

## ***Interactive comment on “Factors controlling shell carbon isotopic composition of land snail *Acusta despecta sieboldiana* estimated from lab culturing experiment” by N. Zhang et al.***

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Received and published: 16 June 2014

We would like to thank Giovanni Zanchetta for his very constructive comments. Here we would like to discuss the general comments firstly.

—Section 4.1 for the calculation of the different carbon source the authors used isotopic composition of body tissues, the reason of that becomes clear later in section 4.2.2. I think a link should be found.

###Discussion: We agree with the referee that the discussions in Sect 4.2.2 are important for understanding why to choose ‘the isotopic composition of snail tissue’ for calculation, but not food tissue, therefore we use the words, ‘see Sect. 4.2.2’. Does the

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referee mean that we need to use a hyperlink to the section 4.2.2 in the final revised manuscript?

—It seems to me that isotopic composition of atmospheric CO<sub>2</sub> is assumed instead to be measured directly in-situ. This can give some concerns, because in a closed environment respired CO<sub>2</sub> would be important (or other sources) component. This may also occur in nature (e.g. canopy conditions). I think a comment on this is necessary.

###Discussion: We thank the two referees point out this important issue and we totally agree that to make a comment or clarification is necessary on this point. In this study, because of the limitation of our experimental apparatus, we didn’t monitor the CO<sub>2</sub> concentration and isotopic values in-situ, but used an annual average value observed in the local urban air. The CO<sub>2</sub> from respiration might more or less affect the composition of the atmospheric CO<sub>2</sub> in the half sealed system, and in further cause a probable overestimation of contribution from atmospheric CO<sub>2</sub>. This is also a weakness of our estimation on atmospheric CO<sub>2</sub> and need further culturing experiment to be better understood. We will point out and discuss this point in the revised manuscript (will be added in the last paragraph of Sect. 4.2.3). In addition, we think this will not significantly affect our estimation of diet and limestone, as discussed in Page 6566, Line 21-29 and Page 6567, Line 1-5.

—Along the manuscript there are interesting points for paleoenvironmental researchers. I think it should be more stressed the relation found between shell weight and isotopic composition. This could be methodologically important: if in past populations we found differences this may depend on carbonate ingestions and not only depending on metabolic rate (both can depend on environmental stress, too). So methodologically would be important to stress that shells need to be well preserved and it is necessary to weight them.

###Discussion: Yes, we found that the differences of land snails in shell carbon isotopic composition may not only depend on C<sub>3</sub>/C<sub>4</sub> plant distribution, but also amount

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of carbonate ingestion (affected by the availability of local limestone or variations of metabolic rate due to environmental stress). However, here we showed a positive relation between shell weight percentage (equal to dry shell weight divide by the total mass of land snail individual) and shell carbon isotopic composition. And this may be difficult to be applied directly in the paleo-environmental studies, because we could not get the total mass information from the preserved shells. By the way, we have also checked the relation of shell weight and isotopic composition, but the correlation is poor (R square is around 0.34).

—Snail shells usually show a very large variability both in experimental conditions and in nature. Do they authors argue that values dispersion can be used as a measure of environmental stress?

###Discussion: Yes, that's what we want to show in Sect. 4.3. The global/ local temperature or other environmental parameters could suddenly change due to some known or unknown event (eg. the Younger Dryas event, ca. 1.3 ka BP), which would result in a large decrease of some species' populations or even cause extinction. Analysis of the carbon isotopic composition in the land snail shell fossils among ages can provide this kind of information. That means, for instance, in this study we find a 5 °C change of temperature will largely affect the carbon isotopic composition in land snail shells because metabolic rates changed significantly by environmental stress. This will be helpful when we combine it with other proxies in the paleo environment study, such as oxygen isotopic composition in shells.

Specific comments, —Pag. 6562 lines 15-18. Here are reported preliminary results. Why preliminary? You use only here the t test, why?

Answer: ###We use the phrase, 'preliminary results' here because our sample numbers of snail fed by corn are limited (n=3) compared with those fed by cabbage (n=26), and we hope some further culturing researches related to this point could be done in the future. ###T test is to show the significance of the difference on shell weight propor-

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tion between two kinds of food sources. For other comparisons in this paragraph, we considered that the readers could easily find the differences, for instance, P6562 Line 11-12, shell weight proportion of snails fed with CaCO<sub>3</sub> vs. those fed without CaCO<sub>3</sub>.

For other specific comments, we accepted all suggestions from the referee. We will show the point-by-point revisions after we uploading our revised manuscript soon.

Finally, we feel very grateful for the encouragement from the referee. Actually, we have also controlled the oxygen isotope of water provided to the land snails (eg. Ocean water Vs. Tap water). Another two papers, oxygen isotope of shell carbonate and clumped isotope of shell carbonate are under writing now. Hopefully they could be useful to improve the paleo-environment study by land snail shells.

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Interactive comment on Biogeosciences Discuss., 11, 6555, 2014.

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