



ISTITUTO NAZIONALE
DI OCEANOGRAFIA E DI GEOFISICA SPERIMENTALE



Università di Roma "La Sapienza" - Centro di Ricerca
"Previsione, Prevenzione e controllo dei Rischi Geologici"

CRUISE REPORT

ECO2-4

(Panarea Island, Italy)



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1. Objectives

Although a well chosen and well engineered sub seafloor CO₂ storage site is not expected to leak, we must have a clear understanding of the behaviour of CO₂ in the marine environment to ensure that we are prepared for any eventuality, no matter how unlikely it may be. In this regard, the study of sites where natural CO₂ is leaking from the sea floor gives an excellent opportunity to study such aspects as the impact of CO₂ on the ecosystem, to test monitoring methods, and to examine how CO₂ migrates from the sediments, in the water column (as a free gas phase or dissolved) and then potentially into the atmosphere.

The Aeolian archipelago (southern Tyrrhenian Sea) represents an excellent environment for studying such issues. In particular, the area near the extinct volcano of Panarea Island is characterised by widespread gas emissions (mainly CO₂ and other trace gases) from the seafloor, mainly in shallow waters from a few metres to 25 metres. In some locations, where bubble flux is strongest and water depth is not more than 12m, a small portion of the bubbles actually reach the water surface. Gas leakage at the Panarea site occurs as low-volume bubble trains up to large-volume bubble “curtains”, along with the co-migration and release of deep hydrothermal brines at a limited number of locations. Fluid release occurs from fault defined lineaments and pock-mark / blow-out areas characterised by coarse-grained sediments (pebbles and gravel) and rare sandy areas.

The aim of the work at this site is to quantify fluxes of dissolved and free gas, study the spread of CO₂ in the water column, analyse the potential for the transfer of deep waters together with the migrating CO₂, and examine the impact of the migrating CO₂ on the pH of the surrounding shallow waters.

Another objective is to examine the effect of increasing pCO₂ on the planktonic system by analysing water samples from a transect which encompasses a set of scenarios, ranging from highly impacted to unaffected sites. Qualitative and quantitative estimates of the planktonic communities from picoplankton to zooplankton across the transect will be used to determine the effect of increasing pCO₂ on natural marine communities.

Finally, this work will estimate the impact of CO₂ leakage on the microphytobenthic community by sampling and analysing it synoptically with Meiofauna, making this latter parameter useful for investigating microalgae and the trophic relations among these two communities.

2. Narrative of this Field Trip

Saturday, June 2nd 2012

Arrival on Panarea Island and set-up of the on-land laboratory.

Meeting with the other ECO2 partners from Germany (MPI-Bremen / Hydra-Elba Island) and a briefing with the diving- and boat- support staff from 'Amphibia' diving center, Panarea.



On land laboratory at Panarea Island

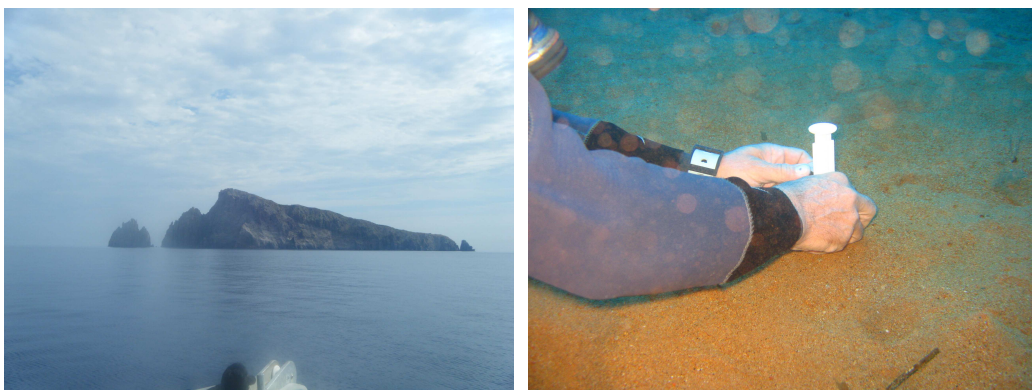
Sunday, June 3rd 2012

Work on the first day concentrated on a small site located just off the eastern tip of Basiluzzo Island, in accordance with work conducted by our ECO2 colleagues MPI/Hydra. This site, where moderate CO₂-only leakage occurs, has been subdivided into three areas based on sediment colour and gas flux. Representative points from each area were sampled: site B1 ("Red with Gas" - 38°39.749'N, 15°07.132'E); site B2 ("Grey no Gas" - 38°39.827'N, 15°07.118'E); and site B3 ("Grey with Gas" - 38°39.82'N, 15°07.137'E);

08:45 UTC.: Sediment samples were collected at the non-leaking, grey sediments control station (B2) to determine following parameters: granulometry, meiobenthic and microphytobenthic abundance and diversity. The PAR intensity was measured as well.

