

Interactive comment on “Sex-associated variations in coral skeletal oxygen and carbon isotopic composition of *Porites panamensis* in the southern Gulf of California” by R. A. Cabral-Tena et al.

Anonymous Referee #2

Received and published: 6 January 2016

Major comments:

This article represents differences of oxygen and carbon stable isotope in the *Porites panamensis* for both male and female colony skeletons. I am interested in the oxygen isotope data in fig 1, which shows obvious differences in oxygen isotope for skeletons in male and female colonies.

Reading many of articles focusing on the stable isotope study in biological carbonate such as coral and foraminifera, it is important to remember the basis of stable isotope

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geochemistry to reconstruct the paleoclimate conditions. Why does many of biogeochemists use the stable isotope compositions in oxygen and carbon in biological carbonates? Since Harold Urey represent the application of stable isotope in Jurassic Pee Dee Belemnite to reconstruct the paleo temperature based on the theory of isotope effect in chemical equilibrium in biological carbonate, it became possible to reconstruct paleotemperature in earthhistory. In each chemical reaction, stable isotope composition in both origin and product has quantitative relationship involving the parameter of reaction condition such as temperature and/or reaction rate etc. (Sharp (2006) represent these theory as text book.) Because foraminifera and shells form their skeletons in the isotope equilibrium, oxygen isotopes and temperature in seawater have quantitative relationship.

For coral skeleton, it is considered as oxygen and carbon are supplied from seawater. But their forming involves multistep chemical reactions with isotope disequilibrium in the biological body, because coral skeleton forms much faster than foraminifera and/or shells. Then isotope composition in the biological carbonate are often blinded.

McConnaughey (1989a) made clear the multistep reaction in the forming of coral skeleton. He represented which chemical reactions cause the isotope disequilibrium in the forming process of coral skeleton and revealed the isotopic trends for both carbon and oxygen isotope compositions named “kinetic isotope effect”, which is called as “vital effect” before McConnaughey (1989).

This paper does not seem to understand why isotope composition in biological carbonate are paleoenvironmental indicator. Authors claim that isotope compositions in oxygen and carbon shows sex associated variations. However, their explanation about differences of physiology for both male and female are shown in line 411-419 only. For geochemists, this paper does not involve critical physiological chemical reaction for both male and female corals. For biologists, this paper does not involve what and how chemical reaction makes change the isotope compositions between chemical origin and product.

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I would recommend that authors add much contents of this part. Almost readers may wonder what causes the differences in physiological pathway with chemical reaction for both male and female corals. Isotope compositions in chemical product such as biological carbonate are controlled by chemical conditions in each chemical reaction, excluding isotope compositions in chemical origins. Understanding of theory in stable isotope compositions is more important than statistics analysis.

Minor comments:

2 Materials and methods 2.1 Collection and identification of gender # Please show the map of study site. Almost readers may not be familiar with Gulfs of California and/or Mexico.

2.3 Isotope analysis p 169 Micromill procedure is the bases of coral isotope study. Many of readers may wonder if powder samples are milled by machine or hand. Milling machine makes the milling to keep equal intervals in coral skeleton, but it is difficult by hand milling procedure. Please describe this process.

3. Results

3.1 Skeletal growth I would like to recommend to show X-ray photographs and graph of skeletal density along growth axis. It is difficult for reader to understand the relationship between isotope compositions and skeletal growth along growth axis.

3.2 Skeletal isotope composition and environmental data The sentences in the line between 243 and 265 should be moved into discussion section.

line 255-257: I do not think that authors show the calculation for d18O in seawater based on the d18O of coral skeleton for current coral. Many of readers may misunderstand that this papers discussing about environmental aspects. I think that authors discuss about biological aspect for isotope variation. . .

4. Discussion line 296-394: These sentences seem like review for related papers, but not essential. Please shorten.

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In this paper, only sentences between 413 and 419 explain about the mechanism, which cause sex-associated isotope variations. I think authors should discuss this mechanism with deeper insight.

Omata et al. (2008) attempted the isolation for both kinetic effects and metabolic effects. Please read this article.

References: McConnaughey (1989a) 13C and 18O isotopic disequilibrium in biological carbonates: I Patterns. *Geochim. Cosmochim. Acta.* V53, 151-162. Sharp, Z. (2006) *Principles of stable isotope geochemistry.* Prentice Hall

Omata et al. (2008) Effect of photosynthetic light dosage on carbon isotope composition in the coral skeleton: Long-term culture of *Porites* spp. *J. Geophys. Res.*, v113. doi:10.1029/2007JG000431.

Interactive comment on *Biogeosciences Discuss.*, 12, 18795, 2015.

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