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eEarth Discussions

Interactive comment on "Stable isotope compositions of a late Jurassic ammonite shell: a record of seasonal surface water temperatures in the southern hemisphere?" *by* C. Lécuyer and H. Bucher

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General comments:

The paper describes an isotope study of a Late Jurassic aragonitic ammonite shell as well as a low-magnesium calcitic bivalve shell. The focus of this contribution is to extract seasonal changes in surface water temperature along an ontogenetic shell transect. While this is an interesting and promising approach, there are some problems with the evaluation of a potential diagenetic overprint of the shells and interpretation of

the data.

Specific comments:

The oxygen isotope data measured on the bivalve Astarte are used as a fixpoint in order to argue for a good preservation of oxygen isotope values measured on the aragonitic ammonite shell. Although the bivalve shell is primarily composed of low-magnesium calcite that has a high potential to be preserved in geological times, the authors do not present any data that definitely "prove" preservation of the bivalve shell (SEM- or cathodoluminescence microphotographs). I recommend to add some data with this respect.

XRF-analysis is used to show that the shells are preserved as aragonite. However, Dauphin and Denis (1990, 1999) report that the diagenetic alteration of the microstructure of ammonite shells may sometimes be observed despite the preservation of their original aragonite mineralogy. The authors should take these studies into account.

Dauphin, Y., Denis, A., 1990. Analyse microstructurale des tests de mollusques du Callovien de Lukow (Pologne) - Comparaison de l'etat de conservation de quelques types structuraux majeurs. Revue de Paléobiologie, 9, 27-36.

Dauphin, Y., Denis, A., 1999, Diagenèse comparée des phases minérales et organiques solubles dans les tests aragonitiques de nautiles et d'ammonites. Bull. Soc. Géol. France, 170, 355-365.

The reconstruction of the seasonal variation in the oxygen isotope ratios of the ammonite shell as well as the surface water temperatures reveal some major problems:

The authors observe low to very low carbon isotope values in the earliest part of the ontogenetic profile and in the intervals from 70 to 90 mm and 130 to 145 mm which in part coincide with low oxygen isotope values. The low carbon isotope values measured from 70 to 90 mm and 130 to 145 mm ("isotopic events") are interpreted as consequence of a change in the environmental conditions. The authors suggest an

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enhanced influx of meteoric waters rich in 12C as potential mechanism. In order to reconstruct seasonal temperature variations, the oxygen isotope values associated with these two isotope events are removed.

(i) However, the authors remove 4 oxygen isotope data points while only 2 samples show depleted carbon isotope values (130 to 145 mm interval). Why this?

(ii) The authors cannot offer a convincing explanation for the very low carbon isotope values from 0 to 30 mm. If the low carbon isotope values from 70 to 90 mm and 130 to 145 mm are explained by enhanced input of freshwaters, why are the values from 0 to 30 mm not indicative of freshwater inputs as well? Why not removing the corresponding oxygen isotope values?

(iii) What about the carbon isotope values from 30 to 60 mm? These values are lower by approx. 2 to 3 permil in comparison to the values from 100 to 340 mm. Does this mean that there was an intermediate input of freshwaters?

In conclusion, this argumentation is not convincing and the derivation of the sinusoidal variation in the oxygen ratios remains problematic. I am aware of the fact that the variations in the carbon isotope ratios may be explained by various mechanism (metabolic effect, diagenetic alteration that can not completely be excluded based on the presented data, and/or environmental changes) and are thus difficult to constrain, but the way the authors exclude certain oxygen values from the interpretation is questionable.

Technical corrections:

Standard deviations (Chapter Sampling Strategy and Methods) should be given as plus/minus

I recommend to plot the calculated oxygen isotope values for modern aragonite from May to Sept (= comparable to reconstructed time period for the ammonite shell).

Interactive comment on eEarth Discuss., 1, 1, 2006.