9:45 UTC: Sediment samples were collected at the leaking, grey sediment station (B3) to determine the following parameters: granulometry, meiobenthic and microphytobenthic abundance and diversity.

11:40 UTC: Sediment samples were collected at the leaking, red sediment station (B1) to compare the benthic communities with those found at the grey sand site (st. B3). Samples were collected to determine granulometry, meiobenthic and microphytobenthic abundance and diversity. The PAR intensity measurement was repeated.



Basiluzzo Isle and sediment sampling for microfitobenthos analysis

11:00 UTC: At the same leaking, red sediment station (B1) the water column profile was measured by means of a CTD (Seabird 19 Plus) and the sampling of seawater at 0.2 m, 7 m and 11 m was performed using 5 L Niskin bottles. The samples were collected to determine following parameters: dissolved oxygen, pH, alkalinity, dissolved inorganic nutrients, dissolved organic phosphorous and nitrogen (DOP and DON), particulate total carbon (PTC), particulate organic carbon (POC), dissolved gasses, H₂S concentration, micro- and nanophytoplankton abundance and diversity (thereinafter called phytoplankton), microzooplankton abundance and diversity (thereinafter called microzooplankton), abundance of heterotrophic nanoplankton (HNAN), prokaryotic abundance and prokaryotic carbon production (PCP).

Monday, June 4th 2012

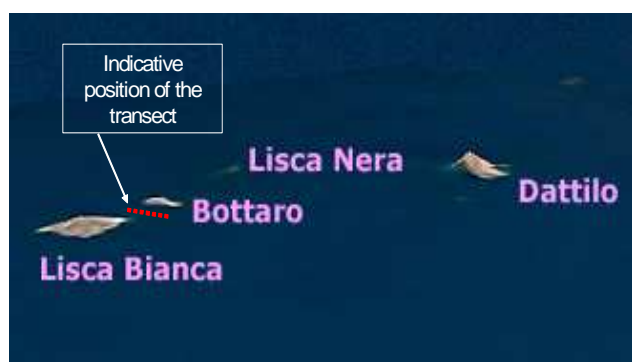
The morning of the second day continued the work at the Basiluzzo site.

08:35 UTC: A CTD profile was made of the water column at the control station (B2) and water samples were collected with a 5L Niskin bottle at 0.5, 5 and 12.5m depths. CTD results showed constant pH values at all sampling depths (pH range of 8.16 to 8.17). The samples were collected to determine following parameters: dissolved oxygen, pH, alkalinity, dissolved inorganic nutrients,

DOP, DON), PTC, POC, dissolved gasses, H₂S concentration, phytoplankton, microzooplankton, HNAN, prokaryotic abundance and PCP.

After completion of the work at Basiluzzo Island, a few strong gas emissions characterized by H₂S smell were detected in the area between Bottaro and Lisca Bianca Isles. CTD-measured pH was used to determine the area influenced by CO₂ emissions and to define the sampling sites along a transect that follows the current direction (at that moment). This transect consists of 7 points (LB1 to LB7), with approximate transect location and station coordinates given in the table / figure below. At all stations a CTD profile was measured and water samples were collected using 5L Niskin bottles.

11:55 UTC: Sampling was conducted at station LB3. Given the shallowness of the site seawater samples were only collected at 0.5 and 5.5 m. The samples were collected to determine following parameters: dissolved oxygen, pH, alkalinity, dissolved inorganic nutrients, DOP, DON), PTC, POC, dissolved gasses, H₂S concentration, phytoplankton, microzooplankton, HNAN, prokaryotic abundance and PCP.



Station	LAT N	LONG E
LB1	38°38.333	15°06.608'
LB2	38°38.322	15°06.616'
LB3	38°38.321	15°06.626'
LB4	38°38.321	15°06.643'
LB5	38°38.315	15°06.666'
LB6	38°38.267	15°06.745'
LB7	38°38.246	15°06.786'

Indicative position and coordinates of water sampling transect between Bottaro and Lisca Bianca

Tuesday, June 5th 2012

07:30 UTC: The sampling was performed at the most distant station of the transect (LB7), situated at a distance of approximately 270 m from station LB3. At this site where the bottom depth was 12 m, the samplings were performed at 0.3 m, 6 m and 11 m.

Due to the shallowness of the area the following samplings were performed only at the surface and the bottom depths.

12:10 UTC: Sampling was conducted at the station LB6 which was situated approximately 70 m from station LB7). Seawater samples were collected at 0.2 m and 7.5 m for the determination of chemical and biological parameters as reported above.

