



## Short communication

## Reply to “Comment on the Badenian–Sarmatian extinction event in the Carpathian foredeep basin of Romania: Paleogeographic changes in the Paratethys (Palcu et al., 2015)” by Silye and Filipescu (2016)



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## ARTICLE INFO

## Article history:

Received 9 May 2016

Received in revised form 12 August 2016

Accepted 22 August 2016

Available online 1 September 2016

The temporal and spatial evolution of Paratethys, an epicontinental sea that covered large parts of Central Europe during the Middle Miocene, is difficult to understand because of its complex and fragmented paleogeography and its mainly endemic fauna that hamper straightforward correlations to the Geologic Time Scale. Traditionally, the boundaries between these regional stages have been correlated to seismic sequence boundaries, commonly interpreted as sea level falls (e.g. Hardenbol et al., 1998). Recently, however, this paradigm was seriously challenged by global paleoclimatic proxy records and modeled sea level curves showing that most of the Paratethyan sequence boundaries do not correspond to any change in global sea level (Zachos et al., 2008a, 2008b; Van de Wal et al., 2011).

The transition between the Badenian and Sarmatian regional stages is especially interesting because the Badenian–Sarmatian Extinction Event (BSEE) occurred around that time: the largest faunal turnover event in the Paratethys realm, with a 94% extinction of Badenian species (Harzhauser and Piller, 2007). We have sampled a continuous sedimentary succession (Tisa section) in the Carpathian foredeep of Romania, and have located the BSEE within a resolution of far less than 10 kyr, and determined the age of the event at  $12.65 \pm 0.01$  Ma (Palcu et al., 2015). Moreover, our micropaleontologic records did not show any evidence for a major sea level change at the BSEE, in contrast to previous hypotheses.

We are aware, that our alternative hypothesis may initially be received with skepticism and that it still awaits confirmation (or rejection) by future studies. Referring to Alegret et al. (2003); Silye and Filipescu (2016) argue that the Tisa section should have been sampled at a decimeter (dm) resolution. Surprisingly, the subject of the cited paper is the K/T boundary section at Agost (Spain), where the mean sedimentation rate is 1 cm/kyr and sampling every dm results in a 10 kyr

resolution; whereas in the Tisa section, with its sedimentation rate of approx. 27 cm/kyr, 1 dm would concur with 370 years which will be completely overshadowed by the age model error.

The same paper (Alegret et al., 2003) is cited to point out that the  $>63 \mu\text{m}$  size fraction should have been used for foraminiferal counts instead of the  $>125 \mu\text{m}$  fraction. In fact, Alegret et al. (2003) refer to Schroeder et al. (1987) here: a paper concerning recent foraminifera. Sieve fractions are and have been a continuous subject of debate (see e.g., Schönfeld, 2012 for an overview). The  $125 \mu\text{m}$  size fraction however, is adequate to capture trends in foraminiferal abundances far more subtle than extinction events (e.g., Baldi, 2006; Baldi and Hohenegger, 2008) and is expected to contain somewhat less transported specimens. We consider the turnover in foraminiferal assemblages at the BSEE convincing enough to be dated.

Planktic foraminifera counts or in-depth stratigraphy and paleoecology were not our aim. In addition, and contrary to the suggestion by Silye and Filipescu (2016), the calcareous nannoplankton data have not been generated with the objective to define the Badenian–Sarmatian boundary, but rather to show that a major turnover in nanofossil assemblages concurs with other proxies at the BSEE.

Furthermore, Silye and Filipescu (2016) provide no valid argumentation against the position of the BSEE in the Tisa section - in fact they apparently agree with this position, accepting the Tisa ash to be equivalent to the Apahida boundary ash - but comment on the early Sarmatian (= post-BSEE) fauna assemblages despite it is common knowledge that *Cycloforina stomata* can occur before *Lobatula dividens* (for instance in Polish basins: Łuczowska, 1974). Apparently Silye and Filipescu (2016) have difficulties accepting that our Sarmatian faunal record from the Carpathian foredeep differs in several details from their Transylvanian basin record. Remarkably, they claim themselves that differences between basins are to be expected because of the complex tectonic evolution of the region. We consider these differences between basins interesting observations that certainly deserve further studies.

Finally, Silye and Filipescu (2016) challenge our conclusion that there is no evidence for shallowing across the BSEE. Indeed, *Martinotiella communis* has a rather large depth range and *Valvulineria complanata* is common in prodelta environments; however, we interpret the abundance shift of these taxa as environmental and associated with the coarser-grained level at ~55 m. Our depth estimate, however, is based on the presence of miliolid taxa, indicating mid-outer shelf

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depths (Łuczowska, 1974), both in the Badenian and the Sarmatian. Consequently, from a sedimentological and a faunal point of view there is no evidence for shallowing associated with the BSEE.

In summary, our assessments of the foraminifera, nannoplankton, magnetic susceptibility and magnetic intensity all point to a radical change at the same level: the level of the extinction of Badenian benthic foraminifera taxa. We have not seen valid arguments in the comment by Silye and Filipescu (2016) to change our interpretation of the data from the Tisa section. We do agree that many other high-resolution records from different Paratethys basins are needed to resolve the many outstanding questions and controversies regarding the BSEE. In our paper (Palcu et al., 2015) we do not claim that our interpretation is the only correct one, but we do try to shed new light on a paradigm in the Paratethys literature that, in our opinion, is highly biased by circular reasoning and has a certain danger to be influenced by the reinforcement syndrome regarding data interpretation.

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