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Solid Earth Discussions

Interactive comment on "Upper Pliensbachian – Toarcian (Jurassic) palaeoenvironmental perturbations in a temporal and regional context: an extended ⁸⁷Sr/⁸⁶Sr, delta;¹³C and delta;¹⁸O belemnite isotope study from Bulgaria" *by* L. S. Metodiev et al.

Anonymous Referee #1

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This paper of Metodiev and colleagues present new geochemical, sedimentological, and paleontological data from Bulgaria illustrating the paleoenvironmental and paleoclimatic disturbances recorded during the Toarcian (Early Jurassic), an interval characterized by a prominent oceanic anoxic event (OAE) and a second-order extinction mass. Of course, studies focusing on this disturbed period are very fashionable but, as

numerous colleagues, I think that the multiplication of data from different paleoenvironments and paleogeographical contexts is necessary to discuss the global vs. regional extent of events as well as their origins. Here, the multiproxy approach, mainly based on strontium, oxygen, and carbon isotope records of belemnites, is very interesting because, through comparisons with current data from NW Europe, it allows a better understanding of spatiotemporal changes in ecosystems recorded during and in the aftermath of the Early Toarcian OAE. Also, the strontium isotope data allow a good temporal calibration of each event. In this context, the authors highlight that most Early Toarcian disturbances recorded in the Euro-Boreal domain also prevailed in Bulgarian paleoseas (carbonate production crisis, positive and negative carbon isotope excursions, global warming event) and discuss potential secondary disturbances during the Late Toarcian. In summary, these new data are interesting, the paper is both well presented and written, the illustrations are of great quality, and I recommend it for a final publication in Solid Earth.

SPECIFIC COMMENTS

P317, Line 10: In NW Europe, the Variabilis Zone belongs to the Middle Toarcian. I think that at the substage level, you should avoid to use a different time scale for Bulgaria (as depicted on the figure 2). The Lower (Whitbian) and Upper (Yeovilian) Toarcian are not commonly used and bring confusion. As the biozonation of Bulgarian outcrops is quite well correlated with the Euro-Boreal divisions, I suggest to use the term Early, Middle, and Late Toarcian (or Lower, Middle, Upper for the stratigraphy) by following the updated biozonation of Page (2003).

P318, Lines 6 to 15: Maybe add here or elsewhere few words to explain what is different compared with Metodiev et al. (2008)?

P324, Lines 17 to 24: As observed in modern environments, iron ooids may also be formed by alteration of volcanic ashes in marine environments (Sturesson et al. 2000). Have you any evidence (e.g., bentonite) for volcanic activities in the vicinity of the Bul-

garian domain during the Jurassic? Could we expect that ashes from the northern Tethyan arc volcanism (to the east of our study area) could reach the Bulgarian paleoenvironments?

P327, Lines 9 to 20: You mention Passaloteuthis in the Middle Toarcian (Bifrons Zone). Did you use the work of Stoyanova-Vergilova (1982) for the determination of species? Unfortunately, I have no access to this paper and I don't know the biostratigraphical extension of belemnite genera in eastern European sections but according to papers of Doyle (1990, 1991), Passaloteuthis (and derivative belemnite genera with 2 lateral apical grooves) occurred in UK and Europe from the Pliensbachian to the Falciferum Zone.

P331 and P332: About the strontium isotope interpretation: Similarly to Sr87/Sr86 data measured on belemnite from Queen Charlotte Islands (Gröcke et al. 2007) or on bulk sediments from the Trento and Campania-Lucania platforms (Italy; Woodfine et al. 2008), I remark that your values from Bulgaria show the same trends that those from UK (McArthur et al. 2000) but display a greater dispersal. This is especially obvious for the Pliensbachian – Toarcian transition where most of your values are more positive than in UK but in the range of data from Italy. I am not a specialist of the strontium geochemistry but are we sure than localized signals related to the restriction of NW European basins, diagenesis or to the nature of locally weathered materials may be totally excluded in Bulgaria and that the curve from UK may be considered as global? Please, could you shortly discuss this or just mention these regional scatters?

P336, Lines 1 to 12: Similarly to data from Germany, Spain, Portugal or Balkan mounts, your new d18O data from Bulgaria display a decrease of 3‰ which cannot solely be ascribed to temperature changes. This interpretation would imply rises in SST greater than +10°C (impossible for subtropical seawaters). As currently invoked, add a discussion and references on the potential influence of freshwater inputs (e.g. Saelen et al. 1996; Bailey et al. 2003).

P336, Line 19: You can also add that the long-term increase in Sr87/Sr86 is also observed in the Mediterranean realm (Woodfine et al. 2008) and Panthalassa (Gröcke et al. 2007).

TECHNICAL COMMENTS

P337, line 24: "Warming" and not "worming" P345, line 5: "significance" P347, line 15: "Nitrogen isotope" P349, line 10: "Effect of" P349, line13: "precursors"

Fig. 2 : I would avoid to use Lower Toarcian (Whitbian) and Upper Toarcian (Yeovilian) for the left column. See my comments above.

Interactive comment on Solid Earth Discuss., 4, 315, 2012.