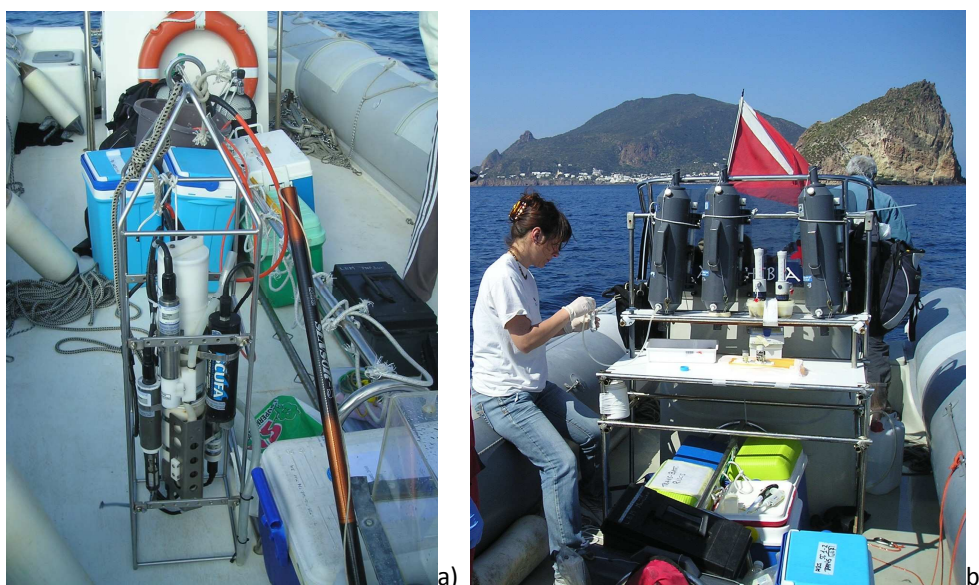
Wednesday, June 6th 2012

08:40 UTC: Sampling was conducted at station LB2. Seawater samples were collected at 0.2 m and 6.5 m for the determination of chemical and biological parameters as reported above.

09:35 UTC: Sampling was conducted at station LB4. Seawater samples were collected at 0.2 m and 4.5 m for the determination of chemical and biological parameters as reported above.

12:00 UTC: Sampling was performed at station LB5 . Seawater samples were collected at 0.2 m and 3.5 m for the determination of chemical and biological parameters as reported above.

13:15 UTC: Despite the fact that the transect was initially traced beginning with the station that corresponded to the maximum emission site (st. LB3), in the course of sampling it was decided to also investigate the area on the opposite side of the transect; as a result, sampling was performed at station LB1 at 0.2 m and 7 m. Seawater samples were collected for the determination of chemical and biological parameters as reported above.



CTD probe (a) and Niskin sampling bottles (b) used during the study.

Thursday, June 7th 2012

A series of tests were conducted to compare the response (and response time) of the University of Rome developed $p\text{CO}_2$ probe with that of the pH sensor mounted on the OGS CTD. This work was performed within work package WP3, addressing intercomparison of tools used to measure different parameters within the carbonate system. Two $p\text{CO}_2$ probes were mounted on the CTD and the unit was lowered to the sea floor in the area called the “crater”, located between the island of Bottaro and Lisca Nera. Measurements were made along a c. 20m long, E-W trending transect, with the first station furthest from the vent and the last located just beside it within the crater. The combined unit was placed on the sediments at each station and left for a period of about 15 minutes to collect data.

09:47 UTC: Station 1 (PI-38°38.227'N', 15°06.596'E), located about 19m from the vent.

10:15 UTC: Station 2, located about 14m from the vent.

10:34 UTC: Station 3, located about 11m from the vent.

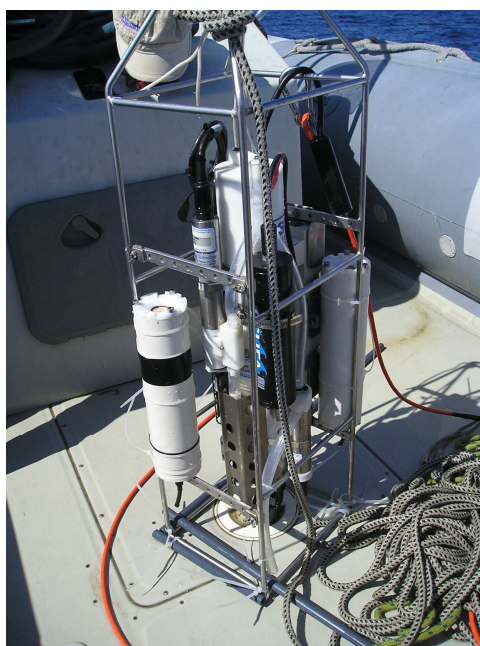
10:52 UTC: Station 4, located about 8m from the vent.

