Impact of increasing pCO_2 on marine potential respiratory activity

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ABSTRACT

Preliminary observations about the effect of the different pCO_2 treatments on potential respiratory activity show that the time-courses of all measured parameters were similar between treatments, ranging from 400 to 2000 µatm. In microplankton time-courses the maximum values reached for potential respiration and biomass occurred in most acidified mesocosm, and in 1000 µatm treatment, it occurred for potential respiratory CO_2 production. On other hand, maximum values for sediment traps parameters occurred in different pCO_2 treatments. All the parameters reached their highest values after the Chl *a* peak. In the sediment traps this values appeared with a lag of 13 days.

INTRODUCTION

The increase in the anthropogenic CO_2 released to the atmosphere, induces an increase in the dissolved CO_2 in the ocean, causing elevated pCO_2 values and a pH decrease. Due to the increasing atmospheric CO_2, several on-going research programs are evaluating the impact of acidification on marine organisms, intent to predict their future.

In this mesocosm experiment (KOSMOS 14GC), we assessed the effect of different CO_2 concentrations on metabolism in microplankton (0.7-50µm size) and in biogenic particles harvested by sediment traps. We measured potential respiration (Φ), potential respiratory CO_2 production (IDH) and protein biomass (B) in each mesocosm and in seawater, a kilometer away, as a microplankton control.

MATERIAL AND METHODS

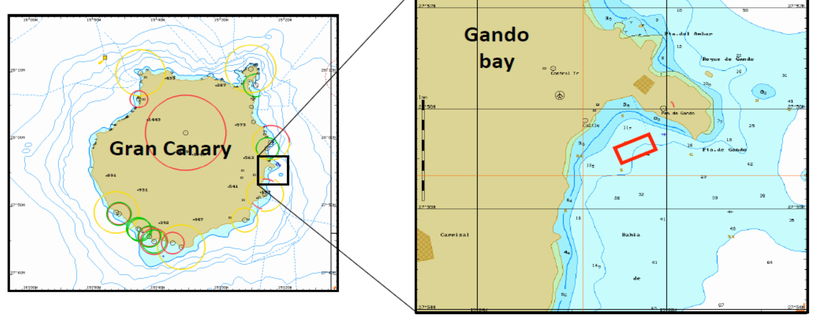


Fig1. Mesocosms location. Gando Bay, Gran Canaria.

7 Mesocosms
- 45m³
- 15m deep

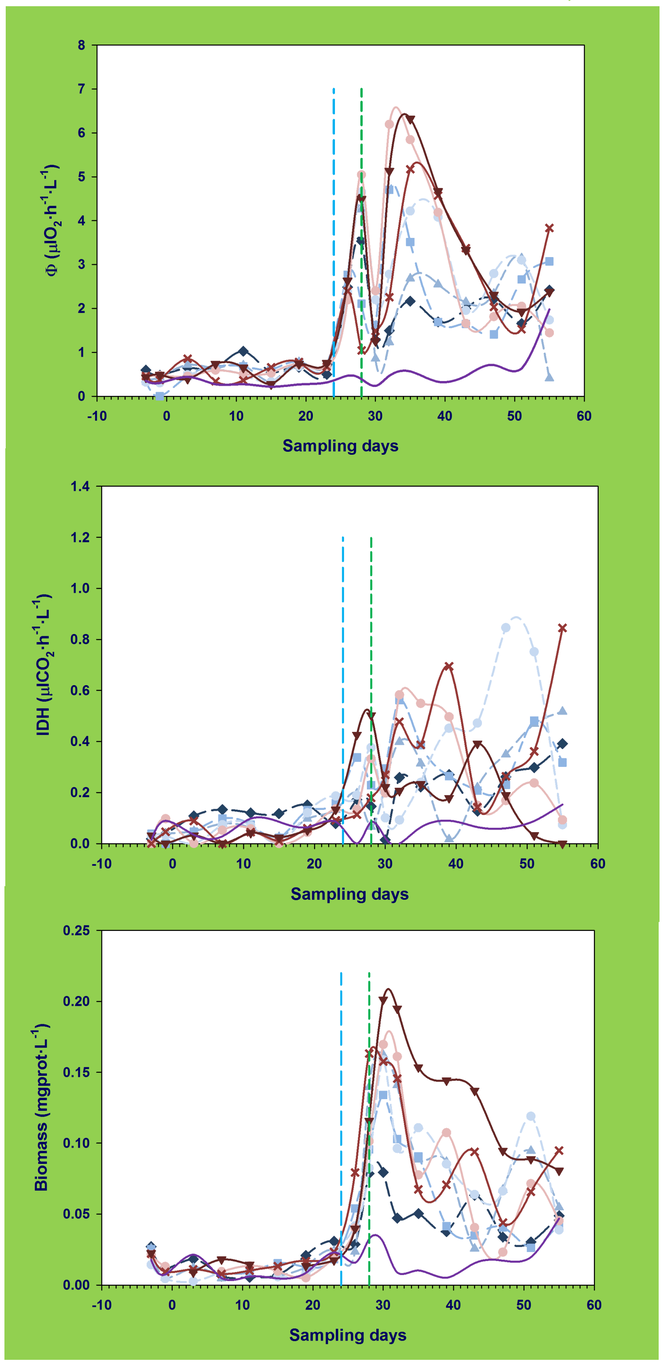
MICROPLANKTON (0.7-50µm)

SEDIMENT TRAPS

- **Φ** Electron transport system activity
- **IDH** Isocitrate dehydrogenase activity
- **B** Proteins

