REPLY: We would like to thank Y. Dauphin for this thorough comment and are confident that we have satisfactorily addressed all the points below.

Nevertheless, some questions persist.

First, only some specialists are able to identify the species of Patella. Only small details are important, and because even the shells of living animals are eroded or encrusted, color patterns are not well visible. Several species often co-exist in a single site. Thus, the taxonomy of "Patella" is still controversial. The morphology (inner and outer views) of the samples will be useful.

REPLY: Patella samples were checked by Francesco Paolo Patti (SZN, Ischia) who confirmed the taxonomy. We included photographs of the shells we analysed in the revised manuscript.

2nd:

microstructural observations are missing. The structure of the shell of this genus is unique: the crossed lamellar layer (the most common structure in Molluks) is calcitic. Some sublayers are aragonitic. But the main part of aragonite is a prismatic layer related to the muscle insertion (myostracum). The absence of thin sections or SEM pictures does not allow the reader to understand what is the structure of what is called "aragonite" in the manuscript.

REPLY: While we agree that it would be, per se, interesting to have information on the microstructure of the shells, this information is irrelevant with respect to the scope of the present manuscript. For our purpose it is sufficient to know which parts of the shells are aragonitic and which are calcitic. We are looking forward to addressing the question of microstructure in the future, though.

Third: despite the high quality of Raman analyses, other
cheaper and faster techniques are available: BSE SEM images with or without staining (Feulgen, spatial resolution about 1 micron), staining of thin sections.

REPLY: Since several techniques were available, we had to make a choice. We did choose Raman microscopy.

Fourth: we have
no data about the age of the samples, and the duration of their exposure to the acidic site.

REPLY: The samples were exposed to the respective sites (normal versus low pH) all their lives. The exact age of the samples is unknown to us. They are probably several years old.

Fifth: there is no data about the parameters of the sea water (salinity, temperature, agitation...); these parameters play a role in the life of the animal, as the nutriment does.
Some decades ago, it was shown that the calcitic/aragonitic ratio in Mytilus shell depends on the sea water salinity (Dodd in the 60's). This controversial interpretation was not confirmed and it has been shown that other factors play a role. It seems there is a similar situation here. The authors of the manuscript deal with a topic regularly mentioned in all the past and present, national and international projects in which the future climate is concerned. They do not compare their results to what is described for other molluscs. At last, the observations are not sufficient enough to be so affirmative regarding the conclusions. The authors must discuss other hypotheses.

REPLY: We agree insofar that data based on field samples do not warrant the same degree of interpretative certainty as data based on experimental samples. Having said

that, the field samples we used are very special and probably as close as one can get to a laboratory experiment. The reason for this is that the Ischia CO2 vent site features a classical DIC-manipulation scenario (for details see e.g. Hoppe et al. 2011) without disturbing secondary influences. We have added a paragraph dealing with possible secondary influences:
"We ascribed the changes in shell mineralogy and shell thickness of our samples to seawater carbonate chemistry changes. Since these are field samples, as opposed to experimental samples, possible secondary influences have to be considered. For Mytilus it was shown that maybe salinity, but certainly temperature influences the aragonite/calcite ratio (Dodd 1966, Eisma 1966). The latter is also true for Patella (Cohen and Branch 1992). In our case, however, both temperature and salinity at the two sites (Figure 1) were the same at any given time (Table 1, Cigliano et al. 2010, Hall-Spencer et al. 2008, Rodolfo-Metalpa et al. 2011), and we conclude that these two parameters did not influence the aragonite/calcite ratio of our samples. Also both the control site and the low pH site we sampled at Ischia are sheltered so that there is no difference in wave action, which could potentially influence shell architecture. Furthermore, it was suggested that the concentrations of inorganic ions such as Mg and Sr can influence the mineralogy of marine calcifying organisms (Watabe 1974). Since salinity was constant in our case, the concentrations of major ions such as Mg and Sr were likewise, and their influence can be ruled out. On the other hand, shells from the low pH site clearly are corroded (see above), so there is a massive impact of seawater carbonate chemistry on the organism. Taken together with the constancy of other environmental parameters, that leads us to conclude that carbonate chemistry changes are the best explanation for the changes in shell mineralogy and shell thickness of our samples."
The effect of the corrosive water at the low pH site is further illustrated by a number of images at our disposal. We attach a few examples to this reply, but don't think it is necessary to include them in the manuscript, because the corrosive nature of the low pH site is already well documented (see page 12573, line 23 of our manuscript).

Figure Caption:

Fig. 1 Gastropod molluscs living adjacent to shallow water CO_2 seeps off Ischia showing severely eroded shells due to the corrosive effects of the seawater a) Hexaplex trunculus, b) Osilinus turbinata and c) Patella caerulea. At control sites these gastropod species were common but were never found with dissolved shells like these

References

Cigliano, M; Gambi, Maria Cristina; Rodolfo-Metalpa, Riccardo; Patti, F P; Hall-Spencer, Jason M (2010): Effects of ocean acidification on invertebrate settlement at volcanic CO2 vents. Marine Biology, 157(11), 2489-2502

Cohen, A.L., Branch, G.M. (1992) Environmentally controlled variation in the structure and mineralogy of Patella granularis shells from the coast of southern Africa: implications for palaeotemperature assessments, Palaeogeography, Palaeoclimatology, Palaeoecology, Volume 91, Pages 49-57

Dodd, J.R. (1966) The Influence of Salinity on Mollusk Shell Mineralogy: A Discussion. The Journal of Geology, Vol. 74, pp. 85-89

Eisma, D. (1966) The Influence of Salinity on Mollusk Shell Mineralogy: A Discussion. The Journal of Geology, Vol. 74, pp. 89-94

Hall-Spencer, J. M., Rodolfo-Metalpa, R., Martin, S., Ransome, E., Fine, M., Turner, S. M., Rowley, S. J., Tedesco, D., and Buia, M.-C. (2008) Volcanic carbon dioxide vents show ecosystem effects of ocean acidification, Nature, 454, 96–99

Hoppe, C., Langer, G. and Rost, B. (2011) Emiliania huxleyi shows identical responses to elevated pCO2 in TA and DIC manipulations, Journal of Experimental Marine Biology and Ecology, 406 (1), 54-62

Rodolfo-Metalpa, R., Houlbreque, F., Tambutte, E., Boisson, F., Baggini, C., Patti, F. P., Jeffree, R., Fine, M., Foggo, A., Gattuso, J.-P., and Hall-Spencer, J. M. (2011) Coral and mollusc resistance to ocean acidification adversely affected by warming, Nature Climate Change, 1, 308–312

Watabe, N. (1974) Crystal growth of calcium carbonate in biological systems, Journal of Crystal Growth, Volumes 24–25, Pages 116-122

End of Reply to C4853Interactive comment on Biogeosciences Discuss., 11, 12571, 2014.