11:10 UTC: Station 5, located about 6m from the vent.

11:30 UTC: Station 6, located about 4m from the vent.

11:49 UTC: Station 7, located about 2m from the vent.

12:04 UTC: Station 8, located just in front of the vent.



CO₂ probes mounted on CTD

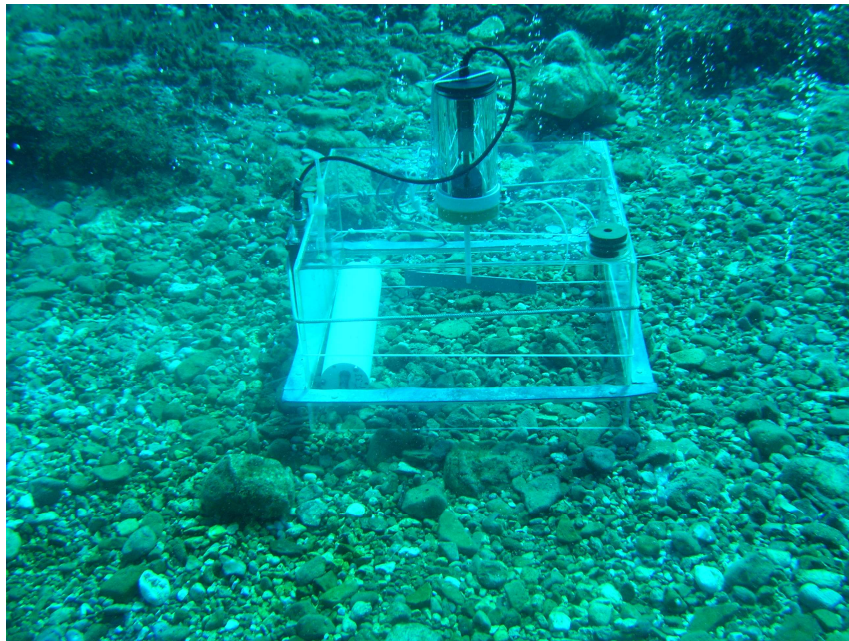
Friday, June 8th 2012

Experiments were conducted whereby the pCO₂ probe was placed within the benthic chamber to see if short-term deployment, dissolved CO₂ flux monitoring could be conducted to: i) improve the method and ii) give information regarding the spatial distribution (and strength) of dissolved CO₂ flux in the area of the crater. A c. 20 m long, E-W trending transect was performed moving from “background” conditions towards a main gas leakage point. At each station, located about 5 m apart from each other, the probe was first placed on the sediments for 10 minutes to equilibrate it

with the surrounding water and then the benthic chamber was placed on top of it for a 20 minute measurement. The hope was that a clear increase in $p\text{CO}_2$ during the period of benthic chamber deployment could be used to calculate the flux. A second $p\text{CO}_2$ probe was placed on the sediments outside and beside the chamber to give ambient concentrations. Samples for the pH and dissolved gas determinations were collected initially and after 20'.

09:24 UTC: Station 1, located 20m from the main leakage point.

10:01 UTC: Station 2, located 15m from the main leakage point.



Benthic chamber with $p\text{CO}_2$ probe

10:36 UTC: Station 3 located 10m from the main leakage point.

11:13 UTC: Station 4, located 5m from the main leakage point.

11:51 UTC: Station 5, located 0m from the main leakage point (not strictly above the bubbles but in the immediate proximity). In that station a CTD water column profile was collected.

Activity in the afternoon was conducted at a just the NE of Panarea Island itself (38°38.536'N, 15°04.714'E) where the sediments are characterized by very different temperatures at a distance of approximately 1 m one from another. This station is referred to here as "Hot-Cold" (HC) and by partners MPI-Hydra as site "Corpi Morti". Work focused on the measurement of dissolved CO_2

benthic fluxes (by deploying pCO₂-probes inside and outside of a benthic chamber) and to the sampling of benthic communities. The sediment samples were collected to determine following parameters: granulometry, meiobenthic and microphytobenthic abundance and diversity.



Sediment subsampling for microphytobenthic analyses

Saturday, June 9th 2012

Another experiment was conducted, like that performed on June 7th, using the pCO₂ sensors mounted on the CTD. The difference between the two experiments was in the placement of the pCO₂ sensors: during the first the sensors were positioned mid-way up the structure on the side, whereas during the second the membrane of the probe was placed just above CTD pump tubing outlet in an effort to increase the speed of gas exchange across the membrane.

The new E-W transect of 5 stations was also located in the area of the “crater”, with each successive station moving closer towards a major gas vent. The registrations at each sampling lasted 20 minutes.

08:37 UTC: Station 1 was located 8 m from the gas vent.

09:10 UTC: Station 2 was located 18m from the gas vent.