RESULTS

MICROPLANKTON (0.7-50µm)



MAXIMUM VALUES	Microplankton	Sediment traps
Potential respiration	6.32 ($\mu lO_2 \cdot h^{-1} \cdot L^{-1}$)	57.41 ($mlO_2 \cdot h^{-1} \cdot L^{-1}$)
Potential CO_2 production	0.846 ($\mu lCO_2 \cdot h^{-1} \cdot L^{-1}$)	1.888 ($mlO_2 \cdot h^{-1} \cdot L^{-1}$)
Biomass	0.201 ($mgprot \cdot L^{-1}$)	457.32 ($mgprot \cdot L^{-1}$)

CO_2 treatments:

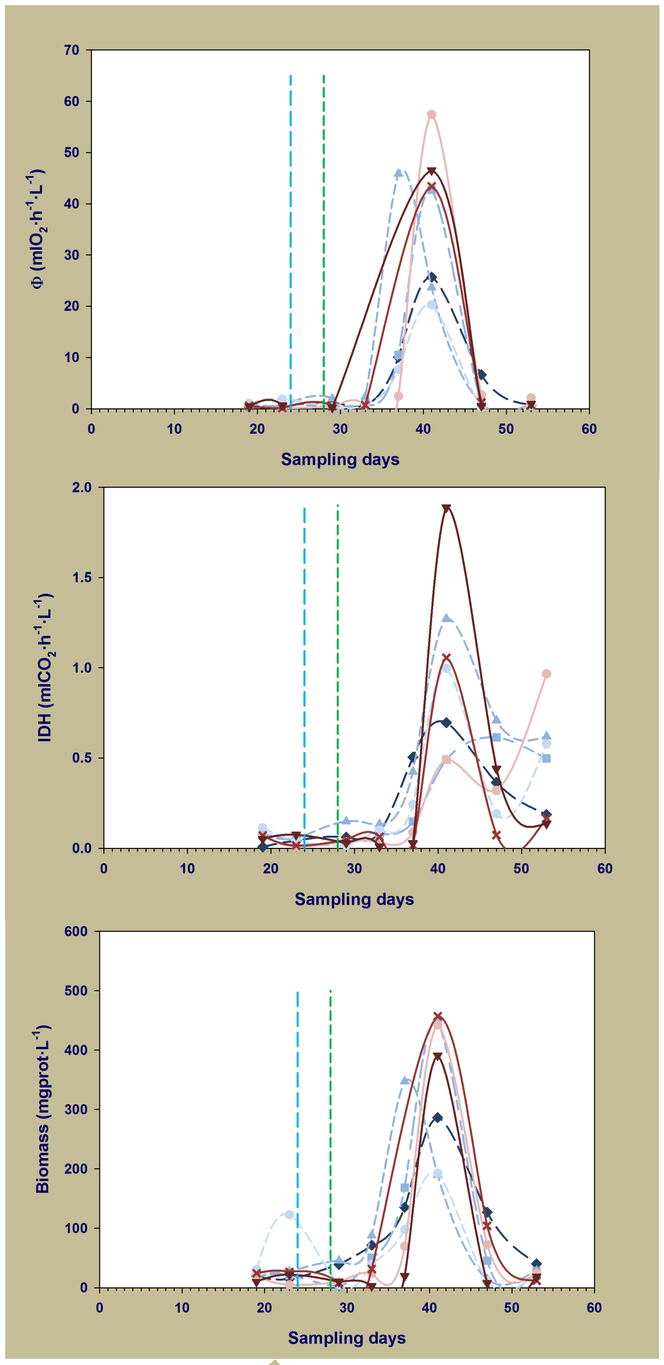
- 400 µatm
- 600 µatm
- 800 µatm
- 1000 µatm
- 1250 µatm
- 1750 µatm
- 2000 µatm
- Control
- Deep-water addition
- Chl *a* peak

Microplankton

- **Φ : Two peaks appear in most of the mesocosms: the first on the same day (or day before) as the chlorophyll peak and the second, several days later. The maximum value corresponds to the second peak, on day 35.**
- **B : The maximum value appears near the chlorophyll peak.**
- **IDH: Although deep-water addition leads to an increase of IDH activity in all the mesocosms, the results are more variable than the ETS activity and the biomass.**
- **All the parameters reach their maximum values at CO_2 levels above 800µatm (Φ and B: 2000µatm; IDH: 1000µatm)**

Sediment traps

- ✓ **Φ: The maximum value, in all mesocosms, appears in the day 41, except for 600 µatm treatment where it appears on day 37.**
- ✓ **B: The maximum value, in all mesocosms, appears in the day 41, except for 600 µatm treatment where it appears on day 37.**
- ✓ **IDH: Even for the 600µatm, the maximum value appears on the day 41 in all the mesocosms, except for the 1250 µatm treatment that still has a peak on the last day of the experiment.**
- ✓ **All the parameters reach their maximum values above 1000µatm (Φ: 1250 µatm, B: 1750µatm, IDH: 2000µatm)**



SEDIMENT TRAPS

CONCLUSIONS

- **The appearance of two peaks the Φ time-course suggests a change in the microplankton community.**
- **IDH activity is more variable than Φ, and may be related to changes in the metabolic pathways of the micro planktonic community.**
- **In sediment traps, the maximum concentration of live biogenic particles occurred around two weeks after deep-water addition.**
- **More information about the composition of the community is needed to examine the fact of both Φ and B reaching their maximum values among the most acidified mesocosms. A community of opportunistic organisms with a good response to acidification, that will lead to a low biodiversity, may be behind it.**

Aknowledgments

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