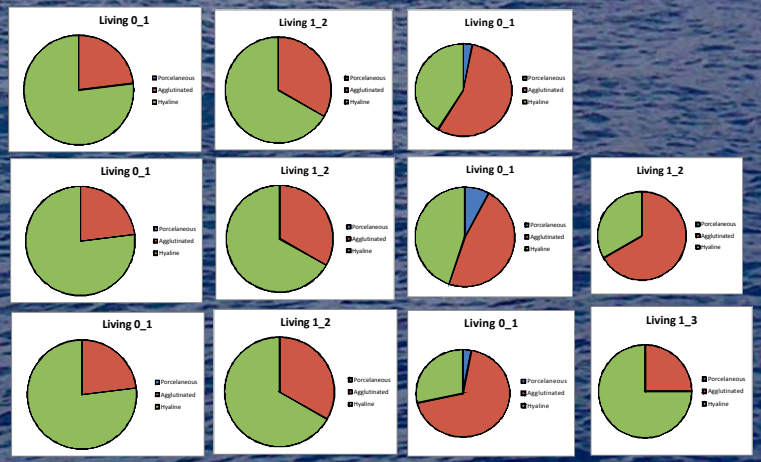
Living Assemblage:
Lenticulina spp.
Lobatula lobatula
Quinqueloculina seminulum
Spiculosiphon oceana
Hyperammina spp.

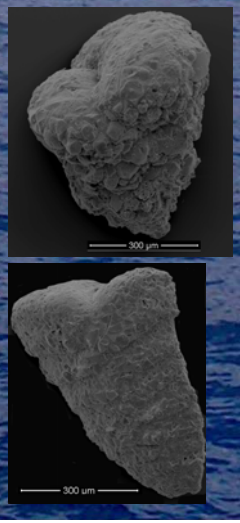


Dead Assemblages:
Cassidulina carinata
Cassidulina crassa
Asterigerinata mamilla
Gavelinopsis lobatulus
Lobatula lobatula
Miliolids
Textularia spp.
Spiroplectinella wrightii

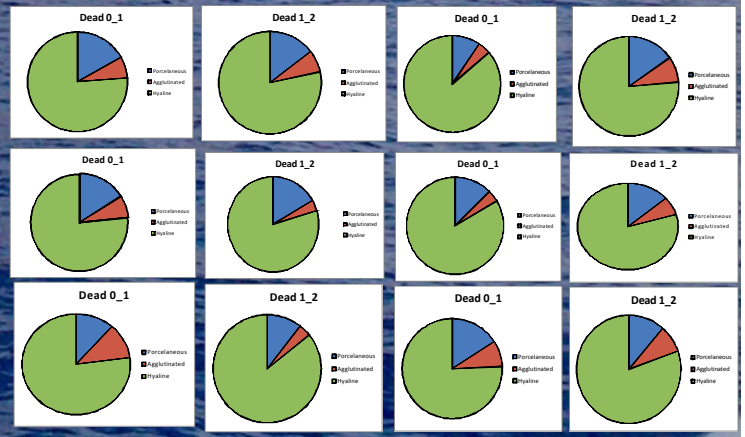
- **The most part of the washed residues is constituted of carbonatic organic fraction (mollusks, bryozoan, forams, ostracods…)**
- **Dead Foraminiferal assembalges are high diverified and more abundant than living assemblages.**

ST5 BN R1-R2-R3 **Living** ST6 BN R1-R2-R3





ST5 BN R1-R2-R3 **Dead** ST6 BN R1-R2-R3



Conclusions

✓ In venting areas, active fluid emissions determines conditions enriched in carbon dioxide, methane and ethane which probably are a factor limiting the micro and macrofauna colonization and controll dissolution processes regarding calcareous test.

✓ Only agglutinated assemblage are present in the area under the vent influence. Faunal density, diversity and compositional features of the assemblages are controlled by different degree of stressed conditions.

✓This study allow us to record peculiar assemblages never recorded in the Mediterranean Sea and increase knowledge about the ecological features of very uncommon species. Among these:

Deuterammina rotaliformis shows higher tolerance to high concentrations of carbon dioxid.

Reophax scorpiurus and ***Spiculosiphon oceana*** are the most abundant species in the intermediate and weaker fluid emissions and can be considered a successful colonizers of stressed environments.

Thanks for the attention

Acknowledgments

• Flagship Project RITMARE Crews of R/V *Urania*

• *Senior Scientist Francesco Italiano* INGV

• Technologies and Health Dpt. Biomaterials and Contaminants Section ISS (Istituto Superiore di Sanità) - Rome - Italy