09:33 UTC: Station 3 was located 13m from the gas vent.

10:05 UTC: Station 4 was located 4m from the gas vent.

10:30 UTC: Station 5 was located just in front of the gas vent, within the crater.

Sunday, June 10th 2012

Desk activities, briefings and equipment packing

Monday, June 11th 2012

Desk activities, briefings, equipment packing and embark

3. Participants

	Full Name	Institution	Activities
1	Cinzia De Vittor	OGS	Benthic chamber, water and sediment sampling, laboratory analyses
2	Stan Beaubien	UniRoma1	pCO ₂ probe, dissolved gas sampling
3	Cinzia Comici	OGS	CTD, water and sediment sampling, laboratory analyses
4	Ana Karuza	OGS	Laboratory analyses

4. Summary

The campaign was conducted in the natural CO₂ seep area near Panarea Island (Aeolian Archipelago) in June 2012 (from 1st to 12th). Several questions within WP2, WP3 and WP4 were addressed. The investigations conducted by OGS (Trieste, Italy) and UniRoma1-CERI (Rome, Italy) purposely overlapped in part with the campaign conducted by MPI / Hydra to take advantage of synergy to achieve the objectives of the project.

The impact of benthic organisms to locally elevated levels of CO₂ was investigated. Samples to determine meiobenthic and microphytobenthic abundance and diversity were collected in two vent areas and at a control station. Within the vent area sandy sediments characterized by different features were distinguished. The stations were defined in accordance with the MPI-Bremen field team.

The impact of CO₂ on the abundance and diversity of plankton communities was investigated to increase our capability to predict marine ecosystem response to potential CO₂ leakage. Several vent fields have been detected. Beside the 3 stations close to Basiluzzo where the benthic community was determined, two stations in the same area and a transect in proximity of Bottaro were defined and sampled to investigate water column features. The physical characterization of the water column was performed using a CTD probe equipped with other several sensors. Samples from the water column (at 2 or 3 levels depending on the depth of the station) were taken for the following analyses: dissolved oxygen, pH, alkalinity, dissolved inorganic nutrients, dissolved organic phosphorous and nitrogen, particulate total carbon, particulate organic carbon, dissolved gasses and H₂S concentration, phytoplankton abundance and diversity, microzooplankton abundance and diversity, heterotrophic nanoplankton abundance and diversity and for the abundance of prokaryotes. The rates of prokaryotic carbon production has also been examined.

The fluxes of dissolved CO₂ across the sediment-seawater interface were assessed using benthic chambers, with the deployment of pCO₂ probes (equipped with temperature sensors) both inside and outside of the chamber. The measured increase of both parameters over the deployment time will be used to estimate the flux of both dissolved CO₂ and deep water into the overlying water column. The pH and pCO₂ sensors were mounted together on the CTD and transects were performed on the sediment floor moving from background to gas vent conditions to compare response and response time of the two sensors.

5. Station list

Event Label	Optional Event Label	Device	Date	Time (UTC)	Latitude	Longitude	Water depth (m)	Area	Comment
ECO2-4-1	sediment grain-size	push corer	03/06/2012	08.45.00	38°39.827' N	15°07.118' E	13,6	Panarea Island	Basiluzzo Island, east (triplicate)
ECO2-4-2	benthos (microphyto- and meio-)	push corer	03/06/2012	08.45.00	38°39.827' N	15°07.118' E	13,6	Panarea Island	Basiluzzo Island, east (triplicate)
ECO2-4-3	PAR measurement	PAR device	03/06/2012	08.45.00	38°39.827' N	15°07.118' E	0,5	Panarea Island	Basiluzzo Island, east
ECO2-4-4	sediment grain-size	push corer	03/06/2012	09.45.00	38°39.82' N	15°07.137' E	13,6	Panarea Island	Basiluzzo Island east, grey sand (triplicate)
ECO2-4-5	benthos (microphyto- and meio-)	push corer	03/06/2012	09.45.00	38°39.82' N	15°07.137' E	13,6	Panarea Island	Basiluzzo Island east, grey sand (triplicate)
ECO2-4-6	sediment grain-size	push corer	03/06/2012	11.40.00	38°39.749' N	15°07.132' E	12,0	Panarea Island	Basiluzzo Island east, red sand (triplicate)
ECO2-4-7	benthos (microphyto- and meio-)	push corer	03/06/2012	11.40.00	38°39.749' N	15°07.132' E	12,0	Panarea Island	Basiluzzo Island east, red sand (triplicate)
ECO2-4-8	PAR measurement	PAR device	03/06/2012	12.20.00	38°39.749' N	15°07.132' E	0,5	Panarea Island	Basiluzzo Island, east
ECO2-4-9	water column profile	CTD multiparametric probe	03/06/2012	11.00.00	38°39.749' N	15°07.132' E	0.2 - 11.5	Panarea Island	Basiluzzo Island, east
ECO2-4-10	water chemistry	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	0,2	Panarea Island	Basiluzzo Island, east
ECO2-4-11	plankton abundance and diversity	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	0,2	Panarea Island	Basiluzzo Island, east
ECO2-4-12	prokaryotic secondary production	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	0,2	Panarea Island	Basiluzzo Island, east
ECO2-4-13	water chemistry	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	7,0	Panarea Island	Basiluzzo Island, east
ECO2-4-14	plankton abundance and diversity	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	7,0	Panarea Island	Basiluzzo Island, east
ECO2-4-15	prokaryotic secondary production	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	7,0	Panarea Island	Basiluzzo Island, east
ECO2-4-16	water chemistry	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	11,0	Panarea Island	Basiluzzo Island, east

ECO2-4-17	plankton abundance and diversity	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	11,0	Panarea Island	Basiluzzo Island, east
ECO2-4-18	prokaryotic secondary production	Niskin bottle	03/06/2012	11.15.00	38°39.749' N	15°07.132' E	11,0	Panarea Island	Basiluzzo Island, east
ECO2-4-19	water chemistry	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	0,5	Panarea Island	Basiluzzo Island, east
ECO2-4-20	plankton abundance and diversity	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	0,5	Panarea Island	Basiluzzo Island, east
ECO2-4-21	prokaryotic secondary production	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	0,5	Panarea Island	Basiluzzo Island, east
ECO2-4-22	water chemistry	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	5,0	Panarea Island	Basiluzzo Island, east
ECO2-4-23	plankton abundance and diversity	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	5,0	Panarea Island	Basiluzzo Island, east
ECO2-4-24	prokaryotic secondary production	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	5,0	Panarea Island	Basiluzzo Island, east
ECO2-4-25	water chemistry	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	12,0	Panarea Island	Basiluzzo Island, east
ECO2-4-26	plankton abundance and diversity	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	12,0	Panarea Island	Basiluzzo Island, east
ECO2-4-27	prokaryotic secondary production	Niskin bottle	04/06/2012	08.45.00	38°39.827' N	15°07.118' E	12,0	Panarea Island	Basiluzzo Island, east
ECO2-4-28	water column profile	CTD multiparametric probe	04/06/2012	11.55.00	38°38.321' N	15°06.626' E	0 - 5.5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB3
ECO2-4-29	water chemistry	Niskin bottle	04/06/2012	12.05.00	38°38.321' N	15°06.626' E	0,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-30	plankton abundance and diversity	Niskin bottle	04/06/2012	12.05.00	38°38.321' N	15°06.626' E	0,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-31	prokaryotic secondary production	Niskin bottle	04/06/2012	12.05.00	38°38.321' N	15°06.626' E	0,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-32	water chemistry	Niskin bottle	04/06/2012	12.05.00	38°38.321' N	15°06.626' E	0,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-33	plankton abundance and diversity	Niskin bottle	04/06/2012	12.05.00	38°38.321' N	15°06.626' E	5,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-34	prokaryotic secondary production	Niskin bottle	04/06/2012	12.05.00	38°38.321' N	15°06.626' E	5,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6

ECO2-4-35	water column profile	CTD multiparametric probe	05/06/2012	07.30.00	38°38.246' N	15°06.786' E	0.3 - 11.5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-36	water chemistry	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	0,3	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-37	plankton abundance and diversity	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	0,3	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-38	prokaryotic secondary production	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	0,3	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-39	water chemistry	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	6,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-40	plankton abundance and diversity	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	6,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-41	prokaryotic secondary production	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	6,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-42	water chemistry	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	11,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-43	plankton abundance and diversity	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	11,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-44	prokaryotic secondary production	Niskin bottle	05/06/2012	07.40.00	38°38.246' N	15°06.786' E	11,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB7
ECO2-4-45	water column profile	CTD multiparametric probe	05/06/2012	12.10.00	38°38.267' N	15°06.745' E	0.2 - 8	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-46	water chemistry	Niskin bottle	05/06/2012	12.20.00	38°38.267' N	15°06.745' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-47	plankton abundance and diversity	Niskin bottle	05/06/2012	12.20.00	38°38.267' N	15°06.745' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-48	prokaryotic secondary production	Niskin bottle	05/06/2012	12.20.00	38°38.267' N	15°06.745' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-49	water chemistry	Niskin bottle	05/06/2012	12.20.00	38°38.267' N	15°06.745' E	7,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-50	plankton abundance and diversity	Niskin bottle	05/06/2012	12.20.00	38°38.267' N	15°06.745' E	7,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-51	prokaryotic secondary production	Niskin bottle	05/06/2012	12.20.00	38°38.267' N	15°06.745' E	7,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB6
ECO2-4-52	water column profile	CTD multiparametric probe	06/06/2012	08.40.00	38°38.322' N	15°06.616' E	0.2 - 7	Panarea Island	between Bottaro and Lisca Bianca, transect station LB2

ECO2-4-53	water chemistry	Niskin bottle	06/06/2012	08.50.00	38°38.322' N	15°06.616' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB2
ECO2-4-54	plankton abundance and diversity	Niskin bottle	06/06/2012	08.50.00	38°38.322' N	15°06.616' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB2
ECO2-4-55	prokaryotic secondary production	Niskin bottle	06/06/2012	08.50.00	38°38.322' N	15°06.616' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB2
ECO2-4-56	water chemistry	Niskin bottle	06/06/2012	08.50.00	38°38.322' N	15°06.616' E	6,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB2
ECO2-4-57	plankton abundance and diversity	Niskin bottle	06/06/2012	08.50.00	38°38.322' N	15°06.616' E	6,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB2
ECO2-4-58	prokaryotic secondary production	Niskin bottle	06/06/2012	08.50.00	38°38.322' N	15°06.616' E	6,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB2
ECO2-4-59	water column profile	CTD multiparametric probe	06/06/2012	09.35.00	38°38.321' N	15°06.643' E	0.2 - 5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-60	water chemistry	Niskin bottle	06/06/2012	09.45.00	38°38.321' N	15°06.643' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-61	plankton abundance and diversity	Niskin bottle	06/06/2012	09.45.00	38°38.321' N	15°06.643' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-62	prokaryotic secondary production	Niskin bottle	06/06/2012	09.45.00	38°38.321' N	15°06.643' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-63	water chemistry	Niskin bottle	06/06/2012	09.45.00	38°38.321' N	15°06.643' E	4,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-64	plankton abundance and diversity	Niskin bottle	06/06/2012	09.45.00	38°38.321' N	15°06.643' E	4,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-65	prokaryotic secondary production	Niskin bottle	06/06/2012	09.45.00	38°38.321' N	15°06.643' E	4,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB4
ECO2-4-66	water column profile	CTD multiparametric probe	06/06/2012	12.00.00	38°38.315' N	15°06.666' E	0.2m - 4m	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-67	water chemistry	Niskin bottle	06/06/2012	12.10.00	38°38.315' N	15°06.666' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-68	plankton abundance and diversity	Niskin bottle	06/06/2012	12.10.00	38°38.315' N	15°06.666' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-69	prokaryotic secondary production	Niskin bottle	06/06/2012	12.10.00	38°38.315' N	15°06.666' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-70	water chemistry	Niskin bottle	06/06/2012	12.10.00	38°38.315' N	15°06.666' E	3,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5

ECO2-4-71	plankton abundance and diversity	Niskin bottle	06/06/2012	12.10.00	38°38.315' N	15°06.666' E	3,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-72	prokaryotic secondary production	Niskin bottle	06/06/2012	12.10.00	38°38.315' N	15°06.666' E	3,5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB5
ECO2-4-73	water column profile	CTD multiparametric probe	06/06/2012	13.15.00	38°38.333' N	15°06.608' E	0.2 - 7.5	Panarea Island	between Bottaro and Lisca Bianca, transect station LB1
ECO2-4-74	water chemistry	Niskin bottle	06/06/2012	13.25.00	38°38.333' N	15°06.608' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB1
ECO2-4-75	plankton abundance and diversity	Niskin bottle	06/06/2012	13.25.00	38°38.333' N	15°06.608' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB1
ECO2-4-76	prokaryotic secondary production	Niskin bottle	06/06/2012	13.25.00	38°38.333' N	15°06.608' E	0,2	Panarea Island	between Bottaro and Lisca Bianca, transect station LB1
ECO2-4-77	water chemistry	Niskin bottle	06/06/2012	13.25.00	38°38.333' N	15°06.608' E	7,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB1
ECO2-4-78	plankton abundance and diversity	Niskin bottle	06/06/2012	13.25.00	38°38.333' N	15°06.608' E	7,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB1
ECO2-4-79	prokaryotic secondary production	Niskin bottle	06/06/2012	13.25.00	38°38.333' N	15°06.608' E	7,0	Panarea Island	between Bottaro and Lisca Bianca, transect station LB1
ECO2-4-80	water column profile	CTD multiparametric probe	07/06/2012	09.30.00	38°38.227' N	15°06.596' E	7,5	Panarea Island	Bottaro Island, west - "Crater" - 19m from gas emission
ECO2-4-81	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	09.47.00	38°38.227' N	15°06.596' E	7,5	Panarea Island	Bottaro Island, west - "Crater" - 19m from gas emission
ECO2-4-82	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	10.15.00	38°38.227' N	15°06.599' E	7,8	Panarea Island	Bottaro Island, west - "Crater" - 14m from gas emission
ECO2-4-83	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	10.34.00	38°38.227' N	15°06.601' E	8,1	Panarea Island	Bottaro Island, west - "Crater" - 11m from gas emission
ECO2-4-84	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	10.52.00	38°38.227' N	15°06.603' E	8,9	Panarea Island	Bottaro Island, west - "Crater" - 8m from gas emission
ECO2-4-85	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	11.10.00	38°38.227' N	15°06.604' E	10,3	Panarea Island	Bottaro Island, west - "Crater" - 6m from gas emission
ECO2-4-86	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	11.30.00	38°38.227' N	15°06.606' E	10,6	Panarea Island	Bottaro Island, west - "Crater" - 4m from gas emission
ECO2-4-87	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	11.49.00	38°38.227' N	15°06.607' E	11,4	Panarea Island	Bottaro Island, west - "Crater" - 2m from gas emission
ECO2-4-88	pCO ₂ - pH meter intercomparison	CTD / pCO ₂ probe	07/06/2012	12.04.00	38°38.227' N	15°06.609' E	11,5	Panarea Island	Bottaro Island, west - "Crater" - 0m from gas emission (in crater)

ECO2-4-89	pCO2 flux measurement	benthic chamber / pCO2 probe	08/06/2012	09.24.00	38°38.227' N	15°06.595' E	12,0	Panarea Island	Bottaro Island, west - "Crater" - 20m from gas emission
ECO2-4-90	pCO2 flux measurement	benthic chamber / pCO2 probe	08/06/2012	10.01.00	38°38.227' N	15°06.599' E	12,0	Panarea Island	Bottaro Island, west - "Crater" - 15m from gas emission
ECO2-4-91	pCO2 flux measurement	benthic chamber / pCO2 probe	08/06/2012	10.36.00	38°38.227' N	15°06.602' E	12,0	Panarea Island	Bottaro Island, west - "Crater" - 10m from gas emission
ECO2-4-92	pCO2 flux measurement	benthic chamber / pCO2 probe	08/06/2012	11.13.00	38°38.227' N	15°06.606' E	12,0	Panarea Island	Bottaro Island, west - "Crater" - 5m from gas emission
ECO2-4-93	pCO2 flux measurement	benthic chamber / pCO2 probe	08/06/2012	11.51.00	38°38.227' N	15°06.609' E	12,0	Panarea Island	Bottaro Island, west - "Crater" - 0m from gas emission
ECO2-4-94	pCO2 - pH meter intercomparison	CTD / pCO2 probe	09/06/2012	08.37.00	38°38.227' N	15°06.604' E	7,6	Panarea Island	Bottaro Island, west - "Crater" - 8m from gas emission
ECO2-4-95	pCO2 - pH meter intercomparison	CTD / pCO2 probe	09/06/2012	09.10.00	38°38.227' N	15°06.597' E	7,6	Panarea Island	Bottaro Island, west - "Crater" - 18m from gas emission
ECO2-4-96	pCO2 - pH meter intercomparison	CTD / pCO2 probe	09/06/2012	09.33.00	38°38.227' N	15°06.600' E	8,3	Panarea Island	Bottaro Island, west - "Crater" - 13m from gas emission
ECO2-4-97	pCO2 - pH meter intercomparison	CTD / pCO2 probe	09/06/2012	10.05.00	38°38.227' N	15°06.607' E	9,7	Panarea Island	Bottaro Island, west - "Crater" - 4m from gas emission
ECO2-4-98	pCO2 - pH meter intercomparison	CTD / pCO2 probe	09/06/2012	10.30.00	38°38.227' N	15°06.609' E	11,4	Panarea Island	Bottaro Island, west - "Crater" - 0m from gas emission (in crater)
ECO2-4-99	pCO2 flux measurement	benthic chamber / pCO2 probe	09/06/2012	14.34.00	38°38.536' N	15°04.714' E	11,9	Panarea Island	Panarea "Corpi Morti" ("cold" sand)
ECO2-4-100	sediment grain-size	push corer	08/06/2012	15.00.00	38°38.536' N	15°04.714' E	11,9	Panarea Island	Panarea "Corpi Morti" (triplicate) Eliminato: 3
ECO2-4-101	benthos (microphyto- and meio-)	push corer	08/06/2012	15.00.00	38°38.536' N	15°04.714' E	11,9	Panarea Island	Panarea "Corpi Morti" (triplicate) Eliminato: 3
ECO2-4-102	pCO2 flux measurement	benthic chamber / pCO2 probe	09/06/2012	15.14.00	38°38.536' N	15°04.714' E	11,9	Panarea Island	Panarea "Corpi Morti" ("hot" sand)

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Gas vents at Panarea test site